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# Assessment of Potential Prevent Plant Acreage Associated with Temporary Water Storage for FM Area Diversion Staging Area

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## **Glossary of Terms**

Affected Acreage	Total acreage of storage area that has some flooded acreage, even if the inundation does not cover the entire storage area. For example, if a storage area is 500 acres in size, but only 200 acres are submerged with flood water, the flooded acreage is 200 and the affected acreage is 500.
Days of Delay	The difference in total days between the Without and With Diversion conditions and does not necessarily reflect the number of days a producer may be delayed. For example, a storage area has 20 total days (days to flood, days of inundation, and dry-down) for Without Diversion conditions and 25 total days With Diversion. The days of delay due to the Diversion are 5 days; however, the number of days of planting delay may be more, the same, or less than the 5 days of difference between conditions—the extent of the delay depends upon when regional planting begins.
Distribution	The range of a known value given the statistical characteristics of the underlying information or data. It represents the relative number of times each possible outcome will occur in a number of trials or replications. Values in a distribution often are combined with the probability of that value occurring over a specified period or under a specific set of conditions.
Dry-down	A period for the land to dry out to the extent that normal field operations may occur. The dry-down period was assumed to include time for removal of flood residue.
Effects of Flooding are gone	In this study, 'effects of flooding are gone' refers to when a storage area has gone through the required dry-down period. At that point, the land may be planted (if regional planting has started) or in the situations where regional planting has not begun, those lands will have to wait for general conditions to improve before planting.
Existing Conditions/ Without Diversion	Refers to the hydrology-related conditions currently present within the staging area and within each individual storage area. "Existing conditions" is synonymous with the terms "Without Diversion."
Flood Event	Spring flood events resulting primarily from snow melt that are sufficiently large to require use of the staging area as part of the FM Diversion.
Flooded Acreage	Only the actual acreage of lands within storage areas that are inundated (submerged) with flood water. These acreages can be equal to the total size of the storage area if the entire storage area is submerged or can represent a portion of acreage within a storage area.
Flood Start	The calendar date when the Red River reaches 17,000 cubic feet per second (cfs) in Fargo. Snow melt and runoff would already be occurring prior to this date so the definition does not necessarily define when a spring flood event actually begins.

Flood Size/Frequency	Flood size or frequency is usually defined by the annual likelihood that the event would occur in any given year. The annual probability of a flood event occurring is inversely related to the size of the flood event; a 25-year flood event is smaller than a 50-year flood event. The annual chance of 25-year flood event is 4 percent (1/25) whereas the annual chance of a 50-year flood event is 2 percent (1/50) and a 100-year flood event is 1 percent (1/100).
Gross Revenue	Defined as crop yield multiplied by crop price. Insurance indemnities and federal farm program payments are excluded.
Hydrology	In this study, hydrology is used as a general reference to the flooding or lack of flooding currently being modeled for storage areas within the staging area. The hydrology information used in this study is the result of modeling the distribution, movement, and volume of flood waters in the southern Red River Basin.
Monte Carlo	A Monte Carlo simulation is an analysis technique that allows for a range of outcomes to be evaluated based on the statistical distribution(s) of factors or values that may affect a particular outcome. The technique uses a random selection of possible model inputs by 'pulling' a value from a statistical distribution. The technique is helpful in defining the frequency, probability, and risk associated with a large number of potential outcomes.
Olympic Average	An Olympic average eliminates the high and low observations and then averages all remaining observations. An Olympic average often is a useful estimator because it is less sensitive to outliers than a simple mean but will still give a reasonable estimate of central tendency or mean for many statistical models.
Period of Record	The range of years of basin hydrology that was used by the U.S. Army Corps of Engineers for FM Diversion project design and evaluation. The period of record is 1902 through 2009.
Probabilistic Maximum Flood	The largest flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions such as probable maximum precipitation and other coincident conditions including snowmelt relevant to the drainage basin south of Fargo, ND. This flood event is an standard design criterion that federal regulatory authorities apply to dams to ensure the structural safety of the structure.
Replication	Defined in this study to represent one combination of the factors generated in the Monte Carlo simulation. A replication would be analogous to the combinations present in one particular year.
Risk	Risk is a term often used to describe financial situations where the outcome of a particular set of conditions may not be known but the odds of occurring can be reasonably measured.

Staging Area	'Staging Area' refers to the area of the FM Diversion project where water will be temporarily stored during spring flood events. Retention of water will be created through man-made levies and natural topography. Water collected in the staging area will subsequently be drained away through the Red and Wild Rice rivers and the Diversion channel.
Staging Activation	The calendar date during a spring flood event when the staging area would begin storing water. Activation of the Diversion staging area is when the Red River reaches 21,000 cfs in Fargo. However, activation of the staging area will actually be based on gages and flow monitoring upstream of Fargo.
Standard Deviation	A measure of how widely values deviate or differ from the average. Standard deviation is a common measure of variability.
Storage Area	Geographic units within the staging area that are delineated by man-made (e.g., roads) and natural features. The effects of temporary water storage were treated equally for all acres within an individual storage area. These areas are identified by range, township, county, acreage, and elevation (msl). For hydrology purposes, the storage areas are treated as one homogenous tract.
Target Yield	Yield that agricultural producers strive to obtain and adjust the level of inputs and farm practices to achieve.
Total days	The number of days from when the staging area is activated to the end of the dry-down period. That period may or may not differ between existing conditions and conditions expected with use of the FM Diversion.
Uncertainty	Uncertainty is a term applied to situations where it may be impossible to reasonably measure the odds of something occurring.
With Diversion	Refers to the hydrology conditions that are expected to prevail during large spring flood events when the FM Diversion project is operational.

### Assessment of Potential Prevent Plant Acreage Associated with Temporary Water Storage for the FM Area Diversion Staging Area

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### **Executive Summary**

The proposed Fargo/Moorhead Area Diversion Project (FM Diversion) is intended to reduce the flood risk for Fargo, Moorhead, and other communities in Cass County, North Dakota and Clay County, Minnesota. The FM Diversion is comprised of a water storage embankment and tie-back levies upstream of Fargo, flood protection dikes in the Fargo/Moorhead communities, and a diversion channel to route water around the Fargo/Moorhead/West Fargo metro area. The embankment, tie back levies, and natural rise in the Red River basin will create a staging area in which water will be temporarily collected during times of high flow during spring flood events.

The implications of temporary water storage raise a number of questions, such as the effects of inundation on public infrastructure (e.g., roads, bridges), cultural landmarks (e.g., cemeteries), residential and commercial structures, delivery of public services (e.g., fire and rescue), and agricultural lands. The FM Diversion Authority enlisted help from the Department of Agribusiness and Applied Economics at North Dakota State University to estimate the risk of spring planting delays and the potential revenue losses that could arise from operation of the staging area.

The most recent study examining the effects of temporary water storage on planting delays was based on the re-alignment of the FM Diversion staging area, often called 'Plan B' (Bangsund et al. 2020). The primary results presented and discussed by Bangsund et al. (2020) did not specifically quantify the acreage of prevent plant that could be attributed to the FM Diversion. The purpose of this report is to take information from the Bangsund et al. (2020) study and quantify the potential prevent plant acreage that may arise from operation of the FM Diversion staging area and also estimate the foregone input purchases as a result of prevented planting.

#### Key Inputs and Assumptions

1) A 10-day period and a 14-day period were used to represent the time necessary for the land to dry-down and complete any required clean up after being inundated, With or Without the Diversion.

2) Flood sizes included a 10-year, 20-year, 25-year, 25-year Long Flood, 25-year Extra Long Flood, 2009-like, 50-year, 100-year, 500-year, and a probabilistic maximum flood (PMF). The staging area would be activated with 25-year and larger floods.

3) If flooding occurred on any portion of a storage area, all acreage of the storage area was assumed to be affected.

4) Land rent was removed from the variable expenses.

5) No inputs were pre-purchased prior to the spring planting season (e.g., application of fall fertilizer, crop seed purchased during winter months).

6) Without provisions stipulating weed control or requirements for producers to plant a cover crop on prevent plant acres, expenses for those potential activities were not included. Including those expenses would offset some foregone production inputs.

7) Crop acreage permanently removed from production for FM Diversion infrastructure was not included.

8) Storage area DIVSA85E was not included in the analysis. If crop production is not permanently discontinued on that storage area, then 150 acres and associated lost inputs should be added to the results presented in this report.

9) The inclusion of foregone crop insurance sales were limited to the per-acre values obtained from the FINBIN farm financial database, and further limited to only those prevent plant acres created by the FM Diversion. The FINBIN values represent a composite of different coverage levels and different insurance types (e.g., multi-peril, hail only). Depending upon eligibility, some Federal crop insurance coverage may not be available for much of the staging area.

#### Results

The hydrology data used for the storage areas comprising the staging area show that not all acreage within the staging is affected by operation of the FM Diversion for any particular flood event. On lands that are adversely affected (i.e., lands that flood longer, and newly flooded land) the length of time for the effects of flooding to be over are generally insufficient to create consistently large delays in planting. Further, the combinations of a long, or late-occurring flood and relatively early planting start dates are required to produce more pronounced levels of planting delays. The risk (annual frequency) of those conditions occurring during a flood year are relatively low.

#### Prevent Plant Acreage

Prevent plant acreage was determined by looking at an average across the entire simulation (10,000 replications), 25<sup>th</sup> percentile (2,500 replications), and 5<sup>th</sup> percentile (500 replications) conditions for both the 10-day and 14-day dry down periods. The crops included were wheat, corn, and soybeans. Sugarbeets were not included in this assessment although sugarbeets are included in the simulation. The reason for excluding sugarbeets is that production is required for beet stock owners, and it is likely that acres not raised within the staging area will be moved to acreage outside the staging area.

<u>10-day Dry Down Period</u>: When all 10,000 replications (each replication represents a year) were averaged, all flood sizes except the 500-year had less than 100 acres of prevent plant attributed to the FM Diversion. The worst-case 25<sup>th</sup> percentile (2,500 replications with highest amounts out of the 10,000 replications) increased the amount of prevent plant acreage, but the increases were relatively minor except for the two largest flood events. If only the 500 worst-case conditions are considered, the 10-year through 100-year flood events still produced less than 200 acres of prevent plant attributable to operation of the Diversion. The 500-year flood would produce over 1,000 acres of prevent plant. The next two largest events for creating prevent

plant acreage were the 2009-like and PMF events, but total prevent plant was less than 400 acres for each flood.

<u>14-day Dry Down Period</u>: Increasing the dry down period from 10 days to 14 days increased the amount of prevent plant acreage in all but the smallest two flood events. However, overall thresholds were similar to the acreages observed with the 10-day dry down. When all 10,000 replications (each replication represents a simulated year) were averaged, only the 500-year and PMF had more than 100 acres of prevent plant. The worst-case 25<sup>th</sup> percentile (2,500 replications with highest amounts out of the 10,000 replications) increased the amount of prevent plant acreage, but the increases were relatively minor except for 2009-like, 500-year, and PMF events. If only the 500 worst-case conditions are considered, the 10-year through 100-year floods produce over 1,200 acres of prevent plant. The next two largest producers of prevent plant acreage were the 2009-like and PMF events, but total prevent plant was considerably lower than the 500-year event with about 450 acres for each flood.





#### Foregone Input Purchases

As expected, the overall value of crop inputs not purchased as a result of prevent plant conditions followed the pattern of prevent plant acreage. For the worst-case 25<sup>th</sup> percentile, most floods resulted in about \$25,000 of foregone input purchases with either the 10-day or 14-day dry down periods. The 2009-like and PMF produced lost inputs generally ranging from \$50,000 to \$100,000 for both dry down periods averaged for the 25<sup>th</sup> worst-case conditions. The 500-year flood increased foregone input purchases to about \$300,000.

When results were examined for only the 5<sup>th</sup> percentile of worst-case conditions, foregone crop production inputs were less than \$50,000 for the 10-year, 20-year, 25-year, 25-year Extra Long, and 50-year events. The PMF and 2009-like events had lost crop production inputs ranging from \$75,000 to \$150,000. The 500-year flood was similar in magnitude to the averages found in the quartile analysis with lost crop production inputs ranging from about \$300,000 to \$350,000 for the 10-day and 14-day dry down periods, respectively.





#### **Foregone Crop Production**

Prevent plant acres create issues for businesses selling crop production inputs and also affect grain handling businesses by reducing the volume of grain that is handled and sold by those businesses. In addition to foregone crop production on prevented planting, the FM Diversion can delay planting, resulting in lower yields. Lost crop production from switch and prevent plant acres and yield loss on land incurring planting delays were combined (Tables 24 through 26).

Ignoring the subtle differences between yields in the four counties having land in the staging area, the staging area would be expected to produce about 5.25 million bushels of grain. Crop production would increase slightly to 5.7 million bushels if corn and soybeans replaced sugarbeet acreage. The worst-case conditions for lost crop production due to the FM Diversion were found with the 500-year flood, and generally ranged from 200,000 bushels to 275,000 bushels, depending upon percentile and dry-down period. At 300,000 lost bushels, the Diversion would reduce grain production from the staging area by about 5 to 6 percent. The amount of lost grain production in smaller, more frequent floods ranged from a few thousand bushels up to 100,000 bushels, with a range of 20,000 to 50,000 bushels being the most frequent as observed in the Monte Carlo simulation. Those conditions imply the Diversion would reduce overall grain production in the staging area by roughly 0.5 percent (20,000 bushels) to about 2 percent (100,000 bushels).



### Conclusions

Spring snow melt and runoff, in most cases, occur early relative to the regional planting season. During much of a spring flood-event, no planting occurs due to snow melt and overall wet conditions. Statistical analysis of the historical data suggest there was limited overlap between spring runoff and planting.

Further adding to the analysis was the inclusion of hydrology data for the storage areas comprising the staging area. That information indicates that not all acreage within the staging is affected by operation of the FM Diversion for any particular flood event. On lands that are adversely affected (i.e., lands that flood longer, and newly flooded land) the length of time for the effects of flooding to be over are generally insufficient to create consistently large delays in planting. Further, the combinations of a long, or late-occurring flood and relatively early planting start dates are required to produce more pronounced levels of planting delays. The risk (annual frequency) of those conditions occurring during any given flood year are relatively low.

The absence of consistently large planting delays limits conditions that would produce large prevent plant circumstances. The estimated acreage of prevent plant due to the FM Diversion within the staging area was modest, even under conditions when wheat and corn acreage was not switched to soybeans. Another factor that acts to limit the overall amount of prevent plant acreage is that about 50 percent of the cropland is planted to soybeans—which are planted later in the spring, reducing the likelihood of planting delays due to the use of the staging area.

The FM Diversion could be expected, based on current data, to have minor impact on creating conditions sufficient to increase prevent planting acreage within the staging area. As a result of relatively small acreage of prevent plant created by the FM Diversion, the loss of input purchases (sales to businesses and firms in the farm service and support sectors) is also modest. Foregone crop production was estimated from both prevent plant acreage and lower yields associated with planting delays. The most likely conditions suggest the FM Diversion would affect about 0.5 to 2 percent of the staging area's total crop production.

All of the prevent plant acreage estimates were based on a single set of producers' behaviors indicating a specific action at a specific point in the planting season. While those assumptions are reasonable (see Bangsund et al. 2020 for results of focus discussion with producers) under current economic conditions and the absence of prevent plant crop insurance, the results in this assessment would change if producers react differently to delayed planting than what was modeled in the Monte Carlo simulation.

### Assessment of the Potential Prevent Plant Acreage Associated with Temporary Water Storage for the FM Diversion Staging Area

Dean A. Bangsund, Saleem Shaik, David Saxowsky, Nancy M. Hodur, and Elvis Ndembe\*

The proposed Fargo/Moorhead Area Diversion (FM Diversion) is intended to reduce the flood risk for Fargo, North Dakota, Moorhead, Minnesota and other communities in Cass County, North Dakota and Clay County, Minnesota. The project is being pursued by the Flood Diversion Board of Authority (FM Diversion Authority) in collaboration with the U.S. Army Corps of Engineers (USACE).<sup>1</sup> The FM Diversion is comprised of a water storage embankment and tie-back levies upstream of Fargo, flood protection dikes in the Fargo/Moorhead communities, and a diversion channel to route water around the Fargo/Moorhead/West Fargo metro area. The embankment, tie back levies, and natural rise in the Red River basin will create a staging area in which water will be temporarily collected during times of high flow during spring flood events.<sup>2</sup>

Current design of the FM Diversion is that temporary water storage will occur during spring flood events when the predicted flow of the Red River exceeds 21,000 cubic feet per second (cfs) in Fargo. Five flood events since 1969, all occurring in the spring, would have triggered use of the FM Diversion using that criterion. The flow of the Red River at Fargo has not exceeded 21,000 cfs more than one flood event within a year's time.

Researchers in the Department of Agribusiness & Applied Economics at North Dakota State University prepared an initial assessment in 2015 of the risk and economic effects on spring planting resulting from the proposed temporary water storage during spring flood events (Bangsund et al. 2015)<sup>3</sup>. Following completion of the initial agricultural risk assessment in 2015 and with a mandate from the North Dakota 2015 Legislature, engineers reviewed and refined hydrology data to ensure all agricultural lands affected by six inches or more of inundation during temporary water storage associated with the FM Diversion were identified and evaluated (Bangsund et al. 2016).

This study represents the third economic assessment relating to temporary water storage associated with operation of the FM Diversion. All of the methods developed in the previous assessments (Bangsund et al. 2015; 2016) were retained in this study while economic values and other parameters were updated through the most recent data.

Previous studies evaluating the risk of planting delays resulting from use of the FM Diversion's staging area were based on the original USACE design. Efforts to mitigate the upstream impacts from temporary water storage associated with the original design resulted in the staging area being moved

http://www.fmDiversion.com/pdf/StructureFeatures20140401 1117.pdf

 <sup>&</sup>lt;sup>1</sup> Additional information is available on the FM Diversion web site <u>http://www.fmDiversion.com/authority.php</u>
<sup>2</sup> Additional materials and information on the physical dimensions and placement of key elements of the FM Diversion can be found on the FM Diversion web site

<sup>&</sup>lt;sup>3</sup> Report is available at: <u>http://ageconsearch.umn.edu/bitstream/211469/2/AAE745.pdf</u>

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west from its original location, and the re-designed staging area is often referred to as 'Plan B'. This study is based on the revised (Plan B) staging area (Figure 1).



Figure 1. Storage Areas Associated With FM Diversion Staging Area, 2019 Source: Houston-Moore Group (2019).

### Analysis of Staging Area Hydrology

Data from the hydrology modeling were used to estimate the difference between the existing conditions and conditions that would be expected if the FM Diversion operated the staging area. Some storage areas naturally flood within the staging area due to proximity or elevation relative to the Red River or Wild Rice River, depending upon size of the flood event. Other storage areas would not flood with existing conditions but the staging area would create conditions where those lands would flood. Therefore, the staging area can create three general outcomes: 1) no effect, as the land either does not flood or the amount of time the land is flooded remains unchanged, 2) change in time flooded, land that would flood naturally Without the Diversion now floods longer or shorter due to the use of the staging area, or 3) new flooding, land floods With the Diversion when that land would not otherwise flood. The hydrology data provided the basis where the effects of operating the staging area could be measured for each storage area.

A critical element in understanding the potential agricultural implications of short-term water storage on farmlands in the FM Diversion staging area relates to the duration or absence of water storage within the staging area. Understanding the hydrology differences between conditions Without the Diversion and conditions created by the FM Diversion form the basis to evaluate the potential effects on spring field work.

The 241 storage areas in this study were grouped into five categories. Each category represents a different set of conditions between current hydrology and hydrology created by the FM Diversion with respect to spring flooding (Table 1).

- **Hydrology Group 1**: Storage areas that will not be flooded/inundated if the FM Diversion is operated. This outcome is due to land at a relatively high elevation in the staging area (*Does Not Flood*).
- **Hydrology Group 2**: Storage areas that will be flooded/inundated for the same duration whether or not the FM Diversion is operated; usually the lowest land in the staging area (*Floods the Same*)
- **Hydrology Group 3**: Land that will be flooded/inundated longer as a result of operating the FM Diversion (*Floods Longer*)
- **Hydrology Group 4**: Storage areas that will be flooded/inundated a shorter duration as a result of operating the FM Diversion because the features of the Diversion will drain the water away more quickly; however, the shortened storage time often is no more than a day (*Floods Shorter*)
- **Hydrology Group 5**: Storage areas that do not flood, but will be flooded/inundated With the FM Diversion (*New Flooding*)

The 241 storage areas will not necessarily be in the same hydrology group for all 10 flood event sizes. A storage area with a relatively low elevation (e.g., 909 ft msl) may be in Group 3 for most flood events, meaning it would flood With or Without the Diversion but floods longer With the Diversion. A storage area with a relatively high elevation (e.g., 925 ft msl) may be in Group 1 for most flood events, meaning that it would not be inundated regardless of the FM Diversion except for very large flood events. A storage area with a mid-elevation (e.g., 919 ft msl) may be in Group 3 during a large flood event, Group 5 in a moderate flood event, and Group 1 during a small flood event.

Table 1. Description of General Hydrology Conditions for Storage Areas			
Within the FM Diversion Staging Area			
Hydrology	Description With Existing		
Group	Conditions	Effects of the FM Diversion <sup>a</sup>	
1	Does not flood	Does not flood	
2	Already floods	Flood duration is unchanged	
3	Already floods	Flood duration is longer	
4	Already floods	Flood duration is shorter	
5	Does not flood	Will now flood With	
		Diversion	
<sup>a</sup> The flooding effects of operating the FM Diversion do not necessarily imply all acreage			
within that storage area is inundated.			

Relating to the timing of spring planting, land contained within Hydrology Groups 3 and 5 are the only storage areas that incur adverse economic effects from the operation of the Diversion staging area and are likely to receive the greatest attention during policy discussions and debates. For most practical purposes dealing with spring planting and flooding activity, storage areas in Groups 1, 2 and 4 are not meaningfully impacted by the operation of the Diversion.

**\*\*\***NOTE: Crop land in hydrology groups 1, 2, and 4 can still incur planting delays and have prevent plant conditions in flood years. However, the hydrology data is showing that those planting conditions are not created by the operation of the Diversion.**\*\*\*** 

The timing and duration of water inundation varies considerably among the storage areas for each of the 10 flood event sizes. In a 10-year flood event, over 77 percent of the acreage as defined by the 241 storage areas is not inundated, whereas in a 500-year flood event only 3 percent of the acreage is not inundated (Table 2). Storage areas that either flood the same duration or flood with less duration With the FM Diversion (Hydrology Groups 2 and 4, respectively) comprise 19 percent of acreage in a 10-year event. That share increases to 45 percent in a 500-year event. Storage areas in Hydrology Groups 3 and 5 (lands that are inundated longer or lands that flood as a result of the Diversion) comprise about 4 percent of the staging area in a 10-year flood but comprise around 50 percent of the acreage in 50-year, 100-year, and 500-year events. (Appendix A contains detailed information on the hydrology groups for the 10 flood events).

The length of time from activation of the staging area until water leaves a storage area varies among the hydrology groups for any particular flood event, and also varies across the 10 flood event sizes for each of the hydrology groups (Table 3). For example, the average length of time from activation of the staging area until water leaves storage areas in Hydrology Group 2 (flood duration is the same) ranges from 4.5 days in a 25-year flood event to 18 days in a 100-year flood event.

Table 2.	2. Acreage of Hydrology Groups, by Size of Flood, Operation of the FM Diversion Staging Area									
									25-year E	xtra Long
	10-year	r Event	20-year	r Event	25-year	25-year Event 25-year Long Event		Eve	ent	
		Percent		Percent		Percent		Percent		Percent
Group	Acres	of Total	Acres	of Total	Acres	of Total	Acres	of Total	Acres	of Total
1 <sup>a</sup>	42,093	77.6	26,264	48.1	19,071	36.1	12,042	25.3	12,042	25.3
2ª	8,210	15.8	13,483	24.9	5,752	7.0	12,082	19.9	15,878	30.7
3ª	908	2.5	7,032	17.4	23,277	46.5	23,657	42.3	12,360	23.6
<b>4</b> <sup>a</sup>	2,155	2.9	5 <i>,</i> 384	6.7	0	0	1,865	2.5	9,366	10.4
5 <sup>a</sup>	1,115	1.2	2,318	2.9	6,381	10.4	4,835	10.0	4,835	10.0
Total <sup>b</sup>	54,481	100	54,481	100	54,481	100	54,481	100	54,481	100
	2009 lik	e Event	50-year	r Event	100-yea	r Event	500-yea	r Event	PMF E	Event
		Percent		Percent		Percent		Percent		Percent
Group	Acres	of Total	Acres	of Total	Acres	of Total	Acres	of Total	Acres	of Total
1 <sup>a</sup>	6,665	11.6	11,086	24.1	6,316	11.6	2,302	2.9	0	0.0
2 <sup>a</sup>	16,971	33.2	11,257	17.0	15,942	29.5	18,724	36.5	22,414	39.0
3 <sup>a</sup>	16,010	35.3	17,126	36.9	16,076	31.5	23,461	49.4	13,636	29.9
4 <sup>a</sup>	11,220	12.0	9,605	10.4	9,773	12.9	7,376	8.7	18,432	31.1
5 <sup>a</sup>	3,617	1.9	5,137	11.6	6,374	14.5	2,618	2.5	0	0.0
Total <sup>b</sup>	54481	100	54481	100	54481	100	54,481	100	54,481	100

PMF = probabilistic maximum flood.

<sup>a</sup>Group 1 represents land that does not flood With Diversion. Group 2 represents land that floods for the same duration. Group 3 represents lands that flood longer With the Diversion. Group 4 represents lands where inundation is shorter With the Diversion. Group 5 represents lands that now flood With Diversion would otherwise not flood. Not all acres within storage areas for Groups 2, 3, 4, and 5 will be inundated.

<sup>b</sup>Based on total acreage of the 241 storage areas.

Source: Houston-Moore Group (2019).

# Table 3. Days from Staging Activation until Water Leaves the Storage Area, Average of All StorageAreas Within Each Hydrology Group for Each Flood Event

	r Each riga									
							25-yeai	<sup>r</sup> Long	25-year	Extra
Hydrology	10-year	Event	20-year	Event	25-year	Event	Eve	nt	Long E	vent
Group	WO	W	WO	W	WO	W	WO	W	WO	W
					day	s				
1	0	0	0	0	0	0	0	0	0	0
2	4.9	4.9	6.1	6.1	6.4	6.4	13.5	13.5	18.9	18.9
3	4.3	4.8	7.1	9.0	7.4	9.6	10.6	12.4	14.6	17.2
4	4.2	2.1	6.9	6.0	na	na	7.8	6.1	15.6	14.1
5	0	17.6	0	8.5	0	7.5	0	7.8	0	9.8
Hydrology	2009 like	e Event	50-year	Event	100-yea	<sup>r</sup> Event	500-yea	r Event	PMF E	vent
Group	WO	W	WO	W	WO	W	WO	W	WO	W
					day	′S				
1	0	0	0	0	0	0	0	0	0	0
2	20.4	20.4	13.0	13.0	17.7	17.7	32.4	32.4	35.5	35.5
3	6.9	10.2	9.2	11.7	10.3	13.3	22.3	24.7	20.9	22.5
4	16.3	14.9	14.7	13.4	17.8	16.3	21.7	19.0	44.9	42.1
5	0	7.5	0	8.9	0	9.5	0	12.5	0	0
WQ = Without Diversion and W = With Diversion. PMF = probabilistic maximum flood.										
Source: Houste	Source: Houston-Moore Group (2019)									

\*\*\*This study is only concerned with the difference in when water leaves the storage area between the Without Diversion and With Diversion conditions. \*\*\* The difference between the Without Diversion and With Diversion conditions excluding dry down, averaged across all storage areas within a hydrology group, varies from zero days for Hydrology Group 2 in all events to 17.5 days for Hydrology Group 5 in a 10-year event (Table 3)<sup>4</sup>. The large difference in days for Group 5 in a 10-year event is due to one storage area. Crop production on that storage area is unlikely, and with few other Group 5 storage areas in that category in a 10-year event, the difference in days is largely due to the extremely long water retention in that one storage area (see details for DIVSA85E in Appendix A).

In Hydrology Group 3, the net difference in time for water to leave the land ranges from 0.3 days in the 2009-like flood event to 3 days in a 100-year flood event. The Diversion is expected to add less than 3 days for water to leave the land for Hydrology Group 3 in the other 9 flood events. Hydrology Group 5 has the largest difference, with no flooding Without the Diversion to having 9 to 12 days from staging area activation until water leaves the land in 4 of the 10 flood events (Table 3).

Table 3 represents the average of all storage areas within each of the five hydrology groups for each of the flood event sizes; some storage areas will experience longer periods for flood waters to leave while others within the same hydrology group will experience shorter periods. Detailed hydrology data for all 241 storage areas is contained in Appendix A.

\*\*\* An important clarification is that some storage areas within certain hydrology groups will be inundated longer than storage areas in other hydrology groups, and that the classification of the storage areas is based on the type of effects created by the Diversion, not based on how long the water is on the land or how long it takes for the water to leave the land. \*\*\* For example, a storage area in Hydrology Group 2 that floods the same duration (e.g., 12 days Without and 12 days With Diversion) may be inundated for a longer period than a storage area in Hydrology Group 3 that now floods longer With the Diversion (e.g., from 8 days of inundation Without Diversion to 10 days of inundation With Diversion).

Based on hydrology data representing HEC-RAS 9.1 CLOMAR modeling<sup>5</sup>, the acreage of land inundated with use of the staging area varies by frequency or size of flood event (Table 4). The hydrology modeling estimates the amount of acreage that would flood with the operation of the Diversion and acreage that would flood naturally with existing conditions. Very little additional flooding occurs within the staging area for a 10-year event With the Diversion. However, for the other flood events, inundated acreage With the Diversion varies from about 13,000 acres for a 20-year event to 51,500 acres for the PMF event (Table 4). By contrast, under existing conditions about 11,400 acres would be naturally flooded with a 20-year event and 49,000 acres would be flooded with a PMF event.

<sup>&</sup>lt;sup>4</sup> One storage area, DIVSA85E, is primarily responsible for the large difference in total days between With and Without Diversion conditions in the 10-year flood event. That storage area shifts to Hydrology Group 3 in the 9 larger flood events. Therefore, the average of storage areas in Hydrology Group 5 for the 10-year flood event are skewed as a result of the conditions in that storage area. Appendix A contains detailed hydrology data for each storage area, and that information can be used to evaluate conditions for any single storage area in the FM Diversion staging area.

<sup>&</sup>lt;sup>5</sup> Houston-Moore Group. Hydrologic Engineering Center - River Analysis System, modeling version 9.1. (2019)

Table 4. Acreage Inundated by Spring Flood Events, by Flood Frequency, With and Without							
FM Diversion Staging Area							
Estimated Acreage of Land							
	Inund	ated <sup>a</sup>	Percentage of Acr	Percentage of Acreage Inundated <sup>b</sup>			
	With Use of FM	With Existing	With Use of FM	With Existing			
Flood	Diversion	Conditions	<b>Diversion Staging</b>	Conditions			
Event	Staging Area	(no Diversion)	Area	(no Diversion)			
10-Yr	4,464	4,423	8.2	8.1			
20-Yr	13,021	11,395	23.9	20.9			
25-Yr	17,943	12,861	32.9	23.6			
25-Yr LF	22,546	17,166	41.4	31.5			
25-Yr ELF	22,864	17,188	42.0	31.5			
2009-like	29,214	20,833	53.6	38.2			
50-Yr	24,399	17,486	44.8	32.1			
100-Yr	31,649	20,975	58.1	38.5			
500-Yr	45,960	39,725	84.4	72.9			
PMF	PMF 51,573 49,102 94.7 90.1						
PMF = probabilistic maximum flood.							
<sup>a</sup> Only acreage submerged by water.							
<sup>b</sup> Based on acreage of 54,481 for defined staging area. Acreage affected by flooding will likely be greater than							

acreage of land inundated/flooded.

Source: Houston-Moore Group (2019).

The hydrology modeling also can show the duration of flooding changes for storage areas inside the staging area. The 10-year event had little difference in the duration of flooding based on acreage of affected storage areas inside the staging area; however, about 16,000 to 23,500 acres associated with storage areas would flood longer with use of the staging area in the 100-year and 500-year events, respectively (Table 5). In some cases, the duration of flooding would be less with use of the staging area due primarily to improved water flow as a result of the Diversion channel, modified culverts, and/or other water conveyance features. About 2,200 acres with the 10-year event and about 7,400 acres with the 500-year event would experience a shorter flood inundation With the Diversion (Table 5). Hydrology modeling indicated that improved hydrology implemented within the staging area would reduce flood durations on over 11,000 acres in a 2009-like flood event and 18,000 acres in a PMF event.

With a 25-year event With the Diversion, the engineering data estimate that 23,300 affected acres would store water longer and 6,400 affected acres would store water that otherwise would not store water. With a 50-year event, the Diversion would cause 17,100 affected acres to store water longer and 5,100 affected acres would store water that would not otherwise be inundated. Table 4 represents flooded acreage, but this study used affected acreage (i.e., all acreage within a storage area) as represented in Tables 5 and 6.

Table E. Difference in Storage Area Acroage affected by Spring Elead Events, by Elead Events							
Table 5. Difference in Storage Area Acreage affected by Spring Flood Events, by Flood Frequency,							
With and Without Five Diversion Staging Area							
	r Inundation <sup>a</sup>						
	Acreage of Storage		Storage Areas				
	Areas <u>NOW</u>	Storage Areas	where Inundation	Storage Areas			
	FLOODED Due to	where Inundation	is <u>LONGER</u> with	where Inundation			
	Use of Staging	is the <u>SAME</u> with	Use of Staging	is <u>SHORTER</u> with			
Flood Event	Area <sup>b</sup>	Use of Staging Area	Area	Use of Staging Area			
	(Group 5)	(Group 2)	(Group 3)	(Group 4)			
		асі	res				
10-Yr	1,115	8,210	908	2,155			
20-Yr	2,318	13,483	7,032	5,384			
25-Yr	6,381	5,752	23,277	0			
25-Yr LF	4,835	12,082	23,657	1,865			
205-Yr ELF	4,835	15,878	12,360	9,366			
2009-like	3,617	16,971	16,010	11,220			
50-Yr	5,137	11,527	17,126	9,605			
100-Yr	6,374	15,942	16,076	9,773			
500-Yr	2,618	18,724	23,461	7,376			
PMF	0	22,414	13,636	18,432			
PMF = probabilistic maximum flood.							

<sup>a</sup> Based on how many days flood water remains on the land.

<sup>b</sup> Only acreage of the 241 storage areas. Not all acres within storage areas will be inundated for any particular flood event. Source: Houston-Moore Group (2019).

Table 6. Total Acreage of Storage Areas affected by Spring Flood Events, by Flood							
Frequency, With and Without FM Diversion Staging Area							
Total Acreage of Storage Areas							
	having Some Sp	Percentage of Acreage Affected <sup>a</sup>					
	With Use of FM	With Existing	With Use of FM	With Existing			
Flood	Diversion	Conditions	<b>Diversion Staging</b>	Conditions			
Event	Staging Area	(no Diversion)	Area	(no Diversion)			
10-Yr	12,388	11,273	22.7	20.7			
20-Yr	28,217	25,899	51.8	47.5			
25-Yr	35,411	29,030	65.0	53.3			
25-Yr LF	42,439	37,604	77.9	69.0			
25-Yr ELF	42,439	37,604	77.9	69.0			
2009-like	47,817	44,200	87.8	81.1			
50-Yr	43,396	38,258	79.7	70.2			
100-Yr	48,165	41,791	88.4	76.7			
500-Yr	52,179	49,561	95.8	91.0			
PMF	PMF 54,481 54,481 100 100						
PMF = probabilistic maximum flood.							
<sup>a</sup> Based on the 241 storage areas encompassing 54,481 acres.							
Source: Houston-Moore Group (2019).							

#### Storage Area versus Land Inundated

Land associated with the FM Diversion can be measured by acreage actually flooded and acreage affected by flooding. In this study, *flooded acreage* represents land that will be submerged or inundated with temporary water and *affected acreage* represents the size of the storage area that contains flooded land (Figure 2). Due to varying elevations, the *acreage affected* by temporary water storage is likely to be greater than the acreage of land that temporarily holds flood water (Table 6). Appendix A contains maps illustrating the *flooded acreage* within the 241 storage areas by size of flood event.

The economic analysis did not distinguish between the amount of flooded acreage within a storage area and the total acreage of the storage area. This study assumes any flooding within a storage area results in the entire storage area being affected. Flooding of land often affects access and/or use of adjacent or nearby lands. The extent or degree to which additional land is affected by flooding within any particular storage area will vary based on a number of factors. While this overall assumption results in a conservative estimate of the acreage affected by temporary water storage, data to refine these assumptions were not available. Including all acreage of a storage area that has some inundation does not influence the per-acre revenue losses estimated in the study.



Figure 2. Conceptual Examples of Potential Land Inundation and Storage Area Size, FM Diversion Staging Area.

Determining the extent that inundated acreage affects non-inundated acreage, from a production agriculture perspective, was beyond the scope of this study. Factors associated with accessibility (e.g., surrounding water prevents, blocks, or delays access to non-flooded land) and farmability (e.g., producer may choose to delay planting until all or a large majority of the acres are fit to plant even though not all acres were inundated) are covered by using the acreage of the entire storage area. Further evaluation of the hydrology, land accessibility, producer planting preferences, and land ownership within the staging area would be required to refine the amount of acreage not inundated but affected by temporary water storage.

#### Dry-down Periods

Inundated land needs time to dry after water recedes. Although the time necessary for drydown will vary based on temperature, wind, precipitation, soil type, fall tillage, and cloud cover, the study used a 10-day and 14-day dry-down and clean-up (e.g., remove or disperse debris) period after the water leaves the land. The dry down period (i.e., 10 days, 14 days) is added to all storage areas that have inundation for either the Without Diversion or With Diversion conditions. The only hydrology group where the additional 10-days or 14-days of dry-down are the result of the Diversion is Hydrology Group 5. For all storage areas in Group 5, the Diversion creates a potential delay equal to the days from staging activation until the water recedes plus additional days (either 10 or 14) for the land to dry out.

Hydrology Groups 2, 3, and 4 also will require a dry-down period before planting, but the drydown period is not an impact attributable to the Diversion. For example, if a storage area floods for 8 days With the Diversion and floods for 8 days Without the Diversion (Group 2), the 10 or 14 days of drydown would have occurred in the absence of the Diversion. Even in situations when the Diversion results in inundation that extends beyond inundation with existing conditions, the Diversion would be responsible for the additional days for the water to leave the land, but not the 10- or 14-day dry-down period.

By placing the hydrology data into a timeline and adding time required for the land to dry out, the study can begin to assess potential planting delays. Bangsund et al. (2020) provides discussion and examples of how the hydrology data was placed into a timeline, and combined with a Monte Carlo simulation that uses historical data on regional planting start dates, regional planting completion rates, and dates when past spring floods have reach sufficient size to trigger use of the Diversion.

### Parameters for Analysis of Prevent Plant and Lost Input Purchases

Three scenarios were used to provide a range of potential prevent plant acreage and corresponding loss of crop production inputs resulting from those prevent plant acres. All three scenarios rely on data produced by the study examining planting delays relating to the operation of the FM Diversion (Bangsund et al. 2020).

**Scenario 1:** This condition treats all wheat and corn acreage not planted by the corresponding switch date into 20 percent unplanted (PP) and 80 percent switched to soybeans. All soybean acreage not planted by the date used by Federal Crop Insurance was considered unplanted. The premise of this scenario is that in the absence of Federal Crop Insurance (or a similar financial tool), enabling producers to claim prevented planting, producers would look to plant most of their potential corn and wheat prevent plant acres to soybeans. Understanding that not all wheat and corn acreage will be capable of being switched undermines only placing 80 percent of those acres into soybeans. The remaining 20 percent of wheat and corn acres were not switched to another crop. This scenario represents a reasonable estimate of potential lost inputs due to prevent plant conditions without prevent plant insurance coverage since the majority of potential PP acres are switched to soybeans.

**Scenario 2:** This condition uses the same data as scenario 1, except instead of switching 80 percent of wheat and corn potential prevent plant acreage to soybeans, that 80 percent is placed into prevent plant. Therefore, 100 percent of acres of wheat and corn that remain unplanted by the switch date are treated as prevent plant.

**Scenario 3:** An alternative condition postulates that the risk of delayed planting on sugarbeet acreage within the staging area is sufficient to move or shift those acres to lands outside of the staging area. This scenario assumes corn and soybeans would be raised on the vacated sugarbeet acres. The amount of wheat raised in the staging area was assumed to be unchanged. The increase in corn and soybean acres receive the same prevent plant conditions found in the Monte Carlo simulation and are subject to the same prevent plant rules found in Scenario 2. This scenario represents a potential worse-case condition with respect to the volume of inputs not purchased do to prevent plant conditions created by the FM Diversion.

#### Treatment of Input Purchases

The FINBIN farm financial database was used to estimate the per-acre variable expenses for wheat, corn, and soybeans for the staging area (Appendix B). Several specific conditions were used in the analysis.

- 1) Land rent was removed from the variable expenses.
- 2) No inputs were pre-purchased prior to the spring planting season (e.g., application of fall fertilizer, crop seed purchased during winter months).
- Without provisions stipulating weed control or requirements for producers to plant a cover crop on prevent plant acres, expenses for those potential activities were not included. Including those expenses would offset some foregone production inputs.

In Scenario 1, lost inputs were adjusted for switch acres since per-acre variable expenses for wheat and corn were higher than soybeans (Appendix B). Inputs not purchased on the switch acres represented the different between wheat and soybean and corn and soybean variable expenses for affected acres. Therefore, switch acres are modeled to have foregone input purchases even though those acres were planted to soybeans.

#### Key Omissions

With respect to measuring the potential foregone input purchases created by operation of the FM Diversion, the following considerations were not included in the analysis.

- 1) Crop acreage permanently removed from production for FM Diversion infrastructure.
- 2) Storage area DIVSA85E. Hydrology data for that storage area suggests low probability that crop production would occur on that storage area, regardless of flood event size. It was assumed that the 150-acre storage area would likely represent a permanent removal from crop production. If crop production is not permanently discontinued on that storage area, then 150 acres and associated lost inputs should be added to the results presented in this report.
- 3) The inclusion of foregone sales of crop insurance was limited to the per-acre values obtained from the FINBIN farm financial database, and further limited to only those prevent plant acres created by the FM Diversion. The FINBIN values represent a composite of different coverage levels and different insurance types (e.g., multi-peril, hail only).

The current (January 2020) understanding is that producers would be ineligible for Federal prevent plant crop insurance coverage on lands within the staging area, or at least lands inundated from operation of the FM Diversion; however, producers may be eligible to obtain hail insurance or other multi-peril coverage that does not include prevent plant provisions. Therefore, the net effect of operating the staging area on the volume of crop insurance sales is not clear, and will probably be not fully understood until specific rules regarding eligibility are developed.

This assessment only includes lost insurance sales on lands subject to prevent plant. The larger issue with crop insurance is the volume of acreage within the staging area that would be ineligible for Federal prevent plant insurance. Regardless of the type of flooding effect created by the FM Diversion, during a flood year, the volume of lost sales for prevent plant insurance will more closely approximate the size of the staging area and not just affected acres. This condition greatly expands the amount of lost crop insurance sales since the staging area comprises over 54,000 acres and in most floods, a sizeable amount of that acreage is inundated with flood waters, even if that inundation is not directly created by the FM Diversion. Therefore, sales of some Federal crop insurance coverage(s) could likely be more aligned with location of acreage within the staging area, and not associated with how the FM Diversion affects flooding on those lands.

#### Results

Prevent plant acres and switch acres were estimated across 10,000 replications from the Monte Carlo simulation for both Without and With Diversion conditions for 10-day and 14-day dry down periods for all 10 flood events (Tables 7 through 16). Each replication of the simulation represents an annual combination of flood start date, planting rate, and planting start date combined with information on hydrology conditions within individual storage areas.

#### Average Conditions

Averaged across all replications, operation of the FM Diversion has little effect on the amount of prevent plant acreage (Tables 7 through 16). The primary reason for the relatively small additional increase in prevent plant acreage is due to the stochastic distribution of data used in the Monte Carlo simulation (i.e., regional planting dates, flood start dates) and the hydrology data. A number of combinations within the simulation do not produce any prevent plant acreage, and those replications with zero prevent plant acres are averaged with replications that contain some prevent plant acreage created by the FM Diversion. These conditions lower the average across the simulation.

In the 10-year and 20-year flood events, the FM Diversion does not operate the staging area, and any planting delays relating to the "With Diversion" conditions are due to the presence of the FM Diversion infrastructure, such as the retention embankment and control structures. As flood size increases, the amount of land inundated increases and the potential for planting delays also increases.

In nearly all conditions, the additional prevent plant acreage created by the FM Diversion is small in both relative terms and in absolute values when compared to the total prevent plant acreage in the staging area. On average for flood years large enough to trigger use of the staging area, prevent plant acreage is likely, but the hydrology data are suggestive that the relatively small additional time for inundated lands to become ready to plant is not creating substantial planting delays, acting to minimize the acreage of prevent plant attributable to the FM Diversion.

While no business wants to forego sales due to prevent plant conditions (either natural or manmade), the amount of foregone input purchases are extremely low compared to the collective amount of input purchases expected for the entire staging area. The entire staging area is defined as encompassing about 54,500 acres, with this analysis assuming all of those acres are tillable (i.e., excluding storage area DIVSA85E). Subtracting for the one storage area unlikely to be placed into crop production means effective crop acreage is about 54,350 acres. Wheat represents about 4 percent of those acres, corn at 44 percent, and soybeans at 52 percent, assuming no sugarbeet acreage within the staging area. Using information in Appendix B, 54,350 acres translates into an approximate total input purchase of \$13.6 million per year using current input practices and prices. The worst-case condition evaluated in this assessment was the 5<sup>th</sup> percentile for a 500-year event with a 14-day dry down period, which indicated the FM Diversion would add an additional 1,400 acres of prevent plant in the staging area. The lost inputs on those acres would represent about \$350,000 or 2.5 percent of total potential input purchases. The 5<sup>th</sup> percentile means a 5 percent chance of occurrence. A 500-year event has a 0.2 percent annual probability of occurrence.

Table 7. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and Corn, Average of Entire Simulation, Difference between Without and With Diversion Conditions, 10-year						
Flood Event, 10-day and 14-day Dry Down Periods Scenario and Treatment of Crop Acres not Planted by Switch Date						
	Baseline with No No Sugarbeets in					
	Baseline	Switch Acres	Staging Area			
	20% of Acres to PP &	No Switch crops	No Switch Crops			
	80% of Acres to Switch	100% of Acres to	100% of Acres to			
Dry Down Period	Crop	PP	PP			
	Av	erage of 10,000 Replica	tions			
<u>10-day Dry Down Period</u>	With Existing	Conditions (Without	Diversion)			
Prevent Plant Acres	271.4	290.5	317.6			
Switch Acres	19.1	0.0	0.0			
Total	290.5	290.5	317.6			
		With Diversion				
Prevent Plant Acres	271.4	290.5	317.6			
Switch Acres	19.1	0.0	0.0			
Total	290.5	290.5	317.6			
	Diffe	erence Due to Diversio	on			
Prevent Plant Acres	0	0	0			
Switch Acres	0	0	0			
lotal	0	0	0			
14-day Dry Down Period						
14-day Dry Down Period	With Existing	Conditions (Without	Diversion)			
Prevent Plant Acres	271 5	291 0	318.3			
Switch Acres	10 5	251.0	0.0			
Total	291.0	291.0	318.3			
		With Diversion				
Prevent Plant Acres	271.5	291.0	318.3			
Switch Acres	19.5	0.0	0.0			
Total	291.0	291.0	318.3			
	Diffe	erence Due to Diversio	on 2			
Prevent Plant Acres	0	0	U			
Total	U	0	U			
TULAI	U	0	U			

Table 8. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and Corn,						
Average of Entire Simulation, Difference between Without and With Diversion Conditions, 20-year Flood Event, 10-day and 14-day Dry Down Periods						
Scenario and Treatment of Crop Acres not Planted by Switch Date						
	Decelies	Baseline with No	No Sugarbeets in			
	Baseline	Switch Acres	Staging Area			
	20% of Acres to PP &					
	80% of Acres to Switch	100% of Acres to	100% of Acres to			
Dry Down Period	Crop	PP	PP			
	Av	erage of 10,000 Replica	tions			
<u>10-day Dry Down Period</u>						
	With Existing	Conditions (Without	Diversion)			
Prevent Plant Acres	271.5	291.1	318.4			
Switch Acres	19.6	0.0	0.0			
Total	291.1	291.1	318.4			
		With Diversion				
Prevent Plant Acres	271.6	291.7	319.0			
Switch Acres	20.1	0.0	0.0			
Total	291.7	291.7	319.0			
	Difference Due to Diversion					
Prevent Plant Acres	0.1	0.6	0.6			
Switch Acres	0.5	0.0	0.0			
Total	0.6	0.6	0.6			
<u>14-day Dry Down Period</u>		o 1911 (1449)				
	With Existing	Conditions (Without)	Diversion)			
Prevent Plant Acres	272.2	294.3	321.9			
Switch Acres	22.1	0.0	0.0			
Total	294.3	294.3	321.9			
		With Diversion				
Prevent Plant Acres	272.7	296.7	324.6			
Switch Acres	24.0	0.0	0.0			
Total	296.7	296.7	324.6			
	Diffe	rence Due to Diversio	n			
Prevent Plant Acres	0.5	2.4	2.7			
Switch Acres	1.9	0.0	0.0			
lotal	2.4	2.4	2./			
Average of Entire Simulation, Difference between Without and With Diversion Conditions, 25-year						
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Flood Event, 10-day and 14	4-day Dry Down Periods					
Scenario and Treatment of Crop Acres not Planted by Switch Date						
	Baseline	Baseline with No	No Sugarbeets in			
		Switch Acres	Staging Area			
	20% of Acres to PP & 80%	100% of Acres to	100% of Acres to			
Dry Down Period	of Acres to Switch Crop	PP	PP			
	Av	erage of 10,000 Replica	tions			
<u>10-day Dry Down Period</u>						
	With Existing (	Conditions (Without D	Diversion)			
Prevent Plant Acres	271.6	291.7	318.9			
Switch Acres	20.0	0.0	0.0			
Total	291.7	291.7	318.9			
		With Diversion				
Prevent Plant Acres	271.8	292.6	319.9			
Switch Acres	20.8	0.0	0.0			
Total	292.6	292.6	319.9			
	Differ	ence Due to Diversior	า			
Prevent Plant Acres	0.2	0.9	1.0			
Switch Acres	0.7	0.0	0.0			
Total	0.9	0.9	1.0			
<u>14-day Dry Down Period</u>						
	With Existing (	Conditions (Without D	Diversion)			
Prevent Plant Acres	272.8	296.9	324.6			
Switch Acres	24.1	0.0	0.0			
Total	296.9	296.9	324.6			
		With Diversion				
Prevent Plant Acres	273.7	301.1	329.2			
Switch Acres	27.4	0.0	0.0			
Total	301.1	301.1	329.2			
	Differ	ence Due to Diversior	า			
Prevent Plant Acres	0.9	4.2	4.6			
Switch Acres	3.3	0.0	0.0			
Total	4.2	4.2	4.6			

Table 9. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and Corn,

Table 10. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and				
Corn, Average of Entire Simulation, Difference between Without and With Diversion Conditions,				
25-year Long Flood Event, 10-day and 14-day Dry Down Periods				
	Scenario and Treatment of Crop Acres not Planted by Switch Date			
	Baseline	Baseline with No	No Sugarbeets in	
		Switch Acres	Staging Area	
	20% of Acres to PP &	1000/	1000/	
Dry Down Poriod	80% of Acres to Switch	100% of Acres to	100% of Acres to	
Dry Down Period	Стор	PP	tions	
10-day Dry Down Period	AV	erage of 10,000 Replica	tions	
10-day bry bownrenod	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	299.6	379.3	412.9	
Switch Acres	79.7	0.0	0.0	
Total	379.3	379.3	412.9	
		With Diversion		
Prevent Plant Acres	303.3	388.9	423.3	
Switch Acres	85.6	0.0	0.0	
Total	388.9	388.9	423.3	
	Diffe	erence Due to Diversio	on	
Prevent Plant Acres	3.7	9.6	10.3	
Switch Acres	5.9	0.0	0.0	
Total	9.6	9.6	10.3	
14 day Dry Day Pariad				
14-day Dry Down Period	With Existing	Conditions (Without		
Prevent Plant Acres			401.2	
Switch Acros	319.0	442.3	481.2	
Total	123.3	0.0	0.0	
Total	442.5	442.5 With Diversion	401.2	
Prevent Plant Acres	377 3	Δ52 Δ	492.2	
Switch Acres	130.1	-32.4	-52.2	
Total	452.4	452.4	492.2	
	Diffe	erence Due to Diversio	on	
Prevent Plant Acres	3.3	10.2	11.0	
Switch Acres	6.9	0.0	0.0	
Total	10.2	10.2	11.0	

Table 11. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and				
Corn, Average of Entire Sim	ulation, Difference betweer	Without and With Di	iversion Conditions,	
25-year Extra Long Flood Event, 10-day and 14-day Dry Down Periods				
Scenario and Treatment of Crop Acres not Planted by Switch Date				
	Pacolino	Baseline with No	No Sugarbeets in	
	Daseinie	Switch Acres	Staging Area	
	20% of Acres to PP &			
	80% of Acres to Switch	100% of Acres to	100% of Acres to	
Dry Down Period	Сгор	PP	PP	
	Av	erage of 10,000 Replica	tions	
10-day Dry Down Period				
	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	312.9	446.0	486.2	
Switch Acres	133.1	0.0	0.0	
Total	446.0	446.0	486.2	
		With Diversion		
Prevent Plant Acres	317.2	459.7	501.0	
Switch Acres	142.5	0.0	0.0	
Total	459.7	459.7	501.0	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	4.3	13.7	14.8	
Switch Acres	9.5	0.0	0.0	
Total	13.7	13.7	14.8	
<u>14-day Dry Down Period</u>				
	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	395.0	723.1	787.3	
Switch Acres	328.1	0.0	0.0	
Total	723.1	723.1	787.3	
		With Diversion		
Prevent Plant Acres	403.2	749.7	816.1	
Switch Acres	346.5	0.0	0.0	
Total	749.7	749.7	816.1	
	Difference Due to Diversion			
Prevent Plant Acres	8.2	26.6	28.9	
Switch Acres	18.4	0.0	0.0	
Total	26.6	26.6	28.9	

Table 12. Prevent Plant Ac	Table 12. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and			
Corn, Average of Entire Simulation, Difference between Without and With Diversion Conditions,				
50-year Flood Event, 10-day and 14-day Dry Down Periods				
Scenario and Treatment of Crop Acres not Planted by Switch Date				
	Baseline	Baseline with No	No Sugarbeets in	
		Switch Acres	Staging Area	
	20% of Acres to PP &			
	80% of Acres to Switch	100% of Acres to	100% of Acres to	
Dry Down Period	Сгор	РР	РР	
	Av	erage of 10,000 Replica	tions	
10-day Dry Down Period	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	279.1	321.4	350.9	
Switch Acres	42.3	0.0	0.0	
Total	321.4	321.4	350.9	
		With Diversion		
Prevent Plant Acres	279.3	322.8	352.4	
Switch Acres	43.4	0.0	0.0	
Total	322.8	322.8	352.4	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	0.3	1.4	1.5	
Switch Acres	1.1	0.0	0.0	
Total	1.4	1.4	1.5	
<u>14-day Dry Down Period</u>				
Durant Diant Arnes	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	294.4	378.4	412.9	
Switch Acres	84.0	0.0	0.0	
Total	378.4	378.4	412.9	
		With Diversion	440.2	
Prevent Plant Acres	295.7	384.3	419.3	
Switch Acres	0.88 2.94 2	0.0	0.0	
IULAI	384.3 Diffa	384.3 ranca Dua ta Divarcia	419.3	
Provent Plant Acres	Dine		ы БЛ	
Switch Acres	1.5	0.0	0.4	
Total	4.7 5 Q	5 Q	6.4	
1000	5.5	5.5	0.7	

Table 13. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and				
Corn, Average of Entire Simulation, Difference between Without and With Diversion Conditions,				
100-year Flood Event, 10-day and 14-day Dry Down Periods				
	Scenario and Treatment of Crop Acres not Planted by Switch Date			
	Baseline	Baseline with No	No Sugarbeets in	
	200/ of Aeros to DD 9	Switch Acres	Staging Area	
	20% of Acres to PP &	1000/ of Acrosta	100% of Across to	
Dry Down Period	00% OF ACTES to Switch	DD DD	DD DD	
Dry Down renou	ορ	verage of 10 000 Replica	tions	
10-day Dry Down Period				
<u>10 ddy bry bounnenou</u>	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	336.8	492.9	535.8	
Switch Acres	156.1	0.0	0.0	
Total	492.9	492.9	535.8	
		With Diversion		
Prevent Plant Acres	337.7	496.5	539.7	
Switch Acres	158.8	0.0	0.0	
Total	496.5	496.5	539.7	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	0.8	3.6	3.9	
Switch Acres	2.8	0.0	0.0	
Total	3.6	3.6	3.9	
14 day Dry Dayy David				
14-day Dry Down Period	With Existing	Conditions (Without		
Brovent Plant Acros	207 7			
Switch Acros	507.7 27E 1	002.7	720.0	
Switch Acres	2/5.1	0.0	0.0 720 C	
Total	662.7	002.7 With Diversion	720.6	
Prevent Plant Acres	390.6	675.3	734.3	
Switch Acres	284.7	0.0	0.0	
Total	675.3	675.3	734.3	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	2.9	12.6	13.7	
Switch Acres	9.6	0.0	0.0	
Total	12.6	12.6	13.7	

Table 14. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and				
Corn, Average of Entire Sim	ulation, Difference betweer	Without and With Di	version Conditions,	
500-year Flood Event, 10-day and 14-day Dry Down Periods				
Scenario and Treatment of Crop Acres not Planted by Switch Date				
	Pacolino	Baseline with No	No Sugarbeets in	
	Baseline	Switch Acres	Staging Area	
	20% of Acres to PP &			
	80% of Acres to Switch	100% of Acres to	100% of Acres to	
Dry Down Period	Crop	PP	PP	
	Av	erage of 10,000 Replica	tions	
<u>10-day Dry Down Period</u>				
	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	1,788	4,347	4,702	
Switch Acres	2,559	0	0	
Total	4,347	4,347	4,702	
		With Diversion		
Prevent Plant Acres	2,175	5,167	5,601	
Switch Acres	2,992	0	0	
Total	5,167	5,167	5,601	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	387	820	899	
Switch Acres	433	0	0	
Total	820	820	899	
14-day Dry Down Period				
	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	2,444	6,008	6,508	
Switch Acres	3,564	0	0	
Total	6,008	6,008	6,508	
		With Diversion		
Prevent Plant Acres	2,852	6,831	7,409	
Switch Acres	3,979	0	0	
Total	6,831	6,831	7,409	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	408	823	901	
Switch Acres	415	0	0	
Total	823	823	901	

Table 15. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat andCorn, Average of Entire Simulation, Difference between Without and With Diversion Conditions,				
Probabilistic Maximum Flood, 10-day and 14-day Dry Down Periods				
	Scenario and Treatment of Crop Acres not Planted by Switch Date			
	Baseline	Baseline with No Switch Acres	No Sugarbeets in Staging Area	
	20% of Acres to PP &			
	80% of Acres to Switch	100% of Acres to	100% of Acres to	
Dry Down Period	Сгор	PP	PP	
	Av	verage of 10,000 Replica	tions	
<u>10-day Dry Down Period</u>	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	868	1,744	1,899	
Switch Acres	876	0	0	
Total	1,744	1,744	1,899	
		With Diversion		
Prevent Plant Acres	873	1,763	1,920	
Switch Acres	890	0	0	
Total	1,763	1,763	1,920	
	Diffe	erence Due to Diversio	n	
Prevent Plant Acres	4.9	18.9	20.7	
Switch Acres	14.0	0.0	0.0	
Total	18.9	18.9	20.7	
<u>14-day Dry Down Period</u>				
Prevent Plant Acres	1 125		2 564	
Switch Acres	1,130	2,300	2,304	
Total	1,221	0 2 255		
Total		With Diversion	2,304	
Prevent Plant Acres	1,152	2,415	2,630	
Switch Acres	1,263	0	0	
Total	2,415	2,415	2,630	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	17.2	59.9	65.5	
Switch Acres	42.8	0.0	0.0	
Total	59.9	59.9	65.5	

Table 16. Prevent Plant Acr	Table 16. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and			
Corn, Average of Entire Simulation, Difference between Without and With Diversion Conditions,				
2009-like Flood Event, 10-day and 14-day Dry Down Periods				
Scenario and Treatment of Crop Acres not Planted by Switch Date				
	Baseline	Baseline with No	No Sugarbeets in	
		Switch Acres	Staging Area	
	20% of Acres to PP &			
	80% of Acres to Switch	100% of Acres to	100% of Acres to	
Dry Down Period	Сгор	РР	РР	
	Av	erage of 10,000 Replica	tions	
10-day Dry Down Period	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	6,125	14,117	15,414	
Switch Acres	7,992	0	0	
Total	14,117	14,117	15,414	
		With Diversion		
Prevent Plant Acres	14,196	14,196	15,500	
Switch Acres	6,148	14,196	15,500	
Total	8,048	0	0	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	23.8	79.4	86.2	
Switch Acres	55.6	0.0	0.0	
Total	79.4	79.4	86.2	
<u>14-day Dry Down Period</u>				
	With Existing	Conditions (Without	Diversion)	
Prevent Plant Acres	7,316	16,874	18,410	
Switch Acres	9,558	0	0	
Total	16,874	16,874	18,410	
		With Diversion		
Prevent Plant Acres	7,368	17,030	18,580	
Switch Acres	9,662	0	0	
Total	17,030	17,030	18,580	
	Diffe	rence Due to Diversio	n	
Prevent Plant Acres	52.8	156.3	169.8	
Switch Acres	103.5	0.0	0.0	
Iotal	156	156	1/0	

## Quartile Analysis

The 10,000 replications were placed into quartiles based on the amount of prevent plant acreage created by the FM Diversion (Tables 17 and 18). The worst-case quartile represents 2,500 replications out of the 10,000 total replications having the largest prevent plant acreage created by operation of the FM Diversion. The best-case quartile represents 2,500 replications with the least prevent plant acreage created by operation of the FM Diversion. The best-case quartile represents 2,500 replications with the least prevent plant acreage created by operation of the FM Diversion. The quartiles represent a 25 percent chance of occurrence during any of the 10 flood event sizes. Flood event probabilities are independent from the annual probabilities measured by the 10,000 replications.

The worst-case quartiles contained modest increases in prevent plant acreage when compared to averages over the entire 10,000 replications. In most floods, the best-case quartiles have nearly zero additional prevent plant acres created by the FM Diversion. The foregone inputs from the worst-case and best-case quartiles were estimated in Tables 19 and 20.

Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods			
Scenario and Treatment of Crop Acres not Planted by Switch Date			
	Baseline	Baseline with No Switch Acres	No Sugarbeets in Staging Area
	20% of Acres to PP &	No Switch crops	No Switch Crops
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to
Event	Crop	PP	PP
	Aver	age of Worst 2,500 Rep	lications
<u>10-day Dry Down Period</u>			
10-year	0.0	0.0	0.0
20-year	2.3	2.3	2.6
25-year	3.7	3.7	4.0
25-year Long	19.1	19.1	20.6
25-year Extra Long	31.4	31.4	34.1
50-year	5.5	5.5	6.0
100-vear	12.7	12.7	13.8
500-vear	1.117.8	1.117.8	1.225.0
2009-like	75.6	75.6	82.7
PMF	208.7	208.7	226.9
<u>14-day Dry Down Period</u> 10-year 20-year 25-year 25-year Long 25-year Extra Long 50-year	0.1 9.6 16.7 31.8 72.5 23.6	0.1 9.6 16.7 31.8 72.5 23.6	0.1 10.7 18.2 34.5 79.1 25.7
100-year	47.1	47.1	51.2
500-year	1,119.9	1,119.9	1,227.1
2009-like	220.7	220.7	241.6
PMF	334.4	334.4	364.2

Table 17. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and

Corn, Average of Best-case Quartile (least prevent plant), Difference between Without and With			
Diversion Conditions, All Floc	d Events, 10-day and 14-d	ay Dry Down Periods	
Scenario and Treatment of Crop Acres not Planted by Switch Date			
	Baseline	Baseline with No	No Sugarbeets in
	Baseline	Switch Acres	Staging Area
	20% of Acres to PP &	No Switch crops	No Switch Crops
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to
Event	Сгор	PP	PP
	Aver	age of Best 2,500 Replic	ations
<u>10-day Dry Down Period</u>			
10-year	0.0	0.0	0.0
20-year	0.0	0.0	0.0
25-year	0.0	0.0	0.0
25-year Long	0.8	0.8	0.8
25-year Extra Long	3.6	3.6	3.8
50-year	0.0	0.0	0.0
100-year	0.0	0.0	0.0
500-year	507.9	507.9	555.9
2009-like	0.0	0.0	0.0
PMF	0.0	0.0	0.0
14-day Dry Down Period			
10-year	0.0	0.0	0.0
20-year	0.0	0.0	0.0
25-year	0.0	0.0	0.0
25-year Long	0.0	0.0	0.0
25-year Extra Long	6.8	6.8	7.2
50-year	0.0	0.0	0.0
100-year	0.3	0.3	0.3
500-vear	509.0	509.0	556.7
2009-like	0.0	0.0	0.0
PMF	14.0	1 <u>4</u> 0	14 S
	14.0	17.0	14.0

Table 18. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and

Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods			
Scenario and Treatment of Crop Acres not Planted by Switch Date			
	Paceline	Baseline with No	No Sugarbeets in
	Daseinie	Switch Acres	Staging Area
	20% of Acres to PP &	No Switch crops	No Switch Crops
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to
Event	Crop	PP	PP
10-day Dry Down Period			
10-vear	0.0	0.0	0.0
20-vear	0.0 ¢E17	0.0 ¢017	0.0 \$007
	۲۱۵۶ ۲۵۲۶	/۱۵۶ ۲۵۱ کر د	2907 61.205
25-year	\$797 \$2,497	\$1,274 ¢5.271	\$1,395 ¢r 71r
25-year Long	\$3,487	\$5,271	\$5,715
25-year Extra Long	\$6,168	\$9,538	\$10,410
50-year	\$1,1//	\$1,888	\$2,056
100-year	\$2,655	Ş4,248	Ş4,633
500-year	\$216,793	\$297,530	\$326,291
2009-like	\$16,330	\$25,423	\$27,846
PMF	\$41,172	\$63,716	\$69,538
14-day Dry Down Period			
10-year	\$14	\$22	\$24
20-year	\$2,119	\$3,335	\$3,702
25-year	\$3,617	\$5,758	\$6,309
25-year Long	\$6,364	\$9,891	\$10,767
25-year Extra Long	\$15.080	\$23.587	\$25.807
50-year	\$5.002	\$8.030	\$8,741
100-year	\$9.894	\$15.766	\$17.220
500-year	\$217,145	\$298,090	\$326,871
2009-like	\$47,474	\$72,998	\$79,993
PMF	\$64.689	\$95.924	\$104.776
	+ )	+/	<i>+</i> · <i>)</i> · · · -

Table 19. Lost Input Sales on Switch Acres and Prevent Plant Acres for Wheat, Corn, and Soybeans, Average of Worst-case Quartile (most prevent plant), Difference between Without and With Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods

Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods			
Scenario and Treatment of Crop Acres not Planted by Switch Date			
	Baseline	Baseline with No	No Sugarbeets in
	Baseline	Switch Acres	Staging Area
	20% of Acres to PP &	No Switch crops	No Switch Crops
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to
Event	Сгор	PP	PP
10-day Dry Down Period			
10-vear	0	0	0
20-vear	0	0	0
25-year	0	0	0
25-year Long	\$131	\$225	\$241
25-year Extra Long	\$607	\$1,062	\$1,144
50-year	0	0	0
100-year	0	0	0
500-year	\$105,667	\$159,291	\$174,597
2009-like	0	0	0
PMF	0	0	0
14-day Dry Down Period			
10-vear	0	0	0
, 20-year	0	0	0
25-year	0	0	0
25-year Long	0	0	0
25-year Extra Long	\$1,160	\$2,032	\$2,189
50-year	0	0	0
100-year	\$51	\$91	\$97
500-year	\$105,889	\$159,626	\$174,860
2009-like	0.0	0.0	0.0
PMF	\$17,582	\$19,336	\$21,141

Table 20. Lost Input Sales on Switch Acres and Prevent Plant Acres for Wheat, Corn, and Soybeans, Average of Best-case Quartile (least prevent plant), Difference between Without and With Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods

## Percentile Analysis

The worst- and best-case 5<sup>th</sup> percentile conditions were compiled from the 10,000 replications (Tables 21 and 22). The worst-case 5<sup>th</sup> percentile represents the 500 replications out of the 10,000 total replications having the largest prevent plant acreage created by operation of the FM Diversion. The best-case 5<sup>th</sup> percentile represents the 500 replications with the least prevent plant acreage created by operation of the FM Diversion. The percentiles represent a 5 percent chance of occurrence during any of the 10 flood events.

The worst-case 5<sup>th</sup> percentile contained slight increases in prevent plant acreage when compared to averages from the worst-case quartile evaluation (compare Table 21 to Table 17). The best-case 5<sup>th</sup> percentile did not contain any prevent plant acreage created by the FM Diversion outside of the 25-year extra long flood and the 500-year flood. The foregone inputs from the worst-case 5<sup>th</sup> percentile are presented in Table 23. Foregone input purchases for the best-case 5<sup>th</sup> percentile were not estimated. Table 21. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and Corn, Average of Worst-case Fifth Percentile (500 highest prevent plant replications), Difference between Without and With Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods

	Scenario and Treatment of Crop Acres not Planted by Switch Date		
	Pacolino	Baseline with No	No Sugarbeets in
	Baseline	Switch Acres	Staging Area
	20% of Acres to PP &	No Switch crops	No Switch Crops
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to
Event	Сгор	PP	PP
10-day Dry Down Period			
10-year	0.0	0.0	0.0
20-year	11.6	11.6	12.9
25-year	18.3	18.3	20.0
25-year Long	35.7	35.7	38.7
25-year Extra Long	79.8	79.8	87.1
50-year	27.4	27.4	29.8
100-year	56.2	56.2	61.3
500-year	1,240.9	1,240.9	1,360.3
2009-like	236.0	236.0	258.5
PMF	344.5	344.5	375.5
14-day Dry Down Period			
10-year	0.3	0.3	0.3
20-year	48.0	48.0	53.3
25-year	83.4	83.4	91.1
25-year Long	100.4	100.4	109.4
25-year Extra Long	187.1	187.1	204.3
50-year	118.2	118.2	128.3
100-year	222.4	222.4	242.4
500-year	1,243.0	1,243.0	1,362.4
2009-like	442.8	442.8	484.7
PMF	471.7	471.7	514.4

Table 22. Prevent Plant Acres for Wheat, Corn, and Soybeans and Switch Acres for Wheat and Corn, Average of Best-case Fifth Percentile (500 lowest prevent plant replications), Difference between Without and With Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods

	Scenario and Treatment of Crop Acres not Planted by Switch Date			
	Baseline	Baseline with No	No Sugarbeets in	
	Baseline	Switch Acres	Staging Area	
	20% of Acres to PP &	No Switch crops	No Switch Crops	
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to	
Event	Сгор	PP	PP	
<u>10-day Dry Down Period</u>				
10-year	0.0	0.0	0.0	
20-year	0.0	0.0	0.0	
25-year	0.0	0.0	0.0	
25-year Long	0.0	0.0	0.0	
25-year Extra Long	0.0	0.0	0.0	
50-year	0.0	0.0	0.0	
100-year	0.0	0.0	0.0	
500-year	272.0	272.0	297.5	
2009-like	0.0	0.0	0.0	
PMF	0.0	0.0	0.0	
14-day Dry Down Period				
10-vear	0.0	0.0	0.0	
20-year	0.0	0.0	0.0	
25-year	0.0	0.0	0.0	
25-year Long	0.0	0.0	0.0	
25-year Extra Long	0.0	0.0 2 1	0.0	
50-year	2.1	2.1	2.2	
J0-year 100-year	0.0	0.0	0.0	
EOO year	U.U 212.2	0.0	0.0	
2000 like	513.3	515.5	342.0	
	0.0	0.0	0.0	
	0.0	0.0	0.0	

Table 23. Lost Input Sales on Switch Acres and Prevent Plant Acres for Wheat, Corn, and Soybeans, Average of Worst-case Fifth Percentile (500 highest prevent plant replications), Difference between Without and With Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods

	Scenario and Treatment of Crop Acres not Planted by Switch Date		
	Baseline	Baseline with No	No Sugarbeets in
		Switch Acres	Staging Area
	20% of Acres to PP &	No Switch crops	No Switch Crops
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to
Event	Crop	PP	PP
10 day Day Davis Davis d			
10-day Dry Down Period	0	0	0
10-year	0	0	0
20-year	\$2,584	\$4,083	\$4,534
25-year	\$3,986	\$6,369	\$6,975
25-year Long	\$7,179	\$11,143	\$12,135
25-year Extra Long	\$16,825	\$26,316	\$28,815
50-year	\$5,883	\$9,442	\$10,280
100-year	\$12,013	\$19,180	\$20,952
500-year	\$216,793	\$297,530	\$326,291
2009-like	\$51,434	\$79,423	\$87,073
PMF	\$66,063	\$96,526	\$105,449
14-day Dry Down Period			
10-vear	\$71	\$112	\$122
20-vear	\$10 594	\$16 673	\$18 506
25-vear	\$18.084	\$28,788	\$31 542
25-year Long	\$21,674	\$20,700	\$37.479
25-year Extra Long	\$20,795	\$5 <del>1</del> ,525 \$61,202	\$67.083
50-year	\$35,203 \$25,012	\$01,252 \$40,150	\$42 706
	\$23,012 \$17.246	\$40,130 ¢75 274	\$43,700 ¢02,202
FOO woor	347,240 ¢240.012	ې د , د / د د مدم مدم	202,392 \$261,241
500-year	\$240,913	\$329,382	\$361,241
2009-like	\$92,507	\$138,358	\$151,624
PMF	\$90,780	\$131,933	\$144,199

## Frequency of Prevent Plant Acreage

The frequency of prevent plant acreage was identified by placing prevent plant acreage into ranges, and then identifying the number of replications for those ranges, based on flood size and dry down period for Hydrology Group 3 (flood longer) and Hydrology Group 5 (new flooding) storage areas (Figures 3 through 40). Across all flood event sizes, the most frequent condition is represented by relatively low levels of prevent plant. As flood size increases, the distribution of prevent plant acreage includes a higher frequency of larger amounts of prevent plant acreage.

Within each flood event and hydrology group, the increase in dry down period from 10 days to 14 days increases the frequency of prevent plant in all flood events except the 10-year event. In some cases, the frequency of a low amount of prevent plant is larger for the Without Diversion condition. What is occurring in those observations are replications where the prevent plant acreage is close to the upper limit for that range and the prevent plant acreage for the With Diversion condition falls into a larger range.













































Prevent Plant and Switch Acres for Hydrology Group Three











Prevent Plant and Switch Acres for Hydrology Group Five










## Foregone Crop Production

Prevent plant acres create issues for businesses selling crop production inputs and also affect grain handling businesses by reducing the volume of grain that is handled and sold by those businesses<sup>6</sup>. In addition to foregone crop production on prevented planting, the FM Diversion can delay planting, resulting in lower yields. Lost crop production from switch and prevent plant acres and yield loss on land incurring planting delays were combined (Tables 24 through 26).

Lost grain production in Tables 24 through 26 were based on the shares of acreage to wheat, corn, soybeans, and sugarbeets in the first two scenarios. Corn and soybean acres were adjusted to account for removal of sugarbeet acres in scenario 3. Ignoring the subtle differences between target yields in the four counties having land in the staging area, the staging area with sugarbeets would be expected to produce about 5.25 million bushels of grain. The worst-case conditions for lost crop production due to the FM Diversion were found with the 500-year flood, and generally ranged from 200,000 bushels to 275,000 bushels depending upon which percentile and dry-down period is used. At 300,000 lost bushels, the Diversion would reduce grain production from the staging area by about 5 to 6 percent. A 500-year flood has an annual probability of occurrence of 0.2 percent.

The amount of lost grain production in smaller, more frequent floods ranges from a few thousand bushels up to 100,000 bushels, with a range of 20,000 to 50,000 being the most frequent as observed in the Monte Carlo simulation. Those conditions imply the Diversion would reduce overall grain production in the staging area by roughly 0.5 percent (20,000 bushels) to about 2 percent (100,000 bushels).

The lost revenue to affected businesses from foregone production is somewhat difficult to estimate since some production on lands in the staging area are likely under contract with local processors (e.g., Pro-Gold plant in Wahpeton). Grain under contract is unlikely to flow through normal grain handling channels, and it is more common for that grain to be directly delivered to the processor by the producer. Data to refine the percentage of foregone grain not handled by traditional grain elevators was not available.

<sup>&</sup>lt;sup>6</sup> There are provisions within Federal crop insurance coverage that allow for the use of prevent plant acreage to grow a different crop. Those provisions are not considered in this study since lands within the FM Diversion staging area are unlikely to qualify for Federal crop insurance prevent plant coverage.

With Diversion Conditions, A	Il Flood Events, 10-day and	14-day Dry Down Pe	riods					
Scenario and Treatment of Crop Acres not Planted by Switch Date								
	Pacolino	Baseline with No	No Sugarbeets in					
	Dasellile	Switch Acres	Staging Area					
	20% of Acres to PP &	No Switch crops	No Switch Crops					
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to					
Event	Сгор	PP	PP					
	Aver	age of 10,000 Replicatio	ns					
<u>10-day Dry Down Period</u>								
10-year	100	100	100					
20-year	3,200	3,300	3,600					
25-year	7,900	7,900	8,600					
25-year Long	9,000	9,300	10,100					
25-year Extra Long	12,600	13,000	14,200					
50-year	9,600	9,700	10,500					
100-year	13,800	13,900	15,200					
500-year	184,100	203,200	223,700					
2009-like	26,400	28,900	31,600					
PMF	19,600	20,200	22,100					
14-day Dry Down Period	200	200	200					
10-year	300	300	300					
20-year	6,800	6,900	7,600					
25-year	17,500	17,600	19,200					
25-year Long	17,000	17,300	18,800					
25-year Extra Long	23,800	24,700	26,900					
50-year	20,400	20,600	22,400					
100-year	27,800	28,300	30,900					
500-year	178,800	197,100	217,400					
2009-like	41,600	46,200	50,700					
PMF	38,800	40,700	44,600					

Table 24. Lost Crop Production, Average of Entire Simulation, Difference between Without and

Table 25. Lost Crop Production, Average of Worst-case Quartile (lowest production), Difference between Without and With Diversion Conditions, All Flood Events, 10-day and 14-day Dry Down Periods

Scenario and Treatment of Crop Acres not Planted by Switch Da							
	Pacolino	Baseline with No	No Sugarbeets in				
	Daseillie	Switch Acres	Staging Area				
	20% of Acres to PP &	No Switch crops	No Switch Crops				
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to				
Event	Сгор	PP	PP				
	Average of Worst 2,500 Replications -						
<u>10-day Dry Down Period</u>							
10-year	400	400	400				
20-year	10,300	10,400	11,500				
25-year	27,400	27,500	30,000				
25-year Long	25,500	25,800	28,000				
25-year Extra Long	33,500	34,300	37,400				
50-year	32,100	32,200	35,000				
100-year	41,800	42,200	46,100				
500-year	216,000	237,200	262,200				
2009-like	52,900	59,000	64,800				
PMF	51,200	53,500	58,600				
<u>14-day Dry Down Period</u>							
10-year	900	900	900				
20-year	18,100	18,400	20,400				
25-year	50,600	51,200	55,900				
25-year Long	45,100	45,800	49,900				
25-year Extra Long	57,700	59,700	65,200				
50-year	56,100	56,900	61,900				
100-year	71,400	72,900	79,800				
500-year	211.900	232.600	257.300				
2009-like	70.200	78.800	87.000				
PMF	96.000	102.500	112.300				
	,	- ,	<b>,</b>				

Table 26. Lost Crop Production, Average of Worst-case Fifth Percentile (lowest production),
Difference between Without and With Diversion Conditions, All Flood Events, 10-day and 14-day
Dry Down Periods

	Scenario and Treatment	of Crop Acres not Plar	nted by Switch Date
	Bacolino	Baseline with No	No Sugarbeets in
	Dasellite	Switch Acres	Staging Area
	20% of Acres to PP &	No Switch crops	No Switch Crops
Dry Down Period and Flood	80% of Acres to Switch	100% of Acres to	100% of Acres to
Event	Сгор	PP	PP
10 day Dry Dayya Dayiad			
10 year	1 100	1 100	1 200
10-year	1,100	1,100	1,200
20-year	19,400	19,800	21,900
25-year	53,300	53,900	58,900
25-year Long	47,300	48,100	52,400
25-year Extra Long	60,400	62,800	68,700
50-year	59,000	60,000	65,200
100-year	74,900	76,700	84,000
500-year	233,200	256,100	283,200
2009-like	70,700	79,500	87,700
PMF	100,800	107,900	118,200
14-day Dry Down Period			
10-year	1,900	1,900	2,100
20-year	33,700	35,300	39,100
25-year	89,900	92,700	101,400
25-year Long	81,000	84,200	91,900
25-year Extra Long	99,500	105,400	115,400
50-year	99,000	102,900	112,200
100-year	130,800	137,900	151,300
, 500-vear	218,700	240.600	266.100
, 2009-like	86.200	97.700	108.300
	,	- ,	

## Conclusions

Spring snow melt and runoff, in most cases, occur early relative to the regional planting season. During much of a spring flood-event, no planting occurs due to snow melt and overall wet conditions. Statistical analysis of the historical data suggest there was limited overlap between spring runoff and planting.

Adding to the analysis was the inclusion of hydrology data for the storage areas comprising the staging area. Hydrology information indicates that not all acreage within the staging is affected by operation of the FM Diversion for any particular flood event. On lands that are adversely affected (i.e., lands that flood longer, and newly flooded land) the length of time for the effects of flooding to be over are generally insufficient to create consistently large delays in planting. Further, the combinations of a long, or late-occurring flood and relatively early planting start dates are required to produce more pronounced levels of planting delays. The risk (annual frequency) of those conditions occurring during a flood year is relatively low.

The absence of consistently large planting delays limits conditions that would produce large prevent plant circumstances. The estimated acreage of prevent plant due to the FM Diversion within the staging area was modest, even under conditions when wheat and corn acreage was not switched to soybeans. Another factor that acts to limit the overall amount of prevent plant acreage is that about 50 percent of the cropland is planted to soybeans—which are planted later in the spring, reducing the likelihood of planting delays due to the use of the staging area.

The FM Diversion could be expected, based on current data, to have minor impact on creating conditions sufficient to increase prevent planting acreage within the staging area. As a result of relatively small acreage of prevent plant created by the FM Diversion, the loss of input purchases (sales to business and firms in the farm service and support sectors) is also modest. Foregone crop production was estimated from both prevent plant acreage and lower yields associated with planting delays for wheat, corn, and soybeans. The most likely conditions suggest the FM Diversion would affect about 0.5 to 2 percent of the staging area's total crop production.

All of the prevent plant acreage estimates were based on a single set of producers' behaviors indicating a specific action at a specific point in the planting season. While those assumptions are reasonable (see Bangsund et al. 2020 for results of focus discussion with producers) under current economic conditions and the absence of prevent plant crop insurance, the results in this assessment would change in producers react differently to delay planting than what was modeled in the Monte Carlo simulation.

## References

Bangsund, Dean A., Saleem Shaik, David Saxowsky, and Nancy M. Hodur. 2015. *Initial Assessment of the Agricultural Risk of Temporary Water Storage for FM Diversion*. AAE Report No. 745, Department of Agribusiness & Applied Economics, North Dakota State University, Fargo. http://ageconsearch.umn.edu/bitstream/211469/2/AAE745.pdf

Bangsund, Dean A., Saleem Shaik, David Saxowsky, and Nancy M. Hodur. 2016. *Expanded Geographic Assessment of the Agricultural Risk of Temporary Water Storage for FM Diversion*. AAE Report No. 754, Department of Agribusiness & Applied Economics, North Dakota State University, Fargo. <u>http://ageconsearch.umn.edu/bitstream/211469/2/AAE754.pdf</u>

Bangsund, Dean A., Saleem Shaik, David Saxowsky, Nancy M. Hodur, and Elvis Ndembe. 2020. Assessment of the Agricultural Risk of Temporary Water Storage for FM Diversion: Re-alignment of FM Diversion Staging Area. AAE Report No. ###, Department of Agribusiness & Applied Economics, North Dakota State University, Fargo. <u>http://ageconsearch.umn.edu/bitstream/211469/2/AAE</u> ###.pdf

FINBIN. 2019. Center for Farm Financial Management: University of Minnesota. Retrieved from http://finbin.umn.edu (originally created September 27, 2019).

Houston Engineering, Inc. 2019. Discussion of field elevations for hydrology modeling. Houston, Engineering, Inc., Fargo, ND.

Houston-Moore Group. 2019. *Hydrologic Engineering Center - River Analysis System: Phase 9.1 Modeling.* Information provided was based on previous work by U.S. Army Corps of Engineers. Houston-Moore Group, LLC. Fargo, ND.

National Agricultural Statistics Service. 2019. Agricultural statistics. <u>https://www.nass.usda.gov/</u> National Agricultural Statistics Service, U.S. Department of Agriculture, Washington, D.C. U.S. Army Corps of Engineers. 2011. *Final Feasibility Report and Environmental Impact Statement: Fargo-Moorhead Metropolitan Area Flood Risk Management*. U.S. Army Corps of Engineers, St. Paul, MN.

U.S. Army Corps of Engineers. 2013. *Supplemental Environmental Assessment: Design Modifications to the Fargo Moorhead Metropolitan Flood Risk Management Project. Appendix D: Hydraulics and Hydrology*. U.S. Army Corps of Engineers, St. Paul, MN.

U.S. Geological Survey. 2019. Red River Flows.

<u>http://waterdata.usgs.gov/nd/nwis/uv?site\_no=05054000</u> U.S. Geological Survey, U.S. Department of the Interior, Washington, D.C.

## Appendix A

Hydrology Data for Storage Areas, With and Without Diversion Conditions, 10-year, 20-year, 25-year, 25 year Long, 25-year Extra Long, 2009-like, 50-year, 100-year, 500-year, and Probabilistic Maximum Flood Events

FM Diversion Staging Area

Appendix Table A1. Storage Area Data, FM Diversion Staging Area, Phase 9.1 HEC-RAS Modeling							
						Approximate	
						Field	
Storage Area	Section	Township	Range	County	State	Elevation <sup>a</sup>	Acres
BD1	2	137	49	Cass	ND	908	23.2
CHRSA01	26	137	49	Cass	ND	915	306.7
CHRSA02	25	137	49	Cass	ND	914.5	305.0
CHRSA03	35	137	49	Cass	ND	918	304.2
CHRSA04	36	137	49	Cass	ND	918	283.6
CHRSA05E	2	136	49	Richland	ND	920	174.9
CHRSA05W	2	136	49	Richland	ND	920	142.7
CHRSA06	2	136	49	Richland	ND	921	116.6
CHRSA07	2	136	49	Richland	ND	915	150.5
CHRSA08	2	136	49	Richland	ND	918.5	160.5
CHRSA09	11	136	49	Richland	ND	923	301.1
CHRSA10	11	136	49	Richland	ND	922	326.5
CHRSA100	8	135	48	Richland	ND	931	46.5
CHRSA101	8	135	48	Richland	ND	924	218.8
CHRSA102	5	135	48	Richland	ND	928	277.6
CHRSA103	29	136	48	Richland	ND	918	135.9
CHRSA104	29	136	48	Richland	ND	926.5	61.4
CHRSA105	32	136	48	Richland	ND	919	88.5
CHRSA106	32	136	48	Richland	ND	925	42.7
CHRSA107	32	136	48	Richland	ND	927.5	75.1
CHRSA108	20	136	48	Richland	ND	923	20.3
CHRSA109	12	136	49	Richland	ND	918	634.0
CHRSA11	14	136	49	Richland	ND	924.5	304.7
CHRSA110	18	136	48	Richland	ND	913.5	146.2
CHRSA111	7	136	48	Richland	ND	921	46.9
CHRSA112	7	136	48	Richland	ND	918	17.1
CHRSA113	7	136	48	Richland	ND	919.5	11.9
CHRSA114	36	137	49	Cass	ND	910.5	447.9
CHRSA115	25	137	49	Cass	ND	918	97.8
CHRSA116	25	137	49	Cass	ND	916.5	129.4
CHRSA117	1	136	49	Richland	ND	919.5	50.8
CHRSA118	1	136	49	Richland	ND	919.5	85.2
CHRSA119	1	136	49	Richland	ND	918.5	226.6
CHRSA12	14	136	49	Richland	ND	924	326.9
CHRSA120	25	137	49	Cass	ND	916	59.8
CHRSA13	13	136	49	Richland	ND	918	628.8
CHRSA14	23	136	49	Richland	ND	924	310.3
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Table A1. Cont	inued									
						Approximate				
						Field				
Storage Area	Section	Township	Range	County	State	Elevation <sup>a</sup>	Acres			
CHRSA17	18	136	48	Richland	ND	918	838.7			
CHRSA18	26	136	49	Richland	ND	922	852.7			
CHRSA18E	26	236	49	Richland	ND	922	252.6			
CHRSA19	25	136	49	Richland	ND	921	807.2			
CHRSA20	30	136	48	Richland	ND	921	631.2			
CHRSA21	36	136	49	Richland	ND	927.5	268.8			
CHRSA22	36	136	49	Richland	ND	927.5	354.0			
CHRSA23	31	136	48	Richland	ND	920	635.3			
CHRSA24	2	135	49	Richland	ND	927.5	632.4			
CHRSA25	1	135	49	Richland	ND	928	631.4			
CHRSA26	6	135	48	Richland	ND	928.5	80.4			
CHRSA27	6	135	48	Richland	ND	924	547.7			
DIVSA100	20	137	48	Clay	MN	913	560.0			
DIVSA101	29	137	48	Clay	MN	914	566.7			
DIVSA102	32	137	48	Clay	MN	915	585.0			
DIVSA105	6	137	49	Cass	ND	915.5	472.5			
DIVSA106E	1	137	50	Cass	ND	919	54.9			
DIVSA107E	12	137	50	Cass	ND	919.5	508.9			
DIVSA84	5	137	49	Cass	ND	913	690.7			
DIVSA84E	32	138	49	Cass	ND	907.5	241.4			
DIVSA85E	29	138	49	Cass	ND	904.5	150.1			
DIVSA86S	28	138	49	Cass	ND	905.5	396.2			
DIVSA87S	27	138	49	Cass	ND	908.5	273.3			
DIVSA88W	34	138	49	Cass	ND	907	442.0			
DIVSA89W	3	137	49	Cass	ND	910.5	453.0			
DIVSA90S	2	137	49	Cass	ND	907.5	65.5			
DIVSA93S	7	137	48	Cass	ND	908	120.1			
DIVSA94	1	137	49	Cass	ND	908	156.2			
DIVSA95	1	137	49	Cass	ND	908.5	119.8			
DIVSA98W	8	137	48	Clay	MN	912.5	159.7			
DIVSA99W	17	137	48	Clay	MN	910.5	439.8			
DRAIN370	8	136	49	Richland	ND	922.5	157.7			
DRAIN371	8	136	49	Richland	ND	921.5	160.3			
DRAIN372	5	136	49	Richland	ND	920	318.8			
DRAIN373	33	137	49	Cass	ND	919	331.6			
DRAIN374	28	137	49	Cass	ND	915	240.7			
RR10	18	137	48	Clay	MN	909	49.7			
RR11	18	137	48	Cass	ND	909	77.8			
RR14	19	137	48	Clay	MN	914	45.6			
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Table A1. Cont	tinued						
						Approximate	
						Field	
Storage Area	Section	Township	Range	County	State	Elevation <sup>a</sup>	Acres
RR15	19	137	48	Cass	ND	908	68.3
RR16	19	137	48	Clay	MN	916	38.5
RR17	25	137	48	Cass	ND	910	95.2
RR18	30	137	48	Clay	MN	913	72.4
RR19	30	137	48	Cass	ND	909	60.1
RR20	30	137	48	Clay	MN	919	34.1
RR21	31	137	48	Cass	ND	909	105.2
RR22	31	137	48	Clay	MN	917.5	55.7
RR23	31	137	48	Cass	ND	912.5	38.6
RR24	31	137	48	Clay	MN	921.5	134.9
RR25	1	136	48	Richland	ND	920	113.7
RR26	1	136	49	Wilkin	MN	913	95.5
RR27	1	136	48	Richland	ND	917	104.2
RR28	1	136	49	Wilkin	MN	923	98.1
RR29	7	136	48	Richland	ND	921	101.6
RR3	6	137	48	Cass	ND	910.5	19.2
RR30	7	136	48	Wilkin	MN	922.5	85.1
RR31	7	136	48	Richland	ND	916.5	59.8
RR32	7	136	48	Wilkin	MN	916	57.0
RR33	18	136	48	Richland	ND	913.5	64.2
RR34	18	136	48	Wilkin	MN	913	82.5
RR35	18	136	48	Richland	ND	914	47.4
RR36	17	136	48	Wilkin	MN	916.5	76.2
RR37	20	136	48	Richland	ND	914.5	174.5
RR38	20	136	48	Wilkin	MN	923.5	83.3
RR39	20	136	48	Richland	ND	915.5	98.8
RR4	6	137	48	Clay	MN	906.5	53.6
RR40	20	136	48	Wilkin	MN	925.5	77.1
RR41	29	136	48	Richland	ND	915.5	61.2
RR42	29	136	48	Wilkin	MN	916	51.6
RR43	29	136	48	Richland	ND	920	104.0
RR44	29	136	48	Wilkin	MN	924	110.0
RR45	32	136	48	Richland	ND	923	61.7
RR46	32	136	48	Wilkin	MN	932	64.1
RR47	32	136	48	Richland	ND	927.5	73.3
RR48	32	136	48	Wilkin	MN	928	96.9
RR49	5	135	48	Richland	ND	926.5	116.0
RR51	5	135	48	Richland	ND	919	96.1
RR52	5	135	48	Wilkin	MN	933	54.6
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Table A1. Cont	inued						
						Approximate	
						Field	
Storage Area	Section	Township	Range	County	State	Elevation <sup>a</sup>	Acres
RR53	8	135	48	Richland	ND	919	168.8
RR54	9	135	48	Wilkin	MN	932.5	37.7
RR55	8	135	48	Richland	ND	919	117.5
RR56	9	135	48	Wilkin	MN	918	45.5
RR57	17	135	48	Richland	ND	919	193.2
RR58	16	135	48	Wilkin	MN	914.5	69.1
RR59	17	135	48	Richland	ND	919	139.2
RR6	7	137	48	Clay	MN	910	39.3
RR60	16	135	48	Wilkin	MN	915	107.9
RR7	7	137	48	Cass	ND	907	47.3
RR8	7	137	48	Clay	MN	909.5	34.9
RR9	18	137	48	Cass	ND	900	90.2
WLVSA200	28	136	48	Wilkin	MN	918	105.4
WLVSA202	33	136	48	Wilkin	MN	928	357.6
WLVSA203	28	136	48	Wilkin	MN	927	13.9
WLVSA204	29	136	48	Wilkin	MN	918	103.5
WLVSA205	17	136	48	Wilkin	MN	924	46.6
WLVSA206	20	136	48	Wilkin	MN	924	110.8
WLVSA207	20	136	48	Wilkin	MN	925.5	139.0
WLVSA208	17	136	48	Wilkin	MN	923.5	26.7
WLVSA209	18	136	48	Wilkin	MN	915.5	51.3
WLVSA210	7	136	48	Wilkin	MN	920.5	90.3
WLVSA211	7	136	48	Wilkin	MN	923	160.7
WLVSA212	30	137	48	Clay	MN	919.5	29.2
WLVSA213	30	137	48	Clay	MN	920	45.9
WLVSA214	30	137	48	Clay	MN	919.5	75.3
WLVSA215	31	137	48	Clay	MN	911	92.9
WLVSA216	31	137	48	Clay	MN	914.5	42.4
WLVSA217	31	137	48	Clay	MN	922	62.4
WLVSA218	6	136	48	Wilkin	MN	921	242.3
WLVSA219	6	136	48	Wilkin	MN	922	188.3
WLVSA220	18	137	48	Clay	MN	908.5	33.6
WLVSA221	18	137	48	Clay	MN	908.5	31.5
WLVSA222	18	137	48	, Clay	MN	913	68.8
WLVSA223	18	137	48	Clay	MN	910	56.2
WLVSA224	19	137	48	, Clay	MN	912.5	81.1
WLVSA227	19	137	48	, Clay	MN	915.5	37.6
WLVSA228	19	137	48	, Clay	MN	911.5	35.8
WLVSA229	19	137	48	, Clay	MN	910	65.7
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Table A1. Cont	inued										
						Approximate					
						Field					
Storage Area	Section	Township	Range	County	State	Elevation <sup>a</sup>	Acres				
WLVSA230	19	137	48	Clay	MN	910	30.8				
WLVSA231	19	137	48	Clay	MN	910.5	8.5				
WLVSA232	19	137	48	Clay	MN	916	40.5				
WLVSA233	30	137	48	Clay	MN	912	154.6				
WLVSA234	30	137	48	Clay	MN	917.5	57.5				
WLVSA235	7	137	48	Clay	MN	908.5	13.8				
WLVSA236	7	137	48	Clay	MN	910	56.1				
WLVSA237	7	137	48	Clay	MN	910	101.8				
WLVSA57	5	136	48	Wilkin	MN	921	210.4				
WLVSA64	8	136	48	Wilkin	MN	922	400.2				
WLVSA65	17	136	48	Wilkin	MN	919.5	127.0				
WLVSA66	17	136	48	Wilkin	MN	923	212.3				
WRRND1	21	136	49	Richland	ND	920	423.4				
WRRND10	34	137	49	Cass	ND	916.5	320.2				
WRRND11	34	137	49	Cass	ND	919.5	197.0				
WRRND12	21	137	49	Cass	ND	916	351.3				
WRRND13	21	137	49	Cass	ND	913.5	288.0				
WRRND14	22	137	49	Cass	ND	912.5	214.1				
WRRND15	22	137	49	Cass	ND	911	172.9				
WRRND16	15	137	49	Cass	ND	912.5	116.6				
WRRND17	15	137	49	Cass	ND	911	75.9				
WRRND18	10	137	49	Cass	ND	908.5	202.4				
WRRND19	11	137	49	Cass	ND	906.5	16.3				
WRRND2	21	136	49	Richland	ND	920	317.3				
WRRND3	16	136	49	Richland	ND	919.5	341.0				
WRRND4	16	136	49	Richland	ND	918.5	288.6				
WRRND5	9	136	49	Richland	ND	918	322.0				
WRRND6	9	136	49	Richland	ND	918.5	315.5				
WRRND7	4	136	49	Richland	ND	917	303.6				
WRRND8	4	136	49	Richland	ND	917	355.2				
WRRND9	34	137	49	Cass	ND	917.5	146.2				
WRSA273	20	136	49	Richland	ND	929.5	627.2				
WRSA280	7	136	49	Richland	ND	925.5	583.0				
WRSA284	6	136	49	Richland	ND	923	597.4				
WRSA300	21	137	49	Cass	ND	909.5	626.3				
WRSA302	23	137	49	Cass	ND	913	245.6				
WRSA303	18	137	49	Cass	ND	919.5	639.6				
WRSA304	17	137	49	Cass	ND	915	634.8				
WRSA289	32	137	49	Cass	ND	923.5	629.3				
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Table A1. Cont	inued						
						Approximate	
						Field	
Storage Area	Section	Township	Range	County	State	Elevation <sup>a</sup>	Acres
WRSA305A	9	137	49	Cass	ND	910.5	225.0
WRSA305B	9	137	49	Cass	ND	910.5	407.9
WRSA305C	15	137	49	Cass	ND	906	808.3
WRSA305D	10	137	49	Cass	ND	906	431.6
WRSA306	13	137	49	Cass	ND	908	495.9
WRSA307	13	137	49	Cass	ND	911	209.5
WRSA308	7	137	49	Cass	ND	917	637.9
WRSA309	8	137	49	Cass	ND	914.5	635.5
WRSA311	11	137	49	Cass	ND	907	305.2
WRSA312	12	137	49	Cass	ND	906.5	631.3
WRSA315	4	137	49	Cass	ND	909.5	613.4
WRSA321	33	138	49	Cass	ND	906.5	625.2
WRSA350	11	137	49	Cass	ND	910.5	274.3
WRSA351	14	137	49	Cass	ND	908.5	308.7
WRSA352	23	137	49	Cass	ND	911	296.9
WRSA353	26	137	49	Cass	ND	917.5	291.9
WRSA354	35	137	49	Cass	ND	919	295.3
WRSA355	3	136	49	Richland	ND	917.5	415.4
WRSA356	10	136	49	Richland	ND	920.5	622.2
WRSA357	15	136	49	Richland	ND	921.5	614.4
WRSA358	22	136	49	Richland	ND	923	491.6
WRSA359	27	136	49	Richland	ND	923	437.5
WRSA360	34	136	49	Richland	ND	924	242.3
WRSA363	15	137	49	Cass	ND	911.5	268.2
WRSA364	22	137	49	Cass	ND	913	251.8
WRSA373	17	136	49	Richland	ND	927.5	631.8
WRSA378	8	136	49	Richland	ND	926	156.1
WRSA383	5	136	49	Richland	ND	924	152.7
WRSA384	8	136	49	Richland	ND	925	155.0
WRSA389	5	136	49	Richland	ND	923	150.7
WRSA390	33	137	49	Cass	ND	917.5	268.9
WRSA501	18	137	48	Cass	ND	911	71.8
WRSA502	18	137	48	Cass	ND	913	13.2
WRSA504	18	137	48	Cass	ND	915	11.7
WRSA507	7	137	48	Cass	ND	902	29.1
WRSA907	28	137	49	Cass	ND	915	393.9

	and without Diversion Conditions, Fivi Diversion Staging Area, Phase 9.1 HEC-RAS Modeling										
	A			Days c	of Water	above S	torage	Area Elev	ation		
Storago	Approx.		Exist	ing Cond	litions	0.5	With Diversion Staging Area				
Area	Fleiu Elevation <sup>a</sup>	10 yr	20 yr	25 yr	25-yr	25-yr	10- Vr	20 yr	25-	25-yr	25-yr
BD1	908.00	5.5	20-yi 9.5	23-yi 10.5	17.5	23.0	5.5	20-yi 10.5	11.0	17.5	23.0
CHRSA01	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	7.0	8.5
CHRSA02	914.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	7.0	9.0
CHRSA03	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA04	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA05E	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA05W	920.00	0.0	3.5	4.0	5.0	8.0	0.0	3.5	4.5	6.0	10.0
CHRSA06	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA07	915.00	0.0	0.0	0.0	6.0	11.5	0.0	0.0	6.0	8.5	13.0
CHRSA08	918.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.5
CHRSA09	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA10	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA100	931.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA101	924.00	0.0	0.0	1.0	7.5	15.0	0.0	0.0	1.5	8.5	15.0
CHRSA102	928.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA103	918.00	0.0	3.0	4.5	12.0	19.0	0.0	3.0	6.5	12.5	19.0
CHRSA104	926.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA105	919.00	0.0	3.5	4.5	12.0	19.0	0.0	3.5	7.0	12.5	19.0
CHRSA106	925.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA107	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA108	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA109	918.00	0.0	0.0	0.0	2.5	4.5	0.0	0.0	0.0	7.0	10.0
CHRSA11	924.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA110	913.50	0.0	6.0	7.5	15.0	21.5	0.0	6.0	9.0	15.0	21.5
CHRSA111	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA112	918.00	0.0	0.0	0.0	2.5	4.5	0.0	0.0	0.0	7.0	10.0
CHRSA113	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	7.0
CHRSA114	910.50	0.0	6.5	8.0	15.0	21.5	0.0	6.5	10.0	15.5	21.5
CHRSA115	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	7.0
CHRSA116	916.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	7.5
CHRSA117	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA118	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA119	918.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.5
CHRSA12	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA120	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	6.5	8.5
CHRSA13	918.00	0.0	0.0	0.0	7.0	14.0	0.0	0.0	4.0	8.5	14.0
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Appendix Table A2. Duration of Water Inundation, by Storage Area, by Flood Event Frequency for With and Without Diversion Conditions, FM Diversion Staging Area, Phase 9.1 HEC-RAS Modeling

Appendix Table A2. Continued											
				Days	of Water	above S	torage	Area Elev	/ation		
	Approx.		Exist	ing Cond	ditions		With Diversion Staging Area				
Storage	Field		20-		25-yr	25-yr	10-		25-	25-yr	25-yr
Area	Elevation <sup>a</sup>	10-yr	yr	25-yr	Long	ELong	yr	20-yr	yr	Long	ELong
CHRSA14	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA15	919.50	0.0	0.0	0.0	3.0	5.5	0.0	0.0	0.0	6.5	10.0
CHRSA16	918.00	0.0	0.0	0.0	7.0	14.0	0.0	0.0	4.0	8.5	14.0
CHRSA17	918.00	0.0	0.0	2.5	9.0	16.5	0.0	0.0	5.5	10.0	16.5
CHRSA18	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA18E	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA19	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.0
CHRSA20	921.00	0.0	0.0	1.5	8.0	15.5	0.0	0.0	3.0	9.5	16.0
CHRSA21	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA22	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA23	920.00	0.0	2.0	3.5	10.0	17.5	0.0	2.0	5.0	11.0	18.0
CHRSA24	927.50	0.0	2.5	3.5	3.5	5.5	0.0	2.5	3.5	3.5	5.5
CHRSA25	928.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA26	928.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA27	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.5
DIVSA100	913.00	0.0	0.0	0.0	3.5	6.0	0.0	0.0	6.5	9.0	12.5
DIVSA101	914.00	0.0	0.0	0.0	5.5	8.0	0.0	0.0	6.5	10.0	13.0
DIVSA102	915.00	0.0	0.0	0.0	7.0	12.0	0.0	0.0	7.5	9.5	13.5
DIVSA105	915.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.0	7.5
DIVSA106E	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA107E	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA84	913.00	0.0	0.0	0.0	3.5	3.5	0.5	2.0	9.5	10.5	12.0
DIVSA84E	907.50	0.0	0.0	0.0	8.0	9.0	0.0	12.0	10.5	10.0	12.0
DIVSA85E	904.50	0.0	4.5	6.5	11.5	16.0	49.0	49.0	49.0	49.0	49.0
DIVSA86S	905.50	0.0	0.0	5.0	11.0	14.5	0.0	13.0	11.0	11.0	13.0
DIVSA87S	908.50	0.0	0.0	0.0	0.0	0.0	0.0	11.0	10.5	10.0	12.0
DIVSA88W	907.00	1.5	8.0	9.5	14.0	21.0	0.0	12.0	10.5	10.0	13.0
DIVSA89W	910.50	0.0	8.0	9.0	12.0	19.5	0.0	8.0	9.0	9.5	11.5
DIVSA90S	907.50	4.5	9.0	10.0	15.5	21.5	0.0	8.0	10.5	16.0	22.0
DIVSA93S	908.00	0.0	5.0	6.5	13.5	20.5	0.0	7.0	10.5	15.0	21.5
DIVSA94	908.00	2.0	9.0	10.0	14.5	21.0	0.0	7.0	10.5	15.0	21.5
DIVSA95	908.50	0.0	5.0	6.5	12.5	19.5	0.0	6.5	10.0	14.0	21.0
DIVSA98W	912.50	0.0	0.0	0.0	3.5	3.5	0.0	0.0	6.5	9.0	12.5
DIVSA99W	910.50	0.0	2.5	4.5	11.0	18.5	0.0	3.5	9.0	12.0	18.5
DRAIN370	922.50	0.5	2.0	2.0	3.5	3.5	0.5	2.0	2.0	3.5	3.5
DRAIN371	921.50	0.0	1.5	1.5	3.0	3.0	0.0	1.5	1.5	3.0	3.0
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Appendix Ta	Appendix Table A2. Continued											
		Days of Water above Storage Area Elevation										
	Approx.		Exist	ing Con	ditions		V	/ith Dive	rsion St	aging Ar	ea	
Storage	Field				25-yr	25-yr				25-yr	25-yr	
Area	Elevation	10-yr	20-yr	25-yr	Long	ELong	10-yr	20-yr	25-yr	Long	ELong	
DRAIN372	920.00	0.0	0.0	0.0	2.0	2.5	0.0	0.0	0.0	2.5	2.5	
DRAIN373	919.00	0.0	2.5	3.5	3.5	4.0	0.0	2.5	3.5	5.5	8.0	
DRAIN374	915.00	3.5	7.0	8.0	12.0	19.0	3.5	7.0	9.0	12.0	19.0	
RR10	909.00	0.0	5.5	7.0	14.0	20.5	0.0	6.0	10.0	14.5	21.0	
RR11	909.00	0.0	6.0	8.0	14.5	21.0	0.0	6.5	10.0	15.0	21.5	
RR11	909.00	0.0	6.0	8.0	14.5	21.0	0.0	6.5	10.0	15.0	21.5	
RR12	909.00	0.0	6.0	8.0	14.5	21.0	0.0	6.5	10.0	15.0	21.5	
RR13	911.50	0.0	2.0	4.5	11.0	18.5	0.0	3.0	8.5	12.0	18.5	
RR14	914.00	0.0	0.0	0.0	4.0	6.5	0.0	0.0	6.0	9.0	12.5	
RR15	908.00	3.5	8.5	9.5	17.0	23.5	3.5	8.5	11.0	17.0	23.5	
RR16	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	7.0	9.0	
RR17	910.00	0.0	6.0	7.5	14.5	21.5	0.0	6.5	10.0	15.0	21.5	
RR18	913.00	0.0	0.0	2.5	9.0	16.0	0.0	0.0	7.0	11.0	17.0	
RR19	909.00	2.0	8.0	9.0	16.5	23.0	2.5	8.0	10.5	16.5	23.0	
RR20	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR21	909.00	3.0	8.0	9.0	16.5	23.0	3.0	8.0	10.5	17.0	23.0	
RR22	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	7.5	
RR23	912.50	0.0	3.0	4.5	12.0	19.0	0.0	3.5	8.0	12.5	19.0	
RR24	921.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR25	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR26	913.00	0.0	3.0	5.5	12.5	19.5	0.0	4.0	8.0	13.0	19.5	
RR27	917.00	0.0	0.0	0.0	5.5	11.0	0.0	0.0	4.0	8.0	12.5	
RR28	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR29	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR3	910.50	0.0	0.0	3.5	10.0	17.0	0.0	2.5	8.5	11.5	17.5	
RR30	922.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR31	916.50	0.0	0.0	2.0	9.0	16.5	0.0	0.0	6.0	10.0	16.5	
RR32	916.00	0.0	1.5	3.5	10.5	18.0	0.0	2.0	6.5	11.0	18.0	
RR33	913.50	0.0	6.0	7.5	15.5	21.5	0.0	6.0	9.0	15.5	21.5	
RR34	913.00	2.0	7.0	8.0	16.0	22.0	2.0	7.0	9.5	16.0	22.0	
RR35	914.00	0.0	6.0	7.5	15.0	21.5	0.0	6.0	9.0	15.0	21.5	
RR36	916.50	0.0	3.0	4.5	11.5	19.0	0.0	3.0	7.0	12.0	19.0	
RR37	914.50	1.0	6.5	7.5	15.5	21.5	1.5	6.5	9.0	15.5	22.0	
RR38	923.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR39	915.50	0.0	5.5	7.0	15.0	21.0	0.0	6.0	8.5	15.0	21.5	
RR4	906.50	2.5	8.5	9.5	17.0	23.0	3.0	8.5	11.0	17.0	23.0	
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Appendix Ta	ppendix Table A2. Continued Days of Water above Storage Area Elevation											
Appendix Table A2: Continued         Days of Water above Storage Area Elevation         Approx.       Existing Conditions       With Diversion Staging Area         Storage       Field       25-yr       25-yr												
	Approx.	Existing Conditions     With Diversion Staging Area       25-yr     25-yr       25-yr     25-yr										
Storage	Field				25-yr	25-yr				25-yr	25-yr	
Area	Elevation	10-yr	20-yr	25-yr	Long	ELong	10-yr	20-yr	25-yr	Long	ELong	
RR40	925.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR41	915.50	2.5	6.5	7.5	16.0	22.0	2.5	7.0	9.0	16.0	22.0	
RR42	916.00	1.0	6.0	7.0	15.0	21.5	1.0	6.5	8.5	15.5	21.5	
RR43	920.00	0.0	1.0	3.0	9.5	17.0	0.0	1.0	5.0	10.0	17.0	
RR44	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	4.5	
RR45	923.00	0.0	0.0	0.0	4.5	9.0	0.0	0.0	0.0	6.0	10.5	
RR46	932.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR47	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR47	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR48	928.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR49	926.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR5	904.00	7.0	10.5	11.5	19.5	26.0	7.0	11.0	12.5	20.0	26.0	
RR50	933.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR51	919.00	4.5	7.0	8.0	16.5	22.5	4.5	7.0	8.5	16.5	23.0	
RR52	933.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR53	919.00	5.0	7.5	8.5	17.0	23.5	5.0	7.5	9.0	17.0	23.5	
RR54	932.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR55	919.00	5.5	8.0	9.0	18.0	24.5	6.0	8.0	9.5	18.0	24.5	
RR56	918.00	6.5	9.0	10.5	19.5	26.0	6.5	9.0	10.5	19.5	26.0	
RR57	919.00	6.0	8.5	9.5	18.5	25.0	6.5	8.5	10.0	18.5	25.0	
RR58	914.50	9.5	15.0	17.5	41.0	34.5	9.5	15.0	17.5	42.0	35.5	
RR59	919.00	6.5	9.0	10.5	19.5	26.0	6.5	9.0	10.5	19.5	26.0	
RR6	910.00	0.0	2.5	5.0	11.0	18.5	0.0	4.0	9.0	12.0	18.5	
RR60	915.00	9.5	15.0	17.5	42.5	36.0	9.5	15.0	18.0	44.5	37.5	
RR7	907.00	2.0	8.5	9.5	16.5	23.0	2.5	8.5	11.0	17.0	23.0	
RR8	909.50	0.0	4.0	6.0	12.5	19.5	0.0	5.0	9.0	13.0	20.0	
RR9	900.00	10.0	14.0	15.5	25.5	31.5	10.0	14.5	16.0	25.5	31.5	
WLVSA200	918.00	0.0	4.0	5.0	12.5	19.5	0.0	4.0	7.5	13.0	19.5	
WLVSA202	928.00	2.0	2.5	3.0	4.0	4.0	2.0	2.5	3.0	4.0	4.0	
WLVSA203	927.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA204	918.00	0.0	3.5	4.5	12.5	19.5	0.0	4.0	7.0	12.5	19.5	
WLVSA205	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA206	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA207	925.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA208	923.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA209	915.50	0.0	3.0	4.5	12.0	19.0	0.0	3.0	7.5	12.0	19.0	
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Appendix Ta	Appendix Table A2. Continued											
Days of Water above Storage Area Elevation												
	Approx.		Exist	ing Con	ditions		V	/ith Dive	rsion St	aging Ar	ea	
Storage	Field				25-yr	25-yr				25-yr	25-yr	
Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	ELong	10-yr	20-yr	25-yr	Long	ELong	
WLVSA210	920.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	6.5	
WLVSA211	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA212	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA213	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA214	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA215	911.00	0.0	5.0	6.5	14.0	20.5	0.0	5.5	9.0	14.0	21.0	
WLVSA216	914.50	0.0	0.0	0.5	8.0	14.0	0.0	0.0	7.5	10.0	15.0	
WLVSA217	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA218	921.00	0.0	0.0	0.0	2.5	2.5	0.0	0.0	0.0	1.0	1.0	
WLVSA219	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA220	908.50	0.0	6.5	8.0	14.5	21.5	0.0	6.5	10.0	15.0	21.5	
WLVSA221	908.50	0.0	6.0	7.5	14.5	21.5	0.0	7.0	10.5	15.0	21.5	
WLVSA222	913.00	0.0	0.0	0.0	3.5	5.5	0.0	0.0	6.5	9.5	12.5	
WLVSA223	910.00	0.0	4.0	5.5	12.5	19.5	0.0	5.0	9.0	13.0	20.0	
WLVSA224	912.50	0.0	0.0	0.0	6.5	13.0	0.0	0.0	6.5	10.0	15.0	
WLVSA225	914.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	10.0	12.0	
WLVSA226	917.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	6.5	
WLVSA227	915.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	7.0	9.0	
WLVSA228	911.50	0.0	1.0	3.5	11.0	18.0	0.0	2.5	8.0	12.0	18.0	
WLVSA229	910.00	0.0	5.0	6.5	13.5	20.5	0.0	5.5	9.0	14.0	20.5	
WLVSA230	910.00	0.0	5.0	6.5	13.5	20.5	0.0	5.5	9.0	14.0	20.5	
WLVSA231	910.50	0.0	4.0	5.5	12.5	19.5	0.0	5.0	9.0	13.0	20.0	
WLVSA232	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	7.0	9.0	
WLVSA233	912.00	0.0	0.0	4.5	10.0	17.0	0.0	0.0	9.0	11.5	17.5	
WLVSA234	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	6.0	
WLVSA235	908.50	0.0	6.5	8.0	14.5	21.0	0.0	6.5	10.0	15.0	21.5	
WLVSA236	910.00	0.0	3.0	5.0	11.5	19.0	0.0	4.0	9.0	12.5	19.0	
WLVSA237	910.00	0.0	2.0	4.0	11.0	18.0	0.0	4.0	9.0	12.0	18.5	
WLVSA57	921.00	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	2.5	2.5	
WLVSA64	922.00	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.5	0.5	
WLVSA65	919.50	0.0	0.0	0.0	1.0	1.5	0.0	0.0	0.0	6.0	8.5	
WLVSA66	923.00	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	
WRRND1	920.00	2.5	6.5	7.0	10.5	18.5	2.5	6.5	7.5	10.5	18.0	
WRRND10	916.50	1.0	6.5	7.0	10.0	18.0	1.0	6.5	8.0	10.5	17.5	
WRRND11	919.50	0.0	1.5	3.0	3.0	3.5	0.0	1.5	3.0	3.5	5.0	
WRRND12	916.00	0.0	6.0	7.0	9.5	17.5	0.0	6.0	8.0	10.0	16.5	
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Appendix Ta	Appendix Table A2. Continued Days of Water above Storage Area Elevation												
	Days of Water above Storage Area Elevation           Approx.         Existing Conditions         With Diversion Staging Area												
	Approx.		Exist	ing Con	ditions		W	/ith Dive	rsion Sta	aging Ar	ea		
Storage	Field				25-yr	25-yr				25-yr	25-yr		
Area	Elevation	10-yr	20-yr	25-yr	Long	ELong	10-yr	20-yr	25-yr	Long	ELong		
WRRND13	913.50	4.0	8.0	8.5	14.0	20.5	4.0	8.0	9.5	14.0	20.0		
WRRND14	912.50	4.5	8.0	9.0	14.5	21.0	4.0	8.5	10.0	14.5	20.5		
WRRND15	911.00	5.0	9.0	10.0	16.0	22.0	5.0	9.5	10.5	16.5	22.0		
WRRND16	912.50	4.0	8.0	8.5	13.5	20.0	4.0	8.0	9.5	13.0	20.0		
WRRND17	911.00	4.5	8.5	9.5	15.5	21.5	4.5	9.0	10.5	15.5	21.5		
WRRND18	908.50	6.0	10.0	10.5	18.0	23.5	6.0	11.0	11.5	18.0	23.5		
WRRND19	906.50	6.5	11.0	11.5	19.5	25.5	6.5	12.0	12.0	19.5	25.5		
WRRND2	920.00	1.0	6.0	6.5	9.5	17.5	1.0	6.0	7.0	10.0	17.5		
WRRND3	919.50	2.0	6.0	7.0	10.0	18.0	1.5	6.0	7.0	10.0	17.5		
WRRND4	918.50	3.0	6.5	7.5	11.0	19.0	3.0	6.5	8.0	11.5	18.5		
WRRND5	918.00	3.0	7.0	7.5	11.5	19.0	3.0	7.0	8.0	11.5	19.0		
WRRND6	918.50	0.0	6.0	6.5	9.0	17.0	0.0	5.5	7.0	9.5	17.0		
WRRND7	917.00	3.5	7.0	8.0	12.0	19.0	3.5	7.0	8.5	12.0	19.0		
WRRND8	917.00	2.0	6.5	7.5	10.5	18.5	2.0	6.5	8.0	10.5	18.0		
WRRND9	917.50	0.0	6.0	6.5	9.0	17.0	0.0	5.5	7.5	9.5	16.5		
WRSA273	929.50	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	3.0	3.0		
WRSA280	925.50	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.5		
WRSA284	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA289	923.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA294	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA299	912.50	0.0	7.0	8.0	11.0	19.0	0.0	7.0	9.5	11.0	18.0		
WRSA300	909.50	5.5	9.0	10.0	16.5	22.5	5.5	10.0	11.0	16.5	22.5		
WRSA302	913.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	9.0	11.5		
WRSA303	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA304	915.00	0.0	3.0	4.5	5.0	6.5	0.0	0.0	7.0	9.0	10.5		
WRSA305A	910.50	4.5	8.5	9.5	15.0	21.5	4.5	9.0	10.5	15.0	21.0		
WRSA305B	910.50	4.5	8.5	9.5	15.0	21.0	4.5	9.0	10.5	15.0	21.0		
WRSA305C	906.00	7.5	12.0	13.0	21.5	28.0	7.5	13.0	13.0	21.5	28.0		
WRSA305D	906.00	7.5	12.0	13.0	21.5	28.0	7.5	13.0	13.0	21.5	28.0		
WRSA306	908.00	3.5	9.0	9.5	14.5	21.0	3.0	8.5	10.5	15.0	21.5		
WRSA307	911.00	0.0	3.0	5.0	10.5	17.5	0.0	2.5	10.0	12.0	17.0		
WRSA308	917.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.0		
WRSA309	914.50	0.0	4.5	5.5	6.5	13.0	0.0	3.0	8.0	9.0	11.5		
WRSA311	907.00	5.0	9.0	10.0	16.0	22.0	2.5	8.5	11.0	16.5	22.5		
WRSA312	906.50	5.5	9.5	10.0	17.0	23.0	4.0	9.0	11.0	17.0	23.0		
WRSA315	909.50	0.0	4.5	6.0	8.0	14.5	0.0	11.0	10.5	10.5	12.5		
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Appendix Ta	Appendix Table A2. Continued													
	Days of Water above Storage Area Elevation           Approx.         Existing Conditions         With Diversion Staging Area													
	Approx.		Exist	ing Con	ditions		V	/ith Dive	rsion St	aging Ar	ea			
Storage	Field				25-yr	25-yr				25-yr	25-yr			
Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	ELong	10-yr	20-yr	25-yr	Long	ELong			
WRSA321	906.50	0.0	0.0	3.5	10.5	13.5	0.0	12.5	11.0	11.0	13.0			
WRSA350	910.50	0.0	8.0	9.0	11.0	18.0	2.5	8.0	10.0	13.0	20.0			
WRSA351	908.50	2.5	9.0	9.5	13.5	20.5	4.0	8.5	10.5	14.5	21.0			
WRSA352	911.00	0.0	8.0	8.5	10.5	17.5	0.0	7.5	10.5	12.0	18.5			
WRSA353	917.50	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	6.0	7.5			
WRSA354	919.00	0.0	3.5	4.0	4.5	7.0	0.0	3.5	4.0	6.5	9.5			
WRSA355	917.50	0.0	6.0	7.0	9.5	17.5	0.0	6.0	7.5	10.0	17.0			
WRSA356	920.50	0.0	4.0	4.5	6.0	12.5	0.0	4.0	5.0	6.5	12.0			
WRSA357	921.50	0.0	3.5	4.0	4.5	7.0	0.0	3.5	4.0	5.0	8.0			
WRSA358	923.00	0.0	0.0         1.5         3.5         3.5         4.0         0.0         1.5         3.5         4.0         4.5           0.0         2.0         4.0         4.5         2.0         2.0         4.0         4.5											
WRSA359	923.00	0.0	0.0         3.0         4.0         4.5         7.5         0.0         3.0         4.0         4.5         8.5											
WRSA360	924.00	0.0	4.5	5.0	6.5	14.0	0.0	4.5	5.0	7.0	14.0			
WRSA363	911.50	0.0	7.5	8.5	10.5	17.5	0.0	7.0	9.5	11.0	17.5			
WRSA364	913.00	0.0	6.5	7.5	9.0	16.0	0.0	5.0	8.5	10.0	12.5			
WRSA373	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
WRSA378	926.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
WRSA383	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
WRSA384	925.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
WRSA389	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
WRSA390	917.50	0.0	5.0	5.5	7.0	14.5	0.0	4.5	6.5	8.5	14.0			
WRSA501	911.00	0.0	0.0	3.5	10.0	17.0	0.0	1.5	8.5	11.5	17.0			
WRSA502	913.00	0.0	0.0	0.0	4.5	8.0	0.0	0.0	6.5	9.5	13.0			
WRSA504	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	7.5	9.5			
WRSA505	909.00	0.0	6.5	8.0	16.0	22.5	0.0	7.5	10.5	16.5	23.0			
WRSA506	909.00	0.0	5.0	7.0	13.0	20.0	0.0	5.5	10.0	13.5	20.5			
WRSA507	902.00	7.5	13.0	14.0	22.5	29.0	7.5	13.5	15.0	23.0	29.0			
WRSA907	915.00	0.0	4.0	5.0	6.0	11.0	0.0	3.5	7.5	9.0	11.0			
<sup>a</sup> Feet above me	ean seal level. L	owest est	imated e	levation fo	or storage a	rea.								
Jource. House		J (2013).												

Appendix Tal	opendix Table A2. Continued										
	Days of Water above Storage Area Elevation										
	Approx.		Existin	g Condit	ions		Wi	th Dive	rsion Sta	aging Ar	ea
Storage	Field	2009-		100-	500-		2009-		100-	500-	
Area	Elevation	like	50-yr	yr	yr	PMF	like	50-yr	yr	yr	PMF
BD1	908.00	20.0	17.0	20.0	30.5	48.5	20.0	17.0	20.0	31.0	48.0
CHRSA01	915.00	0.0	0.0	0.0	5.0	12.0	8.5	8.0	10.5	13.5	19.0
CHRSA02	914.50	0.0	0.0	0.0	13.5	19.0	10.0	9.0	13.0	16.5	21.0
CHRSA03	918.00	0.0	0.0	0.0	0.0	9.0	5.5	4.0	8.0	11.5	14.5
CHRSA04	918.00	0.0	0.0	0.0	9.0	14.5	7.5	4.0	10.0	14.0	17.0
CHRSA05E	920.00	1.5	0.0	2.0	9.5	19.5	4.0	0.0	7.0	11.5	20.0
CHRSA05W	920.00	8.5	9.5	11.5	14.5	31.5	8.5	10.0	11.5	14.5	31.5
CHRSA06	921.00	0.0	0.0	0.0	6.0	14.0	0.0	0.0	4.5	10.0	15.0
CHRSA07	915.00	5.0	3.0	7.5	29.5	29.5	9.0	8.5	11.5	30.0	30.5
CHRSA08	918.50	1.0	0.0	0.0	13.0	15.5	6.5	5.0	8.5	14.5	17.5
CHRSA09	923.00	0.0	0.0	0.0	7.0	15.5	0.0	0.0	0.0	9.0	16.0
CHRSA10	922.00	0.0	0.0	0.0	4.0	12.0	0.0	0.0	0.0	8.5	12.5
CHRSA100	931.00	1.0	0.0	0.0	11.5	14.0	1.0	0.0	0.0	12.5	14.5
CHRSA101	924.00	5.0	5.0	9.0	35.0	32.0	5.5	6.5	11.0	35.0	32.5
CHRSA102	928.00	2.5	0.0	1.5	17.0	16.0	2.5	0.0	3.0	17.0	16.5
CHRSA103	918.00	22.5	8.0	13.5	44.5	40.0	22.5	10.0	13.5	45.0	40.0
CHRSA104	926.50	1.0	0.0	0.0	12.0	14.5	1.5	0.0	0.0	13.0	15.0
CHRSA105	919.00	22.5	8.5	13.5	45.5	40.0	22.5	9.5	14.0	46.0	40.0
CHRSA106	925.00	3.5	0.0	4.0	20.5	49.5	4.0	0.0	6.5	20.5	49.5
CHRSA107	927.50	0.0	0.0	0.0	11.0	48.5	0.5	0.0	0.0	12.0	48.5
CHRSA108	923.00	1.0	0.0	0.0	13.5	15.0	2.5	0.0	4.5	14.0	16.0
CHRSA109	918.00	4.0	0.5	6.0	27.0	26.0	7.5	7.5	10.0	27.0	27.0
CHRSA11	924.50	0.0	0.0	0.0	5.0	13.0	0.0	0.0	0.0	5.5	13.0
CHRSA110	913.50	24.0	10.0	17.0	51.5	45.5	24.0	11.5	17.0	51.5	45.5
CHRSA111	921.00	1.0	0.0	0.0	13.5	15.5	4.5	0.0	6.5	14.0	16.5
CHRSA112	918.00	4.0	0.5	6.0	27.0	26.0	7.5	7.5	10.0	27.0	27.0
CHRSA113	919.50	3.0	0.0	3.0	20.0	18.5	6.0	5.0	8.5	19.5	20.0
CHRSA114	910.50	24.0	11.0	17.0	49.5	47.0	24.0	12.0	17.0	49.5	46.5
CHRSA115	918.00	2.0	0.0	0.5	15.0	16.0	6.5	5.5	9.0	15.5	18.0
CHRSA116	916.50	0.0	0.0	0.0	12.0	17.5	10.0	8.0	12.5	16.0	19.5
CHRSA117	919.50	0.0	0.0	0.0	10.5	14.0	5.0	1.0	7.5	13.0	16.0
CHRSA118	919.50	0.0	0.0	0.0	10.0	14.0	5.0	0.0	7.5	12.5	16.0
CHRSA119	918.50	1.0	0.0	0.0	12.5	15.5	6.5	5.0	8.5	14.5	18.0
CHRSA12	924.00	0.0	0.0	0.0	10.0	14.0	0.0	0.0	0.0	11.5	14.5
CHRSA120	916.00	2.0	0.0	1.5	16.0	17.0	7.5	7.5	9.5	19.0	23.0
CHRSA13	918.00	5.5	4.0	8.5	32.5	31.0	8.5	8.5	11.0	32.5	31.5
		l	<u> </u>	- cont	inued -	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Appendix Tal	opendix Table A2. Continued										
Days of Water above Storage Area Elevation											
	Approx.		Existin	g Condit	ions		Wi	th Dive	rsion Sta	aging Ar	ea
Storage	Field	2009-		100-	500-		2009-		100-	500-	
Area	Elevation	like	50-yr	yr	yr	PMF	like	50-yr	yr	yr	PMF
CHRSA14	924.00	0.0	0.0	0.0	6.0	14.0	0.0	0.0	0.0	7.5	14.0
CHRSA15	919.50	12.5	10.0	13.0	27.5	29.0	12.5	10.0	13.5	27.5	29.0
CHRSA16	918.00	5.5	4.0	8.5	32.5	31.0	8.5	8.5	11.0	32.5	31.5
CHRSA17	918.00	6.0	5.5	10.5	36.5	35.0	8.5	9.0	11.5	36.5	35.0
CHRSA18	922.00	12.5	11.0	14.0	18.5	30.0	12.5	11.0	14.5	19.0	30.0
CHRSA18E	922.00	2.5	0.0	2.5	17.0	17.5	4.0	0.0	7.0	17.0	18.5
CHRSA19	921.00	3.5	0.0	4.0	21.5	20.0	5.5	2.0	8.5	21.0	21.0
CHRSA20	921.00	5.5	5.0	9.5	35.5	33.0	7.0	7.5	11.0	36.0	33.5
CHRSA21	927.50	11.0	9.0	12.5	17.5	28.5	11.0	9.0	13.0	18.0	28.5
CHRSA22	927.50	5.0	0.0	6.5	14.0	24.5	5.0	0.0	7.0	14.5	24.5
CHRSA23	920.00	10.0	9.0	13.0	41.0	37.5	10.0	9.5	13.0	41.0	37.5
CHRSA24	927.50	10.0	8.0	12.0	15.5	27.5	10.0	8.5	12.0	16.0	27.5
CHRSA25	928.00	11.5	9.0	12.5	17.5	29.0	11.5	9.0	13.0	18.0	29.0
CHRSA26	928.50	5.0	2.0	6.0	12.5	22.0	5.0	2.0	6.0	13.5	22.0
CHRSA27	924.00	10.0	8.0	11.5	24.0	26.5	10.0	8.0	11.5	24.5	26.5
DIVSA100	913.00	5.0	2.0	6.5	25.5	28.0	9.0	9.5	11.0	26.5	30.0
DIVSA101	914.00	4.5	1.5	7.0	27.5	27.0	9.5	10.5	12.5	27.5	28.5
DIVSA102	915.00	5.0	5.0	8.5	29.5	29.0	8.5	10.5	12.5	30.0	29.5
DIVSA105	915.50	0.0	0.0	0.0	0.0	6.0	7.5	7.0	10.0	12.0	16.0
DIVSA106E	919.00	0.0	0.0	0.0	0.0	6.5	2.5	0.0	5.5	8.0	7.5
DIVSA107E	919.50	0.0	0.0	0.0	0.0	5.0	2.0	0.0	5.0	7.0	7.5
DIVSA84	913.00	4.5	4.5	8.0	13.0	32.5	20.5	11.5	13.5	16.0	23.0
DIVSA84E	907.50	10.5	10.0	14.5	19.5	46.5	9.5	10.5	12.0	16.0	31.0
DIVSA85E	904.50	13.5	14.0	17.5	24.0	50.0	47.5	50.0	50.5	51.5	51.0
DIVSA86S	905.50	12.5	13.0	17.0	22.5	49.0	11.0	12.5	14.0	19.0	41.5
DIVSA87S	908.50	11.5	0.0	16.0	24.0	45.5	9.5	10.5	11.5	16.5	32.0
DIVSA88W	907.00	15.0	15.0	18.5	30.5	49.0	9.5	11.0	12.5	19.0	35.5
DIVSA89W	910.50	14.0	15.0	17.5	22.5	48.5	8.5	10.0	11.5	15.0	29.0
DIVSA90S	907.50	15.5	16.0	19.0	30.0	49.5	23.5	13.5	18.5	45.5	47.5
DIVSA93S	908.00	10.5	11.0	15.5	37.5	46.5	23.0	12.5	17.0	43.0	47.0
DIVSA94	908.00	15.5	16.0	18.5	29.0	49.5	23.0	12.5	17.0	43.0	47.0
DIVSA95	908.50	11.5	11.0	15.0	35.5	46.5	12.0	12.0	16.0	41.0	46.0
DIVSA98W	912.50	4.5	0.0	5.0	19.0	25.0	9.0	9.5	11.5	25.0	30.0
DIVSA99W	910.50	8.5	8.0	13.0	35.0	40.0	10.5	11.0	14.0	36.0	40.5
DRAIN370	922.50	34.5	3.0	4.0	6.0	47.5	34.5	3.0	4.0	8.0	47.0
DRAIN371	921.50	1.5	3.0	3.5	5.5	47.5	1.5	3.0	3.5	9.0	47.0
				- cont	inued -	-					

Appendix Tal	opendix Table A2. Continued										
Days of Water above Storage Area Elevation											
			Existin	g Condi	tions		Wi	th Dive	rsion Sta	aging Ar	ea
Storage	Existing	2009-					2009-				
Area	Conditions	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
DRAIN372	920.00	4.0	2.5	5.0	9.0	45.5	6.0	5.0	9.0	11.5	45.0
DRAIN373	919.00	7.5	7.5	10.5	13.0	38.0	8.0	9.0	11.0	13.0	36.5
DRAIN374	915.00	14.0	14.5	17.0	20.5	47.0	14.0	14.5	16.5	20.5	46.5
RR10	909.00	22.0	10.5	15.5	42.0	46.0	22.5	12.0	16.0	42.5	45.5
RR11	909.00	23.0	11.0	17.0	45.0	46.5	23.0	12.0	17.0	45.0	46.5
RR12	909.00	23.0	11.0	17.0	45.0	46.5	23.0	12.0	17.0	45.0	46.5
RR13	911.50	8.0	8.0	13.0	36.5	39.5	10.0	10.5	13.5	37.0	39.5
RR14	914.00	5.0	2.0	6.0	27.0	28.0	8.5	9.5	11.0	27.5	29.0
RR15	908.00	25.5	13.0	20.0	51.5	49.5	25.5	13.5	20.0	51.5	49.0
RR16	916.00	3.0	0.0	3.0	17.5	18.5	8.0	8.0	10.0	18.0	22.5
RR17	910.00	23.5	11.0	17.0	47.5	46.5	23.5	12.0	16.5	47.5	46.0
RR18	913.00	6.5	6.0	11.0	33.5	36.0	9.5	10.0	12.5	34.5	36.5
RR19	909.00	25.0	12.0	19.5	51.5	49.0	25.0	12.5	19.0	51.5	48.0
RR20	919.00	0.0	0.0	0.0	7.5	12.0	4.5	2.5	7.5	11.5	15.5
RR21	909.00	25.0	12.0	19.5	51.5	49.0	25.0	12.5	19.5	51.5	48.5
RR22	917.50	2.5	0.0	1.0	15.5	16.5	7.5	6.0	9.5	16.0	19.0
RR23	912.50	8.0	8.5	13.5	40.0	40.5	10.0	10.5	14.0	40.0	40.0
RR24	921.50	0.0	0.0	0.0	4.0	10.0	0.0	0.0	3.0	9.5	12.0
RR25	920.00	0.0	0.0	0.0	11.0	14.0	5.0	0.0	7.0	13.0	16.0
RR26	913.00	22.0	8.5	13.5	42.0	41.0	22.0	10.5	14.0	42.0	41.0
RR27	917.00	5.0	3.5	7.0	29.5	29.0	8.5	8.0	11.0	30.0	29.0
RR28	923.00	0.0	0.0	0.0	5.5	10.5	0.0	0.0	0.0	9.0	12.0
RR29	921.00	2.0	0.0	0.0	15.5	16.0	4.5	0.0	7.5	15.5	17.5
RR3	910.50	8.0	7.5	12.0	31.5	38.5	10.5	11.0	14.0	33.0	39.0
RR30	922.50	0.0	0.0	0.0	10.0	13.5	0.0	0.0	3.5	11.5	15.0
RR31	916.50	6.0	6.0	11.0	36.5	35.5	9.0	9.0	12.0	36.5	35.5
RR32	916.00	6.5	7.0	12.0	40.0	38.0	9.0	9.5	12.5	40.0	38.0
RR33	913.50	24.5	10.5	17.0	51.5	46.0	24.5	11.5	17.0	51.5	45.5
RR34	913.00	25.0	10.5	18.0	51.5	47.0	25.0	11.5	18.0	51.5	47.0
RR35	914.00	24.5	10.0	17.0	51.5	45.5	24.5	11.0	17.0	51.5	45.5
RR36	916.50	22.0	8.0	13.0	42.0	39.5	22.0	10.0	13.5	42.5	39.5
RR37	914.50	24.5	10.0	17.5	51.5	46.0	24.5	11.0	17.5	51.5	46.0
RR38	923.50	2.0	0.0	1.0	16.0	16.5	3.5	0.0	5.5	16.0	17.0
RR39	915.50	24.0	10.0	16.5	51.5	45.0	24.0	11.0	16.5	51.5	45.0
RR4	906.50	24.5	13.5	19.5	50.5	49.5	24.5	13.5	20.0	51.0	48.5
RR40	925.50	0.0	0.0	0.0	11.0	14.5	0.0	0.0	0.0	12.0	14.5
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Appendix Tal	pendix Table A2. Continued Days of Water above Storage Area Elevation											
	Days of Water above Storage Area Elevation           Existing Conditions         With Diversion Staging Area											
_			Existin	g Condi	tions		Wi	th Dive	rsion Sta	aging Ar	ea	
Storage	Existing	2009-					2009-					
Area	Conditions	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF	
	915.30	25.0	10.5	19.0	51.5	47.0	25.0	11.5	19.0	51.5	47.0	
RR42	916.00	24.5	10.5	17.5	51.5	45.5	24.5	11.5	17.5	51.5	45.5	
RR43	920.00	5.5	6.5	11.5	39.5	36.5	8.0	9.0	12.5	39.5	36.5	
RR44	924.00	4.0	0.0	4.5	23.0	21.0	4.5	0.0	7.0	23.5	22.0	
RR45	923.00	4.5	2.0	6.5	29.5	27.5	5.5	4.5	9.5	30.0	28.0	
RR46	932.00	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	5.5	
RR47	927.50	2.0	0.0	0.0	14.0	15.5	2.0	0.0	0.5	15.0	15.5	
RR48	928.00	1.0	0.0	0.0	12.0	14.5	1.0	0.0	0.0	13.0	14.5	
RR49	926.50	3.5	0.0	3.5	20.5	18.0	3.5	0.0	5.0	21.0	18.5	
RR5	904.00	28.0	15.5	24.5	51.5	51.5	28.0	15.5	24.5	51.5	51.5	
RR50	933.00	0.0	0.0	0.0	0.0	6.5	0.0	0.0	0.0	0.0	6.5	
RR51	919.00	26.0	11.0	21.0	51.5	48.5	26.0	11.5	21.0	51.5	48.5	
RR52	933.00	0.0	0.0	0.0	0.5	7.5	0.0	0.0	0.0	0.5	7.5	
RR53	919.00	27.0	11.0	22.5	51.5	50.0	27.0	11.5	22.5	51.5	50.0	
RR54	932.50	0.0	0.0	0.0	5.0	10.0	0.0	0.0	0.0	5.0	10.0	
RR55	919.00	29.5	11.5	27.5	51.5	51.5	29.5	12.0	27.5	51.5	51.5	
RR56	918.00	32.5	12.5	31.0	51.5	51.5	32.5	12.5	31.5	51.5	51.5	
RR57	919.00	31.5	12.0	29.5	51.5	51.5	31.5	12.0	29.5	51.5	51.5	
RR58	914.50	40.5	31.5	50.5	51.5	51.5	40.5	31.5	50.5	51.5	51.5	
RR59	919.00	33.0	12.0	31.5	51.5	51.5	33.0	12.5	32.0	51.5	51.5	
RR6	910.00	9.0	9.0	13.5	34.5	41.0	11.0	11.5	14.5	35.5	41.0	
RR60	915.00	40.5	31.5	50.5	51.5	51.5	40.5	32.0	50.5	51.5	51.5	
RR7	907.00	24.5	12.5	19.5	51.0	49.0	24.5	13.5	20.0	51.0	48.5	
RR8	909.50	9.5	10.0	14.5	38.0	44.0	11.0	11.5	15.5	39.0	43.0	
RR9	900.00	37.0	20.0	38.0	51.5	51.5	37.0	20.0	37.5	51.5	51.5	
WLVSA200	918.00	22.5	8.5	14.0	46.5	40.5	22.5	10.0	14.0	47.0	41.0	
WLVSA202	928.00	22.0	4.0	4.5	11.0	51.5	22.0	4.0	4.5	12.0	15.5	
WLVSA203	927.00	0.0	0.0	0.0	10.5	13.5	0.0	0.0	0.0	11.5	13.5	
WLVSA204	918.00	22.5	8.0	13.5	45.5	40.5	22.5	10.0	14.0	46.0	40.5	
WLVSA205	924.00	1.0	0.0	0.0	13.0	15.0	1.5	0.0	2.5	13.5	15.5	
WLVSA206	924.00	1.0	0.0	0.0	13.5	15.0	2.5	0.0	3.5	14.0	15.5	
WLVSA207	925.50	0.5	0.0	0.0	12.0	14.5	1.0	0.0	0.0	13.0	15.0	
WLVSA208	923.50	1.5	0.0	0.0	13.0	15.0	2.5	0.0	4.0	13.5	15.5	
WLVSA209	915.50	22.0	7.5	13.0	42.0	39.5	22.0	9.5	13.5	42.0	39.5	
WLVSA210	920.50	3.5	0.0	4.0	21.5	19.5	5.5	3.0	8.5	21.5	20.5	
WLVSA211	923.00	0.0	0.0	0.0	9.5	13.0	0.0	0.0	0.0	11.0	14.0	
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Appendix Tab	pendix Table A2. Continued Days of Water above Storage Area Elevation										
		Days of Water above Storage Area Elevation									
			Existin	g Condi	tions		Wi	th Dive	rsion Sta	aging Ar	ea
Storage	Existing	2009-					2009-				
Area	Conditions	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
VVLVSA212	919.50	0.0	0.0	0.0	4.5	10.0	3.5	0.0	6.5	10.5	14.0
VVLVSA213	920.00	0.0	0.0	0.0	5.0	10.5	3.0	0.0	6.0	11.0	14.0
WLVSA214	919.50	0.0	0.0	0.0	7.5	13.0	5.0	0.0	8.0	12.5	15.5
WLVSA215	911.00	23.0	10.0	15.5	45.0	44.5	23.0	11.5	16.0	45.0	44.0
WLVSA216	914.50	5.5	5.5	9.5	31.0	31.0	9.0	10.5	12.5	31.5	31.5
WLVSA217	922.00	0.0	0.0	0.0	3.0	9.5	0.0	0.0	0.0	8.5	11.0
WLVSA218	921.00	0.0	0.0	0.0	15.0	17.5	0.0	0.0	4.5	14.5	16.0
WLVSA219	922.00	0.0	0.0	0.0	9.5	14.5	0.0	0.0	2.5	12.5	15.5
WLVSA220	908.50	23.0	11.5	17.0	44.0	47.0	23.0	12.5	17.0	44.5	46.5
WLVSA221	908.50	23.0	11.5	16.5	44.0	47.0	23.0	12.5	17.0	44.5	46.0
WLVSA222	913.00	4.5	1.5	6.5	25.0	27.5	9.0	9.5	11.5	26.5	30.0
WLVSA223	910.00	9.5	9.5	14.5	39.0	43.0	11.0	11.5	15.0	39.5	42.5
WLVSA224	912.50	6.0	4.5	9.0	29.5	33.0	9.0	10.0	12.0	30.0	33.5
WLVSA225	914.50	5.0	0.0	4.5	18.5	20.5	11.0	10.5	12.5	19.0	26.5
WLVSA226	917.00	0.0	0.0	0.0	8.0	13.0	7.0	6.5	9.0	13.0	17.5
WLVSA227	915.50	2.5	0.0	2.5	16.5	17.5	8.0	8.0	10.0	17.0	23.0
WLVSA228	911.50	8.0	7.5	12.5	35.5	39.5	10.0	10.5	13.5	36.0	39.0
WLVSA229	910.00	22.0	10.0	15.0	42.0	44.5	22.5	12.0	15.5	42.0	44.0
WLVSA230	910.00	22.0	10.0	15.0	42.0	44.5	22.5	12.0	15.5	42.0	44.0
WLVSA231	910.50	9.0	9.5	14.5	40.0	42.5	11.0	11.5	15.0	40.0	42.0
WLVSA232	916.00	3.0	0.0	3.0	18.5	19.0	8.0	8.0	10.0	19.0	23.5
WLVSA233	912.00	7.0	8.0	12.5	34.0	37.5	11.0	12.5	14.0	34.5	37.5
WLVSA234	917.50	0.0	0.0	0.0	7.0	12.0	6.0	5.5	8.5	12.0	16.0
WLVSA235	908.50	23.0	11.5	17.0	43.5	47.0	23.0	12.5	17.0	43.5	46.5
WLVSA236	910.00	9.0	9.0	13.5	35.5	41.5	11.0	11.5	14.5	36.5	41.5
WLVSA237	910.00	9.0	8.5	12.5	33.5	40.5	11.0	11.5	14.5	35.0	40.5
WLVSA57	921.00	0.5	1.0	3.5	16.0	18.5	3.0	0.0	6.5	15.0	17.5
WLVSA64	922.00	1.0	0.0	0.0	15.0	16.5	0.0	0.0	3.0	14.0	16.0
WLVSA65	919.50	4.0	0.0	5.0	26.0	24.0	6.5	6.0	9.5	26.0	25.0
WLVSA66	923.00	2.0	0.0	0.0	15.0	16.0	2.5	0.0	5.0	15.5	16.0
WRRND1	920.00	13.5	14.0	16.0	19.0	36.5	13.0	14.0	16.0	19.0	36.5
WRRND10	916.50	13.0	13.5	16.0	19.0	46.0	12.5	13.0	15.5	19.0	46.0
WRRND11	919.50	6.5	6.5	9.5	12.0	31.0	7.5	8.0	10.0	12.5	30.5
WRRND12	916.00	12.5	13.0	15.5	18.5	46.5	12.0	12.5	15.0	18.5	46.0
WRRND13	913.50	15.0	15.5	18.0	22.0	47.5	14.5	15.5	17.5	22.5	47.0
WRRND14	912.50	15.0	16.0	18.0	23.0	47.5	15.0	15.5	18.0	23.5	47.5
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Appendix Tab	pendix Table A2. Continued Days of Water above Storage Area Elevation										
		Days of Water above Storage Area Elevation									
			Existin	g Condit	ions		Wi	th Dive	rsion Sta	aging Ar	ea
Storage	Existing	2009-					2009-				
Area	Conditions	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
	911.00	10.5	10.5	19.5	25.5	48.0	10.5	10.5	19.0	20.5	47.5
WRRND16	912.50	14.5	15.0	17.5	22.0	47.5	14.5	15.0	17.5	23.0	47.0
WRRIND17	911.00	16.0	16.0	19.0	25.0	48.0	15.5	16.0	18.5	26.5	47.5
WRRND18	908.50	20.5	17.5	20.5	30.0	49.0	20.5	17.5	20.5	30.5	48.5
WRRND19	906.50	21.5	18.5	22.0	35.0	49.5	21.5	18.5	22.0	36.0	49.0
WRRND2	920.00	12.5	13.0	15.5	18.5	36.0	12.5	13.0	15.5	18.0	36.0
WRRND3	919.50	13.0	13.5	16.0	18.5	37.0	13.0	13.5	15.5	18.5	36.5
WRRND4	918.50	13.5	14.0	16.5	19.5	41.0	13.5	14.0	16.5	19.5	39.0
WRRND5	918.00	14.0	14.5	16.5	19.5	45.5	13.5	14.5	16.5	19.5	43.0
WRRND6	918.50	12.5	13.0	15.5	18.0	39.0	12.0	12.5	15.0	18.0	38.0
WRRND7	917.00	14.0	14.5	17.0	20.0	46.0	14.0	14.5	16.5	20.0	46.0
WRRND8	917.00	13.5	14.0	16.0	19.0	46.0	13.0	13.5	16.0	19.0	46.0
WRRND9	917.50	12.5	12.5	15.0	18.0	45.5	12.0	12.5	15.0	18.0	45.5
WRSA273	929.50	0.0	0.0	0.0	4.0	11.0	0.0	0.0	0.0	4.0	11.0
WRSA280	925.50	0.0	0.0	0.0	1.0	46.5	0.0	0.0	0.0	1.0	46.5
WRSA284	923.00	0.0	0.0	0.0	0.0	42.5	0.0	0.0	0.0	0.0	42.5
WRSA289	923.50	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	4.0
WRSA294	919.50	30.5	5.0	7.5	9.5	46.5	44.0	5.0	7.5	10.0	46.5
WRSA299	912.50	35.0	14.0	17.0	21.5	48.0	35.0	13.5	16.0	22.0	47.5
WRSA300	909.50	38.0	17.0	19.5	28.0	48.5	38.0	16.5	19.5	28.0	48.5
WRSA302	913.00	4.0	0.0	3.5	13.0	23.5	9.0	9.5	11.5	17.0	31.0
WRSA303	919.50	4.0	0.0	0.0	0.0	44.5	30.0	0.0	5.0	7.5	44.5
WRSA304	915.00	8.5	8.5	11.5	14.0	42.5	8.0	10.0	11.5	14.0	35.0
WRSA305A	910.50	35.5	16.0	18.5	25.5	48.0	35.0	16.0	18.5	26.5	47.5
WRSA305B	910.50	15.5	16.0	18.5	25.5	48.0	15.0	15.5	18.5	26.5	47.5
WRSA305C	906.00	45.0	20.5	23.5	38.5	50.5	44.0	20.0	23.5	39.0	49.5
WRSA305D	906.00	34.5	20.5	23.5	38.5	50.5	34.0	20.0	23.5	39.0	49.5
WRSA306	908.00	15.0	15.5	18.5	29.5	49.5	23.0	15.0	18.0	43.0	47.5
WRSA307	911.00	9.5	9.0	13.0	33.0	42.5	11.5	11.5	13.5	32.5	39.0
WRSA308	917.00	0.0	0.0	0.0	0.0	43.5	6.0	5.5	8.0	10.5	44.0
WRSA309	914.50	10.0	10.5	13.0	16.0	46.0	9.0	10.5	12.0	15.5	45.5
WRSA311	907.00	16.0	16.0	19.5	31.5	49.5	24.0	14.0	19.0	48.5	48.0
WRSA312	906.50	20.0	16.5	20.0	33.0	49.5	24.5	14.5	20.0	50.5	48.5
WRSA315	909.50	10.5	11.5	14.0	18.0	46.0	10.5	12.0	13.5	16.5	45.0
WRSA321	906.50	12.0	12.5	16.5	21.5	47.5	10.5	12.5	14.0	17.5	34.0
WRSA350	910.50	13.5	14.5	17.0	27.0	49.0	14.0	14.5	17.0	26.0	47.0
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Appendix Tab	Appendix Table A2. Continued												
	Days of Water above Storage Area Elevation  Existing Conditions  With Diversion Staging Area												
			Existin	g Condit	tions		Wi	th Dive	rsion Sta	aging Ar	ea		
Storage	Existing	2009-					2009-						
Area	Conditions	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF		
WRSA351	908.50	15.0	15.5	18.5	29.5	49.5	14.5	15.0	18.0	41.0	47.5		
WRSA352	911.00	13.5	14.5	16.5	25.5	48.5	13.0	13.5	16.5	25.0	47.0		
WRSA353	917.50	3.5	2.0	4.5	9.0	24.5	6.5	6.5	9.5	11.5	24.0		
WRSA354	919.00	8.5	9.0	11.5	14.0	35.5	8.5	9.5	11.5	14.0	34.0		
WRSA355	917.50	12.5	13.0	15.5	18.5	45.5	12.5	13.0	15.5	18.5	45.5		
WRSA356	920.50	10.0	10.5	12.5	15.5	32.5	10.0	10.5	12.5	15.5	32.5		
WRSA357	921.50	9.0	9.0	11.5	14.5	29.5	9.0	9.5	11.5	14.5	29.5		
WRSA358	923.00	7.5	7.0	10.0	13.0	26.5	8.0	7.5	10.5	13.5	26.5		
WRSA359	923.00	9.5	9.5	12.0	15.5	29.0	9.5	10.0	12.0	15.5	29.0		
WRSA360	924.00	10.5	11.0	13.0	16.0	31.0	10.5	11.0	13.0	16.0	31.0		
WRSA363	911.50	13.0	14.0	16.5	22.5	48.5	12.0	13.0	15.5	24.0	46.5		
WRSA364	913.00	12.0	13.0	15.5	19.0	47.5	10.0	11.5	13.5	17.5	39.0		
WRSA373	927.50	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	6.0		
WRSA378	926.00	0.0	0.0	0.0	2.0	10.5	0.0	0.0	0.0	2.5	10.5		
WRSA383	924.00	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	4.0		
WRSA384	925.00	0.0	0.0	0.0	4.0	14.5	0.0	0.0	0.0	5.0	14.5		
WRSA389	923.00	0.0	0.0	0.0	0.0	6.5	0.0	0.0	0.0	0.0	6.5		
WRSA390	917.50	11.0	11.5	14.0	17.0	45.5	10.5	11.5	13.5	16.5	45.5		
WRSA501	911.00	7.5	7.5	12.0	32.0	38.5	10.5	10.5	13.5	32.5	38.5		
WRSA502	913.00	5.0	2.0	6.5	26.0	28.0	9.0	9.5	11.5	27.5	30.5		
WRSA504	915.00	3.5	0.0	4.5	20.0	21.0	8.0	8.5	10.0	16.5	24.0		
WRSA505	909.00	25.0	12.0	18.0	48.0	51.0	25.0	13.0	18.0	48.0	51.0		
WRSA506	909.00	10.0	10.5	15.0	39.0	45.5	11.5	12.0	15.5	40.0	44.5		
WRSA507	902.00	33.5	17.5	30.0	51.5	51.5	33.5	17.5	30.0	51.5	51.5		
WRSA907	915.00	47.5	10.5	13.0	15.5	48.5	47.5	10.5	12.5	15.0	48.5		
PMF - Probabilis	stic Maximum El	00d											

PMF = Probabilistic Maximum Flood.

<sup>a</sup>Feet above mean seal level. Lowest estimated elevation for storage area.

Source: Houston-Moore Group (2019).

Appendix Table A3. Time from Activation of Staging Area to Inundation, by Storage Area, by Flood Event Frequency for With and Without Diversion Conditions, FM Diversion Staging Area, Phase 9.1 HEC-RAS Modeling

			Days from Activation of Staging Area for Field to be Inundated								
	Approx.		Existing Conditions With Diversion Sta							taging A	rea
Storage	Field				25-yr	25-yr				25-yr	25-yr
Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
BD1	908.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA01	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.5	1.5
CHRSA02	914.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	1.5	1.5
CHRSA03	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA04	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA05E	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA05W	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA06	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA07	915.00	0.0	0.0	0.0	1.5	1.5	0.0	0.0	1.5	1.0	1.0
CHRSA08	918.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0
CHRSA09	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA10	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA100	931.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA101	924.00	0.0	0.0	1.0	0.5	0.5	0.0	0.0	1.0	0.5	0.5
CHRSA102	928.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA103	918.00	0.0	1.0	0.5	0.0	0.0	0.0	1.0	0.5	0.0	0.0
CHRSA104	926.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA105	919.00	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0
CHRSA106	925.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA107	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA108	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA109	918.00	0.0	0.0	0.0	2.5	2.5	0.0	0.0	0.0	1.5	1.5
CHRSA11	924.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA110	913.50	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
CHRSA111	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA112	918.00	0.0	0.0	0.0	2.5	2.5	0.0	0.0	0.0	1.5	1.5
CHRSA113	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5
CHRSA114	910.50	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
CHRSA115	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5
CHRSA116	916.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5
CHRSA117	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA118	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA119	918.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0
CHRSA12	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA120	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	2.0	2.0
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Appendix Table A3. Continued											
			Days from Activation of Staging Area for Field to be Inundated								
	Approx.		Existi	ng Conc	litions		W	/ith Dive	ersion St	taging A	rea
Storage	Field				25-yr	25-yr				25-yr	
Area	Elevation	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	25-yr EL
CHRSA15	919.50	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	1.5	1.5
CHRSA13	918.00	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.5	1.0	1.0
CHRSA14	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA16	918.00	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.5	1.0	1.0
CHRSA17	918.00	0.0	0.0	1.0	0.5	0.5	0.0	0.0	1.0	0.5	0.5
CHRSA18	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA18E	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA19	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.5
CHRSA20	921.00	0.0	0.0	1.0	0.5	0.5	0.0	0.0	1.0	0.5	0.5
CHRSA21	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA22	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA23	920.00	0.0	1.0	0.5	0.5	0.5	0.0	1.0	0.5	0.0	0.0
CHRSA24	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA25	928.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA26	928.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA27	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.0
DIVSA100	913.00	0.0	0.0	0.0	2.0	2.0	0.0	0.0	1.5	1.0	1.0
DIVSA101	914.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
DIVSA102	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA105	915.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	2.0	2.0
DIVSA106E	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA107E	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA84	913.00	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0
DIVSA84E	907.50	0.0	0.0	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0
DIVSA85E	904.50	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA86S	905.50	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA87S	908.50	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
DIVSA88W	907.00	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA89W	910.50	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.0	0.0	0.0
DIVSA90S	907.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA93S	908.00	0.0	1.5	1.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
DIVSA94	908.00	2.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
DIVSA95	908.50	0.0	1.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0
DIVSA98W	912.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.5	0.5
DIVSA99W	910.50	0.0	2.0	1.0	0.0	0.0	0.0	1.5	0.5	0.0	0.0
DRAIN370	922.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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Appendix Table A3. Continued												
			Days from Activation of Staging Area for Field to be Inundated									
	Approx.		Existi	ng Conc	litions		١	With Div	ersion S	Staging A	Area	
Storage	Field				25-yr	25-yr			25-	25-yr	25-yr	
Area	Elevation	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	yr	Long	EL	
DRAIN371	921.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DRAIN372	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DRAIN373	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DRAIN374	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR10	909.00	0.0	1.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
RR11	909.00	0.0	1.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
RR12	909.00	0.0	1.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
RR13	911.50	0.0	2.0	1.0	0.0	0.0	0.0	1.5	0.5	0.0	0.0	
RR14	914.00	0.0	0.0	0.0	2.0	2.0	0.0	0.0	1.5	0.5	0.5	
RR15	908.00	1.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	
RR16	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.5	1.5	
RR17	910.00	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
RR18	913.00	0.0	0.0	1.5	0.5	0.5	0.0	0.0	1.0	0.0	0.0	
RR19	909.00	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	
RR20	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR21	909.00	1.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	
RR22	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	
RR23	912.50	0.0	1.5	1.0	0.0	0.0	0.0	1.5	0.5	0.0	0.0	
RR24	921.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR25	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR26	913.00	0.0	1.5	0.5	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
RR27	917.00	0.0	0.0	0.0	1.5	1.5	0.0	0.0	2.0	1.0	1.0	
RR28	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR29	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR3	910.50	0.0	0.0	1.5	0.0	0.0	0.0	2.0	0.5	0.0	0.0	
RR30	922.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR31	916.50	0.0	0.0	1.5	0.5	0.5	0.0	0.0	1.0	0.5	0.5	
RR32	916.00	0.0	1.5	1.0	0.5	0.5	0.0	1.5	1.0	0.5	0.5	
RR33	913.50	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
RR34	913.00	1.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	
RR35	914.00	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
RR36	916.50	0.0	1.0	0.5	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
RR37	914.50	1.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	
RR38	923.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR39	915.50	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR4	906.50	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	
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Appendix Table A3. Continued												
			Days from Activation of Staging Area for Field to be Inundated									
	Approx.		Existi	ng Conc	litions		١	With Div	ersion S	Staging A	Area	
Storage	Field				25-yr	25-yr			25-	25-yr	25-yr	
Area	Elevation	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	yr	Long	EL	
RR40	925.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR41	915.50	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	
RR42	916.00	1.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	
RR43	920.00	0.0	1.5	0.5	0.5	0.5	0.0	1.5	0.5	0.5	0.5	
RR44	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	
RR45	923.00	0.0	0.0	0.0	1.5	1.5	0.0	0.0	0.0	1.5	1.5	
RR46	932.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR47	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR48	928.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR49	926.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR5	904.00	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	
RR50	933.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR51	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR52	933.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR53	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR54	932.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR55	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR56	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR57	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR58	914.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR59	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR6	910.00	0.0	2.0	1.0	0.0	0.0	0.0	1.5	0.5	0.0	0.0	
RR60	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RR7	907.00	2.5	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	
RR8	909.50	0.0	1.5	1.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
RR9	900.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA200	918.00	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
WLVSA202	928.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA203	927.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA204	918.00	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	
WLVSA205	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA206	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA207	925.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA208	923.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA209	915.50	0.0	1.0	0.5	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
WLVSA210	920.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5	
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Appendix Table A3. Continued												
			Days from Activation of Staging Area for Field to be Inundated									
	Approx.		Existi	ng Conc	litions		١	Nith Div	ersion S	Staging A	Area	
Storage	Field				25-yr	25-yr			25-	25-yr	25-yr	
Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	yr	Long	EL	
WLVSA211	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA212	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA213	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA214	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA215	911.00	0.0	1.0	0.5	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
WLVSA216	914.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA217	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA218	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA219	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA220	908.50	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
WLVSA221	908.50	0.0	1.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
WLVSA222	913.00	0.0	0.0	0.0	2.0	2.0	0.0	0.0	1.5	0.5	0.5	
WLVSA223	910.00	0.0	1.5	1.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
WLVSA224	912.50	0.0	0.0	0.0	1.5	1.5	0.0	0.0	1.5	0.5	0.5	
WLVSA225	914.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.5	1.5	
WLVSA226	917.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5	
WLVSA227	915.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.5	1.5	
WLVSA228	911.50	0.0	2.5	1.5	0.0	0.0	0.0	2.0	1.0	0.0	0.0	
WLVSA229	910.00	0.0	1.0	0.5	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
WLVSA230	910.00	0.0	1.0	0.5	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
WLVSA231	910.50	0.0	1.5	1.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	
WLVSA232	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.5	1.5	
WLVSA233	912.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA234	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.5	
WLVSA235	908.50	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
WLVSA236	910.00	0.0	2.0	1.0	0.0	0.0	0.0	1.5	0.5	0.0	0.0	
WLVSA237	910.00	0.0	2.5	1.5	0.0	0.0	0.0	1.5	0.5	0.0	0.0	
WLVSA57	921.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA64	922.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WLVSA65	919.50	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	2.0	2.0	
WLVSA66	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND1	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND10	916.50	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	
WRRND11	919.50	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
WRRND12	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND13	913.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
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Appendix Table A3. Continued												
			Days from Activation of Staging Area for Field to be Inundated									
	Approx.		Existi	ng Conc	litions		١	With Div	ersion S	Staging A	Area	
Storage	Field				25-yr	25-yr			25-	25-yr	25-yr	
Area	Elevation	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	yr	Long	EL	
WRRND14	912.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND15	911.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND16	912.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND17	911.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND18	908.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND19	906.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND2	920.00	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	
WRRND3	919.50	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	
WRRND4	918.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND5	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND6	918.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND7	917.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRRND8	917.00	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	
WRRND9	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA273	929.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA280	925.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA284	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA289	923.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA294	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA299	912.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA300	909.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA302	913.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.5	0.5	
WRSA303	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA304	915.00	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	
WRSA305A	910.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA305B	910.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA305C	906.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA305D	906.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA306	908.00	0.5	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	
WRSA307	911.00	0.0	2.0	1.0	0.0	0.0	0.0	2.0	0.5	0.0	0.0	
WRSA308	917.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	
WRSA309	914.50	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	
WRSA311	907.00	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	
WRSA312	906.50	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	
WRSA315	909.50	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA321	906.50	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
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Appendix Table A3. Continued													
			Days from Activation of Staging Area for Field to be Inundated								1		
	Approx.		Existi	ng Conc	ng Conditions			With Diversion S			aging Area		
Storage	Field				25-yr	25-yr				25-yr	25-yr		
Area	Elevation	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL		
WRSA350	910.50	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0		
WRSA351	908.50	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA352	911.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA353	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5		
WRSA354	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA355	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA356	920.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA357	921.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA358	923.00	0.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0		
WRSA359	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA360	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA363	911.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA364	913.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA373	927.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA378	926.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA383	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA384	925.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA389	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA390	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
WRSA501	911.00	0.0	0.0	1.5	0.0	0.0	0.0	2.5	0.5	0.0	0.0		
WRSA502	913.00	0.0	0.0	0.0	1.5	1.5	0.0	0.0	1.5	0.5	0.5		
WRSA504	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	1.5	1.5		
WRSA505	909.00	0.0	1.5	1.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0		
WRSA506	909.00	0.0	1.0	0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0		
WRSA507	902.00	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0		
WRSA907	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
<sup>a</sup> Feet above mean seal level. Lowest estimated elevation for storage area.													
Source: Housto	Source: Houston-Moore Group (2019).												

Source: Houston-Moore Group (2019).

Appendix Table A3. Continued											
			Days from Activation of Staging Area for Field to be Inundated								
	Approx.		Existi	ng Conc	litions		V	vith Dive	ersion St	taging A	rea
Storage	Field	2009-		100-	500-		2009		100-	500-	
Area	Elevation	yr	50-yr	yr	yr	PMF	-yr	50-yr	yr	yr	PMF
BDI	908.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA01	915.00	0.0	0.0	0.0	4.0	3.0	2.0	2.0	1.0	1.5	1.5
CHRSA02	914.50	0.0	0.0	0.0	3.0	2.5	2.0	2.0	1.5	1.5	1.5
CHRSA03	918.00	0.0	0.0	0.0	4.5	0.0	4.0	3.5	3.0	3.0	2.5
CHRSA04	918.00	0.0	0.0	0.0	3.5	2.5	5.0	3.0	2.0	2.5	2.0
CHRSA05E	920.00	0.0	3.0	3.0	2.5	2.0	0.0	2.5	2.0	2.0	2.0
CHRSA05W	920.00	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5	0.5	0.5
CHRSA06	921.00	0.0	0.0	0.0	3.5	2.5	0.0	4.0	0.0	2.5	2.5
CHRSA07	915.00	2.0	1.5	0.5	1.0	1.0	1.5	1.0	0.0	1.0	1.0
CHRSA08	918.50	0.0	0.0	1.5	2.0	1.5	3.0	2.0	1.0	1.5	1.5
CHRSA09	923.00	0.0	0.0	0.0	3.0	2.5	0.0	0.0	0.0	3.0	2.5
CHRSA10	922.00	0.0	0.0	0.0	4.0	3.0	0.0	0.0	0.0	3.5	2.5
CHRSA100	931.00	0.0	0.0	1.0	2.5	1.5	0.0	0.0	1.0	2.0	1.5
CHRSA101	924.00	0.5	0.5	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.5
CHRSA102	928.00	0.0	2.0	0.5	1.5	1.0	0.0	2.0	0.5	1.5	1.0
CHRSA103	918.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
CHRSA104	926.50	0.0	0.0	1.0	2.0	1.5	0.0	0.0	1.0	2.0	1.5
CHRSA105	919.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
CHRSA106	925.00	0.0	2.0	0.5	2.0	1.0	0.0	1.5	0.5	2.0	1.0
CHRSA107	927.50	0.0	0.0	0.0	3.0	1.5	0.0	0.0	1.5	3.0	1.5
CHRSA108	923.00	0.0	0.0	1.5	2.5	2.0	0.0	3.0	1.5	2.0	1.5
CHRSA109	918.00	2.5	1.5	0.5	1.0	1.0	1.5	1.5	0.5	1.0	1.0
CHRSA11	924.50	0.0	0.0	0.0	3.5	2.5	0.0	0.0	0.0	3.5	2.5
CHRSA110	913.50	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
CHRSA111	921.00	0.0	0.0	1.5	2.0	1.5	0.0	2.5	1.0	2.0	1.5
CHRSA112	918.00	2.5	1.5	0.5	1.0	1.0	1.5	1.5	0.5	1.0	1.0
CHRSA113	919.50	0.0	2.5	1.0	1.5	1.5	2.5	2.0	1.0	1.5	1.5
CHRSA114	910.50	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
CHRSA115	918.00	0.0	3.0	1.5	2.5	2.0	3.0	2.0	1.0	2.0	1.5
CHRSA116	916.50	0.0	0.0	0.0	3.0	2.5	3.0	2.5	1.5	2.0	2.0
CHRSA117	919.50	0.0	0.0	0.0	2.5	2.0	4.5	2.5	1.5	2.0	1.5
CHRSA118	919.50	0.0	0.0	0.0	3.0	2.5	0.0	3.0	2.0	2.5	2.0
CHRSA119	918.50	0.0	0.0	1.5	2.0	2.0	3.0	2.0	1.0	1.5	1.5
CHRSA12	924.00	0.0	0.0	0.0	2.5	2.0	0.0	0.0	0.0	2.5	2.0
CHRSA120	916.00	0.0	3.0	1.5	2.0	1.5	2.0	2.0	1.0	1.5	1.5
CHRSA13	918.00	1.5	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
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Appendix Ta	ble A3. Contir	nued									
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	Days from Activation of Staging Area for Field to be Inundated										
	Approx.		Existi	ng Conc	litions		V	/ith Dive	ersion St	taging A	rea
Storage	Field	2009-		100-	500-				100-		
Area	Elevation	yr	50-yr	yr	yr	PMF	2009-yr	50-yr	yr	500-yr	PMF
CHRSA14	924.00	0.0	0.0	0.0	3.0	2.5	1.0	1.0	0.0	1.0	1.0
CHRSA15	919.50	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	0.5	0.5
CHRSA16	918.00	1.5	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
CHRSA17	918.00	1.0	1.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0
CHRSA18	922.00	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	1.5	1.5
CHRSA18E	922.00	0.0	2.5	1.0	1.5	1.5	3.5	1.5	0.5	1.5	1.0
CHRSA19	921.00	0.0	2.0	0.5	1.5	1.0	1.0	1.0	0.0	0.5	0.5
CHRSA20	921.00	1.0	1.0	0.0	0.5	0.5	2.0	1.5	1.5	1.5	1.0
CHRSA21	927.50	2.0	1.5	1.5	1.5	1.0	0.0	2.0	2.0	2.0	1.5
CHRSA22	927.50	0.0	2.0	2.0	2.0	1.5	0.5	0.5	0.0	0.0	0.0
CHRSA23	920.00	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA24	927.50	0.0	0.0	0.0	0.0	0.0	2.0	1.5	1.0	1.0	1.0
CHRSA25	928.00	2.0	1.5	1.0	1.0	1.0	2.0	1.5	1.0	1.0	1.0
CHRSA26	928.50	2.0	1.5	1.0	1.0	1.0	1.5	1.0	0.0	1.0	1.0
CHRSA27	924.00	1.5	1.0	0.0	1.0	1.0	1.5	1.5	0.5	1.0	1.0
DIVSA100	913.00	2.5	2.0	1.0	1.5	1.5	0.5	0.5	0.5	1.0	0.5
DIVSA101	914.00	2.5	1.0	1.0	1.5	0.0	0.0	0.0	0.5	1.0	0.0
DIVSA102	915.00	0.0	0.0	0.5	1.0	0.0	2.5	2.0	1.5	2.0	2.0
DIVSA105	915.50	0.0	0.0	0.0	4.5	0.0	0.0	4.0	4.0	3.0	4.0
DIVSA106E	919.00	0.0	0.0	0.0	4.0	0.0	0.0	4.0	4.0	3.0	4.0
DIVSA107E	919.50	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	1.5	0.0
DIVSA84	913.00	2.0	2.0	2.5	1.5	1.5	0.5	0.5	0.5	0.5	1.0
DIVSA84E	907.50	3.0	2.5	3.0	1.5	2.0	0.0	0.0	0.0	0.5	0.0
DIVSA85E	904.50	1.0	1.0	1.5	1.0	1.0	0.0	0.0	0.0	0.5	0.5
DIVSA86S	905.50	1.5	1.5	2.0	1.0	1.5	0.5	1.0	0.5	1.0	1.0
DIVSA87S	908.50	0.0	3.0	3.5	2.0	2.0	0.5	0.5	0.5	0.5	0.5
DIVSA88W	907.00	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0
DIVSA89W	910.50	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0
DIVSA90S	907.50	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
DIVSA93S	908.00	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0
DIVSA94	908.00	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.0
DIVSA95	908.50	1.0	1.0	0.0	0.5	0.5	1.0	1.0	0.5	1.0	1.0
DIVSA98W	912.50	0.0	2.5	1.5	1.5	1.0	1.0	1.0	0.0	0.5	0.5
DIVSA99W	910.50	1.5	1.5	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0
DRAIN370	922.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
DRAIN371	921.50	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5
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Appendix Ta	ppendix Table A3. Continued										
	Days from Activation of Staging Area for Field to be Inundated										
	Approx.		Existi	ng Conc	litions		١	With Div	ersion S	Staging A	Area
Storage	Field	2009-		100-	500-		2009		100-	500-	
Area	Elevation	yr	50-yr	yr	yr	PMF	-yr	50-yr	yr	yr	PMF
DRAIN372	920.00	0.5	0.5	0.5	0.5	0.5	1.0	1.0	0.0	1.0	1.0
DRAIN373	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DRAIN374	915.00	1.0	1.0	0.0	0.5	0.0	0.5	0.5	0.0	0.5	0.0
RR10	909.00	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0
RR11	909.00	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0
RR12	909.00	1.0	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
RR13	911.50	2.0	2.0	0.5	1.0	1.0	1.0	1.0	0.5	1.0	1.0
RR14	914.00	0.0	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
RR15	908.00	0.0	2.5	1.0	1.5	1.5	1.5	1.5	0.5	1.0	1.0
RR16	916.00	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0
RR17	910.00	1.5	1.5	0.0	1.0	1.0	1.0	1.0	0.0	0.5	0.5
RR18	913.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
RR19	909.00	0.0	0.0	0.0	3.5	2.5	4.0	2.5	2.0	2.0	2.0
RR20	919.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
RR21	909.00	0.0	3.0	1.0	2.0	1.5	2.5	1.5	0.5	1.5	1.5
RR22	917.50	1.0	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
RR23	912.50	0.0	0.0	0.0	4.0	3.0	0.0	4.5	0.0	3.0	2.5
RR24	921.50	0.0	0.0	0.0	2.5	2.0	0.0	2.5	1.0	2.0	1.5
RR25	920.00	1.0	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
RR26	913.00	1.5	1.5	0.0	1.0	1.0	1.5	1.0	0.0	1.0	1.0
RR27	917.00	0.0	0.0	0.0	4.0	2.5	0.0	0.0	0.0	3.0	2.5
RR28	923.00	0.0	0.0	1.0	2.0	1.5	0.0	2.0	1.0	1.5	1.5
RR29	921.00	1.5	1.5	0.5	1.0	0.5	0.5	0.5	0.0	0.5	0.5
RR3	910.50	0.0	0.0	0.0	2.5	2.0	0.0	3.5	0.0	2.0	2.0
RR30	922.50	1.0	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
RR31	916.50	1.0	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
RR32	916.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
RR33	913.50	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
RR34	913.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
RR35	914.00	0.5	0.5	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.5
RR36	916.50	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
RR37	914.50	0.0	2.5	1.0	1.5	1.5	0.0	2.0	0.5	1.5	1.5
RR38	923.50	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
RR39	915.50	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR4	906.50	0.0	0.0	0.0	2.0	1.5	0.0	0.0	0.0	2.0	1.5
RR40	925.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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Appendix Ta	ble A3. Contir	nued									
	Days from Activation of Staging Area for Field to be Inundated										
	Approx.		Existi	ng Conc	litions		١	Nith Div	ersion S	taging A	Area
Storage	Field	2009-		100-	500-		2009		100-	500-	
Area	Elevation	yr	50-yr	yr	yr	PMF	-yr	50-yr	yr	yr	PMF
RR41	915.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR42	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR43	920.00	0.5	0.5	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.5
RR44	924.00	0.0	1.5	0.0	1.0	1.0	0.0	1.5	0.0	1.0	1.0
RR45	923.00	1.5	1.0	0.0	0.5	0.5	1.5	1.0	0.0	0.5	0.5
RR46	932.00	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	4.5	0.0
RR47	927.50	0.0	0.0	0.5	1.5	1.5	0.0	2.5	0.5	1.5	1.0
RR48	928.00	0.0	0.0	1.0	2.0	1.5	0.0	0.0	1.0	2.0	1.5
RR49	926.50	0.0	1.5	0.0	1.0	1.0	0.0	1.5	0.0	1.0	1.0
RR5	904.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR50	933.00	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	4.0	0.0
RR51	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR52	933.00	0.0	0.0	0.0	4.0	3.0	0.0	0.0	0.0	4.0	3.0
RR53	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR54	932.50	0.0	0.0	0.0	3.5	2.0	0.0	0.0	0.0	3.5	2.0
RR55	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR56	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR57	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR58	914.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR59	919.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR6	910.00	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5
RR60	915.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR7	907.00	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR8	909.50	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.0
RR9	900.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA200	918.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
WLVSA202	928.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA203	927.00	0.0	0.0	0.0	2.5	1.5	0.0	0.0	0.0	2.5	1.5
WLVSA204	918.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
WLVSA205	924.00	0.0	0.0	1.5	2.0	1.5	0.0	3.5	1.5	2.0	1.5
WLVSA206	924.00	0.0	0.0	1.5	2.0	1.5	0.0	3.0	1.0	2.0	1.5
WLVSA207	925.50	0.0	0.0	1.5	2.0	1.5	0.0	0.0	1.5	2.0	1.5
WLVSA208	923.50	0.0	0.0	1.0	2.0	1.5	0.0	2.5	1.0	2.0	1.5
WLVSA209	915.50	1.0	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
WLVSA210	920.50	0.0	2.0	0.5	1.5	1.0	3.0	1.5	0.5	1.5	1.0
WLVSA211	923.00	0.0	0.0	0.0	3.0	2.0	0.0	0.0	0.0	2.5	2.0
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Appendix Tal	ble A3. Contir	nued									
			Days fr	om Acti	vation o	f Staging	g Area f	or Field	to be In	undated	t
	Approx.		Existi	ng Conc	litions		١	Nith Div	version S	Staging A	Area
Storage	Field	2009-		100-	500-		2009		100-	500-	
Area	Elevationa	yr	50-yr	yr	yr	PMF	-yr	50-yr	yr	yr	PMF
WLVSA212	919.50	0.0	0.0	0.0	4.5	3.0	0.0	3.0	2.5	2.5	2.5
WLVSA213	920.00	0.0	0.0	0.0	4.5	3.0	0.0	3.5	3.0	2.5	2.5
WLVSA214	919.50	0.0	0.0	0.0	3.5	2.5	0.0	3.0	2.0	2.5	2.0
WLVSA215	911.00	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5
WLVSA216	914.50	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.5	1.0	0.0
WLVSA217	922.00	0.0	0.0	0.0	4.5	3.5	0.0	0.0	0.0	3.5	3.0
WLVSA218	921.00	0.0	0.0	0.0	2.5	1.0	0.0	4.0	0.0	2.5	1.0
WLVSA219	922.00	0.0	0.0	0.0	3.5	2.5	0.0	5.0	0.0	3.0	2.5
WLVSA220	908.50	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0
WLVSA221	908.50	0.5	1.0	0.0	0.5	0.0	0.5	0.5	0.0	0.5	0.0
WLVSA222	913.00	2.5	2.0	1.0	1.5	1.5	1.0	1.0	0.5	1.0	1.0
WLVSA223	910.00	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5
WLVSA224	912.50	2.0	2.0	0.5	1.5	1.0	1.0	1.0	0.5	1.0	1.0
WLVSA225	914.50	0.0	3.0	1.5	2.0	2.0	2.0	1.5	0.5	1.5	1.5
WLVSA226	917.00	0.0	0.0	0.0	3.0	2.5	2.5	2.0	1.0	1.5	1.5
WLVSA227	915.50	0.0	2.5	1.5	2.0	1.5	1.5	1.5	0.5	1.0	1.0
WLVSA228	911.50	1.5	1.0	0.0	0.5	0.5	1.0	1.0	0.0	0.5	0.5
WLVSA229	910.00	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5
WLVSA230	910.00	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5
WLVSA231	910.50	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5
WLVSA232	916.00	0.0	2.5	1.0	1.5	1.5	1.5	1.5	0.5	1.0	1.0
WLVSA233	912.00	0.5	0.5	0.5	1.0	0.0	0.0	0.5	0.5	1.0	0.5
WLVSA234	917.50	0.0	0.0	0.0	3.5	2.5	3.0	2.0	1.5	2.0	2.0
WLVSA235	908.50	0.5	0.5	0.0	0.5	0.0	0.5	0.5	0.0	0.0	0.0
WLVSA236	910.00	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5
WLVSA237	910.00	1.5	1.5	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.5
WLVSA57	921.00	0.0	0.0	2.0	1.5	0.0	0.0	2.0	1.0	1.5	0.5
WLVSA64	922.00	0.0	0.0	1.5	2.0	0.5	0.0	4.0	0.0	2.0	1.0
WLVSA65	919.50	0.0	2.0	0.5	1.5	1.0	2.0	1.5	0.5	1.5	1.0
WLVSA66	923.00	0.0	0.0	1.0	2.0	1.0	0.0	2.5	1.0	2.0	0.5
WRRND1	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND10	916.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND11	919.50	0.0	0.0	0.5	0.5	0.5	0.0	0.5	0.5	0.5	0.5
WRRND12	916.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND13	913.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND14	912.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RRND14 912.50 0.0 0										

Appendix Tal	ble A3. Contir	nued									
			Days fr	om Acti	vation o	f Staging	g Area f	or Field	to be In	undated	t
	Approx.		Existi	ng Conc	litions		١	Nith Div	version S	Staging A	Area
Storage	Field	2009-		100-	500-		2009		100-	500-	
Area	Elevationa	yr	50-yr	yr	yr	PMF	-yr	50-yr	yr	yr	PMF
WRRND15	911.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND16	912.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND17	911.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND18	908.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND19	906.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND2	920.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND3	919.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND4	918.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND5	918.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND6	918.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND7	917.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND8	917.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRRND9	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA273	929.50	0.0	0.0	0.0	0.5	1.5	0.0	0.0	0.0	0.5	1.5
WRSA280	925.50	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	1.0	2.0
WRSA284	923.00	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	3.0	0.0
WRSA289	923.50	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	4.0	0.0
WRSA294	919.50	2.5	2.5	16.5	0.5	3.0	2.5	2.5	3.0	0.5	2.5
WRSA299	912.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA300	909.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA302	913.00	0.0	2.5	1.5	1.5	1.5	1.0	1.0	0.5	1.0	1.0
WRSA303	919.50	0.0	0.0	30.5	2.5	0.0	0.0	4.0	4.0	2.5	4.0
WRSA304	915.00	0.5	0.5	1.0	0.5	1.0	0.5	0.5	1.0	0.5	1.0
WRSA305A	910.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA305B	910.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA305C	906.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA305D	906.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA306	908.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA307	911.00	1.5	1.5	0.5	1.0	1.0	1.0	1.0	0.0	0.5	0.5
WRSA308	917.00	0.0	0.0	0.0	2.5	0.0	3.0	2.5	2.0	2.0	2.0
WRSA309	914.50	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
WRSA311	907.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA312	906.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA315	909.50	0.5	0.5	1.0	0.5	1.0	0.0	0.0	0.0	0.5	0.0
WRSA321	906.50	1.5	1.5	2.0	1.5	1.5	0.0	0.0	0.5	0.5	0.5
WRSA350	910.50	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0
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Appendix Ta	ble A3. Contir	nued									
			Days fr	om Acti	vation o	f Staging	g Area f	or Field	to be In	undated	ł
	Approx.		Existi	ng Conc	litions		V	Vith Dive	ersion S	taging A	rea
Storage	Field	2009-		100-	500-		2009		100-	500-	
Area	Elevation <sup>a</sup>	yr	50-yr	yr	yr	PMF	-yr	50-yr	yr	yr	PMF
WRSA351	908.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA352	911.00	0.0	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.5
WRSA353	917.50	1.5	1.5	1.5	1.0	1.5	2.0	1.5	1.5	1.0	1.5
WRSA354	919.00	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.5	0.5	0.5
WRSA355	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA356	920.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA357	921.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA358	923.00	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
WRSA359	923.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA360	924.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA363	911.50	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0
WRSA364	913.00	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.5	0.0	0.5
WRSA373	927.50	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	4.5	0.0
WRSA378	926.00	0.0	0.0	0.0	3.5	3.0	0.0	0.0	0.0	3.5	3.0
WRSA383	924.00	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	4.0	0.0
WRSA384	925.00	0.0	0.0	0.0	3.5	3.0	0.0	0.0	0.0	3.5	3.0
WRSA389	923.00	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	3.5	0.0
WRSA390	917.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WRSA501	911.00	1.5	1.5	0.5	1.0	1.0	1.0	1.0	0.0	0.5	0.5
WRSA502	913.00	2.5	2.0	1.0	1.5	1.5	1.0	1.0	0.5	1.0	1.0
WRSA504	915.00	0.0	2.0	1.0	1.5	1.5	1.5	1.5	0.5	1.0	1.0
WRSA505	909.00	1.0	1.0	0.0	0.5	0.5	0.5	1.0	0.0	0.5	0.5
WRSA506	909.00	1.0	1.0	0.0	0.5	0.5	0.5	0.5	0.0	0.5	0.0
WRSA507	902.00	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
WRSA907	915.00	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5
PMF = Probabil	istic Maximum Fl	ood.	1	1	1	1	1	1	1	1	1

<sup>a</sup>Feet above mean seal level. Lowest estimated elevation for storage area.

Source: Houston-Moore Group (2019).

Appendix Table A4. Time from Activation of Staging Area to When Flood Water Leaves, by Storage Area, by Flood Event Frequency for With and Without Diversion Conditions, FM Diversion Staging Area, Phase 9.1 HEC-RAS Modeling

		Days from Activation of Staging Area Until Flood Water Leaves the Storage Area									
	Approx.		Exist	ing Condi	tions		١	Nith Dive	ersion Sta	ging Area	
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
BD1	908.0	5.5	9.5	10.5	17.5	23.0	5.5	10.5	11.0	17.5	23.0
CHRSA01	915.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	8.5	10.0
CHRSA02	914.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	8.5	10.5
CHRSA03	918.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA04	918.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA05E	920.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA05W	920.0	0.0	3.5	4.0	5.0	8.0	0.0	3.5	4.5	6.0	10.0
CHRSA06	921.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA07	915.0	0.0	0.0	0.0	7.5	13.0	0.0	0.0	7.5	9.5	14.0
CHRSA08	918.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	8.5
CHRSA09	923.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA10	922.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA100	931.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA101	924.0	0.0	0.0	2.0	8.0	15.5	0.0	0.0	2.5	9.0	15.5
CHRSA102	928.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA103	918.0	0.0	4.0	5.0	12.0	19.0	0.0	4.0	7.0	12.5	19.0
CHRSA104	926.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA105	919.0	0.0	4.0	5.0	12.0	19.0	0.0	4.0	7.0	12.5	19.0
CHRSA106	925.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA107	927.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA108	923.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA109	918.0	0.0	0.0	0.0	5.0	7.0	0.0	0.0	0.0	8.5	11.5
CHRSA11	924.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA110	913.5	0.0	6.5	7.5	15.0	21.5	0.0	6.5	9.0	15.0	21.5
CHRSA111	921.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA112	918.0	0.0	0.0	0.0	5.0	7.0	0.0	0.0	0.0	8.5	11.5
CHRSA113	919.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	9.5
CHRSA114	910.5	0.0	7.0	8.0	15.0	21.5	0.0	7.0	10.0	15.5	21.5
CHRSA115	918.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	9.5
CHRSA116	916.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	10.0
CHRSA117	919.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA118	919.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA119	918.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	8.5
CHRSA12	924.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA120	916.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	8.5	10.5
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Appendix Tal	ole A4. Cont	inued									
	Days from Activation of Staging Area Until Flood Water Leaves the Storage Area										
	Approx.		Exist	ing Condi	itions		Ň	Nith Dive	ersion Sta	iging Area	
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
CHRSA13	918.0	0.0	0.0	0.0	8.0	15.0	0.0	0.0	5.5	9.5	15.0
CHRSA14	924.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA15	919.5	0.0	0.0	0.0	5.0	7.5	0.0	0.0	0.0	8.0	11.5
CHRSA16	918.0	0.0	0.0	0.0	8.0	15.0	0.0	0.0	5.5	9.5	15.0
CHRSA17	918.0	0.0	0.0	3.5	9.5	17.0	0.0	0.0	6.5	10.5	17.0
CHRSA18	922.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA18E	922.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA19	921.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	8.5
CHRSA20	921.0	0.0	0.0	2.5	8.5	16.0	0.0	0.0	4.0	10.0	16.5
CHRSA21	927.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA22	927.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA23	920.0	0.0	3.0	4.0	10.5	18.0	0.0	3.0	5.5	11.0	18.0
CHRSA24	927.5	0.0	2.5	3.5	3.5	5.5	0.0	2.5	3.5	3.5	5.5
CHRSA25	928.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA26	928.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHRSA27	924.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	8.5
DIVSA100	913.0	0.0	0.0	0.0	5.5	8.0	0.0	0.0	8.0	10.0	13.5
DIVSA101	914.0	0.0	0.0	0.0	5.5	8.0	0.0	0.0	8.0	10.0	13.0
DIVSA102	915.0	0.0	0.0	0.0	7.0	12.0	0.0	0.0	7.5	9.5	13.5
DIVSA105	915.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	8.0	9.5
DIVSA106E	919.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA107E	919.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIVSA84	913.0	0.0	0.0	0.0	4.0	4.0	0.5	2.0	9.5	10.5	12.0
DIVSA84E	907.5	0.0	0.0	0.0	9.5	10.5	0.0	12.0	10.5	10.0	12.0
DIVSA85E	904.5	0.0	5.5	7.0	11.5	16.0	49.0	49.0	49.0	49.0	49.0
DIVSA86S	905.5	0.0	0.0	6.5	11.0	14.5	0.0	13.0	11.0	11.0	13.0
DIVSA87S	908.5	0.0	0.0	0.0	0.0	0.0	0.0	11.5	10.5	10.0	12.0
DIVSA88W	907.0	3.5	8.0	9.5	14.0	21.0	0.0	12.0	10.5	10.0	13.0
DIVSA89W	910.5	0.0	8.0	9.0	12.0	19.5	0.0	9.5	10.0	9.5	11.5
DIVSA90S	907.5	4.5	9.0	10.0	15.5	21.5	0.0	8.0	10.5	16.0	22.0
DIVSA93S	908.0	0.0	6.5	7.5	13.5	20.5	0.0	7.5	10.5	15.0	21.5
DIVSA94	908.0	4.0	9.0	10.0	14.5	21.0	0.0	7.5	10.5	15.0	21.5
DIVSA95	908.5	0.0	6.0	7.0	12.5	19.5	0.0	7.0	10.0	14.0	21.0
DIVSA98W	912.5	0.0	0.0	0.0	3.5	3.5	0.0	0.0	8.0	9.5	13.0
DIVSA99W	910.5	0.0	4.5	5.5	11.0	18.5	0.0	5.0	9.5	12.0	18.5
DRAIN370	922.5	0.5	2.0	2.0	3.5	3.5	0.5	2.0	2.0	3.5	3.5
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Appendix Tal	Appendix Table A4. Continued										
	Days from Activation of Staging Area Until Flood Water Leaves the Storage Area										
	Approx.		Existi	ng Condi	tions		١	Nith Dive	ersion Sta	iging Area	a
	Field			05	25-yr	25-yr			25	25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL 2.0	10-yr	20-yr	25-yr	Long	EL 20
	921.5	0.0	1.5	1.5	3.0	2.5	0.0	1.5	1.5	2.5	3.0
DRAIN372	920.0	0.0	0.0	0.0	2.0	2.5	0.0	0.0	0.0	2.5	2.5
	919.0	0.0	2.5	5.5 0 0	3.5	4.0	0.0	2.5	3.5	5.5 12.0	0.0 10.0
DRAIN374	000.0	3.5	7.0	8.0 7 5	14.0	20.5	3.5	7.0	9.0 10.0	14.5	21.0
PD11	909.0	0.0	7.0	7.5 8.0	14.0	20.5	0.0	7.0	10.0	14.5	21.0
	909.0	0.0	7.0	8.0	14.5	21.0	0.0	7.0	10.0	15.0	21.5
PD12	909.0 011 5	0.0	7.0	5.0	14.5	19 5	0.0	7.0	10.0	12.0	19.5
	911.5	0.0	4.0	0.0	6.0	20.5	0.0	4.5	9.0 7.5	0.5	12.0
RR15	908.0	5.0	8.5	9.5	17.0	23.5	5.0	8.5	11.0	17.0	23.5
RR16	916.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	85	10.5
RR17	910.0	0.0	6.5	75	14 5	21.5	0.0	7.0	10.0	15.0	21.5
RR18	913.0	0.0	0.0	4.0	9.5	16.5	0.0	0.0	8.0	11.0	17.0
RR19	909.0	4.0	8.0	9.0	16.5	23.0	4.5	8.0	10.5	16.5	23.0
RR20	919.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR21	909.0	4.5	8.0	9.0	16.5	23.0	4.5	8.0	10.5	17.0	23.0
RR22	917.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	9.5
RR23	912.5	0.0	4.5	5.5	12.0	19.0	0.0	5.0	8.5	12.5	19.0
RR24	921.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR25	920.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR26	913.0	0.0	4.5	6.0	12.5	19.5	0.0	5.0	8.5	13.0	19.5
RR27	917.0	0.0	0.0	0.0	7.0	12.5	0.0	0.0	6.0	9.0	13.5
RR28	923.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR29	921.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR3	910.5	0.0	0.0	5.0	10.0	17.0	0.0	4.5	9.0	11.5	17.5
RR30	922.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR31	916.5	0.0	0.0	3.5	9.5	17.0	0.0	0.0	7.0	10.5	17.0
RR32	916.0	0.0	3.0	4.5	11.0	18.5	0.0	3.5	7.5	11.5	18.5
RR33	913.5	0.0	6.5	7.5	15.5	21.5	0.0	6.5	9.0	15.5	21.5
RR34	913.0	3.5	7.0	8.0	16.0	22.0	3.5	7.0	9.5	16.0	22.0
RR35	914.0	0.0	6.5	7.5	15.0	21.5	0.0	6.5	9.0	15.0	21.5
RR36	916.5	0.0	4.0	5.0	11.5	19.0	0.0	4.0	7.5	12.0	19.0
RR37	914.5	2.5	6.5	7.5	15.5	21.5	3.0	6.5	9.0	15.5	22.0
RR38	923.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR39	915.5	0.0	6.0	7.0	15.0	21.0	0.0	6.0	8.5	15.0	21.5
RR4	906.5 4.5 8.5 9.5 17.0 23.0 5.0 8.5 11.0 17.0 23.0										
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Appendix Tal	ole A4. Cont	inued									
	Days from Activation of Staging Area Until Flood Water Leaves the Storage Area										
	Approx.		Exist	ing Condi	itions		۱ ۱	With Dive	ersion Sta	iging Area	a
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
RR40	925.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR41	915.5	3.5	6.5	7.5	16.0	22.0	3.5	7.0	9.0	16.0	22.0
RR42	916.0	2.5	6.0	7.0	15.0	21.5	2.5	6.5	8.5	15.5	21.5
RR43	920.0	0.0	2.5	3.5	10.0	17.5	0.0	2.5	5.5	10.5	17.5
RR44	924.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	7.5
RR45	923.0	0.0	0.0	0.0	6.0	10.5	0.0	0.0	0.0	7.5	12.0
RR46	932.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR47	927.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR48	928.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR49	926.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR5	904.0	7.5	10.5	11.5	19.5	26.0	7.5	11.0	12.5	20.0	26.0
RR50	933.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR51	919.0	4.5	7.0	8.0	16.5	22.5	4.5	7.0	8.5	16.5	23.0
RR52	933.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR53	919.0	5.0	7.5	8.5	17.0	23.5	5.0	7.5	9.0	17.0	23.5
RR54	932.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RR55	919.0	5.5	8.0	9.0	18.0	24.5	6.0	8.0	9.5	18.0	24.5
RR56	918.0	6.5	9.0	10.5	19.5	26.0	6.5	9.0	10.5	19.5	26.0
RR57	919.0	6.0	8.5	9.5	18.5	25.0	6.5	8.5	10.0	18.5	25.0
RR58	914.5	9.5	15.0	17.5	41.0	34.5	9.5	15.0	17.5	42.0	35.5
RR59	919.0	6.5	9.0	10.5	19.5	26.0	6.5	9.0	10.5	19.5	26.0
RR6	910.0	0.0	4.5	6.0	11.0	18.5	0.0	5.5	9.5	12.0	18.5
RR60	915.0	9.5	15.0	17.5	42.5	36.0	9.5	15.0	18.0	44.5	37.5
RR7	907.0	4.5	8.5	9.5	16.5	23.0	4.5	8.5	11.0	17.0	23.0
RR8	909.5	0.0	5.5	7.0	12.5	19.5	0.0	6.0	9.5	13.0	20.0
RR9	900.0	10.0	14.0	15.5	25.5	31.5	10.0	14.5	16.0	25.5	31.5
WLVSA200	918.0	0.0	4.5	5.5	12.5	19.5	0.0	4.5	7.5	13.0	19.5
WLVSA202	928.0	2.0	2.5	3.0	4.0	4.0	2.0	2.5	3.0	4.0	4.0
WLVSA203	927.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA204	918.0	0.0	4.0	5.0	12.5	19.5	0.0	4.5	7.5	12.5	19.5
WLVSA205	924.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA206	924.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA207	925.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA208	923.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA209	915.5	0.0	4.0	5.0	12.0	19.0	0.0	4.0	8.0	12.0	19.0
WLVSA210	920.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	9.0
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Appendix Tal	ole A4. Cont	inued									
	Days from Activation of Staging Area Until Flood Water Leaves the Storage Area										
	Approx.		Exist	ing Condi	tions		Ň	Nith Dive	ersion Sta	ging Area	a
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
WLVSA211	923.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA212	919.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA213	920.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA214	919.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA215	911.0	0.0	6.0	7.0	14.0	20.5	0.0	6.5	9.5	14.0	21.0
WLVSA216	914.5	0.0	0.0	0.5	8.0	14.0	0.0	0.0	7.5	10.0	15.0
WLVSA217	922.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA218	921.0	0.0	0.0	0.0	2.5	2.5	0.0	0.0	0.0	1.0	1.0
WLVSA219	922.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WLVSA220	908.5	0.0	7.0	8.0	14.5	21.5	0.0	7.0	10.0	15.0	21.5
WLVSA221	908.5	0.0	7.0	8.0	14.5	21.5	0.0	7.5	10.5	15.0	21.5
WLVSA222	913.0	0.0	0.0	0.0	5.5	7.5	0.0	0.0	8.0	10.0	13.0
WLVSA223	910.0	0.0	5.5	6.5	12.5	19.5	0.0	6.0	9.5	13.0	20.0
WLVSA224	912.5	0.0	0.0	0.0	8.0	14.5	0.0	0.0	8.0	10.5	15.5
WLVSA225	914.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	11.5	13.5
WLVSA226	917.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	9.0
WLVSA227	915.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	8.5	10.5
WLVSA228	911.5	0.0	3.5	5.0	11.0	18.0	0.0	4.5	9.0	12.0	18.0
WLVSA229	910.0	0.0	6.0	7.0	13.5	20.5	0.0	6.5	9.5	14.0	20.5
WLVSA230	910.0	0.0	6.0	7.0	13.5	20.5	0.0	6.5	9.5	14.0	20.5
WLVSA231	910.5	0.0	5.5	6.5	12.5	19.5	0.0	6.0	9.5	13.0	20.0
WLVSA232	916.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	8.5	10.5
WLVSA233	912.0	0.0	0.0	4.5	10.0	17.0	0.0	0.0	9.0	11.5	17.5
WLVSA234	917.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	8.5
WLVSA235	908.5	0.0	7.0	8.0	14.5	21.0	0.0	7.0	10.0	15.0	21.5
WLVSA236	910.0	0.0	5.0	6.0	11.5	19.0	0.0	5.5	9.5	12.5	19.0
WLVSA237	910.0	0.0	4.5	5.5	11.0	18.0	0.0	5.5	9.5	12.0	18.5
WLVSA57	921.0	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	2.5	2.5
WLVSA64	922.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.5	0.5
WLVSA65	919.5	0.0	0.0	0.0	4.0	4.5	0.0	0.0	0.0	8.0	10.5
WLVSA66	923.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0
WRRND1	920.0	2.5	6.5	7.0	10.5	18.5	2.5	6.5	7.5	10.5	18.0
WRRND10	916.5	2.0	6.5	7.0	10.0	18.0	2.0	6.5	8.0	10.5	17.5
WRRND11	919.5	0.0	2.0	3.0	3.0	3.5	0.0	2.0	3.0	3.5	5.0
WRRND12	916.0	0.0	6.0	7.0	9.5	17.5	0.0	6.0	8.0	10.0	16.5
WRRND13	913.5	4.0	8.0	8.5	14.0	20.5	4.0	8.0	9.5	14.0	20.0
		<u> </u>	<u> </u>	- cc	ntinued	<b>-</b>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Appendix Tal	ppendix Table A4. Continued											
	Days from Activation of Staging Area Until Flood Water Leaves the Storage Area											
	Approx.		Exist	ing Condi	itions		Ň	With Dive	ersion Sta	iging Are	a	
	Field				25-yr	25-yr				25-yr	25-yr	
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL	
WRRND14	912.5	4.5	8.0	9.0	14.5	21.0	4.0	8.5	10.0	14.5	20.5	
WRRND15	911.0	5.0	9.0	10.0	16.0	22.0	5.0	9.5	10.5	16.5	22.0	
WRRND16	912.5	4.0	8.0	8.5	13.5	20.0	4.0	8.0	9.5	13.0	20.0	
WRRND17	911.0	4.5	8.5	9.5	15.5	21.5	4.5	9.0	10.5	15.5	21.5	
WRSA355	917.5	0.0	6.0	7.0	9.5	17.5	0.0	6.0	7.5	10.0	17.0	
WRSA356	920.5	0.0	4.0	4.5	6.0	12.5	0.0	4.0	5.0	6.5	12.0	
WRSA357	921.5	0.0	3.5	4.0	4.5	7.0	0.0	3.5	4.0	5.0	8.0	
WRSA358	923.0	0.0	2.5	3.5	3.5	4.0	0.0	2.5	3.5	4.0	4.5	
WRSA359	923.0	0.0	3.0	4.0	4.5	7.5	0.0	3.0	4.0	4.5	8.5	
WRSA360	924.0	0.0	4.5	5.0	6.5	14.0	0.0	4.5	5.0	7.0	14.0	
WRSA363	911.5	0.0	7.5	8.5	10.5	17.5	0.0	7.0	9.5	11.0	17.5	
WRSA364	913.0	0.0	6.5	7.5	9.0	16.0	0.0	5.0	8.5	10.0	12.5	
WRSA373	927.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA378	926.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA383	924.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA384	925.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA389	923.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
WRSA390	917.5	0.0	5.0	5.5	7.0	14.5	0.0	4.5	6.5	8.5	14.0	
WRSA501	911.0	0.0	0.0	5.0	10.0	17.0	0.0	4.0	9.0	11.5	17.0	
WRSA502	913.0	0.0	0.0	0.0	6.0	9.5	0.0	0.0	8.0	10.0	13.5	
WRSA504	915.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	9.0	11.0	
WRSA505	909.0	0.0	8.0	9.0	16.0	22.5	0.0	8.5	11.0	16.5	23.0	
WRSA506	909.0	0.0	6.0	7.5	13.0	20.0	0.0	6.5	10.0	13.5	20.5	
WRSA507	902.0	9.5	13.0	14.0	22.5	29.0	9.5	13.5	15.0	23.0	29.0	
WRSA907	915.0	0.0	4.0	5.0	6.0	11.0	0.0	3.5	7.5	9.0	11.0	
<sup>a</sup> Feet above me	an seal level. L	owest esti	imated ele	evation for	r storage a	irea.						
Source: Housto	n-Moore Group	o (2019).										

Appendix Tak	ole A4. Cont	inued									
	Days from Activation of Staging Area Until Flood Water Leaves the Storage Area										
	Approx.		Exist	ing Condi	tions		١	Nith Dive	ersion Sta	ging Area	I
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	yr 17 O	50-yr	100-yr	500-yr	PMF	yr 17.0	50-yr	100-yr	500-yr	PMF
	906.0	17.0	20.0	20.0	40.5	30.5	17.0	20.0	20.0	40.0	15.0
CHRSAUI	915.0	0.0	0.0	0.0	16.0	8.0	10.0	12.5	9.5	20.5	15.0
CHRSA02	914.5	0.0	0.0	0.0	22.0	16.0	11.0	15.0	11.5	22.5	18.0
CHRSA03	918.0	0.0	0.0	0.0	13.5	0.0	8.0	11.5	8.5	17.5	14.0
CHRSA04	918.0	0.0	0.0	0.0	18.0	11.5	9.0	13.0	9.5	19.5	16.0
CHRSA05E	920.0	0.0	5.0	4.5	22.0	11.5	0.0	9.5	6.0	22.0	13.5
CHRSA05W	920.0	9.5	12.0	9.0	32.0	15.0	10.0	12.0	9.0	32.0	15.0
CHRSA06	921.0	0.0	0.0	0.0	17.5	8.5	0.0	8.5	0.0	17.5	12.5
CHRSA07	915.0	5.0	9.0	5.5	30.5	30.5	10.0	12.5	9.0	31.5	31.0
CHRSA08	918.5	0.0	0.0	2.5	17.5	14.5	8.0	10.5	7.5	19.0	16.0
CHRSA09	923.0	0.0	0.0	0.0	18.5	9.5	0.0	0.0	0.0	19.0	11.5
CHRSA10	922.0	0.0	0.0	0.0	16.0	7.0	0.0	0.0	0.0	16.0	11.0
CHRSA100	931.0	0.0	0.0	2.0	16.5	13.0	0.0	0.0	2.0	16.5	14.0
CHRSA101	924.0	5.5	9.5	5.0	32.0	35.5	7.0	11.5	5.5	32.5	35.5
CHRSA102	928.0	0.0	3.5	3.0	17.5	18.0	0.0	5.0	3.0	18.0	18.0
CHRSA103	918.0	8.5	14.0	22.5	40.0	44.5	10.5	14.0	22.5	40.0	45.0
CHRSA104	926.5	0.0	0.0	2.0	16.5	13.5	0.0	0.0	2.5	17.0	14.5
CHRSA105	919.0	9.0	14.0	22.5	40.0	45.5	10.0	14.5	22.5	40.0	46.0
CHRSA106	925.0	0.0	6.0	4.0	51.5	21.5	0.0	8.0	4.5	51.5	21.5
CHRSA107	927.5	0.0	0.0	0.0	51.5	12.5	0.0	0.0	2.0	51.5	13.5
CHRSA108	923.0	0.0	0.0	2.5	17.5	15.5	0.0	7.5	4.0	18.0	15.5
CHRSA109	918.0	3.0	7.5	4.5	27.0	28.0	9.0	11.5	8.0	28.0	28.0
CHRSA11	924.5	0.0	0.0	0.0	16.5	7.5	0.0	0.0	0.0	16.5	8.0
CHRSA110	913.5	10.5	17.5	24.0	45.5	51.5	12.0	17.5	24.0	45.5	51.5
CHRSA111	921.0	0.0	0.0	2.5	17.5	15.0	0.0	9.0	5.5	18.5	15.5
CHRSA112	918.0	3.0	7.5	4.5	27.0	28.0	9.0	11.5	8.0	28.0	28.0
CHRSA113	919.5	0.0	5.5	4.0	20.0	21.5	7.5	10.5	7.0	21.5	21.0
CHRSA114	910.5	11.5	17.5	24.0	47.0	49.5	12.5	17.5	24.0	46.5	49.5
CHRSA115	918.0	0.0	3.5	3.5	18.5	17.0	8.5	11.0	7.5	20.0	17.0
CHRSA116	916.5	0.0	0.0	0.0	20.5	14.5	11.0	15.0	11.5	21.5	18.0
CHRSA117	919.5	0.0	0.0	0.0	16.5	12.5	5.5	10.0	6.5	18.0	14.5
CHRSA118	919.5	0.0	0.0	0.0	17.0	12.5	0.0	10.5	7.0	18.5	14.5
CHRSA119	918.5	0.0	0.0	2.5	17.5	14.5	8.0	10.5	7.5	19.5	16.0
CHRSA12	924.0	0.0	0.0	0.0	16.5	12.0	0.0	0.0	0.0	17.0	13.5
CHRSA120	916.0	0.0	4.5	3.5	19.0	17.5	9.5	11.5	8.5	24.5	20.5
CHRSA13	918.0	5.5	9.5	5.5	31.5	33.0	9.5	12.0	8.5	32.0	33.0
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Appendix Tak	ole A4. Cont	inued									
		Days from Activation of Staging Area Until Flood Water Leaves the Storage Area									
	Approx.		Exist	ing Condi	tions	1	١	Nith Dive	ersion Sta	ging Area	
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	yr	50-yr	100-yr	500-yr	PMF	yr	50-yr	100-yr	500-yr	PMF
CHRSA14	924.0	0.0	0.0	0.0	17.0	8.5	0.0	0.0	0.0	17.0	10.0
CHRSA15	919.5	11.0	14.0	12.5	30.0	28.5	11.0	14.5	12.5	30.0	28.5
CHRSA16	918.0	5.5	9.5	5.5	31.5	33.0	9.5	12.0	8.5	32.0	33.0
CHRSA17	918.0	6.5	11.5	6.0	35.5	37.0	10.0	12.5	8.5	35.5	37.0
CHRSA18	922.0	11.0	14.0	12.5	30.0	18.5	11.0	14.5	12.5	30.0	19.0
CHRSA18E	922.0	0.0	5.0	3.5	19.0	18.5	0.0	9.0	5.0	20.0	18.5
CHRSA19	921.0	0.0	6.0	4.0	21.5	22.5	5.5	10.0	6.0	22.5	22.0
CHRSA20	921.0	6.0	10.5	5.5	33.5	36.0	8.5	12.0	7.0	34.0	36.5
CHRSA21	927.5	11.0	14.0	12.5	30.0	18.5	11.0	14.5	12.5	30.0	19.0
CHRSA22	927.5	0.0	8.5	7.0	26.5	15.5	0.0	9.0	7.0	26.5	16.0
CHRSA23	920.0	9.5	13.5	10.0	37.5	41.0	10.0	13.5	10.0	37.5	41.0
CHRSA24	927.5	8.0	12.0	10.0	27.5	15.5	8.5	12.0	10.0	27.5	16.0
CHRSA25	928.0	11.0	14.0	12.5	30.0	18.5	11.0	14.5	12.5	30.0	19.0
CHRSA26	928.5	4.0	7.5	6.0	23.0	13.5	4.0	7.5	6.0	23.0	14.5
CHRSA27	924.0	9.5	12.5	10.0	27.5	25.0	9.5	12.5	10.0	27.5	25.5
DIVSA100	913.0	4.5	8.5	6.0	29.5	27.0	11.0	12.5	9.5	31.0	27.5
DIVSA101	914.0	4.0	8.0	5.5	28.5	27.5	11.0	13.0	10.0	29.5	28.0
DIVSA102	915.0	5.0	8.5	5.5	30.0	29.5	10.5	12.5	9.0	30.5	30.0
DIVSA105	915.5	0.0	0.0	0.0	10.5	0.0	9.5	12.0	9.0	18.0	14.0
DIVSA106E	919.0	0.0	0.0	0.0	10.5	0.0	0.0	9.5	6.5	10.5	12.0
DIVSA107E	919.5	0.0	0.0	0.0	9.0	0.0	0.0	9.0	6.0	10.5	11.0
DIVSA84	913.0	6.5	10.0	7.0	34.0	14.5	11.5	13.5	20.5	24.5	16.0
DIVSA84E	907.5	13.0	17.0	13.5	48.0	21.5	11.0	12.5	10.0	31.5	17.0
DIVSA85E	904.5	15.0	18.5	15.0	51.0	25.0	50.0	50.5	47.5	51.5	51.5
DIVSA86S	905.5	14.5	18.5	14.5	50.0	24.0	12.5	14.0	11.0	42.0	19.5
DIVSA87S	908.5	0.0	19.0	15.0	47.5	26.0	11.0	12.5	10.0	33.0	17.5
DIVSA88W	907.0	15.0	18.5	15.0	49.0	30.5	11.5	13.0	10.0	36.0	19.5
DIVSA89W	910.5	15.0	17.5	14.5	48.5	23.0	11.0	12.5	9.5	30.0	16.0
DIVSA90S	907.5	16.0	19.0	15.5	49.5	30.0	13.5	18.5	23.5	47.5	45.5
DIVSA93S	908.0	12.0	16.5	11.0	47.0	38.0	13.0	17.5	23.0	47.0	43.0
DIVSA94	908.0	16.0	18.5	15.5	49.5	29.5	13.0	17.5	23.0	47.0	43.0
DIVSA95	908.5	12.0	16.0	11.5	47.0	36.0	12.5	16.5	12.0	46.0	41.0
DIVSA98W	912.5	0.0	7.5	6.0	26.5	20.0	10.5	12.5	9.5	31.0	26.0
DIVSA99W	910.5	9.5	14.5	8.5	41.0	35.5	12.0	15.0	10.5	41.0	36.5
DRAIN370	922.5	3.0	4.0	34.5	47.5	6.0	3.0	4.0	34.5	47.0	8.0
DRAIN371	921.5	3.0	3.5	1.5	47.5	6.0	3.0	3.5	1.5	47.0	9.5
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Appendix Tal	ppendix Table A4. Continued										
		Days	from Ac	tivation o	of Staging	g Area Ur	ntil Flood	Water Le	eaves the	Storage	Area
	Approx.		Exist	ing Condi	tions		١	Nith Dive	ersion Sta	ging Area	a
	Field	2009-					2009-			500-	
Storage Area	Elevation <sup>a</sup>	yr	50-yr	100-yr	500-yr	PMF	yr	50-yr	100-yr	yr	PMF
DRAIN372	920.0	3.0	5.5	4.5	46.0	9.5	5.5	9.5	6.5	45.5	12.0
DRAIN373	919.0	7.5	10.5	8.0	38.0	13.5	9.0	11.0	8.5	36.5	13.5
DRAIN374	915.0	14.5	17.0	14.0	47.0	20.5	14.5	16.5	14.0	46.5	20.5
RR10	909.0	11.5	16.5	22.0	46.5	42.0	12.5	16.5	22.5	46.0	42.5
RR11	909.0	11.5	17.5	23.0	47.0	45.0	12.5	17.5	23.0	46.5	45.0
RR12	909.0	11.5	17.5	23.0	47.0	45.0	12.5	17.5	23.0	46.5	45.0
RR13	911.5	9.0	14.0	8.0	40.0	37.0	11.5	14.5	10.0	40.0	37.5
RR14	914.0	4.0	8.0	5.5	29.0	28.0	10.5	12.0	9.0	30.0	28.5
RR15	908.0	13.0	20.5	25.5	49.5	51.5	13.5	20.5	25.5	49.0	51.5
RR16	916.0	0.0	5.5	4.0	20.0	19.0	9.5	11.5	8.5	23.5	19.0
RR17	910.0	11.5	17.5	23.5	47.0	47.5	12.5	17.0	23.5	46.0	47.5
RR18	913.0	7.5	12.5	6.5	37.0	34.5	11.0	13.5	9.5	37.0	35.0
RR19	909.0	12.5	20.0	25.0	49.0	51.5	13.0	19.5	25.0	48.0	51.5
RR20	919.0	0.0	0.0	0.0	15.5	10.0	6.5	10.0	6.5	17.5	13.5
RR21	909.0	12.5	20.0	25.0	49.0	51.5	13.0	20.0	25.0	48.5	51.5
RR22	917.5	0.0	4.0	3.5	18.5	17.0	8.5	11.0	8.0	20.5	17.5
RR23	912.5	9.5	14.5	8.0	41.0	40.5	11.5	15.0	10.0	40.5	40.5
RR24	921.5	0.0	0.0	0.0	14.0	7.0	0.0	7.5	0.0	15.0	12.0
RR25	920.0	0.0	0.0	0.0	16.5	13.0	0.0	9.5	6.0	18.0	14.5
RR26	913.0	9.5	14.5	22.0	41.5	42.5	11.5	15.0	22.0	41.5	42.5
RR27	917.0	5.0	8.5	5.0	30.0	30.5	9.5	12.0	8.5	30.0	31.0
RR28	923.0	0.0	0.0	0.0	14.5	8.0	0.0	0.0	0.0	15.0	11.5
RR29	921.0	0.0	0.0	3.0	18.0	17.0	0.0	9.5	5.5	19.0	17.0
RR3	910.5	9.0	13.5	8.5	39.5	32.0	11.5	14.5	10.5	39.5	33.5
RR30	922.5	0.0	0.0	0.0	16.0	12.0	0.0	7.0	0.0	17.0	13.5
RR31	916.5	7.0	12.0	6.0	36.0	37.0	10.0	13.0	9.0	36.0	37.0
RR32	916.0	8.0	13.0	6.5	38.5	40.5	10.5	13.5	9.0	38.5	40.5
RR33	913.5	11.0	17.5	24.5	46.0	51.5	12.0	17.5	24.5	45.5	51.5
RR34	913.0	11.0	18.5	25.0	47.0	51.5	12.0	18.5	25.0	47.0	51.5
RR35	914.0	10.5	17.5	24.5	45.5	51.5	11.5	17.5	24.5	45.5	51.5
RR36	916.5	8.5	13.5	22.0	39.5	42.5	10.5	14.0	22.0	39.5	43.0
RR37	914.5	10.5	18.0	24.5	46.0	51.5	11.5	18.0	24.5	46.0	51.5
RR38	923.5	0.0	3.5	3.0	18.0	17.5	0.0	7.5	4.0	18.5	17.5
RR39	915.5	10.5	17.0	24.0	45.0	51.5	11.5	17.0	24.0	45.0	51.5
RR4	906.5	13.5	20.0	24.5	49.5	50.5	13.5	20.0	24.5	48.5	51.0
RR40	925.5	0.0	0.0	0.0	16.5	12.5	0.0	0.0	0.0	16.5	13.5
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Appendix Tal	ppendix Table A4. Continued										
		Days	s from Ac	tivation o	of Staging	g Area Ur	til Flood	Water Le	eaves the	Storage A	Area
	Approx.		Exist	ing Cond	tions		١	Nith Dive	ersion Sta	ging Area	a
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	yr	50-yr	100-yr	500-yr	PMF	yr	50-yr	100-yr	500-yr	PMF
RR41	915.5	11.0	19.0	25.0	47.0	51.5	11.5	19.0	25.0	47.0	51.5
RR42	916.0	10.5	17.5	24.5	45.5	51.5	11.5	17.5	24.5	45.5	51.5
RR43	920.0	7.0	12.0	5.5	36.5	40.0	9.5	13.0	8.0	36.5	40.0
RR44	924.0	0.0	6.0	4.0	22.0	24.0	0.0	8.5	4.5	23.0	24.5
RR45	923.0	3.5	7.5	4.5	28.0	30.0	6.0	10.5	5.5	28.5	30.5
RR46	932.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0	0.0	10.0	0.0
RR47	927.5	0.0	0.0	2.5	17.0	15.5	0.0	3.0	2.5	17.0	16.0
RR48	928.0	0.0	0.0	2.0	16.5	13.5	0.0	0.0	2.0	16.5	14.5
RR49	926.5	0.0	5.0	3.5	19.0	21.5	0.0	6.5	3.5	19.5	22.0
RR5	904.0	15.5	24.5	28.0	51.5	51.5	15.5	24.5	28.0	51.5	51.5
RR50	933.0	0.0	0.0	0.0	10.5	0.0	0.0	0.0	0.0	10.5	0.0
RR51	919.0	11.0	21.0	26.0	48.5	51.5	11.5	21.0	26.0	48.5	51.5
RR52	933.0	0.0	0.0	0.0	11.5	3.5	0.0	0.0	0.0	11.5	3.5
RR53	919.0	11.0	22.5	27.0	50.0	51.5	11.5	22.5	27.0	50.0	51.5
RR54	932.5	0.0	0.0	0.0	13.5	7.0	0.0	0.0	0.0	13.5	7.0
RR55	919.0	11.5	27.5	29.5	51.5	51.5	12.0	27.5	29.5	51.5	51.5
RR56	918.0	12.5	31.0	32.5	51.5	51.5	12.5	31.5	32.5	51.5	51.5
RR57	919.0	12.0	29.5	31.5	51.5	51.5	12.0	29.5	31.5	51.5	51.5
RR58	914.5	31.5	50.5	40.5	51.5	51.5	31.5	50.5	40.5	51.5	51.5
RR59	919.0	12.0	31.5	33.0	51.5	51.5	12.5	32.0	33.0	51.5	51.5
RR6	910.0	10.0	14.5	9.0	41.5	35.0	12.0	15.0	11.0	41.5	36.0
RR60	915.0	31.5	50.5	40.5	51.5	51.5	32.0	50.5	40.5	51.5	51.5
RR7	907.0	13.0	20.0	24.5	49.0	51.0	13.5	20.0	24.5	48.5	51.0
RR8	909.5	11.0	15.5	9.5	44.5	38.5	12.0	16.0	11.0	43.5	39.0
RR9	900.0	20.0	38.0	37.0	51.5	51.5	20.0	37.5	37.0	51.5	51.5
WLVSA200	918.0	9.0	14.5	22.5	40.5	46.5	10.5	14.5	22.5	41.0	47.0
WLVSA202	928.0	4.0	4.5	22.0	51.5	11.0	4.0	4.5	22.0	15.5	12.0
WLVSA203	927.0	0.0	0.0	0.0	16.0	12.0	0.0	0.0	0.0	16.0	13.0
WLVSA204	918.0	8.5	14.0	22.5	40.5	45.5	10.5	14.5	22.5	40.5	46.0
WLVSA205	924.0	0.0	0.0	2.5	17.0	14.5	0.0	6.0	3.0	17.5	15.0
WLVSA206	924.0	0.0	0.0	2.5	17.0	15.0	0.0	6.5	3.5	17.5	15.5
WLVSA207	925.5	0.0	0.0	2.0	16.5	13.5	0.0	0.0	2.5	17.0	14.5
WLVSA208	923.5	0.0	0.0	2.5	17.0	14.5	0.0	6.5	3.5	17.5	15.0
WLVSA209	915.5	8.5	14.0	22.0	40.0	42.5	10.5	14.5	22.0	40.0	42.5
WLVSA210	920.5	0.0	6.0	4.0	21.0	22.5	6.0	10.0	6.0	22.0	22.5
WLVSA211	923.0	0.0	0.0	0.0	16.0	11.5	0.0	0.0	0.0	16.5	13.0
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Appendix Tal	ole A4. Cont	inued									
		Days	s from Ac	tivation d	of Staging	g Area Ur	ntil Flood	Water Le	eaves the	Storage	Area
	Approx.		Exist	ing Condi	tions		١	Nith Dive	ersion Sta	ging Area	a
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	yr	50-yr	100-yr	500-yr	PMF	yr	50-yr	100-yr	500-yr	PMF
WLVSA212	919.5	0.0	0.0	0.0	14.5	7.5	0.0	9.5	6.0	16.5	13.0
WLVSA213	920.0	0.0	0.0	0.0	15.0	8.0	0.0	9.5	6.0	16.5	13.5
WLVSA214	919.5	0.0	0.0	0.0	16.5	10.0	0.0	11.0	7.0	18.0	14.5
WLVSA215	911.0	11.0	16.5	23.0	45.0	45.5	12.0	16.5	23.0	44.5	45.5
WLVSA216	914.5	5.5	9.5	5.5	32.0	31.0	10.5	12.5	9.5	32.5	31.5
WLVSA217	922.0	0.0	0.0	0.0	14.0	6.5	0.0	0.0	0.0	14.5	11.5
WLVSA218	921.0	0.0	0.0	0.0	20.0	16.0	0.0	8.5	0.0	18.5	15.5
WLVSA219	922.0	0.0	0.0	0.0	18.0	12.0	0.0	7.5	0.0	18.5	15.0
WLVSA220	908.5	12.0	17.5	23.0	47.5	44.0	13.0	17.5	23.0	46.5	44.5
WLVSA221	908.5	12.0	17.5	23.0	47.5	44.0	13.0	17.5	23.0	46.5	44.5
WLVSA222	913.0	4.0	8.5	5.5	29.0	26.5	10.5	12.5	9.5	31.0	27.5
WLVSA223	910.0	10.5	15.5	9.5	43.5	39.5	12.0	15.5	11.0	43.0	40.0
WLVSA224	912.5	6.5	11.0	6.5	34.5	30.5	11.0	13.0	9.5	34.5	31.0
WLVSA225	914.5	0.0	7.5	6.5	22.5	20.5	12.5	14.0	11.5	28.0	20.5
WLVSA226	917.0	0.0	0.0	0.0	16.0	10.5	9.0	11.0	8.0	19.0	14.5
WLVSA227	915.5	0.0	5.0	4.0	19.5	18.0	9.5	11.5	8.5	24.0	18.0
WLVSA228	911.5	9.0	13.5	8.0	40.0	36.0	11.5	14.5	10.0	39.5	36.5
WLVSA229	910.0	11.0	16.0	22.0	45.0	42.5	12.5	16.0	22.5	44.5	42.5
WLVSA230	910.0	11.0	16.0	22.0	45.0	42.5	12.5	16.0	22.5	44.5	42.5
WLVSA231	910.5	10.5	15.5	9.0	43.0	40.5	12.0	15.5	11.0	42.5	40.5
WLVSA232	916.0	0.0	5.5	4.0	20.5	20.0	9.5	11.5	8.5	24.5	20.0
WLVSA233	912.0	8.5	13.0	7.5	38.5	34.0	12.5	14.5	11.5	38.5	35.0
WLVSA234	917.5	0.0	0.0	0.0	15.5	9.5	8.5	10.5	7.5	18.0	14.0
WLVSA235	908.5	12.0	17.5	23.0	47.5	43.5	13.0	17.5	23.0	46.5	43.5
WLVSA236	910.0	10.0	14.5	9.0	42.0	36.0	12.0	15.0	11.0	42.0	37.0
WLVSA237	910.0	10.0	14.0	9.0	41.0	34.0	12.0	15.0	11.0	41.0	35.5
WLVSA57	921.0	1.0	3.5	2.5	20.0	16.0	0.0	8.5	4.0	19.0	15.5
WLVSA64	922.0	0.0	0.0	2.5	18.5	15.5	0.0	7.0	0.0	18.0	15.0
WLVSA65	919.5	0.0	7.0	4.5	25.5	27.0	8.0	11.0	7.0	26.5	27.0
WLVSA66	923.0	0.0	0.0	3.0	18.0	16.0	0.0	7.5	3.5	18.0	16.0
WRRND1	920.0	14.0	16.0	13.5	36.5	19.0	14.0	16.0	13.0	36.5	19.0
WRRND10	916.5	13.5	16.0	13.0	46.0	19.0	13.0	15.5	12.5	46.0	19.0
WRRND11	919.5	6.5	9.5	7.0	31.5	12.5	8.0	10.5	8.0	31.0	13.0
WRRND12	916.0	13.0	15.5	12.5	46.5	18.5	12.5	15.0	12.0	46.0	18.5
WRRND13	913.5	15.5	18.0	15.0	47.5	22.0	15.5	17.5	14.5	47.0	22.5
WRRND14	912.5	16.0	18.0	15.0	47.5	23.0	15.5	18.0	15.0	47.5	23.5
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Appendix Tal	ppendix Table A4. Continued										
		Days	from Ac	tivation o	of Staging	g Area Ur	ntil Flood	Water Le	eaves the	Storage /	Area
	Approx.		Exist	ing Condi	tions		١	Nith Dive	ersion Sta	ging Area	<del>)</del>
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	yr	50-yr	100-yr	500-yr	PMF	yr	50-yr	100-yr	500-yr	PMF
WRRND15	911.0	16.5	19.5	16.5	48.0	25.5	16.5	19.0	16.5	47.5	26.5
WRRND16	912.5	15.0	17.5	14.5	47.5	22.0	15.0	17.5	14.5	47.0	23.0
WRRND17	911.0	16.0	19.0	16.0	48.0	25.0	16.0	18.5	15.5	47.5	26.5
WRRND18	908.5	17.5	20.5	20.5	49.0	30.0	17.5	20.5	20.5	48.5	30.5
WRRND19	906.5	18.5	22.0	21.5	49.5	35.0	18.5	22.0	21.5	49.0	36.0
WRRND2	920.0	13.0	15.5	12.5	36.0	18.5	13.0	15.5	12.5	36.0	18.0
WRRND3	919.5	13.5	16.0	13.0	37.0	18.5	13.5	15.5	13.0	36.5	18.5
WRRND4	918.5	14.0	16.5	13.5	41.0	19.5	14.0	16.5	13.5	39.0	19.5
WRRND5	918.0	14.5	16.5	14.0	45.5	19.5	14.5	16.5	13.5	43.0	19.5
WRRND6	918.5	13.0	15.5	12.5	39.0	18.0	12.5	15.0	12.0	38.0	18.0
WRRND7	917.0	14.5	17.0	14.0	46.0	20.0	14.5	16.5	14.0	46.0	20.0
WRRND8	917.0	14.0	16.0	13.5	46.0	19.0	13.5	16.0	13.0	46.0	19.0
WRRND9	917.5	12.5	15.0	12.5	45.5	18.0	12.5	15.0	12.0	45.5	18.0
WRSA273	929.5	0.0	0.0	0.0	11.5	5.5	0.0	0.0	0.0	11.5	5.5
WRSA280	925.5	0.0	0.0	0.0	47.5	3.0	0.0	0.0	0.0	47.5	3.0
WRSA284	923.0	0.0	0.0	0.0	45.5	0.0	0.0	0.0	0.0	45.5	0.0
WRSA289	923.5	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	8.0	0.0
WRSA294	919.5	7.5	10.0	47.0	47.0	12.5	7.5	10.0	47.0	47.0	12.5
WRSA299	912.5	14.0	17.0	35.0	48.0	21.5	13.5	16.0	35.0	47.5	22.0
WRSA300	909.5	17.0	19.5	38.0	48.5	28.0	16.5	19.5	38.0	48.5	28.0
WRSA302	913.0	0.0	6.0	5.5	25.0	14.5	10.5	12.5	9.5	32.0	18.0
WRSA303	919.5	0.0	0.0	34.5	47.0	0.0	0.0	9.0	34.0	47.0	11.5
WRSA304	915.0	9.0	12.0	9.5	43.0	15.0	10.5	12.0	9.0	35.5	15.0
WRSA305A	910.5	16.0	18.5	35.5	48.0	25.5	16.0	18.5	35.0	47.5	26.5
WRSA305B	910.5	16.0	18.5	15.5	48.0	25.5	15.5	18.5	15.0	47.5	26.5
WRSA305C	906.0	20.5	23.5	45.0	50.5	38.5	20.0	23.5	44.0	49.5	39.0
WRSA305D	906.0	20.5	23.5	34.5	50.5	38.5	20.0	23.5	34.0	49.5	39.0
WRSA306	908.0	15.5	18.5	15.0	49.5	29.5	15.0	18.0	23.0	47.5	43.0
WRSA307	911.0	10.5	14.5	10.0	43.5	34.0	12.5	14.5	11.5	39.5	33.0
WRSA308	917.0	0.0	0.0	0.0	46.0	0.0	8.5	10.5	8.0	46.0	12.5
WRSA309	914.5	11.0	13.5	10.5	46.5	16.5	11.0	12.5	9.5	46.0	16.0
WRSA311	907.0	16.0	19.5	16.0	49.5	31.5	14.0	19.0	24.0	48.0	48.5
WRSA312	906.5	16.5	20.0	20.0	49.5	33.0	14.5	20.0	24.5	48.5	50.5
WRSA315	909.5	12.0	14.5	11.5	46.5	19.0	12.0	13.5	10.5	45.5	16.5
WRSA321	906.5	14.0	18.0	14.0	49.0	23.0	12.5	14.0	11.0	34.5	18.0
WRSA350	910.5	14.5	17.0	14.0	49.0	27.5	14.5	17.0	14.0	47.0	26.0
	ASA350 910.5 14.5 17.0 14.0 49.0 27.5 14.5 17.0 14.0 47.0 26.0 - continued -										

Appendix Tal	ole A4. Cont	inued										
	Days from Activation of Staging Area Until Flood Water Leaves the Storage Area											
	Approx.		Exist	ing Cond	itions		,	With Dive	ersion Sta	ging Area	a .	
	Field	2009-					2009-					
Storage Area	Elevation <sup>a</sup>	yr	50-yr	100-yr	500-yr	PMF	yr	50-yr	100-yr	500-yr	PMF	
WRSA351	908.5	15.5	18.5	15.0	49.5	29.5	15.0	18.0	14.5	47.5	41.0	
WRSA352	911.0	14.5	17.0	14.0	49.0	26.0	13.5	16.5	13.0	47.0	25.5	
WRSA353	917.5	3.5	6.0	5.0	25.5	10.5	8.5	11.0	8.0	25.0	13.0	
WRSA354	919.0	9.0	11.5	9.0	35.5	14.5	9.5	11.5	9.0	34.5	14.5	
WRSA355	917.5	13.0	15.5	12.5	45.5	18.5	13.0	15.5	12.5	45.5	18.5	
WRSA356	920.5	10.5	12.5	10.0	32.5	15.5	10.5	12.5	10.0	32.5	15.5	
WRSA357	921.5	9.0	11.5	9.0	29.5	14.5	9.5	11.5	9.0	29.5	14.5	
WRSA358	923.0	7.5	10.5	8.0	27.0	13.5	8.0	11.0	8.5	27.0	14.0	
WRSA359	923.0	9.5	12.0	9.5	29.0	15.5	10.0	12.0	9.5	29.0	15.5	
WRSA360	924.0	11.0	13.0	10.5	31.0	16.0	11.0	13.0	10.5	31.0	16.0	
WRSA363	911.5	14.0	16.5	13.5	48.5	23.0	13.0	15.5	12.0	46.5	24.0	
WRSA364	913.0	13.0	15.5	12.5	47.5	19.5	11.5	13.5	10.5	39.0	18.0	
WRSA373	927.5	0.0	0.0	0.0	10.5	0.0	0.0	0.0	0.0	10.5	0.0	
WRSA378	926.0	0.0	0.0	0.0	14.0	5.0	0.0	0.0	0.0	14.0	5.5	
WRSA383	924.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	8.0	0.0	
WRSA384	925.0	0.0	0.0	0.0	18.0	7.0	0.0	0.0	0.0	18.0	8.0	
WRSA389	923.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	10.0	0.0	
WRSA390	917.5	11.5	14.0	11.0	45.5	17.0	11.5	13.5	10.5	45.5	16.5	
WRSA501	911.0	9.0	13.5	8.0	39.5	33.0	11.5	14.5	10.5	39.0	33.0	
WRSA502	913.0	4.5	8.5	6.0	29.5	27.5	10.5	12.5	9.5	31.5	28.5	
WRSA504	915.0	0.0	6.5	4.5	22.5	21.5	10.0	11.5	8.5	25.0	17.5	
WRSA505	909.0	13.0	19.0	25.0	51.5	48.5	13.5	19.0	25.0	51.5	48.5	
WRSA506	909.0	11.5	16.0	10.0	46.0	39.5	12.5	16.0	11.5	45.0	40.0	
WRSA507	902.0	18.0	30.5	33.5	51.5	51.5	18.0	30.5	33.5	51.5	51.5	
WRSA907	915.0	10.5	13.0	47.5	48.5	16.0	10.5	12.5	47.5	48.5	15.5	
PMF = Probabili	stic Maximum I	hool			•				•	•		

<sup>a</sup>Feet above mean seal level. Lowest estimated elevation for storage area. Source: Houston-Moore Group (2019).

Appendix Table A5. Difference in Total Days between Without Diversion and With Diversion Conditions, by Storage Area, by Flood Event Frequency, FM Diversion Staging Area, Phase 9.1 HEC-RAS Modeling, 10-day and 14-day Dry Down Periods

		Difference in Total Days Between With and Without Diversion Conditions									
	Approx.	W	ith a 10-d	lay Dry D	own Peri	od	W	ith a 14-c	lay Dry D	own Perio	d
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
BD1	908.0	0	1	0.5	0	0	0	1	0.5	0	0
CHRSA01	915.0	0	0	17	18.5	20	0	0	21	22.5	24
CHRSA02	914.5	0	0	17.5	18.5	20.5	0	0	21.5	22.5	24.5
CHRSA03	918.0	0	0	0	0	0	0	0	0	0	0
CHRSA04	918.0	0	0	0	0	0	0	0	0	0	0
CHRSA05E	920.0	0	0	0	0	0	0	0	0	0	0
CHRSA05W	920.0	0	0	0.5	1	2	0	0	0.5	1	2
CHRSA06	921.0	0	0	0	0	0	0	0	0	0	0
CHRSA07	915.0	0	0	17.5	2	1	0	0	21.5	2	1
CHRSA08	918.5	0	0	0	17	18.5	0	0	0	21	22.5
CHRSA09	923.0	0	0	0	0	0	0	0	0	0	0
CHRSA10	922.0	0	0	0	0	0	0	0	0	0	0
CHRSA100	931.0	0	0	0	0	0	0	0	0	0	0
CHRSA101	924.0	0	0	0.5	1	0	0	0	0.5	1	0
CHRSA102	928.0	0	0	0	0	0	0	0	0	0	0
CHRSA103	918.0	0	0	2	0.5	0	0	0	2	0.5	0
CHRSA104	926.5	0	0	0	0	0	0	0	0	0	0
CHRSA105	919.0	0	0	2	0.5	0	0	0	2	0.5	0
CHRSA106	925.0	0	0	0	0	0	0	0	0	0	0
CHRSA107	927.5	0	0	0	0	0	0	0	0	0	0
CHRSA108	923.0	0	0	0	0	0	0	0	0	0	0
CHRSA109	918.0	0	0	0	3.5	4.5	0	0	0	3.5	4.5
CHRSA11	924.5	0	0	0	0	0	0	0	0	0	0
CHRSA110	913.5	0	0	1.5	0	0	0	0	1.5	0	0
CHRSA111	921.0	0	0	0	0	0	0	0	0	0	0
CHRSA112	918.0	0	0	0	3.5	4.5	0	0	0	3.5	4.5
CHRSA113	919.5	0	0	0	17	19.5	0	0	0	21	23.5
CHRSA114	910.5	0	0	2	0.5	0	0	0	2	0.5	0
CHRSA115	918.0	0	0	0	17.5	19.5	0	0	0	21.5	23.5
CHRSA116	916.5	0	0	0	18	20	0	0	0	22	24
CHRSA117	919.5	0	0	0	0	0	0	0	0	0	0
CHRSA118	919.5	0	0	0	0	0	0	0	0	0	0
CHRSA119	918.5	0	0	0	17	18.5	0	0	0	21	22.5
CHRSA12	924.0	0	0	0	0	0	0	0	0	0	0
CHRSA120	916.0	0	0	16	18.5	20.5	0	0	20	22.5	24.5
		L		- CO	ntinued	·	I.		I.		L

Appendix Tak	ole A5. Cont	inued									
		C	oifference	e in Total	Days Bet	ween W	ith and W	/ithout D	iversion (	Conditions	
	Approx.	W	ith a 10-c	lay Dry D	own Peri	od	W	ith a 14-c	lay Dry D	own Perio	d
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
CHRSA13	918.0	0	0	15.5	1.5	0	0	0	19.5	1.5	0
CHRSA14	924.0	0	0	0	0	0	0	0	0	0	0
CHRSA15	919.5	0	0	0	3	4	0	0	0	3	4
CHRSA16	918.0	0	0	15.5	1.5	0	0	0	19.5	1.5	0
CHRSA17	918.0	0	0	3	1	0	0	0	3	1	0
CHRSA18	922.0	0	0	0	0	0	0	0	0	0	0
CHRSA18E	922.0	0	0	0	0	0	0	0	0	0	0
CHRSA19	921.0	0	0	0	16	18.5	0	0	0	20	22.5
CHRSA20	921.0	0	0	1.5	1.5	0.5	0	0	1.5	1.5	0.5
CHRSA21	927.5	0	0	0	0	0	0	0	0	0	0
CHRSA22	927.5	0	0	0	0	0	0	0	0	0	0
CHRSA23	920.0	0	0	1.5	0.5	0	0	0	1.5	0.5	0
CHRSA24	927.5	0	0	0	0	0	0	0	0	0	0
CHRSA25	928.0	0	0	0	0	0	0	0	0	0	0
CHRSA26	928.5	0	0	0	0	0	0	0	0	0	0
CHRSA27	924.0	0	0	0	15.5	18.5	0	0	0	19.5	22.5
DIVSA100	913.0	0	0	18	4.5	5.5	0	0	22	4.5	5.5
DIVSA101	914.0	0	0	18	4.5	5	0	0	22	4.5	5
DIVSA102	915.0	0	0	17.5	2.5	1.5	0	0	21.5	2.5	1.5
DIVSA105	915.5	0	0	16.5	18	19.5	0	0	20.5	22	23.5
DIVSA106E	919.0	0	0	0	0	0	0	0	0	0	0
DIVSA107E	919.5	0	0	0	0	0	0	0	0	0	0
DIVSA84	913.0	10.5	12	19.5	6.5	8	14.5	16	23.5	6.5	8
DIVSA84E	907.5	0	22	20.5	0.5	1.5	0	26	24.5	0.5	1.5
DIVSA85E	904.5	59	43.5	42	37.5	33	63	43.5	42	37.5	33
DIVSA86S	905.5	0	23	4.5	0	-1.5	0	27	4.5	0	-1.5
DIVSA87S	908.5	0	21.5	20.5	20	22	0	25.5	24.5	24	26
DIVSA88W	907.0	-13.5	4	1	-4	-8	-17.5	4	1	-4	-8
DIVSA89W	910.5	0	1.5	1	-2.5	-8	0	1.5	1	-2.5	-8
DIVSA90S	907.5	-14.5	-1	0.5	0.5	0.5	-18.5	-1	0.5	0.5	0.5
DIVSA93S	908.0	0	1	3	1.5	1	0	1	3	1.5	1
DIVSA94	908.0	-14	-1.5	0.5	0.5	0.5	-18	-1.5	0.5	0.5	0.5
DIVSA95	908.5	0	1	3	1.5	1.5	0	1	3	1.5	1.5
DIVSA98W	912.5	0	0	18	6	9.5	0	0	22	6	9.5
DIVSA99W	910.5	0	0.5	4	1	0	0	0.5	4	1	0
DRAIN370	922.5	0	0	0	0	0	0	0	0	0	0
				- cc	ntinued	-					. <u> </u>

Appendix Tal	ppendix Table A5. Continued										
		Difference in Total Days Between With and Without Diversion Conditions									
	Approx.	W	ith a 10-c	lay Dry D	own Peri	od	W	ith a 14-c	lay Dry D	own Peri	od
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
DRAIN371	921.5	0	0	0	0	0	0	0	0		
DRAIN372	920.0	0	0	0	0.5	0	0	0	0	0.5	0
DRAIN373	919.0	0	0	0	2	4	0	0	0	2	4
DRAIN374	915.0	0	0	1	0	0	0	0			
RRIU DD11	909.0	0	0	2.5	0.5	0.5	0	0	2.5	0.5	0.5
RKII	909.0	0	0	2	0.5	0.5	0	0	2	0.5	0.5
RR12	909.0	0	0	2	0.5	0.5	0	0	2	0.5	0.5
RR13	911.5	0	0.5	3.5	1	0	0	0.5	3.5	1	
RK14	914.0	0	0	17.5	3.5	4.5	0	0	21.5	3.5	4.5
RR15	908.0	0	0	1.5	0	0	0	0	1.5	0	0
RR16	916.0	0	0	16	18.5	20.5	0	0	20	22.5	24.5
RR17	910.0	0	0.5	2.5	0.5	0	0	0.5	2.5	0.5	0
RR18	913.0	0	0	4	1.5	0.5	0	0	4	1.5	0.5
RR19	909.0	0.5	0	1.5	0	0	0.5	0	1.5	0	0
RR20	919.0	0	0	0	0	0	0	0	0	0	0
RR21	909.0	0	0	1.5	0.5	0	0	0	1.5	0.5	0
RR22	917.5	0	0	0	18	19.5	0	0	0	22	23.5
RR23	912.5	0	0.5	3	0.5	0	0	0.5	3	0.5	0
RR24	921.5	0	0	0	0	0	0	0	0	0	0
RR25	920.0	0	0	0	0	0	0	0	0	0	0
RR26	913.0	0	0.5	2.5	0.5	0	0	0.5	2.5	0.5	0
RR27	917.0	0	0	16	2	1	0	0	20	2	1
RR28	923.0	0	0	0	0	0	0	0	0	0	0
RR29	921.0	0	0	0	0	0	0	0	0	0	0
RR3	910.5	0	14.5	4	1.5	0.5	0	18.5	4	1.5	0.5
RR30	922.5	0	0	0	0	0	0	0	0	0	0
RR31	916.5	0	0	3.5	1	0	0	0	3.5	1	0
RR32	916.0	0	0.5	3	0.5	0	0	0.5	3	0.5	0
RR33	913.5	0	0	1.5	0	0	0	0	1.5	0	0
RR34	913.0	0	0	1.5	0	0	0	0	1.5	0	0
RR35	914.0	0	0	1.5	0	0	0	0	1.5	0	0
RR36	916.5	0	0	2.5	0.5	0	0	0	2.5	0.5	0
RR37	914.5	0.5	0	1.5	0	0.5	0.5	0	1.5	0	0.5
RR38	923.5	0	0	0	0	0	0	0	0	0	0
RR39	915.5	0	0	1.5	0	0.5	0	0	1.5	0	0.5
RR4	906.5	0.5	0	1.5	0	0	0.5	0	1.5	0	0
				- CO	ntinued	-					

Appendix Tal	ppendix Table A5. Continued										
	Difference in Total Days Between With and Without Diversion Conditions										
	Approx.	W	ith a 10-d	lay Dry D	own Peri	od	W	ith a 14-c	ay Dry D	own Peri	od
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
RR4U	925.5	0	0	0	0	0	0		0 1 F	0	0
RR41	915.5	0	0.5	1.5	0	0	0	0.5	1.5		0
RR42	916.0	0	0.5	1.5	0.5	0	0	0.5	1.5	0.5	0
RR43	920.0	0	0	2	0.5	175	0	0	2	0.5 10 F	21 5
	924.0	0	0	0	14.5	17.5	0	0	0	10.5	21.5
	925.0	0	0	0	1.5	1.5	0	0	0	1.5	1.5
	952.0	0	0	0	0	0	0	0	0	0	0
	927.5	0	0	0	0	0	0	0	0	0	0
	920.0 026 E	0	0	0	0	0	0	0	0	0	0
	920.5	0		1		0	0		0		0
	904.0	0	0.5	1	0.5	0	0	0.5	1	0.5	0
	955.0	0	0	0	0	0	0	0		0	05
	919.0	0	0	0.5	0	0.5	0	0	0.5	0	0.5
	955.0	0	0	0	0	0	0	0		0	0
	919.0	0	0	0.5	0	0	0	0	0.5	0	0
	932.3		0	0	0	0		0		0	0
	019.0	0.5	0	0.5	0	0	0.5	0	0.5	0	0
PP57	910.0	05	0	05	0	0	05	0	05	0	0
PP58	01/ 5	0.5	0	0.5	1	1	0.5	0	0.5	1	1
PP50	914.J 010.0	0	0	0	1	1	0	0	0	1	1
RR55	010.0	0	1	25	1	0	0	1	25	1	0
RR60	915 O	0	0	0.5	2	15	0	0	0.5	2	15
RR7	907.0	0	0	1.5	0.5	1.5	0	0	1.5	0.5	1.5
RR8	909.5	0	0.5	2.5	0.5	05	0	0.5	2.5	0.5	0.5
RR9	900.0	0	0.5	0.5	0.5	0.5	0	0.5	0.5	0.5	0.5
WIVSA200	918.0	0	0.5	2	0.5	0	0	0.5	2	0.5	0
WLVSA202	928.0	0	0	0	0.5	0	0	0	0	0.5	0
WLVSA202	927.0	0	0	0	0	0	0	0	0	0	0
WLVSA204	918.0	0	0.5	25	0	0	0	0.5	25	0	0
WLVSA205	924.0	0	0	0	0	0	0	0	0	0	0
WLVSA206	924.0	0	0	0	0	0	0	0	0	0	0
WLVSA207	925.5	0	0	0	0	0	0	0	0	0	0
WLVSA208	923.5	0	0	0	0	0	0	0	0	0	0
WLVSA209	915.5	0	0	3	0	0	0	0	3	0	0
WLVSA210	920.5	0	0	0	16.5	19	0	0	0	20.5	23
		<u> </u>	<u> </u>	- CC	ontinued	-	<u> </u>	<u> </u>	<u> </u>		<u> </u>

Appendix Tal	ppendix Table A5. Continued										
	Difference in Total Days Between With and Without Diversion Conditions										
	Approx.	W	ith a 10-d	lay Dry D	own Peri	od	W	th a 14-c	lay Dry D	own Peri	od
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
WLVSA211	925.0 010 E	0	0	0	0	0	0	0	0	0	0
WLVSA212	919.5	0	0	0	0	0	0	0	0	0	0
WLVSA213	920.0 010 F	0	0	0	0	0	0	0	0	0	0
WLVSA214	919.5	0		25	0		0		0 25	0	
WLVSA215	911.0	0	0.5	2.5	0	0.5	0	0.5	2.5	0	0.5
	914.5	0	0	/	2	1	0	0	/	2	1
WLVSA217	922.0	0	0	0	1 5	1 5	0	0	0	1 5	1 Г
WLVSA218	921.0	0	0	0	-1.5	-1.5	0	0	0	-1.5	-1.5
WLVSA219	922.0	0	0	0		0	0	0	0		0
WLVSA220	908.5	0		2	0.5	0	0		2	0.5	0
WLVSA221	908.5	0	0.5	2.5	0.5		0	0.5	2.5	0.5	
WLVSA222	913.0	0	0	18	4.5	5.5	0	0	22	4.5	5.5
WLVSA223	910.0	0	0.5	3	0.5	0.5	0	0.5	3	0.5	0.5
WLVSA224	912.5	0	0	18	2.5	1	0	0	22	2.5	1
WLVSA225	914.5	0	0	19.5	21.5	23.5	0	0	23.5	25.5	27.5
WLVSA226	917.0	0	0	0	17.5	19	0	0	0	21.5	23
WLVSA227	915.5	0	0	16.5	18.5	20.5	0	0	20.5	22.5	24.5
WLVSA228	911.5	0	1	4	1	0	0	1	4	1	0
WLVSA229	910.0	0	0.5	2.5	0.5	0	0	0.5	2.5	0.5	0
WLVSA230	910.0	0	0.5	2.5	0.5	0	0	0.5	2.5	0.5	0
WLVSA231	910.5	0	0.5	3	0.5	0.5	0	0.5	3	0.5	0.5
WLVSA232	916.0	0	0	16	18.5	20.5	0	0	20	22.5	24.5
WLVSA233	912.0	0	0	4.5	1.5	0.5	0	0	4.5	1.5	0.5
WLVSA234	917.5	0	0	0	17	18.5	0	0	0	21	22.5
WLVSA235	908.5	0	0	2	0.5	0.5	0	0	2	0.5	0.5
WLVSA236	910.0	0	0.5	3.5	1	0	0	0.5	3.5	1	0
WLVSA237	910.0	0	1	4	1	0.5	0	1	4	1	0.5
WLVSA57	921.0	0	0	0	-0.5	-0.5	0	0	0	-0.5	-0.5
WLVSA64	922.0	0	0	0	-1.5	-1.5	0	0	0	-1.5	-1.5
WLVSA65	919.5	0	0	0	4	6	0	0	0	4	6
WLVSA66	923.0	0	0	0	0	0	0	0	0	0	0
WRRND1	920.0	0	0	0.5	0	-0.5	0	0	0.5	0	-0.5
WRRND10	916.5	0	0	1	0.5	-0.5	0	0	1	0.5	-0.5
WRRND11	919.5	0	0	0	0.5	1.5	0	0	0	0.5	1.5
WRRND12	916.0	0	0	1	0.5	-1	0	0	1	0.5	-1
WRRND13	913.5	0	0	1	0	-0.5	0	0	1	0	-0.5
				- co	ntinued	_					

Appendix Table A5. Continued											
		Difference in Total Days Between With and Without Diversion Conditions									
	Approx.	W	ith a 10-c	lay Dry D	own Peri	od	w	ith a 14-c	lay Dry D	own Peri	od
<b>C</b> 1 <b>A</b>	Field	10	20	25	25-yr	25-yr	10	20	25	25-yr	25-yr
Storage Area	Elevation®	10-yr	20-yr	25-yr 1	Long	EL	10-yr	20-yr	25-yr	Long	EL
	011 0	-0.5	0.5	0.5	05	-0.5	-0.5	0.5	0.5	05	-0.5
	012.5	0	0.5	1	-0.5	0	0	0.5	0.5	-0.5	0
WRRND17	911.0	0	05	1	0.5	0	0	05	1	0.5	0
	908.5	0	1	1	0	0	0	1	1	0	0
	906.5	0	1	0.5	0	0	0	1	0.5	0	0
	920	0	0	0.5	0.5	0	0	0	0.5	0.5	0
WRRND3	919.5	-0.5	0	0	0	-0.5	-0.5	0	0	0	-0.5
WRRND4	918.5	0	0	0.5	0.5	-0.5	0	0	0.5	0.5	-0.5
WRRND5	918	0	0	0.5	0	0	0	0	0.5	0	0
WRRND6	918.5	0	-0.5	0.5	0.5	0	0	-0.5	0.5	0.5	0
WRRND7	917	0	0	0.5	0	0	0	0	0.5	0	0
WRRND8	917	0	0	0.5	0	-0.5	0	0	0.5	0	-0.5
WRRND9	917.5	0	-0.5	1	0.5	-0.5	0	-0.5	1	0.5	-0.5
WRSA273	929.5	0	0	0	0	0	0	0	0	0	0
WRSA280	925.5	0	0	0	0	0	0	0	0	0	0
WRSA284	923	0	0	0	0	0	0	0	0	0	0
WRSA289	923.5	0	0	0	0	0	0	0	0	0	0
WRSA294	919.5	0	0	0	0	0	0	0	0	0	0
WRSA299	912.5	0	0	1.5	0	-1	0	0	1.5	0	-1
WRSA300	909.5	0	1	1	0	0	0	1	1	0	0
WRSA302	913	0	0	18.5	19.5	22	0	0	22.5	23.5	26
WRSA303	919.5	0	0	0	0	0	0	0	0	0	0
WRSA304	915	0	-13.5	3	4	4	0	-17.5	3	4	4
WRSA305A	910.5	0	0.5	1	0	-0.5	0	0.5	1	0	-0.5
WRSA305B	910.5	0	0.5	1	0	0	0	0.5	1	0	0
WRSA305C	906	0	1	0	0	0	0	1	0	0	0
WRSA305D	906	0	1	0	0	0	0	1	0	0	0
WRSA306	908	0	-0.5	1	0.5	0.5	0	-0.5	1	0.5	0.5
WRSA307	911	0	-0.5	4.5	1.5	-0.5	0	-0.5	4.5	1.5	-0.5
WRSA308	917	0	0	0	17	18	0	0	0	21	22
WRSA309	914.5	0	-1	2.5	2.5	-1.5	0	-1	2.5	2.5	-1.5
WRSA311	907	-1	-0.5	1	0.5	0.5	-1	-0.5	1	0.5	0.5
WRSA312	906.5	-0.5	-0.5	1	0	0	-0.5	-0.5	1	0	0
WRSA315	909.5	0	6	4.5	2.5	-2	0	6	4.5	2.5	-2
WRSA321	906.5	0	22.5	5.5	0.5	-0.5	0	26.5	5.5	0.5	-0.5
				Co	ontinued						

Appendix Table A5. Continued											
		C	oifference	e in Total	Days Bet	ween Wi	th and W	ithout D	iversion (	Condition	IS
	Approx.	W	ith a 10-c	lay Dry D	own Peri	od	W	ith a 14-c	lay Dry D	own Period	
	Field				25-yr	25-yr				25-yr	25-yr
Storage Area	Elevation <sup>a</sup>	10-yr	20-yr	25-yr	Long	EL	10-yr	20-yr	25-yr	Long	EL
WRSA350	910.5	13.5	0	1	2	2	17.5	0	1	2	2
WRSA351	908.5	0.5	-0.5	1	1	0.5	0.5	-0.5	1	1	0.5
WRSA352	911	0	-0.5	2	1.5	1	0	-0.5	2	1.5	1
WRSA353	917.5	0	0	0	4.5	6	0	0	0	4.5	6
WRSA354	919	0	0	0	2	2.5	0	0	0	2	2.5
WRSA355	917.5	0	0	0.5	0.5	-0.5	0	0	0.5	0.5	-0.5
WRSA356	920.5	0	0	0.5	0.5	-0.5	0	0	0.5	0.5	-0.5
WRSA357	921.5	0	0	0	0.5	1	0	0	0	0.5	1
WRSA358	923.0	0	0	0	0.5	0.5	0	0	0	0.5	0.5
WRSA359	923.0	0	0	0	0	1	0	0	0	0	1
WRSA360	924.0	0	0	0	0.5	0	0	0	0	0.5	0
WRSA363	911.5	0	-0.5	1	0.5	0	0	-0.5	1	0.5	0
WRSA364	913.0	0	-1.5	1	1	-3.5	0	-1.5	1	1	-3.5
WRSA373	927.5	0	0	0	0	0	0	0	0	0	0
WRSA378	926.0	0	0	0	0	0	0	0	0	0	0
WRSA383	924.0	0	0	0	0	0	0	0	0	0	0
WRSA384	925.0	0	0	0	0	0	0	0	0	0	0
WRSA389	923.0	0	0	0	0	0	0	0	0	0	0
WRSA390	917.5	0	-0.5	1	1.5	-0.5	0	-0.5	1	1.5	-0.5
WRSA501	911.0	0	14	4	1.5	0	0	18	4	1.5	0
WRSA502	913.0	0	0	18	4	4	0	0	22	4	4
WRSA504	915.0	0	0	17	19	21	0	0	21	23	25
WRSA505	909.0	0	0.5	2	0.5	0.5	0	0.5	2	0.5	0.5
WRSA506	909.0	0	0.5	2.5	0.5	0.5	0	0.5	2.5	0.5	0.5
WRSA507	902.0	0	0.5	1	0.5	0	0	0.5	1	0.5	0
WRSA907	915.0	0	-0.5	2.5	3	0	0	-0.5	2.5	3	0
<sup>a</sup> Feet above me Source: Housto	<sup>a</sup> Feet above mean seal level. Lowest estimated elevation for storage area. Source: Houston-Moore Group (2019).										

Appendix Table A5. Continued											
	Difference in Total Days Between With and Without Diversion Conditions										
	Approx.	W	ith a 10-c	lay Dry D	own Peri	od	W	ith a 14-o	day Dry D	own Perio	d
	Field	2009-					2009-				
Storage Area	Elevation	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
	908.0	0	0	0.5	0 10 F	-0.5	0		0.5	0 22 F	-0.5
	915.0	20	22.5	/	19.5	4.5	24	20.5	/	23.5	4.5
CHRSA02	914.5	21	25	2	21.5 19.5	0.5	25	29	2	25.5	0.5
	918.0	10	21.5	24	10.5	4	22	25.5	28	22.5	4
	918.0	19	25	4.5	19.5	1.5	23	27	4.5	23.5	1.5
CHRSAUSE	920.0	0	4.5	2	1.5	0		4.5	2	1.5	
CHRSAUSW	920.0	0.5	105	0	0	0	0.5	0	0	0	
CHRSAUB	921.0	0	18.5	4	0	0	0	22.5	4	0	
	915.0	2 10	3.5	0.5	5.5	1 Г	5	3.5	0.5	5.5	
CHRSA08	918.5	18	20.5	1.5	5	1.5	22	24.5	1.5	5	1.5
CHRSA09	923.0	0	0	2	0	0.5	0	0	2	0	0.5
	922.0	0	0	4	0	0	0	0	4	0	
CHRSA100	931.0	1 Г	0	1			0 1 F	0	1		
CHRSA101	924.0	1.5	۲ ۲	0	0.5	0.5	1.5	2 1 F	0	0.5	0.5
CHRSA102	928.0	0	1.5		0	0.5	0	1.5		0	0.5
CHRSA103	918.0	2	0	0.5	0		2	0	0.5		
CHRSA104	926.5	0	0	1	0.5	0.5	0		1	0.5	0.5
CHRSA105	919.0	1	0.5	0.5		0	1	0.5	0.5		
CHRSA106	925.0	0	2	0	0.5	0	0	2	0	0.5	
	927.5	0	175	1	12		0	21 5	1	10	
	925.0	0	17.5	0	1.5	0.5	0	21.5	0	1.5	0.5
CHRSA109	918.0	0	4		3.5	1	0	4		3.5	
	924.5	1 Г	0	0.5	0	0		0	0.5	0	
CHRSA110	913.5	1.5	10		0	1	1.5	0		0	
	921.0	0	19	0.5	3	1	0	23	0.5	3	
CHRSA112	918.0		4		3.5	1		4	0	3.5	
CHRSA113	919.5	17.5	5	-0.5	3	1.5	21.5	5	-0.5	3	1.5
	910.5	10.5		0	0	-0.5	1 22 F		0	0	-0.5
CHRSA115	918.0	18.5	7.5	0	4 21 F	1.5	22.5	7.5	0	4	1.5
CHRSA115	910.5		25	3.5	21.5	1 [	25 10 F	29	3.5	25.5	
CHRSA117	919.5	15.5	20	2	10.5	1.5	19.5	24	2	20.5	1.5
CHRSA118	919.5	0	20.5	2	1/	1.5	0	24.5	2	21	1.5
CHRSA119	918.5	78	20.5	1.5	5	2	22	24.5	1.5	5	2
	924.0	U 10 F	U 7	1.5	0	0.5	0	0	1.5	0	0.5
CHRSA120	916.0	19.5	/	3	5	5.5	23.5	/	3	5	5.5
	- continued –										

Appendix Table A5. Continued											
		Difference in Total Days Between With and Without Diversion Conditions									
	Approx.	W	ith a 10-c	lay Dry D	own Peri	od	W	ith a 14-o	day Dry D	own Perio	d
	Field	2009-					2009-				
Storage Area	Elevationa	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
CHRSA13	918.0	4	2.5	0	3	0.5	4	2.5	0	3	0.5
CHRSA14	924.0	0	0	1.5	0	0	0	0	1.5	0	0
CHRSA15	919.5	0	0.5	0	0	0	0	0.5	0	0	0
CHRSA16	918.0	4	2.5	0	3	0.5	4	2.5	0	3	0.5
CHRSA17	918.0	3.5	1	0	2.5	0	3.5	1	0	2.5	0
CHRSA18	922.0	0	0.5	0.5	0	0	0	0.5	0.5	0	0
CHRSA18E	922.0	0	4	0	1.5	1	0	4	0	1.5	1
CHRSA19	921.0	15.5	4	-0.5	2	1	19.5	4	-0.5	2	1
CHRSA20	921.0	2.5	1.5	0.5	1.5	0.5	2.5	1.5	0.5	1.5	0.5
CHRSA21	927.5	0	0.5	0.5	0	0	0	0.5	0.5	0	0
CHRSA22	927.5	0	0.5	0.5	0	0	0	0.5	0.5	0	0
CHRSA23	920.0	0.5	0	0	0	0	0.5	0	0	0	0
CHRSA24	927.5	0.5	0	0.5	0	0	0.5	0	0.5	0	0
CHRSA25	928.0	0	0.5	0.5	0	0	0	0.5	0.5	0	0
CHRSA26	928.5	0	0	1	0	0	0	0	1	0	0
CHRSA27	924.0	0	0	0.5	0	0	0	0	0.5	0	0
DIVSA100	913.0	6.5	4	0.5	3.5	1.5	6.5	4	0.5	3.5	1.5
DIVSA101	914.0	7	5	0.5	4.5	1	7	5	0.5	4.5	1
DIVSA102	915.0	5.5	4	0.5	3.5	0.5	5.5	4	0.5	3.5	0.5
DIVSA105	915.5	19.5	22	24	19	7.5	23.5	26	28	23	7.5
DIVSA106E	919.0	0	19.5	22	16.5	0	0	23.5	26	20.5	0
DIVSA107E	919.5	0	19	21	16	1.5	0	23	25	20	1.5
DIVSA84	913.0	5	3.5	1.5	13.5	-9.5	5	3.5	1.5	13.5	-9.5
DIVSA84E	907.5	-2	-4.5	-4.5	-3.5	-16.5	-2	-4.5	-4.5	-3.5	-16.5
DIVSA85E	904.5	35	32	26.5	32.5	0.5	35	32	26.5	32.5	0.5
DIVSA86S	905.5	-2	-4.5	-4.5	-3.5	-8	-2	-4.5	-4.5	-3.5	-8
DIVSA87S	908.5	21	-6.5	-8.5	-5	-14.5	25	-6.5	-8.5	-5	-14.5
DIVSA88W	907.0	-3.5	-5.5	-11	-5	-13	-3.5	-5.5	-11	-5	-13
DIVSA89W	910.5	-4	-5	-7	-5	-18.5	-4	-5	-7	-5	-18.5
DIVSA90S	907.5	-2.5	-0.5	15.5	8	-2	-2.5	-0.5	15.5	8	-2
DIVSA93S	908.0	1	1	5	12	0	1	1	5	12	0
DIVSA94	908.0	-3	-1	13.5	7.5	-2.5	-3	-1	13.5	7.5	-2.5
DIVSA95	908.5	0.5	0.5	5	0.5	-1	0.5	0.5	5	0.5	-1
DIVSA98W	912.5	20.5	5	6	3.5	4.5	24.5	5	6	3.5	4.5
DIVSA99W	910.5	2.5	0.5	1	2	0	2.5	0.5	1	2	0
DRAIN370	922.5	0	0	2	0	-0.5	0	0	2	0	-0.5
	-	<u> </u>	<u> </u>	- CC	ntinued	-	<u> </u>	<u> </u>			-

Appendix Table A5. Continued											
		Difference in Total Days Between With and Without Diversion Conditions								IS	
	Approx.	W	ith a 10-c	lay Dry D	own Peri	od	W	ith a 14-c	lay Dry D	own Peri	od
	Field	2009-	50-yr	100-	500-	PMF	2009-	50-yr	100-	500-	PMF
Storage Area	Elevation <sup>a</sup>	like		yr	yr		like		yr	yr	
DRAIN371	921.5	0	0	3.5	0	-0.5	0	0	3.5	0	-0.5
DRAIN372	920.0	2.5	4	2.5	2	-0.5	2.5	4	2.5	2	-0.5
DRAIN373	919.0	1.5	0.5	0	0.5	-1.5	1.5	0.5	0	0.5	-1.5
DRAIN374	915.0	0	-0.5	0	0	-0.5	0	-0.5	0	0	-0.5
RR10	909.0	1	0	0.5	0.5	-0.5	1	0	0.5	0.5	-0.5
RR11	909.0	1	0	0	0	-0.5	1	0	0	0	-0.5
RR12	909.0	1	0	0	0	-0.5	1	0	0	0	-0.5
RR13	911.5	2.5	0.5	0.5	2	0	2.5	0.5	0.5	2	0
RR14	914.0	6.5	4	0.5	3.5	1	6.5	4	0.5	3.5	1
RR15	908.0	0.5	0	0	0	-0.5	0.5	0	0	0	-0.5
RR16	916.0	19.5	6	0	4.5	3.5	23.5	6	0	4.5	3.5
RR17	910.0	1	-0.5	0	0	-1	1	-0.5	0	0	-1
RR18	913.0	3.5	1	0.5	3	0	3.5	1	0.5	3	0
RR19	909.0	0.5	-0.5	0	0	-1	0.5	-0.5	0	0	-1
RR20	919.0	16.5	20	3.5	16.5	2	20.5	24	3.5	20.5	2
RR21	909.0	0.5	0	0	0	-0.5	0.5	0	0	0	-0.5
RR22	917.5	18.5	7	0.5	4.5	2	22.5	7	0.5	4.5	2
RR23	912.5	2	0.5	0	2	-0.5	2	0.5	0	2	-0.5
RR24	921.5	0	17.5	5	0	1	0	21.5	5	0	1
RR25	920.0	0	19.5	1.5	16	1.5	0	23.5	1.5	20	1.5
RR26	913.0	2	0.5	0	0	0	2	0.5	0	0	0
RR27	917.0	4.5	3.5	0.5	3.5	0	4.5	3.5	0.5	3.5	0
RR28	923.0	0	0	3.5	0	0.5	0	0	3.5	0	0.5
RR29	921.0	0	19.5	0	2.5	1	0	23.5	0	2.5	1
RR3	910.5	2.5	1	1.5	2	0	2.5	1	1.5	2	0
RR30	922.5	0	17	1.5	0	1	0	21	1.5	0	1
RR31	916.5	3	1	0	3	0	3	1	0	3	0
RR32	916.0	2.5	0.5	0	2.5	0	2.5	0.5	0	2.5	0
RR33	913.5	1	0	0	0	-0.5	1	0	0	0	-0.5
RR34	913.0	1	0	0	0	0	1	0	0	0	0
RR35	914.0	1	0	0	0	0	1	0	0	0	0
RR36	916.5	2	0.5	0.5	0	0	2	0.5	0.5	0	0
RR37	914.5	1	0	0	0	0	1	0	0	0	0
RR38	923.5	0	4	0	1	0.5	0	4	0	1	0.5
RR39	915.5	1	0	0	0	0	1	0	0	0	0
RR4	906.5	0	0	0.5	0	-1	0	0	0.5	0	-1
				- CO	ntinued	_					

Appendix Table A5. Continued											
	Difference in Total Days Between With and Without Diversion Conditions										
	Approx.	W	ith a 10-c	lay Dry D	own Peri	od	W	ith a 14-c	day Dry D	own Peri	od
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
RR4U	925.5		0	1	0	0		0	1	0	0
RR41	915.5	0.5	0	0	0	0	0.5	0	0	0	0
RR42	916.0	1 2 F	0	0	0	0	1 2 F	0	0	0	0
RR43	920.0	2.5			2.5	1	2.5			2.5	0
RR44	924.0		2.5	0.5	0.5			2.5	0.5	0.5	1
	923.0	2.5	3	0.5	1	0.5	2.5	3	0.5	1	0.5
RR40	932.0	0	12		0	0.5	0	17		0	0.5
RK47	927.5	0	13	0.5	0	0	0	1/	0.5	0	0
RR48	928.0 026.5	0	1 5		0		0			0	
RR49	920.5	0	1.5	0.5	0	0.5	0	1.5	0.5	0	0.5
	904.0	0	0	0	0	0	0	0	0	0	0
	933.0		0	0	0	0		0	0	0	0
RRSI	919.0	0.5	0	0	0	0	0.5	0	0	0	0
	933.0		0	0	0	0		0	0	0	0
	919.0	0.5	0	0	0	0	0.5	0	0	0	0
	932.5		0	0	0	0		0	0	0	0
RK55	919.0	0.5	0	0	0	0	0.5	0	0	0	0
RK50	918.0	0	0.5	0	0	0	0	0.5	0	0	0
	919.0	0	0	0	0	0	0	0	0	0	0
	914.5			0	0	0			0	0	0
	919.0	0.5	0.5	0	0	0	0.5	0.5	0	0	0
	910.0	2	0.5	1	2	0	2	0.5	1	2	0
	913.0	0.5	0	0	0	05	0.5	0	0	0	0
	907.0	0.5	05	05	15	-0.5	0.5	05	05	15	-0.5
	909.5	1 0	-0.5	0.5	1.5	-1	1	-0.5	0.5	1.5	-1
WIVSA200	918.0	15	-0.5	05	0	05	15	-0.5	05	0	0.5
WLVSA200	928.0	1.5	0	0.5	0	-36	1.5	0	0.5	0	-36
WLVSA202	927.0	0	0	1	0	0	0	0	1	0	0
WLVSA204	918.0	2	05	0.5	0	0	2	05	0.5	0	0
WLVSA204	924.0	0	16	0.5	0.5	0.5	0	20	0.5	0.5	0.5
WIVSA205	924.0	0	16.5	0.5	1	0.5	0	20 5	0.5	1	0.5
WLVSA207	925.5	0	0	1	0.5	0.5	0	0	1	0.5	0.5
WIVSA208	923.5	0	16 5	05	1	0.5	0	20 5	0.5	1	0.5
WLVSA209	915.5	2	0.5	0	0	0	2	0.5	0	0	0
WLVSA210	920.5	- 16	4	0	2	1	20	4	0	2	1
			•	- cc	- ntinued	-		•			-

Appendix Table A5. Continued											
		Difference in Total Days Between With and Without Diversion Conditions									
	Approx.	W	ith a 10-c	ay Dry D	own Peri	od	W	ith a 14-o	day Dry D	own Peri	od
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
WLVSA211	923.0	0	10 5	1.5	0	0.5	0	0	1.5	0	0.5
WLVSA212	919.5	0	19.5	5.5	16	2 1 F	0	23.5	5.5	20	2
WLVSA213	920.0	0	19.5	5.5	10	1.5	0	23.5	5.5	20	1.5
WLVSA214	919.5	0	21	4.5	17	1.5	0	25	4.5	21	1.5
WLVSA215	911.0	1	0		0	-0.5	1	0		0	-0.5
WLVSA216	914.5	5	3	0.5	4	0.5	5	3	0.5	4	0.5
WLVSA217	922.0	0	105	5	0	0.5	0	0	5	0	0.5
WLVSA218	921.0	0	18.5	-0.5	0	-1.5	0	22.5	-0.5	0	-1.5
WLVSA219	922.0	0	17.5	3	0	0.5	0	21.5	3	0	0.5
WLVSA220	908.5	1	0	0.5	0	-1	1	0	0.5	0	-1
WLVSA221	908.5	I C F	0	0.5	0	-1	I C F	0	0.5	0	-1
WLVSA222	913.0	6.5 1 F	4	1	4	2	6.5 1 F	4	1	4	2
WLVSA223	910.0	1.5	0	0.5	1.5	-0.5	1.5	0	0.5	1.5	-0.5
WLVSA224	912.5	4.5	2	0.5	3		4.5	2	0.5	3	0
WLVSA225	914.5	22.5	0.5	0	5	5.5	26.5	6.5	0	5	5.5
WLVSA226	917.0	19	21	4	18	3	23	25	4	22	3
WLVSA227	915.5	19.5	6.5	0	4.5	4.5	23.5	6.5	0	4.5	4.5
WLVSA228	911.5	2.5	1	0.5	2	-0.5	2.5	1	0.5	2	-0.5
WLVSA229	910.0	1.5	0	0	0.5	-0.5	1.5	0	0	0.5	-0.5
WLVSA230	910.0	1.5	0	0	0.5	-0.5	1.5	0	0	0.5	-0.5
WLVSA231	910.5	1.5	0	0	2	-0.5	1.5	0	0	2	-0.5
WLVSA232	916.0	19.5	6	0	4.5	4	23.5	6	0	4.5	4
WLVSA233	912.0	4	1.5	1	4	0	4	1.5	1	4	0
WLVSA234	917.5	18.5	20.5	4.5	17.5	2.5	22.5	24.5	4.5	21.5	2.5
WLVSA235	908.5	1	0	0	0	-1	1	0	0	0	-1
WLVSA236	910.0	2	0.5	1	2	0	2	0.5	1	2	0
WLVSA237	910.0	2	1	1.5	2	0	2	1	1.5	2	0
WLVSA57	921.0	-11	5	-0.5	1.5	-1	-15	5	-0.5	1.5	-1
WLVSA64	922.0	0	17	-0.5	-12.5	-0.5	0	21	-0.5	-16.5	-0.5
WLVSA65	919.5	18	4	0	2.5	1	22	4	0	2.5	1
WLVSA66	923.0	0	17.5	0	0.5	0	0	21.5	0	0.5	0
WRRND1	920.0	0	0	0	-0.5	0	0	0	0	-0.5	0
WRRND10	916.5	-0.5	-0.5	0	-0.5	0	-0.5	-0.5	0	-0.5	0
WRRND11	919.5	1.5	1	0.5	1	-0.5	1.5	1	0.5	1	-0.5
WRRND12	916.0	-0.5	-0.5	0	-0.5	-0.5	-0.5	-0.5	0	-0.5	-0.5
WRRND13	913.5	0	-0.5	0.5	-0.5	-0.5	0	-0.5	0.5	-0.5	-0.5
				- co	ntinued	_					

Appendix Table A5. Continued											
		Difference in Total Days Between With and Without Diversion Conditions									
	Approx.	W	ith a 10-c	day Dry D	own Peri	od	W	ith a 14-o	day Dry D	own Peri	od
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
WRRIND14	912.5	-0.5	0	0.5	0	0	-0.5	0	0.5	0	0
WRRND15	911.0	0	-0.5	1	0	-0.5	0	-0.5	1	0	-0.5
WRRND16	912.5	0	0		0	-0.5	0	0	1	0	-0.5
WRRND17	911.0	0	-0.5	1.5	-0.5	-0.5	0	-0.5	1.5	-0.5	-0.5
WRRND18	908.5	0	0	0.5	0	-0.5	0	0	0.5	0	-0.5
WRRND19	906.5	0	0	1	0	-0.5	0	0	1	0	-0.5
WRRND2	920	0	0	-0.5	0	0	0	0	-0.5	0	0
WRRND3	919.5	0	-0.5	0	0	-0.5	0	-0.5	0	0	-0.5
WRRND4	918.5	0	0	0	0	-2	0	0	0	0	-2
WRRND5	918	0	0	0	-0.5	-2.5	0	0	0	-0.5	-2.5
WRRND6	918.5	-0.5	-0.5	0	-0.5	-1	-0.5	-0.5	0	-0.5	-1
WRRND7	917	0	-0.5	0	0	0	0	-0.5	0	0	0
WRRND8	917	-0.5	0	0	-0.5	0	-0.5	0	0	-0.5	0
WRRND9	917.5	0	0	0	-0.5	0	0	0	0	-0.5	0
WRSA273	929.5	0	0	0	0	0	0	0	0	0	0
WRSA280	925.5	0	0	0	0	0	0	0	0	0	0
WRSA284	923	0	0	0	0	0	0	0	0	0	0
WRSA289	923.5	0	0	0	0	0.5	0	0	0	0	0.5
WRSA294	919.5	0	0	0	0	0	0	0	0	0	0
WRSA299	912.5	-0.5	-1	0.5	0	-0.5	-0.5	-1	0.5	0	-0.5
WRSA300	909.5	-0.5	0	0	0	0	-0.5	0	0	0	0
WRSA302	913	20.5	6.5	3.5	4	7	24.5	6.5	3.5	4	7
WRSA303	919.5	0	19	21.5	-0.5	0	0	23	25.5	-0.5	0
WRSA304	915	1.5	0	0	-0.5	-7.5	1.5	0	0	-0.5	-7.5
WRSA305A	910.5	0	0	1	-0.5	-0.5	0	0	1	-0.5	-0.5
WRSA305B	910.5	-0.5	0	1	-0.5	-0.5	-0.5	0	1	-0.5	-0.5
WRSA305C	906	-0.5	0	0.5	-1	-1	-0.5	0	0.5	-1	-1
WRSA305D	906	-0.5	0	0.5	-0.5	-1	-0.5	0	0.5	-0.5	-1
WRSA306	908	-0.5	-0.5	13.5	8	-2	-0.5	-0.5	13.5	8	-2
WRSA307	911	2	0	-1	1.5	-4	2	0	-1	1.5	-4
WRSA308	917	18.5	20.5	22.5	18	0	22.5	24.5	26.5	22	0
WRSA309	914.5	0	-1	-0.5	-1	-0.5	0	-1	-0.5	-1	-0.5
WRSA311	907	-2	-0.5	17	8	-1.5	-2	-0.5	17	8	-1.5
WRSA312	906.5	-2	0	17.5	4.5	-1	-2	0	17.5	4.5	-1
WRSA315	909.5	0	-1	-2.5	-1	-1	0	-1	-2.5	-1	-1
WRSA321	906.5	-1.5	-4	-5	-3	-14.5	-1.5	-4	-5	-3	-14.5
		1	I	СС	ntinued	L	1		1	1	

Appendix Tal	ole A5. Cont	inued									
		C	Difference	e in Total	Days Bet	ween W	ith and W	/ithout D	iversion (	Condition	S
	Approx.	W	ith a 10-c	day Dry D	own Peri	od	w	ith a 14-o	own Peri	od	
	Field	2009-					2009-				
Storage Area	Elevation <sup>a</sup>	like	50-yr	100-yr	500-yr	PMF	like	50-yr	100-yr	500-yr	PMF
WRSA350	910.5	0	0	-1.5	0	-2	0	0	-1.5	0	-2
WRSA351	908.5	-0.5	-0.5	11.5	-0.5	-2	-0.5	-0.5	11.5	-0.5	-2
WRSA352	911	-1	-0.5	-0.5	-1	-2	-1	-0.5	-0.5	-1	-2
WRSA353	917.5	5	5	2.5	3	-0.5	5	5	2.5	3	-0.5
WRSA354	919	0.5	0	0	0	-1	0.5	0	0	0	-1
WRSA355	917.5	0	0	0	0	0	0	0	0	0	0
WRSA356	920.5	0	0	0	0	0	0	0	0	0	0
WRSA357	921.5	0.5	0	0	0	0	0.5	0	0	0	0
WRSA358	923.0	0.5	0.5	0.5	0.5	0	0.5	0.5	0.5	0.5	0
WRSA359	923.0	0.5	0	0	0	0	0.5	0	0	0	0
WRSA360	924.0	0	0	0	0	0	0	0	0	0	0
WRSA363	911.5	-1	-1	1	-1.5	-2	-1	-1	1	-1.5	-2
WRSA364	913.0	-1.5	-2	-1.5	-2	-8.5	-1.5	-2	-1.5	-2	-8.5
WRSA373	927.5	0	0	0	0	0	0	0	0	0	0
WRSA378	926.0	0	0	0.5	0	0	0	0	0.5	0	0
WRSA383	924.0	0	0	0	0	0	0	0	0	0	0
WRSA384	925.0	0	0	1	0	0	0	0	1	0	0
WRSA389	923.0	0	0	0	0	0	0	0	0	0	0
WRSA390	917.5	0	-0.5	-0.5	-0.5	0	0	-0.5	-0.5	-0.5	0
WRSA501	911.0	2.5	1	0	2.5	-0.5	2.5	1	0	2.5	-0.5
WRSA502	913.0	6	4	1	3.5	2	6	4	1	3.5	2
WRSA504	915.0	20	5	-4	4	2.5	24	5	-4	4	2.5
WRSA505	909.0	0.5	0	0	0	0	0.5	0	0	0	0
WRSA506	909.0	1	0	0.5	1.5	-1	1	0	0.5	1.5	-1
WRSA507	902.0	0	0	0	0	0	0	0	0	0	0
WRSA907	915.0	0	-0.5	-0.5	0	0	0	-0.5	-0.5	0	0
PMF = Probabili	PMF = Probabilistic Maximum Flood.										

<sup>a</sup>Feet above mean seal level. Lowest estimated elevation for storage area.

Source: Houston-Moore Group (2019).



Appendix Figure A1. Hydrology Groups for Storage Areas, 10-year Flood Event



Appendix Figure A2. Hydrology Groups for Storage Areas, 20-year Flood Event



Appendix Figure A3. Hydrology Groups for Storage Areas, 25-year Flood Event


Appendix Figure A4. Hydrology Groups for Storage Areas, 25-year Long Flood Event



Appendix Figure A5. Hydrology Groups for Storage Areas, 25-year Extra Long Flood Event



Appendix Figure A6. Hydrology Groups for Storage Areas, 2009-year Flood Event



Appendix Figure A7. Hydrology Groups for Storage Areas, 50-year Flood Event



Appendix Figure A8. Hydrology Groups for Storage Areas, 100-year Flood Event



Appendix Figure A9. Hydrology Groups for Storage Areas, 500-year Flood Event



Appendix Table A10: Hydrology Groups for Storage Areas, Probabilistic Maximum Flood Event

## Appendix B

Direct Expenses, Wheat, Corn, and Soybean Inputs, FINBIN Farm Financial Database

Counties, Minnesota, 2014 through 2018							
	All Farms	2018	2017	2016	2015	2014	
Number of farms	94	20	19	19	20	16	
Acres	282.38	388.62	286.17	251.80	249.25	222.80	
Yield per acre (bu.)	62.59	57.98	68.26	64.22	66.30	56.60	
Operators share of yield %	97.23	98.12	96.94	96.89	98.00	95.05	
Value per bu.	5.32	5.34	5.79	4.80	4.90	5.94	
Total product return per acre	324.06	303.80	383.07	298.84	318.57	319.72	
Crop insurance per acre	1.17	0.54	2.45	1.97	-	1.14	
Other crop income per acre	9.80	18.26	8.34	10.04	1.92	4.26	
Gross return per acre	335.02	322.60	393.87	310.85	320.49	325.13	
Direct Expenses (\$/acre)							
Seed	21.67	20.51	21.22	20.59	23.71	23.45	
Fertilizer	82.96	73.74	80.54	79.12	93.13	97.68	
Crop chemicals	17.87	18.99	19.94	12.62	19.30	17.32	
Crop insurance	10.22	9.31	11.31	9.61	10.33	11.23	
Drying expense	0.26	0.44	0.04	-	0.02	0.92	
Storage	0.21	0.53	0.26	-	-	-	
Fuel & oil	13.83	14.84	11.73	10.66	13.99	18.83	
Repairs	25.78	23.57	24.56	26.64	25.99	31.03	
Custom hire	2.65	3.24	3.25	1.75	3.32	0.72	
Land rent	79.76	94.99	71.91	76.25	84.41	56.77	
Machinery leases	2.22	7.57	-	-	-	-	
Marketing	0.22	0.55	-	0.10	-	0.32	
Operating interest	3.69	4.93	4.43	2.68	2.98	2.20	
Miscellaneous	3.39	5.12	6.26	0.07	2.39	1.10	
Total direct expenses per							
acre	264.73	278.32	255.44	240.09	279.56	261.58	

Appendix Table B1. FINBIN Crop Production Budget, Direct Expenses, Wheat, Clay and Wilkin Counties, Minnesota, 2014 through 2018

Source: FINBIN (2019).

Counties, North Dakota, 2014 through 2018							
	All Farms	2018	2017	2016	2015	2014	
Number of farms	89	19	16	17	19	18	
Acres	313.49	289.94	315.84	286.61	403.39	266.73	
Yield per acre (bu.)	66.49	60.49	69.29	75.46	68.24	58.55	
Operators share of yield %	97.97	100.00	100.00	96.55	97.30	96.12	
Value per bu.	5.10	5.33	5.75	4.63	4.56	5.59	
Total product return per acre	332.05	322.70	398.25	337.02	302.82	314.69	
Hedging gains/losses per acre	0.93	3.91	-	0.89	-	-	
Crop insurance per acre	4.67	1.26	4.27	-	6.98	10.05	
Other crop income per acre	3.57	13.13	1.26	1.33	1.87	-	
Gross return per acre	341.21	341.00	403.78	339.25	311.67	324.74	
Direct Expenses (\$/acre)							
Seed	22.24	20.37	21.66	24.18	21.65	23.95	
Fertilizer	82.84	73.40	71.73	78.68	98.10	85.23	
Crop chemicals	21.80	20.56	18.74	21.01	22.35	26.35	
Crop insurance	14.61	13.01	16.19	12.86	12.17	20.46	
Drying expense	0.40	0.13	-	-	0.69	1.07	
Storage	1.50	2.71	1.29	0.33	1.84	0.97	
Fuel & oil	15.36	15.22	13.48	11.89	14.07	23.06	
Repairs	23.18	24.76	24.84	20.26	21.86	24.68	
Custom hire	9.29	7.45	4.71	10.62	11.17	11.88	
Land rent	87.18	103.35	75.15	70.12	93.51	88.50	
Machinery leases	0.48	-	-	-	0.65	1.75	
Operating interest	3.15	4.13	3.84	3.89	1.64	2.93	
Miscellaneous	0.65	0.54	0.84	0.63	0.36	1.06	
Total direct expenses per							
acre	282.66	285.63	252.46	254.47	300.05	311.90	

Appendix Table B2. FINBIN Crop Production Budget, Direct Expenses, Wheat, Cass and Richland Counties, North Dakota, 2014 through 2018

Source: FINBIN (2019).

Counties, Minnesota, 2014 through 2018							
	All Farms	2018	2017	2016	2015	2014	
Number of farms	155	29	32	34	30	30	
Acres	666.06	782.10	762.06	505.82	598.43	700.70	
Yield per acre (bu.)	43.41	48.67	42.10	47.59	42.72	36.44	
Operators share of yield %	98.72	99.20	98.88	98.51	98.75	97.99	
Value per bu.	8.98	8.36	9.04	9.34	8.57	9.83	
Total product return per acre	384.77	403.48	376.24	437.79	361.61	350.88	
Hedging gains/losses per acre	0.32	0.37	-	-1.92	-	2.76	
Crop insurance per acre	5.56	2.68	5.28	4.80	2.77	11.97	
Other crop income per acre	19.24	79.55	5.29	0.55	0.81	1.38	
Gross return per acre	409.89	486.09	386.81	441.21	365.19	366.98	
Direct Expenses (\$/acre)							
Seed	59.80	56.53	59.90	59.63	61.14	62.23	
Fertilizer	5.46	4.83	8.67	4.18	4.99	3.86	
Crop chemicals	34.14	35.09	39.65	34.76	35.21	25.32	
Crop insurance	17.73	17.04	18.87	15.30	18.02	18.90	
Fuel & oil	14.10	13.79	12.22	11.23	13.89	19.13	
Repairs	24.89	20.17	24.39	27.70	25.67	27.61	
Custom hire	1.89	2.47	1.02	1.89	2.98	1.32	
Land rent	90.24	96.25	95.79	83.58	87.01	85.52	
Machinery leases	3.15	14.15	-	-	-	0.20	
Operating interest	4.75	6.29	6.36	3.80	3.43	3.11	
Miscellaneous	2.54	2.40	6.00	0.74	1.56	0.96	
Total direct expenses per							
acre	258.69	269.01	272.87	242.82	253.91	248.18	
Source: FINBIN (2019).							

Appendix Table B3. FINBIN Crop Production Budget, Direct Expenses, Soybeans, Clay and Wilkin Counties, Minnesota, 2014 through 2018

Counties, North Dakota, 2014 through 2018							
All Farms	2018	2017	2016	2015	2014		
233	46	50	50	42	45		
822.40	852.00	856.49	801.37	744.22	850.61		
42.96	47.42	40.89	47.97	41.01	37.06		
99.43	99.54	99.63	99.68	99.41	98.72		
8.92	8.35	9.06	9.20	8.34	9.65		
381.12	394.36	368.91	440.03	340.11	353.07		
0.73	2.13	-	-0.03	0.08	1.45		
6.15	6.35	3.97	1.24	6.23	13.48		
16.54	75.49	1.68	1.43	1.33	1.04		
404.55	478.33	374.56	442.67	347.75	369.04		
59.94	53.11	58.12	60.76	62.41	66.12		
6.78	6.82	6.89	8.55	7.78	3.96		
32.38	35.90	37.70	32.17	31.15	24.06		
22.65	20.70	22.95	21.61	22.60	25.45		
0.57	0.68	0.36	0.85	0.55	0.44		
13.89	14.64	11.57	10.10	14.19	19.44		
21.62	24.39	21.51	19.69	20.12	22.16		
2.92	2.49	3.55	2.84	2.45	3.11		
0.45	0.04	1.70	0.04	0.17	0.15		
99.48	100.41	101.21	101.10	98.88	95.37		
1.09	1.69	0.34	0.24	1.14	2.17		
4.70	5.45	5.15	5.39	3.57	3.64		
0.31	0.49	0.42	0.13	-	0.44		
266.80	266.80	271.47	263.47	265.01	266.50		
	All Farms   233   822.40   42.96   99.43   8.92   381.12   0.73   6.15   16.54   404.55   59.94   6.78   32.38   22.65   0.57   13.89   21.62   2.92   0.45   99.48   1.09   4.70   0.31	All Farms201823346822.40852.0042.9647.4299.4399.548.928.35381.12394.360.732.136.156.3516.5475.49404.55478.3359.9453.116.786.8232.3835.9022.6520.700.570.6813.8914.6421.6224.392.922.490.450.0499.48100.411.091.694.705.450.310.49	All Farms201820172334650822.40852.00856.4942.9647.4240.8999.4399.5499.638.928.359.06381.12394.36368.910.732.13-6.156.353.9716.5475.491.68404.55478.33374.5659.9453.1158.126.786.826.8932.3835.9037.7022.6520.7022.950.570.680.3613.8914.6411.5721.6224.3921.512.922.493.550.450.041.7099.48100.41101.211.091.690.344.705.455.150.310.490.42266.80266.80271.47	All Farms201820172016233465050822.40852.00856.49801.3742.9647.4240.8947.9799.4399.5499.6399.688.928.359.069.20381.12394.36368.91440.030.732.130.036.156.353.971.2416.5475.491.681.43404.55478.33374.56442.6759.9453.1158.1260.766.786.826.898.5532.3835.9037.7032.1722.6520.7022.9521.610.570.680.360.8513.8914.6411.5710.1021.6224.3921.5119.692.922.493.552.840.450.041.700.0499.48100.41101.21101.101.091.690.340.244.705.455.155.390.310.490.420.13	All Farms201820172016201523346505042822.40852.00856.49801.37744.2242.9647.4240.8947.9741.0199.4399.5499.6399.6899.418.928.359.069.208.34381.12394.36368.91440.03340.110.732.130.030.086.156.353.971.246.2316.5475.491.681.431.33404.55478.33374.56442.67347.75259.9453.1158.1260.7662.416.786.826.898.557.7832.3835.9037.7032.1731.1522.6520.7022.9521.6122.600.570.680.360.850.5513.8914.6411.5710.1014.1921.6224.3921.5119.6920.122.922.493.552.842.450.450.041.700.040.1799.48100.41101.21101.1098.881.091.690.340.241.144.705.455.155.393.570.310.490.420.13-266.80266.80271.47263.47265.01		

Appendix Table B4. FINBIN Crop Production Budget, Direct Expenses, Soybeans, Cass and Richland Counties, North Dakota, 2014 through 2018

Source: FINBIN (2019).

Counties, Minnesota, 2014 through 2018							
	All Farms	2018	2017	2016	2015	2014	
Acres	528.13	581.52	592.17	569.76	479.85	409.63	
Yield per acre (bu.)	176.67	188.77	179.3	193.78	170.8	137.12	
Operators share of yield %	99.65	99.88	99.94	99.74	98.96	99.42	
Value per bu.	3.27	3.33	3.03	3.11	3.42	3.74	
Total product return per acre	575.35	627.67	543.33	601.25	578.81	509.5	
Hedging gains/losses per acre	5.7	5.56	1.61	6.87	7.31	8.63	
Crop insurance per acre	18.28	5.09	8.28	14.09	3.49	74.41	
Other crop income per acre	2.48	4.04	2.54	0.61	1.61	3.93	
Gross return per acre	601.81	642.36	555.77	622.82	591.22	596.47	
Direct Expenses (\$/acre)							
Seed	92.77	88.97	89.57	92.6	93.52	102.35	
Fertilizer	113.41	102.82	100.79	111.87	126.82	134.88	
Crop chemicals	25	23.63	29.06	26.09	24.12	20.09	
Crop insurance	20.15	17.45	21.38	18.09	21.02	24.1	
Drying expense	10.26	12.05	10.29	6.7	5.42	18.31	
Storage	0.39	0.76	0.39	0.13	0.05	0.65	
Fuel & oil	25.64	27.46	22.02	20.92	26.32	34.8	
Repairs	42.15	40.6	41.65	43.56	40.68	44.6	
Custom hire	3.56	3.53	3.48	2.8	4.21	4.13	
Hired labor	1.85	2.04	4.33	0.09	0.92	1.43	
Land rent	96.74	112.71	96.81	94.08	85.25	91.01	
Machinery leases	2.3	5.75	1.52	1.81	1.03	0.83	
Marketing	0.31	0.5	0.27	0.35	0.05	0.35	
Operating interest	8.23	10.84	9.44	6.28	6.67	7.34	
Miscellaneous	2.57	4.14	3.31	1.62	1.17	2.18	
Total direct expenses per	445.35	453.27	434.3	426.99	437.25	487.06	
acre							
Miscellaneous Total direct expenses per acre	2.57 445.35	4.14 453.27	3.31 434.3	1.62 426.99	1.17 437.25	2.18 487.06	

Appendix Table B5. FINBIN Crop Production Budget, Direct Expenses, Corn, Clay and Wilkin Counties, Minnesota, 2014 through 2018

Source: FINBIN (2019).

Counties, North Dakota, 2014 through 2018							
	All Farms	2018	2017	2016	2015	2014	
Number of farms	214	45	46	48	38	37	
Acres	594.97	644.52	667.09	624.51	553.87	448.95	
Yield per acre (bu.)	174.22	188.42	181.73	186.4	157.47	134.77	
Operators share of yield %	99.51	99.49	99.59	99.51	99.65	99.2	
Value per bu.	3.25	3.32	3.09	3.13	3.44	3.47	
Total product return per acre	563.02	622.04	560.09	579.72	540.23	464.11	
Hedging gains/losses per acre	1.15	2.03	-0.47	1.81	-0.14	3.05	
Crop insurance per acre	10.02	2.07	1.79	0.33	9.07	57.76	
Other crop income per acre	2.50	2.89	3.06	1.16	0.84	5.3	
Gross return per acre	576.69	629.04	564.47	583.02	550	530.22	
Direct Expenses (\$/acre)							
Seed	96.91	94.36	95.16	97.36	98.37	101.95	
Fertilizer	120.33	110.82	105.91	121.23	131.75	147.52	
Crop chemicals	25.34	26.13	26.21	24.2	27.32	21.89	
Crop insurance	25.36	21.04	24.35	24.28	26.07	35.86	
Drying expense	14.40	19.84	13.54	9.05	8.33	23.81	
Storage	2.46	3.95	1.58	2.01	2.65	2.07	
Fuel & oil	21.55	24.60	18.64	16.13	22.92	29.66	
Repairs	34.79	40.58	34.21	31.68	30.91	36.27	
Custom hire	3.54	2.82	2.51	3.91	5.58	3.44	
Hired labor	1.55	0.32	4.56	0.15	0.97	1.38	
Land rent	100.85	104.80	100.00	105.28	98.42	90.6	
Machinery leases	1.08	1.52	0.48	0.66	1.51	1.64	
Utilities	0.19	-	-	-	-	1.43	
Marketing	0.25	-	0.56	0.24	-	0.47	
Operating interest	9.01	11.74	9.60	9.05	6.9	5.74	
Miscellaneous	0.14	0.11	0.18	0.1	0.09	0.21	
Total direct expenses per							
acre	457.75	462.63	437.48	445.33	461.80	503.95	
Source: FINBIN (2019). Notes: Budgets represent combination of owned land, rented land, and share-crop among farms enrolled in the program for the given geography.							

Appendix Table B6. FINBIN Crop Production Budget, Direct Expenses, Corn, Cass and Richland Counties, North Dakota, 2014 through 2018