



Rainbow Wash, looking NE upstream of Old US 80 crossing, 07-23-2020, Mike Olbinski

## **Flood Control District of Maricopa County**

### **Flood Warning Branch**

## **MSP Verification Report & Season Recap: Monsoon Season 2020**



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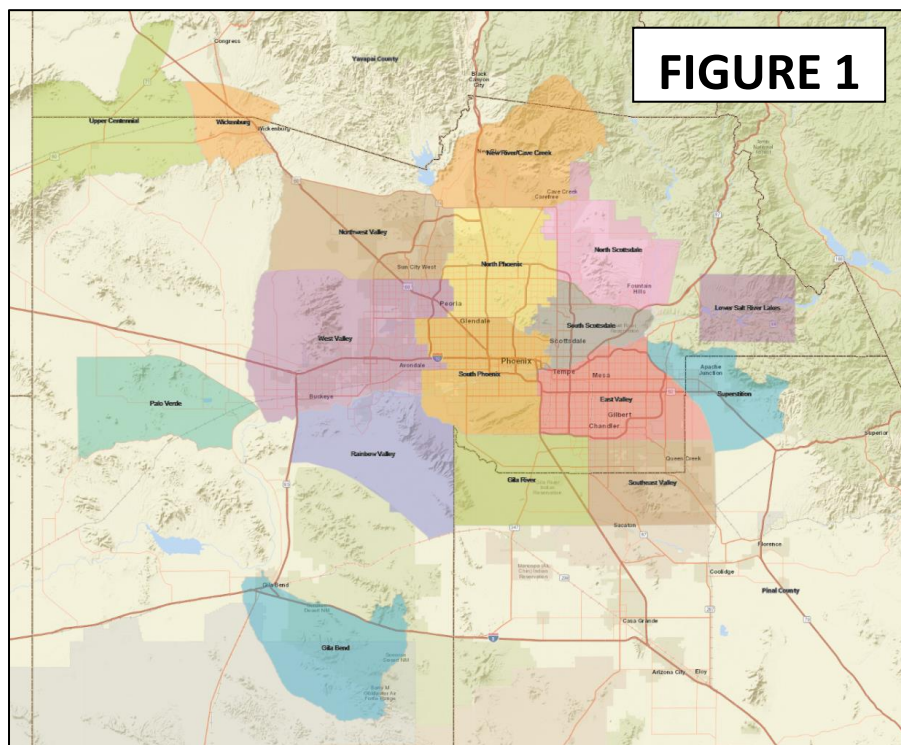
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## INTRODUCTION

This report was generated by the Flood Warning Branch of the Flood Control District of Maricopa County (FCDMC). It covers the length of the 2020 monsoon season as defined by the National Weather Service Phoenix WFO: June 15<sup>th</sup>- September 30<sup>th</sup>. This report includes daily records on Weather Outlooks and Statements issued by the Meteorological Services Program (MSP) as well as a complete verification and summary of these products.

The Flood Warning Branch of the FCDMC operates a year-round MSP that's purpose is to provide detailed meteorological forecasts and support to county, city, and other local agencies. The program covers 5,400 square miles encompassing portions of Maricopa County and surrounding watersheds. The goal of the Flood Control District's MSP is to reduce response time for emergency managers by providing timely and accurate weather information, primarily regarding the potential for flood-producing rainfall. During the length of the Monsoon season the MSP goes on a weekly rotating 24/7 manned schedule. A Duty Officer is selected for each day who is responsible for issuing MSP products, providing support to clients, and serving as the on-call supervisor during non-business hours. A supporting officer is also named and can be available to the duty officer in the case of a significant weather event. All MSP forecast products are disseminated via email and text alerts. Emergency managers may also be notified by telephone to aid in decision making.

The MSP has broken down the 5,400 square mile operational area into 17 forecast zones. These zones are the primary warning areas identified by emergency management officials. A map of the current forecast zone locations is shown below in Figure 1.



## MSP PRODUCT DESCRIPTION

### Weather Outlook:

The Weather Outlook is disseminated to clients daily no later than 2PM during the monsoon season. This product covers the today through tomorrow period and occasionally the following 2-3 days where appropriate. Occasionally, due to unexpected weather pattern changes, Weather Outlooks will be updated throughout the day or first thing the following morning. Weather Outlooks include a synopsis of expected weather conditions; the “probability of occurrence” of rain; the expected “prime time” for the bulk of the rain; and the amount of rain expected during the prime time period. Temperature forecasts and trends are included as well as a forecast of peak wind speeds. Click [here](#) for an example.

### Message 1 – Alert:

When it is believed developing weather conditions may lead to heavy rain and/or minor to moderate flooding an Alert is issued. Lead time will generally be less than an hour in advance of the expected event. The Alert will normally identify the affected zone(s), the time frame of the event (valid time), rainfall potential, and the type of areas that will be impacted, such as roads and/or washes. Click [here](#) for an example.

### Message 2 – Flash Flood Watch:

When it appears the developing weather event may lead to flash flooding a Watch is issued for the possible affected areas. Lead time will generally be 1 to 2 hours in advance of the expected event, but can stretch to a day or more with reliable guidance. The Watch will include the time frame it will be in effect (valid time), and a section describing what may take place (comments). Click [here](#) for an example.

### Message 3 – Flash Flood Warning:

When it appears that significant flash flooding is imminent or has started to take place, a Warning will be issued for the affected areas. Lead time will generally be less than an hour. The Warning will normally identify the affected zone(s), a time frame of the event, rainfall potential, and a section describing what is expected to take place (comments). Click [here](#) for an example.

### Message 1, 2 and 3 Update:

This product, issued as needed, will update an existing Alert, Watch or Warning. Click [here](#) for an example.

### Message 4 – Cancel:

When an event (Watch or Warning) no longer poses a threat, and the expiration time has not been reached, a Cancel message may be issued. Click [here](#) for an example.

Lake Alerts:

In addition to the above MSP program, weather guidance is provided for Maricopa County lakes/reservoirs from June 15 through September 30. Lake Alerts are issued as needed to inform of approaching adverse weather conditions. Emphasis in these statements is on expected wind gusts and lightning activity. Click [here](#) for an example.

Additional Products:

At the request of clients, site specific products may be issued to support unusual or special operations, such as specific wind forecasts to aid in the fighting of fires, or forecasting for special events at the County lakes or parks, or District construction projects.

*Additional information and data regarding the FCDMC can be found online [here](#)*



## 2020 MONSOON SEASON RECAP

According to the FCDMC ALERT rain gage network, the 2020 monsoon season was characterized as being much drier than normal. When averaged across 292 of the oldest county mesonet rain gages, 0.64" of rain fell which was 22% of the mean value of 2.88". This value represents the record driest average monsoon rainfall in our records. An image showing a 38 year period of record can be viewed [here](#). It's worth noting that below-average rainfall was recorded at Sky Harbor Airport for the fifth season in a row. The official rain total as reported by the NWS Phoenix office was 1.00" which was 1.71" below the period average of 2.71". Click [here](#) to see a technical summary plot from Sky Harbor Airport covering the monsoon season courtesy of the University of Arizona CSAP/CLIMAS organization. Figure 2, below, offers a more comprehensive picture of the rainfall distribution across the MSP forecast area. This figure was generated using FCDMC ALERT rain gage data from around the county. The shaded contours depict precipitation totals from June 15<sup>th</sup> – September 30<sup>th</sup>.

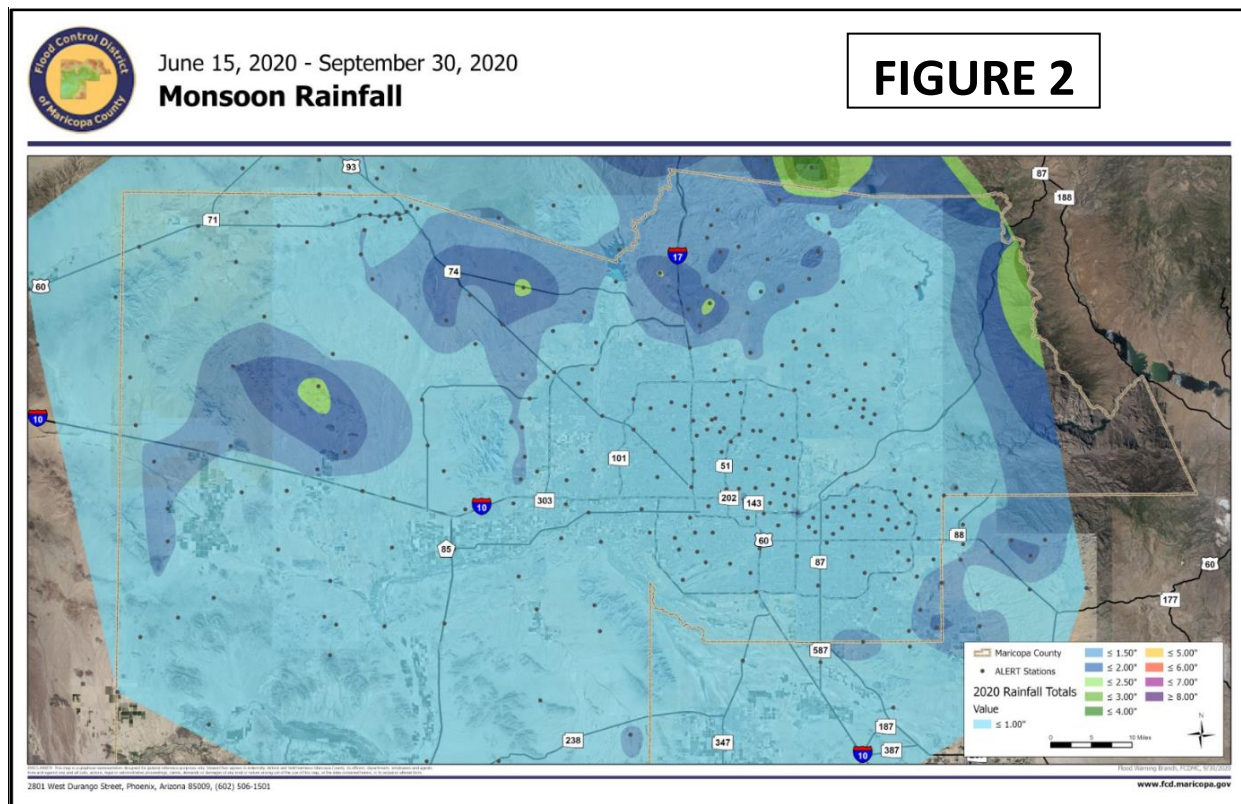
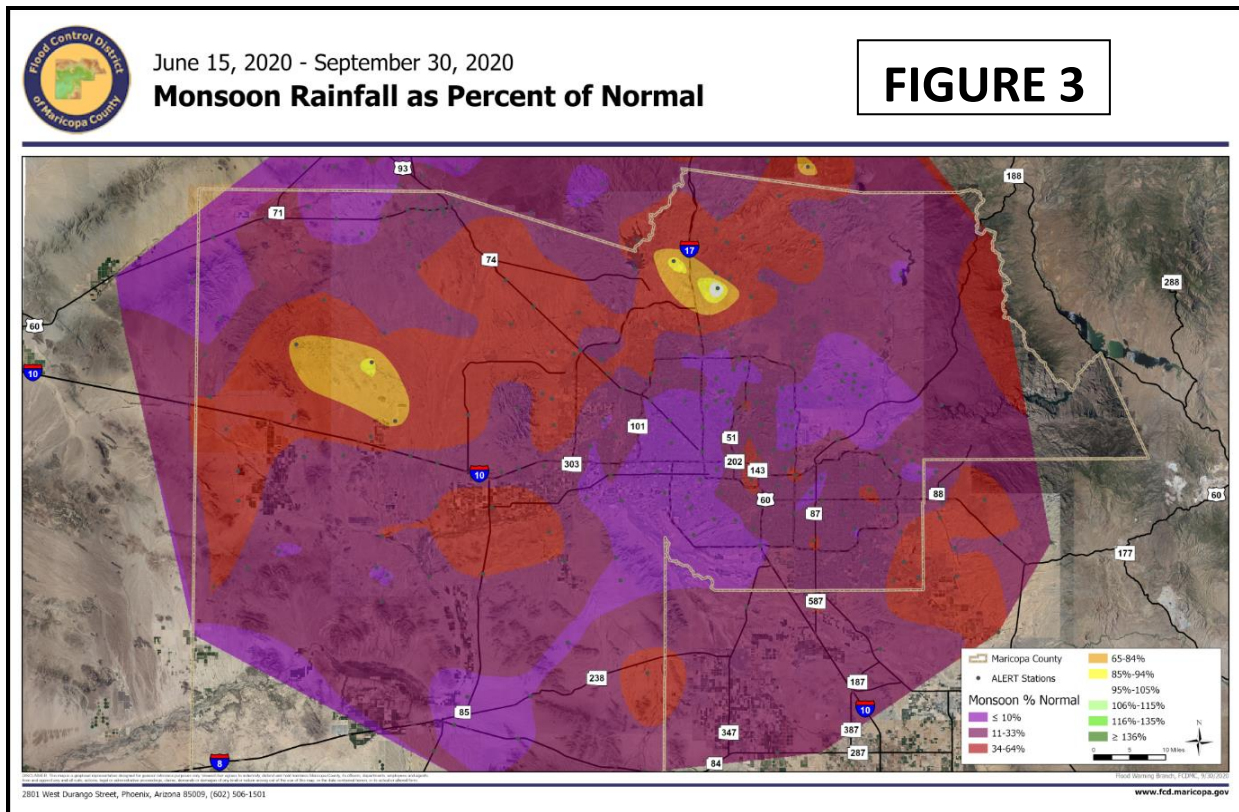


Figure 3, on the next page, shows the ratio of 2020 monsoon precipitation versus average monsoon precipitation. Similar to Figure 2, contours were generated using FCDMC ALERT rain gage data from around the county. The images speak for themselves as it was an incredibly dry Monsoon. Outside of a few localized spots, the majority of Maricopa County and its surrounding watersheds saw well below average or record low rainfall amounts. These two figures serve as a strong reminder to the importance of having a widely distributed rain gage network in order to fully capture the distribution of monsoon rains.



The monsoon got off to a really slow start not only here but across the entire state. Hot and dry conditions prevailed across the region during the second half of June and then continued through most of July. The monsoon high migrated north into the Four Corners region during the first week of July allowing for a brief intrusion of moisture into southern AZ, though this ended up being a false start with moisture values falling short of the necessary thresholds for an official onset. Instead, the onset held off until July 22<sup>nd</sup>, making it the second latest start date according to the NWS (records go back to 1948). Monsoon statistics for Phoenix Sky Harbor can be found [here](#).

The first widespread rainfall event for the Valley occurred on July 23<sup>rd</sup>. While not a particularly impressive setup, several locations received over a half-inch of rain and the first MSP statements were issued due to localized strong thunderstorms and heavy rainfall across portions of the West Valley and Rainbow Valley zones. Our gage at Rainbow Wash registered a rise of nearly four feet and flow of 1,900cfs, which ended up requiring Old US 80 being shut down at the unbridged road crossing in both directions for the evening. Activity continued on the 24<sup>th</sup> with the help of forcing from a passing inverted trough. Scattered t-storms developed that evening extending from Cave Creek to the north and all the way south into the I-10/Loop 202 corridor. This activity brought anywhere from 0.25"-1.25" across most of the eastern and southern County communities. The rest of the month finished quietly with no additional message statements or operationally significant days. July 2020 was reported by NWS to be the hottest July on record in Phoenix. Ten daily high or low temperatures records were set and it also finished as the hottest month on record in terms of average temperature.

August picked up where July left off with furnace like conditions around the state of Arizona. The first two weeks of the month were met with multiple days of 110°F+ heat. The summer ridge of high pressure spent a good amount of time either centered over AZ or meandering southeast along the NM/TX border, both of which supported extended break periods to storm activity. Luckily, towards the middle of the month the ridge shifted northwest near the AZ/UT/NV border region creating a more favorable pattern for storm activity around the state. Isolated t-storms developed on the evening of the 16<sup>th</sup> bringing localized heavy rain to portions of the northwest valley and Lake Pleasant region park where there were radar rainfall estimates of 1.00"-2.00". The following evening another complex of storms moved southwest off the higher terrain, but this time into portions of the far southeast valley bringing localized reports of up to 0.50" along with plenty of dust. The favorable pattern persisted for the next few days but with little results due to a lack of deeper moisture. The next active evening occurred on the 20<sup>th</sup> as lower desert storms erupted along colliding outflow boundaries from earlier higher terrain storms. These storms brought anywhere from 0.50"-1.25" across a good portion of the Phoenix urban corridor and even extended south into the Gila River and Gila Bend zones through the overnight hours. It's worth noting, Phoenix Sky Harbor recorded 0.90" from these storms, which was the largest total for the summer and accounted for 90% of the monsoon total! Storm activity waned over the next week despite continuing record setting temperatures across the region.

The biggest precipitation and severe weather producer of the season occurred across southcentral AZ during the two day period of August 29<sup>th</sup>-30<sup>th</sup>. The rain from this event accounted for 55% of the entire season total! The setup was reminiscent of a late season transitional event with the monsoon ridge centered across NM and a cutoff disturbance off the west coast of CA. Enhanced southerly flow advected a slug of tropical moisture, shed from former Tropical Cyclone Hernan, north into AZ and upper-level dynamics from the cutoff helped fuel multiple rounds of severe weather and widespread heavy rainfall. During the night of the 29<sup>th</sup> scattered t-storms developed from the I-10/I-17 corridors south and east all the way into Apache Junction where upwards of 1.50"- 2.00" rain fell. The second evening of storms was highlighted by an organized line of severe t-storms that developed across the northwestern portions of the county and slowly moved southeast dumping heavy rainfall before falling apart shy of central Phoenix. Many gages across our western zones picked up anywhere from 1.00"-2.00" with this line. There were also widespread reports of damaging wind, hail and flooding with this activity. A map of total rainfall for the event can be found in Figure 4 on the next page. Overall, thirty-two message statements were issued during this two day event including a flash flood watch across each of the MSP forecast zones and all but two verified. This event accounted for 65% of the total message statements issued for the season.

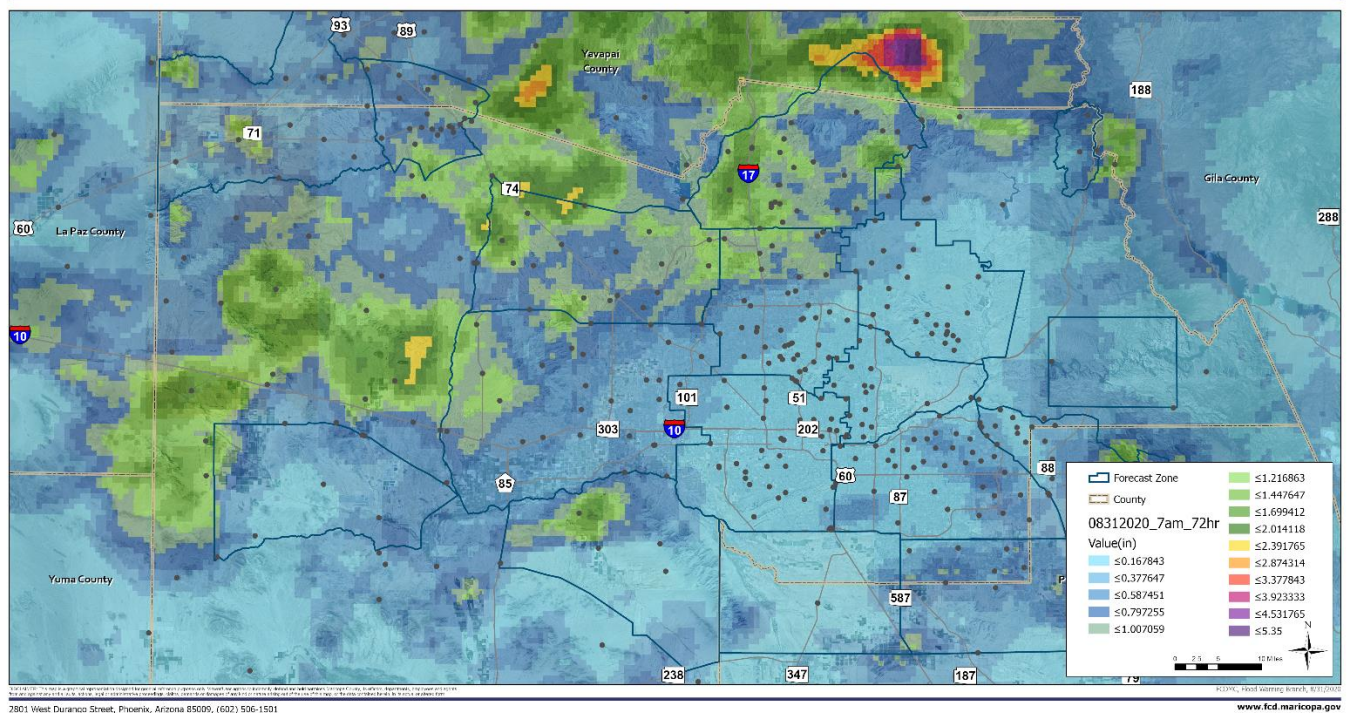
Not to be outdone by July, August 2020 not only went on to become the warmest August on record, but actually surpassed July as the warmest month ever recorded in Phoenix! Numerous other heat records were broken including total number of 110°F+ days (53), 115°F+ days (14), and total number of days with overnight lows above 90°F (28). The heat wasn't limited to just Phoenix either with numerous other locations and the state as a whole recording the warmest summer on record.





3 Day Totals ending 08/31/2020 7am  
**Gage Adjusted Radar Totals**

**FIGURE 4**



The month of September ended up a dud from an operational and precipitation perspective. The placement of the summer ridge was either too far southeast of the region or when in a favorable location not enough moisture was present for widespread storm initiation. Instead well-above average temperatures and dry conditions dominated. This is the first time since this publication has been produced (2012) that there were no message statements issued in September. Phoenix Sky Harbor rain gage measured only a trace on the month (normal 0.64"). Only a handful of the FCDMC gages registered any measurable rainfall. On the season as a whole, 257 out of FCDMC's 357 rain gages received less than an inch of rain. Twenty-four gages measured zero inches of rain for the season. Only thirteen gages surpassed two inches and three gages had near normal to normal rainfall for the season.

### MSP Issued Products Recap:

A total of fifty-four forecast zone-specific messages were issued by the MSP spread across eight different days during the length of the monsoon season. Table 1, below, shows the monthly break down by forecast zone of messages issued including season totals.

TABLE 1: MSP Messages Issued - 2020 Monsoon Season					
Forecast Zone	June	July	August	September	Total
Gila Bend	0	0	2	0	2

<b>TABLE 1: MSP Messages Issued - 2020 Monsoon Season</b>					
<b>Forecast Zone</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>Total</b>
Gila River	0	1	3	0	<b>4</b>
Palo Verde	0	0	2	0	<b>2</b>
Rainbow Valley	0	1	2	0	<b>3</b>
West Valley	0	2	3	0	<b>5</b>
Northwest Valley	0	0	3	0	<b>3</b>
Upper Centennial	0	0	2	0	<b>2</b>
Wickenburg	0	0	3	0	<b>3</b>
New River/Cave Creek	0	1	4	0	<b>5</b>
Phoenix North	0	1	3	0	<b>4</b>
Phoenix South	0	0	2	0	<b>2</b>
Scottsdale North	0	1	3	0	<b>4</b>
Scottsdale South	0	0	2	0	<b>2</b>
East Valley	0	1	4	0	<b>5</b>
Southeast Valley	0	0	3	0	<b>3</b>
Lower Salt River Lakes	0	0	2	0	<b>2</b>
Superstition	0	0	3	0	<b>3</b>
<b>All Zones</b>	<b>0</b>	<b>8</b>	<b>46</b>	<b>0</b>	<b>54</b>

Of the fifty-four Messages issued, thirty-six were Message-1 Alerts, seventeen were Message-2 Flash Flood Watches, one was Message-3 Flash Flood Warnings, and zero Message-4 Cancel. Table 2, below, shows the monthly break down by forecast zone of Lake Alerts issued including season totals. Only seventeen Lake Alert statements were issued for the County Lakes Program including Lake Pleasant, Bartlett Lake, Saguaro Lake, Canyon Lake, and Apache Lake. The Alert Operation Center (AOC) was not activated during this monsoon season as none of the rain events ended up posing any serious threat to county/city dams or District flood control facilities.

<b>TABLE 2: MSP Lake Alerts Issued - 2020 Monsoon Season</b>					
<b>Recreational Zone</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>Total</b>
Lake Pleasant	0	0	1	0	<b>1</b>
Horseshoe Lake	0	0	0	0	<b>0</b>
Bartlett Lake	0	1	3	0	<b>4</b>
Saguaro Lake	0	1	3	0	<b>4</b>
Canyon Lake	0	2	3	0	<b>5</b>
Apache Lake	0	2	1	0	<b>3</b>
<b>All Zones</b>	<b>0</b>	<b>6</b>	<b>11</b>	<b>0</b>	<b>17</b>

## MSP VERIFICATION METRICS AND CRITERIA

Several key verification metrics and a clear set of operational based criteria were adopted in order to conduct a thorough and complete verification of MSP products issued during the 2020 monsoon season. This chapter is broken down into five sections: Outlooks, Messages, Lake Alerts, and Storm Total Precipitation. Each section discusses the verification metrics used and the criteria followed to compute the statistics displayed in the summary chapter sections. A list of frequently used terms including definitions and acronyms as used throughout this report is listed below.

Observed Rainfall: the amounts of total rainfall gathered from either ALERT rain gages, gage corrected radar estimations, or local storm reports (LSRs).

Operationally Significant Event (OSE): a rain event within a MSP forecast zone with observed rainfall equal or greater than 0.50”.

Hit: considered a correct forecast.

Miss: considered an incorrect forecast.

Correct Negative: considered a correct forecast ex. no rain forecast and no rain observed.

Forecast Accuracy: a measure of the ability to correctly forecast daily rainfall potential. Given in percent and calculated using Equation 1 below:

$$(1) \text{ Forecast Accuracy} = \left( \frac{\text{Correct Forecasts}}{\text{Total Forecasts}} \right) \times 100$$

Probability of Detection (POD): a measure of the ability to correctly discriminate heavy rain days (OSEs) from non-rain/minor rain days. Given in percent and calculated using Equation 2 below:

$$(2) \text{ POD} = \left( \frac{\text{OSEs Correctly Detected}}{\text{Total OSEs}} \right) \times 100$$

False Alarm: occurs when an OSE is forecast for a location but does not occur.

False Alarm Rate: measures the number of false alarms compared to forecast days i.e. over-forecasting. Given in percent and calculated using the Equation 3 below:

$$(3) \text{ FAR} = \left( \frac{\text{False Alarms}}{\text{Total Forecasts}} \right) \times 100$$

Threat Score: measures the fraction of observed and/or forecast events that were correctly predicted. TS can be thought of as forecast accuracy when correct negatives have been removed from consideration. Given in percent and calculated using Equation 4 below.

$$(4) \quad TS = \left( \frac{Hits}{Hits + Misses + False\ Alarms} \right) \times 100$$

Percent Error: a measure of relative error given in percent. Calculated using Equation 4 below:

$$(5) \quad \% \text{ Error} = \left( \frac{Forecast - Observed}{Observed} \right) \times 100$$

Quantitative Precipitation Forecast (QPF): forecast zone or basin specific rainfall forecast including a rainfall amount given in inches and/or intensity.

in percent, that rainfall that could occur within a forecast zone or basin, usually given in conjunction with a QPF.

Gage Adjusted Quantitative Precipitation Estimate (GAQPE): radar estimated rainfall total, product provided by WDT Inc.

Lead Time: the amount of time between when the forecast statement was issued/valid and the onset of the event (observable).

Qualifying Event: an issued statement/QPF that counts in the verification process.

*The following five sections explain the development of verification statistics as tabulated in Appendix A-E.*

## OUTLOOKS:

### Forecast Accuracy:

Either a hit or a miss was selected for each day. A hit was assigned when observed rainfall met or exceeded the QPF. A miss was assigned when rainfall was observed and no QPF was made or if observed rainfall failed to reasonably meet the QPF. In some cases a hit was assigned when the QPF was not reasonably met by observed rainfall. In these cases the probability of occurrence was 30% or less and the QPF was below the OSE threshold. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month.

### Probability of Detection:

A dash was assigned to all days when observed rainfall was below the OSE threshold. On days when observed rainfall met or exceeded the OSE threshold either a hit or a miss was assigned. A hit was selected when the observed rainfall reasonably met the QPF. A miss was assigned when observed rainfall greatly exceeded the QPF or if no QPF was issued. Values were then populated for each forecast zone and all zones combined. A probability of detection was calculated by month and season total.



False Alarm Rate:

False alarms were denoted by an “x”. A false alarm was assigned on days where the observed rainfall failed to meet the OSE threshold, yet the QPF called for an OSE with a high probability of occurrence. The two relationships below outline the above criteria.

*Probability  $\geq 40\%$  and QPF  $\geq 0.50$ ” **AND** Observed Rain  $< 0.50$ ”*

*Probability = 30% and QPF  $\geq 1.00$ ” **AND** Observed Rain  $< 0.50$ ”*

Values were then populated for each forecast zone and all zones combined. False alarm rate was then calculated by month and season total.

Threat Score:

Similar to Forecast Accuracy, a Threat Score or Critical Success Index was calculated. Threat score is only concerned with forecasts that count (days with observable rain) and assumes correct negatives are not important. Values were populated for each forecast zone and all zones combined for the length of the season.

*Tables containing all of the raw data used in generating the verification metrics discussed above for the MSP daily Outlooks can be found in [Appendix A](#).*

**MESSAGES:**Forecast Accuracy:

A hit was assigned if a rain, stream, or dam alarm was triggered during the valid period of the issued Message and/or if observed rainfall reasonably met the QPF during the valid period. Conversely a miss was assigned if neither of these two criteria were met. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month and season total.

Lead Time:

Lead time was calculated for each issued Message when possible. Time was measured from Message issuance to the first ALERT alarm triggered (rain, stream, or impoundment).

*Tables containing all of the raw data used in generating the verification metrics discussed above for the MSP Messages can be found in [Appendix B](#).*

**LAKE ALERTS:**Forecast Accuracy:

A hit was assigned if any of the following observations occurred during the valid period of the issued Lake Alert: lightning within the recreational area boundary, wind  $> 30$ mph, or hail/heavy rain. Conversely a miss was assigned if none of these three criteria were observed. Values were then populated for each recreational zone and all zones combined. Forecast accuracy was then calculated by month and season total.

**Lead Time:**

Lead time was calculated for each issued Lake Alert when possible. Time was measured from the Lake Alert issuance to the first observation (lightning within the recreational area boundary, wind > 30mph, or hail/heavy rain).

*Tables containing all of the raw data used in generating the verification metrics discussed above for the MSP Lake Alerts can be found in [Appendix C](#).*

**STORM TOTAL PRECIPITATION:****Forecast Accuracy:**

Only message statements where a QPF storm total precipitation amount was provided were evaluated. Observational data used for this verification included Maricopa County ALERT rain gages, local storm reports, and/or radar GAQPE. Either a hit or a miss was selected for each qualifying event. A hit was assigned if the percent error was less than or equal to 20%. Conversely a miss was assigned if the percent error was greater than 20%. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month and season.

*Tables containing all of the raw data used in generating the verification metrics discussed above for the MSP Messages can be found in [Appendix E](#).*

## OUTLOOK VERIFICATION

Table 3, below, shows the Outlook verification seasonal totals for each Forecast Zone (FZ). Complete data tables for each FZ, separated by month, can be viewed in [Appendix A](#): Table A-1. Overall, Outlook forecast accuracy during the length of the monsoon season for all FZs combined was excellent at 92.4%. Forecast accuracy remained above the 90% threshold for each FZ. A later start to the monsoon onset and subsequent dry July, August, and September largely assisted in the overall forecast accuracy for each of the FZs.

<b>TABLE 3: MSP Weather Outlook Verification - SEASON TOTALS, 2020</b>							
<b>Forecast Zone</b>	<b>Accurate Forecasts</b>	<b>AOF (%)</b>	<b>Sig. Events Detected</b>	<b>POD (%)</b>	<b>False Alarms</b>	<b>FAR (%)</b>	<b>TS (%)</b>
Gila Bend	99/108	91.7%	5/7	71.4%	1/108	0.9%	78.7%
Gila River	100/108	92.6%	3/6	50%	0/108	n/a	82.6%
Palo Verde	103/108	95.4%	2/5	40%	1/108	0.9%	87.2%
Rainbow Valley	103/108	95.4%	2/5	40%	0/108	n/a	89.1%
West Valley	101/108	93.5%	3/6	50%	0/108	n/a	84.8%
Northwest Valley	102/108	94.4%	3/6	50%	0/108	n/a	87%
Upper Centennial	99/108	91.7%	2/4	50%	0/108	n/a	80.4%
Wickenburg	99/108	91.7%	1/2	50%	0/108	n/a	80.4%
New River/Cave Creek	102/108	94.4%	8/8	100%	0/108	n/a	87%
Phoenix North	103/108	95.4%	4/4	100%	0/108	n/a	89.1%
Phoenix South	106/108	98.2%	3/4	75%	0/108	n/a	95.7%
Scottsdale North	100/108	92.6%	4/5	80%	0/108	n/a	82.6%
Scottsdale South	102/108	94.4%	1/2	50%	1/108	0.9%	85.1%
East Valley	100/108	92.6%	3/4	75%	0/108	n/a	82.6%
Southeast Valley	101/108	93.5%	2/4	50%	0/108	n/a	84.8%
Lower Salt River Lakes	98/108	90.7%	6/8	75%	2/108	1.8%	75%
Superstition	100/108	92.6%	5/5	100%	2/108	1.8%	79.2%
<b>All Zones</b>	<b>1718/1836</b>	<b>92.4%</b>	<b>57/85</b>	<b>67.1%</b>	<b>7/1836</b>	<b>0.4%</b>	<b>84.2%</b>

The next metric computed was probability of detection. This metric was quite important because it distinguished how well MSP forecasters detected operationally significant events. Operationally significant events were defined as having 0.50" of rainfall or more. The POD during the length of the monsoon season for all FZs combined was 67.1%. In general, a POD of over 50% is considered sufficient and over 75% excellent in the forecast community. Only eight out of the seventeen FZs were above the 50% accuracy threshold with seven meeting or exceeding the 75% accuracy threshold. It's important to remember that there were only eight-five total operationally significant events this summer. The average over the last nine years is 189, which makes this by far the lowest number seen and smallest sample size. The next metric included in Table 3 was False Alarm Rate (FAR). It is important to keep track of how often MSP forecasters predicted an operationally significant day that did not occur. Too many

false alarms can degrade user confidence in the forecasts. In general a FAR below 50% is sufficient and below 25% is considered excellent within the forecast community. The overall FAR for all zones during the length of the monsoon season was exceptionally low at 0.4% with none of the forecast zones exceeding 2%. Similar to last year, a large part of the low FARs throughout the zones had to do with a much slower and drier monsoon as there were many fewer potential rain days.

The final metric included in Table 2 was Threat Score (TS). The monsoon season officially runs from June 15<sup>th</sup> through September 30<sup>th</sup> of each year, yet the operational season (active weather days) tends to be much shorter beginning sometime in early July and finishing by mid-September. TS is thought to serve as a better metric for overall forecast skill as it removes correct negatives that are not important when computing forecast accuracy i.e. dry days before and after the active monsoon season. This year sixty-two dry days were removed from 108 day total length of the monsoon season. Overall, forecast skill was quite good at 84.2% for all FZs over the length of the active season. All seventeen FZs met or exceeded the 75% accuracy threshold.



## MESSAGE VERIFICATION

The MSP messages carry a higher priority threat-wise than the daily outlooks. These statements (Alerts, Watches, and Warnings) serve as the most critical products issued by the MSP during the monsoon season to our clients. A high level of accuracy is required when forecasting these types of events as the information they provide is directly applicable to the potential or imminent flooding situation. All of the messages issued fall under the category of operationally significant events.

Table 4, on the next page, shows the issued message verification broken down by FZ and month. Complete data tables for each FZ can be viewed in [Appendix B](#): Tables B-1, B-2, and B-3. There were fifty-four qualifying messages (updates and M-4s not included) issued over the length of the season. Forecast accuracy for all FZs combined, over the length of the season, was exceptional at 92.3%. Fifteen out of seventeen FZs met or exceeded the 75% accuracy threshold with the remaining two coming in right at the 50% threshold.

On average, 123 qualifying message statements are issued during the length of the monsoon (based on MSP Verification Reports since 2012). There were significantly fewer number of operationally significant days (nine) and as a result there were only fifty-four messages issued. None of the seventeen FZs had more than five messages issued and six zones only had two issued including the two FZs that had forecast accuracy at the 50% threshold.

For the second straight year, no messages were issued in the month of June. The majority of July was very dry and as a result the first messages of the season were issued on the afternoon of July 23<sup>rd</sup> for portions of the West Valley, including the only M-3. Only five more messages were issued in July and they fell on July 24<sup>th</sup> across the East Valley. All eight messages for the month verified.

August started off where July ended with very quiet conditions through the first two full weeks of the month. Activity began to pick up on the 16<sup>th</sup> and 17<sup>th</sup> with the first three messages issued for the month. August 20<sup>th</sup> was the busiest day for the Central Valley including Phoenix Metro with storms bringing heavy rainfall to these areas. Eight messages were issued on the day, all of which verified. Quiet conditions returned for the next week before the most active two-day stretch of the season on the 29<sup>th</sup> and 30<sup>th</sup>. Thirty-two messages were issued during that two day stretch including the only Flash Flood Watch (M-2s) of the season. Nearly every portion of the County picked up significant rains except for south Scottsdale and Phoenix FZs. These were also the only two false alarms (misses) during the event. No further messages were issued as the entire month of September remained very dry.

Lead time was the final metric included for message statement verification this year. The average lead time (data in [Appendix B](#), Table B-3) for all M-1 Alerts combined over the length of the monsoon season was fifty-two minutes. The average lead time for M-2 Flash Flood Watches was twenty-two hours.

**TABLE 4: MSP Issued Statements Verification, broken down by month and Forecast Zone - Monsoon Season 2020**

	June		July		August		September		Season Totals	
Forecast Zone	Correct Statements	AOF (%)	Correct Statements	AOF (%)	Correct Statements	AOF (%)	Correct Statements	AOF (%)	Correct Statements	AOF (%)
Gila Bend	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
Gila River	0/0	n/a	1/1	100%	3/3	100%	0/0	n/a	4/4	100%
Palo Verde	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
Rainbow Valley	0/0	n/a	1/1	100%	2/2	100%	0/0	n/a	3/3	100%
West Valley	0/0	n/a	2/2	100%	3/3	100%	0/0	n/a	5/5	100%
Northwest Valley	0/0	n/a	0/0	n/a	3/3	100%	0/0	n/a	3/3	100%
Upper Centennial	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
Wickenburg	0/0	n/a	0/0	n/a	3/3	100%	0/0	n/a	3/3	100%
New River/Cave Creek	0/0	n/a	1/1	100%	3/4	75%	0/0	n/a	4/5	80%
Phoenix North	0/0	n/a	1/1	100%	3/3	100%	0/0	n/a	4/4	100%
Phoenix South	0/0	n/a	0/0	n/a	1/2	50%	0/0	n/a	1/2	50%
Scottsdale North	0/0	n/a	1/1	100%	3/3	100%	0/0	n/a	4/4	100%
Scottsdale South	0/0	n/a	0/0	n/a	1/2	50%	0/0	n/a	1/2	50%
East Valley	0/0	n/a	1/1	100%	3/4	75%	0/0	n/a	4/5	80%
Southeast Valley	0/0	n/a	0/0	n/a	3/3	100%	0/0	n/a	3/3	100%
Lower Salt River Lakes	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
Superstition	0/0	n/a	0/0	n/a	3/3	100%	0/0	n/a	3/3	100%
<b>All Zones</b>	<b>0/0</b>	<b>n/a</b>	<b>8/8</b>	<b>100%</b>	<b>42/46</b>	<b>91.3%</b>	<b>0/0</b>	<b>n/a</b>	<b>50/54</b>	<b>92.6%</b>

## LAKE ALERT VERIFICATION

Weather guidance is provided to Maricopa County lakes/reservoirs and the recreational zones which encompass them in the form of lake alerts. These statements are issued as needed to inform staff/personnel of approaching adverse weather conditions with an emphasis on wind gusts and lightning activity and then to a lesser degree hail/heavy rainfall. A high level of accuracy is required when forecasting these types of events as lake alerts are considered warnings to the recreational community (staff, boaters, hikers, and campers).

Table 5, below, shows the issued lake alert verification broken down by recreational zone and month. Complete data tables for each recreational zone can be viewed in [Appendix C: Table C-1](#). There were only seventeen lake alerts issued over the length of the season with the majority of them occurring in August. No statements were issued for the Horseshoe Lake recreational zone for the entire season due to a lack of water in the reservoir. Forecast accuracy for the remaining five recreational zones combined, over the length of the season, was 82.4%. Four out of the five zones met or exceeded the 75% accuracy threshold with the lowest forecast accuracy of 66.7% recorded at Apache Lake. As stated earlier, 50% accuracy is considered sufficient and 75% and above is considered excellent within the forecast community. The average lead time (not shown) for all lakes/reservoirs combined over the length of the monsoon season was just over thirteen minutes.

<b>TABLE 5: MSP Lake Alerts Issued - 2020 Monsoon Season</b>										
	<b>June</b>		<b>July</b>		<b>August</b>		<b>September</b>		<b>Season Totals</b>	
<b>Recreational Zone</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>
Lake Pleasant	0/0	n/a	0/0	n/a	1/1	100%	0/0	n/a	<b>1/1</b>	<b>100%</b>
Horseshoe Lake	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	<b>0/0</b>	<b>n/a</b>
Bartlett Lake	0/0	n/a	1/1	100%	3/3	100%	0/0	n/a	<b>4/4</b>	<b>100%</b>
Saguaro Lake	0/0	n/a	1/1	100%	2/3	66.7%	0/0	n/a	<b>3/4</b>	<b>75%</b>
Canyon Lake	0/0	n/a	1/2	50%	3/3	100%	0/0	n/a	<b>4/5</b>	<b>80%</b>
Apache Lake	0/0	n/a	1/2	50%	1/1	100%	0/0	n/a	<b>2/3</b>	<b>66.7%</b>
<b>All Zones</b>	<b>0/0</b>	<b>n/a</b>	<b>4/6</b>	<b>66.7%</b>	<b>10/11</b>	<b>90%</b>	<b>0/0</b>	<b>n/a</b>	<b>14/17</b>	<b>82.4%</b>

## QPF STORM TOTAL PRECIPITATION VERIFICATION

The MSP has placed added emphasis on including QPF information within message statements, specifically M-1 Alerts. These messages are normally issued before the onset of rain events and precede warning issuance in order to maximize lead time for affected locations. Providing STP that will likely accompany thunderstorms moving through a FZ is intended to help clients make well-informed and proactive decisions.

Figure 6, below, is a scatter plot depicting forecast versus observed storm total precipitation. An accurate forecast will have points on or near the solid black diagonal line. Two black dashed lines were also included that show the “+/-” 20 percent error thresholds used in the verification process (discussed in the [MSP Verification Metrics and Criteria](#) section). All events that fall between the upper and lower thresholds were considered hits. There were thirty-six qualifying message events that counted towards the verification of the STP forecasts and thirty-four events fell within the error threshold.

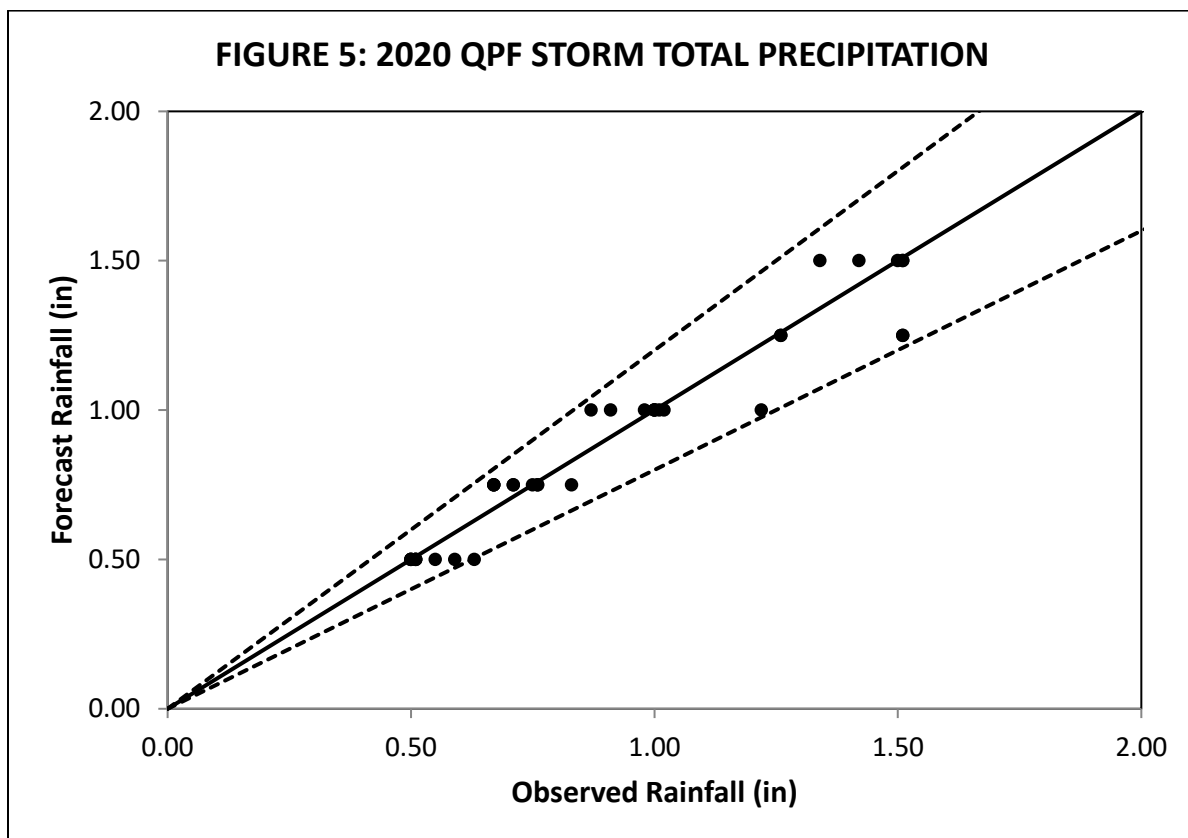


Table 7, on the next page, shows the issued message verification broken down by FZ and month. Complete data tables for each FZ can be viewed in [Appendix E: Table E-1](#). Forecast accuracy for all FZs combined, over the length of the season, was excellent at 97.2%. There were no qualifying events in June and for the first time since records of these metrics have been kept (2012) there were none in September. The only missed event came in July, though



accuracy was still quite good at 85.7%. The largest number events occurred in August with twenty- nine. All of these events verified. It's important to remember, the sample size in both July and August was very small due to meager storm activity, and therefore individual FZ metrics will not be discussed.

It is important to remember observed storm total rainfall data is typically gathered from either ALERT rain gages or provided from local storm reports. In either case, accurate measurements of peak rainfall are contingent upon a thunderstorm rain core directly passing over a gage site. In this case, gage adjusted radar rainfall estimates (e.g. GAQPE) were used to fill in the gaps that would otherwise be missed in the FZs.

**TABLE 7: QPF Storm Total Precipitation Verification - Monsoon Season 2020**

	June		July		August		September		Season Totals	
Forecast Zone	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)
Gila Bend	0/0	n/a	0/0	n/a	1/1	100%	0/0	n/a	1/1	100%
Gila River	0/0	n/a	1/1	100%	2/2	100%	0/0	n/a	3/3	100%
Palo Verde	0/0	n/a	0/0	n/a	1/1	100%	0/0	n/a	1/1	100%
Rainbow Valley	0/0	n/a	1/1	100%	1/1	100%	0/0	n/a	2/2	100%
West Valley	0/0	n/a	1/1	100%	2/2	100%	0/0	n/a	3/3	100%
NW Valley	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
Upper Centennial	0/0	n/a	0/0	n/a	1/1	100%	0/0	n/a	1/1	100%
Wickenburg	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
New River/Cave Creek	0/0	n/a	1/1	100%	3/3	100%	0/0	n/a	4/4	100%
Phoenix North	0/0	n/a	0/1	0%	2/2	100%	0/0	n/a	2/3	66.7%
Phoenix South	0/0	n/a	0/0	n/a	1/1	100%	0/0	n/a	1/1	100%
Scottsdale North	0/0	n/a	1/1	100%	2/2	100%	0/0	n/a	3/3	100%
Scottsdale South	0/0	n/a	0/0	n/a	1/1	100%	0/0	n/a	1/1	100%
East Valley	0/0	n/a	1/1	100%	3/3	100%	0/0	n/a	4/4	100%
Southeast Valley	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
Lower Salt River Lakes	0/0	n/a	0/0	n/a	1/1	100%	0/0	n/a	1/1	100%
Superstition	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
<b>All Zones</b>	<b>0/0</b>	<b>n/a</b>	<b>6/7</b>	<b>85.7%</b>	<b>29/29</b>	<b>100%</b>	<b>0/0</b>	<b>n/a</b>	<b>35/36</b>	<b>97.2%</b>

## SUMMARY

The Flood Warning Branch of the FCDMC operates a year round Meteorological Services Program (MSP) that's purpose is to provide detailed weather forecasts and support to county, city, and other local agencies encompassing Maricopa County and its contributing watersheds. In particular, during the length of the monsoon season, it is the specific the goal of the MSP to reduce response time for emergency managers by providing timely and accurate weather information, primarily regarding the potential for flood-producing rainfall. This report provides a compiled set of verification statistics based on products issued by the MSP during the length of the 2020 monsoon season. Outlooks, Messages, Lake Alerts, and QPF Storm Total Precipitation were the four products analyzed in this report.

Verification of daily outlooks was conducted using four metrics: forecast accuracy, probability of detection, false alarm rate, and threat score. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 92.4%, probability of detection was 67.1%, the false alarm rate was 0.4%, and the Threat Score was 84.2%. All metrics fell into the "excellent" category except for probability of detection, which was still considered "satisfactory" when equating these results with accepted values within the forecast community.

Verification of messages was conducted using forecast accuracy. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 92.6%. Any value of over 75% is considered "excellent" within the forecast community. Forecast skill was consistent across July and August though there was a very small sample size due to below average storm activity. The bulk of the qualifying events occurred during August (forty-six) and Forecast Accuracy was still very good at 91.3%. The average lead time for all M-1 Alerts and M-3 Flash Flood Warnings combined over the length of the Monsoon season was fifty-two minutes. The average lead time for M-2 Flash Flood Watches was just over twenty-two hours. Both lead time metrics were on par with previous years'.

Verification of lake alerts was conducted using forecast accuracy. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 82.4% spread across only seventeen events. It's worth noting again that no lake alerts were issued for Horseshoe Lake this monsoon season as the reservoir remained mostly empty through the summer months. The average lead time for all lakes/reservoirs combined over the length of the season was just over thirteen minutes, which is in-line with previous years'.

Verification of QPF storm total precipitation was conducted using forecast accuracy. Forecast accuracy was determined using computed percent error when looking at forecasts versus observational data sets. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was exceptional at 97.2%. The addition of gage corrected radar rainfall estimation and cooperative rain gage sites in the verification process has proven to be critical for FZs with greater spatial gaps between gage sites.

<b>TABLE 8: Historic Monsoon Season Verification Comparison</b>										
	<b>Outlooks</b>				<b>Messages</b>		<b>Lake Alerts</b>		<b>QPF STP</b>	
<b>Year</b>	<b>AOF</b>	<b>POD</b>	<b>FAR</b>	<b>TS</b>	<b>Events</b>	<b>AOF</b>	<b>Events</b>	<b>AOF</b>	<b>Events</b>	<b>AOF</b>
2012	79.1%	79.6%	8.9%	n/a	102	86.3%	n/a	n/a	n/a	n/a
2013	79.8%	78.7%	6.2%	n/a	137	88.0%	56	89.3%	54	72.2%
2014	77.7%	76.9%	7.1%	67.4%	263	80.2%	57	84.2%	76	72.4%
2015	74.8%	60.3%	2.8%	67.9%	118	75.4%	40	95%	56	82.1%
2016	84.9%	78%	2.6%	77.5%	112	90.2%	46	82.6%	53	88.7%
2017	83.1%	77.9%	1.8%	72.4%	111	86.5%	53	90.6%	67	93.1%
2018	86.1%	82.2%	1.6%	75.6%	129	89.9%	41	82.9%	110	84.5%
2019	90.1%	72.9%	0.7%	80.9%	78	92.3%	18	83.3%	46	80.4%
2020	92.4%	67.1%	0.4%	84.2%	54	92.6%	17	82.4%	36	97.2%

Table 8, above, was included to add more historical perspective in the verification process. Verification metrics for Outlooks, Messages, Lake Alerts, and QPF STP were included for all previous years. Most Outlook forecast metrics improved in 2020 when compared to 2019. Of note forecast accuracy, false alarm rate, and threat score were the best of any of the previous seasons sampled.

Forecast skill for issued messages improved from the 2019 season and was the highest forecast skill for issued messages since we've been keeping records. However, the number of issued messages was significantly lower than any other season, including 2019, due to limited storm activity. Forecast accuracy for Lake Alerts worsened slightly from 2019 and also came in below the seasonal average of 86.3%. Similar to message events, lake alert events were significantly reduced due to the quiet monsoon. The smaller sample size in each instance could have affected forecast skill, especially when looking at the 2020 and 2019 seasons versus more active years. STP skill came in well above the long term average and was the highest recorded. Similar to other metrics, STP saw the fewest number of qualifying events this summer.

When all was said and done, the 2020 monsoon season was well below normal in terms of rainfall. It also surpassed the 2019 season with the record fewest number of products issued by the MSP. It is hoped that this report serves as quantifiable tool used to evaluate forecast performance on a year to year basis. This report will be continued in subsequent years focusing not only the present year's statistical data, but will also serve as a historical comparison to measure future year's performance.

## APPENDIX A: MSP OUTLOOKS - VERIFICATION TABLES

**TABLE A-1:** This table shows the raw verification data of MSP issued precipitation forecasts contained in the daily Outlooks for the 2020 monsoon season. The valid period for rainfall each day is from 2PM same day through 12PM the following day. The table is broken down by date and MSP Forecast Zone. For brevity two Forecast Zones are included for each day. The columns from left to right are defined as follows:

**Prob.** – Percent probability of measureable rain within the Forecast Zone from 0% to 100% over the period.

**QPF** – Total forecast rainfall in inches within the Forecast Zone over the period.

**ALERT** – Peak total observed ALERT gage rainfall value in inches within the Forecast Zone over the period.

**GAQPE** – Radar rainfall estimate (see [Verification Metrics and Criteria](#) section for more details).

**AOF** – Forecast accuracy, assigned an “h” for a hit and “m” for a miss.

**POD** – Probability of detection, assigned an “h” for a hit, “m” for a miss, or “-” for non-significant rainfall.

**FA** – False alarms, assigned an “x”.

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
	Gila Bend							Gila River						
06/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
06/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>16 days</b>					<b>16</b>	<b>0</b>	<b>0</b>					<b>16</b>	<b>0</b>	<b>0</b>
07/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/17/20	0	0.00	0.00	1.26-1.50	m	m	-	0	0.00	0.00	0.00	h	-	-
07/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/21/20	0	0.00	0.00	0.51-0.75	h	-	-	0	0.00	0.00	0.00	h	-	-
07/22/20	30	0.50	0.04	2.01-2.50	m	h	-	10	0.10	0.00	1.10-1.25	m	m	-
07/23/20	40	0.75	0.00	0.11-0.25	m	-	x	20	0.25	0.00	0.00	m	-	-
07/24/20	20	0.50	0.00	0.11-0.25	h	-	-	20	0.50	0.24	1.01-1.25	m	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/20	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					28	1/2	1					28	1/2	0
08/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/20	20	0.50	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
08/13/20	20	0.50	0.00	0.76-1.00	h	h	-	0	0.00	0.00	0.00	h	-	-
08/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/20	10	0.10	0.00	0.26-0.50	m	-	-	10	0.10	0.00	0.00	h	-	-
08/17/20	20	0.25	0.00	0.26-0.50	h	-	-	10	0.10	0.00	0.26-0.50	m	-	-
08/18/20	20	0.25	0.00	0.00	m	-	-	10	0.10	0.00	0.26-0.50	m	-	-
08/19/20	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	1.26-1.50	m	m	-
08/20/20	20	0.25	0.00	0.76-1.00	m	m	-	10	0.25	0.04	1.26-1.50	m	m	-
08/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-



TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/20	30	0.75	0.00	0.51-0.75	h	h	-	10	0.10	0.00	0.00	h	-	-
08/25/20	20	0.50	0.00	0.00	m	-	-	10	0.15	0.00	0.00	h	-	-
08/26/20	20	0.35	0.00	0.00	m	-	-	10	0.10	0.00	0.00	h	-	-
08/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/20	60	1.50	0.08	0.51-0.75	h	h	-	60	1.00	0.28	0.76-1.00	h	h	-
08/30/20	40	0.75	0.28	0.76-1.00	h	h	-	30	1.00	0.00	0.76-1.00	h	h	-
08/31/20	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					25	4/5	0					27	2/4	0
09/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.04	0.26-0.50	m	-	-
09/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/20	10	0.10	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					30	0	0					29	0	0
	Palo Verde							Rainbow Valley						
06/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
06/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16	0	0					16	0	0
07/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/22/20	10	0.10	0.04	0.51-0.75	m	m	-	10	0.10	0.28	0.76-1.00	m	m	-
07/23/20	20	0.50	0.20	0.26-0.50	h	h	-	20	0.25	0.28	1.50-2.00	m	m	-
07/24/20	20	0.50	0.00	0.00	m	-	-	20	0.50	0.00	0.11-0.25	h	-	-
07/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/27/20	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					29	1/2	0					29	0/2	0
08/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/20	0	0.00	0.31	0.76-1.00	m	m	-	10	0.25	0.12	0.01-0.10	h	-	-
08/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/20	10	0.10	0.00	0.11-0.25	h	-	-	10	0.10	0.00	0.26-0.50	m	-	-
08/17/20	10	0.10	0.00	0.05-0.10	h	-	-	10	0.25	0.00	0.11-0.25	h	-	-
08/18/20	10	0.25	0.00	0.11-0.25	h	-	-	10	0.10	0.04	0.11-0.25	h	-	-
08/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/20	10	0.10	0.00	0.1-0.10	h	-	-	10	0.10	0.00	1.51-2.00	m	m	-
08/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/24/20	10	0.25	0.20	1.01-1.25	m	m	-	10	0.10	0.00	0.01-0.10	h	-	-
08/25/20	20	0.35	0.16	0.11-0.25	h	-	-	10	0.25	0.00	0.00	h	-	-
08/26/20	10	0.25	0.00	0.11-0.25	h	-	-	10	0.15	0.00	0.00	h	-	-
08/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.24	0.11-0.25	m	-	-
08/29/20	40	0.50	0.00	0.00	m	-	x	40	1.50	0.63	1.51-2.00	h	h	-
08/30/20	30	1.00	1.02	1.26-1.50	h	h	-	40	0.50	0.16	0.51-0.75	h	h	-
08/31/20	10	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					28	1/3	1					28	2/3	0
09/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					30	0	0					30	0	0
	West Valley							Northwest Valley						
06/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-



TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
16 days					16	0	0					16	0	0
07/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/22/20	10	0.10	0.20	0.51-0.75	m	m	-	20	0.25	0.39	0.51-0.75	h	-	-
07/23/20	20	0.25	0.75	1.50-2.00	m	m	-	20	0.50	0.12	0.11-0.25	h	-	-
07/24/20	20	0.50	0.00	0.26-0.50	h	h	-	30	0.75	0.00	0.11-0.25	m	m	-
07/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					29	1/3	0					30	0/1	0
08/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/20	0	0.00	0.12	0.11-0.25	m	-	-	0	0.00	0.00	0.00	h	-	-
08/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/20	10	0.10	0.12	0.26-0.50	h	-	-	20	0.25	0.55	0.51-0.75	m	m	-
08/17/20	20	0.10	0.04	0.11-0.25	h	-	-	20	0.25	0.00	0.11-0.25	h	-	-
08/18/20	20	0.10	0.04	0.11-0.25	h	-	-	20	0.25	0.00	0.01-0.10	m	-	-
08/19/20	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/20/20	10	0.25	0.51	0.51-0.75	m	m	-	20	0.50	0.24	0.51-0.75	h	h	-
08/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/20	20	0.10	0.00	0.00	m	-	-	20	0.25	0.00	0.00	m	-	-
08/25/20	20	0.25	0.00	0.00	m	-	-	20	0.25	0.04	0.26-0.50	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/26/20	10	0.15	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/20	0	0.00	0.24	0.26-0.50	m	-	-	0	0.00	0.04	0.51-0.75	m	m	-
08/29/20	40	0.50	0.16	0.26-0.50	h	h	-	40	0.75	0.59	0.76-1.00	h	h	-
08/30/20	30	1.00	0.98	1.51-2.00	h	h	-	30	1.00	1.50	1.51-2.00	h	h	-
08/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					26	2/3	0					26	3/5	0
09/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/20	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
09/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					30	0	0					30	0	0
	Upper Centennial							Wickenburg						
06/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16	0	0					16	0	0
07/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/22/20	30	0.25	0.00	0.11-0.25	h	-	-	30	0.25	0.12	0.11-0.25	h	-	-
07/23/20	30	0.50	0.08	2.51-3.00	m	h	-	30	0.50	0.00	0.00	m	-	-
07/24/20	30	0.75	0.00	0.00	m	-	-	30	0.75	0.00	0.00	m	-	-
07/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					29	1/1	0					29	0	0
08/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/20	20	0.25	0.00	0.76-1.00	m	m	-	20	0.40	0.00	0.00	m	-	-
08/17/20	20	0.25	0.00	0.11-0.25	h	-	-	20	0.25	0.00	0.11-0.25	h	-	-
08/18/20	20	0.25	0.00	0.01-0.10	m	-	-	20	0.25	0.00	0.01-0.10	m	-	-
08/19/20	20	0.30	0.00	0.00	m	-	-	20	0.30	0.00	0.00	m	-	-
08/20/20	20	0.50	0.00	0.00	m	-	-	20	0.50	0.00	0.01-0.10	m	-	-
08/21/20	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/20	0	0.00	0.00	0.00	h	-	-	10	0.75	0.00	0.00	h	-	-
08/24/20	20	0.25	0.00	0.26-0.50	h	-	-	20	0.25	0.00	0.00	m	-	-
08/25/20	20	0.25	0.00	0.00	m	-	-	20	0.25	0.04	0.26-0.50	h	-	-
08/26/20	10	0.25	0.00	0.11-0.25	h	-	-	20	0.25	0.75	0.76-1.00	m	m	-
08/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-



TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/28/20	0	0.00	0.04	0.76-1.00	m	m	-	0	0.00	0.08	0.26-0.50	m	-	-
08/29/20	30	0.50	0.00	0.01-0.10	m	-	-	30	0.50	0.39	0.11-0.25	h	-	-
08/30/20	20	1.00	0.59	1.51-2.00	h	h	-	20	1.00	1.10	1.26-1.50	h	h	-
08/31/20	10	0.50	0.00	0.00	h	-	-	10	0.25	0.00	0.01-0.10	h	-	-
31 days					24	1/3	0					24	1/2	0
09/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/20	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
09/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					30	0	0					30	0	0
	New River/Cave Creek							Phoenix North						
06/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16	0	0					16	0	0
07/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/22/20	30	0.50	0.08	0.26-0.50	h	h	-	20	0.25	0.00	0.01-0.10	h	-	-
07/23/20	40	0.75	0.04	0.26-0.50	h	h	-	20	0.25	0.00	0.01-0.10	h	-	-
07/24/20	40	1.25	1.46	2.01-2.50	h	h	-	30	0.75	0.63	0.76-1.00	h	h	-
07/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/20	30	0.75	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
07/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					30	3/3	0					30	1/1	0

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/20	30	0.60	0.35	0.26-0.50	h	-	-	20	0.40	0.00	0.01-0.10	m	-	-
08/17/20	30	0.50	0.00	0.11-0.25	h	-	-	20	0.25	0.00	0.05-0.10	h	-	-
08/18/20	30	0.50	0.20	0.26-0.50	h	h	-	20	0.25	0.08	0.01-0.10	h	-	-
08/19/20	20	0.50	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
08/20/20	30	0.75	1.38	1.01-1.25	h	h	-	20	0.50	0.91	1.26-1.50	h	h	-
08/21/20	10	0.25	0.04	0.11-0.25	h	-	-	10	0.20	0.00	0.00	h	-	-
08/22/20	0	0.00	0.24	0.26-0.50	m	-	-	0	0.00	0.00	0.00	h	-	-
08/23/20	20	1.00	0.00	0.00	m	-	-	10	0.75	0.00	0.00	h	-	-
08/24/20	20	0.50	0.00	0.00	m	-	-	20	0.35	0.00	0.00	m	-	-
08/25/20	20	0.50	0.39	0.76-1.00	h	h	-	20	0.25	0.04	0.00	m	-	-
08/26/20	20	0.50	0.00	0.11-0.25	h	-	-	20	0.25	0.00	0.00	m	-	-
08/27/20	10	0.50	0.04	0.11-0.25	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/20	0	0.00	0.04	0.01-0.10	m	-	-	0	0.00	0.00	0.00	h	-	-
08/29/20	50	1.00	0.28	0.51-0.75	h	h	-	50	1.00	0.75	0.76-1.00	h	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/30/20	40	1.50	1.54	1.51-2.00	h	h	-	40	1.00	0.98	1.01-1.25	h	h	-
08/31/20	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					26	5/5	0					27	3/3	0
09/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/20	10	0.10	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					30	0	0					30	0	0
	Phoenix South							Scottsdale North						
06/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16	0	0					16	0	0
07/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-



TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/22/20	10	0.10	0.08	0.01-0.10	h	-	-	20	0.25	0.16	0.26-0.50	h	-	-
07/23/20	20	0.25	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
07/24/20	30	0.50	0.24	0.76-1.00	h	h	-	40	1.00	0.67	0.76-1.00	h	h	-
07/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/20	10	0.25	0.00	0.00	h	-	-	30	0.50	0.00	0.00	m	-	-
07/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>31 days</b>					<b>30</b>	<b>1/1</b>	<b>0</b>					<b>29</b>	<b>1/1</b>	<b>0</b>
08/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/20	10	0.10	0.00	0.00	h	-	-	20	0.40	0.00	0.01-0.10	m	-	-
08/17/20	10	0.10	0.00	0.11-0.25	h	-	-	20	0.25	0.00	0.11-0.25	h	-	-
08/18/20	10	0.10	0.16	0.11-0.25	h	-	-	20	0.25	0.16	0.11-0.25	h	-	-
08/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.08	0.26-0.50	m	-	-
08/20/20	20	0.25	0.98	1.01-1.25	m	m	-	30	0.50	0.59	0.51-0.75	h	h	-
08/21/20	0	0.00	0.00	0.00	h	-	-	10	0.20	0.00	0.00	h	-	-
08/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.51	0.76-1.00	m	m	-
08/23/20	0	0.00	0.00	0.00	h	-	-	10	0.75	0.00	0.00	h	-	-
08/24/20	10	0.25	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/25/20	10	0.15	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/26/20	10	0.10	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/27/20	0	0.00	0.00	0.00	h	-	-	10	0.25	0.04	0.11-0.26	h	-	-
08/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/20	50	0.75	0.04	0.26-0.50	h	h	-	50	1.00	0.31	0.26-0.50	h	h	-
08/30/20	30	0.50	0.20	0.26-0.50	h	h	-	40	1.00	0.83	0.76-1.01	h	h	-
08/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
31 days					30	2/3	0					25	3/4	0
09/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					30	0	0					30	0	0
	Scottsdale South							East Valley						
06/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16	0	0					16	0	0
07/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/22/20	10	0.10	0.08	0.11-0.25	h	-	-	20	0.25	0.08	0.11-0.25	h	-	-
07/23/20	20	0.25	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
07/24/20	30	0.75	0.63	0.76-1.00	h	h	-	30	0.75	1.26	0.76-1.00	h	h	-
07/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/20	20	0.25	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
07/28/20	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>31 days</b>					<b>29</b>	<b>1/1</b>	<b>0</b>					<b>29</b>	<b>1/1</b>	<b>0</b>
08/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/20	10	0.10	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/17/20	10	0.10	0.00	0.11-0.25	h	-	-	20	0.25	0.39	0.26-0.50	h	-	-
08/18/20	10	0.10	0.00	0.00	h	-	-	20	0.25	0.00	0.11-0.25	h	-	-
08/19/20	0	0.00	0.08	0.26-0.50	m	-	-	0	0.00	0.51	0.76-1.00	m	m	-
08/20/20	20	0.25	0.71	0.76-1.00	m	m	-	20	0.50	0.83	0.76-1.00	h	h	-
08/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/20	10	0.25	0.00	0.00	h	-	-	20	0.35	0.00	0.11-0.25	h	-	-
08/25/20	10	0.15	0.04	0.00	h	-	-	20	0.25	0.04	0.00	m	-	-
08/26/20	10	0.10	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/20	50	0.75	0.00	0.01-0.11	m	-	x	60	1.00	0.71	0.51-0.75	h	h	-
08/30/20	30	0.50	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
08/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					27	0/1	1					26	2/3	0
09/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.12	0.26-0.50	m	-	-
09/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
30 days					30	0	0					29	0	0
	Southeast Valley							Lower Salt River Lakes						
06/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16	0	0					16	0	0
07/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-



TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/22/20	10	0.10	0.00	0.00	h	-	-	30	0.50	0.20	0.76-1.00	h	h	-
07/23/20	20	0.25	0.00	0.00	m	-	-	40	0.75	0.00	0.00	m	-	x
07/24/20	20	0.50	0.43	0.76-1.00	h	h	-	40	1.25	0.12	3.01-4.00	h	h	-
07/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/20	20	0.25	0.00	0.00	m	-	-	30	0.75	0.00	0.51-0.75	h	h	-
07/28/20	10	0.25	0.00	0.00	h	-	-	30	0.50	0.00	0.11-0.25	h	-	-
07/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>31 days</b>					<b>29</b>	<b>1/1</b>	<b>0</b>					<b>30</b>	<b>3/3</b>	<b>1</b>
08/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/20	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/20	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/13/20	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/14/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/20	10	0.25	0.00	0.00	h	-	-	30	0.60	0.00	0.26-0.50	h	-	-
08/17/20	10	0.25	0.00	0.26-0.50	h	-	-	30	0.50	0.51	0.76-1.00	h	h	-
08/18/20	10	0.25	0.00	0.26-0.50	h	-	-	30	0.50	0.00	0.01-0.10	m	-	-
08/19/20	0	0.00	0.51	0.76-1.00	m	m	-	20	0.30	0.00	0.00	m	-	-
08/20/20	20	0.25	0.59	0.76-1.00	m	m	-	30	0.75	0.00	0.00	m	-	-
08/21/20	0	0.00	0.00	0.00	h	-	-	10	0.33	0.00	0.11-0.25	h	-	-
08/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.76-1.00	m	m	-
08/23/20	10	0.75	0.00	0.00	h	-	-	20	1.00	0.00	0.00	m	-	-
08/24/20	20	0.35	0.00	0.11-0.25	h	-	-	30	0.50	0.00	0.26-0.50	h	h	-
08/25/20	20	0.15	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
08/26/20	10	0.10	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
08/27/20	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.01-0.10	h	-	-
08/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/20	60	1.50	0.67	0.76-1.00	h	h	-	60	1.50	1.34	0.26-0.50	h	h	-
08/30/20	30	0.50	0.00	0.00	m	-	-	40	0.75	0.00	0.00	m	-	x
08/31/20	0	0.00	0.00	0.00	h	-	-	0	0.00	1.26	1.01-1.25	m	m	-
31 days					27	1/3	0					22	3/5	1
09/01/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/04/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/20	0	0.00	0.12	0.26-0.50	m	-	-	0	0.00	0.00	0.00	h	-	-
09/09/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/20	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
09/15/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/20	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					29	0	0					30	0	0

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
	Superstition													
06/15/20	0	0.00	0.00	0.00	h	-	-							
06/16/20	0	0.00	0.00	0.00	h	-	-							
06/17/20	0	0.00	0.00	0.00	h	-	-							
06/18/20	0	0.00	0.00	0.00	h	-	-							
06/19/20	0	0.00	0.00	0.00	h	-	-							
06/20/20	0	0.00	0.00	0.00	h	-	-							
06/21/20	0	0.00	0.00	0.00	h	-	-							
06/22/20	0	0.00	0.00	0.00	h	-	-							
06/23/20	0	0.00	0.00	0.00	h	-	-							
06/24/20	0	0.00	0.00	0.00	h	-	-							
06/25/20	0	0.00	0.00	0.00	h	-	-							
06/26/20	0	0.00	0.00	0.00	h	-	-							
06/27/20	0	0.00	0.00	0.00	h	-	-							
06/28/20	0	0.00	0.00	0.00	h	-	-							
06/29/20	0	0.00	0.00	0.00	h	-	-							
06/30/20	0	0.00	0.00	0.00	h	-	-							
<b>16 days</b>					<b>16</b>	<b>0</b>	<b>0</b>							
07/01/20	0	0.00	0.00	0.00	h	-	-							
07/02/20	0	0.00	0.00	0.00	h	-	-							
07/03/20	0	0.00	0.00	0.00	h	-	-							
07/04/20	0	0.00	0.00	0.00	h	-	-							
07/05/20	0	0.00	0.00	0.00	h	-	-							
07/06/20	0	0.00	0.00	0.00	h	-	-							
07/07/20	0	0.00	0.00	0.00	h	-	-							
07/08/20	0	0.00	0.00	0.00	h	-	-							
07/09/20	0	0.00	0.00	0.00	h	-	-							
07/10/20	0	0.00	0.00	0.00	h	-	-							
07/11/20	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/12/20	0	0.00	0.00	0.00	h	-	-							
07/13/20	0	0.00	0.00	0.00	h	-	-							
07/14/20	0	0.00	0.00	0.00	h	-	-							
07/15/20	0	0.00	0.00	0.00	h	-	-							
07/16/20	0	0.00	0.00	0.00	h	-	-							
07/17/20	0	0.00	0.00	0.00	h	-	-							
07/18/20	0	0.00	0.00	0.00	h	-	-							
07/19/20	0	0.00	0.00	0.00	h	-	-							
07/20/20	0	0.00	0.00	0.00	h	-	-							
07/21/20	0	0.00	0.00	0.00	h	-	-							
07/22/20	30	0.50	0.16	0.76-1.00	h	h	-							
07/23/20	40	0.75	0.00	0.00	m	-	x							
07/24/20	40	1.25	0.35	1.26-1.50	h	h	-							
07/25/20	0	0.00	0.00	0.00	h	-	-							
07/26/20	0	0.00	0.00	0.00	h	-	-							
07/27/20	30	0.75	0.00	0.26-0.50	h	h	-							
07/28/20	20	0.50	0.00	0.76-1.00	h	h	-							
07/29/20	0	0.00	0.00	0.00	h	-	-							
07/30/20	0	0.00	0.00	0.00	h	-	-							
07/31/20	0	0.00	0.00	0.00	h	-	-							
<b>31 days</b>					<b>30</b>	<b>4/4</b>	<b>1</b>							
08/01/20	0	0.00	0.00	0.00	h	-	-							
08/02/20	0	0.00	0.00	0.00	h	-	-							
08/03/20	10	0.25	0.00	0.00	h	-	-							
08/04/20	0	0.00	0.00	0.00	h	-	-							
08/05/20	0	0.00	0.00	0.00	h	-	-							
08/06/20	0	0.00	0.00	0.00	h	-	-							
08/07/20	0	0.00	0.00	0.00	h	-	-							
08/08/20	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/09/20	0	0.00	0.00	0.00	h	-	-							
08/10/20	0	0.00	0.00	0.00	h	-	-							
08/11/20	0	0.00	0.00	0.00	h	-	-							
08/12/20	10	0.25	0.00	0.00	h	-	-							
08/13/20	10	0.25	0.00	0.00	h	-	-							
08/14/20	0	0.00	0.00	0.00	h	-	-							
08/15/20	0	0.00	0.00	0.00	h	-	-							
08/16/20	30	0.60	0.00	0.00	m	-	-							
08/17/20	30	0.50	0.43	0.26-0.50	h	h	-							
08/18/20	30	0.50	0.00	0.01-0.10	m	-	-							
08/19/20	10	0.30	0.59	0.76-1.00	h	m	-							
08/20/20	30	0.75	0.12	0.26-0.50	h	h	-							
08/21/20	10	0.25	0.00	0.00	h	-	-							
08/22/20	0	0.00	0.00	0.00	h	-	-							
08/23/20	20	1.00	0.00	0.00	m	-	-							
08/24/20	30	0.50	0.04	0.11-0.25	h	-	-							
08/25/20	30	0.35	0.00	0.00	m	-	-							
08/26/20	20	0.25	0.00	0.00	m	-	-							
08/27/20	10	0.25	0.00	0.01-0.10	m	-	-							
08/28/20	0	0.00	0.00	0.00	h	-	-							
08/29/20	60	2.00	0.31	1.51-2.00	h	h	-							
08/30/20	40	0.75	0.00	0.00	m	-	x							
08/31/20	0	0.00	0.00	0.00	h	-	-							
<b>31 days</b>					<b>24</b>	<b>1/1</b>	<b>1</b>							
09/01/20	0	0.00	0.00	0.00	h	-	-							
09/02/20	0	0.00	0.00	0.00	h	-	-							
09/03/20	0	0.00	0.00	0.00	h	-	-							
09/04/20	0	0.00	0.00	0.00	h	-	-							
09/05/20	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2020														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/06/20	0	0.00	0.00	0.00	h	-	-							
09/07/20	0	0.00	0.00	0.00	h	-	-							
09/08/20	0	0.00	0.00	0.00	h	-	-							
09/09/20	0	0.00	0.00	0.00	h	-	-							
09/10/20	0	0.00	0.00	0.00	h	-	-							
09/11/20	0	0.00	0.00	0.00	h	-	-							
09/12/20	0	0.00	0.00	0.00	h	-	-							
09/13/20	0	0.00	0.00	0.00	h	-	-							
09/14/20	10	0.10	0.00	0.00	h	-	-							
09/15/20	0	0.00	0.00	0.00	h	-	-							
09/16/20	0	0.00	0.00	0.00	h	-	-							
09/17/20	0	0.00	0.00	0.00	h	-	-							
09/18/20	0	0.00	0.00	0.00	h	-	-							
09/19/20	0	0.00	0.00	0.00	h	-	-							
09/20/20	0	0.00	0.00	0.00	h	-	-							
09/21/20	0	0.00	0.00	0.00	h	-	-							
09/22/20	0	0.00	0.00	0.00	h	-	-							
09/23/20	0	0.00	0.00	0.00	h	-	-							
09/24/20	0	0.00	0.00	0.00	h	-	-							
09/25/20	0	0.00	0.00	0.00	h	-	-							
09/26/20	0	0.00	0.00	0.00	h	-	-							
09/27/20	0	0.00	0.00	0.00	h	-	-							
09/28/20	0	0.00	0.00	0.00	h	-	-							
09/29/20	0	0.00	0.00	0.00	h	-	-							
09/30/20	0	0.00	0.00	0.00	h	-	-							
30 days					30	0	0							

**TABLE A-2:** This table shows the verification data of MSP issued precipitation forecasts contained in the daily Outlooks for the 2020 Monsoon Season. It is a monthly tally of the data contained in Table A-1. The table is broken down by month and MSP Forecast Zone. The columns from left to right are defined as follows:

**Accurate Forecasts** – Number of correct forecasts days out of total days in the month.

**Accuracy** – Accuracy of forecasts in percent.

**Op. Sig. Events Detected** – Number of operationally significant days detected correctly.

**POD** – Probability of detection in percent.

**False Alarms** – Number of false alarms that month.

**FAR** – False alarm rate in percent.

<b>TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2020</b>						
<b>Forecast Zone</b>	<b>Accurate Forecasts</b>	<b>AOF (%)</b>	<b>Sig. Events Detected</b>	<b>POD (%)</b>	<b>False Alarms</b>	<b>FAR (%)</b>
<b>JUNE</b>						
Gila Bend	16/16	100%	0/0	n/a	0/16	0%
Gila River	16/16	100%	0/0	n/a	0/16	0%
Palo Verde	16/16	100%	0/0	n/a	0/16	0%
Rainbow Valley	16/16	100%	0/0	n/a	0/16	0%
West Valley	16/16	100%	0/0	n/a	0/16	0%
Northwest Valley	16/16	100%	0/0	n/a	0/16	0%
Upper Centennial	16/16	100%	0/0	n/a	0/16	0%
Wickenburg	16/16	100%	0/0	n/a	0/16	0%
New River/Cave Creek	16/16	100%	0/0	n/a	0/16	0%
Phoenix North	16/16	100%	0/0	n/a	0/16	0%
Phoenix South	16/16	100%	0/0	n/a	0/16	0%
Scottsdale North	16/16	100%	0/0	n/a	0/16	0%
Scottsdale South	16/16	100%	0/0	n/a	0/16	0%
East Valley	16/16	100%	0/0	n/a	0/16	0%
Southeast Valley	16/16	100%	0/0	n/a	0/16	0%
Lower Salt River Lakes	16/16	100%	0/0	n/a	0/16	0%



<b>TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2020</b>						
<b>Forecast Zone</b>	<b>Accurate Forecasts</b>	<b>AOF (%)</b>	<b>Sig. Events Detected</b>	<b>POD (%)</b>	<b>False Alarms</b>	<b>FAR (%)</b>
Superstition	16/16	100%	0/0	n/a	0/16	0%
<b>All Zones</b>	<b>272/272</b>	<b>100%</b>	<b>0/0</b>	<b>n/a</b>	<b>0/272</b>	<b>0%</b>
<b>JULY</b>						
Gila Bend	28/31	90.3%	1/2	50%	1/31	3.2%
Gila River	28/31	90.3%	1/2	50%	0/31	0%
Palo Verde	29/31	93.5%	1/2	50%	0/31	0%
Rainbow Valley	29/31	93.5%	0/2	0%	0/31	0%
West Valley	29/31	93.5%	1/3	33.3%	0/31	0%
Northwest Valley	30/31	96.8%	0/1	0%	0/31	0%
Upper Centennial	29/31	93.5%	1/1	100%	0/31	0%
Wickenburg	29/31	93.5%	0/0	n/a	0/31	0%
New River/Cave Creek	30/31	96.8%	3/3	100%	0/31	0%
Phoenix North	30/31	96.8%	1/1	100%	0/31	0%
Phoenix South	30/31	96.8%	1/1	100%	0/31	0%
Scottsdale North	29/31	93.5%	1/1	100%	0/31	0%
Scottsdale South	29/31	93.5%	1/1	100%	0/31	0%
East Valley	29/31	93.5%	1/1	100%	0/31	0%
Southeast Valley	29/31	93.5%	1/1	100%	0/31	0%
Lower Salt River Lakes	30/31	96.8%	3/3	100%	1/31	3.2%
Superstition	30/31	96.8%	4/4	100%	1/31	3.2%
<b>All Zones</b>	<b>497/527</b>	<b>94.3%</b>	<b>21/29</b>	<b>72.4%</b>	<b>3/527</b>	<b>0.6%</b>
<b>AUGUST</b>						
Gila Bend	25/31	80.6%	4/5	80%	0/31	0%
Gila River	27/31	87.1%	2/4	50%	0/31	0%
Palo Verde	28/31	90.3%	1/3	33.3%	1/31	3.2%
Rainbow Valley	28/31	90.3%	2/3	66.7%	0/31	0%
West Valley	26/31	83.9%	2/3	66.7%	0/31	0%
Northwest Valley	26/31	83.9%	3/5	60%	0/31	0%
Upper Centennial	24/31	77.4%	1/3	33.3%	0/31	0%

<b>TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2020</b>						
<b>Forecast Zone</b>	<b>Accurate Forecasts</b>	<b>AOF (%)</b>	<b>Sig. Events Detected</b>	<b>POD (%)</b>	<b>False Alarms</b>	<b>FAR (%)</b>
Wickenburg	24/31	77.4%	1/2	50%	0/31	0%
New River/Cave Creek	26/31	83.9%	5/5	100%	0/31	0%
Phoenix North	27/31	87.1%	3/3	100%	0/31	0%
Phoenix South	30/31	96.8%	2/3	66.7%	0/31	0%
Scottsdale North	25/31	80.6%	3/4	75%	0/31	0%
Scottsdale South	27/31	87.1%	0/1	0%	1/31	3.2%
East Valley	26/31	83.9%	2/3	66.7%	0/31	0%
Southeast Valley	27/31	87.1%	1/3	33.3%	0/31	0%
Lower Salt River Lakes	22/31	71%	3/5	60%	1/31	3.2%
Superstition	24/31	77.4%	1/1	100%	1/31	3.2%
<b>All Zones</b>	<b>442/527</b>	<b>83.9%</b>	<b>36/56</b>	<b>64.3%</b>	<b>4/527</b>	<b>0.8%</b>
<b>SEPTEMBER</b>						
Gila Bend	30/30	100%	0/0	n/a	0/30	0%
Gila River	29/30	96.7%	0/0	n/a	0/30	0%
Palo Verde	30/30	100%	0/0	n/a	0/30	0%
Rainbow Valley	30/30	100%	0/0	n/a	0/30	0%
West Valley	30/30	100%	0/0	n/a	0/30	0%
Northwest Valley	30/30	100%	0/0	n/a	0/30	0%
Upper Centennial	30/30	100%	0/0	n/a	0/30	0%
Wickenburg	30/30	100%	0/0	n/a	0/30	0%
New River/Cave Creek	30/30	100%	0/0	n/a	0/30	0%
Phoenix North	30/30	100%	0/0	n/a	0/30	0%
Phoenix South	30/30	100%	0/0	n/a	0/30	0%
Scottsdale North	30/30	100%	0/0	n/a	0/30	0%
Scottsdale South	30/30	100%	0/0	n/a	0/30	0%
East Valley	29/30	96.7%	0/0	n/a	0/30	0%
Southeast Valley	29/30	96.7%	0/0	n/a	0/30	0%
Lower Salt River Lakes	30/30	100%	0/0	n/a	0/30	0%
Superstition	30/30	100%	0/0	n/a	0/30	0%
<b>All Zones</b>	<b>507/510</b>	<b>99.4%</b>	<b>0/0</b>	<b>n/a</b>	<b>0/510</b>	<b>0%</b>

## APPENDIX B: MSP MESSAGES - VERIFICATION TABLES

**TABLE B-1:** This table shows each of the individual MSP Statements issued during the 2020 Monsoon season including the detailed forecast rainfall information. The table is broken down by date and MSP Message. The columns from left to right are defined as follows:

**Statement Details** – Message information including date, time issued in local standard time, Forecast Zone, Message type, and issuing forecaster. Data is pulled directly from issued Message.

**Forecast Rain** – Rain information including forecast rainfall intensity and storm total precipitation where applicable. Data is pulled directly from issued Message. It is important to note that not all issued Messages contain forecast rainfall information (noted by an “N/A” in the table).

TABLE B-1: MSP Statements Issued - Monsoon Season 2020							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/23/20	12:43	West Valley	1	Henz	Now-230pm	-	0.25-0.50/1.00-1.25
07/23/20	12:57	Rainbow Valley	1	Henz	Now-230pm	-	0.25-0.50/1.00-1.25
07/23/20	14:14	West Valley	3	Waters	Now-4pm	-	-
07/24/20	17:53	Phoenix North	1	Waters	Now-630pm	0.50/30min	0.50
07/24/20	18:20	Scottsdale North	1	Waters	Now-7pm	0.50/30min	0.50
07/24/20	18:20	New River/Cave Creek	1	Waters	Now-7pm	0.50/30min	0.50
07/24/20	18:35	Gila River	1	Waters	Now-730pm	1.00/30min	1.00
07/24/20	19:02	East Valley	1	Waters	Now-8pm	1.00/30min	1.00
08/16/20	17:34	Northwest Valley	1	Henz	Now-7pm	-	0.50-0.75/1.00
08/17/20	18:36	Superstition	1	Henz	Now-8pm	-	0.50-0.75/1.00
08/17/20	19:25	East Valley	1	Henz	Now-9pm	-	0.50-0.75/1.00
08/20/20	17:40	New River/Cave Creek	1	Henz	Now-730pm	-	0.50-0.75/1.00
08/20/20	18:49	Phoenix North	1	Henz	Now-830pm	-	0.50-0.75/1.00
08/20/20	19:30	Phoenix South	1	Henz	Now-9pm	-	0.50-0.75/1.00-1.50
08/20/20	19:30	Scottsdale South	1	Henz	Now-9pm	-	0.50-0.75/1.00-1.50
08/20/20	19:35	West Valley	1	Henz	Now-9pm	-	0.50-0.75/1.00-1.25
08/20/20	20:20	East Valley	1	Henz	Now-10pm	-	0.50-0.75/1.00-1.25
08/20/20	20:20	Southeast Valley	1	Henz	Now-10pm	-	0.50-0.75/1.00-1.25

**TABLE B-1: MSP Statements Issued - Monsoon Season 2020**

Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
08/20/20	20:46	Gila River	1	Henz	Now-1030pm	-	0.50-0.75/1.00-1.25
08/22/20	20:28	Scottsdale North	1	Waters	Now-915pm	-	0.50-0.75/1.00
08/22/20	21:25	New River/Cave Creek	1	Waters	Now-1015pm	-	0.50-0.75/1.00
08/26/20	17:35	Wickenburg	1	Henz	Now-7pm	-	0.50-0.75/1.00-1.50
08/29/20	8:15	Gila Bend	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Gila River	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Palo Verde	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Rainbow Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	West Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Northwest Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Upper Centennial	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Wickenburg	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	New River/Cave Creek	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Phoenix North	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Phoenix South	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Scottsdale North	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Scottsdale South	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	East Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Southeast Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Superstition	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	8:15	Lower Salt River Lakes	2	Waters/Henz	8/29 12pm-8/31 11pm	-	-
08/29/20	18:51	Rainbow Valley	1	Henz	Now-830pm	-	0.50-1.00/1.25-1.50
08/29/20	20:28	East Valley	1	Henz	Now-1030pm	-	0.50-0.75/1.00-1.50
08/29/20	20:33	Southeast Valley	1	Henz	Now-10pm	-	0.50-0.75/1.25-1.50
08/29/20	20:37	Superstition	1	Henz	Now-10pm	-	0.50-0.75/1.25-1.50
08/29/20	20:48	Lower Salt River Lakes	1	Henz	Now-1030pm	-	0.50-0.75/1.25-1.50
08/30/20	14:33	Gila Bend	1	Henz	Now-5pm	-	0.75-1.00/1.50
08/30/20	15:39	Gila River	1	Henz	Now-5pm	-	0.50-0.75/1.00-1.25
08/30/20	16:39	Upper Centennial	1	Henz	Now-630pm	-	0.50-0.75/1.25-1.50

<b>TABLE B-1: MSP Statements Issued - Monsoon Season 2020</b>							
<b>Statement Details</b>						<b>Forecast Rain</b>	
<b>Date</b>	<b>LST</b>	<b>MSP Forecast Zone</b>	<b>Message</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Intensity (in/min)</b>	<b>STP (in)</b>
08/30/20	16:42	Wickenburg	1	Henz	Now-630pm	-	0.50-0.75/1.00-1.50
08/30/20	17:30	Northwest Valley	1	Henz	Now-7pm	-	0.50-0.75/1.00-1.50
08/30/20	17:34	New River/Cave Creek	1	Henz	Now-715pm	-	0.50-0.75/1.00-1.50
08/30/20	18:09	West Valley	1	Henz	Now-8pm	-	0.50-0.75/1.00-1.50
08/30/20	18:22	Scottsdale North	1	Henz	Now-815pm	-	0.50-0.75/1.00-1.50
08/30/20	18:22	Phoenix North	1	Henz	Now-815pm	-	0.50-0.75/1.00-1.50
08/30/20	19:35	Palo Verde	1	Henz	Now-930pm	-	0.50-0.75/1.00-1.50

**TABLE B-2:** This table shows the raw verification data of MSP issued Messages for the 2020 Monsoon Season. The valid period for rainfall for each Message can be found in Table B-1. The table is broken down by date and MSP Message. The columns from left to right are defined as follows:

**Statement Details** – Statement information including date, Forecast Zone, and Message type.

**Forecast Rain** – Rain information including forecast rainfall intensity and forecast storm total precipitation where applicable. It is important to note that not all issued statements contain forecast rainfall information (noted by an “n/a” in the table).

**Rain Observations** – Observed rainfall amounts within the forecast zone including ALERT rain gages, gage adjusted radar rainfall totals, and local storm reports submitted to NWS Phoenix WFO.

**Alarms** – Triggered alarms on ALERT gage sensors. These alarms are broken down by alarm type including rain, stream, and dam.

**Verification** – The verification was broken down by rain and by alarm. Hits and misses were assigned based on thresholds previously discussed in the [MSP Verification Metrics and Criteria](#) section of this report.

<b>TABLE B-2: MSP Statements Issued - Monsoon Season 2020</b>											
<b>Statement Details</b>			<b>Forecast Rain</b>		<b>Rain Observations (in)</b>			<b>Alarms</b>			<b>Verification</b>
<b>Date</b>	<b>MSP Forecast Zone</b>	<b>Message</b>	<b>Intensity (in/min)</b>	<b>STP (in)</b>	<b>ALERT</b>	<b>GAQPE</b>	<b>LSRs</b>	<b>Rain</b>	<b>Stream</b>	<b>Dam</b>	<b>Hit/Miss</b>
07/23/20	West Valley	1	-	0.25-0.50/1.00-1.25	0.75	1.51-2.00	-	-	X	-	Hit
07/23/20	Rainbow Valley	1	-	0.25-0.50/1.00-1.25	0.28	1.51-2.00	-	-	X	-	Hit
07/23/20	West Valley	3	-	-	0.75	1.51-2.00	-	-	X	-	Hit
07/24/20	Phoenix North	1	0.50/30min	0.50	0.63	0.76-1.00	-	-	-	-	Hit
07/24/20	Scottsdale North	1	0.50/30min	0.50	0.59	0.76-1.00	-	-	-	-	Hit
07/24/20	New River/Cave Creek	1	0.50/30min	0.50	0.55	2.01-2.50	-	-	-	-	Hit
07/24/20	Gila River	1	1.00/30min	1.00	0.24	1.01-1.25	-	-	-	-	Hit
07/24/20	East Valley	1	1.00/30min	1.00	1.22	1.01-1.25	0.94	-	-	-	Hit
08/16/20	Northwest Valley	1	-	0.50-0.75/1.00	0.55	0.51-0.75	-	-	-	-	Hit
08/17/20	Superstition	1	-	0.50-0.75/1.00	0.43	0.51-0.75	-	-	-	-	Hit
08/17/20	East Valley	1	-	0.50-0.75/1.00	0.39	0.26-0.50	-	-	-	-	Miss
08/20/20	New River/Cave Creek	1	-	0.50-0.75/1.00	1.38	1.01-1.25	-	X	-	-	Hit
08/20/20	Phoenix North	1	-	0.50-0.75/1.00	0.91	1.26-1.50	-	-	-	-	Hit

**TABLE B-2: MSP Statements Issued - Monsoon Season 2020**

Statement Details			Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Message	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
08/20/20	Phoenix South	1	-	0.50-0.75/1.00-1.50	0.98	1.01-1.25	-	X	-	-	Hit
08/20/20	Scottsdale South	1	-	0.50-0.75/1.00-1.50	0.71	0.76-1.00	-	-	-	-	Hit
08/20/20	West Valley	1	-	0.50-0.75/1.00-1.25	0.51	0.51-0.76	-	-	-	-	Hit
08/20/20	East Valley	1	-	0.50-0.75/1.00-1.25	0.67	0.51-0.76	-	-	-	-	Hit
08/20/20	Southeast Valley	1	-	0.50-0.75/1.00-1.25	0.59	0.76-1.00	-	-	-	-	Hit
08/20/20	Gila River	1	-	0.50-0.75/1.00-1.25	0.04	1.26-1.50	-	-	-	-	Hit
08/22/20	Scottsdale North	1	-	0.50-0.75/1.00	0.51	0.76-1.00	-	-	-	-	Hit
08/22/20	New River/Cave Creek	1	-	0.50-0.75/1.00	0.24	0.26-0.50	-	-	-	-	Miss
08/26/20	Wickenburg	1	-	0.50-0.75/1.00-1.50	0.75	0.76-1.00	-	-	-	-	Hit
08/29/20	Gila Bend	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Gila River	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Palo Verde	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Rainbow Valley	2	-	-	-	-	-	-	-	-	Hit
08/29/20	West Valley	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Northwest Valley	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Upper Centennial	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Wickenburg	2	-	-	-	-	-	-	-	-	Hit
08/29/20	New River/Cave Creek	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Phoenix North	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Phoenix South	2	-	-	-	-	-	-	-	-	Miss
08/29/20	Scottsdale North	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Scottsdale South	2	-	-	-	-	-	-	-	-	Miss
08/29/20	East Valley	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Southeast Valley	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Superstition	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Lower Salt River Lakes	2	-	-	-	-	-	-	-	-	Hit
08/29/20	Rainbow Valley	1	-	0.50-1.00/1.25-1.50	0.63	1.51-2.00	0.78	-	-	-	Hit
08/29/20	East Valley	1	-	0.50-0.75/1.00-1.50	0.71	0.51-0.75	0.62	X	-	-	Hit
08/29/20	Southeast Valley	1	-	0.50-0.75/1.25-1.50	0.67	0.76-1.00	0.76	-	-	-	Hit

**TABLE B-2: MSP Statements Issued - Monsoon Season 2020**

Statement Details			Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Message	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
08/29/20	Superstition	1	-	0.50-0.75/1.25-1.50	1.34	1.51-2.00	0.79	-	-	-	Hit
08/29/20	Lower Salt River Lakes	1	-	0.50-0.75/1.25-1.50	0.31	0.26-0.50	-	-	-	-	Hit
08/30/20	Gila Bend	1	-	0.75-1.00/1.50	0.28	0.76-1.00	-	-	-	-	Hit
08/30/20	Gila River	1	-	0.50-0.75/1.00-1.25	0.00	0.76-1.00	-	-	-	-	Hit
08/30/20	Upper Centennial	1	-	0.50-0.75/1.25-1.50	0.31	1.51-2.00	-	X	-	-	Hit
08/30/20	Wickenburg	1	-	0.50-0.75/1.00-1.50	1.02	1.26-1.50	-	X	-	-	Hit
08/30/20	Northwest Valley	1	-	0.50-0.75/1.00-1.50	1.50	1.51-2.00	-	X	-	-	Hit
08/30/20	New River/Cave Creek	1	-	0.50-0.75/1.00-1.50	1.42	1.51-2.00	0.94	X	-	-	Hit
08/30/20	West Valley	1	-	0.50-0.75/1.00-1.50	0.87	1.51-2.00	-	-	-	-	Hit
08/30/20	Scottsdale North	1	-	0.50-0.75/1.00-1.50	0.67	0.76-1.00	-	-	-	-	Hit
08/30/20	Phoenix North	1	-	0.50-0.75/1.00-1.50	0.83	0.76-1.00	-	-	-	-	Hit
08/30/20	Palo Verde	1	-	0.50-0.75/1.00-1.50	1.02	1.26-1.50	-	X	-	-	Hit



**TABLE B-3:** This table shows the lead time data of MSP issued Messages for the 2020 Monsoon Season. The table is broken down by Statement details and lead time. The columns from left to right are defined as follows:

**Statement Details** – Statement information including date, issue time, forecast zone, message type, forecaster, and valid time.

**Statement Lead time** – The first column denotes the time when the first ALERT Alarm (rain, stream, or impoundment) was triggered if any. The second column depicts the calculated lead time based on beginning statement valid time and when the first alarm was triggered.

<b>TABLE B-3: MSP Statement Lead Time - Monsoon Season 2020</b>							
<b>Statement Details</b>						<b>Statement Lead Time</b>	
<b>Date</b>	<b>LST</b>	<b>MSP Forecast Zone</b>	<b>Message</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Alarm Triggered</b>	<b>Lead Time(min)</b>
07/23/20	12:43	West Valley	1	Henz	Now-230pm	14:23	100
07/23/20	12:57	Rainbow Valley	1	Henz	Now-230pm	14:20	83
07/23/20	14:14	West Valley	3	Waters	Now-4pm	12:43	0
08/20/20	17:40	New River/Cave Creek	1	Henz	Now-730pm	19:08	88
08/20/20	19:30	Phoenix South	1	Henz	Now-9pm	20:26	56
08/29/20	8:15	Gila Bend	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 14:33	1583
08/29/20	8:15	Gila River	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 15:39	1649
08/29/20	8:15	Palo Verde	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 19:35	1885
08/29/20	8:15	Rainbow Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	8/29 18:51	411
08/29/20	8:15	West Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 18:09	1799
08/29/20	8:15	Northwest Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 17:30	1760
08/29/20	8:15	Upper Centennial	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 16:39	1709
08/29/20	8:15	Wickenburg	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 16:42	1712
08/29/20	8:15	New River/Cave Creek	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 17:34	1764
08/29/20	8:15	Phoenix North	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 18:22	1812
08/29/20	8:15	Scottsdale North	2	Waters/Henz	8/29 12pm-8/31 11pm	8/30 18:22	1812
08/29/20	8:15	East Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	8/29 20:28	508
08/29/20	8:15	Southeast Valley	2	Waters/Henz	8/29 12pm-8/31 11pm	8/29 20:33	513
08/29/20	8:15	Superstition	2	Waters/Henz	8/29 12pm-8/31 11pm	8/29 20:37	517
08/29/20	20:28	East Valley	1	Henz	Now-1030pm	21:14	46

**TABLE B-3: MSP Statement Lead Time - Monsoon Season 2020**

Statement Details						Statement Lead Time	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Alarm Triggered	Lead Time(min)
08/30/20	16:39	Upper Centennial	1	Henz	Now-630pm	17:56	77
08/30/20	16:42	Wickenburg	1	Henz	Now-630pm	17:30	48
08/30/20	17:30	Northwest Valley	1	Henz	Now-7pm	17:27	0
08/30/20	17:34	New River/Cave Creek	1	Henz	Now-715pm	17:48	74
08/30/20	19:35	Palo Verde	1	Henz	Now-930pm	19:28	0

## APPENDIX C: MSP LAKE ALERTS - VERIFICATION TABLES

**TABLE C-1:** This table shows each of the individual MSP Lake Alerts issued during the 2020 Monsoon season. The table is broken down by statement Details, observations, and verification. The columns from left to right are defined as follows:

**Statement Details** – Message information including date, time issued in local standard time, lake, issuing forecaster, and valid time. Data is pulled directly from issued Message.

**Observations** – Rain information including forecast rainfall intensity and storm total precipitation where applicable. Data is pulled directly from issued Message. It is important to note that not all issued Messages contain forecast rainfall information (noted by an “N/A” in the table).

**Lead Time** – amount of lead time in minutes from when Lake Alert was issued to when first observation occurred.

**Verification** – Hits and misses were assigned based on thresholds previously discussed in the [MSP Verification Metrics and Criteria](#) section of this report.

TABLE C-1: MSP Lake Alerts Issued - Monsoon Season 2020									
Statement Details					Observations			Lead Time	Verification
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	1st Obs.	Hit/Miss
07/24/20	16:33	Bartlett	Waters	Now-6pm	X	X	X		Hit
07/24/20	16:33	Apache	Waters	Now-6pm	X	X	X	0	Hit
07/24/20	16:33	Canyon	Waters	Now-6pm	X	X	X	-	Hit
07/24/20	16:33	Saguaro	Waters	Now-6pm	X	X	X	-	Hit
07/28/20	13:33	Apache	Henz	Now-3pm	-	-	-	-	Miss
07/28/20	13:33	Canyon	Henz	Now-3pm	-	-	-	-	Miss
08/16/20	14:49	Canyon	Henz	Now-430pm	-	-	X	-	Hit
08/16/20	14:49	Saguaro	Henz	Now-430pm	-	-	X	-	Hit
08/16/20	14:53	Bartlett	Henz	Now-430pm	X	X	X	23	Hit
08/16/20	17:19	Pleasant	Henz	Now-630pm	X	X	X	11	Hit
08/17/20	17:56	Apache	Henz	Now-7:15pm	X	X	X	14	Hit
08/17/20	17:56	Canyon	Henz	Now-7:15pm	X	X	X	19	Hit
08/17/20	17:56	Saguaro	Henz	Now-7:15pm	X	X	X	29	Hit

<b>TABLE C-1: MSP Lake Alerts Issued - Monsoon Season 2020</b>									
<b>Statement Details</b>					<b>Observations</b>			<b>Lead Time</b>	<b>Verification</b>
<b>Date</b>	<b>LST</b>	<b>Lake</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Lightning</b>	<b>Wind &gt; 30mph</b>	<b>Hail/Heavy Rain</b>	<b>1st Obs.</b>	<b>Hit/Miss</b>
08/20/20	18:04	Bartlett	Henz	Now-7:15pm	X	X	X	9	Hit
08/24/20	16:11	Canyon	Henz	Now-530pm	X	-	-	13	Hit
08/24/20	16:11	Saguaro	Henz	Now-530pm	-	-	-	-	Miss
08/25/20	17:19	Bartlett	Henz	Now-630pm	X	-	-	0	Hit

## APPENDIX E: QPF STORM TOTAL PRECIPITATION - VERIFICATION TABLES

**TABLE E-1:** This table shows each of the individual MSP Lake Alerts issued during the 2020 Monsoon season including the detailed forecast rainfall information. The table is broken down by statement Details, observations, and verification. The columns from left to right are defined as follows:

**Statement Details** – Message information including date and forecast zone. Data is pulled directly from issued Message.

**Peak Storm Total Precipitation** – Rain information including forecast (QPF), observed (ALERT), radar estimated (GAQPE), and local storm report total (LSR). Data is pulled directly from issued Message. Observations are gathered the ALERT database, WDT Inc radar products, and NWS local storm reports.

**Error** – Percent error was calculated based on Equation 4 previously discussed in the [MSP Verification Metrics and Criteria](#) section of this report.

**Verification** – Hits and misses were assigned based on thresholds previously discussed in the [MSP Verification Metrics and Criteria](#) section of this report.

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2020											
Statement Details		Peak STP (in)					Error (%)				Verification
Date	MSP Forecast Zone	QPF	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	Hit/Miss
07/23/20	West Valley	1.25	0.75	1.51	2.00	-	66.67	-17.22	-37.50	-	Hit
07/23/20	Rainbow Valley	1.25	0.28	1.51	2.00	-	346.43	-17.22	-37.50	-	Hit
07/24/20	Phoenix North	0.50	0.63	0.75	1.00	-	-20.63	-33.33	-50.00	-	Miss
07/24/20	Scottsdale North	0.50	0.59	0.75	1.00	-	-15.25	-33.33	-50.00	-	Hit
07/24/20	New River/Cave Creek	0.50	0.55	2.00	2.50	-	-9.09	-75.00	-80.00	-	Hit
07/24/20	Gila River	1.00	0.24	1.00	1.25	-	316.67	0.00	-20.00	-	Hit
07/24/20	East Valley	1.00	1.22	1.00	1.25	0.94	-18.03	0.00	-20.00	6.38	Hit
08/16/20	Northwest Valley	0.50	0.55	0.51	0.75	-	-9.09	-1.96	-33.33	-	Hit
08/17/20	Superstition	0.50	0.43	0.51	0.75	-	16.28	-1.96	-33.33	-	Hit
08/17/20	East Valley	0.50	0.39	0.26	0.50	-	28.21	92.31	0.00	-	Hit
08/20/20	New River/Cave Creek	1.00	1.38	1.01	1.25	-	-27.54	-0.99	-20.00	-	Hit
08/20/20	Phoenix North	1.00	0.91	1.26	1.50	-	9.89	-20.63	-33.33	-	Hit

**TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2020**

Statement Details		Peak STP (in)					Error (%)				Verification
Date	MSP Forecast Zone	QPF	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	Hit/Miss
08/20/20	Phoenix South	1.00	0.98	1.01	1.25	-	2.04	-0.99	-20.00	-	Hit
08/20/20	Scottsdale South	0.75	0.71	0.76	1.00	-	5.63	-1.32	-25.00	-	Hit
08/20/20	West Valley	0.50	0.51	0.51	0.76	-	-1.96	-1.96	-34.21	-	Hit
08/20/20	East Valley	0.75	0.67	0.51	0.76	-	11.94	47.06	-1.32	-	Hit
08/20/20	Southeast Valley	0.75	0.59	0.76	1.00	-	27.12	-1.32	-25.00	-	Hit
08/20/20	Gila River	1.25	0.04	1.26	1.50	-	3025.00	-0.79	-16.67	-	Hit
08/22/20	Scottsdale North	0.75	0.51	0.76	1.00	-	47.06	-1.32	-25.00	-	Hit
08/22/20	New River/Cave Creek	0.50	0.24	0.26	0.50	-	108.33	92.31	0.00	-	Hit
08/26/20	Wickenburg	0.75	0.75	0.76	1.00	0.78	0.00	-1.32	-25.00	-3.85	Hit
08/29/20	Rainbow Valley	1.50	0.63	1.51	2.00	0.62	138.10	-0.66	-25.00	141.94	Hit
08/29/20	East Valley	0.75	0.71	0.51	0.75	0.76	5.63	47.06	0.00	-1.32	Hit
08/29/20	Southeast Valley	0.75	0.67	0.76	1.00	0.79	11.94	-1.32	-25.00	-5.06	Hit
08/29/20	Superstition	1.50	1.34	1.51	2.00	-	11.94	-0.66	-25.00	-	Hit
08/29/20	Lower Salt River Lakes	0.50	0.31	0.26	0.50	-	61.29	92.31	0.00	-	Hit
08/30/20	Gila Bend	1.00	0.28	0.76	1.00	-	257.14	31.58	0.00	-	Hit
08/30/20	Gila River	1.00	0.00	0.76	1.00	-	#DIV/0!	31.58	0.00	-	Hit
08/30/20	Upper Centennial	1.50	0.31	1.51	2.00	-	383.87	-0.66	-25.00	-	Hit
08/30/20	Wickenburg	1.00	1.02	1.26	1.50	-	-1.96	-20.63	-33.33	-	Hit
08/30/20	Northwest Valley	1.50	1.50	1.51	2.00	0.94	0.00	-0.66	-25.00	59.57	Hit
08/30/20	New River/Cave Creek	1.50	1.42	1.51	2.00	-	5.63	-0.66	-25.00	-	Hit
08/30/20	West Valley	1.00	0.87	1.51	2.00	-	14.94	-33.77	-50.00	-	Hit
08/30/20	Scottsdale North	0.75	0.67	0.76	1.00	-	11.94	-1.32	-25.00	-	Hit
08/30/20	Phoenix North	0.75	0.83	0.76	1.00	-	-9.64	-1.32	-25.00	-	Hit
08/30/20	Palo Verde	1.25	1.02	1.26	1.50		22.55	-0.79	-16.67	-	Hit

\* GAQPE (Radar) estimated data given in ranges: (LT) Lower Total and (UT) Upper Total