



EMF South of Hunt Highway, 08-18-2021, FCD O&M Staff

Flood Control District of Maricopa County

Flood Warning Branch

**MSP Verification Report & Season Recap:
Monsoon Season 2021**



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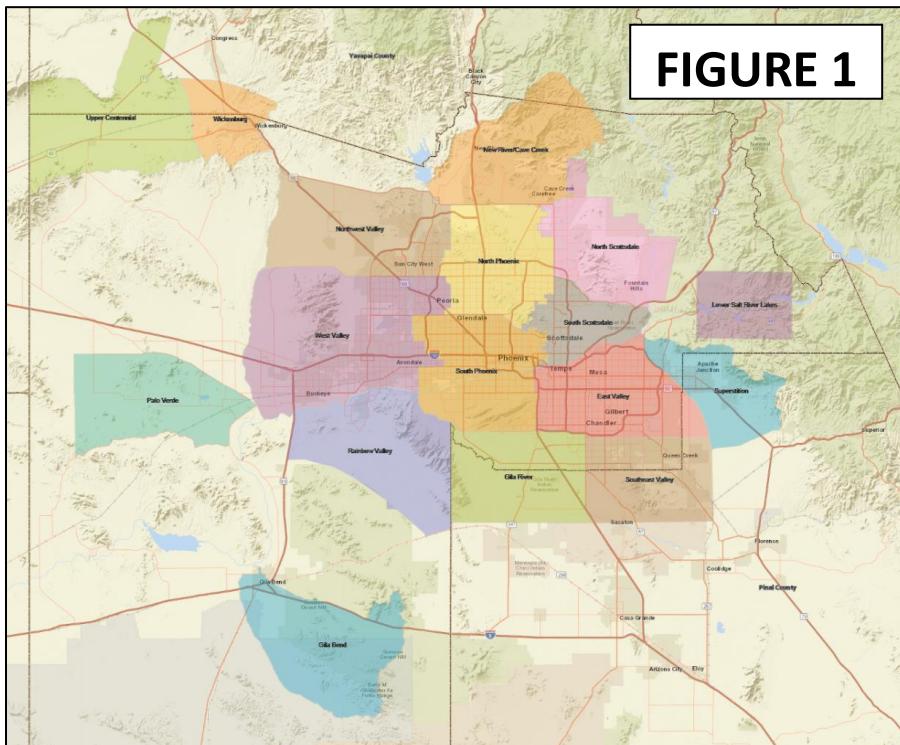
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INTRODUCTION

This report was generated by the Flood Warning Branch of the Flood Control District of Maricopa County (FCDMC). It covers the length of the monsoon season as defined by the National Weather Service Phoenix WFO: June 15th- September 30th. 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 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 serves 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 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.

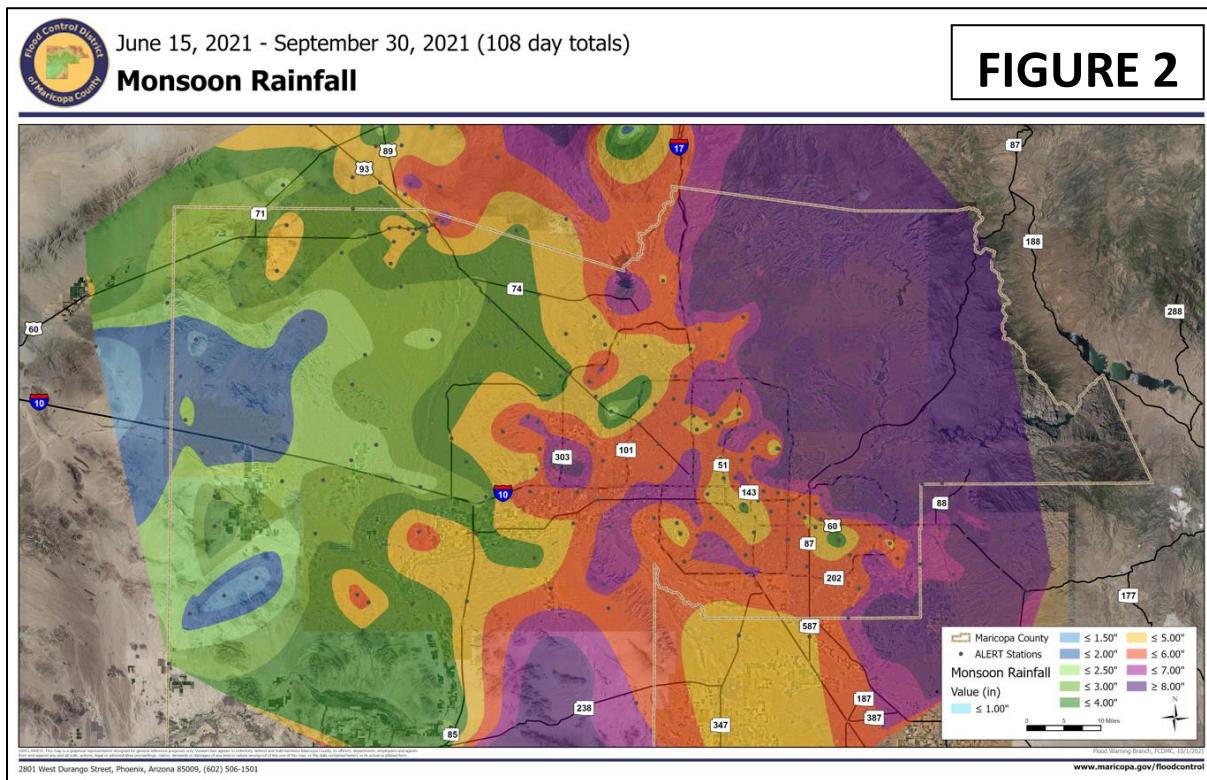
Additional Products:

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, 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](#)

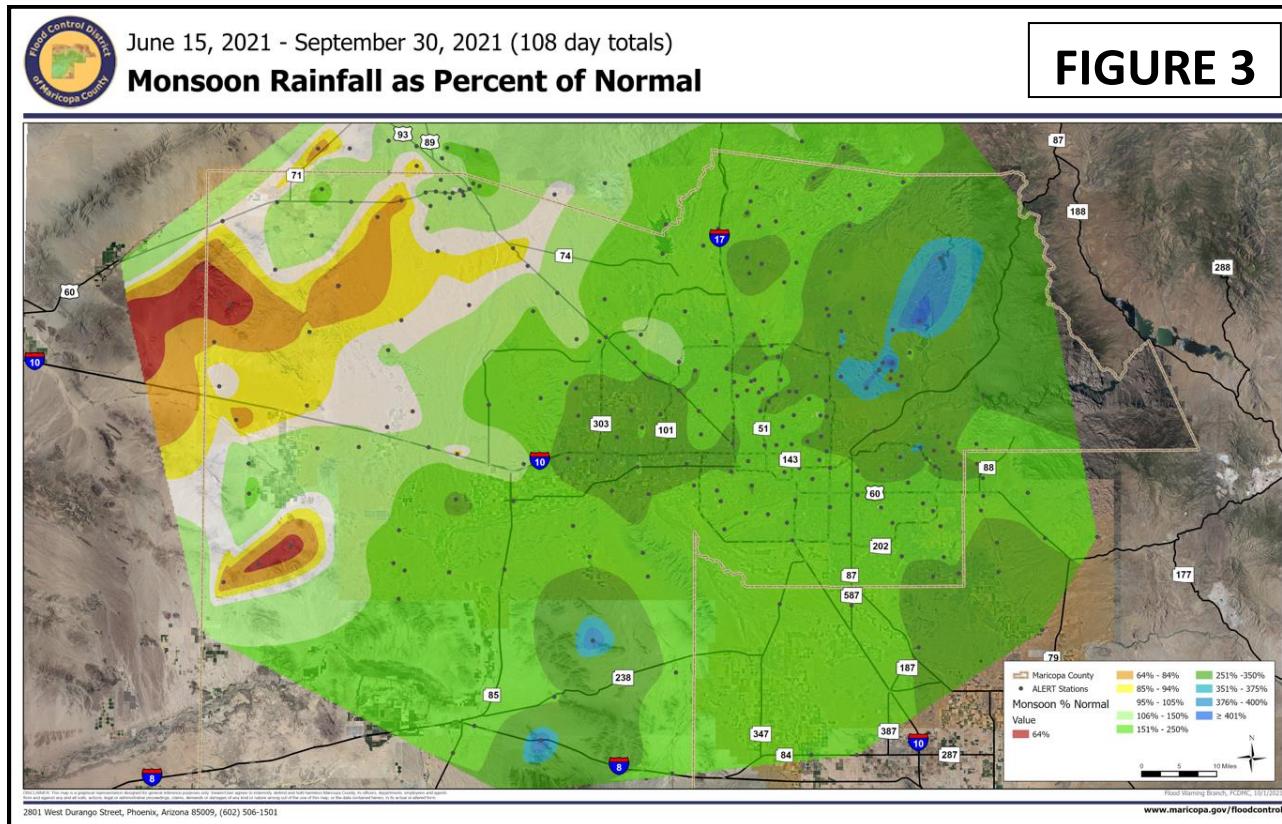
2021 MONSOON SEASON RECAP

According to the FCDMC ALERT rain gage network, the 2021 monsoon season was characterized as being much wetter than normal. When averaged across 287 of the oldest county rain gages, 6.07" of rain fell which was just over 200% of the mean value of 3.01" and ranked as third wettest on record. An image showing a 41 year period of record can be viewed [here](#). It's worth noting well above normal rainfall was recorded at Sky Harbor Airport for the first time since 2018. The official rain total as reported by the NWS Phoenix office was 4.20" which was 1.77" above the period average of 2.43" and ranked as the twenty-sixth wettest on record. 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 15th – September 30th. The largest



rainfall totals fell across the higher terrain eastern and northern portions of Maricopa County. Totals steadily trended downward while heading west towards La Paz and Yuma County borders. Figure 3, on the next page, shows the ratio of 2021 monsoon precipitation versus normal monsoon precipitation. Similar to Figure 2, contours were generated using FCDMC ALERT rain gage data from around the county. The only near normal to below normal values present were across west central Maricopa County. Most of the greater Phoenix urban corridor registered anywhere from 150%-300% of normal. Some higher terrain areas north and east of

the Valley and far southwestern locales (near Gila Bend) observed 300% to 400%+ of normal, which further puts an exclamation point on how wet the 2021 monsoon was. 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.



June Recap/Notable Events:

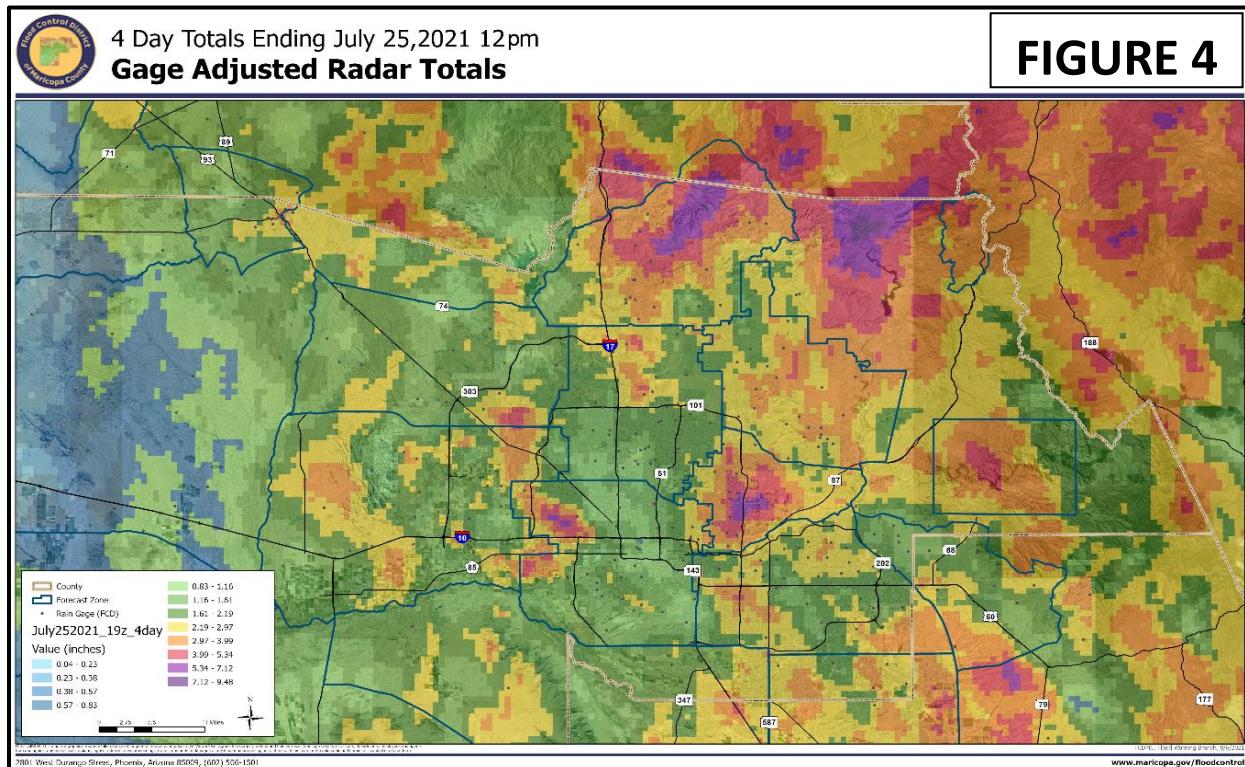
- After an abnormally dry winter, the onset of the 2021 monsoon season came a week early, initiating on June 30th. Monsoon statistics for Phoenix Sky Harbor can be found [here](#).
- According to the NWS Phoenix WFO, Sky Harbor Airport registered the hottest average temperature for June on record at 95.3°F and warmest average low temperature on record at 82.5°F. Nine daily heat records were tied/broken. The airport registered 0.17" of rain during June good for seventeenth wettest on record.

July Recap/Notable Events:

- A favorable setup aided by a passing inverted trough led multiple waves of strong thunderstorms moving down off the higher terrain into the lower deserts of Maricopa County July 14th through the 16th. Anywhere from 1.00"-2.00" fell across the majority of the region.
- A high-grade monsoon pattern strongly aided by a slow-moving inverted trough led to widespread heavy rain across southcentral Arizona during a four-day period ending on

the 25th. Maricopa County rain gages measured event totals anywhere from 1.00"-5.30" (see Figure 4, below). Residents in Phoenix, Scottsdale, New River, Glendale, Avondale, Surprise, Buckeye, and many other communities experienced significant flash and urban flooding due to heavy rain from this event. A complete storm overview of this event was generated by the FCDMC and can be viewed [here](#).

- According to the NWS Phoenix WFO, Sky Harbor Airport registered 1.73" of rain during the month good for seventeenth wettest on record. The average high temperature of 103.7°F tied for thirty-seventh coolest on record. Two daily rainfall records were also set on the 3rd and 23rd respectively.



August Recap/Notable Events:

- A high-grade Rim to Valley monsoon pattern led to the development of organized clusters of severe thunderstorms that rolled across the greater Phoenix Valley during the evening of 13th before continuing into Gila Bend during the early morning hours on the 14th. Maricopa County rain gauges measured event totals anywhere from 1.00"-3.95". There were reports of urban flooding in Fountain Hills, Mesa, and Phoenix and the Town of Gila Bend experienced significant flash flooding due to runoff along Sand Tank Wash and other local washes. A complete storm overview of this event was generated by the FCDMC and can be viewed [here](#).
- A southwesterly flow transition event occurred on the 18th that lead to significant rainfall totals across north central Maricopa County. Noteworthy flooding occurred in Camp Creek, Cave Creek, Galloway Wash along with other rivers/washes in the region. A

complete storm overview of this event was generated by the NWS Phoenix WFO and can be viewed [here](#).

- According to the NWS Phoenix WFO, Sky Harbor Airport registered 1.54" of rain during the month good for twenty-sixth wettest on record. The average temperature of 92.6°F was the thirty-fourth warmest on record.

September Recap/Notable Events:

- An early season trough brought localized areas of heavy rain and flooding to the Phoenix Valley on the 1st. Anywhere from 0.50"-1.50" fell across northern portions of the County as well as southern Phoenix and far east Valley.
- According to the NWS Phoenix WFO, Sky Harbor Airport registered 0.76" of rain for the month good for forty-fifth wettest on record. The average temperature of 89.2°F tied for nineteenth warmest on record. A new record daily high of 111°F was set on the 9th.

MSP Issued Products Recap:

A total of two hundred twenty-six forecast zone-specific messages were issued by the MSP spread across twenty-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 - 2021 Monsoon Season					
Forecast Zone	June	July	August	September	Total
Gila Bend	0	3	3	1	7
Gila River	0	7	5	1	13
Palo Verde	0	2	2	1	5
Rainbow Valley	0	2	6	2	10
West Valley	0	8	6	2	16
Northwest Valley	0	8	3	1	12
Upper Centennial	0	5	5	2	12
Wickenburg	0	8	5	2	15
New River/Cave Creek	0	8	4	2	14
Phoenix North	0	9	6	1	16
Phoenix South	0	8	9	2	19
Scottsdale North	0	6	10	1	17
Scottsdale South	0	9	7	2	18
East Valley	0	9	9	2	20
Southeast Valley	0	7	6	1	14
Lower Salt River Lakes	0	2	3	0	5
Superstition	0	6	6	1	13
All Zones	0	107	95	24	226

Of the two hundred twenty-six Messages issued, one hundred sixty-two were Message-1 Alerts, forty-six were Message-2 Flash Flood Watches, eighteen were 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. Thirty-two 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.

TABLE 2: MSP Lake Alerts Issued - 2021 Monsoon Season

Recreational Zone	June	July	August	September	Total
Lake Pleasant	1	5	4	1	11
Horseshoe Lake	0	0	0	0	0
Bartlett Lake	1	3	2	0	6
Saguaro Lake	0	4	2	0	6
Canyon Lake	0	4	2	0	6
Apache Lake	0	1	2	0	3
All Zones	2	17	12	1	32

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 2021 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:

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

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:

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

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:

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

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 ≥ 40% and QPF ≥ 0.50” AND Observed Rain < 0.50”
Probability = 30% and QPF ≥ 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 > 30mph, 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 25%. Conversely a miss was assigned if the percent error was greater than 25%. 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 83%. Forecast accuracy remained above the 72% threshold for each FZ. Furthermore, eleven out of the seventeen FZs accuracy was above 80% with Rainbow Valley coming in the highest at 91.7%. An early start to the monsoon onset and very wet July, August, and September likely assisted in lowering the overall forecast accuracy for each of the FZs.

TABLE 3: MSP Weather Outlook Verification - SEASON TOTALS, 2021

Forecast Zone	Accurate Forecasts	AOF (%)	Sig. Events Detected	POD (%)	False Alarms	FAR (%)	TS (%)
Gila Bend	81/108	75%	18/27	66.7%	2/108	1.9%	63.3%
Gila River	93/108	86.1%	14/18	77.8%	1/108	0.9%	79.5%
Palo Verde	91/108	84.3%	15/21	71.4%	3/108	2.8%	75%
Rainbow Valley	99/108	91.7%	19/24	79.2%	1/108	0.9%	87.2%
West Valley	94/108	87%	18/22	81.8%	0/108	0%	81.8%
Northwest Valley	86/108	79.6%	12/15	80%	4/108	3.7%	67.9%
Upper Centennial	82/108	75.9%	22/28	78.6%	5/108	4.6%	62.2%
Wickenburg	78/108	72.2%	18/21	85.7%	5/108	4.6%	57.3%
New River/Cave Creek	85/108	78.7%	26/26	100%	8/108	7.4%	63.5%
Phoenix North	92/108	85.2%	19/21	90.5%	4/108	3.7%	75.3%
Phoenix South	95/108	88%	16/19	84.2%	3/108	2.8%	80%
Scottsdale North	88/108	81.5%	22/23	95.7%	4/108	3.7%	70.4%
Scottsdale South	94/108	87%	15/18	83.3%	3/108	2.8%	78.8%
East Valley	95/108	88%	17/20	85%	4/108	3.7%	79%
Southeast Valley	91/108	84.3%	17/18	94.4%	5/108	4.6%	73.2%
Lower Salt River Lakes	86/108	79.6%	23/25	92%	7/108	6.5%	65.5%
Superstition	93/108	86.1%	25/26	96.2%	6/108	5.6%	74.7%
All Zones	1523/1836	83%	318/372	85.5%	65/1836	3.5%	72.5%

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 85.5%. In general, a POD of over 50% is considered sufficient and over 75% excellent in the forecast community. Fifteen out of the seventeen FZs were above the 75% accuracy threshold with six meeting or exceeding the 90% accuracy threshold. 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 exceptional at 3.5% with none of the forecast zones exceeding 8%.

The final metric included in Table 2 was Threat Score (TS). The monsoon season officially runs from June 15th through September 30th 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 thirty-one dry days were removed from 108-day total length of the monsoon season. Overall, forecast skill was very good at 72.5% for all FZs over the length of the active season. Eight of the seventeen FZs met or exceeded the 75% accuracy threshold, while the remaining three FZs remained above 57%.

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 two hundred nineteen 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 94.1%. Fifteen out of seventeen FZs met or exceeded the 75% accuracy threshold with thirteen exceeding 90%. The lowest accuracy was observed at Gila Bend Forecast Zone at 42.9% and Lower Salt River Lakes Forecast Zone at 60%.

Overall, it ended up being a very active and wetter than normal Monsoon. As a result, the total number of qualifying messages issued on the season (219) significantly exceed the seasonal average of 132 (based on MSP Verification Reports since 2012). Despite the early onset, no messages were issued during the month of June. July was the busiest month with one 107 messages issued across fourteen operationally significant days. The first messages of the season were issued on the evening of July 3rd for most of the central Valley and all seven verified. July 22nd-25th was the most active multi-day event with thirty-six messages issued and all but four verified. Overall, forecast accuracy for the month across all zones was very good at 92.5%.

Ninety-three messages were issued in August spread out across eleven operationally significant days. Remarkably, forecast accuracy for the month across all FZs combined improved to 95.7%. 80% of the messages issued (74) for the month came during a very active nine day stretch spanning the 10th-18th. Seventy-three of those messages verified. August 13th was the busiest day of the month with seventeen messages issued, and they all verified.

September saw a sharp decrease in the total number of messages issued (19), but overall forecast accuracy for the month remained very good at 94.7%. Issued messages were spread across three operationally significant days. September 1st was the busiest day of the month and nearly the season with fifteen messages issued. All but one verified.

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 forty-five minutes. The average lead time for M-2 Flash Flood Watches was just over thirty-four hours.

TABLE 4: MSP Issued Statements Verification, broken down by month and Forecast Zone - Monsoon Season 2021

	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	1/3	33.3%	1/3	33.3%	1/1	100%	3/7	42.9%
Gila River	0/0	n/a	7/7	100%	5/5	100%	1/1	100%	13/13	100%
Palo Verde	0/0	n/a	1/2	50%	2/2	100%	1/1	100%	4/5	80%
Rainbow Valley	0/0	n/a	2/2	100%	5/5	100%	1/1	100%	8/8	100%
West Valley	0/0	n/a	8/8	100%	5/5	100%	1/1	100%	14/14	100%
Northwest Valley	0/0	n/a	8/8	100%	3/3	100%	1/1	100%	12/12	100%
Upper Centennial	0/0	n/a	4/5	80%	5/5	100%	2/2	100%	11/12	91.7%
Wickenburg	0/0	n/a	8/8	100%	5/5	100%	1/2	50%	14/15	93.3%
New River/Cave Creek	0/0	n/a	8/8	100%	4/4	100%	2/2	100%	14/14	100%
Phoenix North	0/0	n/a	9/9	100%	6/6	100%	1/1	100%	16/16	100%
Phoenix South	0/0	n/a	8/8	100%	9/9	100%	1/1	100%	18/18	100%
Scottsdale North	0/0	n/a	5/6	83.3%	9/10	90%	1/1	100%	15/17	88.2%
Scottsdale South	0/0	n/a	9/9	100%	7/7	100%	1/1	100%	17/17	100%
East Valley	0/0	n/a	8/9	88.9%	9/9	100%	1/1	100%	18/19	94.7%
Southeast Valley	0/0	n/a	7/7	100%	6/6	100%	1/1	100%	14/14	100%
Lower Salt River Lakes	0/0	n/a	0/2	0%	3/3	100%	0/0	n/a	3/5	60%
Superstition	0/0	n/a	6/6	100%	5/6	83.3%	1/1	100%	12/13	92.3%
All Zones	0/0	n/a	99/107	92.5%	89/93	95.7%	18/19	94.7%	206/219	94.1%

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 thirty-two lake alerts issued over the length of the season with the majority of them occurring in July and August (29). 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 87.5%. All five zones met or exceeded the 75% accuracy threshold with the lowest forecast accuracy of 81.8% recorded at Lake Pleasant. 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 twenty-six minutes.

TABLE 5: MSP Lake Alerts Issued - 2021 Monsoon Season

Recreational Zone	June		July		August		September		Season Totals	
	Correct Alerts	AOF (%)	Correct Alerts	AOF (%)	Correct Alerts	AOF (%)	Correct Alerts	AOF (%)	Correct Alerts	AOF (%)
Lake Pleasant	1/1	100%	5/5	100%	2/4	50%	1/1	100%	9/11	81.8%
Horseshoe Lake	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a
Bartlett Lake	1/1	100%	3/3	100%	2/2	100%	0/0	n/a	6/6	100%
Saguaro Lake	0/0	n/a	3/4	75%	2/2	100%	0/0	n/a	5/6	83.3%
Canyon Lake	0/0	n/a	3/4	75%	2/2	100%	0/0	n/a	5/6	83.3%
Apache Lake	0/0	n/a	1/1	100%	2/2	100%	0/0	n/a	3/3	100%
All Zones	2/2	100%	15/17	88.2%	10/12	83.3%	1/1	100%	28/32	87.5%

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 “+/-” 25 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 one hundred twenty-two qualifying message events that counted towards the verification of the STP forecasts and one hundred one events fell within the error threshold.

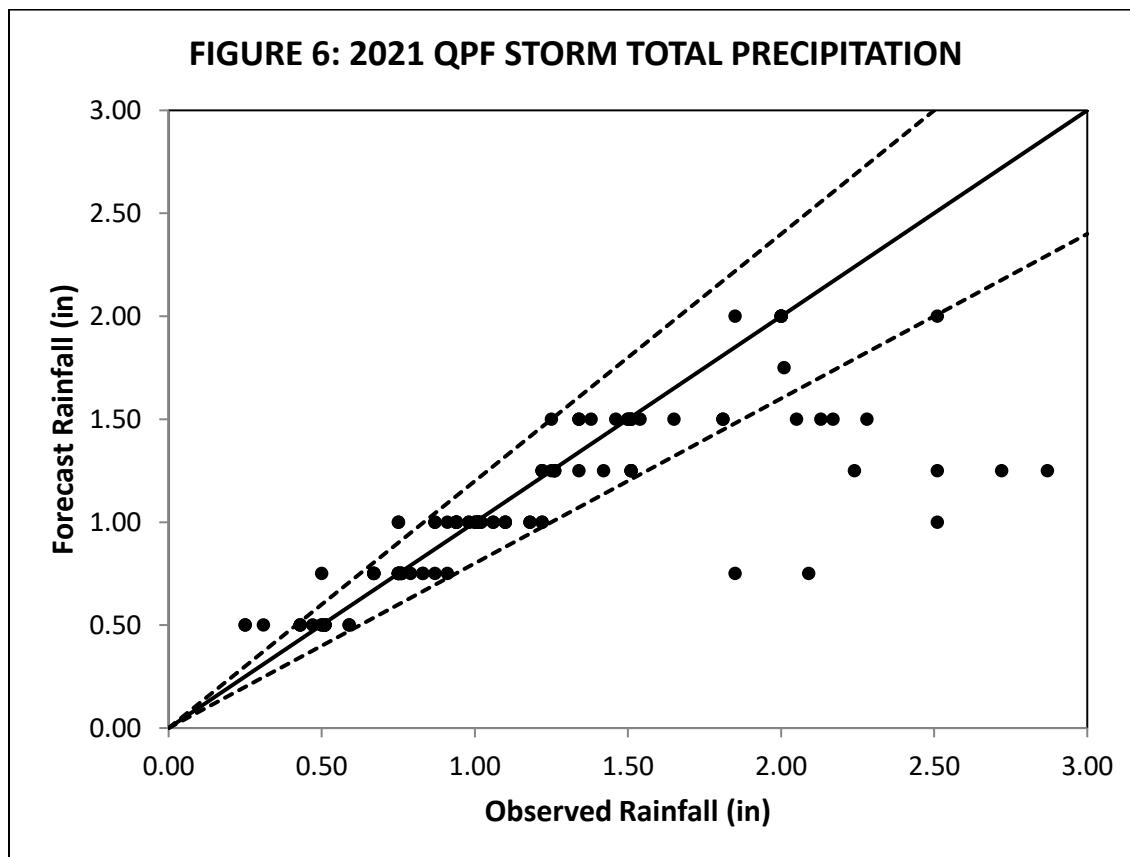


Table 7, on the next page, shows the issued message verification broken down by FZ and month. Complete data tables for each FZ can be viewed in [Appendix E](#): Table E-1. Forecast accuracy for all FZs combined, over the length of the season, was 82.8%. Figure 6 above clearly shows that the majority of missed events over the course of the monsoon tended to be

under-forecast (forecast rainfall value < observed rainfall value) by the MSP. There were no qualifying events in June. Accuracy in July came in at 84.6% across fifty-two qualifying events spread over fourteen storm days. There were no events in Palo Verde, Rainbow Valley, and Lower Salt River Lakes FZs. Of the remaining fourteen zones, twelve stayed at or above the 75% accuracy threshold. Accuracy in August dipped down to 76.5% across fifty-one events spread over eleven storm days. There were no events in the Palo Verde FZ. Of the remaining sixteen zones, eleven stayed at or above 75% accuracy threshold. Seven of the twelve misses for the month were spread across Gila Bend, New River/Cave Creek, and Southeast Valley FZs where the combined forecast accuracy was 0%. Accuracy in September jumped up to 94.7% across nineteen events spread across three storm days. Forecast accuracy was 100% at fifteen of the sixteen FZs with qualifying events. Wickenburg had the lowest accuracy for the month at 50%.

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 2021

Forecast Zone	June		July		August		September		Season Totals	
	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)
Gila Bend	0/0	n/a	1/1	100%	0/2	0%	1/1	100%	2/4	50%
Gila River	0/0	n/a	3/4	75%	2/3	66.7%	1/1	100%	6/8	75%
Palo Verde	0/0	n/a	0/0	n/a	0/0	n/a	1/1	100%	1/1	100%
Rainbow Valley	0/0	n/a	0/0	n/a	2/2	100%	1/1	100%	3/3	100%
West Valley	0/0	n/a	2/3	66.7%	3/3	100%	1/1	100%	6/7	85.7%
NW Valley	0/0	n/a	4/5	80%	1/1	100%	1/1	100%	6/7	85.7%
Upper Centennial	0/0	n/a	2/2	100%	3/3	100%	2/2	100%	7/7	100%
Wickenburg	0/0	n/a	3/3	100%	2/2	100%	1/2	50%	6/7	85.7%
New River/Cave Creek	0/0	n/a	3/4	75%	0/2	0%	2/2	100%	5/8	62.5%
Phoenix North	0/0	n/a	5/6	83.3%	3/3	100%	1/1	100%	9/10	90%
Phoenix South	0/0	n/a	3/3	100%	7/7	100%	1/1	100%	11/11	100%
Scottsdale North	0/0	n/a	4/4	100%	2/5	40%	1/1	100%	7/10	70%
Scottsdale South	0/0	n/a	4/5	80%	5/5	100%	1/1	100%	10/11	90.9%
East Valley	0/0	n/a	3/5	60%	6/6	100%	1/1	100%	10/12	83.3%
Southeast Valley	0/0	n/a	4/4	100%	0/3	0%	1/1	100%	5/8	62.5%
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	3/3	100%	3/4	75%	1/1	100%	7/8	87.5%
All Zones	0/0	n/a	44/52	84.6%	39/51	76.5%	18/19	94.7%	101/122	82.8%

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 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 2021 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 83%, probability of detection was 85.5%, the false alarm rate was 3.5%, and the Threat Score was 72.5%. All metrics fell into the “excellent” category except for Threat Score, 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 94.1%. Any value of over 75% is considered “excellent” within the forecast community. Forecast skill was consistent across July (92.5%) and August (95.7%) with over ninety qualifying messages each month. September saw a sharp decreased in the total number of messages issued to nineteen, but overall forecast accuracy for the month remained very high at 94.7%. The average lead time for all M-1 Alerts over the length of the Monsoon season was forty-five minutes. The average lead time for M-2 Flash Flood Watches was just over thirty-four hours. Both lead time metrics were on above average when compared 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 87.5% spread across thirty-two 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 twenty-six minutes, which is above average when compared 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 82.8%. Seventeen of the twenty-one missed events resulted from under-predicting storm total rainfall amounts, which showed a clear bias that was last present in 2015.

TABLE 8: Historic Monsoon Season Verification Comparison										
Year	Outlooks				Messages		Lake Alerts		QPF STP	
	AOF	POD	FAR	TS	Events	AOF	Events	AOF	Events	AOF
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%
2021	83.0%	85.5%	3.5%	72.5%	219	92.7%	32	87.5%	122	82.8%
AVG	83.1%	75.9%	3.6%	74.8%	132.3	87.4%	40	86.4%	68.9	83.7%

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 worsened in 2021 when compared to 2020-2018. However, 2021 was much more active from an operational perspective (operationally significant events, storm days, products issued). Furthermore, these products were in line or better than the long term average. It was worth noting probability of detection was the best of any of the previous years sampled.

Forecast skill for issued messages has continued to improve since the 2017 season and was the highest value since we've been keeping records. This was even more impressive when viewing the significant rise in qualifying events from recent years and the longer term average. Regarding issued messages, this was the second busiest season only falling short of 2014. Forecast accuracy for Lake Alerts improved slightly from the previous three years and came in above the longer term average of 86.4%, while also showing a jump in total number of issued alerts. STP skill came in just below the long term average, but it was worth noting this very active season had nearly double the number of qualifying events. STP saw the largest number of qualifying events this summer and forecast skill still came in well above the 75% threshold.

When all was said and done, the 2021 monsoon season was considered well above normal in terms of active days and rainfall. The season also recorded the second most number of products issued by the MSP. It is hoped that this report will serve 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 2021 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 measurable 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 2021														
	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
Gila Bend								Gila River						
06/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/21	20	0.15	0.43	0.51-0.75	m	m	-	20	0.15	0.04	0.26-0.50	h	-	-
06/23/21	20	0.25	0.08	1.26-1.50	m	m	-	20	0.25	0.04	0.11-0.25	h	-	-
06/24/21	10	0.50	0.00	0.05-0.10	m	-	-	10	0.25	0.00	0.00	h	-	-
06/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/21	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 2021														
	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
06/27/21	0	0.00	0.04	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/21	0	0.00	0.04	0.51-0.75	m	-	-	0	0.00	0.00	0.00	h	-	-
06/29/21	20	0.25	0.00	1.51-2.00	m	m	-	20	0.25	0.00	0.00	m	-	-
06/30/21	10	0.50	0.20	0.51-0.75	h	h	-	10	0.25	0.00	0.00	h	-	-
16 days					11	1/4	0					15	0/0	0
07/01/21	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.26-0.50	m	-	-
07/02/21	40	1.00	0.00	0.26-0.50	m	-	x	30	0.50	0.00	0.00	m	-	-
07/03/21	30	1.00	0.43	0.51-0.75	h	h	-	30	0.75	0.47	1.51-2.00	h	h	-
07/04/21	0	0.00	0.00	0.05-0.10	m	-	-	0	0.00	0.00	0.00	h	-	-
07/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/21	10	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/21	20	0.50	0.04	0.26-0.50	h	-	-	10	0.75	0.08	0.51-0.75	h	h	-
07/10/21	30	0.50	0.00	0.51-0.76	h	h	-	30	0.75	0.20	0.51-0.76	h	h	-
07/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/21	10	0.50	0.00	0.11-0.25	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/21	20	0.50	0.00	0.51-0.75	h	h	-	30	0.75	0.47	1.51-2.00	h	h	-
07/14/21	0	0.00	0.04	1.01-1.25	m	m	-	0	0.00	0.04	1.01-1.25	m	m	-
07/15/21	0	0.00	0.00	0.51-0.75	m	m	-	0	0.00	0.51	0.51-0.75	m	m	-
07/16/21	0	0.00	1.42	1.01-1.25	m	m	-	20	0.50	0.00	0.26-0.50	h	-	-
07/17/21	20	0.25	0.00	0.11-0.25	h	-	-	20	0.25	0.00	0.00	m	-	-
07/18/21	20	0.25	0.00	0.26-0.50	h	-	-	10	0.25	0.08	0.11-0.25	h	-	-
07/19/21	20	0.50	0.04	0.76-1.00	h	h	-	10	0.25	0.00	0.05-0.10	h	-	-
07/20/21	20	0.50	0.04	0.76-1.00	h	h	-	10	0.25	0.00	0.00	h	-	-
07/21/21	30	1.00	0.08	0.11-0.25	m	-	x	10	0.50	0.00	0.26-0.50	h	-	-
07/22/21	40	1.00	0.24	1.26-1.50	h	h	-	40	0.50	0.94	2.51-3.00	m	h	-
07/23/21	40	1.00	0.31	1.01-1.25	h	h	-	40	1.25	1.10	1.51-2.00	h	h	-
07/24/21	40	0.75	0.35	3.01-4.00	m	h	-	40	0.75	0.12	2.01-2.50	m	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
07/25/21	50	0.50	0.04	0.26-0.50	h	-	-	10	0.50	0.04	0.11-0.25	m	-	-
07/26/21	0	0.00	0.00	0.11-0.25	m	-	-	0	0.00	0.00	0.00	h	-	-
07/27/21	10	0.50	0.00	0.51-0.75	h	h	-	10	0.25	0.00	0.00	h	-	-
07/28/21	10	0.25	0.24	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/21	40	0.25	1.38	1.51-2.00	m	m	-	30	0.25	0.00	0.00	m	-	-
07/30/21	50	0.75	0.24	2.51-3.00	m	h	-	30	0.75	0.31	1.001-1.25	h	h	-
07/31/21	10	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					21	10/14	2					22	8/10	0
08/01/21	10	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/21	0	0.00	0.00	0.26-0.50	m	-	-	0	0.00	0.00	0.00	h	-	-
08/08/21	10	0.25	0.04	2.01-2.50	m	m	-	0	0.00	0.00	0.11-0.25	m	-	-
08/09/21	40	0.75	1.30	4.01-5.00	m	h	-	40	0.50	0.55	1.01-1.25	h	h	-
08/10/21	40	0.50	0.16	0.26-0.50	h	-	-	20	0.75	0.35	0.76-1.00	h	h	-
08/11/21	20	0.50	0.55	0.5-0.75	h	h	-	10	0.25	0.00	0.11-0.25	h	-	-
08/12/21	40	0.75	0.04	0.51-0.75	h	h	-	10	0.75	0.00	0.26-0.50	h	-	-
08/13/21	30	2.50	3.94	3.01-4.00	h	h	-	30	2.50	1.26	2.01-2.50	h	h	-
08/14/21	20	0.15	0.00	0.00	m	-	-	20	0.15	0.00	0.05-0.10	h	-	-
08/15/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.08	0.11-0.25	h	-	-
08/16/21	50	0.50	0.00	0.26-0.50	h	-	-	50	1.00	0.24	1.01-1.25	h	h	-
08/17/21	0	0.00	0.00	0.00	h	-	-	40	1.00	0.12	0.11-0.25	m	-	x
08/18/21	20	0.50	0.00	0.00	m	-	-	30	0.75	0.39	1.51-2.00	h	h	-
08/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/21/21	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 2021														
	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
08/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/21	0	0.00	0.00	0.51-0.75	m	m	-	0	0.00	0.00	0.00	h	-	-
08/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/21	10	0.10	0.04	0.05-0.10	h	-	-	10	0.25	0.00	0.51-0.75	m	m	-
08/30/21	10	0.50	1.10	3.01-4.00	m	h	-	10	0.50	0.04	0.26-0.50	h	-	-
08/31/21	40	0.50	0.00	0.26-0.51	h	-	-	50	0.50	0.16	0.26-0.50	h	-	-
31 days					24	5/7	0					28	5/6	1
09/01/21	10	0.10	0.08	0.05-0.10	h	-	-	20	0.50	0.98	3.01-4.00	m	h	-
09/02/21	10	0.50	0.00	0.76-1.00	h	h	-	0	0.00	0.00	0.00	h	-	-
09/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/21	0	0.00	0.00	0.26-0.50	m	-	-	0	0.00	0.00	0.00	h	-	-
09/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/21	30	0.10	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
09/18/21	0	0.00	0.28	0.26-0.50	m	-	-	0	0.00	1.02	1.01-1.25	m	m	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021

	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
09/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/21	30	0.50	1.34	2.51-3.00	m	h	-	20	0.25	0.00	0.11-0.25	h	-	-
09/24/21	10	0.10	0.00	0.05-0.10	h	-	-	10	0.10	0.00	0.00	h	-	-
09/25/21	30	0.50	0.00	0.26-0.50	h	-	-	20	0.50	0.16	0.26-0.50	h	-	-
09/26/21	10	0.25	0.00	0.11-0.25	h	-	-	60	0.10	0.04	0.11-0.25	h	-	-
09/27/21	10	0.10	0.00	0.05-0.10	h	-	-	10	0.10	0.04	0.11-0.25	h	-	-
09/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/21	10	0.25	0.00	1.26-1.50	m	m	-	0	0.00	0.00	0.00	h	-	-
09/30/21	10	0.25	0.00	0.25-0.50	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					25	2/2	0					28	1/2	0

	Palo Verde					Rainbow Valley								
06/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/21	20	0.15	0.00	0.11-0.25	h	-	-	20	0.15	0.04	0.26-0.50	h	-	-
06/23/21	20	0.25	0.00	0.05-0.10	h	-	-	20	0.25	0.04	0.11-0.25	h	-	-
06/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/21	0	0.00	0.00	0.11-0.25	m	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
06/29/21	20	0.25	0.00	0.11-0.25	h	-	-	20	0.25	0.00	0.11-0.25	h	-	-
06/30/21	10	0.25	0.16	0.26-0.50	h	-	-	10	0.25	0.00	0.00	h	-	-
16 days					15	0/0	0					16	0/0	0
07/01/21	10	0.25	0.00	0.26-0.50	h	-	-	10	0.25	0.35	0.51-0.75	m	m	-
07/02/21	40	1.00	0.00	0.11-0.25	m	-	x	30	0.75	0.00	0.00	m	-	x
07/03/21	30	0.75	0.28	0.26-0.50	h	-	-	30	0.75	0.43	1.51-2.00	h	h	-
07/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/21	20	0.50	0.00	0.05-0.10	m	-	-	20	0.50	0.00	0.11-0.25	h	-	-
07/10/21	20	0.50	0.00	0.00	m	-	-	10	0.50	0.12	0.26-0.50	h	-	-
07/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/13/21	20	0.50	0.08	0.51-0.75	h	h	-	30	0.75	0.24	0.76-1.00	h	h	-
07/14/21	0	0.00	0.00	1.50-2.00	m	m	-	0	0.00	0.00	0.00	h	-	-
07/15/21	0	0.00	0.00	0.11-0.25	m	-	-	0	0.00	0.00	0.00	h	-	-
07/16/21	0	0.00	0.04	0.76-1.00	m	m	-	0	0.00	0.83	1.26-1.50	m	m	-
07/17/21	10	0.25	0.04	0.26-0.50	h	-	-	10	0.25	0.00	0.11-0.25	h	-	-
07/18/21	10	0.50	0.28	0.76-1.00	h	h	-	10	0.75	0.28	0.76-1.00	h	h	-
07/19/21	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.11-0.25	h	-	-
07/20/21	10	0.25	0.00	0.05-0.10	h	-	-	10	0.25	0.00	0.11-0.25	h	-	-
07/21/21	20	0.75	1.10	1.26-1.50	h	h	-	20	0.50	0.12	0.51-0.75	h	h	-
07/22/21	30	0.75	0.00	0.00	m	-	x	30	0.75	0.12	0.76-1.00	h	h	-
07/23/21	40	1.00	0.67	0.76-1.00	h	h	-	40	1.00	0.91	1.01-1.25	h	h	-
07/24/21	50	0.75	0.51	0.76-1.00	h	h	-	40	0.75	1.93	2.01-2.50	m	h	-
07/25/21	50	0.50	0.31	0.26-0.50	h	-	-	40	0.50	1.02	0.76-1.00	h	h	-
07/26/21	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 2021														
	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
07/27/21	0	0.00	0.00	1.51-2.00	m	m	-	0	0.00	0.00	0.00	h	-	-
07/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/21	40	0.25	0.00	2.01-2.50	m	m	-	40	0.25	0.35	0.51-0.75	h	-	-
07/30/21	50	0.75	1.06	2.01-2.50	h	h	-	50	0.75	0.04	0.51-0.75	h	h	-
07/31/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					22	6/10	2					27	9/11	1
08/01/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/21	20	0.75	0.35	0.51-0.75	h	h	-	20	0.50	0.39	0.76-1.00	h	h	-
08/10/21	30	0.25	0.16	0.26-0.50	h	-	-	20	0.25	0.00	0.00	m	-	-
08/11/21	10	0.75	0.71	1.51-2.00	h	h	-	20	1.00	0.31	2.01-2.50	h	h	-
08/12/21	30	0.75	0.28	0.51-0.75	h	h	-	30	0.75	0.31	0.51-0.75	h	h	-
08/13/21	40	2.50	2.44	2.01-2.50	h	h	-	40	2.50	1.42	1.51-2.00	h	h	-
08/14/21	20	0.50	0.47	1.01-1.25	h	h	-	20	0.50	0.35	0.76-1.00	h	h	-
08/15/21	10	0.25	0.08	0.51-0.75	m	m	-	10	0.25	0.24	0.26-0.50	h	-	-
08/16/21	40	1.00	0.59	0.76-1.00	h	h	-	40	1.00	0.87	0.76-1.00	h	h	-
08/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/18/21	20	0.75	0.00	0.00	m	-	-	20	0.75	0.75	1.01-1.25	h	h	-
08/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/21	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 2021														
	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
08/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.51-0.75	m	m	-
08/30/21	10	0.50	0.08	0.76-1.00	h	h	-	10	0.50	0.08	0.51-0.75	h	h	-
08/31/21	40	0.50	0.00	0.11-0.25	m	-	x	50	0.50	0.08	0.26-0.50	h	-	-
31 days					28	7/8	1					29	8/9	0
09/01/21	20	0.40	0.87	1.51-2.00	m	m	-	20	0.50	1.50	1.51-2.00	m	h	-
09/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/21	0	0.00	0.00	0.26-0.50	m	-	-	0	0.00	0.00	0.51-0.75	m	m	-
09/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/21	20	0.10	0.00	0.00	m	-	-	20	0.25	0.00	0.26-0.50	h	-	-
09/18/21	0	0.00	0.00	0.00	h	-	-	0	0.00	1.01	0.51-0.75	m	m	-
09/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/21	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 2021														
	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
09/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/21	30	0.50	0.20	5.00-6.00	m	h	-	20	0.50	0.04	0.51-0.75	h	h	-
09/24/21	10	0.10	0.04	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
09/25/21	30	0.75	0.08	0.76-1.00	h	h	-	20	0.10	0.12	0.11-0.25	h	-	-
09/26/21	20	0.25	0.12	0.11-0.25	h	-	-	30	0.10	0.12	0.11-0.25	h	-	-
09/27/21	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.11-0.25	h	-	-
09/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/21	10	0.25	0.08	0.26-0.50	h	-	-	10	0.10	0.00	0.00	h	-	-
09/30/21	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
30 days					26	2/3	0					27	2/4	0

	West Valley						Northwest Valley							
06/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/21	20	0.15	0.04	0.26-0.50	h	-	-	30	0.25	0.04	0.26-0.50	h	-	-
06/23/21	20	0.25	0.04	0.05-0.10	h	-	-	30	0.50	0.00	0.00	m	-	-
06/24/21	0	0.00	0.00	0.05-0.10	m	-	-	10	0.25	0.00	0.11-0.25	h	-	-
06/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/21	10	0.15	0.00	0.11-0.25	h	-	-	10	0.25	0.00	0.11-0.25	h	-	-
06/29/21	20	0.25	0.00	0.11-0.25	h	-	-	30	0.35	0.00	0.00	m	-	-
06/30/21	20	0.25	0.12	0.11-0.25	h	-	-	20	0.35	0.00	0.00	m	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
16 days					15	0/0	0					13	0/0	0
07/01/21	10	0.25	0.04	0.76-1.00	m	m	-	10	0.25	0.00	0.26-0.50	h	-	-
07/02/21	20	0.75	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
07/03/21	30	0.50	0.63	1.26-1.50	h	h	-	30	0.75	1.42	1.51-2.00	h	h	-
07/04/21	0	0.00	0.00	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
07/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/21	0	0.00	0.12	0.26-0.50	m	-	-	0	0.00	0.00	0.00	h	-	-
07/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/21	0	0.00	0.00	0.00	h	-	-	10	0.35	0.00	0.00	h	-	-
07/13/21	30	0.75	0.63	1.51-2.00	h	h	-	30	1.00	0.51	1.01-1.25	h	h	-
07/14/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.04	0.05-1.10	h	-	-
07/15/21	0	0.00	0.20	2.51-3.00	m	m	-	0	0.00	0.98	1.26-1.50	m	m	-
07/16/21	10	0.50	1.46	1.51-2.00	m	h	-	10	0.50	0.83	3.01-4.00	m	h	-
07/17/21	10	0.25	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
07/18/21	10	0.75	0.24	1.26-1.50	h	h	-	20	0.25	0.12	0.11-0.25	h	-	-
07/19/21	10	0.25	0.04	0.05-0.10	h	-	-	10	0.75	0.08	0.26-0.50	h	-	-
07/20/21	10	0.25	0.00	0.00	m	-	-	10	0.75	0.00	0.00	m	-	-
07/21/21	10	0.50	0.12	0.51-0.75	h	h	-	20	0.75	0.12	0.51-0.75	h	h	-
07/22/21	30	0.75	0.04	0.26-0.50	h	-	-	50	1.00	0.98	2.01-2.50	h	h	-
07/23/21	40	1.00	0.67	0.76-1.00	h	h	-	50	0.50	0.47	0.51-0.75	h	h	-
07/24/21	40	0.75	2.72	4.01-5.00	m	h	-	60	1.25	2.64	4.01-5.00	m	h	-
07/25/21	30	0.50	1.02	1.51-2.00	h	h	-	10	0.50	0.20	0.26-0.50	h	-	-
07/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
07/29/21	30	0.25	0.24	0.51-0.75	h	-	-	20	0.25	0.31	0.51-0.75	m	m	-
07/30/21	40	0.50	1.30	1.26-1.50	h	h	-	30	0.50	0.94	1.51-2.00	h	h	-
07/31/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
31 days					24	9/11	0					24	8/10	0
08/01/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/21	30	1.00	0.28	0.76-1.00	h	h	-	40	0.75	0.00	0.51-0.75	h	h	-
08/10/21	30	0.50	0.00	0.00	m	-	-	40	0.50	0.00	0.11-0.25	m	-	x
08/11/21	0	0.00	0.98	2.01-2.50	m	m	-	10	0.75	1.89	1.51-2.00	h	h	-
08/12/21	20	0.75	0.04	0.51-0.75	h	h	-	20	0.75	0.00	0.00	m	-	-
08/13/21	50	2.50	2.17	2.01-2.50	h	h	-	40	2.50	2.40	2.01-2.50	h	h	-
08/14/21	20	0.50	0.08	0.51-0.75	h	h	-	20	0.15	0.00	0.11-0.25	h	-	-
08/15/21	20	0.25	0.24	0.26-0.50	h	-	-	30	0.50	0.00	0.00	m	-	-
08/16/21	40	1.00	1.73	2.01-2.50	h	h	-	50	0.50	0.00	0.11-0.25	m	-	x
08/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.26-0.50	m	-	-
08/18/21	30	0.75	0.79	1.01-1.25	h	h	-	40	1.25	0.20	0.26-0.50	m	-	x
08/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/21	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 2021														
	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
08/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/21	10	0.25	0.00	0.05-0.10	h	-	-	20	0.25	0.00	0.00	m	-	-
08/29/21	0	0.00	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/30/21	10	0.25	0.12	0.26-0.50	h	-	-	30	0.50	0.08	0.26-0.50	h	-	-
08/31/21	50	0.50	0.12	0.26-0.50	h	-	-	50	1.00	0.12	0.26-0.50	m	-	x
31 days					29	6/7	0					22	3/3	4
09/01/21	20	0.75	1.34	2.51-3.00	h	h	-	40	1.25	0.39	2.51-3.00	h	h	-
09/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/21	0	0.00	0.00	0.11-0.25	m	-	-	0	0.00	0.00	0.00	h	-	-
09/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/21	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
09/18/21	0	0.00	0.20	1.26-1.50	m	m	-	0	0.00	0.08	0.51-0.75	m	m	-
09/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/21	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 2021														
	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
09/23/21	20	0.50	0.20	2.01-2.50	m	h	-	20	0.25	0.00	0.00	m	-	-
09/24/21	10	0.10	0.00	0.05-0.10	h	-	-	10	0.25	0.08	0.26-0.50	h	-	-
09/25/21	20	0.50	0.31	0.51-0.75	h	h	-	30	0.25	0.08	0.11-0.25	h	-	-
09/26/21	40	0.50	0.35	0.26-0.50	h	-	-	90	0.50	0.43	0.26-0.50	h	-	-
09/27/21	20	0.10	0.00	0.00	h	-	-	30	0.25	0.00	0.11-0.25	h	-	-
09/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/21	20	0.10	0.00	0.00	m	-	-	30	0.25	0.00	0.00	m	-	-
09/30/21	10	0.10	0.00	0.00	h	-	-	30	0.50	0.12	0.51-0.75	h	h	-
30 days					26	3/4	0					27	1/2	0
	Upper Centennial							Wickenburg						
06/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/21	10	0.10	0.00	0.05-0.10	h	-	-	10	0.10	0.00	0.05-0.10	h	-	-
06/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/21	30	0.25	0.00	0.11-0.25	h	-	-	30	0.25	0.00	0.05-0.11	h	-	-
06/23/21	30	0.50	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
06/24/21	20	0.25	0.12	0.51-0.75	m	m	-	20	0.25	0.16	0.51-0.75	m	m	-
06/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/21	20	0.35	0.08	0.26-0.50	h	-	-	20	0.35	0.04	0.26-0.50	h	-	-
06/29/21	40	0.50	0.04	0.51-0.75	h	h	-	40	0.50	0.00	0.05-0.10	m	-	x
06/30/21	20	0.35	0.08	0.11-0.25	h	-	-	20	0.35	0.00	0.00	m	-	-
16 days					14	1/2	0					12	0/1	1
07/01/21	20	0.25	0.00	0.05-0.10	h	-	-	20	0.33	0.20	0.51-0.75	h	m	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
07/02/21	20	0.50	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
07/03/21	30	0.75	0.00	0.11-0.25	m	-	x	30	0.75	0.83	0.76-1.00	h	h	-
07/04/21	10	0.50	0.00	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
07/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/21	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/21	20	0.75	0.00	0.00	m	-	-	20	0.75	0.00	0.00	m	-	-
07/12/21	10	0.35	0.00	0.00	h	-	-	10	0.35	0.00	0.00	h	-	-
07/13/21	30	1.00	0.04	2.01-2.50	h	h	-	30	0.50	0.00	0.51-0.75	h	h	-
07/14/21	10	0.75	0.59	3.01-4.00	m	h	-	10	0.25	0.00	0.00	h	-	-
07/15/21	10	0.33	1.65	3.01-4.00	m	m	-	10	0.50	1.06	1.26-1.50	m	h	-
07/16/21	10	0.75	0.00	0.76-1.00	h	h	-	20	0.75	1.89	1.51-2.00	m	h	-
07/17/21	20	0.25	0.12	0.26-0.50	h	-	-	20	0.50	0.51	0.51-0.75	h	h	-
07/18/21	20	0.25	0.20	0.26-0.50	h	-	-	20	0.25	0.00	0.00	m	-	-
07/19/21	20	0.75	0.20	0.11-0.25	m	-	x	20	0.75	0.00	0.11-0.25	m	-	-
07/20/21	20	0.75	0.87	1.26-1.50	h	h	-	20	0.75	0.16	0.05-0.10	m	-	-
07/21/21	30	1.00	2.05	2.01-2.50	h	h	-	30	1.00	1.54	1.51-2.00	h	h	-
07/22/21	40	1.00	0.00	0.00	m	-	x	40	1.00	0.51	0.76-1.00	h	h	-
07/23/21	40	0.50	0.31	0.51-0.75	h	h	-	40	0.50	0.35	0.51-0.75	h	h	-
07/24/21	60	1.25	0.67	1.26-1.50	h	h	-	60	1.25	1.38	1.26-1.50	h	h	-
07/25/21	10	0.50	0.39	0.51-0.75	h	h	-	10	0.50	1.22	1.51-2.00	m	h	-
07/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/21	10	0.25	0.59	1.26-1.50	m	m	-	0	0.00	0.00	0.00	h	-	-
07/28/21	10	0.25	0.16	0.76-1.00	m	m	-	10	0.25	0.04	0.26-0.50	h	-	-
07/29/21	20	0.25	0.55	1.26-1.50	m	m	-	20	0.25	0.75	0.76-1.00	m	m	-
07/30/21	20	0.50	0.39	1.26-1.50	m	h	-	20	0.50	1.30	1.01-1.25	m	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
07/31/21	10	0.25	0.04	0.51-0.75	m	m	-	10	0.25	0.00	0.26-0.50	h	-	-
31 days					19	9/14	3					21	11/13	0
08/01/21	10	0.50	0.00	0.05-0.10	m	-	-	10	0.50	0.00	0.05-0.10	m	-	-
08/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/21	0	0.00	0.00	0.26-0.50	m	-	-	0	0.00	0.00	0.26-0.50	m	-	-
08/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/21	40	0.50	0.16	0.26-0.50	h	-	-	40	0.50	0.28	0.26-0.50	h	-	-
08/10/21	40	1.25	0.94	1.51-2.00	h	h	-	40	1.25	0.51	1.26-1.50	h	h	-
08/11/21	20	1.25	0.83	2.01-2.50	h	h	-	10	1.25	1.89	1.51-2.00	h	h	-
08/12/21	40	1.50	0.20	1.01-1.25	h	h	-	50	0.75	0.04	0.05-0.10	m	-	x
08/13/21	40	1.00	1.02	1.26-1.50	h	h	-	40	1.00	0.87	1.26-1.50	h	h	-
08/14/21	20	0.15	0.00	0.00	m	-		20	0.15	0.00	0.00	m	-	-
08/15/21	30	1.00	0.87	1.01-1.25	h	h	-	30	0.50	0.35	0.26-0.50	h	-	-
08/16/21	50	0.75	0.00	0.00	m	-	x	50	0.75	0.00	0.00	m	-	x
08/17/21	0	0.00	0.04	0.26-0.50	m	-	-	0	0.00	0.04	0.11-0.25	m	-	-
08/18/21	30	1.00	0.00	0.00	m	-	x	40	1.25	0.47	0.26-0.50	m	-	x
08/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/21	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 2021														
	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
08/28/21	20	0.75	0.39	0.51-0.75	h	h	-	20	0.25	0.24	0.26-0.50	h	-	-
08/29/21	20	0.75	0.51	1.26-1.50	h	h	-	20	0.25	0.00	0.00	m	-	-
08/30/21	30	1.00	0.20	0.76-1.00	h	h	-	30	1.00	0.59	0.76-1.00	h	h	-
08/31/21	50	1.00	0.67	1.01-1.25	h	h	-	60	1.00	0.08	0.11-0.25	m	-	x
31 days					25	9/9	2					22	4/4	4
09/01/21	40	0.75	0.63	0.76-1.00	h	h	-	40	1.50	0.94	1.26-1.50	h	h	-
09/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.11-0.25	m	-	-
09/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/21	20	0.25	0.00	0.11-0.25	h	-	-	20	0.10	0.00	0.00	m	-	-
09/18/21	0	0.00	0.00	0.05-0.10	m	-	-	0	0.00	0.24	0.26-0.50	m	-	-
09/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/21	20	0.50	0.28	1.26-1.50	m	h	-	20	0.50	0.00	1.26-1.50	m	h	-
09/24/21	10	0.25	0.00	0.11-0.25	h	-	-	10	0.25	0.04	0.11-0.25	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
09/25/21	50	0.10	0.00	0.00	m	-	-	50	0.10	0.04	0.05-0.10	h	-	-
09/26/21	100	0.50	0.24	0.51-0.75	h	h	-	100	0.50	0.43	0.51-0.75	h	h	-
09/27/21	30	0.25	0.00	0.00	m	-	-	30	0.25	0.00	0.00	m	-	-
09/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/21	20	0.25	0.00	0.00	m	-	-	20	0.25	0.00	0.00	m	-	-
09/30/21	30	0.25	0.00	0.00	m	-	-	30	0.25	0.00	0.00	m	-	-
30 days					24	3/3	0					23	3/3	0
	New River/Cave Creek							Phoenix North						
06/15/21	0	0.00	0.00	0.11-0.25	m	-	-	0	0.00	0.00	0.00	h	-	-
06/16/21	20	0.10	0.00	0.05-0.10	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/21	0	0.00	0.00	0.11-0.25	m	-	-	0	0.00	0.00	0.00	h	-	-
06/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/21	40	0.25	0.08	0.11-0.25	h	-	-	30	0.15	0.04	0.11-0.25	h	-	-
06/23/21	40	0.50	0.04	0.11-0.25	h	-	-	30	0.25	0.12	0.11-0.25	h	-	-
06/24/21	0	0.00	0.00	0.05-0.10	m	-	-	0	0.00	0.00	0.00	h	-	-
06/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/21	20	0.35	0.00	0.00	m	-	-	20	0.25	0.00	0.00	m	-	-
06/29/21	40	0.50	0.16	0.11-0.25	m	-	-	30	0.35	0.00	0.00	m	-	-
06/30/21	30	0.60	0.08	0.26-0.50	h	-	-	20	0.35	0.00	0.00	m	-	-
16 days					11	0/0	0					13	0/0	0
07/01/21	20	0.50	0.00	0.11-0.25	m	-	-	20	0.33	0.31	1.26-1.50	m	m	-
07/02/21	30	0.75	0.00	0.11-0.25	m	-	x	20	0.75	0.00	0.00	m	-	x
07/03/21	50	1.00	1.10	0.76-1.00	h	h	-	40	0.75	0.79	0.76-1.00	h	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
07/04/21	20	1.00	0.24	0.51-0.75	h	h	-	10	0.50	0.00	0.00	h	-	-
07/05/21	10	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/21	20	0.50	0.00	0.00	m	-	-	10	0.35	0.00	0.00	h	-	-
07/09/21	20	1.00	0.00	0.00	m	-	x	20	1.00	0.00	0.00	m	-	x
07/10/21	30	1.00	0.35	0.51-0.75	h	h	-	10	0.75	0.28	0.26-0.50	m	-	-
07/11/21	20	1.00	0.00	0.00	m	-	x	0	0.00	0.00	0.00	h	-	-
07/12/21	20	0.75	0.00	0.00	m	-	x	20	0.50	0.12	0.51-0.75	h	h	-
07/13/21	50	1.50	0.39	1.51-2.00	h	h	-	40	1.00	0.39	0.51-0.75	h	h	-
07/14/21	10	0.75	0.08	0.51-0.75	h	h	-	0	0.00	0.00	0.00	h	-	-
07/15/21	20	0.75	0.98	1.01-1.25	h	h	-	10	0.50	0.20	0.51-0.75	h	h	-
07/16/21	40	1.25	1.10	2.51-3.00	h	h	-	30	1.00	0.75	0.76-1.00	h	h	-
07/17/21	20	0.50	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
07/18/21	20	1.25	0.75	1.26-1.50	h	h	-	20	0.50	0.04	0.00	m	-	-
07/19/21	20	1.00	0.00	0.11-0.25	m	-	x	10	0.50	0.16	0.26-0.50	h	-	-
07/20/21	20	1.00	0.00	0.00	m	-	x	10	0.50	0.00	0.00	h	-	-
07/21/21	30	1.00	0.31	0.51-0.75	h	h	-	20	0.75	0.08	0.26-0.50	m	-	x
07/22/21	60	1.50	2.28	2.01-2.50	h	h	-	50	1.00	1.34	2.01-2.50	h	h	-
07/23/21	80	2.00	2.99	5.01-6.00	h	h	-	70	1.50	0.98	1.01-1.25	h	h	-
07/24/21	70	1.50	1.18	1.51-2.00	h	h	-	50	1.25	1.85	2.51-3.00	h	h	-
07/25/21	30	1.25	1.06	1.26-1.50	h	h	-	30	1.25	0.71	0.76-1.00	h	h	-
07/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/21	10	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/21	40	0.75	1.22	1.26-1.50	h	h	-	40	0.50	0.08	0.11-0.25	h	-	-
07/30/21	30	0.50	0.94	1.01-1.25	h	h	-	30	0.50	0.94	1.51-2.00	h	h	-
07/31/21	10	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					22	15/15	6					24	10/11	3

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
08/01/21	10	0.50	0.00	0.26-0.50	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/21	0	0.00	0.04	0.26-0.50	m	-	-	0	0.00	0.00	0.00	h	-	-
08/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/21	40	0.75	0.00	0.10-0.25	m	-	x	30	0.75	0.16	0.76-1.00	h	h	-
08/10/21	20	1.00	1.18	1.51-2.00	h	h	-	20	0.75	0.71	0.76-1.00	h	h	-
08/11/21	10	1.00	2.52	3.01-4.00	m	h	-	0	0.00	0.98	1.51-2.00	m	m	-
08/12/21	30	0.75	0.04	0.00	m	-	x	20	0.75	0.04	0.00	m	-	x
08/13/21	50	1.00	1.14	1.26-1.50	h	h	-	50	2.50	2.40	2.01-2.50	m	h	-
08/14/21	30	0.15	0.00	0.05-0.10	h	-	-	30	0.15	0.20	0.11-0.25	h	-	-
08/15/21	30	0.50	0.04	0.26-0.50	h	-	-	20	0.25	0.00	0.26-0.50	h	-	-
08/16/21	60	0.75	0.47	0.76-1.00	h	h	-	50	1.25	1.42	3.01-4.00	h	h	-
08/17/21	40	2.00	1.81	0.51-0.75	h	h	-	40	1.00	0.55	0.00	h	h	-
08/18/21	50	1.75	3.62	4.01-5.00	m	h	-	50	1.25	1.26	1.51-2.00	h	h	-
08/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/21	20	0.25	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
08/29/21	20	0.25	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
08/30/21	20	0.50	0.00	0.00	m	-	-	10	0.25	0.00	0.00	h	-	-
08/31/21	70	1.00	0.91	1.01-1.25	h	h	-	60	0.75	0.47	0.51-0.75	h	h	-
31 days					23	7/7	2					28	7/8	1
09/01/21	40	1.50	1.18	1.26-1.50	h	h	-	30	1.25	0.35	1.01-1.25	h	h	-
09/02/21	10	0.50	0.00	0.51-0.75	h	h	-	0	0.00	0.00	0.00	h	-	-
09/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/21	10	0.10	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/21	0	0.00	0.04	0.05-0.10	m	-	-	0	0.00	0.08	0.11-0.25	m	-	-
09/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/21	20	0.50	0.08	0.76-1.00	h	h	-	10	0.25	0.00	0.26-0.50	h	-	-
09/24/21	20	0.25	0.08	0.11-0.25	h	-	-	10	0.25	0.08	0.26-0.50	h	-	-
09/25/21	70	0.75	0.79	0.76-1.00	h	h	-	50	0.25	0.31	0.26-0.50	h	-	-
09/26/21	100	0.50	0.35	0.26-0.50	h	-	-	100	0.50	0.59	1.01-1.25	h	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
09/27/21	30	0.25	0.24	0.26-0.50	h	-	-	20	0.25	0.08	0.11-0.25	h	-	-
09/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/21	50	0.25	0.12	0.00	h	-	-	40	0.25	0.00	0.00	m	-	-
09/30/21	30	0.75	0.75	0.76-1.00	h	h	-	10	0.25	0.20	0.76-1.00	m	m	-
30 days					29	4/4	0					27	2/2	0
Phoenix South														
06/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.05-0.10	m	-	-
06/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/21	20	0.15	0.04	0.26-0.50	h	-	-	20	0.25	0.08	0.26-0.50	h	-	-
06/23/21	20	0.25	0.20	0.11-0.25	h	-	-	20	0.50	0.12	0.11-0.25	h	-	-
06/24/21	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/21	10	0.15	0.00	0.00	h	-	-	20	0.35	0.00	0.00	m	-	-
06/29/21	20	0.25	0.00	0.00	m	-	-	30	0.35	0.00	0.05-0.10	m	-	-
06/30/21	20	0.25	0.08	0.11-0.25	h	-	-	30	0.50	0.00	0.00	m	-	-
16 days					15	0/0	0					12	0/0	0
07/01/21	0	0.00	0.20	0.51-0.75	m	m	-	20	0.33	0.28	0.26-0.50	h	-	-
07/02/21	30	0.75	0.00	0.00	m	-	x	20	0.75	0.00	0.26-0.50	h	-	-
07/03/21	30	0.50	0.79	1.51-2.00	h	h	-	40	0.75	1.26	1.26-1.50	h	h	-
07/04/21	0	0.00	0.00	0.00	h	-	-	10	0.75	0.00	0.00	h	-	-
07/05/21	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 2021														
	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
07/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/21	10	0.25	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
07/09/21	10	0.75	0.00	0.00	h	-	-	20	1.00	0.00	0.00	m	-	x
07/10/21	10	0.50	0.12	0.26-0.50	h	-	-	20	1.00	0.47	1.01-1.25	h	h	-
07/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/21	10	0.50	0.04	0.00	h	-	-	20	0.50	0.94	1.01-1.25	h	h	-
07/13/21	30	1.25	1.46	2.01-2.50	h	h	-	40	1.00	0.63	1.01-1.25	h	h	-
07/14/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/15/21	0	0.00	0.08	0.26-0.50	m	-	-	10	0.50	0.47	0.51-0.75	h	h	-
07/16/21	30	0.75	0.08	0.11-0.25	m	-	x	30	1.25	0.63	1.26-1.50	h	h	-
07/17/21	10	0.10	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
07/18/21	10	0.75	0.08	0.76-1.00	h	h	-	20	0.50	0.00	0.05-0.10	m	-	-
07/19/21	10	0.25	0.08	0.26-0.50	h	-	-	10	0.50	0.00	0.00	h	-	-
07/20/21	10	0.25	0.00	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
07/21/21	10	0.50	0.51	0.51-0.75	h	h	-	20	1.00	0.71	1.01-1.25	h	h	-
07/22/21	40	0.75	1.93	2.01-2.50	m	h	-	60	1.25	2.40	2.51-3.00	h	h	-
07/23/21	50	1.00	0.83	0.76-1.00	h	h	-	70	1.00	1.14	1.26-1.50	h	h	-
07/24/21	40	0.75	2.99	4.01-5.00	m	h	-	50	1.50	0.98	2.01-2.50	h	h	-
07/25/21	20	0.50	1.14	1.51-2.00	m	h	-	30	1.25	0.91	2.51-3.00	h	h	-
07/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/21	30	0.25	0.04	0.26-0.50	h	-	-	40	0.50	0.00	0.00	m	-	x
07/30/21	20	0.50	1.10	1.51-2.00	m	h	-	30	0.50	0.28	0.51-0.75	h	h	-
07/31/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					23	9/10	2					26	12/12	2
08/01/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/21	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 2021														
	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
08/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/21	20	0.75	0.79	1.26-1.50	h	h	-	30	1.25	0.35	1.26-1.50	h	h	-
08/10/21	20	0.25	0.16	0.05-0.10	h	-	-	20	0.75	2.17	2.51-3.00	m	h	-
08/11/21	0	0.00	0.91	0.76-1.00	m	m	-	0	0.00	2.60	3.01-4.00	m	m	-
08/12/21	10	0.75	0.00	0.00	h	-	-	20	0.75	0.00	0.00	m	-	x
08/13/21	50	2.50	2.91	3.01-4.00	h	h	-	50	2.50	2.48	2.51-3.00	h	h	-
08/14/21	30	0.50	0.20	0.51-0.75	h	h	-	30	0.50	0.20	0.26-0.50	h	-	-
08/15/21	20	0.50	0.35	0.51-0.75	h	h	-	30	0.50	0.08	0.26-0.50	h	-	-
08/16/21	40	1.00	0.79	0.76-1.00	h	h	-	60	1.25	1.22	1.01-1.25	h	h	-
08/17/21	40	1.00	0.08	0.26-0.50	m	-	x	50	1.00	0.35	0.26-0.50	m	-	x
08/18/21	40	1.00	1.02	1.51-2.00	h	h	-	50	1.25	3.19	4.01-5.00	m	h	-
08/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/21	0	0.00	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/29/21	10	0.25	0.00	0.26-0.50	h	-	-	20	0.25	0.00	0.00	m	-	-
08/30/21	10	0.25	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
08/31/21	50	0.50	0.28	0.26-0.50	h	-	-	50	1.00	1.10	1.26-1.50	h	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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					29	6/7	1					23	6/7	2
09/01/21	30	0.75	1.30	1.51-2.00	h	h	-	40	1.00	0.28	0.76-1.00	h	h	-
09/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/21	0	0.00	0.47	0.76-1.00	m	m	-	0	0.00	0.16	0.11-0.25	m	-	-
09/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/21	10	0.25	0.00	0.11-0.25	h	-	-	10	0.50	0.31	2.01-2.50	m	h	-
09/24/21	10	0.25	0.00	0.11-0.25	h	-	-	10	0.25	0.00	0.11-0.25	h	-	-
09/25/21	30	0.25	0.16	0.26-0.50	h	-	-	50	0.75	0.59	0.51-0.75	h	h	-
09/26/21	100	0.25	0.20	0.11-0.25	h	-	-	100	0.50	0.43	0.26-0.50	h	-	-
09/27/21	10	0.10	0.04	0.05-0.10	h	-	-	20	0.50	0.35	0.51-0.75	h	h	-
09/28/21	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 2021														
	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
09/29/21	30	0.10	0.00	0.00	m	-	-	50	0.25	0.00	0.00	m	-	-
09/30/21	10	0.10	0.08	0.05-0.10	h	-	-	30	0.75	0.75	0.76-1.00	h	h	-
30 days					28	1/2	0					27	4/4	0
	Scottsdale South							East Valley						
06/15/21	0	0.00	0.00	0.05-0.10	m	-	-	0	0.00	0.00	0.11-0.25	m	-	-
06/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/21	20	0.15	0.08	0.11-0.25	h	-	-	20	0.15	0.04	0.26-0.50	h	-	-
06/23/21	20	0.25	0.16	0.11-0.25	h	-	-	20	0.25	0.08	0.11-0.25	h	-	-
06/24/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
06/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/21	10	0.15	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
06/29/21	20	0.25	0.00	0.11-0.25	h	-	-	20	0.25	0.04	0.00	m	-	-
06/30/21	20	0.25	0.08	0.00	m	-	-	20	0.25	0.08	0.05-0.10	h	-	-
16 days					14	0/0	0					14	0/0	0
07/01/21	0	0.00	0.31	0.11-0.25	m	-	-	0	0.00	0.24	0.11-0.25	m	-	-
07/02/21	30	0.75	0.00	0.05-0.10	m	-	x	30	0.50	0.00	0.00	m	-	x
07/03/21	30	0.50	0.71	1.01-1.25	h	h	-	30	0.75	0.28	0.26-0.50	h	-	-
07/04/21	0	0.00	0.00	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
07/05/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/21	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 2021														
	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
07/08/21	10	0.25	0.00	0.00	h	-	-	20	0.35	0.00	0.00	m	-	-
07/09/21	10	0.75	0.00	0.00	h	-	-	10	0.75	0.04	0.11-0.25	m	-	-
07/10/21	20	0.75	0.16	0.51-0.76	h	h	-	30	0.75	0.79	0.76-1.00	h	h	-
07/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/21	10	0.50	0.04	0.00	h	-	-	20	0.75	0.00	0.00	m	-	x
07/13/21	30	0.50	0.51	0.51-0.75	h	h	-	40	1.00	0.94	0.76-1.00	h	h	-
07/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/15/21	0	0.00	0.43	0.76-1.00	m	m	-	0	0.00	0.83	1.51-2.00	m	m	-
07/16/21	30	0.75	0.16	0.11-0.25	m	-	x	30	0.75	0.00	0.05-0.10	m	-	x
07/17/21	10	0.10	0.00	0.00	h	-	-	10	0.25	0.04	0.05-0.10	h	-	-
07/18/21	10	0.10	0.00	0.05-0.10	h	-	-	10	0.25	0.00	0.00	h	-	-
07/19/21	10	0.25	0.00	0.00	h	-	-	10	0.25	0.08	0.05-0.10	h	-	-
07/20/21	10	0.25	0.00	0.00	h	-	-	10	0.25	0.08	0.00	h	-	-
07/21/21	10	0.50	0.51	1.01-1.26	h	h	-	20	0.75	0.20	0.26-0.50	h	-	-
07/22/21	40	0.75	3.43	4.01-5.00	m	h	-	50	1.00	1.93	2.01-2.50	h	h	-
07/23/21	60	1.25	0.98	1.01-1.25	h	h	-	70	1.25	1.06	1.51-2.00	h	h	-
07/24/21	40	0.75	1.02	1.51-2.00	h	h	-	50	0.75	1.46	1.51-2.00	h	h	-
07/25/21	20	0.50	0.20	1.01-1.25	h	h	-	10	1.25	0.87	1.01-1.25	h	h	-
07/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/21	30	0.25	0.00	0.00	m	-	-	30	0.25	0.08	0.11-0.25	h	-	-
07/30/21	20	0.50	0.24	0.26-0.50	h	-	-	30	0.50	0.67	0.76-1.00	h	h	-
07/31/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
31 days					25	8/9	2					24	7/8	3
08/01/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/21	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 2021														
	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
08/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/21	20	0.25	0.12	0.26-0.50	h	-	-	20	0.50	0.79	1.51-2.00	h	h	-
08/10/21	20	0.50	1.38	2.51-3.00	m	h	-	20	0.50	1.81	2.51-3.00	m	h	-
08/11/21	0	0.00	1.69	3.01-4.00	m	m	-	0	0.00	1.57	3.01-4.00	m	m	-
08/12/21	10	0.75	0.04	0.00	m	-	-	10	0.75	0.00	0.00	h	-	-
08/13/21	50	2.50	1.46	1.51-2.00	h	h	-	30	2.50	2.52	2.01-2.50	h	h	-
08/14/21	30	0.50	0.20	0.26-0.50	h	-	-	30	0.15	0.16	0.11-0.25	h	-	-
08/15/21	20	0.25	0.28	0.26-0.50	h	-	-	20	0.75	0.83	0.76-1.00	h	h	-
08/16/21	40	1.00	1.42	1.01-1.25	h	h	-	50	1.25	0.79	1.51-2.00	h	h	-
08/17/21	50	1.00	0.08	0.11-0.25	m	-	x	50	1.00	0.24	0.11-0.25	m	-	x
08/18/21	40	1.00	0.98	0.76-1.00	h	h	-	40	1.25	0.51	0.51-0.75	h	h	-
08/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/30/21	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/31/21	50	1.00	0.63	1.26-1.50	h	h	-	60	0.75	0.75	0.76-1.00	h	h	-
31 days					27	5/6	1					28	7/8	1
09/01/21	30	0.75	0.39	1.01-1.25	h	h	-	30	0.75	1.22	2.51-3.00	h	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
09/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/21	0	0.00	0.24	0.51-0.75	m	m	-	0	0.00	0.35	0.51-0.75	m	m	-
09/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/21	10	0.50	0.28	1.51-2.00	m	h	-	20	0.50	0.87	0.76-1.00	h	h	-
09/24/21	10	0.10	0.00	0.05-0.10	h	-	-	10	0.25	0.04	0.11-0.25	h	-	-
09/25/21	30	0.50	0.24	0.26-0.50	h	-	-	20	0.75	0.63	0.51-0.75	h	h	-
09/26/21	100	0.50	0.31	0.26-0.50	h	-	-	80	0.25	0.12	0.11-0.25	h	-	-
09/27/21	10	0.25	0.00	0.26-0.50	h	-	-	10	0.10	0.08	0.05-0.10	h	-	-
09/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/21	40	0.25	0.00	0.11-0.25	h	-	-	50	0.25	0.04	0.26-0.50	h	-	-
09/30/21	10	0.25	0.04	0.11-0.25	h	-	-	10	0.10	0.04	0.05-0.10	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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					28	2/3	0					29	3/4	0
Southeast Valley														
06/15/21	0	0.00	0.00	0.05-0.10	m	-	-	10	0.10	0.00	0.05-0.10	h	-	-
06/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/21	20	0.15	0.00	0.11-0.25	h	-	-	40	0.25	0.00	0.11-0.25	h	-	-
06/23/21	20	0.25	0.08	0.26-0.50	h	-	-	40	0.50	0.00	0.11-0.25	h	-	-
06/24/21	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/21	10	0.25	0.00	0.00	h	-	-	20	0.35	0.00	0.00	m	-	-
06/29/21	20	0.25	0.00	0.00	m	-	-	30	0.50	0.00	0.05-0.10	m	-	-
06/30/21	20	0.25	0.00	0.00	m	-	-	30	0.50	0.16	0.11-0.25	h	-	-
16 days					13	0/0	0					14	0/0	0
07/01/21	0	0.00	0.00	0.00	h	-	-	10	0.33	0.04	0.51-0.75	m	m	-
07/02/21	30	0.50	0.00	0.00	m	-	-	30	0.75	0.00	0.00	m	-	x
07/03/21	30	0.75	0.47	0.51-0.75	h	h	-	40	1.00	1.46	1.51-2.00	h	h	-
07/04/21	10	0.50	0.00	0.00	h	-	-	20	1.00	0.00	0.00	m	-	x
07/05/21	10	0.25	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
07/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/21	20	0.35	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
07/09/21	10	0.75	0.91	1.01-1.25	h	h	-	20	1.00	0.12	0.26-0.50	m	-	x

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
07/10/21	30	0.75	0.75	1.01-1.25	h	h	-	20	1.00	0.00	0.05-0.10	m	-	x
07/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/12/21	20	0.75	0.00	0.00	m	-	x	30	1.00	0.00	0.26-0.50	m	-	x
07/13/21	40	1.00	0.31	1.01-1.25	h	h	-	50	2.00	0.20	2.01-2.50	h	h	-
07/14/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.11-0.25	h	-	-
07/15/21	0	0.00	0.51	0.76-1.00	m	m	-	0	0.00	0.51	1.51-2.00	m	m	-
07/16/21	30	0.75	0.00	0.26-0.50	h	-	-	40	1.25	0.43	0.76-1.00	h	h	-
07/17/21	20	0.25	0.00	0.11-0.25	h	-	-	20	0.50	0.00	0.51-0.75	h	h	-
07/18/21	20	0.25	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
07/19/21	10	0.25	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
07/20/21	10	0.25	0.00	0.00	h	-	-	20	0.50	0.00	1.51-2.00	m	h	-
07/21/21	20	0.75	0.04	0.26-0.50	h	-	-	30	1.00	0.59	1.01-1.25	h	h	-
07/22/21	50	1.00	1.50	2.01-2.50	h	h	-	60	1.50	0.67	1.51-2.00	h	h	-
07/23/21	70	1.25	0.94	1.51-2.00	h	h	-	80	2.00	0.35	2.51-3.00	h	h	-
07/24/21	50	0.75	1.14	1.51-2.00	h	h	-	60	1.50	0.31	2.01-2.50	h	h	-
07/25/21	10	0.50	0.00	0.11-0.25	h	-	-	20	0.50	0.43	1.26-1.50	h	h	-
07/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/21	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/21	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/29/21	40	0.50	0.00	0.00	m	-	x	40	0.75	0.00	0.00	m	-	x
07/30/21	30	0.75	0.91	0.76-1.00	h	h	-	40	0.75	0.20	1.01-1.25	h	h	-
07/31/21	10	0.25	0.00	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
31 days					26	8/9	2					18	11/13	6
08/01/21	0	0.00	0.00	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
08/02/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/21	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 2021														
	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
08/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/21	0	0.00	0.00	0.11-0.25	m	-	-	0	0.00	0.00	0.00	h	-	-
08/09/21	20	0.50	3.27	2.51-3.00	m	h	-	30	1.25	0.71	2.51-3.00	h	h	-
08/10/21	20	0.75	1.14	1.51-2.00	h	h	-	20	0.75	0.91	1.01-1.25	h	h	-
08/11/21	10	0.75	0.00	0.76-1.00	h	h	-	10	0.75	2.24	2.51-3.00	m	h	-
08/12/21	20	0.75	0.00	0.00	m	-	x	30	0.75	0.00	0.00	m	-	x
08/13/21	30	2.50	1.26	2.01-2.50	h	h	-	40	1.00	0.63	1.51-2.00	h	h	-
08/14/21	30	0.15	0.00	0.00	m	-	-	40	0.50	0.00	0.51-0.75	h	h	-
08/15/21	20	0.25	0.08	0.11-0.25	h	-	-	30	0.50	0.04	0.11-0.25	h	-	-
08/16/21	50	1.25	1.34	2.51-3.00	h	h	-	60	1.75	1.10	1.51-2.00	h	h	-
08/17/21	50	1.00	0.00	0.26-0.50	m	-	x	50	1.00	0.35	0.76-1.00	h	h	-
08/18/21	40	1.00	0.20	0.26-0.50	m	-	x	60	1.75	0.47	1.51-2.00	h	h	-
08/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/21	0	0.00	0.00	0.00	h	-	-	20	0.25	0.00	0.00	m	-	-
08/29/21	10	0.25	0.00	0.11-0.25	h	-	-	20	0.25	0.00	0.05-0.10	h	-	-
08/30/21	10	0.25	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
08/31/21	60	0.75	0.47	0.76-1.00	h	h	-	70	3.00	0.43	1.51-2.00	h	h	-
31 days					25	6/6	3					27	9/9	1
09/01/21	20	0.75	1.06	2.51-3.00	m	h	-	40	0.75	0.16	0.51-0.75	h	h	-
09/02/21	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
09/03/21	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 2021														
	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
09/04/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/21	0	0.00	0.35	0.51-0.75	m	-	-	0	0.00	0.00	0.05-0.10	m	-	-
09/19/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/21	20	0.50	0.00	1.01-1.25	m	h	-	30	0.50	0.00	0.76-1.00	h	h	-
09/24/21	10	0.10	0.00	0.00	h	-	-	10	0.25	0.04	0.26-0.50	h	-	-
09/25/21	20	0.75	0.31	0.51-0.75	h	h	-	30	0.50	0.31	0.51-0.75	h	h	-
09/26/21	50	0.25	0.04	0.11-0.25	h	-	-	50	0.10	0.00	0.05-0.10	h	-	-
09/27/21	10	0.10	0.00	0.00	h	-	-	10	0.25	0.00	0.26-0.50	h	-	-
09/28/21	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/21	0	0.00	0.00	0.00	h	-	-	70	0.25	0.00	0.00	m	-	-
09/30/21	0	0.00	0.00	0.00	h	-	-	30	0.25	0.00	0.00	m	-	-
30 days					27	3/3	0					27	3/3	0

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
Superstition														
06/15/21	10	0.10	0.00	0.05-0.10	h	-	-							
06/16/21	0	0.00	0.00	0.00	h	-	-							
06/17/21	0	0.00	0.00	0.00	h	-	-							
06/18/21	0	0.00	0.00	0.00	h	-	-							
06/19/21	0	0.00	0.00	0.00	h	-	-							
06/20/21	0	0.00	0.00	0.00	h	-	-							
06/21/21	0	0.00	0.00	0.00	h	-	-							
06/22/21	30	0.25	0.04	0.11-0.25	h	-	-							
06/23/21	30	0.50	0.08	0.11-0.25	h	-	-							
06/24/21	0	0.00	0.00	0.00	h	-	-							
06/25/21	0	0.00	0.00	0.00	h	-	-							
06/26/21	0	0.00	0.00	0.00	h	-	-							
06/27/21	0	0.00	0.00	0.00	h	-	-							
06/28/21	20	0.35	0.00	0.11-0.25	h	-	-							
06/29/21	30	0.50	0.00	0.00	m	-	-							
06/30/21	30	0.50	0.24	0.26-0.50	h	-	-							
16 days					15	0/0	0							
07/01/21	10	0.33	0.20	0.11-0.25	h	-	-							
07/02/21	30	0.75	0.00	0.00	m	-	x							
07/03/21	50	1.00	0.59	0.51-0.75	h	h	-							
07/04/21	10	1.00	0.00	0.00	h	-	-							
07/05/21	10	0.50	0.00	0.00	h	-	-							
07/06/21	0	0.00	0.00	0.00	h	-	-							
07/07/21	0	0.00	0.00	0.00	h	-	-							
07/08/21	20	0.50	0.04	0.11-0.25	h	-	-							
07/09/21	20	1.00	0.67	1.01-1.25	h	h	-							
07/10/21	30	1.00	0.63	0.26-0.50	h	h	-							
07/11/21	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
07/12/21	30	1.00	0.00	0.11-0.25	m	-	x							
07/13/21	50	1.00	0.79	0.76-1.00	h	h	-							
07/14/21	10	0.25	0.00	0.00	h	-	-							
07/15/21	0	0.00	0.94	0.76-1.00	m	m	-							
07/16/21	30	1.25	0.55	0.26-0.50	m	h	-							
07/17/21	20	0.50	0.67	0.76-1.00	h	h	-							
07/18/21	20	0.50	0.04	0.00	m	-	-							
07/19/21	20	0.50	0.00	0.11-0.25	h	-	-							
07/20/21	20	0.50	0.39	0.76-1.00	h	h	-							
07/21/21	30	1.00	0.55	0.51-0.76	h	h	-							
07/22/21	60	1.50	1.14	1.51-2.00	h	h	-							
07/23/21	80	1.00	0.94	1.51-2.00	h	h	-							
07/24/21	60	1.50	0.47	3.01-4.00	h	h	-							
07/25/21	20	0.50	0.67	1.26-1.50	h	h	-							
07/26/21	0	0.00	0.00	0.00	h	-	-							
07/27/21	10	0.25	0.00	0.00	h	-	-							
07/28/21	10	0.25	0.00	0.00	h	-	-							
07/29/21	40	0.75	0.00	0.00	m	-	x							
07/30/21	40	0.75	0.16	0.11-0.25	m	-	x							
07/31/21	10	0.50	0.00	0.00	h	-	-							
31 days					24	12/13	4							
08/01/21	10	0.50	0.00	0.00	h	-	-							
08/02/21	0	0.00	0.00	0.00	h	-	-							
08/03/21	0	0.00	0.00	0.00	h	-	-							
08/04/21	0	0.00	0.00	0.00	h	-	-							
08/05/21	0	0.00	0.00	0.00	h	-	-							
08/06/21	0	0.00	0.00	0.00	h	-	-							
08/07/21	0	0.00	0.00	0.00	h	-	-							
08/08/21	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
08/09/21	30	0.50	0.51	0.76-1.00	h	h	-							
08/10/21	20	0.75	1.81	1.51-2.00	m	h	-							
08/11/21	10	0.75	1.42	1.26-1.50	h	h	-							
08/12/21	20	0.75	0.00	0.00	m	-	x							
08/13/21	40	2.50	2.32	2.01-2.50	h	h	-							
08/14/21	40	0.15	0.12	0.11-0.25	h	-	-							
08/15/21	30	0.75	0.71	0.51-0.75	h	h	-							
08/16/21	60	1.50	2.09	2.01-2.50	h	h	-							
08/17/21	50	1.00	0.04	0.11-0.25	m	-	x							
08/18/21	50	1.50	0.24	0.51-0.75	m	h	-							
08/19/21	0	0.00	0.00	0.00	h	-	-							
08/20/21	0	0.00	0.00	0.00	h	-	-							
08/21/21	0	0.00	0.00	0.00	h	-	-							
08/22/21	0	0.00	0.00	0.00	h	-	-							
08/23/21	0	0.00	0.00	0.00	h	-	-							
08/24/21	0	0.00	0.00	0.00	h	-	-							
08/25/21	0	0.00	0.00	0.00	h	-	-							
08/26/21	0	0.00	0.00	0.00	h	-	-							
08/27/21	0	0.00	0.00	0.00	h	-	-							
08/28/21	20	0.25	0.00	0.00	m	-	-							
08/29/21	20	0.25	0.00	0.05-0.10	h	-	-							
08/30/21	20	0.50	0.00	0.00	m	-	-							
08/31/21	70	1.00	0.75	0.76-1.00	h	h	-							
31 days					25	8/8	2							
09/01/21	30	1.25	0.98	1.51-2.00	h	h	-							
09/02/21	10	0.25	0.00	0.00	h	-	-							
09/03/21	0	0.00	0.00	0.00	h	-	-							
09/04/21	0	0.00	0.00	0.00	h	-	-							
09/05/21	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2021														
	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
09/06/21	0	0.00	0.00	0.00	h	-	-							
09/07/21	0	0.00	0.00	0.00	h	-	-							
09/08/21	0	0.00	0.00	0.00	h	-	-							
09/09/21	0	0.00	0.00	0.00	h	-	-							
09/10/21	0	0.00	0.00	0.00	h	-	-							
09/11/21	0	0.00	0.00	0.00	h	-	-							
09/12/21	0	0.00	0.00	0.00	h	-	-							
09/13/21	0	0.00	0.00	0.00	h	-	-							
09/14/21	0	0.00	0.00	0.00	h	-	-							
09/15/21	0	0.00	0.00	0.00	h	-	-							
09/16/21	0	0.00	0.00	0.00	h	-	-							
09/17/21	0	0.00	0.00	0.00	h	-	-							
09/18/21	0	0.00	0.16	0.26-0.50	m	-	-							
09/19/21	0	0.00	0.00	0.00	h	-	-							
09/20/21	0	0.00	0.00	0.00	h	-	-							
09/21/21	0	0.00	0.00	0.00	h	-	-							
09/22/21	0	0.00	0.00	0.00	h	-	-							
09/23/21	30	0.50	0.28	0.76-1.00	h	h	-							
09/24/21	10	0.10	0.04	0.05-0.10	h	-	-							
09/25/21	30	0.50	0.39	0.51-0.75	h	h	-							
09/26/21	50	0.50	0.94	0.26-0.50	h	h	-							
09/27/21	10	0.50	0.20	0.51-0.75	h	h	-							
09/28/21	0	0.00	0.00	0.00	h	-	-							
09/29/21	70	0.25	0.08	0.11-0.25	h	-	-							
09/30/21	30	0.75	0.51	0.51-0.75	h	h	-							
30 days					29	5/5	0							

TABLE A-2: This table shows the verification data of MSP issued precipitation forecasts contained in the daily Outlooks for the 2021 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.

TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2021

Forecast Zone	Accurate Forecasts	AOF (%)	Sig. Events Detected	POD (%)	False Alarms	FAR (%)
JUNE						
Gila Bend	11/16	68.8%	1/4	25%	2/16	12.5%
Gila River	15/16	93.8%	0/0	n/a	0/16	0%
Palo Verde	15/16	93.8%	0/0	n/a	0/16	0%
Rainbow Valley	16/16	100%	0/0	n/a	0/16	0%
West Valley	15/16	93.8%	0/0	n/a	0/16	0%
Northwest Valley	13/16	81.3%	0/0	n/a	0/16	0%
Upper Centennial	14/16	87.5%	1/2	50%	0/16	0%
Wickenburg	12/16	75%	0/1	0%	1/16	6.3%
New River/Cave Creek	11/16	64.7%	0/0	n/a	0/16	0%
Phoenix North	13/16	81.3%	0/0	n/a	0/16	0%
Phoenix South	15/16	93.8%	0/0	n/a	0/16	0%
Scottsdale North	12/16	75%	0/0	n/a	0/16	0%
Scottsdale South	14/16	87.5%	0/0	n/a	0/16	0%
East Valley	14/16	87.5%	0/0	n/a	0/16	0%
Southeast Valley	13/16	81.3%	0/0	n/a	0/16	0%
Lower Salt River Lakes	14/16	87.5%	0/0	n/a	0/16	0%

TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2021						
Forecast Zone	Accurate Forecasts	AOF (%)	Sig. Events Detected	POD (%)	False Alarms	FAR (%)
Superstition	15/16	93.8%	0/0	n/a	0/16	0%
All Zones	232/272	85.3%	2/7	28.6%	3/272	1.1%
JULY						
Gila Bend	21/31	67.7%	10/14	71.4%	2/31	6.5%
Gila River	22/31	71%	8/10	80%	0/31	0%
Palo Verde	22/31	71%	6/10	60%	2/31	6.5%
Rainbow Valley	27/31	87.1%	9/11	81.8%	1/31	3.2%
West Valley	24/31	77.4%	9/11	81.8%	0/31	0%
Northwest Valley	24/31	77.4%	8/10	80%	0/31	0%
Upper Centennial	19/31	61.3%	9/14	64.3%	3/31	9.7%
Wickenburg	21/31	67.7%	11/13	84.6%	0/31	0%
New River/Cave Creek	22/31	71%	15/15	100%	6/31	19.4%
Phoenix North	24/31	77.4%	10/11	90.9%	3/31	9.7%
Phoenix South	23/31	74.2%	9/10	90%	2/31	6.5%
Scottsdale North	26/31	83.9%	12/12	100%	2/31	6.5%
Scottsdale South	25/31	80.6%	8/9	88.9%	2/31	6.5%
East Valley	24/31	77.4%	7/8	87.5%	3/31	9.7%
Southeast Valley	26/31	83.9%	8/9	88.9%	2/31	6.5%
Lower Salt River Lakes	18/31	58.1%	11/13	84.6%	6/31	19.4%
Superstition	24/31	77.4%	12/13	92.3%	4/31	12.9%
All Zones	392/527	74.4%	162/193	83.9%	38/527	7.2%
AUGUST						
Gila Bend	24/31	77.4%	5/7	71.4%	0/31	0%
Gila River	28/31	90.3%	5/6	83.3%	1/31	3.2%
Palo Verde	28/31	90.3%	7/8	87.5%	1/31	3.2%
Rainbow Valley	29/31	93.5%	8/9	88.9%	0/31	0%
West Valley	29/31	93.5%	6/7	85.7%	0/31	0%
Northwest Valley	22/31	71%	3/3	100%	4/31	12.9%
Upper Centennial	25/31	80.6%	9/9	100%	2/31	6.5%

TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2021						
Forecast Zone	Accurate Forecasts	AOF (%)	Sig. Events Detected	POD (%)	False Alarms	FAR (%)
Wickenburg	22/31	71%	4/4	100%	4/31	12.9%
New River/Cave Creek	23/31	74.2%	7/7	100%	2/31	6.5%
Phoenix North	28/31	90.3%	7/8	87.5%	1/31	3.2%
Phoenix South	29/31	93.5%	6/7	85.7%	1/31	3.2%
Scottsdale North	23/31	74.2%	6/7	85.7%	2/31	6.5%
Scottsdale South	27/31	87.1%	5/6	83.3%	1/31	3.2%
East Valley	28/31	90.3%	7/8	87.5%	1/31	3.2%
Southeast Valley	25/31	80.6%	6/6	100%	3/31	9.7%
Lower Salt River Lakes	27/31	87.1%	9/9	100%	1/31	3.2%
Superstition	25/31	80.6%	8/8	100%	2/31	6.5%
All Zones	442/527	83.9%	108/119	90.8%	26/527	4.9%
SEPTEMBER						
Gila Bend	25/30	83.3%	2/2	100%	0/30	0%
Gila River	28/30	93.3%	1/2	50%	0/30	0%
Palo Verde	26/30	86.7%	2/3	66.7%	0/30	0%
Rainbow Valley	27/30	90%	2/4	50%	0/30	0%
West Valley	26/30	86.7%	3/4	75%	0/30	0%
Northwest Valley	27/30	90%	1/2	50%	0/30	0%
Upper Centennial	24/30	80%	3/3	100%	0/30	0%
Wickenburg	23/30	76.7%	3/3	100%	0/30	0%
New River/Cave Creek	29/30	96.7%	4/4	100%	0/30	0%
Phoenix North	27/30	90%	2/2	100%	0/30	0%
Phoenix South	28/30	93.3%	1/2	50%	0/30	0%
Scottsdale North	27/30	90%	4/4	100%	0/30	0%
Scottsdale South	28/30	93.3%	2/3	66.7%	0/30	0%
East Valley	29/30	96.7%	3/4	75%	0/30	0%
Southeast Valley	27/30	90%	3/3	100%	0/30	0%
Lower Salt River Lakes	27/30	90%	3/3	100%	0/30	0%
Superstition	29/30	96.7%	5/5	100%	0/30	0%
All Zones	457/510	89.6%	44/53	83%	0/510	0%

APPENDIX B: MSP MESSAGES - VERIFICATION TABLES

TABLE B-1: This table shows each of the individual MSP Statements issued during the 2021 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 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/03/21	17:10	Wickenburg	1	Henz	Now-645pm	-	0.50-0.75/1.00-1.50
07/03/21	17:13	Northwest Valley	1	Henz	Now-645pm	-	0.50-0.75/1.00-1.25
07/03/21	18:00	West Valley	1	Henz	Now-730pm	-	0.50-0.75/1.00-1.25
07/03/21	18:50	Phoenix North	1	Henz	Now-8pm	-	0.50-0.75/1.00-1.25
07/03/21	18:50	Phoenix South	1	Henz	Now-8pm	-	0.50-0.75/1.00-1.25
07/03/21	18:27	Scottsdale North	1	Henz	Now-8pm	-	0.50-0.75/1.00-1.25
07/03/21	18:30	Scottsdale South	1	Henz	Now-8pm	-	0.50-0.75/1.00-1.25
07/09/21	22:19	Southeast Valley	1	Waters	Now-11pm	-	0.50-0.75/1.00
07/09/21	22:15	East Valley	1	Waters	Now-1130pm	-	0.50-0.75/1.00
07/09/21	22:15	Gila River	1	Waters	Now-1130pm	-	0.50-0.75/1.00
07/09/21	22:30	Gila Bend	1	Waters	Now-12am	-	0.50-0.75/1.00
07/10/21	20:56	Southeast Valley	1	Waters	Now-11pm	-	-
07/12/21	21:55	Scottsdale North	1	Henz	Now-1130pm	-	0.50-0.75/1.00-1.25
07/12/21	22:02	Phoenix North	1	Henz	Now-1130pm	-	0.50-0.75/1.00-1.25
07/13/21	12:30	Northwest Valley	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	West Valley	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	New River/Cave Creek	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	Phoenix North	2	Henz	Now-10pm 7/14	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/13/21	12:30	Phoenix South	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	Gila River	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	Scottsdale North	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	Scottsdale South	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	East Valley	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	Southeast Valley	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	Lower Salt River Lakes	2	Henz	Now-10pm 7/14	-	-
07/13/21	12:30	Superstition	2	Henz	Now-10pm 7/14	-	-
07/14/21	4:32	Northwest Valley	1	Henz	Now-6am	-	0.50-0.75/1.00-1.50
07/14/21	4:40	West Valley	1	Henz	Now-6am	-	0.50-0.75/1.00-1.50
07/14/21	4:45	Phoenix South	1	Henz	Now-615am	-	0.50-0.75/1.00-1.50
07/14/21	4:52	New River/Cave Creek	1	Henz	Now-630am	-	0.50-0.75/1.00-1.50
07/14/21	5:03	Phoenix North	1	Henz	Now-630am	-	0.50-0.75/1.00-1.50
07/14/21	5:10	Scottsdale South	1	Henz	Now-630am	-	0.50-0.75/1.00-1.50
07/14/21	5:17	East Valley	1	Henz	Now-645am	-	0.50-0.75/1.00-1.50
07/14/21	5:31	Phoenix South	3	Henz	Now-8am	-	-
07/14/21	5:45	Superstition	1	Henz	Now-730am	-	0.50-0.75/1.00-1.50
07/14/21	5:53	Gila River	1	Henz	Now-730am	-	0.50-0.75/1.00-1.50
07/14/21	6:03	Southeast Valley	1	Henz	Now-730am	-	0.50-0.75/1.00-1.50
07/14/21	11:15	Superstition	1	Waters	Now-1230pm	-	0.25-0.50/0.75-1.00
07/15/21	14:40	Upper Centennial	1	Waters	Now-4pm	-	-
07/15/21	15:10	West Valley	1	Waters	Now-5pm	-	-
07/15/21	15:22	Upper Centennial	3	Waters	Now-6pm	-	-
07/15/21	16:05	Northwest Valley	1	Waters	Now-530pm	-	up to 1.00
07/15/21	16:05	New River/Cave Creek	1	Waters	Now-530pm	-	up to 1.00
07/15/21	16:05	Phoenix North	1	Waters	Now-530pm	-	up to 1.00
07/15/21	17:02	Scottsdale South	1	Waters	Now-6pm	-	up to 1.00
07/15/21	17:02	East Valley	1	Waters	Now-6pm	-	up to 1.00
07/15/21	17:16	Superstition	1	Waters	Now-630pm	-	up to 1.00

TABLE B-1: MSP Statements Issued - Monsoon Season 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/15/21	17:20	Wickenburg	1	Waters	Now-7pm	1.00/60min	-
07/16/21	8:50	Southeast Valley	1	Waters	Now-10am	-	0.50
07/16/21	10:00	Southeast Valley	1	Waters	Now-12pm	-	0.50
07/16/21	10:00	East Valley	1	Waters	Now-12pm	-	0.50
07/16/21	10:00	Gila River	1	Waters	Now-12pm	-	0.50
07/16/21	19:40	Northwest Valley	1	Waters	Now-830pm	0.50/60min	-
07/16/21	20:05	Wickenburg	1	Waters	Now-9pm	0.75/60min	-
07/16/21	21:00	West Valley	1	Waters	Now-10pm	-	-
07/20/21	15:27	Upper Centennial	1	Henz	Now-5pm	-	0.50-0.75/1.25-1.50
07/20/21	21:00	Superstition	1	Waters	Now-1030pm	-	-
07/21/21	15:18	Upper Centennial	1	Henz	Now-5pm	-	0.50-0.75/1.50-2.00
07/21/21	16:00	Wickenburg	1	Henz	Now-530pm	-	0.50-0.75/1.50-2.00
07/21/21	16:35	Wickenburg	3	Henz	Now-7pm	-	-
07/22/21	12:00	Upper Centennial	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Wickenburg	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Palo Verde	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Gila Bend	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Rainbow Valley	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	West Valley	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Northwest Valley	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	New River/Cave Creek	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Phoenix North	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Phoenix South	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Gila River	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Scottsdale North	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Scottsdale South	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	East Valley	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Southeast Valley	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	12:00	Lower Salt River Lakes	2	Henz	Now-12pm Sun 7/25	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/22/21	12:00	Superstition	2	Henz	Now-12pm Sun 7/25	-	-
07/22/21	20:00	Gila River	1	Henz	Now-930pm	-	0.50-0.75/1.00-1.25
07/22/21	20:37	Scottsdale North	1	Henz	Now-10pm	-	0.50-0.75/1.00-1.25
07/22/21	20:37	Scottsdale South	1	Henz	Now-1015pm	-	0.50-0.75/1.00-1.25
07/22/21	21:15	Northwest Valley	1	Henz	Now-1045pm	-	0.50-0.75/1.00-1.25
07/22/21	21:27	Scottsdale South	3	Henz	Now-12am	-	-
07/22/21	21:45	Phoenix North	1	Henz	Now-1115pm	-	0.50-0.75/1.25-1.75
07/22/21	21:50	East Valley	1	Henz	Now-1130pm	-	0.50-0.75/1.25-1.75
07/23/21	4:25	New River/Cave Creek	1	Henz	Now-6am	-	0.50-0.75/1.25-1.75
07/23/21	11:56	New River/Cave Creek	1	Waters	Now-3pm	-	0.50-0.75/1.00-1.25
07/23/21	11:56	Scottsdale North	1	Waters	Now-3pm	-	0.50-0.75/1.00-1.25
07/23/21	11:56	Phoenix North	1	Waters	Now-3pm	-	0.50-0.75/1.00-1.25
07/23/21	11:56	Scottsdale South	1	Waters	Now-3pm	-	0.50-0.75/1.00-1.25
07/23/21	11:56	Phoenix South	1	Waters	Now-3pm	-	0.50-0.75/1.00-1.25
07/23/21	13:05	New River/Cave Creek	3	Waters	Now-4pm	-	-
07/25/21	7:10	West Valley	1	Waters	Now-10am	-	0.50-0.75
07/25/21	7:10	Northwest Valley	1	Waters	Now-10am	-	0.50-0.75
07/25/21	7:45	Wickenburg	1	Waters	Now-10am	-	-
07/25/21	12:09	Rainbow Valley	3	Waters	Now-6pm	-	-
07/25/21	12:20	West Valley	3	Waters	Now-6pm	-	-
07/29/21	13:40	Gila Bend	1	Waters	Now-4pm	-	-
07/29/21	18:15	New River/Cave Creek	1	Waters	Now-9pm	-	-
07/29/21	18:42	Wickenburg	1	Waters	Now-8pm	-	-
07/30/21	21:11	Palo Verde	1	Waters	Now-12am	-	-
07/30/21	22:00	Phoenix North	1	Waters	Now-11pm	-	-
07/30/21	22:00	Phoenix South	1	Waters	Now-11pm	-	-
07/30/21	22:42	East Valley	1	Waters	Now-12am	-	-
07/30/21	22:42	Scottsdale South	1	Waters	Now-12am	-	-
07/30/21	23:43	East Valley	1	Waters	Now-1am	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/30/21	23:43	Gila River	1	Waters	Now-1am	-	-
07/30/21	23:43	Phoenix South	1	Waters	Now-1am	-	-
08/10/21	7:51	East Valley	1	Henz	Now-930am	-	0.25-0.50/1.00-1.25
08/10/21	7:51	Southeast Valley	1	Henz	Now-930am	-	0.25-0.50/1.00-1.25
08/10/21	16:23	Upper Centennial	1	Henz	Now-630pm	-	0.50-1.00/1.50-2.00
08/10/21	16:23	Wickenburg	1	Henz	Now-630pm	-	0.50-1.00/1.50-2.00
08/11/21	6:42	Scottsdale North	1	Henz	Now-830am	-	0.50-0.75/1.00-1.50
08/11/21	7:10	East Valley	1	Waters	Now-9am	-	0.50-0.75/1.00-1.50
08/11/21	7:10	Superstition	1	Waters	Now-9am	-	0.50-0.75/1.00-1.50
08/11/21	8:19	East Valley	3	Waters	Now-10am	-	-
08/11/21	8:19	Superstition	3	Waters	Now-10am	-	-
08/11/21	15:45	Wickenburg	1	Henz	Now-530pm	-	0.50-0.75/1.00-1.50
08/11/21	16:06	Wickenburg	3	Henz	Now-7pm	-	-
08/11/21	17:26	Phoenix North	1	Henz	Now-7pm	-	0.50-0.75/1.00-1.50
08/11/21	17:29	Phoenix South	1	Henz	Now-7pm	-	0.50-0.75/1.00-1.50
08/11/21	17:39	Scottsdale South	1	Henz	Now-7pm	-	0.50-0.75/1.00-1.50
08/11/21	18:10	Rainbow Valley	3	Waters	Now-9pm	-	-
08/11/21	18:49	Scottsdale North	1	Waters	Now-8pm	-	0.50-0.75/1.00-1.50
08/11/21	19:08	West Valley	1	Waters	Now-8pm	-	0.75-1.00
08/11/21	19:44	Upper Centennial	1	Waters	Now-9pm	-	0.50-0.75/1.00-1.50
08/12/21	5:18	Scottsdale North	1	Waters	Now-8am	-	0.50-0.75/1.00-1.50
08/12/21	5:18	New River/Cave Creek	1	Waters	Now-8am	-	0.50-0.75/1.00-1.50
08/12/21	6:44	Scottsdale North	3	Waters	Now-11am	-	-
08/12/21	8:02	Northwest Valley	1	Waters	Now-11am	-	0.50-0.75/1.00-1.50
08/13/21	21:25	Wickenburg	1	Waters	Now-1030pm	-	-
08/13/21	21:25	Upper Centennial	1	Waters	Now-1030pm	-	-
08/13/21	21:37	Scottsdale North	1	Waters	Now-1030pm	-	-
08/13/21	21:37	Phoenix North	1	Waters	Now-1030pm	-	-
08/13/21	22:02	Scottsdale North	3	Waters	Now-12am	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
08/13/21	22:13	Phoenix South	1	Waters	Now-1130pm	-	-
08/13/21	22:13	Northwest Valley	1	Waters	Now-1130pm	-	-
08/13/21	22:13	West Valley	1	Waters	Now-1130pm	-	-
08/13/21	22:13	Scottsdale South	1	Waters	Now-1130pm	-	-
08/13/21	22:13	East Valley	1	Waters	Now-1130pm	-	-
08/13/21	22:13	Rainbow Valley	1	Waters	Now-1130pm	-	-
08/13/21	22:50	Superstition	1	Waters	Now-2am	-	-
08/13/21	22:50	Southeast Valley	1	Waters	Now-2am	-	-
08/13/21	22:50	Gila River	1	Waters	Now-2am	-	-
08/13/21	23:12	West Valley	1U	Waters	Now-2am	-	-
08/13/21	23:12	Rainbow Valley	1U	Waters	Now-2am	-	-
08/13/21	23:12	Palo Verde	1	Waters	Now-2am	-	-
08/14/21	12:48	Gila Bend	1	Waters	Now-3am	-	0.50-0.75/1.00-1.50
08/15/21	22:43	East Valley	1	Henz	Now-12am	-	0.50-0.75/1.00-1.50
08/15/21	23:23	Phoenix South	1	Henz	Now-1am	-	0.50-0.75/1.00-1.50
08/15/21	23:23	Gila River	1	Henz	Now-1am	-	0.50-0.75/1.00-1.50
08/16/21	21:30	Lower Salt River Lakes	1	Henz	Now-11pm	-	0.75-1.00/1.50
08/16/21	22:03	Superstition	1	Henz	Now-11:30pm	-	0.75-1.00/1.50
08/16/21	22:18	East Valley	1	Henz	Now-12am	-	0.75-1.00/1.50
08/16/21	22:18	Southeast Valley	1	Henz	Now-12am	-	0.75-1.00/1.50
08/16/21	22:23	Scottsdale North	1	Henz	Now-12am	-	0.75-1.00/1.50
08/16/21	22:36	Superstition	3	Henz	Now-1am	-	-
08/16/21	22:40	Scottsdale South	1	Henz	Now-1230am	-	0.75-1.00/1.50-2.00
08/16/21	23:02	Phoenix South	1	Henz	Now-12:45am	-	0.75-1.00/1.50-2.00
08/16/21	23:02	Gila River	1	Henz	Now-12:45am	-	0.75-1.00/1.50-2.00
08/16/21	23:27	Rainbow Valley	1	Henz	Now-130am	-	0.75-1.00/1.50-2.00
08/16/21	23:35	Southeast Valley	3	Henz	Now-2am	-	-
08/16/21	23:52	Gila Bend	1	Henz	Now-130am	-	0.75-1.00/1.50-2.00
08/17/21	5:55	West Valley	1	Henz	Now-715am	-	0.75-1.00/1.50

TABLE B-1: MSP Statements Issued - Monsoon Season 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
08/17/21	6:54	Scottsdale South	1	Henz	Now-830am	-	0.75-1.50
08/17/21	6:54	Phoenix North	1	Henz	Now-830am	-	0.75-1.50
08/17/21	7:09	Southeast Valley	1	Waters	Now-830am	-	0.50-0.75/1.00
08/17/21	7:35	Phoenix South	1	Waters	Now-9am	-	0.50-0.75/1.00
08/18/21	12:46	New River/Cave Creek	1	Henz	Now-2pm	-	0.75-1.25/2.00
08/18/21	12:52	Scottsdale North	1	Henz	Now-3pm	-	0.75-1.25/2.00
08/18/21	12:52	Phoenix North	1	Henz	Now-3pm	-	0.75-1.25/2.00
08/18/21	12:52	Scottsdale South	1	Henz	Now-3pm	-	0.75-1.25/2.00
08/18/21	13:19	Phoenix South	1	Henz	Now-3pm	-	0.75-1.25/2.00
08/18/21	13:50	New River/Cave Creek	3	Henz	Now-4pm	-	-
08/18/21	14:00	Phoenix North	3	Henz	Now-4pm	-	-
08/18/21	14:00	Scottsdale North	3	Henz	Now-4pm	-	-
08/18/21	14:43	East Valley	1	Henz	Now-5pm	-	0.75-1.25/2.00
08/18/21	16:45	West Valley	1	Henz	Now-630pm	-	0.50-1.00/1.50
08/18/21	16:45	Rainbow Valley	1	Henz	Now-630pm	-	0.50-1.00/1.50
08/18/21	16:45	Phoenix South	1	Henz	Now-630pm	-	0.50-1.00/1.50
08/18/21	16:53	East Valley	1	Henz	Now-630pm	-	0.50-1.00/1.25
08/18/21	16:53	Gila River	1	Henz	Now-630pm	-	0.50-1.00/1.25
08/18/21	17:55	Phoenix South	1	Waters	Now-730pm	-	0.50-1.00/1.25
08/18/21	17:55	Scottsdale South	1	Waters	Now-730pm	-	0.50-1.00/1.25
08/29/21	16:46	Upper Centennial	1	Henz	Now-630pm	-	0.50-0.75/1.00
08/31/21	11:00	Upper Centennial	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Wickenburg	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Palo Verde	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Gila Bend	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Rainbow Valley	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	West Valley	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Northwest Valley	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	New River/Cave Creek	2	Henz	Now-5am Thurs 9/2	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
08/31/21	11:00	Phoenix North	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Phoenix South	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Gila River	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Scottsdale North	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Scottsdale South	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	East Valley	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Southeast Valley	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Lower Salt River Lakes	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	11:00	Superstition	2	Henz	Now-5am Thurs 9/2	-	-
08/31/21	16:30	Lower Salt River Lakes	1	Henz	Now-630pm	-	0.50-0.75/1.00-2.00
09/01/21	1:55	Upper Centennial	1	Waters	Now-330am	-	0.50-0.75/1.00
09/01/21	1:55	Wickenburg	1	Waters	Now-330am	-	0.50-0.75/1.00
09/01/21	16:35	Upper Centennial	1	Henz	Now-630pm	-	0.50-0.75/1.00-2.00
09/01/21	16:35	Wickenburg	1	Henz	Now-630pm	-	0.50-0.75/1.00-2.00
09/01/21	16:52	New River/Cave Creek	1	Henz	Now-645pm	-	0.50-0.75/1.00-2.00
09/01/21	17:59	Northwest Valley	1	Henz	Now-8pm	-	0.50-0.75/1.00-2.00
09/01/21	17:59	Phoenix North	1	Henz	Now-8pm	-	0.50-0.75/1.00-2.00
09/01/21	19:26	Phoenix South	1	Henz	Now-930pm	-	0.50-0.75/1.00-2.00
09/01/21	19:26	Scottsdale South	1	Henz	Now-930pm	-	0.50-0.75/1.00-2.00
09/01/21	19:26	East Valley	1	Henz	Now-930pm	-	0.50-0.75/1.00-2.00
09/01/21	19:52	West Valley	1	Henz	Now-930pm	-	0.50-0.75/1.00-2.00
09/01/21	19:52	Rainbow Valley	1	Henz	Now-930pm	-	0.50-0.75/1.00-2.00
09/01/21	21:32	Gila River	1	Henz	Now-1130pm	-	0.50-0.75/1.00-2.00
09/01/21	21:32	Southeast Valley	1	Henz	Now-1130pm	-	0.50-0.75/1.00-2.00
09/01/21	21:38	West Valley	1U	Henz	Now-1130pm	-	-
09/01/21	21:38	Rainbow Valley	1U	Henz	Now-1130pm	-	-
09/01/21	21:41	Phoenix South	1U	Henz	Now-1130pm	-	-
09/01/21	21:41	Scottsdale South	1U	Henz	Now-1130pm	-	-
09/01/21	21:41	East Valley	1U	Henz	Now-1130pm	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2021							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
09/01/21	22:27	Palo Verde	1	Henz	Now-1230am	-	0.50-0.75/1.00-2.00
09/24/21	7:49	Gila Bend	1	Waters	Now-12pm	-	0.50-0.75/1.00-2.00
09/30/21	16:23	New River/Cave Creek	1	Henz	Now-630pm	-	0.50-0.75/1.00-1.50
09/30/21	16:23	Scottsdale North	1	Henz	Now-630pm	-	0.50-0.75/1.00-1.50
09/30/21	17:55	Superstition	1	Henz	Now-8pm	-	0.50-0.75/1.00-1.50

TABLE B-2: This table shows the raw verification data of MSP issued Messages for the 2021 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.

TABLE B-2: MSP Statements Issued - Monsoon Season 2021

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
07/03/21	Wickenburg	1	-	0.50-0.75/1.00-1.50	0.75	0.76-1.00	-	-	-	-	Hit
07/03/21	Northwest Valley	1	-	0.50-0.75/1.00-1.25	1.34	1.51-2.00	-	-	-	-	Hit
07/03/21	West Valley	1	-	0.50-0.75/1.00-1.25	0.59	1.26-1.50	-	-	-	-	Hit
07/03/21	Phoenix North	1	-	0.50-0.75/1.00-1.25	0.39	0.76-1.00	-	-	X	-	Hit
07/03/21	Phoenix South	1	-	0.50-0.75/1.00-1.25	0.43	1.51-2.00	-	-	X	-	Hit
07/03/21	Scottsdale North	1	-	0.50-0.75/1.00-1.25	1.22	1.26-1.50	-	-	-	-	Hit
07/03/21	Scottsdale South	1	-	0.50-0.75/1.00-1.25	0.59	1.01-1.25	-	-	-	-	Hit
07/09/21	Southeast Valley	1	-	0.50-0.75/1.00	0.91	1.01-1.25	-	-	-	-	Hit
07/09/21	East Valley	1	-	0.50-0.75/1.00	0.04	0.26-0.50	-	-	-	-	Miss
07/09/21	Gila River	1	-	0.50-0.75/1.00	0.08	0.51-0.75	-	-	-	-	Hit
07/09/21	Gila Bend	1	-	0.50-0.75/1.00	0.00	0.26-0.50	-	-	-	-	Miss
07/10/21	Southeast Valley	1	-	-	0.12	1.01-1.25	-	X	-	-	Hit
07/12/21	Scottsdale North	1	-	0.50-0.75/1.00-1.25	1.22	1.01-1.25	0.52	X	-	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2021

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
07/12/21	Phoenix North	1	-	0.50-0.75/1.00-1.25	0.12	0.51-0.75	-	-	-	-	Hit
07/13/21	Northwest Valley	2	-	-	-	-	-	-	-	-	Hit
07/13/21	West Valley	2	-	-	-	-	-	-	X	-	Hit
07/13/21	New River/Cave Creek	2	-	-	-	-	-	-	-	-	Hit
07/13/21	Phoenix North	2	-	-	-	-	-	-	-	-	Hit
07/13/21	Phoenix South	2	-	-	-	-	-	-	X	-	Hit
07/13/21	Gila River	2	-	-	-	-	-	-	-	-	Hit
07/13/21	Scottsdale North	2	-	-	-	-	-	-	-	-	Miss
07/13/21	Scottsdale South	2	-	-	-	-	-	-	-	-	Hit
07/13/21	East Valley	2	-	-	-	-	-	-	-	-	Hit
07/13/21	Southeast Valley	2	-	-	-	-	-	-	-	-	Hit
07/13/21	Lower Salt River Lakes	2	-	-	-	-	-	-	-	-	Miss
07/13/21	Superstition	2	-	-	-	-	-	-	-	-	Hit
07/14/21	Northwest Valley	1	-	0.50-0.75/1.00-1.50	0.51	1.01-1.25	-	-	-	-	Hit
07/14/21	West Valley	1	-	0.50-0.75/1.00-1.50	0.63	1.51-2.00	-	-	X	-	Hit
07/14/21	Phoenix South	1	-	0.50-0.75/1.00-1.50	1.38	2.01-2.50	-	X	-	-	Hit
07/14/21	New River/Cave Creek	1	-	0.50-0.75/1.00-1.50	0.43	1.51-2.00	-	-	-	-	Hit
07/14/21	Phoenix North	1	-	0.50-0.75/1.00-1.50	0.00	0.51-0.75	-	-	-	-	Hit
07/14/21	Scottsdale South	1	-	0.50-0.75/1.00-1.50	0.35	0.51-0.75	-	-	-	-	Hit
07/14/21	East Valley	1	-	0.50-0.75/1.00-1.50	0.39	0.76-1.00	-	-	-	-	Hit
07/14/21	Phoenix South	3	-	-	1.38	2.01-2.50	-	-	-	-	Hit
07/14/21	Superstition	1	-	0.50-0.75/1.00-1.50	0.75	0.76-1.00	-	-	-	-	Hit
07/14/21	Gila River	1	-	0.50-0.75/1.00-1.50	0.47	1.01-1.25	-	-	-	-	Hit
07/14/21	Southeast Valley	1	-	0.50-0.75/1.00-1.50	0.39	1.01-1.25	-	-	-	-	Hit
07/14/21	Superstition	1	-	0.25-0.50/0.75-1.00	0.20	0.76-1.00	-	-	-	-	Hit
07/15/21	Upper Centennial	1	-	-	1.65	3.01-4.00	-	-	-	-	Hit
07/15/21	West Valley	1	-	-	0.20	2.51-3.00	-	-	-	-	Hit
07/15/21	Upper Centennial	3	-	-	1.65	3.01-4.00	-	-	-	-	Hit
07/15/21	Northwest Valley	1	-	up to 1.00	0.94	1.26-1.50	-	-	-	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2021

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	
07/15/21	New River/Cave Creek	1	-	up to 1.00	0.94	1.01-1.25	-	-	-	-	Hit	
07/15/21	Phoenix North	1	-	up to 1.00	0.00	0.51-0.75	-	-	-	-	Hit	
07/15/21	Scottsdale South	1	-	up to 1.00	0.63	0.76-1.00	-	-	-	-	Hit	
07/15/21	East Valley	1	-	up to 1.00	0.75	1.51-2.00	-	-	-	-	Hit	
07/15/21	Superstition	1	-	up to 1.00	0.94	0.76-1.00	-	-	-	-	Hit	
07/15/21	Wickenburg	1	1.00/60min	-	1.06	1.26-1.50	-	X	-	-	Hit	
07/16/21	Southeast Valley	1	-	0.50	0.51	0.76-1.00	-	-	-	-	Hit	
07/16/21	Southeast Valley	1	-	0.50	0.43	0.76-1.00	-	-	-	-	Hit	
07/16/21	East Valley	1	-	0.50	0.31	1.51-2.00	-	-	-	-	Hit	
07/16/21	Gila River	1	-	0.50	0.51	0.51-0.75	-	-	-	-	Hit	
07/16/21	Northwest Valley	1	0.50/60min	-	0.83	3.01-4.00	-	-	-	-	Hit	
07/16/21	Wickenburg	1	0.75/60min	-	1.89	1.51-2.00	-	X	-	-	Hit	
07/16/21	West Valley	1	-	-	1.46	1.51-2.00	-	-	-	-	Hit	
07/20/21	Upper Centennial	1	-	0.50-0.75/1.25-1.50	0.87	1.26-1.50	-	-	-	-	Hit	
07/20/21	Superstition	1	-	-	0.39	0.76-1.00	-	-	-	-	Hit	
07/21/21	Upper Centennial	1	-	0.50-0.75/1.50-2.00	1.85	2.01-2.50	-	X	-	-	Hit	
07/21/21	Wickenburg	1	-	0.50-0.75/1.50-2.00	1.54	1.51-2.00	-	X	-	-	Hit	
07/21/21	Wickenburg	3	-	-	1.54	1.51-2.00	-	X	-	-	Hit	
07/22/21	Upper Centennial	2	-	-	-	-	-	-	-	-	Miss	
07/22/21	Wickenburg	2	-	-	-	-	-	X	X	-	Hit	
07/22/21	Palo Verde	2	-	-	-	-	-	-	-	-	Miss	
07/22/21	Gila Bend	2	-	-	-	-	-	-	-	-	Miss	
07/22/21	Rainbow Valley	2	-	-	-	-	-	-	X	X	-	Hit
07/22/21	West Valley	2	-	-	-	-	-	-	-	X	-	Hit
07/22/21	Northwest Valley	2	-	-	-	-	-	-	-	-	-	Hit
07/22/21	New River/Cave Creek	2	-	-	-	-	-	-	X	X	-	Hit
07/22/21	Phoenix North	2	-	-	-	-	-	-	-	X	X	Hit
07/22/21	Phoenix South	2	-	-	-	-	-	-	X	-	-	Hit
07/22/21	Gila River	2	-	-	-	-	-	-	-	-	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2021

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
07/22/21	Scottsdale North	2	-	-	-	-	-	X	-	-	Hit
07/22/21	Scottsdale South	2	-	-	-	-	-	X	X	X	Hit
07/22/21	East Valley	2	-	-	-	-	-	X	X	-	Hit
07/22/21	Southeast Valley	2	-	-	-	-	-	X	-	-	Hit
07/22/21	Lower Salt River Lakes	2	-	-	-	-	-	-	-	-	Miss
07/22/21	Superstition	2	-	-	-	-	-	X	-	-	Hit
07/22/21	Gila River	1	-	0.50-0.75/1.00-1.25	0.00	2.51-3.00	-	-	-	-	Hit
07/22/21	Scottsdale North	1	-	0.50-0.75/1.00-1.25	1.10	2.51-3.00	-	X	-	-	Hit
07/22/21	Scottsdale South	1	-	0.50-0.75/1.00-1.25	2.24	4.01-5.00	-	X	X	-	Hit
07/22/21	Northwest Valley	1	-	0.50-0.75/1.00-1.25	0.98	2.01-2.50	0.50	-	-	-	Hit
07/22/21	Scottsdale South	3	-	-	2.24	4.01-5.00	-	X	X	X	Hit
07/22/21	Phoenix North	1	-	0.50-0.75/1.25-1.75	0.91	2.01-2.50	-	-	X	X	Hit
07/22/21	East Valley	1	-	0.50-0.75/1.25-1.75	1.22	2.51-3.00	-	X	-	-	Hit
07/23/21	New River/Cave Creek	1	-	0.50-0.75/1.25-1.75	1.02	2.01-2.50	-	X	-	-	Hit
07/23/21	New River/Cave Creek	1	-	0.50-0.75/1.00-1.25	2.87	5.01-6.00	-	X	X	-	Hit
07/23/21	Scottsdale North	1	-	0.50-0.75/1.00-1.25	1.69	1.26-1.50	0.50	X	-	-	Hit
07/23/21	Phoenix North	1	-	0.50-0.75/1.00-1.25	1.57	1.51-2.00	-	-	-	X	Hit
07/23/21	Scottsdale South	1	-	0.50-0.75/1.00-1.25	1.42	1.01-1.25	-	X	X	X	Hit
07/23/21	Phoenix South	1	-	0.50-0.75/1.00-1.25	0.63	1.01-1.25	-	-	-	X	Hit
07/23/21	New River/Cave Creek	3	-	-	2.87	5.01-6.00	-	X	X	-	Hit
07/25/21	West Valley	1	-	0.50-0.75	2.09	3.01-4.00	-	-	X	-	Hit
07/25/21	Northwest Valley	1	-	0.50-0.75	1.85	4.01-5.00	-	-	X	-	Hit
07/25/21	Wickenburg	1	-	-	1.18	1.26-1.50	-	X	X	-	Hit
07/25/21	Rainbow Valley	3	-	-	2.05	2.01-2.50	-	X	X	-	Hit
07/25/21	West Valley	3	-	-	2.68	3.01-4.00	-	-	-	-	Hit
07/29/21	Gila Bend	1	-	-	1.34	1.51-2.00	-	-	-	-	Hit
07/29/21	New River/Cave Creek	1	-	-	1.22	1.26-1.50	-	X	X	-	Hit
07/29/21	Wickenburg	1	-	-	0.75	1.26-1.50	-	-	-	-	Hit
07/30/21	Palo Verde	1	-	-	1.02	2.51-3.00	-	X	X	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2021

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
07/30/21	Phoenix North	1	-	-	0.91	1.51-2.00	-	-	X	-	Hit
07/30/21	Phoenix South	1	-	-	1.10	1.51-2.00	-	-	X	-	Hit
07/30/21	East Valley	1	-	-	0.91	0.76-1.00	-	-	-	-	Hit
07/30/21	Scottsdale South	1	-	-	0.28	0.51-0.75	-	-	-	-	Hit
07/30/21	East Valley	1	-	-	0.91	0.76-1.00	-	-	-	-	Hit
07/30/21	Gila River	1	-	-	0.31	1.01-1.25	-	-	-	-	Hit
07/30/21	Phoenix South	1	-	-	1.10	1.51-2.00	-	-	-	-	Hit
08/10/21	East Valley	1	-	0.25-0.50/1.00-1.25	0.67	1.26-1.50	0.95	-	-	-	Hit
08/10/21	Southeast Valley	1	-	0.25-0.50/1.00-1.25	2.72	2.51-3.00	0.95	-	-	-	Hit
08/10/21	Upper Centennial	1	-	0.50-1.00/1.50-2.00	0.79	1.51-2.00	-	-	-	-	Hit
08/10/21	Wickenburg	1	-	0.50-1.00/1.50-2.00	0.51	1.51-2.00	-	X	-	-	Hit
08/11/21	Scottsdale North	1	-	0.50-0.75/1.00-1.50	2.13	2.51-3.00	-	X	X	-	Hit
08/11/21	East Valley	1	-	0.50-0.75/1.00-1.50	1.81	2.51-3.00	-	X	-	-	Hit
08/11/21	Superstition	1	-	0.50-0.75/1.00-1.50	1.81	2.51-3.00	-	X	-	-	Hit
08/11/21	East Valley	3	-	-	1.81	2.51-3.00	-	X	-	-	Hit
08/11/21	Superstition	3	-	-	1.81	2.51-3.00	-	X	-	-	Hit
08/11/21	Wickenburg	1	-	0.50-0.75/1.00-1.50	1.89	1.51-2.00	-	X	X	-	Hit
08/11/21	Wickenburg	3	-	-	1.89	1.51-2.00	-	X	X	-	Hit
08/11/21	Phoenix North	1	-	0.50-0.75/1.00-1.50	0.63	1.51-2.00	1.50	-	-	X	Hit
08/11/21	Phoenix South	1	-	0.50-0.75/1.00-1.50	0.87	0.76-1.00	1.50	-	-	-	Hit
08/11/21	Scottsdale South	1	-	0.50-0.75/1.00-1.50	1.10	2.51-3.00	-	X	-	-	Hit
08/11/21	Rainbow Valley	3	-	-	2.28	2.01-2.50	-	-	-	-	Hit
08/11/21	Scottsdale North	1	-	0.50-0.75/1.00-1.50	0.94	3.01-4.00	-	-	-	-	Hit
08/11/21	West Valley	1	-	0.75-1.00	0.94	2.01-2.50	-	-	-	-	Hit
08/11/21	Upper Centennial	1	-	0.50-0.75/1.00-1.50	0.83	2.51-3.00	-	-	-	-	Hit
08/12/21	Scottsdale North	1	-	0.50-0.75/1.00-1.50	2.17	3.01-4.00	-	X	-	-	Hit
08/12/21	New River/Cave Creek	1	-	0.50-0.75/1.00-1.50	2.28	2.51-3.00	-	X	X	-	Hit
08/12/21	Scottsdale North	3	-	-	2.17	3.01-4.00	-	X	-	-	Hit
08/12/21	Northwest Valley	1	-	0.50-0.75/1.00-1.50	1.65	1.51-2.00	-	-	X	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2021

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
08/13/21	Wickenburg	1	-	-	0.83	1.26-1.50	-	X	-	-	Hit
08/13/21	Upper Centennial	1	-	-	0.98	1.51-2.00	-	-	-	-	Hit
08/13/21	Scottsdale North	1	-	-	2.09	2.51-3.00	-	X	-	X	Hit
08/13/21	Phoenix North	1	-	-	2.05	2.51-3.00	1.04	X	X	X	Hit
08/13/21	Scottsdale North	3	-	-	2.09	2.51-3.00	-	X	-	X	Hit
08/13/21	Phoenix South	1	-	-	2.24	3.01-4.00	-	X	-	X	Hit
08/13/21	Northwest Valley	1	-	-	2.05	2.01-2.50	-	X	-	-	Hit
08/13/21	West Valley	1	-	-	1.77	2.01-2.50	-	X	X	-	Hit
08/13/21	Scottsdale South	1	-	-	1.50	1.51-2.00	-	X	X	-	Hit
08/13/21	East Valley	1	-	-	2.17	2.01-2.50	0.64	X	-	X	Hit
08/13/21	Rainbow Valley	1	-	-	0.98	1.51-2.00	-	-	-	-	Hit
08/13/21	Superstition	1	-	-	2.24	2.01-2.50	-	X	-	X	Hit
08/13/21	Southeast Valley	1	-	-	1.14	2.01-2.50	-	-	-	-	Hit
08/13/21	Gila River	1	-	-	1.02	2.01-2.50	-	-	-	-	Hit
08/13/21	West Valley	1U	-	-	-	-	-	-	-	-	-
08/13/21	Rainbow Valley	1U	-	-	-	-	-	-	-	-	-
08/13/21	Palo Verde	1	-	-	2.17	2.01-25.0	-	X	-	-	Hit
08/14/21	Gila Bend	1	-	0.50-0.75/1.00-1.50	3.78	3.01-4.00	-	X	X	-	Hit
08/15/21	East Valley	1	-	0.50-0.75/1.00-1.50	0.83	0.76-1.00	-	X	-	-	Hit
08/15/21	Phoenix South	1	-	0.50-0.75/1.00-1.50	0.35	0.76-1.00	-	-	-	-	Hit
08/15/21	Gila River	1	-	0.50-0.75/1.00-1.50	0.08	0.11-0.25	-	-	-	-	Hit
08/16/21	Lower Salt River Lakes	1	-	0.75-1.00/1.50	1.10	1.51-2.00	-	-	-	-	Hit
08/16/21	Superstition	1	-	0.75-1.00/1.50	2.05	2.01-2.50	-	-	-	-	Hit
08/16/21	East Valley	1	-	0.75-1.00/1.50	1.50	1.51-2.00	-	X	-	-	Hit
08/16/21	Southeast Valley	1	-	0.75-1.00/1.50	1.34	2.51-3.00	-	-	-	-	Hit
08/16/21	Scottsdale North	1	-	0.75-1.00/1.50	1.22	1.01-1.25	-	X	-	-	Hit
08/16/21	Superstition	3	-	-	2.05	2.01-2.50	-	-	X	-	Hit
08/16/21	Scottsdale South	1	-	0.75-1.00/1.50-2.00	1.22	1.01-1.25	-	-	X	-	Hit
08/16/21	Phoenix South	1	-	0.75-1.00/1.50-2.00	0.67	1.01-1.25	-	-	-	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2021

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
08/16/21	Gila River	1	-	0.75-1.00/1.50-2.00	0.24	1.01-1.25	-	-	-	-	Hit
08/16/21	Rainbow Valley	1	-	0.75-1.00/1.50-2.00	0.79	0.76-1.00	-	-	-	-	Hit
08/16/21	Southeast Valley	3	-	-	1.34	2.51-3.00	-	-	-	-	Hit
08/16/21	Gila Bend	1	-	0.75-1.00/1.50-2.00	0.00	0.26-0.50	-	-	-	-	Miss
08/17/21	West Valley	1	-	0.75-1.00/1.50	0.67	2.01-2.50	-	-	-	-	Hit
08/17/21	Scottsdale South	1	-	0.75-1.50	0.98	1.01-1.25	-	-	X	-	Hit
08/17/21	Phoenix North	1	-	0.75-1.50	0.98	1.51-2.00	-	-	X	X	Hit
08/17/21	Southeast Valley	1	-	0.50-0.75/1.00	0.04	2.51-3.00	-	-	X	-	Hit
08/17/21	Phoenix South	1	-	0.50-0.75/1.00	0.35	1.01-1.25	-	-	-	X	Hit
08/18/21	New River/Cave Creek	1	-	0.75-1.25/2.00	3.62	4.01-5.00	-	X	X	-	Hit
08/18/21	Scottsdale North	1	-	0.75-1.25/2.00	3.94	4.01-5.00	-	X	-	-	Hit
08/18/21	Phoenix North	1	-	0.75-1.25/2.00	1.26	1.51-2.00	-	-	X	-	Hit
08/18/21	Scottsdale South	1	-	0.75-1.25/2.00	0.98	1.01-1.25	-	-	X	-	Hit
08/18/21	Phoenix South	1	-	0.75-1.25/2.00	1.02	1.51-2.00	-	X	-	-	Hit
08/18/21	New River/Cave Creek	3	-	-	3.62	4.01-5.00	-	-	X	-	Hit
08/18/21	Phoenix North	3	-	-	1.26	1.51-2.00	1.10	-	X	-	Hit
08/18/21	Scottsdale North	3	-	-	3.94	4.01-5.00	-	-	-	-	Hit
08/18/21	East Valley	1	-	0.75-1.25/2.00	0.67	0.51-0.75	-	-	-	-	Hit
08/18/21	West Valley	1	-	0.50-1.00/1.50	0.79	1.01-1.25	-	-	X	-	Hit
08/18/21	Rainbow Valley	1	-	0.50-1.00/1.50	0.75	1.01-1.25	-	-	-	-	Hit
08/18/21	Phoenix South	1	-	0.50-1.00/1.50	1.02	1.51-2.00	-	-	-	-	Hit
08/18/21	East Valley	1	-	0.50-1.00/1.25	0.67	0.51-0.75	-	-	-	-	Hit
08/18/21	Gila River	1	-	0.50-1.00/1.25	0.39	1.51-2.00	-	-	-	-	Hit
08/18/21	Phoenix South	1	-	0.50-1.00/1.25	1.02	1.51-2.00	-	-	-	-	Hit
08/18/21	Scottsdale South	1	-	0.50-1.00/1.25	0.98	1.01-1.25	-	-	-	-	Hit
08/29/21	Upper Centennial	1	-	0.50-0.75/1.00	0.51	1.26-1.50	-	-	-	-	Hit
08/31/21	Upper Centennial	2	-	-	-	-	-	X	X	-	Hit
08/31/21	Wickenburg	2	-	-	-	-	-	-	-	-	Miss
08/31/21	Palo Verde	2	-	-	-	-	-	-	X	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2021

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
08/31/21	Gila Bend	2	-	-	-	-	-	-	-	-	Miss
08/31/21	Rainbow Valley	2	-	-	-	-	-	-	-	-	Miss
08/31/21	West Valley	2	-	-	-	-	-	X	-	-	Hit
08/31/21	Northwest Valley	2	-	-	-	-	-	-	-	-	Miss
08/31/21	New River/Cave Creek	2	-	-	-	-	-	X	-	-	Hit
08/31/21	Phoenix North	2	-	-	-	-	-	-	-	-	Hit
08/31/21	Phoenix South	2	-	-	-	-	-	X	-	-	Hit
08/31/21	Gila River	2	-	-	-	-	-	-	-	-	Hit
08/31/21	Scottsdale North	2	-	-	-	-	-	-	-	-	Miss
08/31/21	Scottsdale South	2	-	-	-	-	-	X	-	-	Hit
08/31/21	East Valley	2	-	-	-	-	-	-	-	-	Hit
08/31/21	Southeast Valley	2	-	-	-	-	-	-	-	-	Hit
08/31/21	Lower Salt River Lakes	2	-	-	-	-	-	-	-	-	Hit
08/31/21	Superstition	2	-	-	-	-	-	-	-	-	Miss
08/31/21	Lower Salt River Lakes	1	-	0.50-0.75/1.00-2.00	0.00	1.51-2.00	-	-	-	-	Hit
09/01/21	Upper Centennial	1	-	0.50-0.75/1.00	0.67	1.01-1.25	-	X	X	-	Hit
09/01/21	Wickenburg	1	-	0.50-0.75/1.00	0.00	0.11-0.25	-	-	-	-	Miss
09/01/21	Upper Centennial	1	-	0.50-0.75/1.00-2.00	0.63	0.76-1.00	-	-	-	-	Hit
09/01/21	Wickenburg	1	-	0.50-0.75/1.00-2.00	0.94	1.01-1.25	-	X	-	-	Hit
09/01/21	New River/Cave Creek	1	-	0.50-0.75/1.00-2.00	1.18	1.26-1.50	-	X	-	-	Hit
09/01/21	Northwest Valley	1	-	0.50-0.75/1.00-2.00	0.39	2.51-3.00	-	-	-	-	Hit
09/01/21	Phoenix North	1	-	0.50-0.75/1.00-2.00	0.35	1.01-1.25	-	-	-	-	Hit
09/01/21	Phoenix South	1	-	0.50-0.75/1.00-2.00	1.18	1.51-2.00	-	X	-	-	Hit
09/01/21	Scottsdale South	1	-	0.50-0.75/1.00-2.00	0.35	1.01-1.25	-	X	-	-	Hit
09/01/21	East Valley	1	-	0.50-0.75/1.00-2.00	0.75	2.51-3.00	0.75	-	-	-	Hit
09/01/21	West Valley	1	-	0.50-0.75/1.00-2.00	1.34	3.01-4.00	-	X	-	-	Hit
09/01/21	Rainbow Valley	1	-	0.50-0.75/1.00-2.00	1.46	1.51-2.00	-	-	-	-	Hit
09/01/21	Gila River	1	-	0.50-0.75/1.00-2.00	0.75	3.01-4.00	-	-	-	-	Hit
09/01/21	Southeast Valley	1	-	0.50-0.75/1.00-2.00	1.06	2.01-2.50	-	-	-	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2021												
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
09/01/21	West Valley	1U	-	-		-	-	-	-	-	-	-
09/01/21	Rainbow Valley	1U	-	-		-	-	-	-	-	-	-
09/01/21	Phoenix South	1U	-	-		-	-	-	-	-	-	-
09/01/21	Scottsdale South	1U	-	-		-	-	-	-	-	-	-
09/01/21	East Valley	1U	-	-		-	-	-	-	-	-	-
09/01/21	Palo Verde	1	-	0.50-0.75/1.00-2.00	0.87	1.51-2.00	-	X	-	-	-	Hit
09/24/21	Gila Bend	1	-	0.50-0.75/1.00-2.00	1.34	2.01-2.50	-	X	-	-	-	Hit
09/30/21	New River/Cave Creek	1	-	0.50-0.75/1.00-1.50	0.75	0.75-1.00	-	-	-	-	-	Hit
09/30/21	Scottsdale North	1	-	0.50-0.75/1.00-1.50	0.75	0.75-1.00	-	-	-	-	-	Hit
09/30/21	Superstition	1	-	0.50-0.75/1.00-1.50	0.51	0.51-0.75	-	-	-	-	-	Hit

TABLE B-3: This table shows the lead time data of MSP issued Messages for the 2021 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.

TABLE B-3: MSP Statement Lead Time - Monsoon Season 2021							
Statement Details						Statement Lead Time	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Alarm Triggered	Lead Time(min)
07/03/21	18:50	Phoenix North	1	Henz	Now-8pm	20:08	78
07/03/21	18:50	Phoenix South	1	Henz	Now-8pm	20:08	78
07/10/21	20:56	Southeast Valley	1	Waters	Now-11pm	20:29	0
07/12/21	21:55	Scottsdale North	1	Henz	Now-1130pm	22:03	8
07/13/21	12:30	Northwest Valley	2	Henz	Now-10pm 7/14	4:32	962
07/13/21	12:30	West Valley	2	Henz	Now-10pm 7/14	4:40	970
07/13/21	12:30	New River/Cave Creek	2	Henz	Now-10pm 7/14	4:52	982
07/13/21	12:30	Phoenix North	2	Henz	Now-10pm 7/14	5:03	993
07/13/21	12:30	Phoenix South	2	Henz	Now-10pm 7/14	4:45	975
07/13/21	12:30	Gila River	2	Henz	Now-10pm 7/14	5:53	1043
07/13/21	12:30	Scottsdale South	2	Henz	Now-10pm 7/14	5:10	1000
07/13/21	12:30	East Valley	2	Henz	Now-10pm 7/14	5:17	1007
07/13/21	12:30	Southeast Valley	2	Henz	Now-10pm 7/14	6:03	1053
07/13/21	12:30	Superstition	2	Henz	Now-10pm 7/14	11:15	1365
07/14/21	4:40	West Valley	1	Henz	Now-6am	5:44	64
07/14/21	4:45	Phoenix South	1	Henz	Now-615am	5:13	28
07/15/21	17:20	Wickenburg	1	Waters	Now-7pm	17:37	17
07/16/21	20:05	Wickenburg	1	Waters	Now-9pm	20:17	12
07/21/21	15:18	Upper Centennial	1	Henz	Now-5pm	16:06	48
07/21/21	16:00	Wickenburg	1	Henz	Now-530pm	16:17	17

TABLE B-3: MSP Statement Lead Time - Monsoon Season 2021							
Statement Details						Statement Lead Time	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Alarm Triggered	Lead Time(min)
07/22/21	12:00	Wickenburg	2	Henz	Now-12pm Sun 7/25	7/25 7:45	4065
07/22/21	12:00	Rainbow Valley	2	Henz	Now-12pm Sun 7/25	7/25 12:09	4329
07/22/21	12:00	West Valley	2	Henz	Now-12pm Sun 7/25	7/25 7:10	4030
07/22/21	12:00	Northwest Valley	2	Henz	Now-12pm Sun 7/25	7/22 21:15	555
07/22/21	12:00	New River/Cave Creek	2	Henz	Now-12pm Sun 7/25	7/23 4:25	985
07/22/21	12:00	Phoenix North	2	Henz	Now-12pm Sun 7/25	7/22 21:45	585
07/22/21	12:00	Phoenix South	2	Henz	Now-12pm Sun 7/25	7/23 11:56	1436
07/22/21	12:00	Gila River	2	Henz	Now-12pm Sun 7/25	7/22 20:00	480
07/22/21	12:00	Scottsdale North	2	Henz	Now-12pm Sun 7/25	7/22 20:37	517
07/22/21	12:00	Scottsdale South	2	Henz	Now-12pm Sun 7/25	7/22 20:37	517
07/22/21	12:00	East Valley	2	Henz	Now-12pm Sun 7/25	7/22 21:50	590
07/22/21	12:00	Southeast Valley	2	Henz	Now-12pm Sun 7/25	7/22 22:18	618
07/22/21	12:00	Superstition	2	Henz	Now-12pm Sun 7/25	7/24 14:22	3022
07/22/21	20:37	Scottsdale North	1	Henz	Now-10pm	20:49	12
07/22/21	20:37	Scottsdale South	1	Henz	Now-1015pm	21:13	36
07/22/21	21:45	Phoenix North	1	Henz	Now-1115pm	22:30	45
07/22/21	21:50	East Valley	1	Henz	Now-1130pm	22:17	27
07/23/21	4:25	New River/Cave Creek	1	Henz	Now-6am	04:13	0
07/23/21	11:56	New River/Cave Creek	1	Waters	Now-3pm	11:53	0
07/23/21	11:56	Scottsdale North	1	Waters	Now-3pm	11:22	0
07/23/21	11:56	Phoenix North	1	Waters	Now-3pm	17:08	304
07/23/21	11:56	Scottsdale South	1	Waters	Now-3pm	12:04	8
07/23/21	11:56	Phoenix South	1	Waters	Now-3pm	12:04	8
07/25/21	7:10	Northwest Valley	1	Waters	Now-10am	8:49	99
07/25/21	7:10	West Valley	1	Waters	Now-10am	9:52	162
07/25/21	7:45	Wickenburg	1	Waters	Now-10am	7:48	3
07/29/21	18:15	New River/Cave Creek	1	Waters	Now-9pm	20:25	130
07/30/21	21:11	Palo Verde	1	Waters	Now-12am	20:31	0
07/30/21	22:00	Phoenix North	1	Waters	Now-11pm	21:57	0

TABLE B-3: MSP Statement Lead Time - Monsoon Season 2021							
Statement Details						Statement Lead Time	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Alarm Triggered	Lead Time(min)
07/30/21	22:00	Phoenix South	1	Waters	Now-11pm	21:57	0
08/10/21	16:23	Wickenburg	1	Henz	Now-630pm	17:36	73
08/11/21	6:42	Scottsdale North	1	Henz	Now-830am	6:35	0
08/11/21	7:10	East Valley	1	Waters	Now-9am	7:54	44
08/11/21	7:10	Superstition	1	Waters	Now-9am	7:54	44
08/11/21	15:45	Wickenburg	1	Henz	Now-530pm	15:45	0
08/11/21	17:26	Phoenix North	1	Henz	Now-7pm	18:02	36
08/11/21	17:39	Scottsdale South	1	Henz	Now-7pm	17:58	19
08/12/21	5:18	Scottsdale North	1	Waters	Now-8am	4:49	0
08/12/21	5:18	New River/Cave Creek	1	Waters	Now-8am	4:57	0
08/12/21	8:02	Northwest Valley	1	Waters	Now-11am	10:31	149
08/13/21	21:25	Wickenburg	1	Waters	Now-1030pm	22:30	65
08/13/21	21:37	Scottsdale North	1	Waters	Now-1030pm	21:44	7
08/13/21	21:37	Phoenix North	1	Waters	Now-1030pm	22:16	39
08/13/21	22:13	Phoenix South	1	Waters	Now-1130pm	22:24	11
08/13/21	22:13	Northwest Valley	1	Waters	Now-1130pm	22:57	44
08/13/21	22:13	West Valley	1	Waters	Now-1130pm	00:51	158
08/13/21	22:13	Scottsdale South	1	Waters	Now-1130pm	22:03	0
08/13/21	22:13	East Valley	1	Waters	Now-1130pm	23:18	65
08/13/21	22:50	Superstition	1	Waters	Now-2am	23:16	26
08/13/21	23:12	Palo Verde	1	Waters	Now-2am	00:04	52
08/14/21	12:48	Gila Bend	1	Waters	Now-3am	01:47	59
08/15/21	22:43	East Valley	1	Henz	Now-12am	23:27	44
08/16/21	22:18	East Valley	1	Henz	Now-12am	22:51	33
08/16/21	22:23	Scottsdale North	1	Henz	Now-12am	23:08	45
08/16/21	22:40	Scottsdale South	1	Henz	Now-1230am	23:30	50
08/17/21	6:54	Scottsdale South	1	Henz	Now-830am	6:30	0
08/17/21	6:54	Phoenix North	1	Henz	Now-830am	6:30	0
08/17/21	7:35	Phoenix South	1	Waters	Now-9am	7:35	0

TABLE B-3: MSP Statement Lead Time - Monsoon Season 2021							
Statement Details						Statement Lead Time	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Alarm Triggered	Lead Time(min)
08/18/21	12:46	New River/Cave Creek	1	Henz	Now-2pm	12:31	0
08/18/21	12:52	Scottsdale North	1	Henz	Now-3pm	13:06	14
08/18/21	12:52	Phoenix North	1	Henz	Now-3pm	13:36	44
08/18/21	12:52	Scottsdale South	1	Henz	Now-3pm	13:36	44
08/18/21	13:19	Phoenix South	1	Henz	Now-3pm	14:10	51
08/18/21	16:45	West Valley	1	Henz	Now-630pm	19:40	175
08/31/21	11:00	Upper Centennial	2	Henz	Now-5am Thurs 9/2	9/1 1:55	2335
08/31/21	11:00	Wickenburg	2	Henz	Now-5am Thurs 9/2	9/1 16:35	3215
08/31/21	11:00	Palo Verde	2	Henz	Now-5am Thurs 9/2	9/1 22:27	3567
08/31/21	11:00	Rainbow Valley	2	Henz	Now-5am Thurs 9/2	9/1 19:52	3412
08/31/21	11:00	West Valley	2	Henz	Now-5am Thurs 9/2	9/1 19:52	3412
08/31/21	11:00	Northwest Valley	2	Henz	Now-5am Thurs 9/2	9/1 17:59	3299
08/31/21	11:00	New River/Cave Creek	2	Henz	Now-5am Thurs 9/2	9/1 16:52	3232
08/31/21	11:00	Phoenix North	2	Henz	Now-5am Thurs 9/2	9/1 17:59	3299
08/31/21	11:00	Phoenix South	2	Henz	Now-5am Thurs 9/2	9/1 19:26	3386
08/31/21	11:00	Gila River	2	Henz	Now-5am Thurs 9/2	9/1 21:32	3512
08/31/21	11:00	Scottsdale South	2	Henz	Now-5am Thurs 9/2	9/1 19:26	3386
08/31/21	11:00	East Valley	2	Henz	Now-5am Thurs 9/2	9/1 19:26	3386
08/31/21	11:00	Southeast Valley	2	Henz	Now-5am Thurs 9/2	9/1 21:32	3512
08/31/21	11:00	Lower Salt River Lakes	2	Henz	Now-5am Thurs 9/2	8/31 16:30	450
09/01/21	1:55	Upper Centennial	1	Waters	Now-330am	2:12	17
09/01/21	16:35	Wickenburg	1	Henz	Now-630pm	15:52	0
09/01/21	16:52	New River/Cave Creek	1	Henz	Now-645pm	17:17	25
09/01/21	19:26	Phoenix South	1	Henz	Now-930pm	21:05	99
09/01/21	19:26	Scottsdale South	1	Henz	Now-930pm	21:20	114
09/01/21	19:52	West Valley	1	Henz	Now-930pm	21:40	108
09/01/21	22:27	Palo Verde	1	Henz	Now-1230am	23:16	49
09/24/21	7:49	Gila Bend	1	Waters	Now-12pm	9:36	107

APPENDIX C: MSP LAKE ALERTS - VERIFICATION TABLES

TABLE C-1: This table shows each of the individual MSP Lake Alerts issued during the 2021 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 2021										
Statement Details					Observations				Lead Time	Verification
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	1st Obs.	Hit/Miss	
06/30/21	14:12	Pleasant	Henz	Now-330pm	X	-	-	18	Hit	
06/30/21	14:36	Bartlett	Henz	Now-345pm	X	X	-	0	Hit	
07/03/21	16:31	Pleasant	Henz	Now-6pm	X	X	X	33	Hit	
07/03/21	16:38	Bartlett	Henz	Now-6pm	X	X	X	60	Hit	
07/03/21	17:27	Apache	Henz	Now-7pm	X	-	X	12	Hit	
07/03/21	17:27	Canyon	Henz	Now-7pm	X	-	X	70	Hit	
07/03/21	17:27	Saguaro	Henz	Now-7pm	X	-	X	70	Hit	
07/10/21	19:10	Bartlett	Waters	Now-8pm	X	X	-	20	Hit	
07/13/21	11:10	Saguaro	Waters	Now-12pm	-	-	-	-	Miss	
07/13/21	11:10	Canyon	Waters	Now-12pm	-	-	-	-	Miss	
07/15/21	14:15	Pleasant	Waters	Now-3pm	-	X	X	0	Hit	
07/15/21	15:25	Pleasant	Waters	Now-430pm	X	X	X	35	Hit	
07/15/21	17:30	Canyon	Waters	Now-7pm	-	-	-	-	Hit	

TABLE C-1: MSP Lake Alerts Issued - Monsoon Season 2021										
Statement Details					Observations			Lead Time	Verification	
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	1st Obs.	Hit/Miss	
07/15/21	17:30	Saguaro	Waters	Now-7pm	X	X	-	0	hit	
07/16/21	18:00	Canyon	Waters	Now-7pm	X	-	X	-	Hit	
07/16/21	18:00	Saguaro	Waters	Now-7pm	-	-	X	0	Hit	
07/16/21	18:50	Bartlett	Waters	Now-8pm	X	-	-	-	Hit	
07/16/21	19:05	Pleasant	Waters	Now-8pm	X	X	X	25	Hit	
07/29/21	17:50	Pleasant	Waters	Now-630pm	-	-	-	-	Miss	
08/10/21	16:30	Pleasant	Henz	Now-6pm	-	-	-	-	Miss	
08/11/21	14:40	Pleasant	Henz	Now-4pm	X	X	-	4	Hit	
08/12/21	7:04	Pleasant	Waters	Now-830am	X	-	X	-	Hit	
08/14/21	17:50	Bartlett	Henz	Now-7pm	X	-	X	12	Hit	
08/18/21	10:55	Pleasant	Henz	Now-1230pm	X	-	-	26	Hit	
08/18/21	11:49	Apache	Henz	Now-3pm	X	-	X	-	Hit	
08/18/21	11:49	Canyon	Henz	Now-3pm	X	-	X	-	Hit	
08/18/21	11:49	Saguaro	Henz	Now-3pm	X	X	X	-	Hit	
08/18/21	11:52	Bartlett	Henz	Now-3pm	X	X	X	-	Hit	
08/31/21	16:35	Apache	Henz	Now-630pm	X	-	X	-	Hit	
08/31/21	16:35	Canyon	Henz	Now-630pm	X	-	X	-	Hit	
08/31/21	16:35	Saguaro	Henz	Now-630pm	X	-	-	-	Hit	
09/30/21	16:14	Pleasant	Henz	Now-6pm	X	-	X	62	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 2021 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 2021

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
07/03/21	Wickenburg	0.75	0.75	0.76	1.00	-	0.00	-1.32	-25.00	-	Hit
07/03/21	Northwest Valley	1.25	1.34	1.51	2.00	-	-6.72	-17.22	-37.50	-	Hit
07/03/21	West Valley	0.50	0.59	1.26	1.50	-	-15.25	-60.32	-66.67	-	Hit
07/03/21	Phoenix North	0.75	0.39	0.76	1.00	-	92.31	-1.32	-25.00	-	Hit
07/03/21	Phoenix South	0.50	0.43	1.51	2.00	-	16.28	-66.89	-75.00	-	Hit
07/03/21	Scottsdale North	1.25	1.22	1.26	1.50	-	2.46	-0.79	-16.67	-	Hit
07/03/21	Scottsdale South	0.50	0.59	1.01	1.26	-	-15.25	-50.50	-60.32	-	Hit
07/09/21	Southeast Valley	1.00	0.91	1.01	1.26	-	9.89	-0.99	-20.63	-	Hit
07/09/21	East Valley	0.50	0.04	0.26	0.50	-	1150.00	92.31	0.00	-	Hit
07/09/21	Gila River	0.75	0.08	0.51	0.75	-	837.50	47.06	0.00	-	Hit
07/09/21	Gila Bend	0.50	0.00	0.26	0.50	-	-	92.31	0.00	-	Hit

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2021

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
07/12/21	Scottsdale North	1.25	1.22	1.01	1.25	0.52	2.46	23.76	0.00	140.38	Hit
07/12/21	Phoenix North	0.50	0.12	0.51	0.75	-	316.67	-1.96	-33.33	-	Hit
07/14/21	Northwest Valley	0.50	0.51	1.01	1.25	-	-1.96	-50.50	-60.00	-	Hit
07/14/21	West Valley	1.50	0.63	1.51	2.00	-	138.10	-0.66	-25.00	-	Hit
07/14/21	Phoenix South	1.50	1.38	2.01	2.50	-	8.70	-25.37	-40.00	-	Hit
07/14/21	New River/Cave Creek	0.50	0.43	1.51	2.00	-	16.28	-66.89	-75.00	-	Hit
07/14/21	Phoenix North	0.50	0.00	0.51	0.75	-	-	-1.96	-33.33	-	Hit
07/14/21	Scottsdale South	0.50	0.35	0.51	0.75	-	42.86	-1.96	-33.33	-	Hit
07/14/21	East Valley	0.75	0.39	0.76	1.00	-	92.31	-1.32	-25.00	-	Hit
07/14/21	Superstition	0.75	0.75	0.76	1.00	-	0.00	-1.32	-25.00	-	Hit
07/14/21	Gila River	0.50	0.47	1.01	1.25	-	6.38	-50.50	-60.00	-	Hit
07/14/21	Southeast Valley	1.00	0.39	1.01	1.25	-	156.41	-0.99	-20.00	-	Hit
07/14/21	Superstition	0.75	0.20	0.76	1.00	-	275.00	-1.32	-25.00	-	Hit
07/15/21	Northwest Valley	1.00	0.94	1.26	1.50	-	6.38	-20.63	-33.33	-	Hit
07/15/21	New River/Cave Creek	1.00	0.94	1.01	1.25	-	6.38	-0.99	-20.00	-	Hit
07/15/21	Phoenix North	1.00	0.00	0.51	0.75	-	-	96.08	33.33	-	Miss
07/15/21	Scottsdale South	1.00	0.63	0.76	1.00	-	58.73	31.58	0.00	-	Hit
07/15/21	East Valley	1.00	0.75	1.51	2.00	-	33.33	-33.77	-50.00	-	Miss
07/15/21	Superstition	1.00	0.94	0.76	1.00	-	6.38	31.58	0.00	-	Hit
07/15/21	Wickenburg	1.00	1.06	1.26	1.50	-	-5.66	-20.63	-33.33	-	Hit
07/16/21	Southeast Valley	0.50	0.51	0.76	1.00	-	-1.96	-34.21	-50.00	-	Hit
07/16/21	Southeast Valley	0.50	0.43	0.76	1.00	-	16.28	-34.21	-50.00	-	Hit
07/16/21	East Valley	0.50	0.31	1.51	2.00	-	61.29	-66.89	-75.00	-	Miss
07/16/21	Gila River	0.50	0.51	0.51	0.75	-	-1.96	-1.96	-33.33	-	Hit
07/20/21	Upper Centennial	0.75	0.87	1.26	1.50	-	-13.79	-40.48	-50.00	-	Hit
07/21/21	Upper Centennial	2.00	1.85	2.01	2.50	-	8.11	-0.50	-20.00	-	Hit
07/21/21	Wickenburg	1.50	1.54	1.51	2.00	-	-2.60	-0.66	-25.00	-	Hit
07/22/21	Gila River	1.25	0.00	2.51	3.00	-	-	-50.20	-58.33	-	Miss
07/22/21	Scottsdale North	1.00	1.10	2.51	3.00	-	-9.09	-60.16	-66.67	-	Hit

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2021											
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
07/22/21	Scottsdale South	1.25	2.24	4.01	5.00	-	-44.20	-68.83	-75.00	-	Miss
07/22/21	Northwest Valley	1.00	0.98	2.01	2.50	0.50	2.04	-50.25	-60.00	100.00	Hit
07/22/21	Phoenix North	0.75	0.91	2.01	2.50	-	-17.58	-62.69	-70.00	-	Hit
07/22/21	East Valley	1.25	1.22	2.51	3.00	-	2.46	-50.20	-58.33	-	Hit
07/23/21	New River/Cave Creek	1.75	1.02	2.01	2.50	-	71.57	-12.94	-30.00	-	Hit
07/23/21	New River/Cave Creek	1.25	2.87	5.01	6.00	-	-56.45	-75.05	-79.17	-	Miss
07/23/21	Scottsdale North	1.25	1.69	1.26	1.50	0.50	-26.04	-0.79	-16.67	150.00	Hit
07/23/21	Phoenix North	1.25	1.57	1.51	2.00	-	-20.38	-17.22	-37.50	-	Hit
07/23/21	Scottsdale South	1.25	1.42	1.01	1.25	-	-11.97	23.76	0.00	-	Hit
07/23/21	Phoenix South	1.00	0.63	1.01	1.25	-	58.73	-0.99	-20.00	-	Hit
07/25/21	West Valley	0.75	2.09	3.01	4.00	-	-64.11	-75.08	-81.25	-	Miss
07/25/21	Northwest Valley	0.75	1.85	4.01	5.00	-	-59.46	-81.30	-85.00	-	Miss
08/10/21	East Valley	1.25	0.67	1.26	1.50	0.95	86.57	-0.79	-16.67	31.58	Hit
08/10/21	Southeast Valley	1.25	2.72	2.51	3.00	0.95	-54.04	-50.20	-58.33	31.58	Miss
08/10/21	Upper Centennial	2.00	0.79	1.51	2.00	-	153.16	32.45	0.00	-	Hit
08/10/21	Wickenburg	0.50	0.51	1.51	2.00	-	-1.96	-66.89	-75.00	-	Hit
08/11/21	Scottsdale North	1.50	2.13	2.51	3.00	-	-29.58	-40.24	-50.00	-	Miss
08/11/21	East Valley	1.50	1.81	2.51	3.00	-	-17.13	-40.24	-50.00	-	Hit
08/11/21	Superstition	1.50	1.81	2.51	3.00	-	-17.13	-40.24	-50.00	-	Hit
08/11/21	Wickenburg	1.50	1.89	1.51	2.00	-	-20.63	-0.66	-25.00	-	Hit
08/11/21	Phoenix North	1.50	0.63	1.51	2.00	1.50	138.10	-0.66	-25.00	0.00	Hit
08/11/21	Phoenix South	1.00	0.87	0.76	1.00	1.50	14.94	31.58	0.00	-33.33	Hit
08/11/21	Scottsdale South	1.00	1.10	2.51	3.00	-	-9.09	-60.16	-66.67	-	Hit
08/11/21	Scottsdale North	1.00	0.94	3.01	4.00	-	6.38	-66.78	-75.00	-	Hit
08/11/21	West Valley	1.00	0.94	2.01	2.50	-	6.38	-50.25	-60.00	-	Hit
08/11/21	Upper Centennial	0.75	0.83	2.51	3.00	-	-9.64	-70.12	-75.00	-	Hit
08/12/21	Scottsdale North	1.50	2.17	3.01	4.00	-	-30.88	-50.17	-62.50	-	Miss
08/12/21	New River/Cave Creek	1.50	2.28	2.51	3.00	-	-34.21	-40.24	-50.00	-	Miss
08/12/21	Northwest Valley	1.50	1.65	1.51	2.00	-	-9.09	-0.66	-25.00	-	Hit

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2021											
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
08/14/21	Gila Bend	1.50	3.78	3.01	4.00	-	-60.32	-50.17	-62.50	-	Miss
08/15/21	East Valley	0.75	0.83	0.76	1.00	-	-9.64	-1.32	-25.00	-	Hit
08/15/21	Phoenix South	0.75	0.35	0.76	1.00	-	114.29	-1.32	-25.00	-	Hit
08/15/21	Gila River	0.50	0.08	0.11	0.25	-	525.00	354.55	100.00	-	Miss
08/16/21	Lower Salt River Lakes	1.00	1.10	1.51	2.00	-	-9.09	-33.77	-50.00	-	Hit
08/16/21	Superstition	1.50	2.05	2.01	2.50	-	-26.83	-25.37	-40.00	-	Miss
08/16/21	East Valley	1.50	1.50	1.51	2.00	-	0.00	-0.66	-25.00	-	Hit
08/16/21	Southeast Valley	1.50	1.34	2.51	3.00	-	11.94	-40.24	-50.00	-	Miss
08/16/21	Scottsdale North	1.00	1.22	1.01	1.25	-	-18.03	-0.99	-20.00	-	Hit
08/16/21	Scottsdale South	1.00	1.22	1.01	1.25	-	-18.03	-0.99	-20.00	-	Hit
08/16/21	Phoenix South	0.75	0.67	1.01	1.25	-	11.94	-25.74	-40.00	-	Hit
08/16/21	Gila River	1.00	0.24	1.01	1.25	-	316.67	-0.99	-20.00	-	Hit
08/16/21	Rainbow Valley	0.75	0.79	0.76	1.00	-	-5.06	-1.32	-25.00	-	Hit
08/16/21	Gila Bend	0.75	0.00	0.26	0.50	-	-	188.46	50.00	-	Miss
08/17/21	West Valley	0.75	0.67	2.01	2.50	-	11.94	-62.69	-70.00	-	Hit
08/17/21	Scottsdale South	1.50	0.98	1.01	1.25	-	53.06	48.51	20.00	-	Hit
08/17/21	Phoenix North	1.50	0.98	1.51	2.00	-	53.06	-0.66	-25.00	-	Hit
08/17/21	Southeast Valley	1.00	0.04	2.51	3.00	-	2400.00	-60.16	-66.67	-	Miss
08/17/21	Phoenix South	1.00	0.35	1.01	1.25	-	185.71	-0.99	-20.00	-	Hit
08/18/21	New River/Cave Creek	2.00	3.62	4.01	5.00	-	-44.75	-50.12	-60.00	-	Miss
08/18/21	Scottsdale North	2.00	3.94	4.01	5.00	-	-49.24	-50.12	-60.00	-	Miss
08/18/21	Phoenix North	1.25	1.26	1.51	2.00	-	-0.79	-17.22	-37.50	-	Hit
08/18/21	Scottsdale South	1.25	0.98	1.01	1.25	-	27.55	23.76	0.00	-	Hit
08/18/21	Phoenix South	2.00	1.02	1.51	2.00	-	96.08	32.45	0.00	-	Hit
08/18/21	East Valley	0.75	0.67	0.51	0.75	-	11.94	47.06	0.00	-	Hit
08/18/21	West Valley	1.00	0.79	1.01	1.25	-	26.58	-0.99	-20.00	-	Hit
08/18/21	Rainbow Valley	1.00	0.75	1.01	1.25	-	33.33	-0.99	-20.00	-	Hit
08/18/21	Phoenix South	1.00	1.02	1.51	2.00	-	-1.96	-33.77	-50.00	-	Hit
08/18/21	East Valley	0.50	0.67	0.51	0.75	-	-25.37	-1.96	-33.33	-	Hit

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2021											
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
08/18/21	Gila River	1.25	0.39	1.51	2.00	-	220.51	-17.22	-37.50	-	Hit
08/18/21	Phoenix South	1.00	1.02	1.51	2.00	-	-1.96	-33.77	-50.00	-	Hit
08/18/21	Scottsdale South	1.00	0.98	1.01	1.25	-	2.04	-0.99	-20.00	-	Hit
08/29/21	Upper Centennial	0.50	0.51	1.26	1.50	-	-1.96	-60.32	-66.67	-	Hit
08/31/21	Lower Salt River Lakes	2.00	0.00	1.51	2.00	-	-	32.45	0.00	-	Hit
09/01/21	Upper Centennial	0.75	0.67	1.01	1.25	-	11.94	-25.74	-40.00	-	Hit
09/01/21	Wickenburg	0.50	0.00	0.11	0.25	-	-	354.55	100.00	-	Miss
09/01/21	Upper Centennial	1.00	0.63	0.76	1.00	-	58.73	31.58	0.00	-	Hit
09/01/21	Wickenburg	1.00	0.94	1.01	1.25	-	6.38	-0.99	-20.00	-	Hit
09/01/21	New River/Cave Creek	1.00	1.18	1.26	1.50	-	-15.25	-20.63	-33.33	-	Hit
09/01/21	Northwest Valley	2.00	0.39	2.51	3.00	-	412.82	-20.32	-33.33	-	Hit
09/01/21	Phoenix North	1.00	0.35	1.01	1.25	-	185.71	-0.99	-20.00	-	Hit
09/01/21	Phoenix South	1.00	1.18	1.51	2.00	-	-15.25	-33.77	-50.00	-	Hit
09/01/21	Scottsdale South	1.00	0.35	1.01	1.25	-	185.71	-0.99	-20.00	-	Hit
09/01/21	East Valley	0.75	0.75	2.51	3.00	0.75	0.00	-70.12	-75.00	0.00	Hit
09/01/21	West Valley	1.50	1.34	3.01	4.00	-	11.94	-50.17	-62.50	-	Hit
09/01/21	Rainbow Valley	1.50	1.46	1.51	2.00	-	2.74	-0.66	-25.00	-	Hit
09/01/21	Gila River	0.75	0.75	3.01	4.00	-	0.00	-75.08	-81.25	-	Hit
09/01/21	Southeast Valley	1.00	1.06	2.01	2.50	-	-5.66	-50.25	-60.00	-	Hit
09/01/21	Palo Verde	1.00	0.87	1.51	2.00	-	14.94	-33.77	-50.00	-	Hit
09/24/21	Gila Bend	2.00	1.34	1.51	2.00	-	49.25	32.45	0.00	-	Hit
09/30/21	New River/Cave Creek	0.75	0.75	0.75	1.00	-	0.00	0.00	-25.00	-	Hit
09/30/21	Scottsdale North	0.75	0.75	0.75	1.00	-	0.00	0.00	-25.00	-	Hit
09/30/21	Superstition	0.50	0.51	0.51	0.75	-	-1.96	-1.96	-33.33	-	Hit

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