



**PUBLIC SERVICE BOARD MEETING
AGENDA ITEM
REGULAR MEETING**

Wednesday, May 13, 2020

SUBJECT

Hydro-Meteorological Consulting Services Contract with Ragin Cajun Enterprises, LLC

BACKGROUND

Since 2015 staff have utilized hydro-meteorological services to provide more effective planning and mitigation of stormwater runoff. Severe thunderstorms can produce moderate to heavy rainfall which become especially frequent during the monsoon months of July-September and cause flash flooding. Information received through these services assist staff to anticipate and prepare a quick response to short term flash flooding. In addition, reports received with these services include winter season snowfall outlooks and upstream snowpack report.

STRATEGIC OBJECTIVES SUPPORTED

Improve Efficiency

EVALUATION PROCESS

EPWater has contracted with Ragin Cajun Enterprises, LLC for the past three years attesting to its effective reporting of probable storm events. This information is critical for preparedness actions taken to protect works undertaken by construction jobs, stormwater operations and engineering groups. Staff recommends Ragin Cajun Enterprises, LLC as the most qualified firm for these services.

FINANCIAL IMPLICATIONS

Sufficient funds are available in Account Number 220-7720, and the funding source is Stormwater Operating Fund.

PROPOSED ACTION REQUESTED

Consider and approve a Consulting Services Contract for Hydro-Meteorological services to Ragin Cajun Enterprises, LLC in the amount of \$155,377 for a term of three years, with an option of a one-year extension and a contract increase in the estimated amount of \$50,000.

Hydro-Meteorological Consulting Services

Exhibit A – Scope of Services

Background Information

Since 2015, El Paso Water Utilities-Storm Water (EPWater-SW) has received and utilized hydro-meteorological services to provide more effective planning and mitigation of storm water runoff. The hydro-meteorological services were acquired due to a lack of such services in the past and now allow EPWater-SW to incorporate time and money saving preparation in advance of a significant weather event. This short term flash flooding is known to be caused by general and severe thunderstorms producing moderate to heavy rainfall. Flash flooding can and does pose a risk to life and property. The flooding events at High Ridge in July of 2017, High Ridge and Bear Ridge in August of 2016 and the major citywide flooding of 2006 are examples of this risk. Finally, there is a general lack of rainfall and rainfall rate data for much of the city due to the lack of weather hardened rain gauges capable of rainfall and rain rate logging in the El Paso area. This lack of data reduces EPWater-SW ability to get the required data to acquire the needed grants and/or bonds to develop and implement various flood control measures. The flash flooding risk and lack of a robust rain gauge system emphasizes the continued need for specialized hydro-meteorological services and development and deployment of a weather hardened rain gauge/rain rate system. These services will enable EPWater-SW an effective and efficient method to mitigate flash flooding events in El Paso, and to better protect life and property.

General Scope of Work

This proposal is for a three year contract with a commencement year of 2020 and ending in the year 2023 of the same month. The hydro-meteorological services to be provided to the EPWater-SW comprise of five (5) distinct areas. This proposal also contains two (2) contract options that can be executed at the discretion of EPWater-SW.

- The first is a general precipitation outlook and a quarterly seasonal outlook. The purpose of this service is to assist EPWater-SW in planning and preparation for significant adverse affects of precipitating weather events. Additionally, this will give EPWater-SW the confidence to take equipment down for maintenance during expected dry periods.
- The second will be forensic. The forensic services will be utilized to determine the conditions that caused a significant flooding event in which either significant property damaged occurred, loss of life or both. The purpose of a forensic report would be to determine the root causes of the incident and to identify any potential corrective action that could be taken. These forensic studies will be initiated at the option and request of EPWater-SW
- The third is verification. The verification services will take the form of daily rainfall recording and analysis of the reported rainfall by region and the month in which it fell. The regions are defined by EPWater-SW. There will also be snow pack conditions and spring/summer stream flow outlooks for the four major upstream snow basins of the Rio Grande River.

- The fourth is an in depth study of EPWater-SW's area of responsibility (AOR) in order to determine how many and where a set of robust, weather hardened and logging capable rain gauges should be placed. These gauges will also be capable of recording rain rates at a minimum. The study will identify EPWater-SW properties that are ideal for placement of a potential sensor. Additionally, at least two (2) at most four (4) sensors will be acquired for testing and evaluation in Kansas to identify the capabilities, strengths/weaknesses and ease of operation.
- The fifth will be conducted at the request/approval of EPWater-SW and will consist of the acquisition of selected weather hardened rain gauges, site surveys of the selected EPWater-SW sites and installation of the rain gauges themselves. This action will also instigate an annual cleaning and calibration requirement of any installed sensors.

Contract Options

This proposal includes two options which EPWater-SW can exercise should EPWater-SW feel it is appropriate.

- The first option is the fifth area of work mentioned above (Task 500). This option can be exercised by EPWater-SW after the study described above has been delivered to EPWater-SW.
- The second option is a one year extension. Should EPWater-SW feel it is required to extend this contract at its indicated pricing structure when it comes to an end in 2023, this contract shall be extended for an additional year into 2024. This option will include tasks 100, 200 and 300.

Tasks

EPWater-SW is the entity in charge of this project and will need to provide drainage information/sensitivities to the hydro-meteorologist. Information such as the existing capacities and planned storm water mitigation infrastructure as well as detailed maps of their locations and the drainage basins they serve. Locations of EPWater-SW property and managed structures will also be required to aid in identifying potential rain gauge sites. Additionally, communication with EPWater-SW operations personnel will be required as part of task 400. This communication will aid in the selection of rain gauges best suited to EPWater-SW needs. The hydro-meteorologist is directly responsible for the following series of tasks unless otherwise noted.

<u>Task</u>	<u>Title</u>
100	Quarterly/Weekly Precipitation Outlooks
200	Hydro-Meteorological Forensic Reports
300	Rainfall recording and Verification Reports

400 Study of EPWater-SW AOR, identify the number of and test/evaluate potential rain gauges

500 Site surveys, installation and ongoing maintenance of weather hardened rain gauges.

100 Precipitation Outlooks

100.01 Quarterly/Seasonal Precipitation Outlooks

Activities: Develop seasonal precipitation outlook for the El Paso area. The seasonal outlook is intended to provide the EPWater-SW a general idea of the expected precipitation for the next three months. This product is also intended to assist the EPWater-SW in planning activities for existing projects and maintenance of equipment. The seasonal outlooks will cover Jan-Mar, Apr-Jun, Jul-Sep and Oct-Dec.

Deliverables: Seasonal Precipitation Outlooks by the 15th of Dec, Mar, Jun and Sep.

100.02 Winter Season Snowfall outlooks

Activities: Develop a winter season snowfall outlook for the snowfall basins of the Rio Grande River focusing on the Upper Rio Grande River Basin (headwaters), Sangre de Cristo Mountain Range Basin, Rio Chama River Basin and the Jemez River Basin. This product is intended to provide EPWater-SW information needed to plan for the next year's Rio Grande flow during the summer due to snow melt. The Winter Season Snowfall Outlook will be provided twice a year in September with an update in December.

Deliverables: Winter Season Snowfall Outlook by the 15th of Sep and Dec. This outlook will be attached to the quarterly Seasonal outlook for September and December indicated in section 100.01.

100.03 Precipitation Outlooks

Activities: Develop a precipitation outlook covering the El Paso area for the next seven days. The intent of this product is to provide the EPWater-SW with lead time to prepare equipment and personnel to respond to impending weather events.

Deliverables: Precipitation outlooks will be delivered on Monday, Wednesday and Friday mornings during the monsoon season (July-September) and then Monday and Thursday morning other times (October-June). During the

January-March time frame, outlooks will be provided once a week on Monday with a second issued on Thursday if the meteorological situation deems this is required. Additionally, any time a “Significant” or higher threat is indicated in the first four days of the outlook, a map of the City of El Paso that is mostly likely to be affected by indicated event will be provided along with the outlook.

200 Hydro-Meteorological Forensic Reports

200.01 Forensic Hydro-Meteorological Incident Reports

Activities: Upon notification/request of the El Paso Water-Storm Water, conduct the following tasks remotely (no physical visit):

- a. Collect, analyze, archive and correlate cause and effect of the atmospheric conditions leading up to and during the flooding incident.
- b. Cross reference timing of flooding and damage to property and infrastructure. Note: El Paso Water will need to provide specific information about the timing and extent of any damage (e.g. detailed maps, photos, etc) as well as estimated flow rate of flood water if possible.
- c. Research/analyze all factors of the weather incident and develop a forensic hydro-meteorological report.

Deliverables: Hydro-Meteorological Forensic report.

300 Rainfall/Snowfall recording and verification reports

300.01 Activities: Record daily rainfall from selected reliable rainfall reporting sites from the El Paso International Airport (KELP) and known reliable Community Collaborative Rain, Hail and Snow Network (CoCoRaHS). Separate the data into four regions of the City of El Paso. These regions will be West, Northeast, Central and Valley. Provide a monthly and annual report showing the total average rainfall which occurred in each area.

Deliverables: Monthly and annual rainfall reports. Reports will be delivered within 10 days of the end of each month as defined in section 100. Annual rainfall reports will be delivered within 15 days of the end of the calendar year.

300.02 Activities: Collect and record snowfall reports from the upstream rain/snowfall basins of the Rio Grande River. Separate data into Upper Rio Grande Basin, Rio Chama River Basin, Sangre de Cristo Mountain Range Basin and the Jemez River Basin. Provide monthly reports of the water equivalent of the snow pack in comparison to normal for the year starting

in December of each year through May of each year or until the snow pack has melted, whichever comes first.

Deliverables: Monthly snow water equivalency reports for the four basins mentioned in 300.02 in comparison to normal every month starting in December and ending in May of each year or until the snow pack has melted, whichever comes first. Attach these reports to the monthly verification data as mentioned in 300.01.

400 Study of EPWater-SW AOR to identify the number and locations of rain gauges

400.01 Activities: Conduct a study of EPWater-SW's AOR and determine the best locations for placing a system of robust, weather hardened rain gauges. Study the locations of the EPWater-SW property and locations of EPWater-SW facilities to develop a grid type of network for the rain gauge placement. EPWater-SW will need to provide the hydro-meteorologist with information on the operations process of the their field/operations personnel. This information will be needed to help determine which type of rain gauge equipment will be ideal and at which locations.

Deliverables: Provide this information in the final rain gauge study report which will also include work conducted in sections 400.02

400.02 Activities: Research, identify and acquire at least two (2), at most four (4), different types of rain gauges to be installed for testing on site in Kansas. The sensors/gauges identified must be capable of recording total rainfall, rain rate and be compatible with a weather data logging system. This data logging system must be compatible with EPWU-SW's SCADA communication system.

Deliverables: Results and information will be included in the full report from task 400.03.

400.03 Activities: Test and evaluate the selected sensors/gauges during a significant portion of a Kansas convective season (March-September). Evaluate the performance, accuracy, durability, ease of maintenance/calibration, ease of data collection and survive-ability of the selected sensors. Provide continuous testing of sensors to assist in any trouble shooting of the gauges should any issue arise.

Deliverables: A full report on which sensors/gauges are recommended for use in EPWater-SW's AOR and identification of potential rain gauge sites where the sensors should be placed. This report will include the advantages and disadvantages of each sensor and location in question. Cost, accuracy, performance, convenience of data collection, maintenance and calibration issues will also be included.

500 Site surveys, installations and ongoing maintenance of rain gauge system (enacted upon request of EPWater-SW)

500.01 Activities: Conduct physical site surveys of proposed sites for new weather harden rain gauges. Site surveys will include but not limited to physical exposure at the site, availability of power, security of the site, availability of SCADA reporting system or line of site to one, identification of physical barriers inhibiting proper installation and/or operation of weather equipment and meetings with operations personnel to determine if the site is suitable for EPWater-SW's needs.

Deliverables: Site survey report of potential gauge sites with estimated cost of install for each site. Report will include the potential for the need of sub-contractors to complete some of the install work.

500.02 Activities: Upon approval from EPWater-SW, perform the physical installation of the rain gauges to the specified sites. Install all support and power requirements for each site and conduct an initial calibration and testing of the gauge.

Deliverables: A completed weather harden rain gauge site

500.03 Activities: Conduct an annual cleaning, preventative maintenance and calibration of all install sensors operated by EPWater-SW.

Deliverables: Cleaned, calibrated and tested rain gauge.

End of Exhibit A – Scope of Work

Exhibit B – Project Schedule and Description

Quarterly/Seasonal Precipitation Outlooks

Note: Refer to Attachment 3 for an example.

Frequency: Products will be produced every quarter and will arrive on the 15th of the month prior to the quarter beginning. The seasonal quarters are offset slightly to ensure the primary months of El Paso's seasonal monsoon are captured in a single quarterly outlook (July-September). The seasonal outlook for the January-March time frame will be delivered on the 15th of December or the first work day after the 15th of December, whichever comes last. The seasonal outlooks for the remaining quarters will also be delivered on the 15th of the month preceding the start of the seasonal outlooks valid times.

Scope: The quarterly seasonal outlooks will involve a significant number of long term variables and climate indicators. The El Nino/Nina Southern Oscillation (ENSO) will be investigated as well as other global climate patterns. Other climate influencing patterns that will be analyzed will be: North Atlantic Oscillation (NAO), Arctic Oscillation (AO), Pacific/North American Pattern (PNA) and the Madden-Julian Oscillation (MJO). Of these climate patterns, the AO and the MJO can have significant impacts to the El Paso area but they are primarily felt in the fall and winter months. The affects of the AO and MJO on the El Paso area are second only to the ENSO.

Format: The seasonal outlook is a fairly simple report and will be broken down into two parts. The first part will be a brief general discussion of the state of the climate at the time and a general expectation of how the climate will affect the region. The second section will be broken into five short tables. The first table will include the normal high/low temperatures as well as the normal rainfall for each of the three months in question. The second table will provide the actual high/low temperatures and actual precipitation that occurred last year for the same three months. The third table will provide the record highs, lows and highest precipitation and the year in which it occurred. This table is intended to indicate the “high end limit” of precipitation possible for a given month. The fourth table will be the National Oceanographic and Atmospheric Administrations (NOAA) official climate forecast for the coming months. The last table will be official climate outlook from Ragin' Cajun Enterprises LLC.

Winter Season Snowfall Outlooks

Note: Refer to Attachment 4 for an example

Frequency: Product will be produced twice a year in September and December and will arrive on the 15th of these months. These outlooks will be attached to the quarterly outlooks scheduled for the same delivery time.

Scope: The winter season snowfall outlooks will utilize the same long term variables and climate indicators that are used for the quarterly looks. This will include the AO, NAO, PNA, MJO and ENSO. In addition to these long term patterns, some experimental procedures will be used to develop a snow fall potential outlook for the Upper Rio Grande Basin (Rio Grande headwaters), Sangre De Cristo Mountain Range Basin, Rio Chama Basin and the Jemez Basin.

Format: The winter season snowfall outlooks will be a simple product broken into the two sections. The first section will describe the general state of the climate like the Quarterly/Seasonal Outlook but in how it will affect potential snowfall. The second section will be a table showing the four basins mentioned in the scope. The table will include the expected liquid equivalent for the basins (both NOAA climate forecast and Ragin' Cajun's), the normal snowfall for the basins and if the snowfall will be well below normal, below normal, normal, above normal or well above normal. The snowfall portion will only be from Ragin Cajun Enterprises LLC as NOAA does not produce expected snowfall potential.

Seven day Precipitation Outlooks

Note: Refer to Attachment 5 for an example.

Frequency: The seven day precipitation outlooks will be produced and delivered during the morning hours. These outlooks will be delivered at various times throughout the year depending on the season. During the months of January, February and March, the outlooks will be delivered once a week on Monday. A second outlook will be prepared and delivered on Thursday but only if required. Please note, EPWater-SW will only be charged for the Thursday outlook if the weather situation requires it. During the months of April through June and October through December, outlooks will be produced twice a week on Monday and Thursday morning respectively. During the months of July through September, three outlooks a week will be produced and will be delivered on Monday, Wednesday and Friday. **Note: If a federal holiday occurs on a day in which an outlook is to be delivered, the outlook will be delivered either the day before or the day after the federal holiday depending on the weather situation.** EPWater-SW may request the specific day for delivery if operations tempo indicate a specific day is better for EPWater-SW decision making process.

Scope: The seven day outlooks are designed to provide a week long precipitation outlook and possible impacts to operations for the next seven days. While these outlooks cover seven days, the outlook is designed to provide high resolution of the expected rainfall and possible flooding impacts to the El Paso area for the first four days. The remaining three days are intended more as a “heads up” of what may be coming. The delivery time in the morning is designed to ensure the most current data is available for the creation of the outlook and to ensure the outlook is available first thing the day the outlook is due.

Format: Please refer to Attachment 5 for this section. The “Valid Time” indicates when the outlook is valid. A valid time of “13-19 Jul 15” would be valid from 13 July to 19 July. The start time on each day is 0700 Local Standard Time (no daylight savings). This start time is chosen as many precipitation and other weather reports start and stop at this time. This allows for much of the precipitation data to correlate better with the outlook. The “Issued” is the time the outlook was issued. The outlook has been broken up into seven different sections which represent the days of the week. Each day has two distinct sections. The right side of each day labeled “Remarks and Potential Problem Areas” will provide information on which part of El Paso will be at an increased risk for flooding (e.g. West Side of the Franklin Mountains or Lower Valley). This determination will be made based on the hydro-meteorological information and indicators available at the time the outlook was made. Additionally, any other information pertinent to that day will be placed here. The left side of each section provides

four different parameters which are Threat Level (Overall), Maximum Rain Rate, Maximum 24 Hour Rainfall and Precipitable Water (PW). Each one of these parameters is explained below.

Threat Level (Overall):

This provides an indication of the overall threat to the El Paso area. This parameter is heavily influenced by rain rate and precipitable water with the intent to give an indication of the overall flood risk for the day. The levels with maximum rain rates are explained below:

- Minimal:** Little or no rain expected with inconsequential run off. Rain rate of <0.10 inches/hour expected.
- Light:** Measurable rain likely, minor street flooding possible with higher rain rates. Rain rates of 0.10-0.40 inches/hour. Run off is not expected to impede transit system for more than a half an hour.
- Moderate:** Heavy rain possible. Street flooding may impede transit systems for a short period of time. Rainfall rates of 0.40-1.10 inches/hour possible.
- Significant:** Heavy rain likely. Flooding and damage to transit, drainage systems and property possible. Rainfall rate: 1.10-1.75 inches/hour.
- Severe:** Very Heavy rain possible. Disruption of primary transit systems likely for more than an hour. Damage likely to drainage and secondary/tertiary transit systems. Rainfall rate 1.75-3 inches/hour.
- Extreme:** Very heavy rain likely. Severe disruption to transit systems can be expected. Damage to transit systems and drainage systems can also be expected. Rainfall range of 3+ inches/hour.

Maximum 24 hour rainfall:

This section provides the maximum expected rainfall in the next 24 hours that will impact the drainage systems in El Paso. This is a relatively minor contributor to the overall threat assessment above. This parameter's significance is dependent on two primary issues of soil saturation and the current and expected stage of the Rio Grande River. Since the soil composition for El Paso county is of a type that tends to saturate quickly in heavy rain, this parameter is generally considered constant. The current and expected stage of the Rio Grande has much greater affect on the El Paso drainage system. If the Rio Grande River is swollen by upstream rain, this will hinder El Paso's drainage systems ability to remove runoff water. This becomes likely when flow through the Rio Grande at El Paso reaches 7 feet and when Canutillo TX reaches 5.5 feet. This is also possible when Rio Grande at Mesilla NM reaches 10 feet. These levels represent a flow of approximately 2000 cubic ft/sec. Should the Rio Grande stage or expected stage reach the aforementioned levels for Mesilla, NM, Canutillo, TX and at El Paso, this category will be highlighted in **yellow**.

Precipitable Water (PW):

This section describes how much moisture is in the atmosphere and if removed all at once, that is the amount of water that would fall at that moment. This value shows the highest amount for the day in question. In short, the higher the PW, the greater the risk for flash flooding. This category can heavily influence the rain rate and overall threat level. It is important to note, a high PW value does not mean there will be a high threat level. There must be a trigger present to produce convection and a ready moisture stream to maintain heavy rain. This section just provides the amount of moisture that is present for the day in question.

Area Threat Map (See attachment 6 for an example).

The Area Threat Map will **only** be issued when an overall threat level of “Significant” or greater is indicated in the **first four days** of the outlook. While the overall threat level covers the entire City of El Paso for the day indicated on the outlook, the Area Threat Map is intended to provide a graphical look of what parts of the city are at the greatest risk for the up coming event. This determination is made based on the atmospheric conditions for the day in question combined with the local geography. This map will highlight areas of the city that are at an elevated risk to receive the rainfall indicated on the outlook and areas at the “highest risk” or most likely to be impacted by the overall threat level in the outlook. The date at the top of the map is the day in which the map is valid for.

Hydro-Meteorological Forensic Reports

Frequency: hydro-meteorological forensic reports will only be produced when requested by EPWater-SW.

Scope: The hydro-meteorological forensic reports will vary in scope and will depend greatly on the complexity of the weather event in question. The greater the complexity, the greater the scope. This will also greatly affect the amount of time it will take to complete a scientifically sound report. A complex weather event could take more than four weeks to complete.

Format: hydro-meteorological forensic reports will vary in format depending on the complexity of the weather event in question. In all cases however, forensic reports will always include information on the state of the atmosphere at the time of the event, timeline of the changes in the atmosphere in correlation with the significant events on the ground (these events will need to be provided by EPWater-SW) and provide possible causes for the event if the evidence supports such causes. Other information that can be gleaned from radar, satellite and observations will also be included provided it is considered viable and/or scientifically sound.

Study of EPWater-SW AOR to identify the number and locations of rain gauges

Frequency: Will begin upon execution of a contract with this proposal.

Scope: Conduct and in-depth study of EPWater-SW's area of responsibility (AOR) to identify potential locations for weather hardened rain gauges. A full review will be conducted of EPWater-SW's properties around the city of El Paso. Locations that are spaced in such a way to provide a grid-like

network will be identified and marked as a potential gauge site. Teleconference calls and/or virtual meetings will also be held with EPWater-SW personnel to determine needs and/or constraints EPWater-SW is operating under. EPWater-SW operations personnel (individuals that will use the rain gauge data in real time) will also need to be included in these discussions to ensure the correct logging equipment is tested and included with the rain gauges. Discussions with Information Technology (IT) personnel will also be required to ensure that any potential rain gauge equipment selected will work within EPWater-SW's IT infrastructure.

Acquisition of at least two (2) and at most four (4) different rain gauges will be acquired by Ragin' Cajun Enterprises LLC for installation, testing and evaluation of performance in Kansas. The testing will take place in Kansas and will be considered ongoing throughout this contract period. This testing will require a minimum of 100 inches of rainfall before a final determination of equipment will be made. This length of testing time will ensure the selected equipment will perform as expected, be easy to maintain with data collection and calibration procedures that will have minimal impact to EPWater-SW operations. This testing is likely to last at least a year to ensure the potential equipment is able to withstand rain rates up to 7 inches per hour, hail up to 2 inches in diameter, high winds in excess of 80mph and repeated freezing and snowfall events without failure.

Format: A report on the results of the remote survey will be provided when completed. This report will include all the locations identified as potential gauge sites for EPWater-SW to consider. Each site will be marked with a priority level indicating the importance of each site. Priority will be based on its geographical location in comparison to other known and reliable reporting locations. These priorities can and will be influenced by the needs of EPWater-SW. An example of this will be the potential site is upstream of a major flood control system.

Additionally, updated reports will be sent on the performance of the rain gauges being tested in Kansas. Reports of their performance in extreme weather events will also be included when they occur. This information will be recorded in a final report. This final report will be delivered when the tested gauges have been subjected to all the conditions indicated in scope. Once this has occurred, Ragin' Cajun Enterprises LLC will make a recommendation on which gauges should be used

Site Surveys, installation and ongoing maintenance of rain gauge system/network

Frequency: This will be conducted when EPWater-SW exercises this option of the contract.

Scope: Physical site surveys will be conducted of all sites selected by EPWater-SW to receive a rain gauge. Each site will be inspected for their physical suitability, placement of the gauge and construction/installation barriers to the install. A determination of the need for a sub-contractor will also be made by Ragin' Cajun Enterprises LLC should a site prove to have an installation barrier that requires a specialized installation method.

Once the site survey has been completed and the installation needs have been identified, installation will take place at the site. Testing and calibration of the gauge will also take place at this time. If this site in question is to have a remote communication system installed such as SCADA, that too will be tested with the receiving station. Once all gauges are installed, each site will need to be physically visited, cleaned and calibrated at least once a year.

Data access/rights: EPWater-SW and Ragin' Cajun Enterprises LLC will have equal access to the rain gauge data. Ragin' Cajun Enterprises LLC access to rain gauge data will continue so long as a valid contract for hydro-meteorological services remains in effect between EPWater-SW and Ragin' Cajun Enterprises LLC. EPWater-SW and Ragin' Cajun Enterprises LLC will have the right equally to collect, archive, analyze, sell, and use gathered data gathered from the installed rain gauges for publication purposes.

Format: Format of the gauge set up and data stream will be determined upon mutual agreement derived from activities described in section 400 of the scope of work. The agreed upon format will be implemented at the time of installation.

Mutual Non-Disclosure and Confidentiality

By acceptance of this proposal into a contract, both EPWater-SW and Ragin' Cajun Enterprises LLC agree to full confidentiality of operations and/or trade secrets of EPWater-SW and Ragin' Cajun Enterprises LLC, including those of the entities, contractors and sub-contractors whose information required for Ragin' Cajun Enterprises LLC to complete activities stipulated in this contract. Neither Ragin' Cajun Enterprises LLC or EPWater-SW may share, distribute or disseminate any information of this project to outside parties that do not have a genuine need for this said information to complete functions not related to this contract or the activities of either Ragin' Cajun Enterprises LLC and/or EPWater-SW. Entity, contractors or sub-contractors requiring information arising from this contract from either EPWater-SW and/or Ragin' Cajun Enterprises LLC to complete the entities', contractor's or sub-contractor's contracted work, they may do so provided the receiving entity, contractor or sub-contractor understand they are subject to this non-disclosure and confidentiality clause and the indemnification clause of this contract. **This mutual non-disclosure and confidentiality clause shall survive the termination of this agreement.**

Indemnification of Ragin' Cajun Enterprises LLC

By acceptance of this proposal into a contract, EPWater-SW agrees to indemnify, hold harmless and defend Ragin' Cajun Enterprises LLC, their members, directors, officers, agents and employees from any and all claims for injuries and/or damages to persons or property (including death), or any other type of claim alleged to have been received or suffered as a result of or arising out of the operations of Ragin' Cajun Enterprises LLC or its agents, contractors, sub-contractors, consultants, sub-consultants and employees due to the performance of Ragin' Cajun Enterprises LLC duties resultant from provided services in this contract to EPWater-SW. The indemnification of Ragin' Cajun Enterprises LLC shall survive the termination of this agreement.

Exhibit C -- Consultant Fee Schedule

Task Number	Scope and Description	Hydro-Meteorologist		
		Quantity/3 yr	Hours	\$42.00/hr
100	Precipitation Outlooks			
.01	Provide Quarterly/Seasonal Outlooks. Work includes all tasks and sub-tasks required to complete including collecting, analyzing, archiving data and development of the precipitation outlook. There are four quarterly outlooks that will be produced for the 2019-2020 contract year.	12	8	\$4,032.00
.02	Provide Winter Season Snowfall Outlooks. Work includes all tasks and sub-tasks required to complete including collecting, analyzing, archiving and development of the snowfall outlook. There are two outlooks that will be provided in September and December of the 2019-2020 contract year.	6	2	\$504.00
.03	Provide weekly precipitation outlooks. Work includes tasks and sub-tasks required to include collecting, analyzing, archiving data and development of the precipitation outlooks. Outlooks will be provided three times a week during the monsoon (Jul-Sept) and twice a week other times (Apr-Jun and Oct-Dec), once week from Jan-Mar	351	3	\$44,226.00
200	Hydro-Meteorological Forensic Reports			
.01	Analyzing, researching previous events and developing conclusions of each incident. Developing and delivering detailed hydro-meteorological reports to EPWU-SWU (per event) Note: actual hours involved may vary based on complexity of the event. (Assuming 3 reports per year)	9	60	\$22,680.00

Exhibit C -- Consultant Fee Schedule

Task Number	Scope and Description	Hydro-Meteorologist		
		Quantity/yr	Hours	\$42.00/hr
300	Rainfall recording and verification			
.01	Record daily rainfall from reliable reporting sites, analysis of rainfall reports by region as defined by EPWater and the production of monthly rainfall reports (per year)	36	5	\$7,560.00
.02	Record daily and weekly snowfall reports from the Upper Rio Grande Basin, Sangre de Cristo Mountain Range basin, Rio Chama Basin and the Jemez River Basin. Analyze, develop and deliver monthly snow pack reports for these four basins for the winter months (Dec-May). Additionally, provide expected spring and summer stream flow outlooks (Jan-May)	18	1.25	\$945.00
400	Rain Gauge Site Study and Testing/Evaluation of Equipment			
.01	Conduct a study of EPWater-SWU's AOR to identify potential locations to place weather hardened rain gauges. Identified locations should, whenever possible, be collocated with existing EPWater-SWU facilities. Rain gauges should, in addition to being weather hardened, be capable of logging both rain fall and rain rate.	1	95	\$3,990.00
.02	Identify, acquire, and install at least two (2), at most four (4) potential rain gauges in Kansas. (Estimate here is based on four (4) sensors and four (4) data loggers and related equipment)	4	N/A	\$8,000.00
.03	Test/evaluate at least two (2) at most four (4) potential rain gauges for a convective season in Kansas. Evaluation will include: performance, ease of calibration/maintenance and ease of data collection	1	150	\$6,300.00

Exhibit C -- Consultant Fee Schedule

Task Number	Scope and Description	Hydro-Meteorologist		
		Quantity/yr	Hours	\$42.00/hr
500	Site surveys, installations and ongoing maintenance of range gauge network			
.01	Conduct physical site surveys of the potential rain gauge sites. Work will consist of identifying the suitability of each site, installation barriers and the need for a sub contractor. This portion of the work includes travel/lodging expenses incurred. This includes up to 10 sites.	10	90	\$3,780.00
.02	Install and test rain gauges up to 10 sites selected and surveyed for installation. An initial calibration will take place at this time as will data collection testing and remote communications test as required. This includes all sub-contract work required for installation	10	N/A	\$50,000.00
.03	Annual cleaning, maintenance/repair and calibration of installed rain gauges. This activity will take place between December and May of each year. Includes travel and lodging expenses.	10	80	\$3,360.00
Task Totals for the 2019-2020 Contract Year				
	Task 100 estimated cost			\$48,762.00
	Task 200 estimated cost			\$22,680.00
	Task 300 estimated cost			\$8,505.00
	Task 400 estimated cost			\$18,290.00
	Task 500 estimated cost			\$57,140.00
	Total Cost estimate for all tasks and <u>shall not exceed</u>			\$155,377.00
	Cost of the one year extension option <u>shall not exceed</u>			\$50,000.00

**Seasonal Precipitation Outlook
 For El Paso Texas**

January, February and March 2018

Major Climate Factors:

The general state of the climate has El Nino/La Nina Southern Oscillation is in a weak La Nina state. This condition is expected the persist through March of 2018. La Nina conditions in winter tend to provide warmer temperatures and less precipitation than normal. Combine this with other dominate climate factors, it appears that January and February are likely to be rather warm and dry. Late February and into March on the other hand could start returning to normal with precipitation becoming more likely.

El Paso Normal Temperatures and Precipitation

	January	February	March
Average High	58	63	70
Average Low	33	37	43
Average Rain	0.40	0.46	0.26

Actual High/Low and Precipitation for 2017

	Jan 2017	Feb 2017	March 2017
Average High	59.6	69	79.6
Average Low	37.9	42.9	50.4
Total Precipitation	1.05	0.16	Trace

All time Extremes

	January	February	March
Extreme High	80 (1970)	85 (2016)	93 (2017)
Extreme Low	-8 (1962)	1 (2011)	14 (1971)
Highest Precip	1.84 (1949)	1.42 (1944)	2.26 (1958)

NOAA Climate Forecast

	January	February	March
Average High	64	67	76
Average Low	39	45	48
Total Precipitation	0.20	0.25	0.10

El Paso Climate Outlook

	January	February	March
Average High	62	65	72
Average Low	35	40	46
Total Precipitation	0.17	0.30	0.26

Attachment 4--Sample Winter Snowfall Outlook

Product ID:

Issued:

**Winter Snowfall Outlook
For the Upper Rio Grande River Basin**

November, December, January, February and March

Major Climate Factors:

This section will included the major climate factors that will affect the upper Rio Grande River Basin where nearly all snow melt comes from. Some of this information will be similar to the Seasonal Climate outlook for the El Paso area but will include additional analysis for snowfall potential in the four basins of interest as a whole. The four basins include: Upper Rio Grande (headwaters), the Rio Chama Basin, they Sangre de Cristo Mountain Range Basin and the Jemez River Basin. For the purposes of this product, these four basins will be collectively considered the "Rio Grande Snowfall Basin"

Normal Precipitation and Snowfall for the Rio Grande Snowfall Basin

Normal	November	December	January	February	March
Precipitation	1.4	2.8	2.5	2.8	2.9
Snowfall	16	33	30	33	26

**Expected Snowfall for the Rio Grande Snowfall Basin
(as a percentage of normal)**

November	December	January	February	March	Total
25%	30%	45%	50%	25%	40%

Seven Day Precipitation Outlook for El Paso Texas

Sunday, January 01, 2017		Remarks and Potential Problem Area(s)
Precipitable Water (PW)	0.30 Inches	****SAMPLE...NOT A VALID OUTLOOK****
Maximum Rain Rate	0	
Maximum 24 hour rainfall	0	
Threat level (overall)	Minimal	
Monday, January 02, 2017		Remarks and Potential Problem Area(s)
Precipitable Water (PW)	0.40 Inches	
Maximum Rain Rate	0	
Maximum 24 hour rainfall	0	
Threat level (overall)	Minimal	
Tuesday, January 03, 2017		Remarks and Potential Problem Area(s)
Precipitable Water (PW)	0.60 inches	
Maximum Rain Rate	<0.10 inches/hour	
Maximum 24 hour rainfall	<0.10 inches	
Threat level (overall)	Minimal	
Wednesday, January 04, 2017		Remarks and Potential Problem Area(s)
Precipitable Water (PW)	0.80 inches	
Maximum Rain Rate	0.40 inches/hour	
Maximum 24 hour rainfall	0.20 inches	
Threat level (overall)	Light	
Thursday, January 05, 2017		Remarks and Potential Problem Area(s)
Precipitable Water (PW)	0.80 inches	
Maximum Rain Rate	0.60 inches/hour	
Maximum 24 hour rainfall	0.40 Inches	
Threat level (overall)	Moderate	
Friday, January 06, 2017		Remarks and Potential Problem Area(s)
Precipitable Water (PW)	1.2 inches	
Maximum Rain Rate	1.30 inches/hour	
Maximum 24 hour rainfall	0.90 inches	
Threat level (overall)	Significant	
Saturday, January 07, 2017		Remarks and Potential Problem Area(s)
Precipitable Water (PW)	1.5 inches	
Maximum Rain Rate	1.9 inches/hour	
Maximum 24 hour rainfall	1.4 inches	
Threat level (overall)	Severe	
Valid:	NOT A VALID OUTLOOK	Contact: Eric Metzger
Issued:	SAMPLE ONLY	raginweather@gmail.com 915-929-1792

Threat Level (Overall) Key	
Minimal	Little or no rain expected. Rainfall rate: no more than 0.10 inches per hour.
Light	Measurable rain possible. During the monsoon minor street flooding possible in localized areas for short periods of time. Rainfall rate: 0.10-0.40 inches per hour. Major transit systems should not be affected.
Moderate	Brief heavy rain possible. Street flooding of primary transit systems possible for short periods of time. Rainfall Rate: 0.40-1.10 inches/hour
Significant	Heavy rain likely. Disruption of secondary transit systems likely. Primary transit systems may experience short term disruptions as well. Rainfall Rate: 1.10-1.75 inches/hour
Severe	Very heavy rain possible. Disruption of primary transit systems likely for more than an hour. Damage possible to drainage and secondary/tertiary transit systems. 1.75-3 inches/hour
Extreme	Very heavy rain likely. Severe disruption to transit systems likely. Damage to transit systems, drainage systems and property likely. Rainfall rate: 3+ inches/hour.
Explanation of Additional Parameters	
PW	Precipitable Water or PW is the amount of moisture in the atmosphere and if removed all at once, is the amount of water that would fall at that moment. PW is a major contributor to rain rate and rainfall amount. Amounts of 1.4 inches or more are dangerous for El Paso and can produce long term heavy rain and flooding which can cause significant damage. NOTE: High PW does not mean flooding will occur. Additional atmospheric dynamics are required to produce the heavy rain.
Maximum Rain Rate	A major contributor to the overall threat assessment This parameter is based on how city drainage systems will handle runoff. The higher the rain rate, the higher the threat will be.
Maximum 24 hour rainfall	A relatively minor contributor to the overall threat assessment. This value is the maximum expected rainfall for the El Paso area. This value can contribute to the overall threat assessment when the stage of the Rio Grande is high enough to impede the rate of runoff from El Paso. When Rio Grande reaches this stage, this parameter will be highlighted in yellow.

Glossary	
Advection	A process that moves moisture/temperature changes from one place to another.
Atmospheric River	A relatively long and narrow region in the atmosphere, like rivers in the sky, that transport large amounts of tropical moisture from the tropic regions to the mid latitude regions. Atmospheric rivers are extraordinarily rare for El Paso. If this term is used, an extremely dangerous event is expected for El Paso (at least a Severe Threat). The last atmospheric river to affect El Paso was in 2006.
Convection	The process that produces shower and thunderstorm activity.
Isotropic Lift	A process by which moisture is lifted into the atmosphere that will assist in thunderstorm development and heavy rain.
Precipitable Water (PW)	A measure of the amount of water in the atmosphere at any one time. Higher PW=higher rain rate risk. PW of 1.4 and above significantly increase flood risk.
Synoptic Forcing	The presence of a frontal system or a trough which forces air upward. This condition tends to increase thunderstorm activity and rain rate.
Trigger	The process that initiates convection. Trigger must be present to allow showers and thunderstorms to occur regardless of how much moisture is present.

Area Threat Map DD/MM/YYYY

