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HYDROLOGY & GEOMORPHOLOGY, INC.

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July 13th, 2017

Karen Riggs, PE
Cochise County Highway & Floodplain
1415 Melody Lane
Bisbee, AZ 85603

RE: Proposal – Ephemeral Streamflow and Groundwater Monitoring Year 2

Dear Karen:

Per your request, JE Fuller/Hydrology & Geomorphology (JE Fuller) is providing you with this proposal for the referenced services. This proposal is based on the Scope of Work (SOW) dated July 12, 2017 (Attachment A). Note that our current contract Ephemeral Streamflow Monitoring period ends June 30, 2017. It is requested that our contract be executed beginning July 1, 2017 in order to provide a continuous monitoring period.

The following items are attached:

A. Cochise County and the Nature Conservancy Scope of Work, Ephemeral Streamflow and Groundwater Monitoring Year 2, dated July 12, 2017 (hereafter referred to as the Ephemeral Streamflow Monitoring Year 2 SOW);
B. Summary Cost Sheet for the Ephemeral Streamflow and Groundwater Monitoring Year 2 SOW;
C. JE Fuller cost estimate; and,
D. GeoSystems Analysis, Inc. (GSA) cost estimate.

JEF appreciates the opportunity to provide you with this proposal. You may indicate your acceptance of this proposal and provide notice to proceed by forwarding the applicable Professional Services Agreement (PSA) for signature. As always, please feel free to contact me by email (cyrus@jefuller.com) or by phone at 520-623-3112 if you have any questions regarding this proposal.

Sincerely,
JE Fuller/Hydrology & Geomorphology, Inc.

Cyrus D. Miller, P.E., CFM
Vice President

ATTACHMENT A

Cochise County and the Nature Conservancy Ephemeral Streamflow and Groundwater Monitoring Year 2 Scope of Work Dated July 12, 2017

COCHISE COUNTY & THE NATURE CONSERVANCY
SCOPE OF WORK (SOW)
EPHEMERAL STREAMFLOW AND GROUNDWATER MONITORING YEAR 2
Date: July 12, 2017

Introduction

Following the 2016 installation of a network of surface flow monitoring sensor stations along ephemeral watercourses tributary to the Upper San Pedro River at or near project site locations, Cochise County (County) and The Nature Conservancy (TNC) will maintain that network and support the acquisition and processing of data provided by the sensors during the second year of monitoring activities. Measurements of groundwater depths at selected locations are also included in this Scope of Work (SOW).

The goal of establishing this network of monitoring stations is to estimate the natural surface water runoff flow depths, rates and volumes that are conveyed by the tributary watercourses on an annual basis in order to facilitate understanding of the rainfall/runoff characteristics of the subject watersheds, guiding improvements in potential future aquifer recharge facility design. Another goal of the network is to document groundwater depth changes over time at selected locations at or near project sites.

The data collected by this network of surface- and groundwater monitoring stations will provide the context within which future aquifer recharge projects will be conceptualized, designed, constructed and operated. It is intended that the results of these monitoring efforts will provide a comprehensive pre-project monitoring program to continue following project development, allowing for direct measurement of the effects of future recharge project implementation. It is also intended that the results of these monitoring efforts will be used to guide and refine modeling practices for estimating rainfall/runoff responses for future projects.

Project deliverables will include maintenance/replacement of monitoring equipment at the selected stations, topographic survey of the monitoring stations (if required), data collection and analysis, and reporting.

Consultants will perform the tasks listed in the SOW. The SOW includes participation in the regularly-scheduled monthly Cochise County Recharge Network Technical Team meetings for a calendar year following contract award. Contract administration will be conducted by the County.

It is understood that the intent of this monitoring network is to estimate annual runoff flow volumes, typically reporting to the stations under low-stage conditions. These monitoring installations are considered temporary, and damage to the installed stations may occur if the sites are subjected to large (high-stage) flows.

Descriptions of proposed work for each task are provided in the Scope of Work Outline, below.

Scope of Work Outline

The tasks listed below are the identified elements to this SOW.

Task 1: Project Management

The Consultant shall:

- Identify a project manager who will be responsible for managing the budget, schedule, and deliverables throughout the project, including the management of budget, schedule, and deliverables of any Subconsultants, as well as report directly to the County's project manager;
- Identify all Subconsultants who will be involved in the project;
- Schedule and coordinate field work, including equipment installation, data collection, and periodic data downloads;
- Participate in and lead monthly conference calls/meetings for the duration of the contract, including the regularly-scheduled monthly Cochise Conservation and Recharge Network (CCRN) Technical Team Meetings;
- Assign roles and communication system for Consultant and Subconsultant project team members; and
- Identify key stakeholders groups, contacts for each group, and timing for project participation with assistance from the Project Team.

Deliverable 1: Monthly Reports and Invoices and Monthly Conference Calls/Meetings

Task 2: Monitoring Equipment Maintenance and Stabilization

High intensity runoff during the first annual monitoring period resulted in frequent disturbances of Continuous Slope Area (CSA) and HEC-RAS streamflow monitoring sensors installed at Miracle Valley in the Schoolhouse Wash (Palominas, 2 gauges), Horseshoe Draw (4 gauges), and Bella Vista (8 gauges). Disturbances require frequent maintenance to correct and may also compromise data integrity during subsequent flow events prior to maintenance.

Task 2 consists of a field visit at the start of monitoring year 2 (prior to onset of monsoon season) to modify the USGS CSA sensor design and deepen the sensor housing installation within the stream bed. This visit will occur concurrently with the final data download visit for the first monitoring year contract to save on mobilization costs and also includes replacement of one CSA sensor lost due to high flows in 2016 at Horseshoe Draw.

Task 3: Survey of Monitored Channel Reaches/Stations

Ephemeral streamflow monitoring stations installed during the first year of monitoring activities were surveyed using real-time kinematic (RTK) satellite positioning during installation. Stream flow events have the potential to alter cross section geometry, presenting the need to update the cross section geometry used in the analyses. Each sensor location will be visually assessed for changes since installation/survey to evaluate the need for re-survey. Where re-survey is warranted, the sensor locations will be re-surveyed using RTK.

Information gathered during site surveys will be used to modify monitoring sensor placement locations as needed, and to generate data necessary for input into the CSA2SAC computer model, the HEC-RAS files, and the roadway crossing analyses.

Task 4: Monitoring and Data Reporting

Task 4a: Quarterly and Mid-Monsoon Data Downloads

Data will be manually downloaded from all monitoring equipment at Bella Vista, Riverstone, Horseshow Draw and Palominas five times during the annual monitoring period. All pressure transducers, rain gauges, and the surface water imagery stations will be assessed for functionality, battery life, and sensor and clock drift. Data trends will be examined in the field to assure data quality, and any necessary adjustments will be made.

Task 4b: Equipment Maintenance

Flow events at the sensor stations may create the need to routinely clear vegetation and other debris from the sensors in order to allow for accurate measurement readings. Minor debris removal will occur coincidentally with the data downloads. Large flow events have the potential to scour channel bottoms and erode channel banks, which may necessitate adjustments to sensor installation locations and depths, as well as re-survey of channel cross sections and characteristics (roughness, uniformity, etc). Two additional site visits shall be assumed to allow for such maintenance, as changes may not be evident until data has been processed and analyzed.

Task 4c: Data Processing and Analysis

Data from the second year monitoring period at all CSA stations will be analyzed following methods provided in Smith et al (2010), and using HEC-RAS, depending on the station. Data for individual runoff events will be pre-processed and formatted as necessary for input into the CSA2SAC program developed by the USGS AZ Water Science Center (provided by Steven Wiele) or HEC-RAS. Output files provide instantaneous stream discharge estimates which will be used to develop complete event hydrographs of discharge.

Data from the second year of monitoring activities at roadway crossing stations will be analyzed following accepted engineering methods provided by the FHWA. At roadway crossing stations (Palominas watershed), culvert and/or roadway overtopping rating curves/tables will be generated to provide stage-discharge relationships to estimate flow volumes.

Data collected at the stock pond installations within the Riverstone property will be analyzed using the County's 2-foot contour resolution mapping, in order to develop a stage/storage relationship to translate recorded depths to volumes. The Ramsey drop structure data will be analyzed through the use of a broad-crested weir rating, to translate recorded flow depths to volumes.

Task 4d: Reporting-Ephemeral Streamflow Monitoring

Following analysis of monitoring data, an annual report will be generated which summarizes project findings. The following metrics will be calculated for each of the monitoring stations:

- Complete event hydrographs of discharge
- Total annual and individual event flow volumes (acre-feet)
- Peak channel discharge (cfs)
- Event flow durations (hours)

Data from the surface water imagery station will be summarized to provide estimates of water depth and extent during flow events.

Task 4e: Reporting-Groundwater Monitoring

Groundwater data for the annual monitoring period will be summarized in a data memo (subtask 3e), and provided to Cochise County and The Nature Conservancy in support of development of the Walton Family Foundation's Groundwater Metric.

Task 4f: Annual Results Presentation

Following report submittal, a meeting will be held with the CCRN technical team to present results for year 2 ESM monitoring

Deliverables 2, 3 and 4: A Draft Annual Monitoring Report will be submitted to the project team at the end of the one year monitoring period. All project activities will be clearly documented, including data interpretation and analysis. All associated data will be provided in electronic format, as an appendix to the draft and final reports. (Deliverable 2)
A Final Annual Monitoring Report will be submitted within one month of receipt of comments from the project team. (Deliverable 3)
A memorandum summarizing the groundwater monitoring data will be submitted to the project team. (Deliverable 4)

Schedule

It is anticipated that the contract will be awarded beginning July 1, 2017 in order to provide a monitoring period continuous from the end of the year 1 monitoring period. The Consultant shall work closely with the County's project manager to develop a schedule for review and approval by the Project Team within 10 days of contract award.

Manual data downloads (Task 4a) will occur during August 2017, October 2017, January 2018, and July 2018.

ATTACHMENT B
Summary Cost Sheet for the Ephemeral Streamflow and Groundwater Monitoring SOW

PROJ: Cochise County/Ephemeral Streamflow and Groundwater Monitoring Year 2 Project
DETAIL: Total Project Cost Calculation
DATE: July 12, 2017
Prepared by: JE Fuller/Hydrology & Geomorphology (JE Fuller)

ATTACHMENT B - Summary Cost Sheet for the Ephemeral Streamflow and Groundwater Monitoring SOW

Task	Title	Deliverable (see SOW for task details)	Costs		
			JE Fuller	GSA	TOTAL
1	Project Management	Deliverable 1: Monthly Reports and Invoices and Monthly Meetings/Conference Calls	$12,970	$8,408	**$21,378**
2	Monitoring Equipment Maintenance and Stabilization	-	$379	$7,578	**$7,957**
3	Survey of Monitored Channel Reaches/Stations	-	$6,170	$0	**$6,170**
4a	Quarterly & Mid-Monsoon Data Downloads	Deliverables 2, 3, and 4: A Draft Annual Monitoring Report will be submitted to the project team at the end of the one year monitoring period. All project activities will be clearly documented, including data interpretation and analysis. All associated data will be provided in electronic format, as an appendix to the draft and final reports. (Deliverable 2) A Final Annual Monitoring Report will be submitted within one month of receipt of comments from the project team. (Deliverable 3) A memorandum summarizing the groundwater monitoring data will be submitted to the project team. (Deliverable 4)	$564	$11,273	**$11,837**
4b	Equipment Maintenance		$1,182	$4,048	**$5,230**
4c	Data Processing and Analysis		$8,017	$8,734	**$16,751**
4d	Reporting-Ephemeral Streamflow Monitoring		$3,286	$5,522	**$8,808**
4e	Reporting-Groundwater Monitoring		$375	$3,104	**$3,479**
4f	Annual Results Presentation		$946	$1,327	**$2,273**
		TOTALS	**$33,890**	**$49,994**	**$83,884**

Notes:
5.00% Subconsultant markup included in JE Fuller Cost
All fee estimates are approximate.
The total fee is a not-to-exceed (NTE) amount and individual task fees may vary within the total NTE.
Where needed tasks may be performed concurrently or out of the sequence indicated above.

ATTACHMENT C
JE Fuller Fee Estimate

PROJ: Cochise County/Ephemeral Streamflow and Groundwater Monitoring Year 2 Project
DETAIL: JEF Cost Calculation
DATE: July 12, 2017
Prepared by: JE Fuller/Hydrology & Geomorphology (JE Fuller)

ATTACHMENT C - JE Fuller Cost Sheet for the Ephemeral Streamflow and Groundwater Monitoring SOW

Task	Title	Deliverable (see SOW for task details)	JE Fuller Hours PM II $135.00	JE Fuller Hours PE II $110.00	JE Fuller Labor Cost	JE Fuller Direct Costs	JE Fuller Total Cost
1	Project Management	**Deliverable 1:** Monthly Reports and Invoices and Monthly Meetings/Conference Calls	6	104	$12,250	$300	**$12,550**
2	Monitoring Equipment Maintenance and Stabilization	-	0	0	$0	$0	**$0**
3	Survey of Monitored Channel Reaches/Stations	-	0	52	$5,720	$450	**$6,170**
4a	Quarterly & Mid-Monsoon Data Downloads	**Deliverables 2, 3, and 4:** A Draft Annual Monitoring Report will be submitted to the project team at the end of the one year monitoring period. All project activities will be clearly documented, including data interpretation and analysis. All associated data will be provided in electronic format, as an appendix to the draft and final reports. (Deliverable 2) A Final Annual Monitoring Report will be submitted within one month of receipt of comments from the project team. (Deliverable 3) A memorandum summarizing the groundwater monitoring data will be submitted to the project team. (Deliverable 4)	0	0	$0	$0	**$0**
4b	Equipment Maintenance		0	8	$880	$100	**$980**
4c	Data Processing and Analysis		4	64	$7,580	$0	**$7,580**
4d	Reporting-Ephemeral Streamflow Monitoring		2	24	$2,910	$100	**$3,010**
4e	Reporting-Groundwater Monitoring		0	2	$220	$0	**$220**
4f	Annual Results Presentation		0	8	$880	$0	**$880**
		TOTALS	**12**	**262**	**$30,440**	**$950**	**$31,390**

Notes:
All fee estimates are approximate.
The total fee is a not-to-exceed (NTE) amount and individual task fees may vary within the total NTE.
Where needed tasks may be performed concurrently or out of the sequence indicated above.

ATTACHMENT D
GSA Fee Estimate

San Pedro Ephemeral Streamflow Monitoring - Year 2

1725 - JE Fuller

June 22, 2017

Table 1 - Cost Summary By Task

	Total Costs
1 - Project Management	**$8,408**
1a - Project Coordination and Management	$2,632
1b - Monthly CCRN Technical Team Meetings	$5,776
2 - Monitoring Equipment Maintenance and Stabilization	**$7,578**
2.1 - Purchase and Prepare Supplies for Equipment Stabilization	$2,952
2.2 - Equipment Stabilization	$4,626
3 - Monitoring and Reporting	**$34,008**
3a - Quarterly and Mid-Monsoon Data Downloads (5 total, ESM & Groundwater)	$11,273
3b - Equipment Maintenance	$4,048
3c - ESM & Groundwater Data Processing and Analysis	$8,734
3d - ESM Annual Report	$5,522
3e - Groundwater Monitoring Data Memo	$3,104
3f - Present Annual Results	$1,327
Proposal Grand Total	**$49,994**

San Pedro Ephemeral Streamflow Monitoring - Year 2
Table 2 - Detailed Costs

Task: 1 - Project Management

		Quantity	Unit Cost	Shipping	Total Cost
Personnel Costs					
Subtask: 1a - Project Coordination and Management					
Program Director	Milczarek	6	$145	NA	870
Staff Hydrologist	Bunting	12	$90	NA	1080
Clerical Staff	Torres	8	$65	NA	520
			Subtask Total:		*$2,470*
Subtask: 1b - Monthly CCRN Technical Team Meetings					
Program Director	Milczarek	24	$145	NA	3480
Staff Hydrologist	Bunting	18	$90	NA	1620
			Subtask Total:		*$5,100*
Other Direct Costs					
Subtask: 1a - Project Coordination and Management					
Communications		1	$50	NA	50
Miscellaneous		2	$50	NA	100
			Subtask Total:		*$162*
Subtask: 1b - Monthly CCRN Technical Team Meetings					
Miscellaneous		2	$50	NA	100
Communications		4	$50	NA	200
Reproduction		2	$50	NA	100
2WD Transportation		400	$1	NA	226
			Subtask Total:		*$676*
	8.00% Overhead: $62.08		**Task Total**		**$8,408**

San Pedro Ephemeral Streamflow Monitoring - Year 2
Table 2 - Detailed Costs

Task: 2 - Monitoring Equipment Maintenance and Stabilization

		Quantity	Unit Cost	Shipping	Total Cost
Personnel Costs					
Subtask: 2.1 - Purchase and Prepare Supplies for Equipment Stabilization					
Program Director	Milczarek	2	$145	NA	290
Staff Hydrologist	Bunting	4	$90	NA	360
Technician	Heydorn	8	$65	NA	520
			Subtask Total:		*$1,170*
Subtask: 2.2 - Equipment Stabilization					
Staff Hydrologist	Bunting	24	$90	NA	2160
Hydrologist 1	Calabrese	24	$75	NA	1800
			Subtask Total:		*$3,960*
Other Direct Costs					
Subtask: 2.1 - Purchase and Prepare Supplies for Equipment Stabilization					
In-Situ Rugged Troll 100		1	$380	NA	380
Auger bit rental		2	$75	NA	150
Installation Supplies		6	$50	NA	300
Gas Powered Auger Rental		2	$50	NA	100
Shipping		2	$50	NA	100
2" Galvanized Steel Pipe		14	$35	$100	590
2" locking well cap		1	$20	NA	20
Padlock		1	$10	NA	10
			Subtask Total:		*$1,782*
Subtask: 2.2 - Equipment Stabilization					
Lodging		2	$85	NA	170
Miscellaneous Items		2	$50	NA	100
Subsistence		4	$46	NA	184
4WD Truck		250	$1	NA	162.5
			Subtask Total:		*$666*
	8.00% Overhead: $181.32		**Task Total**		**$7,578**

San Pedro Ephemeral Streamflow Monitoring - Year 2
Table 2 - Detailed Costs

Task: 3 - Monitoring and Reporting

		Quantity	Unit Cost	Shipping	Total Cost
Personnel Costs					
Subtask: 3a - Quarterly and Mid-Monsoon Data Downloads (5 total, ESM & Groundwater)					
Program Director	Milczarek	2	$145	NA	290
Staff Hydrologist	Bunting	12	$90	NA	1080
Technician	Heydorn	120	$65	NA	7800
			Subtask Total:		*$9,170*
Subtask: 3b - Equipment Maintenance					
Program Director	Milczarek	1	$145	NA	145
Staff Hydrologist	Bunting	6	$90	NA	540
Technician	Heydorn	24	$65	NA	1560
			Subtask Total:		*$2,245*
Subtask: 3c - ESM & Groundwater Data Processing and Analysis					
Program Director	Milczarek	4	$145	NA	580
Staff Hydrologist	Bunting	40	$90	NA	3600
Hydrologist 1	Calabrese	60	$75	NA	4500
			Subtask Total:		*$8,680*
Subtask: 3d - ESM Annual Report					
Program Director	Milczarek	8	$145	NA	1160
Staff Hydrologist	Bunting	40	$90	NA	3600
AutoCAD/GIS	Buchanan	8	$75	NA	600
			Subtask Total:		*$5,360*
Subtask: 3e - Groundwater Monitoring Data Memo					
Program Director	Milczarek	2	$145	NA	290
Staff Hydrologist	Bunting	24	$90	NA	2160
AutoCAD/GIS	Buchanan	8	$75	NA	600
			Subtask Total:		*$3,050*
Subtask: 3f - Present Annual Results					
Program Director	Milczarek	4	$145	NA	580
Staff Hydrologist	Bunting	8	$90	NA	720
			Subtask Total:		*$1,300*
Other Direct Costs					
Subtask: 3a - Quarterly and Mid-Monsoon Data Downloads (5 total, ESM & Groundwater)					
Lodging		5	$85	NA	425
Miscellaneous		4	$50	NA	200
Communications		1	$50	NA	50
Subsistence		10	$46	NA	460
4WD Truck		1250	$1	NA	812.5
			Subtask Total:		*$2,103*

San Pedro Ephemeral Streamflow Monitoring - Year 2
Table 2 - Detailed Costs

Subtask: 3b - Equipment Maintenance					
	Hobo Rain Gauge	1	$420	NA	420
	In-Situ Rugged Troll 100	2	$380	NA	760
	Lodging	1	$85	NA	85
	Miscellaneous	2	$50	NA	100
	Communications	1	$50	NA	50
	Subsistence	2	$46	NA	92
	4WD Truck	250	$1	NA	162.5
			Subtask Total:		*$1,803*
Subtask: 3c - ESM & Groundwater Data Processing and Analysis					
	Communications	1	$50	NA	50
			Subtask Total:		*$54*
Subtask: 3d - ESM Annual Report					
	Communications	1	$50	NA	50
	Reproduction	2	$50	NA	100
			Subtask Total:		*$162*
Subtask: 3e - Groundwater Monitoring Data Memo					
	Communications	0.5	$50	NA	25
	Reproduction	0.5	$50	NA	25
			Subtask Total:		*$54*
Subtask: 3f - Present Annual Results					
	Communications	0.5	$50	NA	25
			Subtask Total:		*$27*
	8.00% Overhead: $311.36		**Task Total**		**$34,008**
			PROPOSAL GRAND TOTAL:		**$49,994**