

**To:** Grimm, Paul[pgrimm@blm.gov]  
**Cc:** Matthew J Betenson[mbetenso@blm.gov]; James Bradshaw[jbradshaw@blm.gov]; Dana Backer[dbacker@blm.gov]  
**From:** Staszak, Cynthia  
**Sent:** 2017-08-15T10:47:50-04:00  
**Importance:** Normal  
**Subject:** Fwd: permit for USGS use of UAS for sediment loading in retention basins  
**Received:** 2017-08-15T10:48:40-04:00  
[USGS Salinity mckinney UT-2017-030-006-H permit.docx](#)  
[blm\\_salinity\\_sturctures\\_utm.xlsx](#)  
[BLM-sed basin assessment of erosion TSM \(2\).docx](#)  
[OAS-30U -9-16 remote pilot Tim McKinney.pdf](#)  
[salinity\\_structures.pdf](#)  
[USGS Salinity mckinney UT-2017-030-006-H letter.docx](#)

Paul:

Please put the letter on GSENM letterhead, and then bring it to me for signature before I leave at noon.

Then get the letter back to Dana.

Thanks

***Cindy Staszak  
Monument Manager  
Grand Staircase-Escalante National Monument  
669 S. Hwy 89-A  
Kanab, UT 84741  
Office: 435 644-1240  
Cell: 435 691-4340  
Fax: 435 644-1250***

----- Forwarded message -----

From: **Backer, Dana** <dbacker@blm.gov>  
Date: Tue, Aug 15, 2017 at 8:39 AM  
Subject: permit for USGS use of UAS for sediment loading in retention basins  
To: Matthew Betenson <mbetenso@blm.gov>, Cynthia Staszak <cstaszak@blm.gov>  
Cc: "Bradshaw, James" <jbradshaw@blm.gov>

Matt/Cindy

BLM State Office has a project with USGS to fly a UAS to take photographs (simplified term for what Structure from Motion photogrammetry) to quantify the sediment loads in saline retention

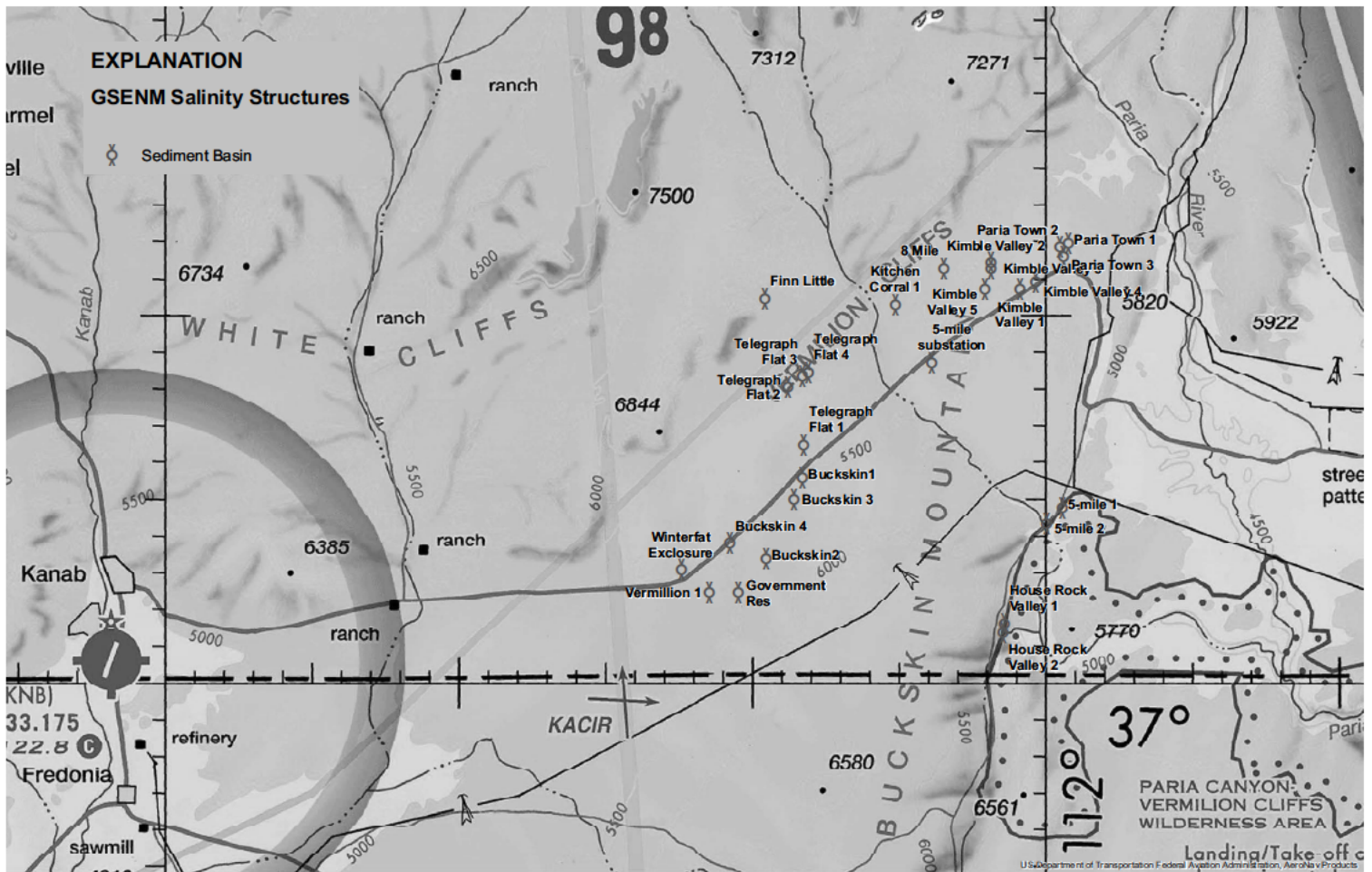
basins. They will be putting several rebar markers for repeat photography within the disturbed area. Matt Z, Cameron, and Ken (project lead) have all signed off on the permit.

Attached is the letter for your signature, the permit, and all the support documentation. USGS lead, Tim McKinney has already notified Bryan Brazzeal of his flight plans and I will notify Law Enforcement. They want to fly August 27-31 because the basins are filling up so I am trying to fast track this.

Thank you.

Dana

Dana Backer  
Science Program Administrator  
Grand Staircase Escalante National Monument  
Kanab, UT 84741  
435-644-1257



File no: xxxx

**Letter Head**

U.S. Geological Survey, Utah Water Science Center  
2329 W Orton Circle  
Salt Lake City, UT 84119

Dear Mr. McKinney

Enclosed you will find your formal research permit for Grand Staircase-Escalante National Monument (GSENM), as requested. The permit is effective August 15, 2017 through December 31, 2022. As noted in the permit and correspondence, this permit authorizes the use of flying UAS for the purpose of estimating the sediment yields in retention basins using Structure from Motion photogrammetry. Each year you plan on flying, please notify the Science Program Administrator and Cedar City District Aviation Program Manager, Bryan Brazzeal.

We look forward to having you conduct research at GSENM. Please look over the details of the stipulations for doing work on the Monument and become familiar with your responsibilities. Please sign the research permit and return it to the Science Program Administrator. Note that you are required to carry your permit with you at all times when working on the Monument. Also, please contact one of our visitor centers to inquire about current weather and road conditions.

Your research will contribute to a growing body of knowledge that will inform management and contribute to the appreciation of the unique resources on the Monument. As part of our effort to promote science on the Monument, we ask that you prepare a short presentation or other public education outreach to be given at one of the visitor centers or prepare a research brief that can be shared with the staff, volunteers, and visitors. Examples can be made available upon request. Please send the required annual progress report and monitoring results, including copies of any publications, by December 31 of each year.

If you have further questions please contact Dana Backer, Science Program Administrator by phone at 435-644-1257 or email [dbacker@blm.gov](mailto:dbacker@blm.gov).

Sincerely,

Cynthia Staszak  
Monument Manager

Enclosures:   Research permit  
                  Standard permit stipulations  
                  Map  
                  Table of flight locations




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**Scientific Research and Collection Permit  
Grand Staircase-Escalante National Monument**

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**Applicant Names:** Tim McKinney**Application Date:** 08/11/2017**Address:**

U.S. Geological Survey, Utah Water Science Center  
2329 W Orton Cir  
Salt Lake City, UT 84119

**State Permit Number (if applicable):****Federal Permit Number (if applicable):**

**1. Is the research covered by an assistance agreement with this office and/or other BLM offices? If yes provide the number.**

L13PG00072

**2. Description of research. Include as an attachment** Assessment of erosion, sediment yield, and salinity loading from BLM lands using reconstructed retention basins. See attachments in file for survey purpose, summary, deliverables, map and salinity structure locations (27). FAA UAS pilot license on file.

Area to be flown: lat-long boundary 37.2035 dd83 -112.2114 dd83 and 37.0209 dd83 -111.986 dd83

Permanent rebar markers(3-6 per site) will need to be placed within the existing sediment basin so images can detect change over the time period of this permit. They will then be removed. Ground crews will have a visual on the aircraft at all times.

**3. Contact information**

**Phone:** (801) 908-5060 **Cell:** (801) 633-0924 **Fax:** (801) 908-5001 **E-mail:** tmckinney@usgs.gov

**4. If collecting is authorized. Materials to be collected:** NA

**For GSENM office use only below this line.**

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**GSENM Number:** UT-2017-030-006-H

**Issue Date:** August 15, 2017**Expiration Date:** December 31, 2022

**5. Specialist review complete?** ☒ Yes ☐ No

Name: McQuivey, Zweifel,  
Bradshaw

**9. Curation agreement?** ☐ Yes ☒ No  
Attach

**6. Complies w/ MMP?** ☒ Yes ☐ No

**10. Permit granted?** ☒ Yes ☐ No

**7. In WSA status?** ☐ Yes ☒ No

**11. Permit extension?** ☐ Yes ☒ No

**8. Special Stipulations?** ☐ Yes ☒ No

**Authorization.** Permission is hereby given to the above named individual to collect material(s) specified in the approved research proposal, within the guidelines of permit stipulations outlined below.

By:  
Cynthia Staszak  
Monument Manager

Date

I have read and agree to the stipulations of this permit.

By:  
Science Permittee Name

Date

## STANDARD RESEARCH PERMIT STIPULATIONS

We ask that you follow all **Leave No Trace Principles** (<https://lnt.org>) and the following.

1. This permit may not be assigned to any other institution, group, or individual. Any modifications to the permit must be requested in writing to the Science Program Administrator.
2. This permit is valid only for the period specified. The permit may be suspended or modified at the discretion of the Monument Manager. Field work under this permit may be halted temporarily by either verbal or written notice from the Monument Manager or other Authorized Officer for violations of permit terms and conditions or for administrative purposes of the BLM.
3. All terms and conditions of this permit shall remain in effect, including reporting requirements, until all permit terms and conditions have been met, regardless of permit expiration date.
4. A copy of this permit must be carried by the individual in direct charge of field work during the course of all work conducted under permit.
5. This permit shall not be exclusive in character, and the Bureau of Land Management reserves the right to authorize other uses of the land during the tenure of this permit. Field work shall be carried out in such a manner as to not impede other legitimate uses of the Monument, except when a provision has been made by the Monument Manager or delegated representative.
6. The Department of Interior, including its bureaus and employees, shall be held blameless for any and all events, deeds, or mishaps, regardless of whether or not they arise from operations under this permit.
7. Field schedule must be coordinated with the Science Program Administrator or a designated representative in advance of field work.
8. The Monument Manager, and /or designated representatives shall have access to the study area during or after performance of field work, and shall have the right to inspect all materials removed.
9. Any stakes, flagging, or other temporary materials used to identify localities in the field shall be removed upon completion of field activity. No permanent survey monuments or markers shall be disturbed or removed during the course of field work.
10. Unless otherwise agreed, all costs shall be borne by the permittee, including costs of curation.
11. Interpreting and sharing the science conducted on GSENM with staff, volunteers and the public, is critical. There shall be a public outreach component for each research project. Recommendations or opportunities for public presentations, a field trip, or the something similar shall be coordinated with the Science Program Administrator.
12. Collections, if authorized, of materials acquired from public lands under the provisions of this permit remain the property of the United States Government and may be recalled at any time for use by the BLM. A designated repository for this project is not necessary. Any recall or transfer of material will be coordinated by BLM with the designated repository. Public display of material collected under this permit shall cite Grand Staircase-Escalante National Monument, Bureau of Land Management, Utah.
13. Grand Staircase-Escalante National Monument, and the BLM, Utah shall be cited in any report, publication, paper, news article, film, television program or other media, resulting from field work under

this permit. Copies of such documents shall be provided to the Grand Staircase-Escalante National Monument Headquarters. To assist in producing the best possible science, you are encouraged to forward manuscripts for review to the Science Program Administrator prior to submitting them for publication.

14. Access to research site(s) is authorized only across BLM administered lands. Use of private lands or lands administered by another agency must be secured separately.

15. A report of all activities conducted under this permit shall be prepared by December 31 of each year during the tenure of the permit. This report will be submitted to the Monument Headquarters, in care of the Science Program Administrator. The report shall include a catalog of all specimens collected, if authorized, a description of work accomplished, results, copies of datasets (with FGDC compliant metadata for final reports) and any recommendations for future research or management activities.

16. For any collections that will be curated, a list of all specimens collected must be provided in the annual report to the Science Program Administrator. Each specimen must contain the following information: scientific name, description, collection location (latitude / longitude or UTM Zone 12, NAD83), collection number, and facility's accession number. Provide the curation facility, address, and a point of contact at the facility.

17. Pursuant to the Native American Graves Protection and Repatriation Regulations at 43 CFR 10.4, the permittee shall notify the Science Program Administrator or Monument Manager immediately upon the inadvertent discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony, with written confirmation. All work in the vicinity must and reasonable efforts shall be made to protect the remains pending BLM action. Activities may resume within 30 days of receipt of the written confirmation of notification unless the situation is resolved sooner.

18. Commercially provided services such as transportation, cooking and packing must be sought from outfitters authorized by the Monument. For a current list of outfitters, please contact Science Program Administrator at 435-644-1257 or [dbacker@blm.gov](mailto:dbacker@blm.gov).

19. Please be aware of current hunting activities and locations by visiting [www.wildlife.ut.gov](http://www.wildlife.ut.gov).

### **Camping**

1. Overnight camping in the Monument requires a permit. Currently, permits are free of charge and may be obtained at Visitor Centers or at designated trailheads. Camping restrictions described in the GSENM Management Plan, p. 35, must be followed. The GSENM Management Plan is available on line [https://www.blm.gov/nlcs\\_web/sites/style/medialib/blm/ut/grand\\_staircase-escalante/planning/monument\\_management.Par.83655.File.dat/GSENM%20Management%20Plan.pdf](https://www.blm.gov/nlcs_web/sites/style/medialib/blm/ut/grand_staircase-escalante/planning/monument_management.Par.83655.File.dat/GSENM%20Management%20Plan.pdf)

2. No camping within 300 feet of an isolated water source (i.e., seep, spring, pond, rock pool, water pocket).

3. Permittee will maintain all premises to standards of repair, orderliness, neatness, and sanitation acceptable to the Monument. Camp areas will be regularly cleaned and no trash or litter will be allowed to accumulate.

### **Fire**

1. Campfires are not allowed in the Escalante and Paria/Hackberry Canyons, No Mans Mesa, nor in archaeological sites, rock shelters and alcoves throughout the Monument.

2. In the Front country and Passage Zones, campfires are allowed only in designated fire grates,



designated fire pits, or mandatory fire pans. Wood collection for campfires is not allowed. Burn all wood and coals to ash, put out campfires completely; leave cool ashes.

3. In the Outback and Primitive Zones campfires are allowed. Use an existing fire ring instead of building a new one. The use of fire pans is encouraged. Only dead and down wood can be collected. Burn all wood and coals to ash, put out campfires completely, scatter cool ashes, and restore the area to a natural condition before leaving.

### **Group Size Limits**

1. Group size is limited to 25 people in the Passage and Outback Zones including guides.
2. Group size within the Primitive Zone is limited to 12 people and 12 pack animals including guides, however within the Paria River corridor in the Primitive Zone group size is limited to 25 people including guides.
3. Group size limits cannot be achieved by staggering individual groups along a single route by time or distance. Instead, individual groups must comply with group size limits by utilizing separate and unique routes, or by traveling from opposite ends of a single route. If traveling from opposite ends of a single route, groups may pass each other, however they cannot gather at a single location.

### **Wilderness Study Areas**

1. Permittee is responsible for knowing the location of wilderness and wilderness study areas (WSA) comply with the restrictions that apply to such areas. Maps and information concerning restrictions are available at the Monument website

### **Transportation and Access**

1. All machinery (street legal motorized vehicles, non-street legal all-terrain vehicles, dirt bikes etc.) that has been used outside the Monument must be cleaned prior to use in the Monument, to prevent the possible introduction and spread of noxious weeds.
2. Motorized or mechanized vehicles may pull off designated routes no more than 50 feet for direct access to dispersed camping areas in the Outback Zone, except in Wilderness Study Areas, endangered plant areas, relict plant areas and riparian areas.
3. Access onto the Monument will be along defined roads listed on the transportation map in the Grand Staircase- Escalante National Monument Management Plan.
4. Cross-country motorized travel on the Monument is prohibited. All motorized and mechanized (bicycles, deer carts) vehicles must stay on designated roads while traveling in the Monument.
5. Permittee shall not construct new trails, or maintain existing trails without written authorization from the Monument.
6. The permittee shall not use paint or flagging, or construct cairns to mark trails, unless specifically allowed by this permit.

### **Sanitation and Aesthetics**

1. Burning and burying food waste are prohibited.
2. Utilize a portable self-contained toilet system when less than 300 feet from water sources, campsites, and trails. All human waste must be packed out and disposed of at a certified disposal site.

3. If a small portable toilet cannot be used, deposit solid human waste in catholes dug 4 to 6 inches deep at least 300 feet from water sources, camp, and trails. Cover and disguise the cathole when finished. Never dig a cathole under an overhang or shelter.

4. If camping in one location for multiple days, a trench may be dug to dispose of human waste. To dig a trench, start with a cathole dug 4 to 6 inches deep and expand it in one direction as additional people use it; soil dug from the trench should be used to cover the feces.

5. To wash yourself or your dishes, carry water 300 feet away from water sources and use small amounts of biodegradable soap. Scatter strained dishwater and pack out remaining food particles.

**Supplemental Stipulations for Permittees using Riding or Pack Animals**

1. Horses or other pack animals are not allowed in relict plant communities, archaeological sites, rock shelters, or alcoves. Sheep species will not be allowed for pack use.

2. Weed free hay, straw and non-germinable grains may be used to feed and bed livestock, or be placed in the bottom of stock carrying vehicles.

Name	Easting zone 12 nad83	Northing zone 12 nad 83
Telegraph Flat 1	398867.059200	4107508.622560
Telegraph Flat 4	399181.771064	4111126.619600
Telegraph Flat 3	398891.790461	4110932.661130
Telegraph Flat 2	398146.337528	4110421.866540
Finn Little	397030.251238	4114879.387530
8 Mile	406075.899735	4116296.090720
Kimble Valley 1	409923.256733	4115212.728140
Buckskin1	398819.673399	4105870.727140
Buckskin2	396911.907280	4101794.625040
5 mile 1	411899.106495	4104190.459550
5 mile 2	411120.576418	4103408.305240
House Rock Valley 1	408900.674947	4098403.748560
Paria Town 1	412379.032081	4117509.552730
Paria Town 2	411942.994788	4117286.516240
Kimble Valley 3	408472.010490	4116248.604970
Kimble Valley 2	408438.641193	4116536.144580
Kimble Valley 5	408114.235124	4115209.900390
Paria Town 3	412116.559359	4116834.339290
Buckskin 3	398387.002973	4104734.862660
House Rock Valley 2	408861.642070	4097978.495110
Buckskin 4	395097.766960	4102593.595210
Kitchen Corral 1	403610.781940	4114509.421270
Kimble Valley 4	410688.571503	4115551.050060
Vermillion 1	394010.950010	4100098.356570
Government Res	395524.448215	4100088.179780
Winterfat Exclosure	392616.809074	4101277.354760
5 mile substation	405411.807151	4111560.316020

**Assessment of erosion, sediment yield, and salinity loading from BLM lands using reconstructed retention basins: Grand Staircase National Monument and Kanab Field Office area**

**Introduction:** Marine shales and other poorly vegetated geologic units are highly susceptible to erosion and can be a major source of salinity to the Colorado River in the Upper Colorado River Basin. A common approach to controlling erosion, sediment and salinity loads from natural landscapes is to install sediment retention basins in ephemeral washes. These structures retain and capture sediment and dissolved constituents transported via erosion in the watershed. Over time these structures fill with sediment and can be over topped resulting in channelization, stream channel down cutting and remobilization of stored sediment. BLM has a program to maintain and reconstruct sediment retention basins in Grand Staircase National Monument and in Kanab Field Office area. Each year 10-15 sediment basins are reconstructed and vary in size from about 0.5 – 5 acres. The proposed study will leverage and support this ongoing program and provide new data and information for BLM’s salinity control program. This study will assess erosion and sediment transport rates in watersheds above sediment retention basins to:

- a) Determine sediment yield from watersheds and estimate annual sediment retention and salinity control from sediment basins.
- b) Correlate sediment yield with watershed characteristics
- c) Improve estimates of basin life cycle and maintenance requirements

**Relevance and Benefits:** This study will improve our understanding of erosion and sediment and salinity production from BLM lands in the Colorado River Basin. These data will assist BLM in quantifying results of sediment and salinity control efforts within the Upper Colorado River Basin. Annual sediment volumes deposited in the basin determined by the study will be valuable for planning the long-term maintenance structures. This study is consistent with the USGS strategic science “A Water Census of the United States” identified in the 2007-17 science strategy of the USGS (U.S. Geological Survey, 2007)

**Approach:** The general approach of the study will determine sediment yields in watersheds above sediment retention basins using repeat topographic surveys and derived digital surface models (DSM) of differences. Topographic data will be acquired using an emerging photogrammetric technique referred to as Structure from Motion (SfM) photogrammetry. The method employs classic photogrammetric principles to derive topography from photography, but utilizes advances in computer vision to substantially relax photo quality and acquisition requirements and increase the ease of use while maintain high accuracy (see Fonstad and others (2013) for a complete overview of the method). These methods are well suited to areas that are unvegetated.

The acquisition of a modern SfM survey consists of collecting a set of overlapping, offset images of the area of interest and collecting a set of ground control points used to reference those photos (Westoby and others, 2012). The acquisition of ground control necessitates on-the-ground access to the field site, though a single set of points can be used to reference all planned photo acquisitions, and so only a single visit is needed. Usable ground control points can include any visually identifiable object or point with known coordinates. These can include bench marks, distinct rocks, or features, and may also

include temporary chalk marks placed during the ground survey. Coordinates of control points will be obtained using RTK-GNSS. Subsequent surveys will only require recollection of photographs.

Photos and ground control will be processed in Structure for Motion software and will generate:

- 1) A topographic raster with 0.25 - 0.5m horizontal resolution and a vertical precision of approximately 0.1 m, and
- 2) An orthophoto with approximately 0.1m horizontal resolution.

The output products will then be analyzed using a GIS-framework to assess change in volume in the sediment retention basin. Watershed sediment yields will be derived from watershed area and characteristics. We are also proposing at selected sites to install remote automated "game cameras" to collect daily photographs of retention basin to monitor when they are active. The project will analyze 10-15 sites per year. It is anticipated complexity of data collection and processing will vary between sites and the number of sites analyzed will vary. Resurveys will take less time in the field but require additional GIS processing to develop sediment volume estimates.

Watershed characteristics (elevation, slope, aspect, geology, soils and vegetation) will be compiled for selected watersheds and related to observed sediment deposition in basins and estimated yields. Empirical relations between sediment concentrations and salinity loading at gaging stations observed in similar geologic setting in the Upper Colorado River Basin will be used to estimate salinity loading from the watersheds.


**Products:** The investigation will result in a digital data report of topographic data consisting of derived DSMs and raster products and an interpretative report describing the results of the analysis watershed sediment yields, correlation with watershed characteristics and salinity loads.

**Data management:** All derived field data, including the ground control, DSMs and orthophotos will be archived in ScienceBase in accordance with USGS (2016) and associated memoranda (OSQI IM 2015-01, 2015-02, 2015-03, 2015-04).

## References

Westoby, M.J., Brasington, J., Glasser, N.F., Hambrey, M.J. and Reynolds, J.M., 2012. 'Structure-from-Motion' photogrammetry: A low-cost, effective tool for geoscience applications. *Geomorphology*, 179, pp.300-314.

U.S. Geological Survey, 2007, Facing tomorrow's challenges—U.S. Geological Survey Science in the Decade 2007-2017: U.S. Geological Survey Circular 1309, 69 p.

 <div style="text-align: center;"> <p>U.S. DEPARTMENT OF THE INTERIOR</p> <p>sUAS Remote Pilot/Operator</p> <p><b>QUALIFICATION CARD</b></p> </div>		<p style="text-align: center;"><b>Qualifications/Special Use</b></p> <p>GCS Operator <u>Tower</u> <span style="float: right;"><b>Exp. Date</b></span></p> <p>Rail Launch _____ <span style="float: right;"><u>NA</u></span></p> <p>Hand Launch _____</p> <p>Trainee (must be accompanied by qualified PIC-Instructor sign off when proficient)</p> <p>GCS _____</p> <p>Joystick/Manual Operator _____</p> <p>_____</p> <p>_____</p>
<p>Operator Name: <u>McKinney, Tim</u></p> <p>Bureau/Agency: <u>USGS</u></p> <p>Issued By: <u>Thurau, Richard</u></p> <p><b>RICHARD THURAU</b> <small>(Digitally signed by RICHARD THURAU Date: 2017.06.14 12:27:18 -06'00')</small></p> <p style="text-align: right;"><small>(Signature)</small> <u>06/09/17</u></p> <p><small>OAS-30U (01/16)</small> <span style="float: right;">Issue Date:</span></p>		
<p style="text-align: center;"><b>Make/Model/Config.</b></p> <p><u>3DR Solo</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p style="text-align: center;"><b>Exp. Date</b></p> <p><u>06/19</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p style="text-align: center;"><b>Limitations</b></p> <p><u>To fly 3DR Solo with Mission Planner, a DOI must fly with an DOI Remote Pilot that has been trained and qualified on Mission Planner. Any DOI remote Pilot that has been through Falcon Training is approved and qualified on Mission Planner. Others will be identified on their card as proficient. Your mentor will identify that you are proficient.</u></p> <p>_____</p> <p>_____</p>