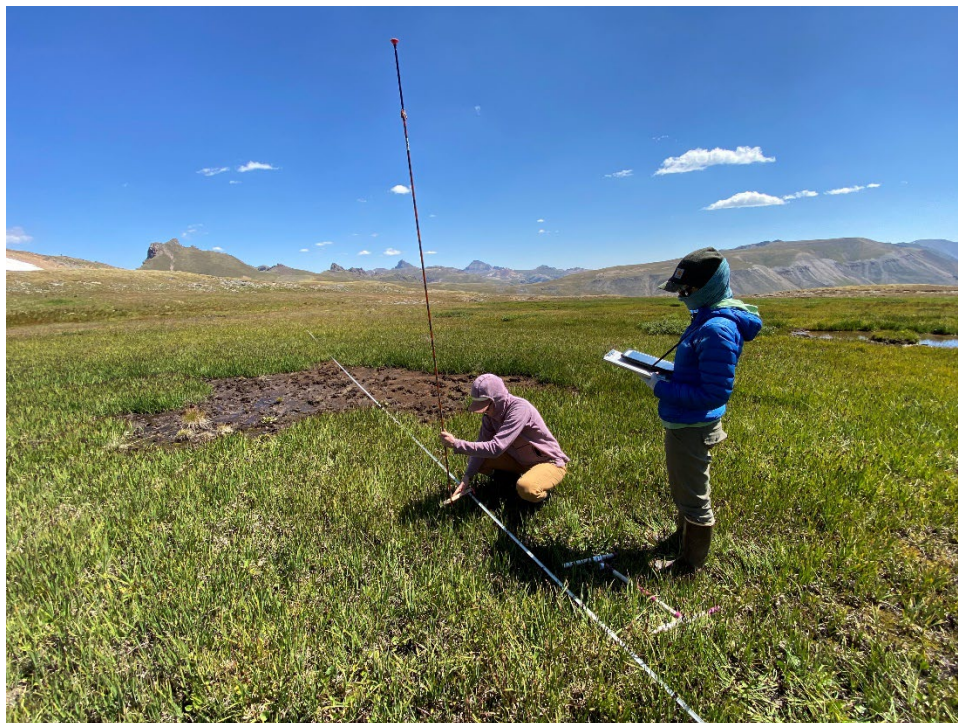




BLM's Riparian and Wetland Assessment, Inventory, and Monitoring (AIM) Data Management, Quality Assurance, and Quality Control Protocol 2022 Field Season



VERSION 2.0 – April 2022

**Produced by BLM National Operations Center (NOC) and Colorado State University (CSU)'s
Colorado Natural Heritage Program (CNHP)**

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PROTOCOL OVERVIEW

The purpose of this protocol is to detail steps for managing data and assuring data quality during the field season (Figure 1). The protocol describes six steps and includes responsible parties and required files and tools for each step.

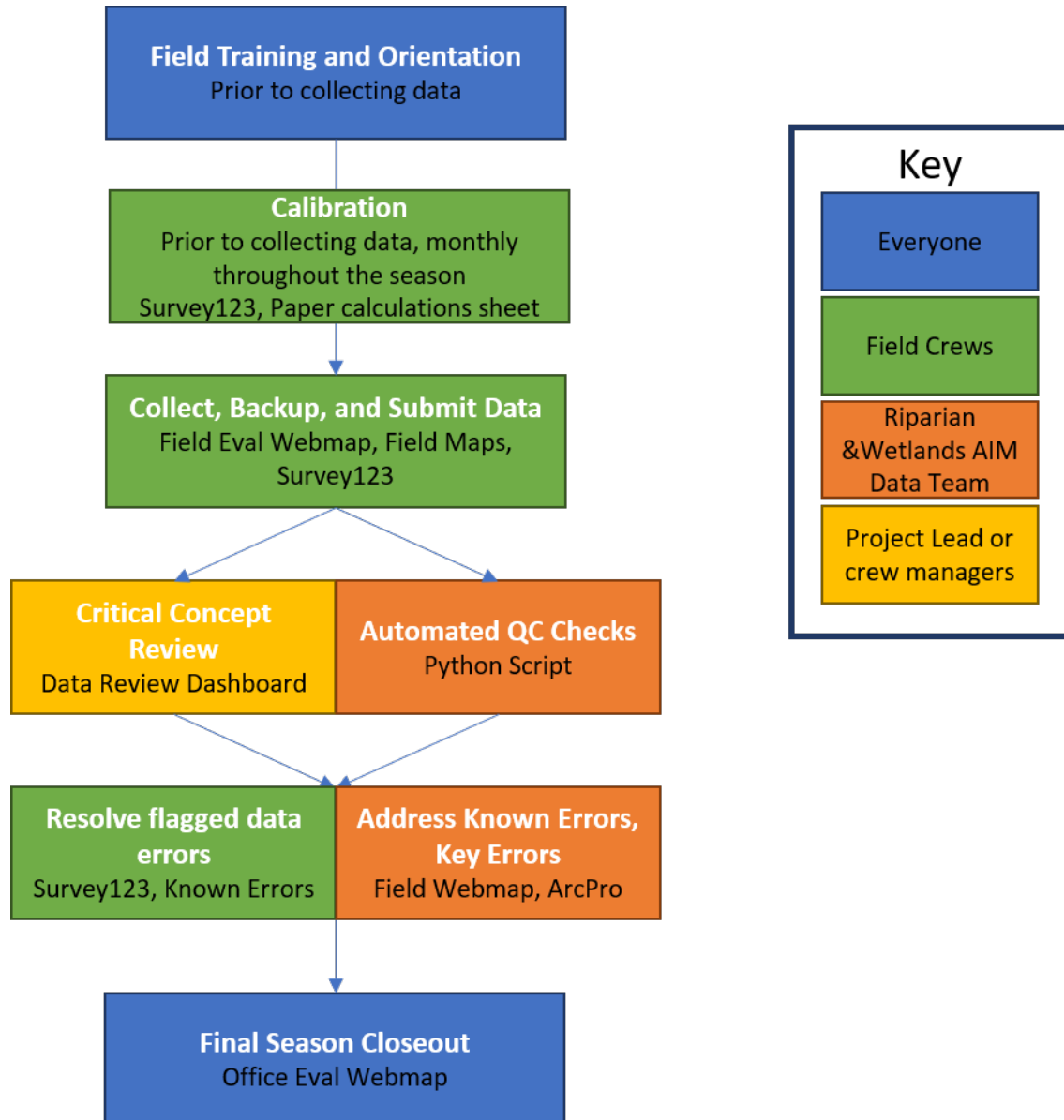


Figure 1. Six steps for managing data and assuring data quality during the field season. Steps are color-coded by responsible parties and the timeframe for completing.

Users should consult this protocol for data collection, management, and ensuring data quality. Refer to Appendix B: *Riparian and Wetland AIM Technology Manual* for details on how to use data collection tools such as Survey123 and Field Maps. If questions remain after reading this protocol, the Technology Manual, or the Evaluation and Design Management Protocol, please reach out to your contract lead, BLM Project Lead, or State Lead. If you need additional support, please contact the appropriate National AIM Team member:

- Sample design related questions: Lindsay Reynolds (lreynolds@blm.gov, 303-236-9045) and Julian Scott (jascott@blm.gov)
- General project coordination and implementation support: State Lead or Michelle Stropky (mstropky@blm.gov)
- Field data collection questions (e.g., field methods protocol): Lindsay Reynolds (lreynolds@blm.gov, 303-236-9045) or Joanna Lemly (joanna.lemly@colostate.edu; 970-491-2127)
- Technology and applications questions (e.g., Survey123, Field Maps, ArcGIS Online Webmaps): Ruth Whittington (ruth.whittington@colostate.edu) and Julian Scott (jascott@blm.gov)
- If someone from the list above is not available and there is an immediate issue please contact Lindsay Reynolds (lreynolds@blm.gov, 303-236-9045) or Joanna Lemly (joanna.lemly@colostate.edu; 970-491-2127)

I. FIELD TRAINING AND ORIENTATION

Overview

Prior to field data collection each year, the National Riparian and Wetland AIM Team and local BLM resource specialists lead annual field methods trainings following the *2022 Review Draft: AIM National Aquatic Monitoring Framework: Field Protocol for Lentic Riparian and Wetland Systems*. The trainings are a combination of online pre-training coursework and five days of in-person field instruction. The main objective of this field-based training is for participants to be proficient in the application of Riparian and Wetland AIM core and contingent field methods.

Training requirements vary among participants and include:

- ☐ All Riparian and Wetland AIM training attendees must complete the online training materials before attending the field methods training.
- ☐ Seasonal BLM data collectors or contractor/agreement staff responsible for Riparian and Wetland AIM data collection must have successfully completed Riparian and Wetland AIM field methods training during the year in which data will be collected.
- ☐ Contractor/agreement staff not collecting Riparian and Wetland AIM data directly, but responsible for Riparian and Wetland AIM crew management and Riparian and Wetland AIM data QAQC should attend training at minimum every other year.
- ☐ BLM staff collecting Riparian and Wetland AIM data must have successfully completed Riparian and Wetland AIM field methods training within the last three years and must review protocol updates and training materials every year as a refresher. They should also have actively collected Riparian and Wetland AIM data in the years since attending a training.
- ☐ Project Leads overseeing Riparian and Wetland AIM data collection should attend the first 3 days of field methods training at least one out of three years and should review protocol updates every year.
- ☐ State Leads are encouraged to attend the first 3 days of the training at least every other year, but it is not required.

Field training cannot fully introduce individuals to the diversity of riparian and wetland types present on BLM lands, so a local orientation to critical concepts and vegetation communities is recommended. The field orientation activity, described below, is recommended depending on BLM Project Lead and contractor staff availability and expertise.

Responsible Parties

Field training: The National AIM Team develops and leads content delivery for field methods training. State and Project Leads are recruited to host and/or serve as trainers. BLM Project Leads, contractor management staff (if applicable), field crews, and other BLM and contractor staff are required to attend as specified in the overview above.

Field orientation: Contractor crew managers, BLM Project Leads, a BLM Botanist (or plant specialist), and other BLM and contractor staff, as appropriate and available, facilitate local field orientation for field crews. Ideally, subject matter experts in hydrology, soils, and wetland vegetation would be present.

When and Estimated Time

Field training: The field training is five days long, not including travel. Several trainings are conducted annually in spring or early summer. Online pre-training material takes at least 6 hours to complete.

Field orientation: Field orientation should occur after field training and prior to the start of data collection. Field orientation takes 0.5 – 1 days.

Tools and Files

- 2022 Review Draft: AIM National Aquatic Monitoring Framework: Field Protocol for Lentic Riparian and Wetland Systems
- Pre-training videos
- Riparian and Wetland AIM Gear List
- Local vegetation identification guides

Instructions

Field training (required)

- A. Watch pre-training videos and complete video-based quizzes and activities
- B. Attend a full five-day core methods training
- C. Complete one calibration exercise while at training (see Section II for Calibration Protocol)

Field orientation activity - field tour of critical concepts and protocol review (recommended)

- A. Tour a variety of riparian and wetland systems that represent the hydrologic, geomorphic, and vegetation diversity crews will encounter throughout the field season. Visit two or three different systems, but the more the better!
- B. At each of the visited systems, conduct the following exercises:
 - I. Work as a group to walk the plot area, review protocol Sections 3.2 and 4.0, and discuss whether the site meets sampling criteria and plan a plot layout. Encourage crew members responsible for data collection to lead these discussions. Identify:
 - a. Riparian or wetland boundaries
 - b. Ideal plot layout
 - II. Conduct a 10-minute species inventory to develop a species list and review the wetland status of common species at the site.
 - III. Walk the plot and review protocol Section 5.3 Hydrology. Specifically, have the crew identify:
 - a. Water sources
 - b. Surface water characteristics, if present
 - c. Channel characteristics, if present
 - IV. After walking the site, complete the Plot classification and description form
- C. At the conclusion of the field orientation activity, review major discussion points and reiterate any protocol application clarifications or corrections. If questions or clarifications exist for the National AIM Team, capture those and identify who is reaching out to get questions answered.

II. CALIBRATION PROTOCOL

Overview: Why Calibrate?

“Calibration of data gatherers is an integral component of the quality assurance process. Calibration ensures that a data gatherer collects data accurately each time and that data are collected consistently with other data gatherers...” Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems: Volume 1 2nd Edition (Herrick et. al., 2017), page 4.

Calibration ensures the defensibility and integrity of data by providing evidence that the data are consistent and trustworthy.

Responsible Parties

- Field crews are responsible for calibrating once during training and once a month after training (see specifics below).
- BLM Project Leads and contractor management staff should notify State Leads when calibration has been completed.
- State Leads should review the calibration data and notify the National AIM Team when all calibration data from their state is available.

Before Getting Started

1. Calibration can be time consuming. Please allow for adequate time for this critical step, usually 0.5-1 day.
2. Identify a riparian area or wetland having representative hydrologic, soils, and vegetative conditions similar to those the crew will be working with this summer. If the crew is working among multiple field offices or districts, field calibration might be required more frequently.
3. Calibration can be done at a site that will be sampled. Crews should set up 1 or 2 calibration transects off to the side of the plot, in the same vegetation community. However, if space is limited, crews can also set up a calibration transect in between plot transects, but must have at least 5 m buffer on either side from the plot transects.
4. If it's a new system that the crew is calibrating for (woody vegetation in a site and the crew hasn't encountered a woody site before) calibration should take place prior to sampling the plot.

Methods to Calibrate on:

- Line-point intercept (LPI) (required)
- Vegetation Heights (required)
- Species Inventory (required)
- Woody Structure (required)
- Annual use (recommended)
- Soil Texturing (recommended)

When to Calibrate

- After training and field orientation, but before data collection begins.
- A month has passed since the last calibration.
- A new data collector joins the team.

- A significant change in vegetative community. For example, the first woody site of the summer.
- Optional: Soil texturing calibration can be completed once per month

Calibration and Vegetative Communities

Riparian and wetland vegetative communities can be *significantly different* across a project area. It is up to the discretion of the Project Lead or crew lead to decide whether the difference in the vegetative community is great enough to call for a calibration.

Example:

A crew may have only encountered graminoid-dominated sites thus far in the season. If the next plot in hitch is shrub-dominated then a calibration is likely needed. If this scenario occurs and the crew returns to a graminoid-dominated plot within the same work hitch or within a month, then the crew does NOT need to recalibrate to collect data in that graminoid-dominated community.

Calibration Tools and Materials:

- Transect tape (Remember to take care to not trample the sample area along the transect or to move the tape)
- Chaining pins (or other anchoring tools for the transect)
- Calibration data sheets or electronic data capture device (Survey123)
- Pins for LPI (flag pins, laser, or similar. Must be consistent.)
- Multi-tool, avalanche pole, or other means of measuring vegetation heights
- *Field Protocol for Lentic Riparian and Wetland Systems 2022 REVIEW DRAFT*
- Optional: MIM Frame
- Optional: Soil samples (5 minimum) that have been lab tested and/or verified by a soils expert that represent a range of textures (e.g., sand, sandy loam, loam, clay, silt).
- Optional: Soil texture worksheet
- Optional: Spray bottle and water for texturing

Calibration Instructions:

1. For LPI and Woody structure calibration, establish the standard length transect for your project (usually 25 m) in a location representative of the riparian or wetland systems where AIM data will be collected. Crews can set up calibration transects off to the side of the plot, in the same vegetation community. If space is limited, crews can also set up a calibration transect in between plot transects, but must have at least 5 m buffer on either side from the plot transects.
2. For species inventory, establish a second standard length (25-m) transect, parallel to the first transect used for LPI and Woody Structure, and separated by 5 meters. This will create a 25 m x 5 m rectangle.
 - a. Walk the rectangle following species inventory protocol outlined in the *Field Protocol for Lentic Riparian and Wetland Systems 2022 REVIEW DRAFT*, recording the number of species found in a 10-minute search. Species Inventory may have additional 2 minute “popcorn” time additions if crew

members continue to find more species within the rectangle once the 10-minute time increment is reached.

3. Conduct LPI calibration using the same method implementation as required by normal data collection. For example, if you normally collect data along a 25-meter transect with LPI pin drops each 50 cm, height measurements each 250 cm, continue with that during calibration.
4. Have each data collector complete LPI and Vegetation Heights, and Litter, Thatch and Water Depths along a first pass of the transect. Data collectors should select “calibration” as their line number at the beginning of the Survey123 form. At the end of their pass, each data recorder should write down the summary statistics reported on the last page of the form. Once all data collectors have completed the first pass, then each data collector should complete the Woody Structure (and optional Annual use methods) along a second pass of the transect, if woody species are present.
 - a. While doing the first pass for LPI methods, take care to protect the left side of the transect, as multiple runs through a line may change the observed environment.
 - b. If there are many observers to calibrate, set up a separate transect for each pass of the transect method (e.g., one transect for LPI, Heights, and Depths and a second transect for Woody Structure and Annual Use).
5. Calculate the calibration indicators for each observer. You may do this manually with a calculator or using the indicator report on the last page of the Survey123 form (see Appendix B for specific instructions).
6. Compare results between observers. Verify the ranges between observers against the calibration criteria (Table 1).
7. If any range between observers (Table 1) is greater than the acceptable range, attempt to identify why calibration was not achieved.
8. All indicators for a method must meet the defined criteria for that method to be considered calibrated. The data collectors must repeat the whole method, for all indicators, if they demonstrated that they were not calibrated for one or more indicators. However, if the data collectors calibrate on one method’s criteria but not another method’s criteria, then they only repeat the calibration for the method that did not meet the criteria. See the examples below.
9. Repeat the calibration exercise on a new transect until each method is completely calibrated. If you are concerned that one transect will be insufficient sample size to achieve successful calibration, you may calibrate all methods across more than one transect as long as the number of transects is determined prior to commencing a calibration event.

What If the Calibration Criteria is Not Met?

- Identify the methods and indicators that exceeded the acceptable range of variation.
- Discuss possible reasons with one another and compare technique and definitions.
- Remember that an outlier value may be the correct observation value.
- Consider equipment used (e.g., Did all the collectors use the same pin?)

Example:

Jack collects a litter cover of 22%, Fred collects a litter cover of 10%, and Amina collects a litter cover of 12%. The range of values is 12% ($22 - 10 = 12$), which is greater than the maximum permitted range of 10% and the crew must repeat the LPI calibration for all indicators. If Fred, Amina, and Jack do not meet the criteria for one or more of the LPI indicators, but do calibrate on all Woody Structure indicators, each collector will repeat only the LPI method until collectors meet the acceptable range of variation for all LPI indicators.

Steps to Calibrate on Soil Texture (Optional):

1. Select a minimum of 5 samples that have been lab tested and/or verified by a soils expert that represent a range of textures (e.g., sand, sandy loam, loam, clay, silt).
2. Each crew member texture and record their classification for each sample on a soil texture worksheet.
3. To meet calibration criteria, each crew member must exactly match the official soil classification for 2 or more samples (40% of the sample population) and match the official classification or an adjacent classification (using the soil texture triangle) for 4 or more samples (80% of the sample population).

Example:

Casey records a tested soil sample as being a sandy loam. The lab testing had determined that the soil was actually a loam. Casey cannot count this as one of their two exact matches, but loam and sandy loam polygons are adjacent on the soil texture triangle and so they can count it towards their four soils for the lower precision criterion.

Table 1. Calibration criteria by method

Species Inventory Indicator	Calibration Criteria
Total Species Recorded Inside a 25 x 5 m rectangle	Absolute difference ≤ 4 species records
Line Point Intercept Cover Indicator	Calibration Criteria
Foliar Cover	Absolute difference $\leq 10\%$
Bare Ground	Absolute difference $\leq 10\%$
Litter + Thatch Cover	Absolute difference $\leq 10\%$
Water Cover	Absolute difference $\leq 10\%$
OM + Soil Cover	Absolute difference $\leq 10\%$
Height Classes and Surface Cover Depths	Calibration Criteria
Woody Plants Count: 0 to 50 cm	Absolute difference ≤ 2 height records
Woody Plants Count: 51 cm to 1 m	Absolute difference ≤ 2 height records
Woody Plants Count: 1.01 m to 2 m	Absolute difference ≤ 2 height records
Woody Plants Count: >2m	Absolute difference ≤ 2 height records
Herbaceous Plants Count: 0 to 10 cm	Absolute difference ≤ 2 height records

Herbaceous Plants Count: 11 cm to 30 cm	Absolute difference ≤ 2 height records
Herbaceous Plants Count: 31 cm to 50 cm	Absolute difference ≤ 2 height records
Herbaceous Plants Count: > 50 cm	Absolute difference ≤ 2 height records
Mean Litter +Thatch Depth	Absolute difference ≤ 10 cm
Mean Water Depth	Absolute difference ≤ 10 cm

Woody Structure Indicators	Calibration Criteria
Woody Heights Count: 0 to 0.5m	Absolute difference ≤ 2 height records
Woody Heights Count: 0.51 m to 1 m	Absolute difference ≤ 2 height records
Woody Heights Count: 1.01 m to 2 m	Absolute difference ≤ 2 height records
Woody Heights Count: 2.01 m to 4.0 m	Absolute difference ≤ 2 height records
Woody Heights Count: 4.01 m to 8.0 m	Absolute difference ≤ 2 height records
Woody Heights Count: >8.01 m	Absolute difference ≤ 2 height records
Woody Age Count: Rhizomatous	Absolute difference ≤ 2 age records
Woody Age Count: Seedling/sapling	Absolute difference ≤ 2 age records
Woody Age Count: Young	Absolute difference ≤ 2 age records
Woody Age Count: Mature	Absolute difference ≤ 2 age records

Annual Use Indicators	Calibration Criteria
Woody Use Count: 10	Absolute difference ≤ 2 use records
Woody Use Count: 30	Absolute difference ≤ 2 use records
Woody Use Count: 50	Absolute difference ≤ 2 use records
Woody Use Count: 70	Absolute difference ≤ 2 use records
Woody Use Count: 90	Absolute difference ≤ 2 use records
Mean Stubble Height	Absolute difference $\leq 10\%$
Mean Soil Alteration	Absolute difference $\leq 10\%$

Soil Texture Criteria	Calibration criteria
Soils exactly matching official classification	Sample proportion $\geq 40\%$
Soils matching official classification or adjacent classification	Sample proportion $\geq 80\%$

Table 2. Calibration calculation tables.

SPECIES INVENTORY			
Name	Number of species	Name	Number of species
Min			
Max			

LINE-POINT INTERCEPT CALIBRATION – Top and lower plant hits					
			OPTIONAL:		
Name	% Foliar Cover	%Bare Ground	Spp 1 % Cover	Spp 2 % Cover	Spp 3 % Cover
Min					
Max					

LINE-POINT INTERCEPT CALIBRATION – Lower and Surface codes					
Name	%Litter + %Thatch	% Water	% OM + % Soil	Mean Litter / Thatch Depth	Mean Water Depth
Min					
Max					

VEGETATION HEIGHT CALIBRATION								
Name	Total Woody Heights				Total Herbaceous Heights			
	≤0.5 m	>0.5–1 m	>1–2 m	>2 m	≤10 cm	11–30 cm	30–50 cm	>50 cm
Min								
Max								

WOODY STRUCTURE CALIBRATION										
Name	Woody Heights						Woody Ages			
	≤0.5 m	>0.5–1 m	>1–2 m	>2–4 m	>4–8 m	>8 m	Rhiz.	Seedling/ sapling	Young	Mature
Min										
Max										

ANNUAL USE CALIBRATION								
Name	Woody Use Classes						Stubble Height	Soil Alteration
	10	30	50	70	90	NA	Mean	Mean
Min								
Max								

III. COLLECT, BACKUP, AND SUBMIT DATA

Overview

Electronic data collection and submission is centrally managed by the National AIM Team and relies on two different ESRI applications. Field Maps is used for navigating to points and for recording which points were field visited. Survey123 is used to collect field data. Use of Field Maps and Survey123 are part of field training, but proficiency is only gained through consistent use. We recommend that first time users watch the Survey123 and Field Maps pre-training videos, following along with an iPad if possible, prior to field training. Detailed instructions on using Survey123 and Field Maps can be found in Appendix B: *Riparian and Wetland AIM Technology Manual*. Best data entry practices and requirements are detailed there.

The crew will need to backup both Survey123 and Field Maps data during each trip using a USBflash drive device. Backups will allow data recovery if, for example, the iPad is lost, damaged, or stolen. Crews should sync Field Maps and Survey123 data to the Office and Field Eval Webmaps as soon as they are back from their trip or are at a location where strong reliable internet access (4G or Wi-Fi) is available. Step by step instructions for data backups can be found in Appendix B.

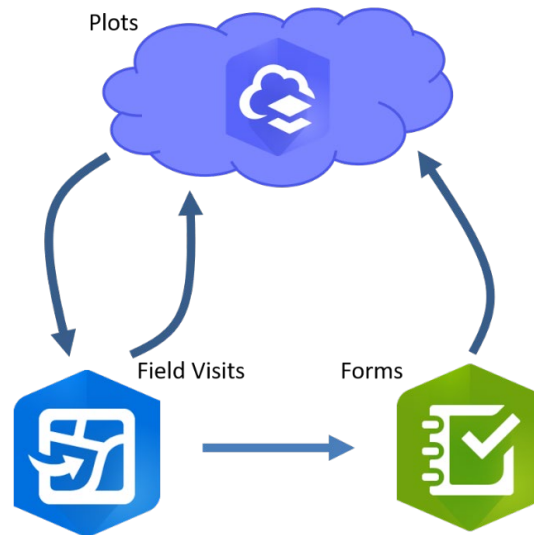


Figure 2. Diagram of relationships between Webmaps (top blue cloud), Field Maps (bottom left blue hexagon) and Survey123 (bottom right green hexagon) data.

Responsible Parties

- Field Crew

When and Estimated Time

Data collection should occur in riparian and wetland areas when vegetation is most identifiable, annual soil alteration or disturbance is minimal, and water levels have receded from their seasonal high level. In the Western U.S., optimal timing usually ranges from May to September, though exact timing should be confirmed with local specialists. Data collection takes 6-8 hours per plot.

Data backup preferably occurs daily after every sample plot, but it MUST occur after every two plots. Backup to USB drives should only take 1-2 minutes. Final data submission should occur once the crew has reliable Wi-Fi immediately during or after each trip. The Photos form is much larger than the other forms and may require stronger Wi-Fi.

Note: The data review dashboard will sync instantaneously with uploaded data, but the static EvaluationID (PlotID + Field Eval Date) used to filter data in the Review Dashboard will be generated each evening. For this reason, data should be synced at the end of the hitch and reviewers should wait until the following day to begin data review.

Tools and Files

- *2022 Review Draft: AIM National Aquatic Monitoring Framework: Field Protocol for Lentic Riparian and Wetland Systems*
- Riparian and Wetland AIM Gear List
- Local vegetation identification guides
- Backup paper copies of field data collection forms
- Water quality labels
- iPads (2 per crew)
- External USB drive
- Field Maps app
- Survey123 app

Instructions

The following steps outline data collection in the field. For step-by-step instructions, form-specific recommendations, and other information regarding the use of Field Maps and Survey123 and best practices for data collection, refer to the Technology Manual found in Appendix B.

1. Use the Plot layer in Field Maps to navigate to a Sample Design Location. From there, launch a new Field Visit for every unique visit to a plot. This will create a unique EvaluationID (PlotID + Field Eval Date). Please launch a Field Visit for all visits to a plot, **including sampling events, reconnaissance visits, and plot rejections**. The Field Visit will be the data point from which all Survey123 forms will be launched.
 - a. Plots sampled over two days should maintain the Field Eval Date of the first day of sampling.
 - b. Each iPad used for data collection must launch a Field Visit. It is critical that the EvaluationID (PlotID + Field Eval Date) be identical across all Field Visits referring to the same sampling event.
2. Launch all Survey123 forms from your Field Visit by clicking the link provided after submitting Field Visit point.
3. If you experience issues using Field Maps while in the field and are unable to create a Field Visit, forms may be launched directly from Survey123. However, this strategy will not allow you to enter Plot identification information. Instead, you should clearly identify

the PlotID in form comments, and the National Riparian and Wetland AIM Data Team will need to correct all data submitted for these plots.

4. If electronic data collection is impossible (e.g., iPad breaks), record all data on paper datasheets and then enter into Survey123 and Field Maps at a later date. All data must be entered into Field Maps and Survey123 for the National AIM Team to ingest it into the National Riparian and Wetland AIM database. Additionally, photos or scans should be taken of paper datasheets and uploaded to Teams.
5. When you are finished with data collection, forms should be sent to the outbox using the check mark on the last page of each form. Some forms you may want to save in Drafts until the end of the hitch. Others should be submitted to the outbox immediately. Additional instructions on submitting forms can be found in Section III of Appendix B.. When you return from your trip, send all forms in your outbox and sync your offline area from Field Maps.
 - a. Forms will need to be manually sent from the outbox associated with each form. There is no way to send all forms at once.
 - b. Once the forms have been sent and you have synced your offline area, click on your Field Visits. Scroll down past the hyperlinks for launching Survey123 forms to the Form Count section. Here you will see the names of all of the forms and a count of the associated records. Ensure that all the correct appropriate numbers of forms have been submitted. See Appendix B for more details.
6. Update the Eval Status and Hitch fields in the online Office Eval Webmap upon returning from hitch for all plots visited during that hitch.

IV. DATA REVIEW

Overview

After crews return from the field and upload all their data, contractor crew managers, Project Leads, and the data team will review various aspects of the data for major errors. This QC process primarily consists of two types of review: *Critical Concept Review*, and *Automated QC Checks* for cross-form validity and data completeness. Prior to the end of the season, crews should work together with the data team and crew managers to ensure all necessary edits are made to the data before turning it over to the BLM, following the instructions in the next section. This section will go into these QC checks in more detail.

The data review process should also be used to verify the ‘Eval Status’ for all field visited plots. The ‘Eval Status’ in the Plots layer tracks which plots have been sampled or not. This status and the ‘Rejected Reason’ (if applicable) will need to be updated after a crew field visits a plot. This is an iterative step in design management throughout the field season but is also relevant for data management. Updating evaluation statuses in the Data Review Dashboard or Office Eval Webmap ensures that the crew is sampling the correct plots and that the design is being implemented and tracked properly and consistently.

When and Estimated Time

Review should occur within a week after each trip and takes 0.5–1.5 hours per plot, depending on the number of errors. The data review dashboard will sync instantaneously with uploaded data, but static EvaluationIDs (PlotID + Field Eval Date) used to filter data in the Review Dashboard will be generated each evening. For this reason, data should be synced at the end of the hitch and reviewers should wait until the following day to begin data review. Reviewers should also consider scheduling the post-trip check-in with the crew for the day before their next trip.

Responsible Parties

- *Critical Concept Review*: Contractor crew managers and/or Project Leads, depending on terms of the contract
- *Automated QC Checks*: National Riparian and Wetland AIM Data Team

Instructions: Critical Concepts Review

Contractor crew managers and/or Project Leads are responsible for reviewing all Critical Concept data for each sampled plot after each hitch within a week of the crew’s return. At the beginning of the season, the National Riparian and Wetland AIM Data Team will create a data review dashboard, compiling important fields which require manual QC. This dashboard can be used to compare data collected across forms to look for inconsistencies in the data.

While much of the data will be available for review using this dashboard, it is important to note that it is not comprehensive. When errors are found, it may be important to look at data collected in the original forms using the Field Map linked on the Riparian and Wetland AIM AGOL group page. If there are fields or data you would like to see in the dashboard, contact the Riparian and Wetland AIM Data Team.

Data Review Dashboard

Early in the field season, the National Riparian and Wetland AIM Data Team will provide instruction on dashboard use. Essential components to the dashboard include:

- **Selector bar** to filter Plot List and Plots showing in map.
- **PlotID list** used to zoom into a particular plot and filter Field Visits.
- **Field Visit List** used to filter Information and Photo widgets.
- **Map** to review GPS locations of Plot Characterization, Location Verification, LPI, Soil Pit and Water Quality samples.
- **Webmap** used to update Eval Status to “Sampled – Data Reviewed” after completing site review.
- **Information widgets** stacked showing important data fields from various forms. Use tabs at the bottom to toggle between forms.
- **Photo widgets** stacked showing various categories of photos. Use tabs at the bottom to toggle between different types of photos.

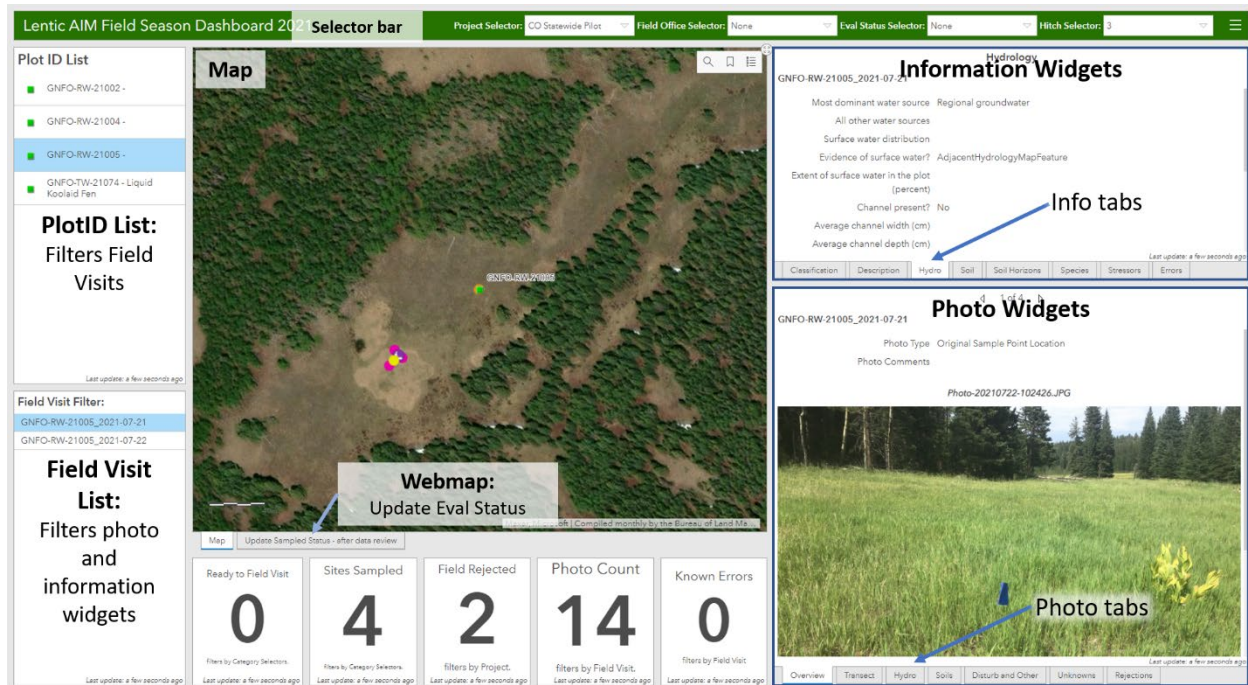


Figure 3. Screenshot of the data review dashboard used during the 2021 field season. PlotID and Field Visit lists can be used to filter data to specific sites. Once a specific field visit is selected, the map, photo, and information widgets can be used to review collected data.

Tips for Dashboard Use

- **Map Icons**
 - A full list of symbology can be toggled on using the legend icon.
 - The search icon can be used to search by PlotID.
 - The bookmark icon can be used to zoom into preset extents.

- To enlarge any of the boxes on the dashboard, click the arrows in the upper righthand corner of the box. If using a smaller screen, photo widgets may need to be enlarged to allow clicking through photos.
- Field Visit EvaluationIDs need to be populated by the National Riparian and Wetland AIM Data Team after data has been submitted. If a Field Visit is missing, contact the data team to resolve the issue.

Critical Concept Review Steps

The following is a step-by-step list of recommended data checks that require manual review. It is recommended that the full list be reviewed for each site sampled during early hitches, while crews are still learning the protocol. Reviewers should expect to spend a considerable amount of time on data review early in the season (1–1.5 hrs per site). As a crew demonstrates competency in correctly applying the protocol, reviewers may reduce the checks they perform to a smaller list of concepts that are especially error prone.

For each of the categories below, reviewers should make note of the errors or questions that come up to share and discuss with the crew. Together, reviewers and crew members should finalize these comments into a list of changes that need to be made and discuss how they should be implemented. To begin review of a particular field visit, reviewers should select the appropriate PlotID and FieldVisit, then complete the following steps to review. Comment fields should also be reviewed to ensure the correct information is indicated with an appropriate level of detail. Examples of various comment fields can be found in Appendix B.

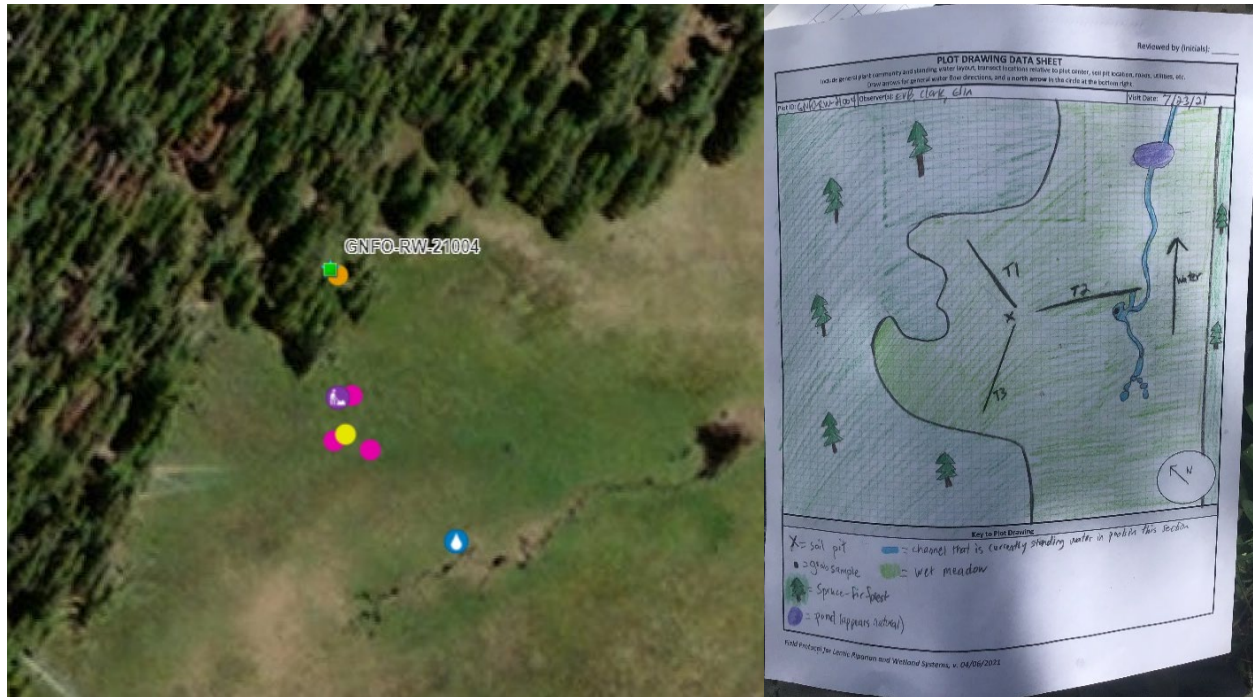


Figure 4. Imagery from the Data Review Dashboard alongside the plot drawing. The Original Sample Location (Green Square) is directly on top of the Field Visit point (blue star, hidden), with the Location Verification form nearby (Orange dot). LPI transect starts (pink dots) roughly form a triangle around

plot center (yellow dot for Plot Characterization). Soil pit (purple) and water quality (blue water drop) are in locations that match those shown in the plot drawing.

1. **GPS Locations:** Check the GPS locations of each form to make sure crews are launching forms in the correct locations (see Figure 4).
 - a. Are Field Visit points (two blue stars for Full Sample Visits) on top of Sample Location.
 - b. Was Location Verification launched close to original sample location, or is there a clear explanation as to why they were not able to reach the sample location?
 - c. Was Plot Characterization launched at plot center based on plot drawing and the locations of the LPI forms?
 - d. Are LPI transects in reasonable locations that match the plot drawing?
 - e. Do the locations of Water Quality and Soil forms make sense? Do they match the plot drawing?
 - i. Is there water quality on top of soil pit? Should there be?
 - ii. Are all water quality points collected within the plot boundaries?
 - f. Click the pop up for Location Verification to check that directions are thorough and begin from the nearest city or town.
2. **Plot Layout:** Consider plot and transect placement based on imagery, photos in the Overview and Transect tabs, and the Layout information contained in the Classification tab of the information window in the Data Review Dashboard.
 - a. Check if they moved the plot, and if so that their justifications make sense.
 - i. Did they use a valid reason for why they were forced to move the plot?
 - Random plots **must** be placed within 50m of the Original Sample Location and should be moved minimally.
 - Targeted plots may be moved further, depending on the requests from the BLM office.
 - ii. Did they photograph the Original Sample Location? Does it confirm their justification for moving the plot?
 - b. What layout did they use? If they didn't use a spoke, does their justification make sense?
 - i. Plot layouts should preferentially favor maximum plot dimensions.
 - ii. Did they successfully avoid too much upland/non-target inclusion?
 - iii. If using a transverse, diagonal, or linear layout, does the recorded actual length of the riparian or wetland area correlate with aerial imagery?
 - c. Are the azimuths in photos and LPI forms reasonable for transects (facing the right direction from transect start to transect end)?
 - i. Do the azimuths in the LPI forms match the photos and imagery? Have they been changed from the defaults if necessary? (Transect 1: 0°, Transect 2: 120°, Transect 3: 240°)?
 - ii. Do the azimuths marked in the photos make sense? Are photos of the beginning and end of a transect given different azimuths on photo placards?

- d. Check Transect photos for errors.
 - i. Check that photo placards are legible, that beginnings and ends are marked with an A or B, respectively, and that Azimuths are marked correctly. Azimuths for transect ends, should be 180 degrees from transect beginnings.
 - ii. Check that the transect lines are centered in the photo frame and that photos are taken horizontally.
 - iii. Check that photos do not have crew members within the frame.
- e. Does slope and aspect look right for the plot?
 - i. Was aspect measured looking downhill?
- f. Check that the plot drawing is complete.
 - i. Make sure it includes details such as soil pit and water quality sample locations, transects, plot boundary, vegetative communities, water flow paths, and landscape features.
 - ii. Does the plot drawing make sense with the azimuths recorded in LPI (remember field directions are **not declinated** and will be slightly off from what you see from the office)?
- 3. **Species List:** Review the species list found on the Species information tab.
 - a. Check that unknown codes are being applied correctly.
 - b. Do the number of species make sense given the wetland type? Saline marshes have generally limited species lists, while sites that straddle multiple habitats tend to have extensive lists.
 - c. Do the cover classes make sense?
 - i. Limited numbers of species will have a cover class of 4 (>50% cover) in a given site.
 - ii. Forbs are going to be less likely to have as high a cover.
 - iii. Large trees, such as Populus, will rarely ever have a cover class of 1 even if there is just one individual.
- 4. **Soils:** Look through soil photos and compare to Soil and Soil Horizons information tabs.
 - a. Do soil pictures clearly demonstrate necessary information?
 - i. Is lighting even across the profile?
 - ii. Is the photo of the soil profile in portrait orientation?
 - iii. Are the horizon breaks shown and do they make sense? Do they match the depths called in the horizon information?
 - iv. Is the measuring tape clearly visible?
 - v. Is there a photo showing the soil pit in context?
 - b. Do soil colors look roughly accurate (check for value / chroma, proper use of gley page)?
 - c. Does the hydric soil indicator match the picture and horizon information?
 - i. Mucky mineral should not be selected as a hydric soil indicator until we get more guidance on application.
 - d. Do depth to saturation and/or depth to groundwater make sense according to photos and comments (and water quality data when applicable)?

- i. Depth to saturation should be ≤ 0 .
 - e. Do the majority of horizon textures match the major soil type?
 - i. If the major soil type was recorded as Sandy, the majority of the soil pit horizons should be recorded as sand or loamy sand. Keep in mind that sandy soils are uncommon in riparian and wetland environments.
- 5. **Hydrology:** Look through photos on the Hydro tab and consider whether they match the information contained in the Hydro information tab above it.
 - a. Is the dominant water source applicable given the landscape position, photos, and plot information?
 - i. Precipitation should only be used on flat wetlands in areas with high seasonal or annual precipitation.
 - ii. Stream inflow should only be used in terminal wetlands.
 - iii. Pond, lake, or reservoir should only be used for wetlands on pond or lake margins tied directly to the rise and fall of the water level.
 - b. Are additional water sources used sparingly and only include water sources that sustain the plot water regime?
 - c. Does surface water extent match description and photos?
 - d. Is there a channel on the plot?
 - i. Are channel dimensions taken from a clearly defined channel, even if it does not contain water at the time of sampling?
 - ii. Are there at least 2 photos provided looking up and downstream of the channel?
 - e. Does the description include supporting information on the dominant water sources and additional data collected on the hydrology of the site, such as alterations or disturbances to the natural hydrologic regime and/or evidence of wetter/drier historic conditions?
- 6. **Water Chemistry:** Look for Water Quality points in the map and open their pop-up windows.
 - a. Were all parameters collected?
 - b. Check for any values that may fall out of the typical range.
 - i. 5.5-8.5 for pH, 30-1500 for conductivity
 - c. Was WQ collected in the morning to limit the impact of diurnal changes in WQ due to temp fluctuations and metabolic activity of organisms in water?
 - d. Was water depth sufficient enough for the collection of a grab sample?
- 7. **Classification:** Putting all the previously reviewed data together, evaluate the classifications found in the Classification tab of the information widget.
 - a. For general wetland type: Does the site information, photos, soils, vegetation community, and dominant water source line up with the description in the protocol appendix?
 - b. Does the Cowardin class match the plot's vegetation community?
 - c. Does the water regime line up with the soil pit data, site description, hydrology information, time of year (early vs. late in the growing season), and water year?

8. **Natural and Human Disturbances:** Review disturbances called out in the Disturbances tab, comparing with the photos found in the “Disturb and Other” tab of the Photos widget.
 - a. Is language objective, sharing just what is being observed at the site? Inferences and judgments should not be used (e.g. “heavy grazing”).
 - b. Do photos match what disturbances were marked?
 - c. Do the ratings make sense for the disturbances?
 - i. Linear features like roads and powerlines rarely effect more than 10% of the plot and are unlikely to have a scope larger than 1.
 - ii. Are the recommended ratings for degree what they used? (Pay close attention to invasive species vs. Noxious species and the degree rating used.)
 - iii. Are the landscape disturbances inside the 100-m envelopes as shown in georeferenced maps?
 - d. Ensure there are not any obvious disturbances not included on the site’s disturbance checklist. Features like impoundments, occasional hummocks, and non-native plants can be checked through species lists, aerial imagery, and transect photos.
9. **Plot Description:** Read the plot description found in the Description tab of the information widgets.
 - a. Is the plot description thorough (full sentences, no abbreviations, etc.)? Does the description cover the major characteristics of the plot? Including: wetland type, landscape position, dominant vegetation (scientific names preferred over common names or USDA Plants codes), general hydrology, soil type, and any major land uses.
 - b. Inform the crew of any data edits encountered in previous steps that would necessitate any updates to the plot description (this includes changes to classification, water sources, soil, etc.).
10. Update EvalStatus to “Sampled – Data reviewed” using the Webmap on the second tab of the map widget.

Critical Concept Review Checklist

- ☐ Check the GPS locations of each form
- ☐ Plot Layout and transect placement
- ☐ Species List
- ☐ Soils
- ☐ Hydrology
- ☐ Water Chemistry
- ☐ Classification
- ☐ Plot Description
- ☐ Natural and Human Disturbances
- ☐ After all of the above are complete: Update EvalStatus

Instructions: Automated QC Checks

After every hitch, the National Riparian and Wetland AIM Data Team will run a Python-based script to look for common errors in the data. This will produce an error log in excel that will need to be reviewed by both the data team and crews and their managers to assess how best to correct errors before the end of the season.

Errors in these logs primarily consist of the following types:

- Missing or incorrect fields in Plots or Field Visits layers based on the sites having been sampled.
- Missing or duplicate forms for Field Visits designated as “Full Sample Visits”
- GPS locations in Location Verification, LPI and Soil Pits that are outside of what is expected.
- Missing ID’s and Keys (i.e. EvaluationIDs or LineKeys representing the unique combination of EvaluationID and Transect Number).
- Mismatches between Species and Unknown Codes used and the full Species Inventory or Unknown Plants lists for that Field Visit.

Error logs should be used as a starting place to understand where the problem occurred, how it should be fixed, and how crews can prevent the issue from happening in the future. Frequently, several errors may refer to the same problem. For example, an incorrect code used in LPI may show up as a code missing from Species Inventory and Unknown Plants.

Some issues may have multiple explanations and their solutions can depend on why the error occurred. For this reason, the responsibility for tracking down and resolving errors is shared by both the crew and the data team, depending on the issue at hand (Table 3). Species code errors are particularly common, and frequently need further examination by the crew. For example, if POTR2 were seen on an LPI transect, but missing from Species Inventory, this may be due to two different reasons:

1. The crew selected the wrong code. The crew accidentally selected POTR2 (*Poa trivialis*) in place of POTR5 (*Populus tremuloides*). In this case, POTR2 should be changed to POTR5 by the data team.
2. POTR2 (*Poa trivialis*) was found on the transect, but the crew forgot to add it to the species list. In this case, POTR2 should be added to the species list by the crew.

When reviewing the error log, crews and crew managers should use Table 3 to assess how best to address issues found in error logs.

Table 3. Explanation of possible warning messages from the Automated QC error log, including likely explanations and solutions to the issue. If crews are initially responsible, they should consider where the problem comes from and fix it if possible. If data team is responsible, they will take care of the issue, but crews should note that the problem occurred and avoid repeating the mistake. For more complicated data issues, more detailed directions on recommended solutions are described below.

Error Message	Initial Responsibility	Likely Explanations	Potential Solutions
"Project is not specified in Field Visit."	Crew	Crew forgot to add project information when Field Visit point was added.	Crew edit Field Visit point in Field Maps app.
"Hitch/Eval Status has not been updated"	Crew	Field Lead/Crew forgot to update these fields in Office Webmap after returning from hitch.	Crew edit Plots layer in Office Eval Webmap on browser.
"Has 0/2 forms"	Crew	-Crew copied data to new form and resubmitted to AGOL. -Odd issue where duplicate forms submitted. Unknown cause. -Crew forgot to submit form.	-Crew submit known error with information on which duplicate needs to be deleted. -See below.
"Has __ LPIDetail points for line _"	Data Team	Crew changed transect field after LPI pin drops began.	Select all EvaluationID RecKeys in ArcPro and recalculate field with correct LineKey information.
"Has bad Line numbers – line numbers found are..."	Crew	Missing form for one transect Multiple forms submitted for one transect (one transect labeled incorrectly).	Assess where the issue occurred. Submit known errors as necessary and communicate with the data team.
"Has bad Latitude" / "Has bad Longitude" / "Has bad Northing Start or End for line _"	Crew	Form indicated was opened or updated to a GPS location outside of Western US. May also result from crew accidentally deleting GPS info.	Crew update form with correct GPS coordinates in indicated form. See below.
"Is too far from Plot Design OR GPS override – DistanceFromDesign is..."	Crew	Location Verification opened/GPS updated more than 10 m from Original Sample Location or GPS override used. Location Verification should be opened as close to original design as crew was able to physically reach.	If crew was unable to reach sample location, no action is required. Data is correct. If they were able, GPS should be updated to correct location in the form. See below.
"Found a Blank EvaluationID in FieldVisits"	Data Team	Not sure why/how this would happen. Perhaps blank line added during data editing.	Assess issue and go from there.
"Orphan LPIDetail record" / "...has no Line Number or no RecKey for LPIDetail record"	Data Team	-Form opened from Survey123 instead of Field Maps app. -Transect selected after LPI pin drops started.	Select all EvaluationID RecKeys in ArcPro and recalculate field with correct RecKey information. May also need to do for Unknown Code Keys if EvaluationID skipped altogether.

"Error ...EvaluationID is Null or blank"	Data Team	-Form opened from Survey123 instead of Field Maps app. -Glitches from S123, not totally understood.	Select all EvaluationID RecKeys in ArcPro and recalculate field with correct RecKey information. May also need to do for Unknown Code Keys if EvaluationID skipped altogether in species form.
"Unknown Code Key ____ from Species Inventory/LPI/Woody Species/Annual Use does not have a Unknown Plants form..."	Crew	-Forgot to add UnknownCode to Unknown Plants form. -Accidentally used the wrong UnknownCode during data entry.	-Add unknown code to Unknown Plants form. -Submit known error form changing code to correct code. -See below for more.
"____ is in LPI or Woody but not Species Inventory..."	Crew	-Forgot to add species to Species Inventory -Accidentally hit the wrong plant species during data entry (ex. POTR3 instead of POTR5).	-Add species to Species Inventory -Submit known error form changing code to correct code. -See below for more.
"Corrected Species code ____ from Known Errors is not in Species Inventory..." / "Corrected Unknown Code Key ____ from Known Errors does not have an Unknown Plants form..."	Crew	-Crew requested a code change in LPI and/or Woody Structure, but did not add the correct code to Species Inventory or Unknown Plants	-Crew add correct species to the end of Species Inventory or Unknown Plants and resubmit. -See below for more.
"____ has requested changes in LPI or Woody Structure Annual Use but still appears in Species Inventory."	Crew	-Crew did not indicate species whether species needed to be deleted from Species Inventory	-All deletions from Species Inventory must be taken care of by the data team. -Crew comment in error log whether species needs to be deleted.

V. RESOLVE ERRORS

Overview

After data has been reviewed, there may be a list of required corrections that develop between the suggestions of crew managers and Project Leads as well as errors logged by scripted data checks. Making it clear who is responsible for enacting data edits and where they should make those edits is crucial to ensuring high data quality.

In general, Survey123 forms on crew tablets can be edited and resubmitted. For many reasons, directly editing forms on iPads may be the best method to implementing data edits:

- Forms on tablets will always override edits made to the data uploaded to the ArcGIS Online Server, meaning edits made to the Webmap will disappear for a particular form if the crew edits that form on their tablets and resubmits.
- Survey123 forms incorporate many quality assurance checks that limit the ways data can be entered. These same QA checks are not enacted when edits are made to online data.
- While Project Leads and/or crew managers may have a wealth of experience, no one knows the data for a particular site better than the crew that was there.
- Crews often learn and improve their data collection when they correct their own mistakes.

However, while there are many reasons that edits are best made through the originally submitted forms, some forms are limited in the kinds of edits that can be made after submission to ArcGIS Online. Others are tedious to edit in Survey123.

Table 4 should be used by crews, crew managers, Project Leads, and the National Riparian and Wetland AIM Team to assess how and where data errors should be addressed. While not explicitly included in this table, crew managers and Project Leads may also wish to play a direct role in the editing process and may do so using the Field Webmap on ArcGIS Online; however, for the reasons mentioned above, **they should discuss edits with the Wetland AIM Data Team prior to attempting them to ensure they understand the risks associated with editing live season data.** Further descriptions of how to fix common errors are outlined below in the Common Errors and Recommended Solutions section.

Responsible Parties

Everyone – see Table 4.

When and Estimated Time

Errors should be resolved after each hitch before heading out on the next hitch, and at the least, monthly. The more time that lapses between when errors are recorded and resolved, the greater the likelihood the crew will not be able to remember the plot and adequately answer any questions that have arisen. The first few plots may have a large number of comments or errors that may take 3 hours or so per hitch to investigate, but these should decrease significantly as the field season goes on. If there is continuing evidence of protocol confusion, we recommend having a crew manager meet up with the crew and possibly conduct another calibration exercise.

Table 4. Editing responsibilities by form.

Form	Common Errors	Editor	Crew Action
Characterization Forms			
Location Verification	Not launched from Sample Location.	Crew	Crews edit directly in the previously submitted forms.
Plot Characterization	Aspect in wrong direction. Revision of plot classification.		
Hydrology	Revision of Water Sources.		
Soils	Incorrect Hydric Soil Indicators used.		
Transect-Based Forms			
LPI	Species Errors, mix up Dead vs Alive for annuals	Data Team	Crews submit known errors for each individual issue occurring on Transect-based data forms.
Woody Structure and Annual Use	Identifying Rhizomatous species		
Hummocks	Missing transects		
Other Repeat-Format Forms			
Species Richness	Species missing that was seen on LPI.	Crews add-or edit correct entries. Data Team deletes incorrect entries.	Crew can add additional species but cannot edit or delete what has already been submitted. See below for more.
Unknown Plants	Missing Unknown Code from other species forms. Species identified after submission.		Crew can edit submitted entries and add additional entries. See below for more.
Water Quality	WQ samples taken outside plot. Grab sample taken without YSI. Bad YSI data needs to be deleted.		Crews can edit submitted entries if not against form logic. Most edits should be addressed by submitting known errors to the data team.
Natural and Human Disturbances	Scope and/or severity rated incorrectly. Incorrect category used.		Crews can edit submitted entries and add additional entries, but cannot delete what has already been submitted. Submit known error for stressor to be removed.
Photos	Missing photos. Updating/correcting photos.		Crews can add photos, but cannot edit or delete what has already been submitted. See below.

Common Errors and Recommended Solutions

Missing or duplicate forms

1. Missing forms must be created by field crews by launching the form from the original Field Visit point in Field Maps.
 - a. This most commonly occurs when the feature to be measured is missing (i.e., forgetting to submit hummocks forms on sites without hummocks). For forms like these, opening and submitting forms after the fact should not be a problem. If you are confident that no hummocks were on the site, the form can be submitted from the office.
 - i. GPS information will need to be entered manually, following the directions found below under *Incorrect GPS Location*.
 - ii. It is good practice to add in the form comments that the form was submitted away from the Plot.
 1. Ex: “Form submitted from the office, but crew is confident that no hummocks were observed on plot at the time of sampling.”
 - b. If this occurs on forms for which data will be needed (i.e. Hydrology), then submitting afterwards becomes more difficult. In most cases, some fields may be able to be filled out from the office, while others would be inaccurate to do so. Crews should discuss the issue with crew manager and data team to decide what should be done. This will likely be one of two options:
 - i. Submitting a known error form documenting the issue. If you were unable to complete LPI on a third transect due to weather concerns, there’s nothing that can be done except documenting the known error.
 - ii. Submitting the form filled out with your best guesses. For fields that cannot be assessed from the office, field crews may have to fill in data, then explicitly inform data team using known error form to request those fields be deleted. Notes should also be made in the form itself to indicate data was submitted after returning from the field.
2. Duplicate forms occur due to technology or communication issues in the field.
 - a. For transect data, it may be that one form has the incorrect transect information and one transect needs to be edited. In this case, a known error should be submitted indicating which transect needs to be changed. These edits will need to be made by the National Riparian and Wetland AIM Data Team.
 - b. In some cases, the same copy of the form may have been submitted twice. In this case, crews should let the National AIM Team know that the forms are identical and one can be deleted. The data team will then compare the data from the two forms to verify that they are identical before choosing one to delete at random.
3. The error log script looks for errors in all plots with related field visits indicating a plot had a “Full Sample Visit”. A plot with a lot of missing forms may have the wrong Visit Type indicated in its field visit. If a Plot was temporarily or permanently rejected, “Full Sample Visit” is not the correct visit type. Changing this Field Visit to a temporary or permanent rejection will resolve all missing form issues.

Incorrect GPS Location

1. GPS issues can be flagged either through critical concept review or from the error script. In general, GPS data should only be updated if issues with the location are due to a misunderstanding of where the forms should be located and not when GPS accuracy of iPads effected the location.
2. Crews should update GPS points by manually editing the data in their forms.
 - a. First, they should use Google maps or Field Maps to get a correct latitude and longitude for the location of the form.
 - b. Next, open the form from Survey123 to edit and resubmit the form.
 - c. Navigate to the page with GPS and click open the GPS window.
 - d. Type GPS coordinates into the search bar at the top. Switching the basemap to imagery using the widget on the right hand side can help to more precisely place the form location.
 - e. When the blue flag is in the correct location, click the check mark in the lower right hand corner, then resubmit the form to AGOL.
3. At the beginning of the season, systematic GPS errors may occur, making individual updates tedious. In this case, crew managers should consult with the National Riparian and Wetland AIM Team to consider editing GPS in the Webmap rather than in the tablet. There are a couple of important notes for edits in the Webmap:
 - a. While forms in Survey123 provide many QA checks on entered data, the Webmap does not require data to follow the same checks. For this reason, all editing to the data itself should be completed by crew members on tablets or by the National Riparian and Wetland AIM team. **When editing location data be VERY careful to exit out of editing mode as soon as you are happy with the location of the data.**
 - b. Forms existing on crew tablets will always trump data edited in the Webmap. For example, if a crew manager modifies the location of Plot Characterization in the Webmap, then the crew edits plot classification data and resubmits, the GPS in the Survey123 form from the crew will write over edits to the Webmap. **Any data modification to the Webmap should only occur when the plot data has been reviewed and the crew has completed all necessary edits.**

Changing photos in photos form

1. In general, you will always be able to add photos to the form after submitting to AGOL, but you won't be able to delete them.
2. **If you want to delete a photo**, you'll have to submit a known error indicating which one(s) needs to be deleted. It can be helpful if you're updating a photo (i.e. adding a new one and requesting another be deleted) that you add to the photo comments of the old photo something like "Old copy of overview photo. Can be deleted". This makes it easier to find the one that should be removed.

Species Errors

1. Most species errors will be identified through the error log, which performs the following checks:

- a. All unknown codes used in Species Inventory, LPI, Woody Structure and Annual Use have a matching unknown code entry.
 - b. All species and unknown codes used in LPI and Woody Structure and Annual Use have a matching entry in Species Inventory.
 - c. All species corrections requested in known errors are accounted for in Unknown Plants and Species Inventory.
2. Frequently multiple errors may show up for the same species code. Grouping errors in the error log by 'OtherKey' can help to understand the underlying cause better.
 - a. For example, if a crew accidentally used PG_01 instead of POACEA_01 on their transects, they will likely find the following errors:
 - i. PG_01 is in LPI or Annual Use but not Species Richness.
 - ii. PG_01 is in LPI but has no unknown plants form.
 - iii. PG_01 is in Annual Use but has no unknown plants form.
 - b. Correspondingly, a single solution may solve multiple problems. If the correct code, POACEA_01, has already been added to Species Inventory and Unknown Plants, once PG_01 is switched in LPI and Annual use, all three of the above issues will be resolved.
3. For Unknown codes missing from the Unknown Plant form:
 - a. This error is mainly caused by two issues:
 - i. A code was *accidentally* used in a form and needs to be changed to something else.
 - ii. A code was *intentionally* used in a form, but the crew forgot to add it to Unknown Plants.
 - b. These errors require evaluation by the crew to assess why the issue is occurring.
 - c. To fix an incorrect code used in Species inventory, LPI or Woody Structure and Annual Use:
 - i. To replace a code already used in a transect form, crews can indicate the code it should be replaced with in a known error form.
 - ii. For transect-based forms, the National Riparian and Wetland AIM Team will take care of all edits once the known error form has been submitted.
 - iii. For Species Inventory, the correct species should be added to the form and the form should be resubmitted. If the old code needs to be removed, crews will need to indicate this in a Known Error form, as all species deletions must be completed by the National Riparian and Wetland AIM Team.
 - iv. The following table shows an example of potential errors that might come up if PG_01 was accidentally used during LPI and species inventory in place of AG_01.

Error Log Flag:	Crew Action	Known Error Comment
"Unknown Code Key AAFO-TW-21000_2021- 06-01_PG_01 from	Add AG_01 to Species Inventory.	"PG_01 used by accident instead of AG_01 in Species List. Please

Species Inventory does not have an Unknown Plants form.”	Indicate in Known Error to delete PG_01.	delete PG_01 from Species Inventory.”
“Unknown Code Key AAFO-TW-21000_2021-06-01_PG_01 from LPI does not have an Unknown Plants form.”	Indicate in Known Error that all calls of PG_01 should be switched to AG_01.	“PG_01 called by accident on LPI. Switch all PG_01 calls to AG_01.”

- d. To add or edit an entry in Unknown Plants:
 - i. Open and edit unknown plants form.
 - ii. Unknown Codes already submitted can be edited, including changes to identification status, codes, and characteristics, but cannot be deleted. If an entry must be deleted, add that information to the plant description and resend the form. Then, indicate in the known error form that a species needs to be deleted.
 - iii. Once the correct entry has been added, this error should be fixed.
4. For species and codes missing from Species Inventory...
 - a. Much like Unknown Plant errors, these errors flag one of two possibilities:
 - i. A species was *accidentally* used in a form and needs to be changed to something else.
 - ii. A species was *intentionally* used in a form, but the crew forgot to add it to species inventory.
 - b. To fix an incorrect code used in LPI or Woody Structure and Annual Use:
 - i. The crew should submit a Known Error requesting that the problem code be changed to the correct one.
 1. Indicate the incorrect species and what it needs to be updated to.
 2. Indicate the transect if you only want the species updated on a single transect. Transect does not need to be indicated if the species only occurred on one transect. We'll only replace the species if it matches the Plot-code combination entered into species inventory, so transects without that species will be untouched.
 - ii. The crew should ensure that the correct code is added to Species Inventory, to prevent additional errors in the future.
 - c. To add a code to Species Inventory:
 - i. Open and edit Species Inventory
 - ii. **You cannot delete entries after you've submitted the form for the first time**, but you can edit previous entries.
 - iii. Indicate any species codes that need to be deleted using a Known Error form. The National Riparian and Wetland AIM Team will take care of these edits on the backend.

VI. CHECK-IN AND PROJECT CLOSE-OUT

Overview

One-month check-in

A check-in meeting should be held one month into the field season with the crew, crew manager, Project Lead, State Lead and/or monitoring coordinator, and the National Riparian and Wetland AIM Team to make sure data management and data quality steps are being completed and that there is good communication among team members.

During this meeting, the one-month check list and agenda topics can provide a starting point of questions to address unresolved protocol questions, app and iPad quirks, or logistical and gear issues such as YSIs malfunctioning. The State Leads or monitoring coordinators should schedule and lead this meeting and all other parties should come prepared to discuss issues that have arisen thus far throughout the season. If the State Lead or monitoring coordinator is not able to schedule and lead these meetings, they should coordinate with the Project Leads to ensure these meetings occur.

Close-out meeting

The project close-out meeting should be scheduled by the State Lead and/or monitoring coordinator before the end of contracts such that crews and crew supervisors are still available to clear up any data questions that may arise. The end of season check list below should serve as an exhaustive list of everything that needs to be done to close out the project. In summary, all final data should be submitted and the evaluation statuses in the Point and Field Visits layers should be finalized. Project Leads or crew managers should submit all water quality samples to NAMC following the Water Quality Submission Protocol.

Responsible Parties

Everyone

When and Estimated Time

One-month check-in: One month into data collection. Meeting lasts 1-2 hours.

Close-out meeting: At the end of the season while the crew is still working. The close-out meeting must occur no sooner than one week after the crew's last field day and no later than 4 weeks after. Crews may need up to one additional week to finalize and submit data to the NOC prior to the end of their employment period. Crews must have access to internet for the meeting so that they can view dashboards. Meeting lasts 1-2 hours.

Tools and Files

- Check lists below
- Teams
- Data Review Dashboard
- Webmaps
- Water Quality Submission Protocol.

One-month check list and agenda topics

The purpose of the one-month check-in meeting is to discuss data quality processes for design management, data collection, and data submission to date with the goal of resolving any questions or issues so they don't propagate throughout the field season.

Pre-meeting preparation checklist:

- ☐ The Project Lead has prepared a quick assessment of number of points sampled and crew productivity.
- ☐ The crew has submitted ~1 month worth of data 1 week prior to this meeting.
- ☐ The crew has selected plot overview, soil pit, and hydrology photos from at least 3 plots and sent their PlotIDs to all meeting attendees prior to the call for discussion. Photos should include: 1) a typical plot, 2) the most challenging plot visited to date, and 3) something in between or that warrants discussion. All attendees should reference photos in the Data Review Dashboard.
- ☐ All parties involved have prepared a list of protocol questions and clarifications and potentially some photos to facilitate discussion.
- ☐ All parties involved have prepared a list of design management and data questions to discuss during the meeting. Ensure that all parties are staying up to date on Data Review and are actively resolving errors.
- ☐ The National Riparian and Wetland AIM Team has a list of questions regarding any submitted data to discuss during the meeting.

Discussion topics and questions:

Sampling Time	Action Items and Notes
If crews are taking more than 6-8 hours per plot, or not sampling ~1 plot per day, what can we do to help improve efficiency? Consider the following.	
Does the crew feel they have been provided with adequate office evaluation information to get to point coordinates? Are trip plans organized in a realistic manner? If not, what do they suggest for improvements?	
Does the Project Lead feel that it is realistic to meet the project's total sample size by the end of the summer? If not, how do we adjust and prioritize, what's in the contract, etc.?	
Is it clear to the crew who they are supposed to call for protocol questions, access issues, trip schedule issues, etc.?	
Water Quality	Action Items and Notes
Is everyone aware of the WQ Submission requirements highlighted in Water Quality Submission Protocol?	
Is the crew clear that they should be collecting duplicate and blank WQ samples for total nitrogen and phosphorus at 10% of sites with surface water and labeling these samples appropriately? How many plots has the crew collected duplicates and blanks for so far?	

Design management	Action Items and Notes
Are Project Leads finalizing eval statuses so that designs can be managed iteratively? Are there any related questions?	
Are the trip planners managing the design iteratively according to guidance in the design management protocol? Is the Plots layer being properly and completely updated?	
Has the Project Lead assigned merged PlotIDs properly and is the crew clear on what coordinates and PlotIDs should be used?	
Local Field/District Office orientation training and calibration:	Action Items and Notes
Who was able to make it to this local training? How many and what types of sites were visited?	
Did this enhance everyone's understanding (especially the crew) of how to identify the critical concepts? Which critical concept caused the most discussion?	
Which other methods caused a lot of discussion and why?	
Was calibration data saved electronically on Teams?	
Photo review (Use Data Review Dashboard):	Action Items and Notes
The crew presents overview, soil pit, and hydrology photos and discusses their experience at 3 sampled plots: 1) a typical plot, 2) a challenging plot, and 3) 1 other plot that you would like to share. Does everyone agree on the critical concepts? Is the crew confident identifying critical concepts across a diversity of plots? Other discussion?	
Does anyone else have photos or specific methods they want to discuss?	
Has the crew encountered any of the below challenging situations yet this field season, and how did they go? What methods were difficult in these systems?	Action Items and Notes
Edges of the target population (e.g., dry floodplains, aspen stands with dry understory)	
Classification questions (e.g., slope wetlands along streams)	
Ambiguous channels or multiple channels, no clear dominant	
Mixed plot layouts	
Water quality sample locations (e.g., challenging collection sites in shallow surface water)	
Shifting sample locations, shifting plots	
Targeted sites with special considerations (e.g., plot layouts, exceptions)	
Survey123 and QAQC	Action Items and Notes
Has the crew found any Survey123 glitches preventing efficient data collection, QAQC, backup, and submission?	
Is the crew backing up data after at least every two plots? If not, why?	
Are there reoccurring themes or issues being discussed at the weekly QAQC meetings? Who is attending? How can we improve?	

How often is the Project Lead able to review data? What issues have arisen?	
Does the National AIM Team have questions for the team about data?	
Do crews know how to make edits to their data? Do they understand the process for resolving the errors flagged in their error logs?	
Are there any other unresolved data issues?	

End of season check list and agenda topics

The purpose of the end of season meeting is to ensure all that all data questions have been resolved, all design and field data have been finalized, and no more information or tasks are required prior to the end of the field season. The End of season check-in must occur no sooner than one week after the crew's last field day and no later than 4 weeks after. Crews will then need one week minimum to finalize and submit data to the NOC prior to the end of their employment period.

Pre-meeting preparation checklist:

- ☐ Crews have submitted all final data.
- ☐ Project Lead has reviewed all data and will come to the meeting with any questions. All attendees should reference the Data Review Dashboard
- ☐ National AIM team has reviewed submitted data and will come to the meeting with any questions.
- ☐ All questions in the Error Review Check lists have been resolved or will be resolved during the meeting.
- ☐ The National AIM Team has reviewed the finalized Evaluation Statuses in the Webmap and will come to the meeting with any questions. All attendees should reference the Webmap for their official numbers.
- ☐ Crews prepare a list of gear that needs to be replaced, replenished, or fixed and share with whomever is responsible for gear (using the master gear list as a checklist could be helpful).
- ☐ Contractors have submitted water quality samples following the Water Quality Submission Protocol.
- ☐ State Lead/Coordinator organizes meeting with National AIM Team, Project Leads, contractors, and crews. Keeps notes in the Teams Mid and End of season check folder.

Pre-meeting table to be completed by Project Lead:

Crew manager/Project Lead Name		
Project Area		
Year of design (e.g., first year of 3)		
Field season start and end dates		
Contract/agreement company and crew members		
<i>Design Summary</i>	<i>Random</i>	<i>Targeted</i>
Number of sites in design		
Number of plots sampled		
Number of permanent rejections (office or field)		
Number of temporary rejections (field)		
Number of sites that were not visited		
Preliminary notes about the design (e.g., any priority targeted sites need to be sampled next year?). National AIM Team will follow up during future planning stages.		

Discussion topics/questions, and final checks (minimum):

Design management

- ☐ Resolve any disagreements on 'Eval Status' in Plots Layer in the Office Webmap.
- ☐ Resolve any other questions regarding the Plots or Field Visits layers in the Office Webmap. Any other follow-up needed on plots that should be revisited in future years?
- ☐ Have all PlotIDs that were merged been properly noted as such with the merged site code in the Plots layer?

Data

- ☐ Discuss any remaining problem plots, photos, indicators, or field methods.
- ☐ Final data questions follow-up.

- ☐ Have WQ samples been submitted? If not, what is the plan?
- ☐ All electronic data, photos, etc. have been sent to National AIM Team. If not, resolve issues at meeting.

APPENDIX A. RIPARIAN AND WETLAND AIM TECHNOLOGY MANUAL

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I. Setting up your iPad

Overview

The recommendations found in this section only need to be completed once at the beginning of the season. They include downloading apps, signing in, and changing settings to ensure your iPad and apps function as they need to for field sampling. While crew leads may be the only ones to complete these setting changes, it is essential that all crew members understand the necessary settings so they do not get changed accidentally.

Review iPad setup and settings

- Ensure you have iOS of 13 or more. If not, go to settings, “General” and then “Software Update” to update your iOS. If your device only supports iOS 12, please contact the National AIM team for more information.
- Ensure your iPad has a data plan and is cellularly enabled. You will not be able to take GPS coordinates otherwise.
- Ensure you have a waterproof case for your iPad.
- The iPad battery lasts for approximately one reach worth of data collection and iPads will overheat if the temperature gets above 95 degrees. Therefore, care should be taken to maximize battery life and keep iPads out of direct sunlight.
- Review your settings
 - Ensure you know how to save battery life by adjusting screen brightness, setting airplane mode on, and turning off Bluetooth.

Download necessary apps for data collection and file sharing

From the Apple App Store, download the following applications:

- ArcGIS Field Maps
- ArcGIS Survey123
- ArcGIS Companion (if no access to computer)
- Microsoft Teams
- OneDrive (optional, if your organization has it)
- Paper Maps
- Recommended but not necessary
 - Email specific application
 - Excel app
 - Other maps applications
 - Avenza Maps
 - Google Maps
 - Google Earth
 - Field Safety apps
 - Fires – Wildfire Maps and Info
 - SpotX
 - AirNow
 - Plant ID apps:
 - Seek from iNaturalist
 - Colorado Wetlands app with offline plant data downloaded
 - A botanical resource for wetland plants. While it is specific to Colorado, many Colorado plants can be found in wetlands across the West.
 - State-specific botanical resources

- Many state heritage programs have created their own botanical applications to be used in the field. At the beginning of the season, it may be worth spending a little time to look for one of these applications.
- CNHP Specific
 - WEX Connect
 - Pulse Secure

Once you have all applications downloaded, it can be helpful to organize your two iPad home screens the same way, so you always know where to find the apps on the screen.

Logging into ArcGIS Online

1. If you are a contractor or a BLM employee using a non-government iPad or computer, you'll need a geoplatform account to access the Webmap and associated forms.
 - a. Create a login.gov account by going to https://secure.login.gov/sign_up/enter_email. Fill out the requested information and click Submit.
 - b. You will receive an email to confirm your email address and create a password to set up an account.
 - c. Set up an authentication method/methods. We recommend you set up multiple authentication methods and **avoid using Microsoft Authenticator** at this time.
 - d. Login to your Login.gov account via [AGOL Login page](#) and associate it with your GeoPlatform account.
 - i. Click “Your ArcGIS organization’s URL” and type ‘geoplatform’ in the box provided and click continue. This will redirect you to the Geoplatform Login page.
 - ii. Click “GeoPlatform Login.gov Account”.
 - iii. Follow the prompts for entering your Login.gov account credentials and click “Sign In”.
 - iv. In the Update Account Information window, confirm your username and address. Do NOT change the username.
 - v. Return to your email and verify an email from geoplatform.gov.
 - e. Please read and sign the [GeoPlatform editor agreement](#) using either option below:
 - i. Print, sign, and take a photo/scan of signed document.
 - ii. Download the PDF, use adobe to e-sign the document, and save the document.
 - f. Send your username and signed document to Ruth Whittington at ruth.whittington@colostate.edu, do NOT include your password!
2. If you are a BLM employee, email Ruth Whittington to get your BLM mobile account added to the BLM AIM Riparian and Wetland group on AGOL

Log in to applications

Two crew members should use their login information for Microsoft and Esri applications.

1. Esri-based applications: Field Maps, Survey123, and ArcGIS Companion
 - a. Create a Geoplatform account using the instructions found above.
 - b. For all Esri applications, signing in with Geoplatform requires a couple extra steps.
 - i. Continue for below for app-specific instructions on navigating to the login page.
 - ii. When you get to the Esri sign in page, below the ArcGIS login open the “Your ArcGIS organization’s URL” banner.
 - iii. In the box provided, type in “geoplatform.maps.arcgis.com”. Check the box that says remember this URL, then hit continue.
 - iv. Hit the button that says “GeoPlatform Login.gov Account”

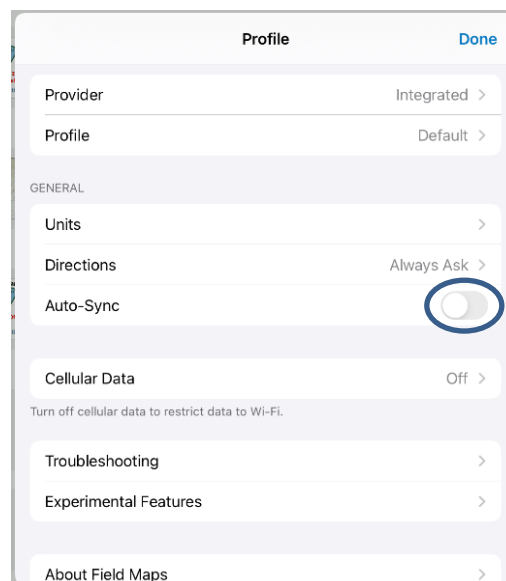
- v. This will direct you to the lovin.gov sign in page, complete with an authentication method.
 - vi. If when you log in, the application doesn't seem like you've logged in, you may have to do this process a couple times before the app registers your username.
 - c. **To navigate to the login page in Survey123**, hit the three lines symbol next to the satellite symbol at the top right of the page, then "Sign in"
 - d. **To navigate to the login page in Field Maps**, hit "Sign in with ArcGIS Online" then continue as above.
 - e. **To navigate to the login page in ArcGIS Companion**, hit sign in, then continue as above.
2. Microsoft Teams
- a. Crew leads should sign into their Microsoft teams account on your iPad.
 - b. For CNHP employees, emails using your eID sometimes work better for logging in that your true email address (i.e. jsmith@colostate.edu instead of John.Smith@colostate).

Change important settings for the field season

Disable Field Maps Auto Sync

The first time users open Field Maps they should disable auto-sync. Auto-Sync is a feature in Field Maps that tries to automatically sync maps and data continuously. This works great if you are in an urban environment; however it presents issues when you are working in the backcountry. When you do come across cell service you do not want your Field Maps app to choke itself trying to send and receive new data. Syncing is covered later in this document; however, it should be noted that syncing should only occur when the user has a strong, stable, reliable internet connection.

1. On the main screen of Field Maps, locate the "Account" icon in the upper left-hand corner.
2. In the popup, scroll down until you locate "Auto-Sync". Click the slider button to turn off.



3. While on this page, you may also want to turn on "Cellular Data" if you intend on syncing data using your cellular provider. Note if this is turned off, you will be forced to only sync data when you are connected to a WiFi signal.

Setting tablet GPS Accuracy

Field Maps allows users to specify GPS accuracy thresholds that the user must meet in order for the application to allow them to collect data. By default, the app is set at 30 ft accuracy (9.144m). For most users, this should be fine, however this can cause problems if you are in a confined valley with limited view of the sky. To avoid any potential hiccups during your trip, we recommend that users change this setting so that it is extremely high. Essentially, we want to tell the device to allow you to collect data regardless of how poor your GPS accuracy is.

1. On the main screen of Field Maps, locate the “Account” icon in the upper left-hand corner.
2. In the popup, choose the second option “Collection.” On the following page select the first option “Accuracy.”
3. Click where it says “Distance (feet)”, delete the default value of 30, and type in 1000.

Disabling Survey123 Auto-update

Disabling the Survey123 app store auto update feature is CRITICAL for successful data collection throughout the field season. Esri periodically releases new versions of the Survey123 application throughout the year. By default, your device will try to automatically update your app to this latest version like any other app. Our forms have been created and tested for the version of Survey123 that is available to the public at the time of training. Updating this version could change how the app works and break our forms completely preventing any data collection. If this occurs, DO NOT count on the National AIM Team to fix this problem overnight. Users are UNABLE to download older versions of Survey123 than what is available in the app store so there is no going back. This is a BIG DEAL and should not be taken lightly. If a crew accidentally updates their app, they risk being sidelined for a week while we rebuild the entire project from scratch. The National AIM Team will send out a message to all users on Teams if and when users should update their version of Survey123.

It is essential that that individual setting up the iPads for their crews knows to change this setting. It is also very important that all crew members are aware of this as well so they know not to tinker with these settings.

To disable Automatic Updates:

1. Go to your iPads Settings
2. On the left side of your screen, locate “App Store”
3. “Automatic Downloads” should be the first option you see. Below that, ensure that “App Updates” is disabled.

In order to update other applications on your device, you will need to manually choose to update it in the app store. As a reminder, you should never update your version of Survey123 unless advised by the National AIM Team, however, devices that were used in the past year, may need to update Survey123 at the beginning of the season.

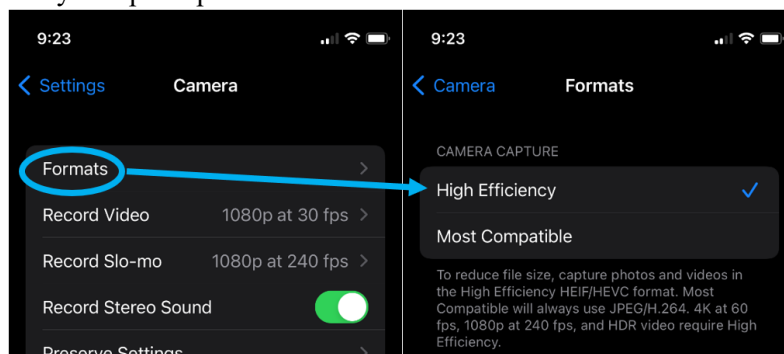
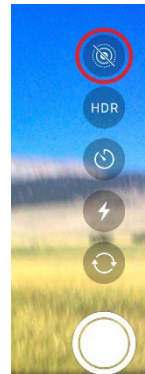
To update apps:

1. Go to the Apple App Store on your iPad
2. Locate the “profile” icon in the upper right corner. It may have a red number on it. Click this.
3. Locate the “Available Updates” section. DO NOT HIT the “Update All” button.
4. Any apps with available updates can be manually updated by hitting the “Manual” button next to each item.

Change photo settings to take and store photos as jpegs

For the purpose of the Riparian and Wetland AIM program, photos are best taken without the live photo function. Generally live photo formats are more difficult store and transfer to different devices. At the beginning of the season, it is recommended that this function is turned off and photos are uploaded in their most compatible format, rather than their most efficient.

1. In your camera app, click the live button so that it shows a slash through it.
2. In Settings > Camera, go into Preserve Settings and make sure Live Photo is turned on so that your photos app will always have live photos turned off.
3. Under Settings > Camera > Format, select “High Efficiency”. This will automatically compress photos into a smaller format.



For CNHP employees:

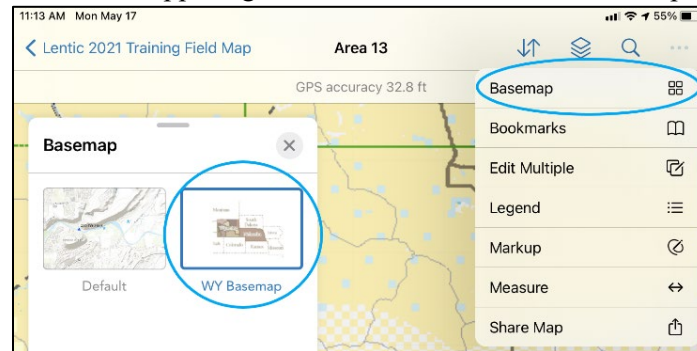
1. All iPads used for collecting AIM data are all set up using the same iCloud account, so some settings should be changed to make sure your iPads are not syncing with data from other iPads.
2. Disable photo syncing.
 - a. In settings, click on Photos, then under iCloud, turn the toggle switch to off.
3. Turn iMessage off.
 - a. Go into settings, then down to “Messages”. Turn the iMessage toggle switch to off.

Download basemaps to the Field Maps App

For most states, a basemap is available in your state folder of Teams. If imported to the Field Maps app, this can provide road and land ownership information for the state without requiring additional offline area download. At the beginning of the field season, downloading basemaps should only need to be done once.

1. To use basemaps, you need to copy the basemaps into the files app on your iPads.
2. First you'll want to download the basemap for offline use. These files are large—often between 1 and 2 GB of data, but they provide a wealth of information.
3. In Teams, navigate to the basemap folder in your state's folder.
 - a. In this folder, there should be one large statewide map, though there may also be additional basemaps available for download. Click the three dots next to the file you want to download and select “Make Available Offline”.
4. After this has finished downloading to your iPad, open your Files app and click the “< Files” button in the upper left hand corner.
 - a. From the list of files, select OneDrive, then navigate to the folder in which you just downloaded the tile pack.
 - b. Hold that document until a dropdown menu appears and select “Copy”

5. Use the folder button in the upper left-hand corner to get back to the list of file folders until it shows the side panel, and switch over to the “On My iPad” folder.
 - a. Open the Field Maps folder and press and hold anywhere in the folder to paste your copied file.
6. Within the Field Maps app, your basemap should now be available for use offline.
 - a. Open any offline map.
 - b. Select the three dots in the upper righthand corner, then select “Basemap”



- c. When the basemap panel opens, you should see the basemap you just downloaded as one of the options. Change your basemap to this option to use this basemap with any offline area.

Download documents for offline use

It is advisable at the beginning of the season to download helpful documents to the iPad for offline use. All files on the Teams site will also be available for download in the Teams app. While there is an option to make available offline, any download in Teams that is unused for 14 days will automatically be deleted from your device. For this reason, it is advisable to download all files you want to keep available to an app specific for file storage, such as the files app or OneDrive, if your organization has a OneDrive subscription.

1. Within the teams page of the Teams app, you should see a list of all Teams you’ve been added to along the left hand side.
2. Select the AIM Riparian & Wetland Team.
3. The General channel will have universally applicable files, such as all field season protocols and wetland soils resources. Your state channel may have some additional files that pertain just to your state.
4. For any document you want to download for offline use, select the three dots next to the document, then “Send a copy.” This will download a copy that you can then place in your preferred application.

Recommended documents to download for offline use include:

- Riparian and Wetland AIM Resources:
 - 2022 Review Draft: AIM National Aquatic Monitoring Framework: Field Protocol for Lentic Riparian and Wetland Systems
 - 2022 Riparian and Wetland AIM Data Management Protocol
 - Plot Checklist
 - Gear List
- Technical Resources
 - Classification resources
 - Field Indicators for Hydric Soils in the United States

- Necessary regional supplements from the US Army Corps of Engineers
 - Safety Documents
 - Tech contact list
 - Emergency contact list for crew
 - Safety plan
-

II. Preparing for Field Visits

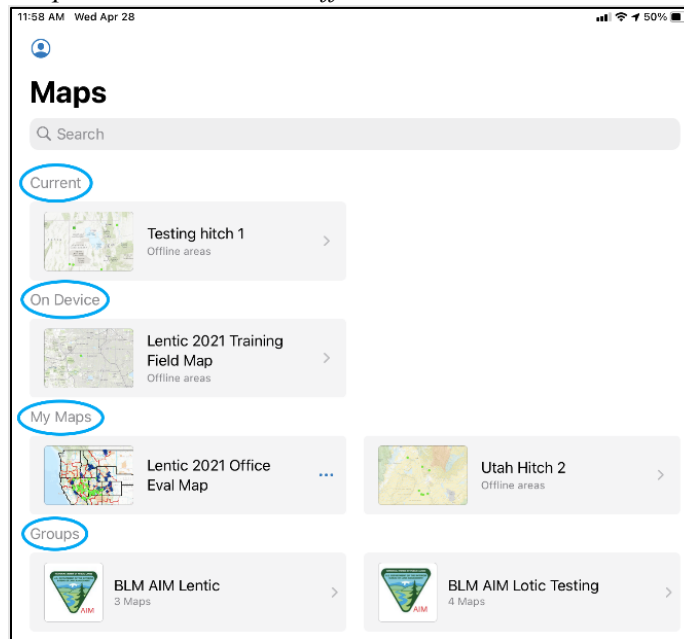
Overview

Prior to leaving Wi-Fi, field crews should make sure you have all necessary files downloaded and available offline. During field visits, field crews will use the Field Maps application to track field visits as well as to launch field forms with important identifying information. In this section, we'll specifically outline the steps to download offline areas in Field Maps. This step is essential before every hitch, otherwise you may be unable to see your specific sites in Field Maps. This may include maps for specific sites from BLM Project Leads, digital copies of this and other protocols, as well as the maps required to navigate and collect data in Field Maps.

Navigating the Field Maps application

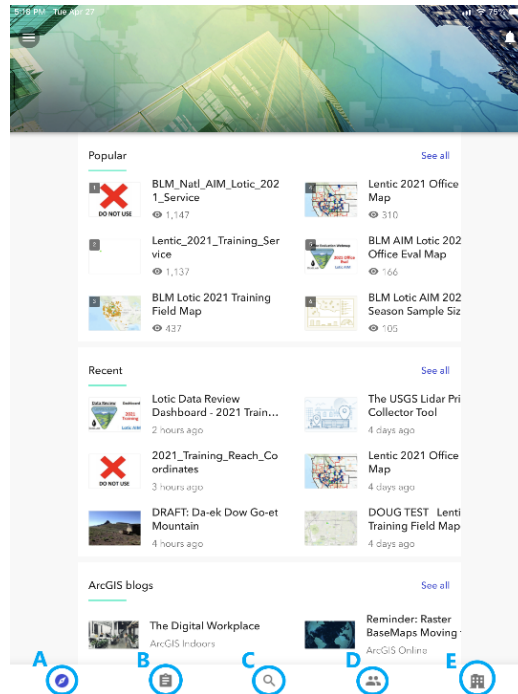
Below is a screenshot of the main screen of Field Maps once you are signed in. There are four categories of maps shown.

- **Current:** This displays the last map that you opened in Field Maps.
- **On Device:** This is a list of all maps that you have downloaded onto your device to take offline.
- **My Maps:** This is a list of maps that you have saved to your Geoplatform User Account. Examples of this include maps filtered by trip and saved so that only a subset of Plots are displayed on the map within Field Maps.
- **Groups:** This is a list of all AGOL Groups that your profile belongs to. Clicking a group, for instance BLM AIM Riparian and Wetland, you will see all maps that are part of the group. *Note that only Field Eval maps are set to be taken offline.*



Navigating the ArcGIS Companion Application

ArcGIS Companion is an Esri application for accessing ArcGIS Online features from a tablet device. This guidance will focus only on what the user is required to know in order to set filters on maps for use in Field Maps. Below is a screenshot of the main screen of Companion once you are signed in. Along the bottom, five pages are available as follows.



- A. Companion home page
- B. Content page
- C. Search
- D. Groups page
- E. Geoplatform Organization page

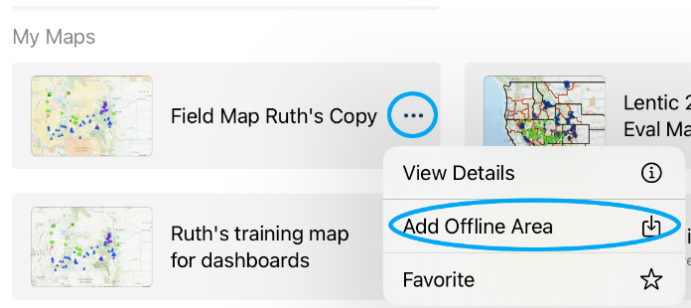
Download maps for offline use in Field Maps

In order to use maps in Field Maps offline, an area needs to be downloaded for offline use. This can be completed using two methods. The first is more straightforward, but does not allow for any customization. If crews want to filter their points or add additional layers, they'll need to follow method two to create their own map on ArcGIS online before downloading that map to their tablet.

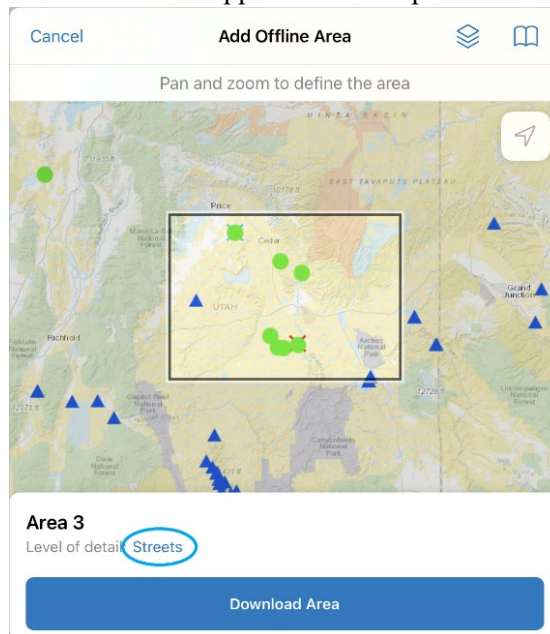
1. **Offline areas should be refreshed and redownloaded before every hitch.** If you are creating your own map, before every hitch, **you should re-create a new map from the original copy on the Riparian and Wetland AIM Group page, as any updates that may have occurred will not transfer to your map.** These edits are more important than edits which happen to the Office Eval Webmap, and may impact the function of Survey123 forms and data QC checks. This is particularly important at the beginning of the season, when the map and forms are being fine tuned.
2. Before leaving service or taking your device offline, **double check that your download has completely finished** before taking your device offline. This process can take a long time and may abort itself if you try to do too many other things on your iPad at the same time.
3. If the download is taking too long, consider reducing the level of detail of the area you are downloading, reducing the size of map, or breaking up your sample area into multiple, smaller offline areas. Proceeding all the way to the third method for download can also help with download speeds.

Method 1: Download an offline area from the Wetland Field Map in the BLM AIM Riparian and Wetland Group

1. To download an offline area for a given map, select the three dots on the right side of the maps ribbon. Then select “Add Offline Area”.



- a. This will open a window to adjust the frame and level of detail you want in your downloaded map. The higher the level of detail, the smaller the area you can download, as indicated by the black box that will appear on the map.

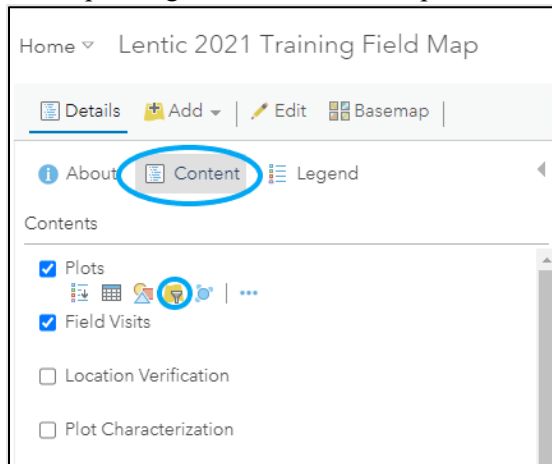


- b. Hit the “Room” level of detail to adjust to a lower level. “Streets” or “Neighborhood” is usually fine enough detail for Field Maps purposes.
 - c. Pan and zoom the map so that the black box includes all points up for sampling during your next hitch, then select download area.
 - d. This will begin the download process, but make sure the offline area has fully downloaded before leaving wifi. This can take a long time, so try and do this before other preparation tasks so you can let it download while you do other things.
2. If you plan to visit multiple areas during one hitch that would be better downloaded as separate map areas, you can download an additional offline area by selecting the map you want from the main menu, then select the three dots in the upper right hand corner of the screen. The dropdown menu should show the same options as before including “Add Offline Area”.

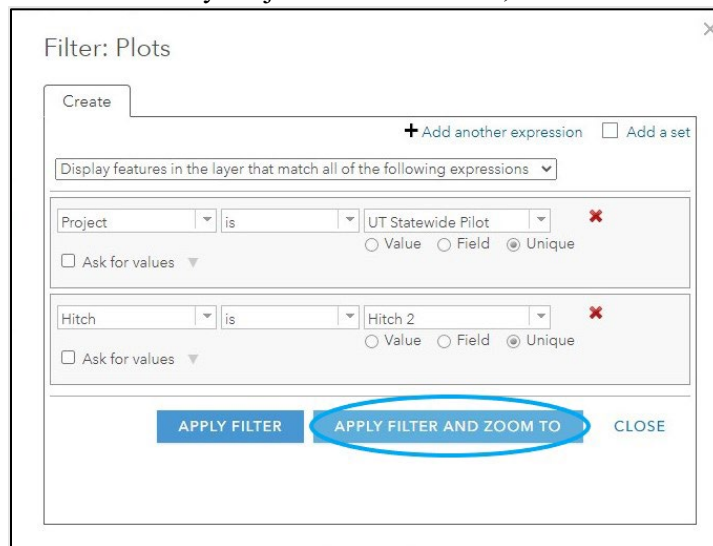
Method 2: Create your own copy of the Field Map in AGOL or ArcGIS Companion, then download an offline area.

1. **In AGOL:**

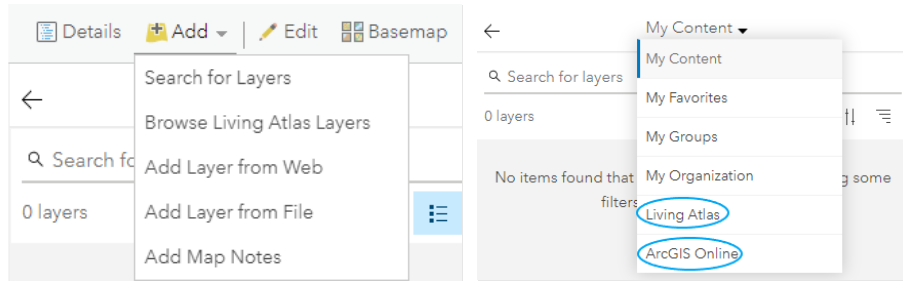
- a. Open the Wetland Field Map, navigate to the “Content” panel on the left side.



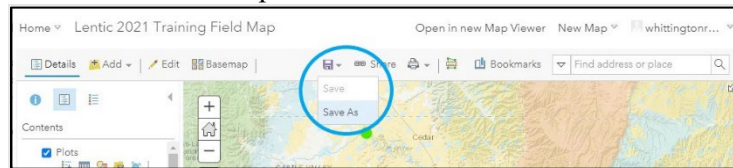
- b. Filter the Plots later by Project and Hitch fields, then zoom to the layer.



- c. Add any layers you want to show in the field.
- Note you should only add layers that are offline enabled.** If you add a layer that is not enabled for offline use, the option to download offline areas will not be available in Field Maps.
 - Select the “+ Add” button, then “Search for Layers”.
 - Use the dropdown to search in the appropriate location for necessary layers. Most public layers from the BLM will be found in ArcGIS Online, while Esri-supported layers will be in the Living Atlas.



- iv. Search using exact matches. Once you found the layer you want, click the small “+” button in the lower right hand corner of the description to add it to the map.
- d. Once you are happy with your map, click “Save” on the toolbar at the top of the map, then select “Save As” from the dropdown menu.



- i. Name the filtered map something meaningful like “Hitch 2”, then make sure the “Save In Folder” is your Geoplatform profile name. Click “Save Map”.

×

Save Map

Title:

Hitch 2

Categories:

+ Assign Category ▾

Tags:

Lentic ×

2021 ×

Training ×

AIM ×

BLM ×

Add tags

Summary:

Lentic 2021 Training Field Map for Hitch 2

Save in folder:

whittingtonruth_geoplatform ▾

SAVE MAP

CANCEL

2. **In ArcGIS Companion** the process for creating a trip map is very similar but can be completed on an iPad rather than a computer.
 - a. Navigate to the groups page, then select the BLM AIM Riparian and Wetland group.
 - b. Click the link to the 2022 Wetland AIM field map. A map should open, much like the map in AGOL.
 - c. From here, follow the instructions above for creating and saving a map in AGOL. All functions in ArcGIS Companion for saving a map are very similar.
3. Once you have saved a map, you should be able to download an offline area of your newly created map in Field Maps following the instructions in Method 1 above. If you do not see this option in Field Maps, you may have added a layer that is not enabled for offline use. Try removing unnecessary layers, save your map, and try again.
 - a. Make sure the download progress has finished downloading before taking your device offline. Your map area should show under “On Device” after it has finished downloading.

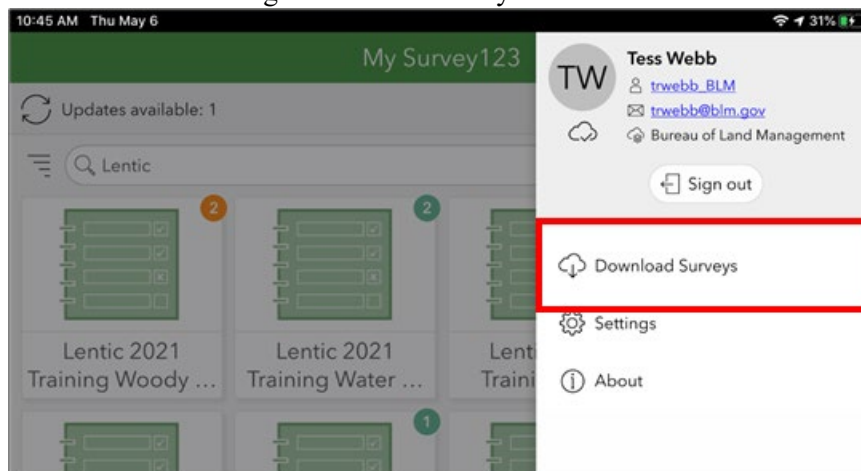
Download, update, or delete Survey123 forms

Before leaving on a trip, the crew will need to download each Survey123 form using the Survey123 application. In an ideal world, crews would download each form at the start of the season and never have

to update them. Unfortunately, situations may arise where crews need to update forms or download new ones. The Riparian and Wetland AIM Team will utilize Teams to broadcast announcements to all users when updates are required.

Downloading Survey123 Forms

1. Once you have successfully logged into Survey123 on both devices, click the ‘Download Surveys’ button at the bottom of the window. This button will only appear here if you do not have any downloaded surveys.
 - a. You can also download surveys at any time by clicking your profile icon in the upper right hand corner and selecting “Download Surveys”.



2. On the next page type “BLM Natl AIM Wetland 2022” into the search bar. You should now see 15 forms for Wetland 2022 (see list below). If you are sampling in the lower 48 states, download 13 of those forms on each device by clicking on the cloud icon on the right side of each form. Alaska crews will need to download all 15 forms. NOTE: once the form has been downloaded the icon changes from a cloud to a refresh icon.

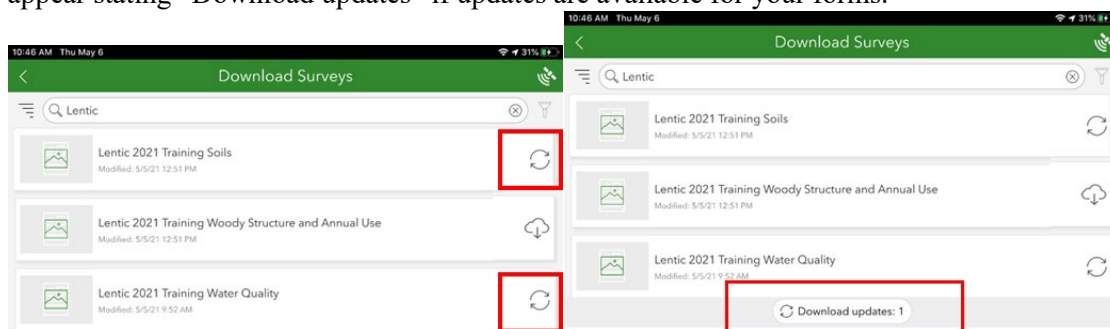
- a. Wetland AIM Forms
 - i. Location Verification
 - ii. Plot Characterization
 - iii. Photos
 - iv. Hydrology
 - v. Soils
 - vi. Water Chemistry
 - vii. Natural and Human Disturbances
 - viii. Species Inventory
 - ix. Unknown Plants
 - x. LPI
 - xi. Woody Structure and Annual Use
 - xii. Hummocks
 - xiii. Known Errors
- b. Alaska Only Wetland AIM Forms
 - i. Gap
 - ii. Soil Stability

Updating Survey123 Forms

Periodically, small glitches may appear in the forms, or dropdown lists, causing everyone to need to

update their form. These updates will update your existing form and do not require you to delete and redownload anything. It is important that you check for updates to forms before leaving on each trip to the field.

1. In Survey123, click on the circle with the profile icon in the upper right corner of the screen.
 2. Click “Download Surveys” and navigate to the forms you would like to update.
 3. Once you have found the correct forms, click the refresh icon to the right of the form.
- Alternatively, on the “Download Surveys” page at the bottom of the screen, you will see a button appear stating “Download updates” if updates are available for your forms.



4. Occasionally this method can cause the update process to freeze. If download takes more than a couple minutes, force close the Survey123 app. Relaunch it and either download the updated forms manually or give the “Download updates” button another try.
5. Sometimes you will see a notification at the top of the main survey screen letting you know there are updates available, click this notification to see all forms that have updates available. We will send notifications via email and Teams chat to ensure everyone sees that updates are available.

Deleting Survey123 forms

1. Rarely, it may be necessary to delete forms. NEVER delete forms unless instructed by the National Riparian and Wetland AIM Team that it is ok to do so. The one exception is at the beginning of the season when you’ll want to delete training forms.
2. To delete a Survey123 form, select the form you want to delete from the form menu.
3. From the form page, click the menu icon in the upper right corner.
4. Click “Delete Survey”.
5. In the following popup, select Delete. Note that deleting a form will delete all associated data, so ensure everything has been backed up before proceeding.

Deleting sent Survey123 forms and drafts

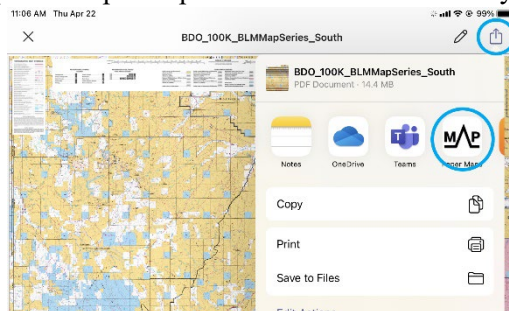
It is highly recommended that users try to keep all of their sent and draft forms in Survey123 throughout the entire season, in case any forms need to be edited. Realistically however, some users may start to notice that they are running short on storage space on their device later in the season. If this is the case, users can delete sent forms to clean up Survey123. **Note that users should ensure that all data has been sent and backed up on their USB device prior to deleting any sent forms.** Photos should never be deleted. If you have unsent drafts ensure that they are junk data and not something outstanding that you forgot about before deleting.

1. On the My Surveys page, click the form you want to delete.
2. From the form page, click either “Outbox” or “Drafts”.
3. Once you have found the correct form, click the trashcan icon to the right of the form.
4. On the warning page, click “Yes” to permanently delete the form.

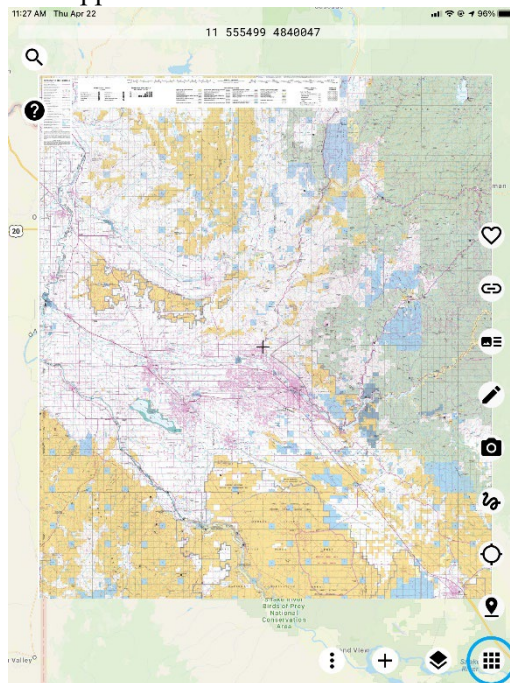
5. Deleting a form will delete all associated data as well, be sure you have submitted/sent everything associated with that form before deleting it

Downloading georeferenced maps to Paper Maps app

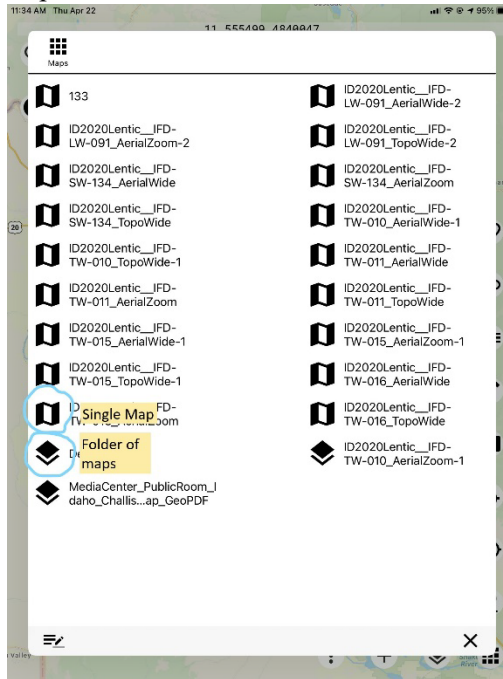
1. Organize your files.
 - a. All Georeferenced maps will be found in your state's folder on Teams: [State] -> Georeferenced Maps. After assembling a hitch plan and a list of all sites you may visit during that hitch, create a hitch folder within this folder.
 - b. Add a copy of all georeferenced maps for the sites you are likely visit during your next hitch to the folder you created. For every site, there should be three different maps labeled "Aerial Wide", "Aerial Zoom" and "Topo Wide".
2. Open each pdf you wish to be available in Paper Maps in the field in Teams apps, then launch in Paper Maps.
 - a. In Teams, open the georeferenced pdf. Then click the share button in the upper righthand corner. An option to open in PaperMaps should show immediately.



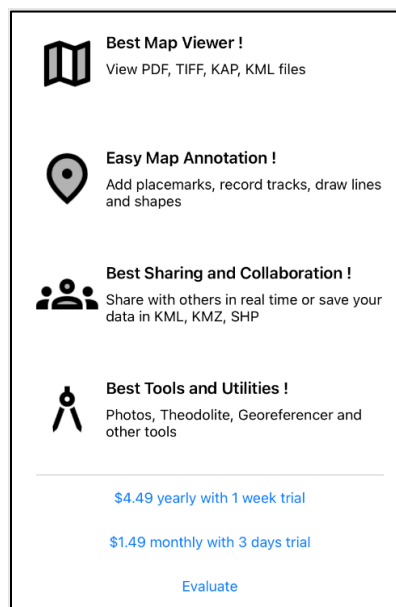
- b. Open each of the pdf's in Paper Maps prior to leaving wifi. This will automatically preserve those maps for offline use.
3. Once you have imported your map into the Paper Maps App, it should be visible and available offline in the maps folder of the app:



- a. Occasionally, maps place themselves in folders within your maps, so if you know you've imported a map but don't see it in the immediate folder, look for labels that are folders of maps rather than the maps themselves.



- b. From here, Paper Maps should automatically follow your location. Once you located inside the map boundaries, you should see a dot representing your current location.
- c. Your GPS accuracy within the Paper Maps app is generally lower than in Field Maps. Additionally, the accuracy seems to vary with the scale of the map, so that smaller scale maps of a whole district appear to be less precise than the Aerial Zoom maps. For this reason, technicians should use the Field Maps app once you get to within 20m of the point to get you more accurately to the Sample Location.
- i. Occasionally, Paper Maps will come up with an error about an annual fee. If you select “Evaluate,” it will function as usual.



III. Survey123 and field data collection

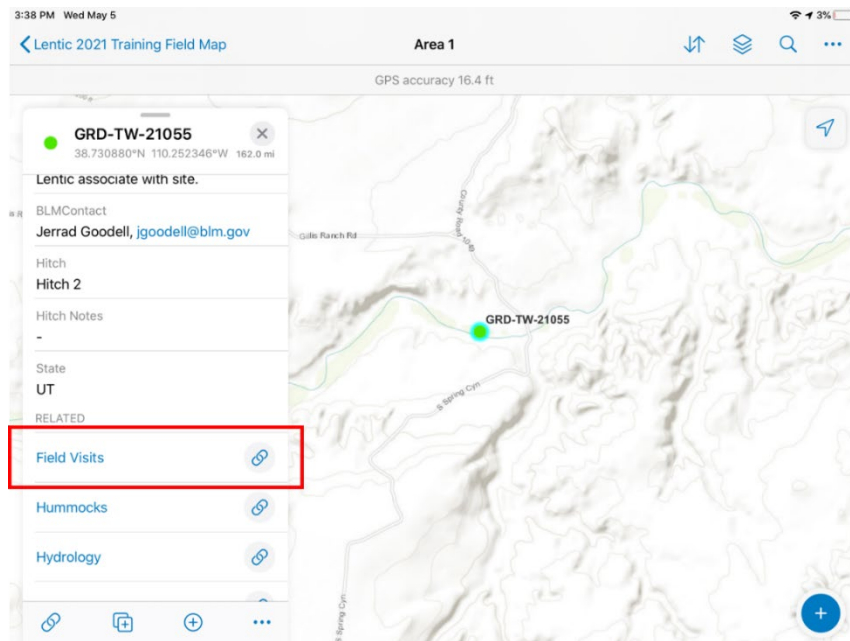
Overview

All data collection for this field season will be completed by first creating a field visit point in Field Maps, then launching all forms from that Field Visit point from Field Maps to Survey123. It is absolutely critical that this process is followed during data collection, as forms have been created to automatically control certain fields based on information in Field Maps. While Survey123 forms have been created to limit potential errors, it is essential that all field members take ownership of double checking that their data collection procedures are in line with AIM protocols. Follow below for detailed instructions on required data collection workflows.

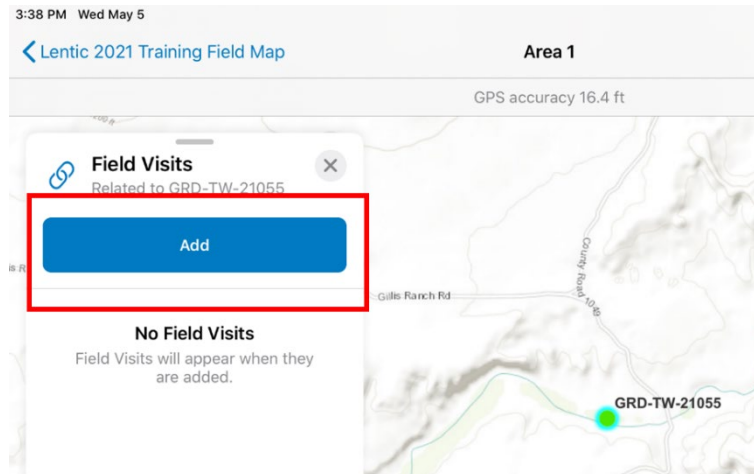
Creating a Field Visit

At the plot, use the plot in Field Maps to navigate to the Sample Design Location. From there, launch a new Field Visit for every unique sampling event with its own unique EvaluationID, a combination of the PlotID and Field Visit Date. This will be the field visit from which all Survey123 forms will be launched. Plots sampled over two days should maintain the Field Eval Date of the start of sampling. While multiple Field Visits may be submitted if a crew is using multiple iPads, **it is critical that the EvaluationID (PlotID + Field Eval Date) be identical across all field visits referring to the same sampling event.**

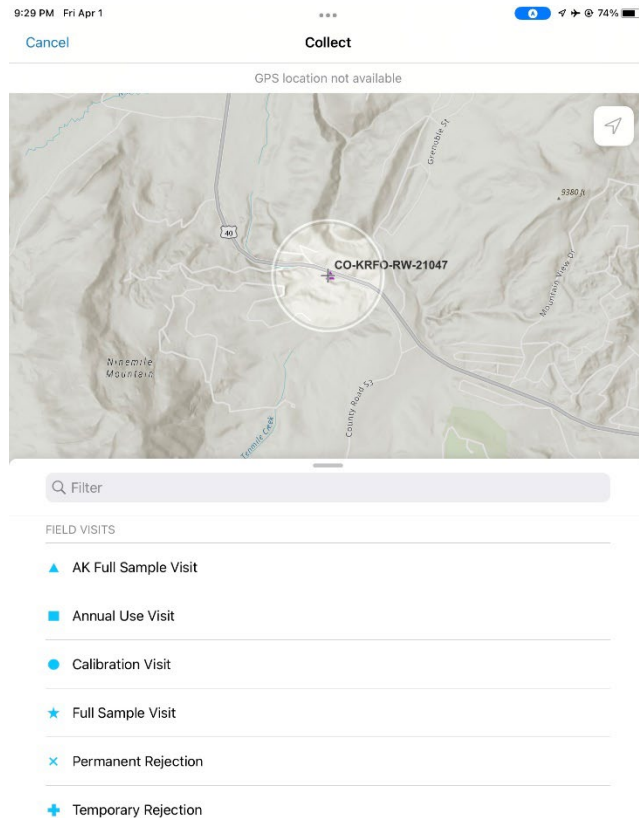
1. After arriving on plot, in Field Maps, click the associated point on the map from the Plots layer. Scroll down and select the “Field Visits” button.



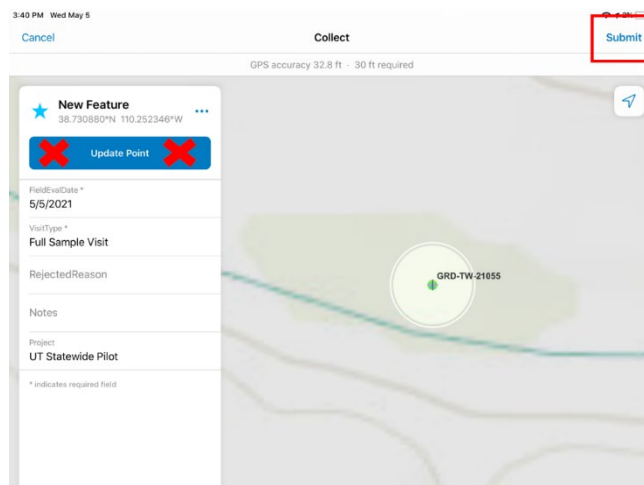
2. Next hit “Add”.



3. Choose a Field Visit Type from the available options.
 - a. **Full Sample Visit** will be the most common visit type. This type should be used for sampling events during which all Core methods will be completed.
 - b. **Permanent Rejection** should be used for non-target or inaccessible sites which will never be able to be sampled.
 - c. **Temporary Rejection** should be used for reconnaissance visits or temporary access issues that prevent full sampling.
 - d. **Annual Use Visit** should be used for sampling events during which only annual use data will be collected.
 - e. **Calibration Visit** should be used for a second full sample visit for the purposes of testing the precision of data collection across crews. This should **not** be used for regular within-crew calibration.
 - f. **AK Full Sample Visit** should be used by crews in Alaska. Because these field visits have different form requirements, we've separated these field visits out during QC.
4. After selecting a visit type, a point will show on the map with your current location. This point should be launched as close as possible to the Original Sample Design Location. If you were not able to reach the Sample Design Location due to access issues, you should move the crosshairs manually back over to the sample location and update the point.



5. Fill out all of the required information to document your field visit.
 - a. The project must be entered manually. If you are unsure which project you are sampling in, that information can always be found in the attributes from the original Plot layer.
6. The update point button should only be used if you intentionally changed your physical location or manually changed the location of the point and would like to update the location of the field visit with that new location. If you move away from the Original Sample Location after opening a new Field Visit, using the update point button will change the location of the field visit point to your new physical location.



7. Once you have finished recording your field visit, hit the “Submit” button in the upper righthand corner of the screen.

8. **Repeat these steps** to create a field visit on the second device. **Ensure the field visit type, Field Eval Date and Project matches the field visit on the primary device.**
 - a. We recommend you launch the field visit points at the same time on the two devices with the two iPads lined up next to each other to make sure the information entered is identical.
 - b. If you are rejecting a sample location, you will only need to launch one field visit point, since you will only need to collect one form.

Editing a Field Visit in Field Maps

You may need to edit a field visit. For example, you may have selected the wrong project from the dropdown when it was created, or you selected a permanent rejection instead of a temporary rejection.

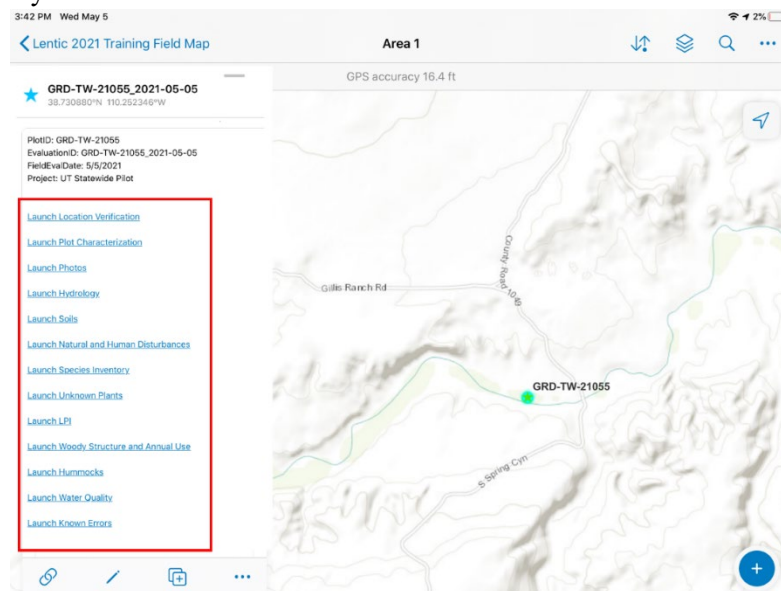
1. Launch the map containing the Plot you visited. Click the point and scroll down to the bottom of the attribute list and click “Field Visits”.
2. Click the recorded Field Visit. Scroll to the bottom of the attribute list and locate the ‘Edit’ button.
3. Click the ‘Edit’ button and make the edit. When you are finished hit ‘Submit’. If this is in an offline map, be sure to sync changes to push them to the Webmap.

Collecting data using Survey123

Survey123 is a form-based data collection application developed by Esri that is fully integrated with their enterprise suite of software products. Data collected in the Survey123 application is then synced to ArcGIS Online and can be viewed in our Webmaps. The following sections walk new users through the general use of Survey123, form layouts, and form specific notes.

Launching Survey123 Forms from Field Maps

1. Once you have created and submitted a Field Visit using Field Maps, you can begin launching forms. **ALWAYS launch forms from Field Maps and not Survey123.**
2. To launch a form, click on the Field Visits on the map you want to open, in the popup there will be a list of forms you can launch.



3. Click on the form you want to launch. The form will automatically open in Survey123 and populate the PlotID, EvaluationID, and other information needed.

4. The first page of every form is the Plot ID and Coordinates Setup page. This page is where PlotID is recorded and where the user can set up certain parameters that dictate how the data collection section of the form is configured (e.g. Selecting transect line number). Many of these fields will be pre-populated based off the Field Visit that you launched the form from. Ensure that everything is correctly populated. If a read-only field is incorrect, you may have an issue with your field visit. Return to the field visit, and verify that the information is correctly entered.
5. While on the first page of the form, check that your location is correct and update your GPS if needed.
 - a. To update your GPS, click the target like symbol to the left of the coordinates.
 - b. To ensure your GPS is working properly and to check accuracy, click the Location Status button in the upper right.
6. Before moving on to the next form, be careful to either save your current form in drafts or submit it to the outbox. During sampling, we recommend that you save all plot-based forms in draft until you complete sampling. Then, **before leaving the site** make sure you have completed the correct number of all forms before submitting to the outbox.
 - a. Many forms have checks that only occur upon submitting them, so it is essential that you submit most forms to your outbox before you leave a plot to make sure you can correct any errors that come up.
 - b. For transect-based forms such as LPI and Woody Structure and Annual Use, we recommend you submit to the outbox as soon as you have completed them. You are unlikely to edit these forms, so it's better to just submit straight to the outbox when you are done.
 - c. Species Inventory and Unknown Plants likely need to be edited after leaving a plot. For this reason, make sure to open the forms on site, but save in drafts until you are happy with them. These must be submitted by the time a crew goes on break to ensure they are included in QC data checks.
7. Once started, an individual form must be completed on the same device. You cannot split data across multiple devices for the same form. However; you can collect any transect specific forms (LPI, woody structure, etc.) on two separate devices so long as the line numbers are different. In order to keep track of data collected we suggest designating each device with a relatively consistent set of forms.
 - a. Primary Device: Location Verification, Photos, Species Inventory, Unknown Plants, Known Errors
 - b. Second Device: Begin collecting transect data on this iPad.
 - i. The realities of field sampling may dictate that all transect data is not collected on one iPad, but consistently starting transect data will generally keep most other forms on the primary iPad.

Layout and Form Elements

The following screenshot highlights commonly referred to terms and sections of forms that users should be aware of while using Survey123.

The screenshot shows a mobile application interface for a form titled "Woody Structure and Annual Use". The form is divided into several sections with expandable/collapsible headers. At the top, there is a "Close Form" button. The "Points Repeat" section includes a "Line Position (cm)" field with a value of 0, a "Current Repeat Label" button, a "Location Status" button, and a "Menu" button. Below this is a "Stubble height quadrat image" section with a "Stubble Height Dominant Species *" dropdown menu and a "Radio button". The "Soil Alteration *" section has radio buttons for values 0 through 5, with 2 selected. The "Woody Species Repeat" section includes a "Woody Species Quadrant image" button, an "Image Group" button, and a "Woody Species *" dropdown menu. A red warning message states: "Woody Use Class is only collected on living, riparian woody species which are rooted in the woody structure quadrat. Omit dead, upland, or overhanging species." Below this is a "Woody Use Class Descriptions" section with a "Repeat Delete" button, a "Repeat Bar" button, and a "Woody Structure Repeat --> Add additional species here:" button. At the bottom, there is an "End Point Repeat --> Add the next point here:" button, a "Previous Page" button, a "Page Number" field showing "3 of 6", and a "Next Page/Submit Form" button. The status bar at the top shows the time as 7:39 PM, the date as Thu May 13, and the battery level as 100%.

Data checks and warnings

The forms have been built with various data checks and warnings to catch errors in the data before submitting.

Types of checks and when they are run:

- **Warning/note:** Warning and Note checks run immediately if an entered value does not meet certain criteria. For example, pH is typically between 5.5-8.5, if you entered a 9, you will receive an note right away alerting you that your value is high.
- **Constraints:** If a check is a constraint, it will alert you of a data error when you try to add another repeat or try to save the form to the outbox or send the form. For example, hummocks must be less than 200 cm wide. If your value does not match the constraint, you will be alerted and returned to this question until it falls within the allowed range.
 - You will NOT get an error message by going to the next page or saving your form to drafts.
 - Errors are run one at a time. The first error will be flagged until it is fixed. To move on, you need to fix that error, then try to move on/submit again. Then the next error will be flagged. The form will continue to flag errors until all errors are fixed.

Types of value checks:

- **Legal values:** Certain values have a specific range of allowed values. For example, pH values must be between 0 and 14. These values will be flagged until they are fixed. You cannot submit a form if a value is different than what you expect.

- **Typical values:** Certain fields have ranges that are possible, but not typical. These values will come up with a warning note. While you can submit a form with a warning, it is best practice to make a comment justifying your value. For example, while a conductivity of 1500 μs is possible, it's a little unusual. If I took this value in a salt marsh, I'd add a comment on the last page of the form such as, "High conductivity values are expected based on salt crusts on bare soil patches and location on salt marsh."
- **Logical values:** Certain fields have logical data checks based on the values entered into other fields. For example, water depth in a soil pit should be greater than or equal to 0 if surface water was observed at the soil pit, while groundwater should be less than 0. These may have either an associated warning message, a constraint, or both. In most cases, you will not be able to submit the forms until these issues are fixed.
- **Required fields:** Required fields are denoted by a red asterisk in the form. If you see this next to a question, you will not be able to proceed to the next repeat or submit the form until you answer it.
 - In some cases, fields will only be required after another question is answered. For example, channel depth questions will only be required after you have selected that there is a channel in your plot. Be careful, if you entered depth questions, then accidentally changed the channel present question to no, your data will be cleared.

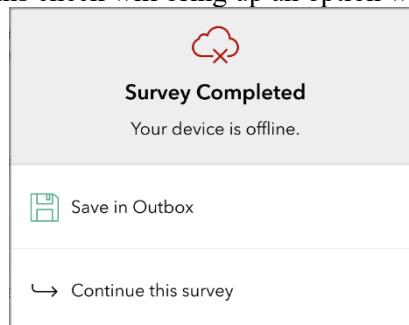
Summary pages

Many of the complex forms have summary pages on the last page of the form. These pages can help pull together data in ways that Users can navigate to this page at any time during data collection and review the summary data for what they have been able to accomplish. For some forms, this summary page can be used to check data as they enter it. For example, the list of required and submitted photos can be used to check which photos still need to be added to the form. Other summary pages should be checked at the end of the form to ensure values entered seem reasonable before submitting the data.

Forms will also complete all calculations necessary for calibration on a summary page of the given form. During a calibration event, each technician will need to write the values from their calibration even on the calibration tables included in Section II of this protocol.

Saving forms in your Outbox

If you are completely done with the form, review the summary page if it occurs, and make sure that everything is filled out and well documented. Then locate the check mark in the bottom right corner. If all form checks are cleared, clicking this check will bring up an option window:



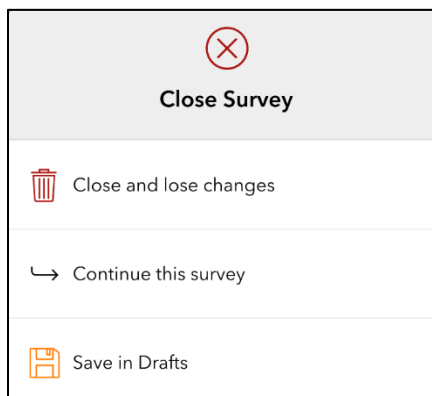
From here you can select "Save in Outbox" to submit the form.

It is recommended that LPI and Woody Structure and Annual Use forms are submitted directly to the outbox upon completion. This saves a copy that is more difficult to delete from your iPad than forms submitted as drafts. Because these forms require a lot of time to complete and are unlikely to be edited

after they are completed, it is better to submit them to your outbox rather than to drafts.

Saving forms in Drafts

Alternatively, if you need to move to another form before you have finished your current form, you can exit the form using the “X” in the upper left-hand corner. **Always be very careful when exiting a form, as clicking the “close and lose changes” button will completely delete an unsaved form and erase any changes you’ve made to an edited draft form.** To save this form in drafts, click the “Save in Drafts” button.



All forms besides LPI and Woody Structure and Annual Use forms can be saved in drafts until you finish a site. Before leaving a site, it is recommended that all forms besides Species Inventory and Unknown Plants are submitted into the outbox. This ensures that all QC checks will be completed on the forms before you leave and any issues that come up can be addressed immediately. Species Inventory and Unknown Plants forms are frequently edited further over the course of the hitch and they become more difficult to edit after they have been sent to the outbox. Additionally, data contained in these forms are backed up on paper, since Species Inventory is generally completed on paper during site sampling. These forms should only be submitted to the outbox at the end of the hitch when data is finalized.

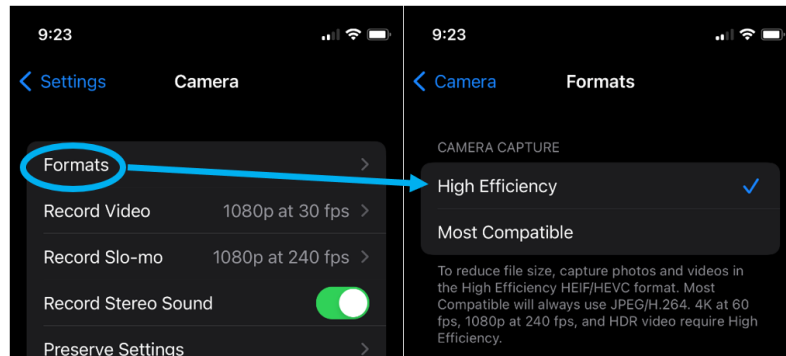
Form-specific recommendations

Plot Characterization

- The third page of this form can be used to assist in deciding plot layout. These fields follow the directions found in Section 4.0 in the field protocol.
- During plot characterization, technicians should also complete a plot drawing on paper. While an image of this drawing should be uploaded to the photo form, there is a question on the Plot Characterization form to ensure the drawing is complete before you can submit the Plot Characterization form.

Photos

- The structure of this form will allow technicians to submit as many photos as they want. 20 photos is not unusual, but many photos beyond that should be avoided to reduce the storage required on the backend.
- There are two ways to add photos to this form. Which method we recommend depends on the settings available on your iPad. Under settings for the camera app, most iPads will have format options. Here you should see an option to store photos in High Efficiency format, rather than most compatible.



- If your iPad has this option, we recommend taking photos in the camera app, then uploading to the Photos form once you've taken your best photos. This offers the best option for uploading photos with the highest compression while also being able to view photos in your photos app later.
- If your iPad does not have this option, your iPad will not compress photos as they are taken. In this case we request you take photos directly in the Survey123 app, where Survey123 will automatically compress the photos taken.
- Photos taken directly in Survey123 can be viewed later by going to your files app, then navigating to: On my iPad>Survey123>ArcGIS>My Survey Attachments. These photos can also be saved and viewed in the photos app.
- It can also be good to consolidate photos onto the primary iPad following each site to reduce the amount of iPad juggling.
 - While offline in the field, this can be accomplished by using the AirDrop feature. To use this feature, Bluetooth will need to be enabled on both iPads. Settings may also need to be adjusted (Settings>General>AirDrop) so that receiving is turned on for Everyone.
 - If some photos were taken directly on the camera, it is also possible to upload files from your photos app into Survey123.
- The final page of this form includes both a list of all required photos and which photos have been submitted. Use this page while putting together all the photos to remind you of which photos have already been added.
- After this form has been submitted to the outbox, you will no longer be able to edit photos that have already been added. Make sure you are happy with the form before submitting it to the outbox. If you need to switch out a photo later, add to the comments of the photo you want deleted, add the photo you want to replace it with, and submit a known errors form requesting the data team delete a photo.

Soils

- Technicians may prefer to write data down on paper first, then transfer the data into the form after filling in the soil pit. If you do this, make sure **to launch the form at the soil pit, as the location of the form should indicate the location of the soil pit.**
- Hydric soil indicators are filtered based on LRR and Major soil type. Before entering hydric soil indicators, ensure both of these fields are populated correctly.

Natural and Human Disturbances

- Technicians should always refer to Table 9 on page 83 of their protocol while completing this form for detailed descriptions of ratings for each disturbance. Many disturbances have standard impact scores that can assist technicians with properly rating a given disturbance.

- Some disturbances should only be rated on either the monitoring plot or the surrounding landscape. When selecting one of these disturbances, the scope and degree fields will only show for the appropriate area.
- After submitting the form the first time, Disturbances can be added and edited, but they cannot be deleted. Crews should submit known error forms for any Disturbances they want deleted after submitting the form.

Species Inventory

- Species inventory will show a wetland indicator status based on the Wetland Indicator Region of the plot. This can be helpful before deciding whether a plot falls within the target population to assess whether there is a dominance of hydrophytic species.
- Species Inventory forms should be completed after finishing a site by transferring data from a paper datasheet into the form and should only be sent to the outbox when a crew is confident that no more edits will be made or on the final day of a hitch.
- A list of all species entered into the form can be seen on the final page of the form. This can be used to check that your list is complete without needing to flip through all of the species repeats. It can also be used to check where in the list of repeats a particular species occurs.
- After submitting this form to ArcGIS online, you will be able to add species and edit species, but deleting entries will no longer be possible. Follow the recommendations found in Section 5 of the Data Management Protocol on resolving species errors.

Unknown Plants

- Unknown Plants forms should be completed after finishing a site by transferring data from a paper datasheet into the form. This form should only be sent to the outbox when a crew is confident that no more Unknown Code edits will be made or on the final day of a hitch.
- On the final page of this form, there is a list of all unknown plants entered into the form. This list should be used to double check that unknown plants have been entered correctly. It should also be used to double check that no duplicate species have been entered. **This form does not have a QA check on duplicates, so crew members are responsible for double checking this list before sending the form.**
- For each unknown species, Family, and Genus fields should only be used with high confidence.
 - For plants never identified to species, Family and Genus fields will be used after the field season to provide additional information about that plant.
 - For example, if FABACEAE_01 is identified to the genus Trifolium, it will be counted as a non-native species since all Trifolium species are considered nonnative. Likewise if SH_02 is identified as a Ribes, it will be counted as a shrub. If you are not confident of family or genus, you can select “Unknown” for these fields.
- After this form has been submitted, crews will still be able to add additional species and edit old entries, but they will not be able to delete an entry. Follow the recommendations found in Section 5 of the Data Management Protocol for more information on resolving species errors.

LPI

- This form can be used either going from transect start to end (0 – 25 m) or end to start (25 – 0 m) using the ‘Direction’ field found on the fourth page.
 - If a transect is being sampled backwards, crew members will need to flip to the fifth page to update the transect data for the end of transect before starting the form. After LPI is finished, they will then need to flip back to the second page at the start of the transect to update the start of transect GPS data.

- After the first repeat is added to the form, the direction of sampling cannot be changed. If you wish to change this before you start dropping pins, the form will need to be deleted and reopened.
- Default values can be entered for Top Canopy, Lower1, and Soil Surface on the third page of the form. A question in the point repeats will allow you to automatically push these values into a point.
 - These values can be changed mid transect. If values are changed, the new defaults will be applied to point repeats going forward, but they will not change previous points which used the old default.
 - It is also possible to partially change a default. This can be useful in cases where the Top Canopy is different from the default, but the Lower1 and Soil Surface codes are the same. The form should correctly update fields appropriately.
- No QA checks will verify that lower hit codes are used in the correct order. For example, if you skip Lower 1 and enter values for Lower 2, the form will not correct you. For this reason, it is essential that technicians ensure these fields are used correctly.

Woody Structure and Annual Use

- This form is created for three different potential sampling approaches:
 - Full sample visit with annual use methods – visits when you are collecting both Woody Structure and Annual Use methods. In the Plots layer of the webmap, a field, ‘CollectAnnualUse’ will indicate whether annual use should be collected by the contract crew during their full sample visit.
 - Full sample visit without annual use methods – visits for which project leads have not requested Annual Use data.
 - Annual Use visit – visits when you are only collecting annual use metrics.
- These options are captured by the questions on the first page:
 - Answers to these two questions will filter which questions appear in the rest of the form.

Will annual use be collected? *

☐ Yes ☐ No

Will woody structure (stem size and height class) be collected? *

Select no if this visit is for collecting annual use only.

☐ Yes ☐ No

- Additionally, we’ve provided a way to submit the form more quickly in the event of a site with no woody species present.
 - In this case, you are intending to collect a method on woody species, so “yes” should be answered to the appropriate question above to indicate you will be collecting that method.
 - On the third page of the form, a question at the top can be used to skip woody species measurements on that transect, rather than filling in “N” for every quadrat.

Are there woody species present on this transect?

Be sure to walk the entire transect before selecting no.

☐ Yes ☐ No

- **If there are no woody species on the transect and you are not collecting annual use,** you will want to submit the form with no points added

Hummocks

- This method is a contingent method. It is only required if the ‘CollectHummocks’ field in the Plots layer of field maps says “Yes”. Make sure to check whether Hummocks is expected at the site before launching this form.
- If Hummocks are expected but there are no hummocks on the plot, a question in the form allows you to complete the form without entering any hummocks.

Water Quality

- This method is a contingent method. It is only required if the ‘CollectWQ’ field in the Plots layer of field maps says “Yes”. Make sure to check whether Water Quality is expected at the site before launching this form.
- If this method is expected for the current plot and there is enough surface or groundwater at a site, technicians are required to record one or more measurements of water quality.

Known Errors

- Known errors forms should be used by technicians for two different reasons:
 1. To correct errors in your forms that ***you cannot fix yourself***. Examples include:
 - Deleting any repeats from already submitted forms.
 - Corrections to species in LPI that will not be fixed by the Unknown Plants forms
 - This includes changing an unknown code to a different species or unknown plant or changing a species code to an alternate code.
 - This does not include changing an unknown plant to what it was identified as. This is not an error and should be addressed using the Unknown Plant form.
 - Changing the PlotID or EvaluationID and any other fields that are read only in the forms.
 - Logging forms you forgot to collect and can no longer fill out outside of the field
 - This does not include forms like Hummocks, Woody Structure and Annual Use, Water Quality, or Soils which were not collected because they were not observed. These forms have alternate ways to submit them without collecting any data.
 2. To submit issues or suggestions for improving the functionality of technology.
 - Take a screenshot of any warnings that come up that pose a problem. This will help us diagnose where the problem is coming from.
 - Issues that need a more immediate resolution should be communicated directly with the Riparian and Wetland AIM Data Team. This will allow them to troubleshoot and consider ways to avoid the same issue occur in the future.
 - If you find a QA check in the form prevents you from entering what you see, first check your protocol to make sure the measured value is possible based on the method details.
 - Be sure to indicate whether a technology issue prevented you from entering data as it was measured.
 - General issues that continue to come up do not need to be submitted for every plot unless a value needs to be changed in every plot. For example, if you wish a field were in a different place of the form, submit this as a known error the first time you observe it, rather than every time you use that form.
- The National Riparian and Wetland AIM Data Team is also working on a method to log any errors we find in this form as well. These errors will be logged using the Issue Type of “Scripted Error Check”. Technicians should not use this issue type.

- When logging an error for the first time, all information about the initial problem should be logged in the “Initial Error Documentation” section of the form. For most errors, the ‘Respond to Issue’ group, should only be used in a browser after the issue has been submitted the first time. Additional information explaining this functionality will be provided in the future.
- If you are requesting an edit by the National Riparian and Wetland AIM Team, include all information in the comments that we would need to locate and fix the issue.
- **Species errors** are a special kind of issue that require careful documentation to correct. If entering information on a species error, you’ll also have to provide information on how best to resolve the issue.
 - Most often species errors will be found during the QC process after all data has been submitted. In these cases, crews will more often be responding to species issues, rather than submitting new issues.
 - Under the respond to issue category, you’ll find a few options of ways to resolve the errors you are documenting.
 - “Crew added species code...” will only be used if the Data Team documents an error that the crew can easily resolve themselves. In this case, a crew may respond by fixing the issue in their forms.
 - “Delete species code...” should only be used to remove species from Unknown Plants or Species Inventory. Entries cannot be deleted from these forms by crews, so this field will indicate to the Data Team that edits are needed from them.
 - “Switch species code...” should only be used for transect based forms and **not species inventory or unknown plants**.
 - If a species needs to be switched out in both Woody Structure and Annual Use and LPI, you’ll need to submit two forms to resolve this issue.
 - For all code replacements on transect forms, use the ‘Line number’ field to indicate which transect a species occurs on. We will use the Incorrect Species field to search and replace codes on either the whole plot or a specific transect for all occurrences of a species.
 - “Other” should be used when the Data Team needs to complete more manual editing not covered by one of the other options. For example, if I need all POPR hits occurring after 1800 m to be replaced with POSE, but not those occurring before 1800 m, I’ll need to use the other category to specify these edits.

Data Backup

Survey123 Data

All sampling data is contained within the Survey123 app until it is submitted to AGOL at the end of the hitch. This data should be backed up after every two plots at a minimum.

1. Open your Files app and navigate to the Survey123 data folder (On My iPad > Survey123).
2. Click and hold the ArcGIS folder until the popup appears with more options. Click Compress. This will create a zipped copy of this folder directory.
3. Click and hold the .zip file you created and give the file a more logical name with the date.

Next, using your USB drive, transfer your zipped file to your external storage device. Users can keep replacing zipped files from the previous backups so there is only one backup file on their USB.

Field Maps Data

Field visit data is recorded in Field Maps and should be backed up at the same time as Survey123 data. Plots and Field Visits are stored in a geodatabase within a Field Maps folder under your iPads files. This is the file that you backup to your USB drive, but it can be tricky to navigate to.

1. First ensure that the USB Drive is connected to your iPad. Next open the “Files” app on your iPad and open the “Field Maps” folder.
2. Select the folder starting with your geoplatform account username, then select the mapareas folder.
3. Inside this folder, you will see folders named with alpha numeric codes. You will have one folder here for each Offline Area you make in Field Maps. There is no easy way to identify which folder contains which map. If you are looking for one in particular, you can open each folder and see the thumbnail jpg that is stored and displayed in Field Maps.
4. Within each of the “Offline Areas” folders along with the jpg thumbnails, there is another folder with an alpha numeric UID name. Open this. Next, locate the file called “p13” and open it.
5. Within the folder called “p13” you will notice a few files. As you can see, the largest file in this folder is likely the .tpk base map. We do not want this file. The only file that we want to backup is the file that ends with a “.geodatabase” extension
6. Click and hold the file with the “.geodatabase” extension and then select “Compress”. This will create a .zip file of your selection in the same folder. Now select the zip file you just created and click and hold it. From the dropdown list, select “Share”.
7. In the “Share” popup, where it shows the list of apps on the device, scroll to the right until you see the three dots that say “More”. Click this. In the next window, scroll down until you see the name of your USB drive and select it.
8. This will launch the app and it will ask where you want to save the file. Click the “Create New Folder” button and create a folder to store all Field Maps Backups. Once you determine where to save this file, hit “Save Here” at the bottom of the screen.
9. You have now backed up a geodatabase containing the Points and Field Visit features that you took offline in your map. If your device dies or you accidentally delete something, you can send this zipped geodatabase export to the Riparian and Wetland AIM Data Team.
 - a. Note that it is also recommended that users go back into the Files app and delete the zip file that you created.
 - b. Feel free to rename the zipped folder to something you can remember more easily. It may be further advantageous to create a categorical folder structure where you move the zipped files to organize things by trip.

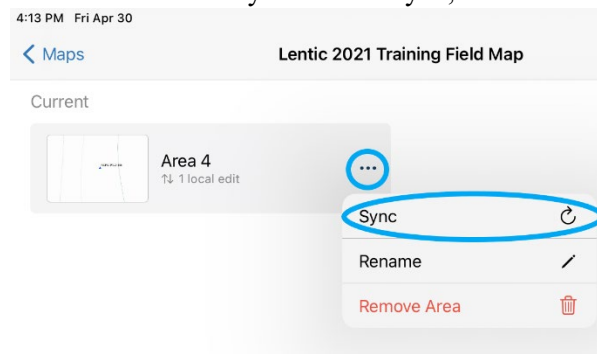
IV. Returning from a hitch: Data review and submission

Overview

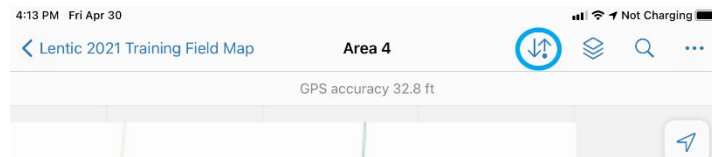
Upon returning from the field, all data needs to be synced and submitted to ArcGIS Online. From there, the National Riparian and Wetland AIM Team, Project Leads and/or crew managers will review data following the guidance found in Section 4 of this protocol. All of these steps expect that your iPad is connected either to cell service or Wi-Fi.

Syncing Field Maps back to ArcGIS Online

1. Once your iPad is connected back to a strong reliable Wi-Fi connection, you can either submit from a Map offline area menu or from the map itself.
2. To submit from the main menu, select the Field Map from the list of maps.
 - a. Any maps with local edits will show the edits beneath their titles in the main menu.
 - b. Select the three dots on the offline area you want to sync, then select Sync.

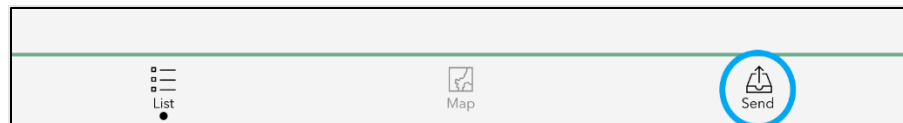


3. Alternatively, you can sync edits from the map itself by selecting the sync button on the top bar of the map screen.



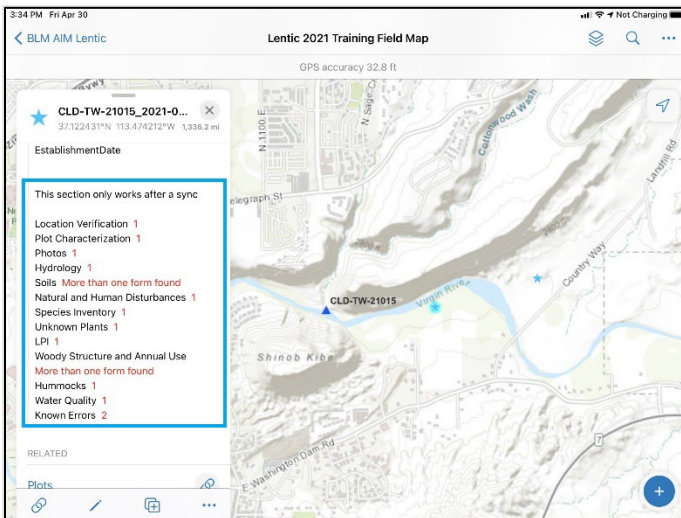
Submitting forms from Survey123 to ArcGIS Online

1. After every hitch, make sure all forms have been submitted to online.
 - a. You can check whether this has been done by opening the Survey123 app and looking at all your downloaded forms.
 - b. All forms in drafts will show up as an orange number in the upper left corner of its form. All forms in the Outbox will show as a green circle in the same place.
2. For any forms in your outbox, select the form with a green circle, then select the “Outbox” ribbon at the bottom of the screen.
 - a. If all forms in your outbox are ready, click the “Send” button at the lower right corner of the screen.



- b. All Outbox forms from one form type will be submitted at the same time.
3. For any forms in drafts, select the form with an orange circle, then select the “Drafts” ribbon at the bottom of the screen.

- a. Each form in draft will have to be opened and clicked through in order to send.
 - b. Be careful not to accidentally change any data as you are reviewing forms.
 - c. Some QA checks in Survey123 only occur when the form is submitted. For this reason, it is recommended that all forms aside from Unknown Species and Species Inventory are submitted to the outbox prior to leaving a site. This way, any errors that come up can be corrected on site.
4. At this point, after Field Maps have been synced and Survey123 forms submitted, your field visit point will show how many of each of the forms have been submitted.
 - a. In Field Maps, select one of the field visit points for a specific site.
 - i. After syncing both iPads, you will have two Field Visit points per sampled point, as each iPad will have created its own point with identical information. This will be fixed after the field season by the National Riparian and Wetland AIM Team.
 - b. In the pop-up, scroll down to the last section of the pop-up listing all the field forms. Check that all form counts are what you expect.
 - i. For Full Sample visits, you should see at least 1 form submitted for all forms except for Known Errors, and three forms for LPI, Woody Structure and Annual Use.



- ii. For Temporary and Permanent Rejections, only a Location Verification form should show up.
 - iii. For Annual Use Visits, only 3 Woody Structure and Annual Use forms should be submitted, as well as a Species Inventory and Unknown Species form as needed.

Updating sampled sites in Office Eval Webmap

1. After returning from a hitch, crew leads should update information in the Plots layer of the Office Eval Webmap to reflect information gained during field sampling.
2. Go to ArcGIS Online using this link: <https://www.arcgis.com/index.html>
 - a. Login using your geoplatform account
 - b. Navigate to the BLM AIM Riparian and Wetland group in Groups, then select the link in the description to the Office Eval Webmap.
3. Update information for sites you visited during your most recent hitch.
 - a. It may help to filter the map to only the points in Hitch 1 of your Webmap.
 - b. For sampled sites:
 - i. Update OfficeEvalStatus to “Sampled – Waiting for Data Review”

- ii. Update Plot Layout comments field with how you actually ended up laying out the plot.
 - iii. Update Access Instructions to reflect any changes in directions that occurred in the field that may help future crews navigate to the site.
 - iv. Update Hitch Notes with comments about how sampling actually went, including difficulties in access, unexpected challenges, and any other information that may help crews know what to expect at the site.
- c. For Rejected sites:
 - i. Update OfficeEvalStatus to either “Rejected – Waiting for Project Manager approval” or “Reattempted – This season at another date” as appropriate.
 - ii. Update RejectedReason to the appropriate option. This should match the rejected reason found in your Field Visit point and the Location Verification Form.
 - iii. Update the RejectedReason1 and 2 with information that led to rejection. Your field visit may be one of the two lines of evidence used for the rejection.

APPENDIX B. EXAMPLE TEXT FOR COMMENT FIELDS

Overview

Throughout all Survey123 forms, comment fields are provided for crews to add additional comments that are important for understanding the context of site sampling. These can be good places to put more thorough observational information or issues that came up during sampling that may explain measurement values. To understand the format these comments should take, below are examples of comments submitted to various comment fields. While the following is not an exhaustive list of potential information to include in each field, they should be used to understand the level of detail recommended for these fields. Not all comment fields are required, and crews should only use optional comment fields to add context to submitted data. In all cases, crews should be careful to ensure comments are clear and free of spelling errors.

Location Verification

Sample Location Status Comments

This field should only be used for rejections or sites on the borderline of the target population.

- Site was dominated by UPL and FACU plant species. *Pascopyrum smithii* was the dominant plant species with *Artemisia ludoviciana* beginning to encroach. There was no possible riparian or wetland area within 50 m where we could locate the plot.
- Could not access due to flooded roads.
- Small wetland area at sample design location with dominant species of IVAX, JUARL, and *Epilobium* species. The area was around 15m by 20m and too small to accommodate three transects.

Detailed directions and access comments

These can often be copied directly from access comments written in the plots layer of the Field Eval Webmap in Field Maps. Directions should start with a specific location or landmark (such as a town or mile marker on a highway) and describe all turns and mileage required to access the site location.

- From Dillon drive south on Interstate 15 for 41 miles. Take exit 23 for Dell. Turn left to Main St, left again on Red Rock Rd N for 0.4 miles then E (right) onto Sage Creek gravel road for 17 miles. Turn NE (right) for 0.6 miles up 2 track, then right again down the drainage 500 yards. Pull over before crossing the creek and hike S 400 Meters.
- Take Hwy 50 west from Gunnison to Co Rd 867/Alpine Plateau Rd. Take Alpine Plateau Rd south off of 50. Continue south to Co Rd 65, at 38.245740°N 107.368835°W. Turn right. Continue on Co Rd 65 for 5.3 mi and park at the end of BLM Rd 3006c. From there, hike the ATV road north until you hit a road that switch backs down into the valley (about 1.5 mi). Once in the valley follow the road 1.3 miles north to the point. Right before the road crosses the creek, stay on the right side of the creek and continue through the willows to the plot. This hike is about 3 miles total, but mostly all on roads.
- Head S out of Cannonville, UT on Kodachrome Basin Rd for 2.7 miles to Skutumpah Rd (signed Bull Valley Gorge). Follow Skutumpah Rd for about 2.65 miles. The site will be on the right/ to the W of the road. Skutumpah Rd becomes impassable after heavy rainfall.

Plot Characterization

Comments on why the plot was shifted

- Sample Location could accommodate a spoke layout by moving a little N.
- Plot was moved to avoid non target vegetation.
- Shifted out of deep water and to maximize plot dimensions. Targeted site allowed for shifting >50m.

Plot Layout Justification

- The Riparian or Wetland area is a narrow v-shape which does not provide enough area for a spoke layout. The wedge of upland vegetation in the middle of the v-shape also does not provide enough hydric vegetation to sample for a transverse layout.
- Site was too narrow for a spoke, constricted by upland vegetation on both sides of the meadow.
- The dominant OBL and FACW vegetation was only within a 15 by 32 meter area. Using the diagonal plot layout design was our only option for setting up a plot given the size of the wetland.

Classification comments

Classification comments should be used in sites which were difficult to classify or had multiple categories that applied.

- Topographic maps classify water regime as 'C' but due to the amount of water present and nature of the system (cattails, well shaded), water regime 'F' seemed the best overall fit.
- Wet meadow was dominant wetland type, but pockets of wetter marshy vegetation were also on plot.
- We considered Riverine as the HGM type, but the plot also receives significant input from regional groundwater.

General Plot Description

This should be a short paragraph describing various aspects of the plot. Start by briefly describing the wetland type, landscape position, dominant vegetation, general hydrology, soil type, and major land uses observed during sampling. Crews should do their best to make this description flow well, avoiding abbreviations and editing for grammar and spelling.

- The plot is a seasonally saturated meadow that sits at the toe of a slope near the head of a valley, and is surrounded on 3 sides by forest. Vegetation is dominated by *Veratrum tenuipetalum*, *Calamagrostis canadensis*, and *Caltha leptosepala*. Outside the plot, meadows with varying hydrology continue linearly in a forested corridor down to Oso Creek. There is a small dry depression/pond about 10ft across at the SW edge of the plot. The soil pit had a narrow fibric surface layer subtended by very dark clay layers with redox soft masses and concretions, meeting hydric soil indicator F6 (redox dark surface). There are cow pies present in and around the plot, indicating at least some use by cattle.
- This spring site is located in a drainage valley between two hills. It has a dominance of *Salix boothii* and *Salix geyeriana* with an understory of various forbs, graminoids (*Poa pratensis*, *Glyceria striata*, *Carex pachystachya*, *Carex nebraskensis*), and shrubs (*Actaea rubra*, *Ribes* sp.). The main hydrological features are springs and a seep located on the southern part of the plot, flowing northwest. The soil had four horizons: a shallow

organic horizon sat upon clay and alluvial horizons with small, varied redox features. There is some evidence cattle grazing based on obvious signs of herbivory on *Salix* and various graminoids as well as hummocking and soil alteration throughout the plot.

- The sample plot is located in an emergent riparian zone adjacent to and including parts of Short Creek. The plot appears to be dominated by local floodplain groundwater, with some parts of the plot likely experiencing some overbank flooding in wetter years. Short Creek was dry at the time of sampling. The plot was dominated by *Poa pratensis* and *Salix boothii*. The soils were fine textured and exhibited no hydric soil indicators. A sign was located at the edge of the road indicating that this is a wilderness study area so the major land use for the area appears to be preservation.

Photos

Photo comments

Photo comments will be used as captions for submitted photos. Comments are recommended especially for photo types that may include many different kinds of photos, such as Disturbance and Hydrology.

- Spring-fed pond NW of plot center.
- Headcut 10 m north of plot center demonstrating channel erosion of Spring Creek.
- Overview taken north of Transect 3 facing SW.

Hydrology

Hydrology description

- Predominant inflow is seepage from the impoundment. It forms a wet meadow at the base of impoundment and continues to flow downstream. Appears that there is also seepage coming from northern slope. The site currently has standing water in depressions and it seems to be there for most of the year based on aquatic vegetation.
- Pond fed by inlets and regional groundwater. Two small inlet channels feeding into NW corner of pond. One small outlet channel on SE side of pond. Soil on edge of lake smells like sulphur. Sporadic saturated soil throughout plot. Dry channel, vegetated with *Carex utriculata* and lined with thatch, feeding into pond across plot between T1 and T2. Evidence of some erosion upslope at start of dry channel, but no head cut exists.
- Overland flow moves from uplands into closed depression on landscape. Soil pit had gleyed horizons with redox above gleyed layers which might indicate longer periods of saturation in lower soil horizons as a result of high groundwater.

Soils

Horizon Comments

- High density of roots made texturing difficult.
- Redox features showed as root nodules and soft masses.

Comments

- Pungent hydrogen sulfide odors were an obvious hydric soil indicator for this site, as well as qualification for Black Histic (A3) from the deep fibric and hemic layers observed. This soil may also qualify for A2, histic epipedon, but we did have the definition for “aquic conditions” provided in the Keys to Soil Taxonomy.
- Distinct horizonation consistent with pit location adjacent to stream channel.

- Second pit dug 20m north of plot center in spongy area revealed a histic epipedon, but full profile description not completed.

Natural and Human Disturbances

Disturbance Comment

Be careful to avoid subjective or critical language.

- Road adjacent to wetland area that stretches throughout the private and BLM lands. Well maintained and gravel.
- There's an old, abandoned car about 100 m from the plot and a few pieces of trash were found on the plot.
- Invasives *Bromus tectorum* and *Cirsium arvense* observed on plot.
- Multiple cattle trails cross the site and there are many patches of fresh cow pies.

Unknown Plants

Additional description of Unknown Species

- Multiple florets per spikelet. Hairy ligule. Rhizomatous.
- Very densely woolly hairs, alternate leaves, tap root. No flowers observed.
- Identified as *Plantago major*, but species missing from state species list.

LPI

Transect Notes

- Transect bent at 13.34 m and azimuth changed to 256 degrees.
- Points at 24-25 meters were estimated due to extremely dense willow patch.

Water Quality

Water chemistry comments

- Conductivity read consistently above 1700 us, but values make sense given salt crusts and salt-loving plant species observed on plot.
- YSI measurement 2 taken adjacent to hot spring, explaining the high water temperature.

Known Errors

Reason or Explanation

- Incorrect photo submitted for overview with markup. Correct photo added. Delete original overview uploaded.
- Incorrect subspecies selected. Delete JUAR2 from species inventory. Has been replaced with JUARL.
- Change CIAR2 at 2250 on transect 1 to dead.