WETTED HABITAT ASSESSMENT PROTOCOL

California Sea Grant - Russian River Coho Salmon Monitoring Program

Overview

Wetted habitat assessments, also known as wet/dry mapping, are conducted to document the presence of surface water in the stream channel during the dry season. The number and frequency of surveys depends on project-specific objectives and funding. Most streams are sampled once annually at the driest point in the season, generally in September or early October. Intensively-monitored streams are surveyed at defined intervals between April and October.

During all wetted habitat assessments, surveyors start at the mouth of the stream or at the downstream end of a pre-established survey reach, and use the ArcCollector Class application on a tablet or other GPS-enabled mobile device to map surface flow conditions as they move upstream through a reach. Point measurements of water temperature and dissolved oxygen (DO) are measured using a handheld DO meter at set temporal intervals. Additional data, such as DO calibration points or canopy cover, may also be collected at designated pools where continuous loggers are deployed.

Segments of wet or dry streambed are recorded as line features. Guidelines for defining wet and dry lines are as follows:

- **Wet lines** are defined by continuous surface water, meaning the pool or flatwater unit downstream is connected to the one upstream by a **continuous**, visible path of water.
    - If the path of the water is shallow, unpassable for fish, or standing, it is still considered a wet line as long as there is an unbroken, visible path of water.
- **Dry lines** are defined by **any disconnection** in surface water.
    - Dry lines have no measureable water, even if the gravel appears wet. Disconnections of any length, even several inches, should be recorded as dry lines due to the potential impacts to water quality.
- If a riffle is not entirely dry but is disconnected at multiple points, start your **dry** line at the furthest downstream disconnected point and continue it through the furthest upstream disconnected point within the riffle.
- An isolated pool should have a minimum length of 10’ and/or a minimum depth of 1.0’ in order to be recorded as its own wet line feature.
    - Small, uninhabitable puddles within a dry line do not constitute a wet line.
    - Surveyors should use their best judgement to characterize anomalies with the understanding that these maps have been used to guide fish rescue and/or flow augmentation strategies.
    - Isolated pools that contain high numbers of salmonids should be documented in the comments of that line feature and reported to supervisors at the end of the survey.

NEW COVID-19 Special Circumstances

Please read through both the general COVID-19 safety guidelines and the wetted habitat survey specific instructions which can be found in Y:\Administration\Safety\COVID-19\SocialDistancing_SafetyPlans.

Protocol

Before leaving the office

Collect the gear listed below. If the wet/dry survey is paired with a CMP survey, any duplicate gear, such as backpacks, SPOTs, and first aid kits, is not needed. GPS-enabled device, such as Trimble, Mesa, or cellular-enabled device (such as personal cell phone), or a tablet paired with Bad Elf.

- Garmin
- DO meter and accompanying field bag with fresh batteries and screwdriver for installation
- Dry backpack
- SPOT safety tracking device
- First aid kit
- Clipboard with permit, wet/dry paper data sheet, and following protocols
    - Wetted Habitat, Dissolved Oxygen, Flow
- Field notebook and pencils
- Pink flagging
- Hand pruners
- Conductivity meter
    - ***Only if collecting data in conjunction with CMP snorkel surveys on WIL, DUT, GRE and MIL creeks. Measure conductivity in the first pool unit and include the value in the comments to help us determine limitations to electrofishing.***

Ensure that the field data collection device is signed into the Sea Grant Enterprise portal on both **ArcCollector Classic** (the new Collector app does not support our workflow) and **Survey123**. Failure to sign into these applications before leaving the office will result in an inability to collect data. Follow setup instructions on **page 6** to confirm that the application and data collection settings are correct.

In ArcCollector Classic, confirm that you have downloaded “Field Map: Wetted Habitat”. Maps should be synched daily, so tap **Sync** (see page 7 for example) and open the map. If there is a red badge with a number next to the **Sync** button on the field map, that indicates that previously collected data was not uploaded to the cloud. Once the map is open, confirm that the stream scheduled to be surveyed, associated reach information, and if applicable, any previous survey lines are accessible.

Maps will be downloaded to the devices at the beginning of the sampling season, but it is helpful to routinely re-download maps throughout the field season. In Survey123, confirm that the Wetted Habitat data collection form is downloaded. Routinely check for and download updates to this form.

If using a device with built-in GPS, ensure that it is functioning correctly. If using an iPad and Bad Elf, you must pair them in the Bluetooth settings as well as the Collector Classic and Survey123 application settings. Make sure that the Bad Elf serial number displayed in the pairing settings matches the one on the back of the device. For more information on pairing the Bad Elf GPS units with non-cellular enabled tablets, refer to the separate **Elf Pairing Protocol_2019** and **Troubleshooting and Data Quality** protocols.

Finally, turn on the handheld DO meter and wet the sponge in the grey calibration boot. This device needs 15 minutes of warm-up and acclimation time before it can be calibrated. It must be calibrated every day. For more details on the handheld DO meter, check the **DO YSI Pro20 Field Protocol 2021**.

Spatial data collection

At the beginning of the survey, confirm that the DO meter is still on (auto-shutoff should be disabled, but confirm before collecting data). Open ArcCollector Classic and follow the steps below and the visual aids on pages 6-8. *Be aware that icons and prompts may appear differently on different types of devices*. Survey data are designed to be gathered and stored on ArcGIS Online servers. If there is a problem with the ArcCollector Classic application contact crew supervisors before using Garmin and paper datasheets. Garmins and paper data should be a last resort unless scheduled ahead of time.

Navigate to the Field Map: Wetted Habitat Map and click the **+** tab on the right or top. You will be prompted to **Collect a new feature**. Select either **Dry** or **Wet**, depending on the stream condition at the start of the survey. Fill in the all of the fields as described:

SurveyDate: The current date
SampleYear: The current calendar year
Crew: 2-3 letter initials of crew members in capitals, separated by a space (no commas)
CrewID: If only crew on stream, select **A**. Otherwise, label in ascending order from downstream (A) to upstream (G)
Agency: Select from dropdown list
Tributary: Select from dropdown list
SampleNum: The number of times this reach has had a wetted habitat survey conducted for the current season. For recurring survey streams, the current survey number will be posted on the warehouse whiteboard. ***If conducting an opportunistic survey in conjunction with a CMP survey, this can be populated as -9999.***
Condition: Wet or Dry; after first entry, will self-populate based on your initial selection, so change as needed
EstLenFT: (Optional.) Enter the estimated length of the current wet or dry stream segment if line segment is very short. This is useful in areas of high intermittency. After first entry, field will self-populate based on your initial entry, so be sure to change as needed for the duration of the survey.
Comments: Enter any relevant comments (i.e., fish stranded, flow release point)
WHID: Leave Blank

At the beginning of a wet/dry stretch:

When ready to begin hiking, slide the feature window to the right, on tablet, or select the map icon at the top of the page, on iPhone, to view the full map. Digitize a point at the beginning of your survey reach by tapping on the map where you'd like to place the first point, which will be at the beginning of the designated survey reach. GPS accuracy ranges from 1-5m in ideal conditions, so it is important to use major features (such as large bends or tributary inputs) to guide the placement of line features.

Discrete measurements of water temperature and DO are to be measured in pool units at 5-minute intervals. There is no need to measure PTC, as in previous years. Set the timer on the device for 5 minutes, refer to the **Environmental data collection** section on pages 8-10 for instructions on taking these measurements.

Put the tablet in sleep mode so you don't accidentally hit the screen and create a point. Walk upstream until the stream condition changes or the timer goes off. If you are streaming the lines instead of manually digitizing them, refer to "Digitizing vs Streaming lines" section below in the protocol.

At the end of a wet/dry stretch:

When the stream condition changes and the timer has not gone off, stop hiking and pause the timer. With the first point you digitized highlighted, drop another point upstream. Continue to do this and coarsely follow the shape of the stream until you reach your location. If the blue location icon is not displayed, give it a moment and then tap the **My Location** button. This will draw a point from the highlighted vertex all the way to your location. Erase that point if needed and finish digitizing your line feature.

Submit the feature by tapping the check mark, this will save the feature to the device's internal storage and prompt you to begin collecting another line. Notice that the line will be colored blue until you submit, and then will be colored blue or red based on whether it is wet or dry. Select **Like the last one, new shape** to copy the attributes, such as survey date, crew, tributary, and stream conditions, into the new feature. It is important to make sure the features are in sequential order from downstream to upstream.

Note: If the information in the fields does not carry over when you select "Like the last one, new shape," exit data collection, after submitting your feature, and go to the Collector settings. Make sure data collection style is set to "Continuous."

Change the condition (wet or dry) of this line segment to represent the next stretch of stream. Anything entered into the **EstLenFT** and **Comment** fields will carry over from the previous line feature, so edit or delete the text as needed. Digitize your first point upstream of the previous feature's end. Be careful not to overlap lines or leave large gaps in between features, as this will cause problems during data processing. Resume the timer and continue to hike until the stream conditions changes or the timer goes off (to indicate the need for a DO measurement), and then repeat.

Editing a submitted line feature:

To edit a line feature, exit the data collection by submitting the feature that is open. Situations in which you would want to edit a line feature include if the condition is incorrect, a comment is needed, or overlapping points need to be discarded. Never collect two lines of the same condition back-to-back. If you collect a wet line, submit it, and collect another wet line, this will cause issues with the data processing. Any loops digitized on the line feature will also cause problems, so discard any unneeded points. The cleaner the data collection is in the field, the easier it is to process at the office.

Tap the feature you wish to edit; it should highlight in light blue on the map. Tap the box at the bottom of the screen to open the attributes and click the pencil icon (pictured, top) in the lower left to make changes. Click the map icon (pictured, bottom) to edit vertices or individual points. When the edits are complete, submit the line once more. To collect data after editing a feature, you will have to re-enter the attributes for the next feature you collect.

Special circumstances:

If there is a portion of the stream that cannot be surveyed due to landowner access constraints, it is crucial that the line feature ends at the LOA-no property line and you start a new one when/if access resumes. Even if you can visibly see the stream as you go around the creek, do not digitize through a no-access parcel. Relevant landowner access information can be found in the map, in the reach information pop-up. To open the reach or

landowner information, exit editing mode by submitting the feature and then tapping on the stream reach or landowner parcel to open the pop-up window.

Digitizing versus streamline lines:

Digitizing lines is the standard method for collecting spatial data for wetted habitat surveys, as the surveyor is controlling the quality of the data during collection. This method yields cleaner lines which are easier to process in ArcGIS desktop software.

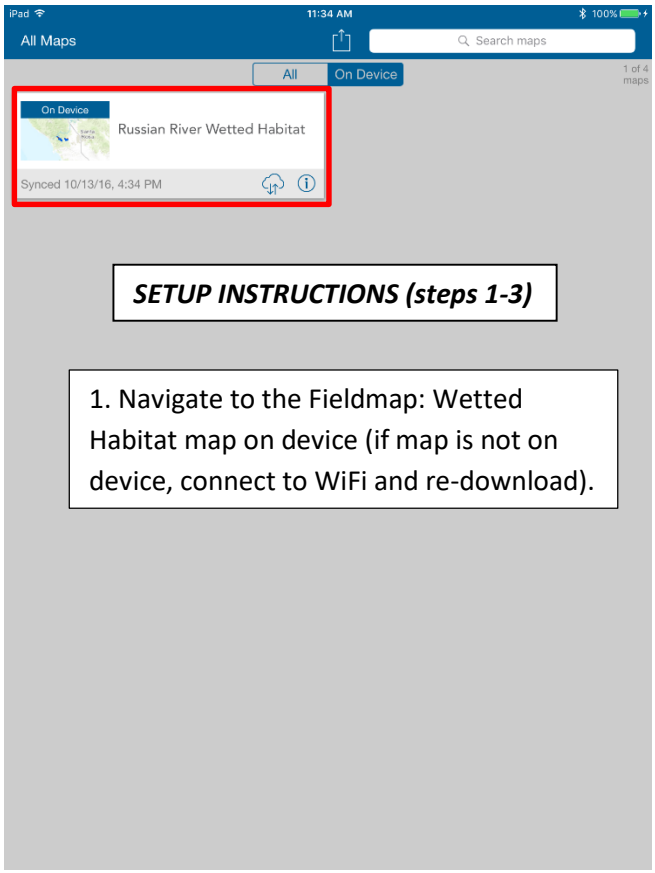
The **Streaming** mode is a tool best used for creating lines for long sections of uniform habitat conditions. With this collection method, the device takes a GPS point at a user-defined interval, typically every 15-30 seconds, and generates the feature as you walk. However, due to the accuracy of the GPS unit, the dropped points may drift away from the stream centerline. Additionally, overlapping points can be caused by stopping in the creek to talk to landowners, navigate around obstacles, or take a water quality measurement. If using streaming, be sure to pause the data collection if stopped at any point, and then resume once hiking begins again.

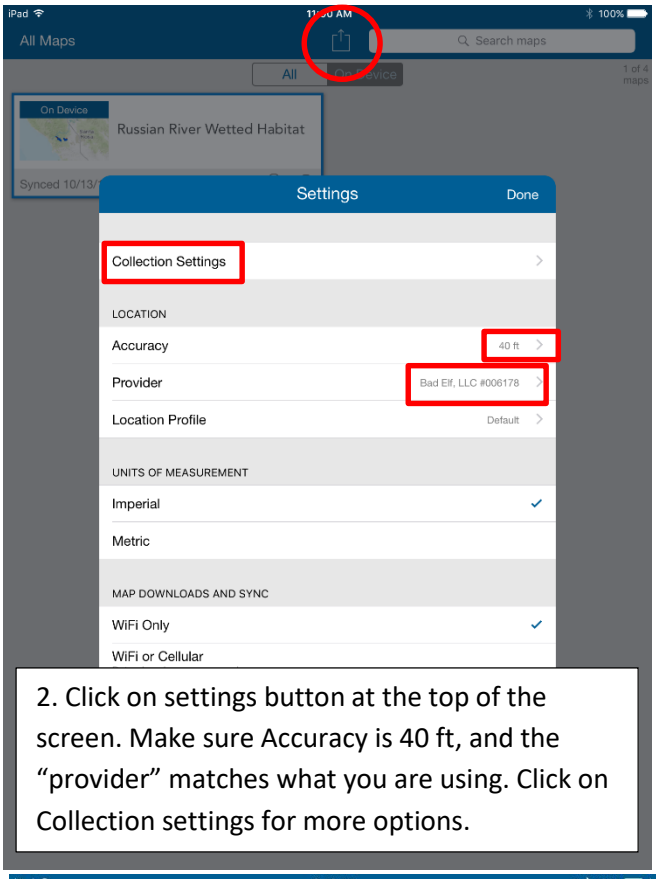
At the end of the survey:

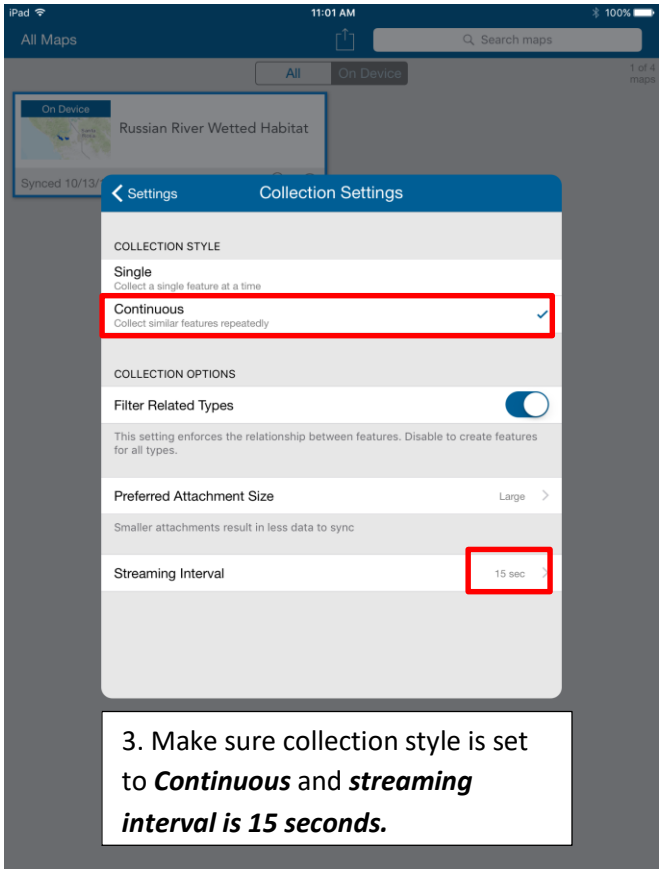
Instead of collecting another feature, tap **Cancel** in the top left corner of the screen or tap outside of the data collection box. If you are surveying an additional creek, travel to that creek before beginning a new feature. Create a new feature as described in the steps above, being sure to complete all attribute fields with the information associated with the creek.

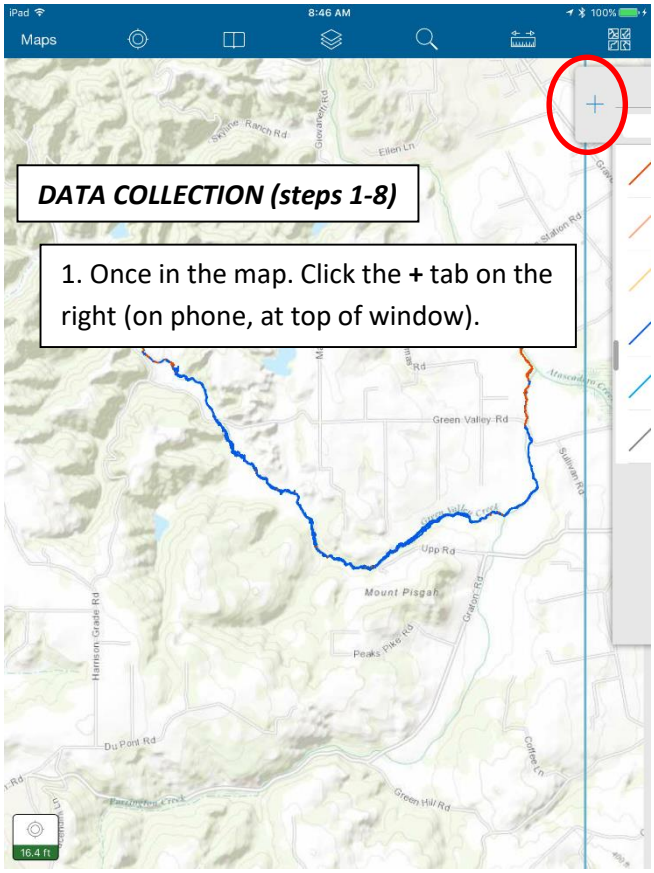
Tap **Map** to return to the map screen. There should be a red badge with a number on it next to the **Sync**  button. This is the number of wet/dry features that are ready to be uploaded back at the office while connected to the Wi-Fi.

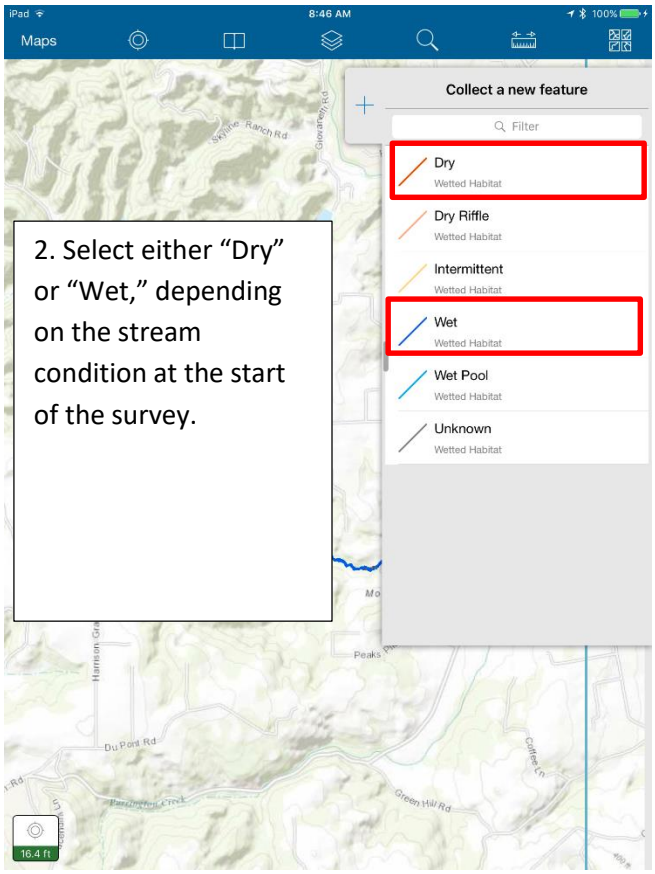
ArcCollector screenshots:



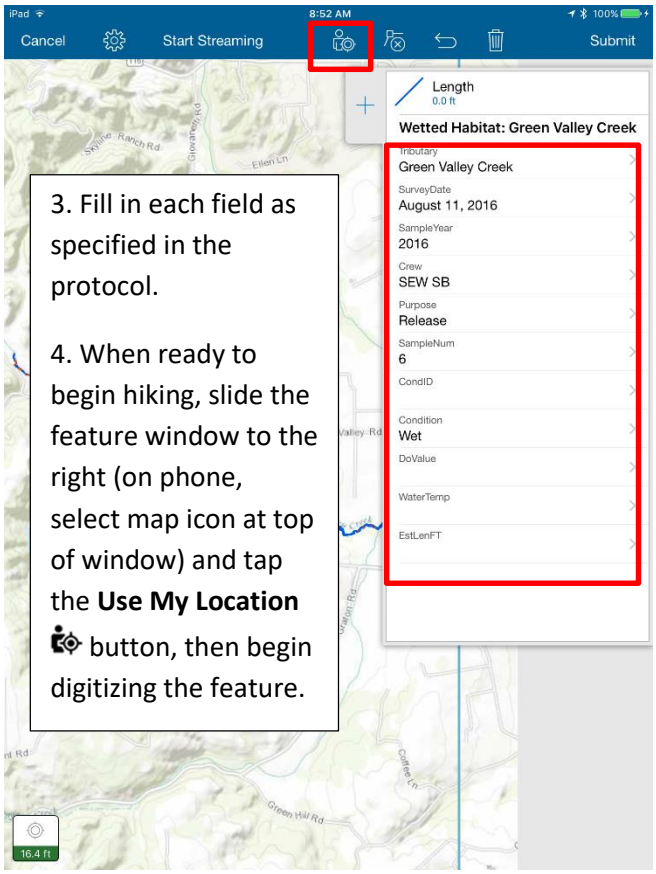






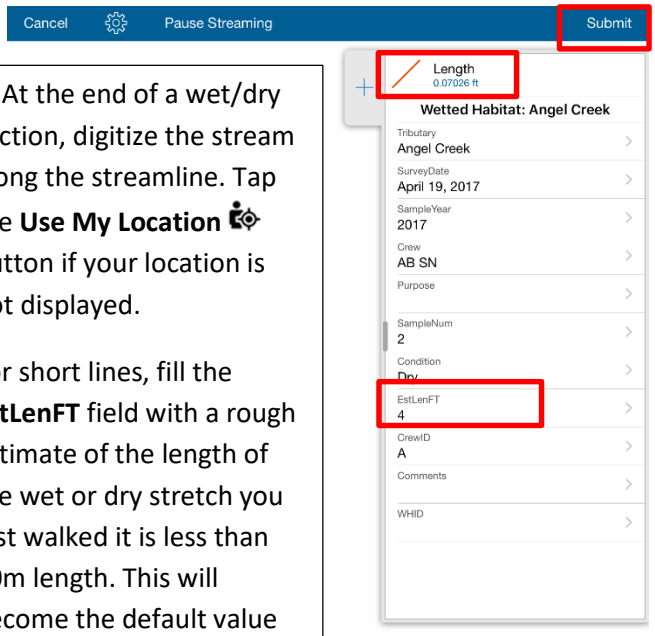


2. Select either “Dry” or “Wet,” depending on the stream condition at the start of the survey.



3. Fill in each field as specified in the protocol.

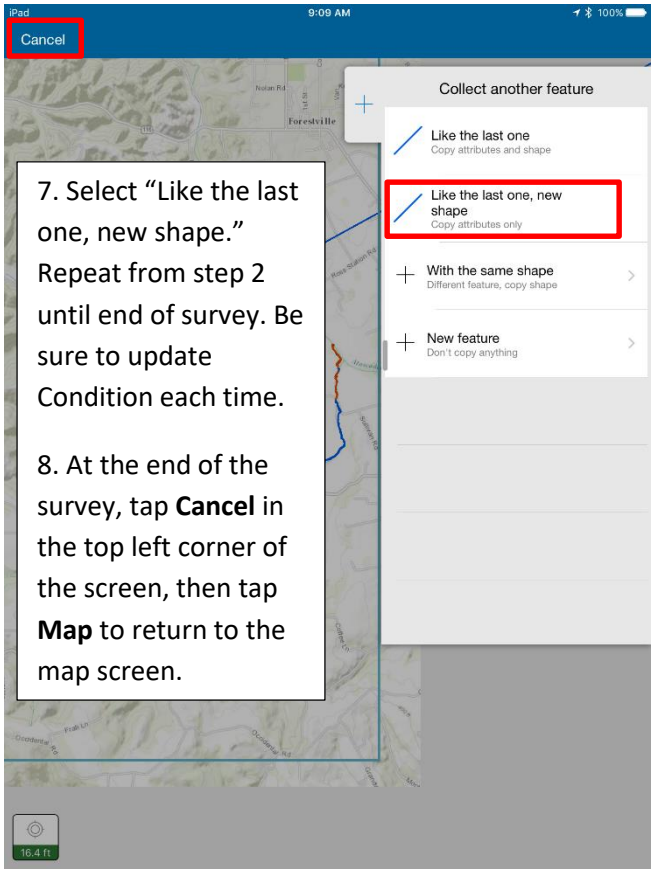
4. When ready to begin hiking, slide the feature window to the right (on phone, select map icon at top of window) and tap the **Use My Location** button, then begin digitizing the feature.



5. At the end of a wet/dry section, digitize the stream along the streamline. Tap the **Use My Location** button if your location is not displayed.

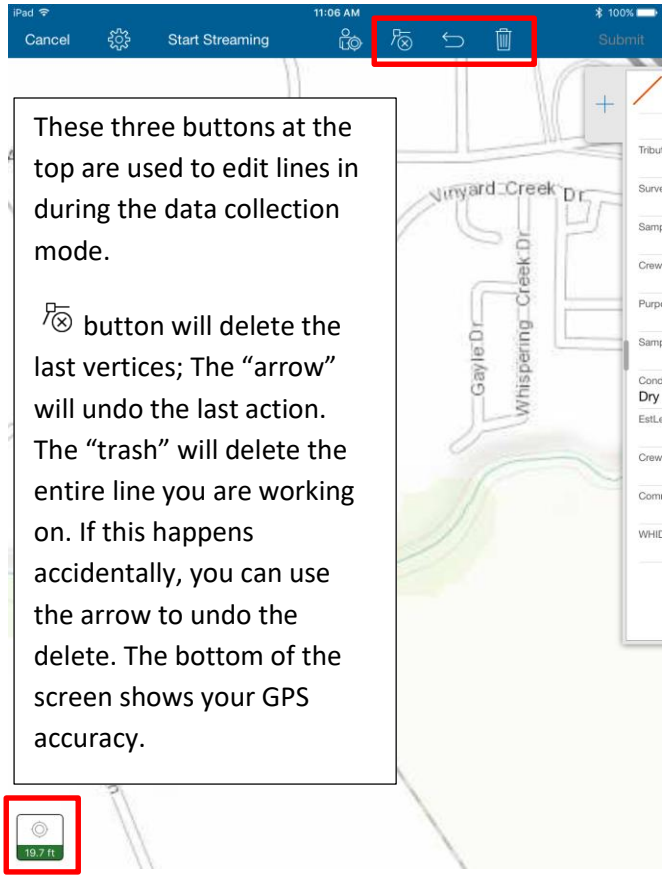
For short lines, fill the **EstLenFT** field with a rough estimate of the length of the wet or dry stretch you just walked it is less than 10m length. This will become the default value for all new features and will need to be updated each time – leave blank if desired.

6. Tap **Submit**



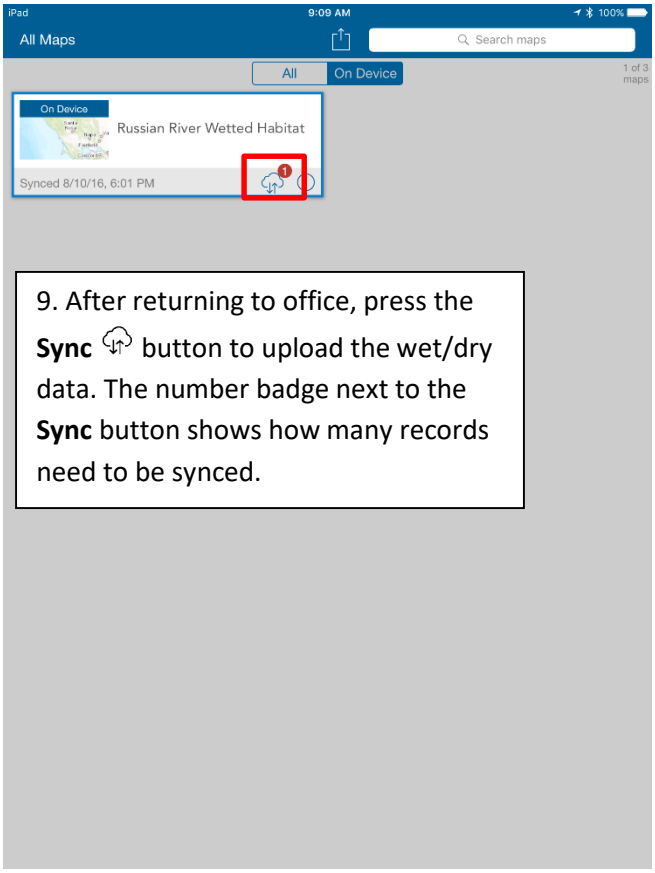
7. Select “Like the last one, new shape.” Repeat from step 2 until end of survey. Be sure to update Condition each time.

8. At the end of the survey, tap **Cancel** in the top left corner of the screen, then tap **Map** to return to the map screen.



These three buttons at the top are used to edit lines in during the data collection mode.

button will delete the last vertices; The "arrow" will undo the last action. The "trash" will delete the entire line you are working on. If this happens accidentally, you can use the arrow to undo the delete. The bottom of the screen shows your GPS accuracy.



9. After returning to office, press the **Sync** button to upload the wet/dry data. The number badge next to the **Sync** button shows how many records need to be synced.

Environmental data collection

DO and water temperature readings should be taken at 5-minute intervals and recorded in the Survey123 **Wetted Habitat** form refer to pages 9-12 for screenshots. At the beginning of <u>every GRTS reach</u>, begin a form and fill in the trip information as follows:

Date: The current date (auto-generated)
Time: Start time (auto-generated)
Sample Number: The number of times this reach has had a wetted habitat survey conducted for the current season. For recurring survey streams, the current survey number will be posted on the warehouse whiteboard. ***If conducting an opportunistic survey in conjunction with a CMP survey, this can be populated as -9999.***
Tributary: Select from dropdown list
GRTS Reach: Select from dropdown list. If doing more than one reach in a day, submit one form per survey reach.
CrewID: If only crew on stream, select **A**. Otherwise, label in ascending order from downstream (A) to upstream (G)

When the timer goes off, pause it and measure the current pool unit or the next pool unit upstream. If you are conducting this survey with a CMP snorkel survey, sample water temperature and DO in every fourth pool, or every other snorkeled pool. In all cases, DO and water temperature are measured at the approximate location. If it is too deep to wade to the deepest part of the pool, take as close to the max as possible. At this point, the DO meter should have remained on since leaving the office and been calibrated.

Remove the grey calibration boot and place the sensor into the water at approximately 0.8' depth (tape on cable should be at water's surface). Wave the unit back and forth steadily at a rate of approximately 1.0' per second on the YSI Pro20; if using the older YSI 55D model, move it approximately 0.5' per second. Dissolved oxygen is consumed by the meter, and if it is not moved gently back and forth, the reading will be artificially low. However, the movement of the sensor during the measurement is gentle and should not significantly agitate the water.

While one crew person is measuring the DO and temperature, the other person will record the data in the **Wetted Habitat** form. Scroll down to the **Pool Measurements** sub-form and fill it out as follows:

Pool Number: Pool number, beginning with 1 and increasing as you move upstream
Is Pool Dry: No or Yes. *If pool is dry, collect DO and temp measurements in the next wet pool even if it does not fall on the 5-minute interval, then reset timer.*
Is Bad Elf broken: No or Yes.
This field is not needed if you are using a device with an integrated GPS unit. If using a Bad Elf, select "Yes" only if it is malfunctioning and you have tried everything to fix it. Refer to the **Bad Elf Troubleshooting** document on the tablet or in the clipboard.

Location: Tap the compass icon  while standing in the pool. Try to be ± 10 meters and under 20 meters if possible. *S123 will automatically take a GPS point when each pool is added to the form, make sure you refresh your location when you are taking the measurement.*
Pool Latitude: Auto-generated from location.
Pool Longitude: Auto-generated from location.

Connected Downstream: Yes or No. A pool is considered connected downstream if there is an unbroken path of water between the pool tail and the next downstream unit.
Pool Tail Crest: Leave blank.
Temperature (°C): Water temperature in °C.
Dissolved Oxygen (mg/L): DO in mg/L. If the top of the unit is connected, wait 30 seconds before recording the DO in mg/L. If the units are disconnected, wait 60 seconds, as the DO reading takes longer to stabilize at lower DO concentrations.
Connected Upstream: Yes or No. A pool is considered connected upstream if there is an unbroken path of water between the pool tail and the next downstream unit.
Does Unit Appear Habitable?: Yes, No, or -9999. This is a visual assessment of habitability based on apparent water quality limitations. Do not consider DO or temperature values when answering this question. Enter **Y** if there is no visible impairment to water quality that would lead you to believe the pool would not be habitable by salmonids. Enter **N** if the water quality in the pool appears too poor to support fish (e.g., water is black or very dark, pool is overrun with algae or iron deposits, anything else that is obviously inhibiting fish). Make a comment if you enter N. Enter **-9999** if unknown.
Comments: Record comments regarding the habitability, as well as any relevant information, like the presence of stranded or stressed salmonids.

Once you have finished collecting the pool data, return to ArcCollector. You do not need to save or exit Survey123. If needed, digitize up to your location. Reset the timer and continue your survey.

At each subsequent measurement pool:

Press the **"+"** at the bottom of the form to add another pool record. If you added a new pool record before you arrived at the current sample pool, *be sure to refresh the location*. Number sequentially, using the number of pool records at the bottom of the form to stay on-track. Collect all necessary fields. Reset the timer and continue the wet/dry mapping.

At pools with continuous DO loggers:

At each of the pools with a continuous logger, you must take a field calibration point using the handheld DO meter. This is slightly different than collecting pool data at five minute intervals, and the locations of these monitoring sites will be available on the WH map.

When you reach a pool with a continuous DO logger, select "Yes" under "Is this a logger calibration pool." Check the flagging and/or the Wetted Habitat map to confirm the monitoring site code. Select the site from the dropdown.

Stand next to the logger and lower the handheld DO sensor into the water, at approximately the same depth as the continuous sensor, near the bottom of the PVC housing. Gently move the handheld sensor back and forth while watching the display. When the DO mg/L measurement on the screen has *remained the same* for 30 seconds, record the value and the time.

Note: It is critical that the measurements taken at the continuous DO loggers have been allowed sufficient time to stabilize. If the DO concentration changes more than 0.2mg/L, start your 30 seconds over. These values and the associated measurement time will be used to adjust the continuous data for instrument drift. The measurement time must be recorded as the moment you took the measurement.

Once you have finished taking the field calibration point, continue with your survey, reverting to the instructions outlined in the section above for the non-logger pools.

At the end of the survey:

When you have reached the end of the GRTS reach, tap the check mark in the bottom right corner of the screen to save the survey. A message will pop up asking whether you would like to send the survey now, tap **Send Later**, this will save it to the device. If you are surveying an additional reach or stream, begin a new Survey123 form at the beginning of that reach.

Returning to the office

Before cleaning and storing the field gear, upload the spatial data. Open ArcCollector and tap **Sync** to send the data you collected to the cloud. Open Survey123, selected the Wetted Habitat form, and navigate to the **Outbox.** There will be a small green badge with the number of completed forms. Tap **Send Surveys.**

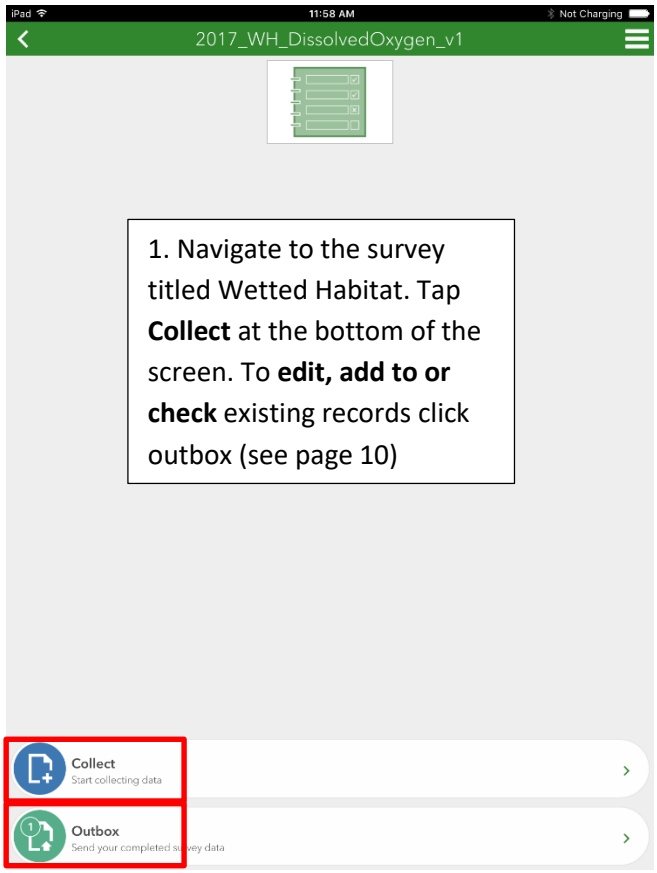
Note: You may need to re-enter logins in order to sync.

Use the download computer to access the Environmental Database, which is in the Projects folder of the Y-drive. It will open to the switchboard, where you can select **WH Environmental** in the drop down menu. Click **Download Survey123 Data** and **Yes** in the popup window. It will take a moment to download, and when the **Download Successful** window pops up, click **OK**, then select **View Survey Information**.

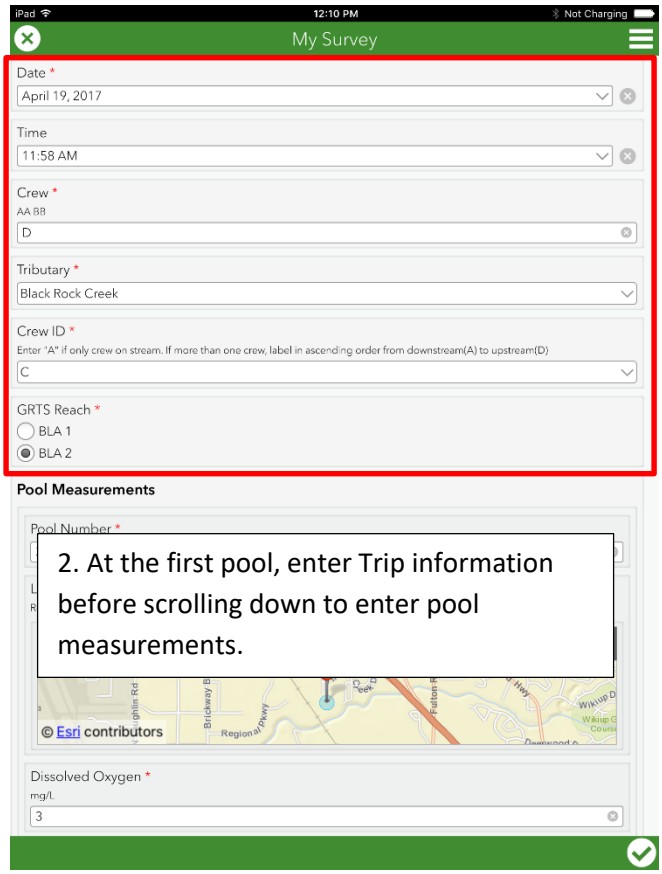
Scroll to your survey and check the trip information for any errors. Select the blue **Show Pool Info** button to review the pool measurements. If there are any changes that need to be made, click the **Edit** button. Changes made in editing mode are permanent. Click **Done Editing** to complete your changes and exit the editing mode.

Place electronic devices on chargers and sign back into the office using the **Crew Checkout** form. Check in with crew leads or supervisors about the survey, especially if stranded fish were documented.

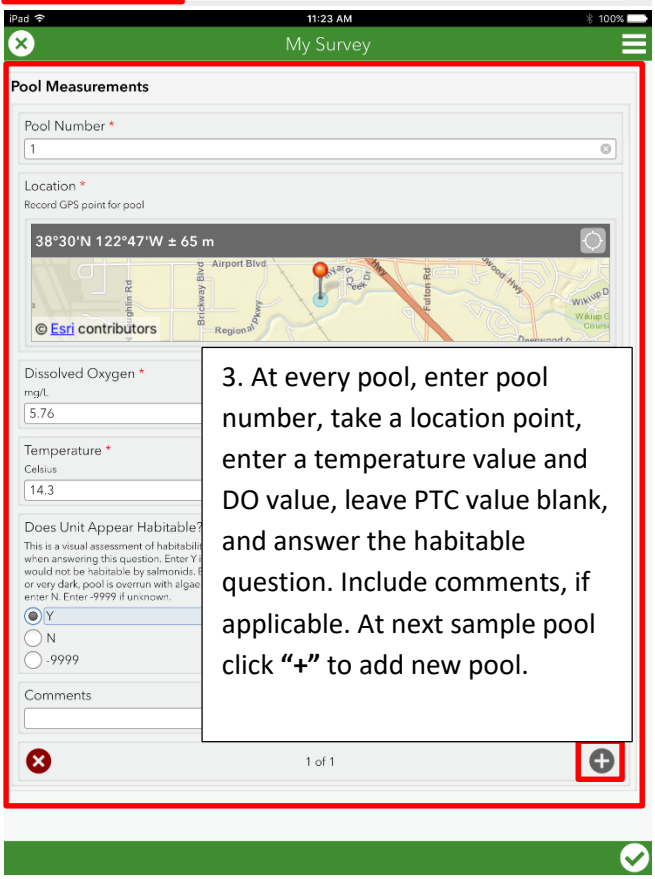
Survey123 Screenshots:



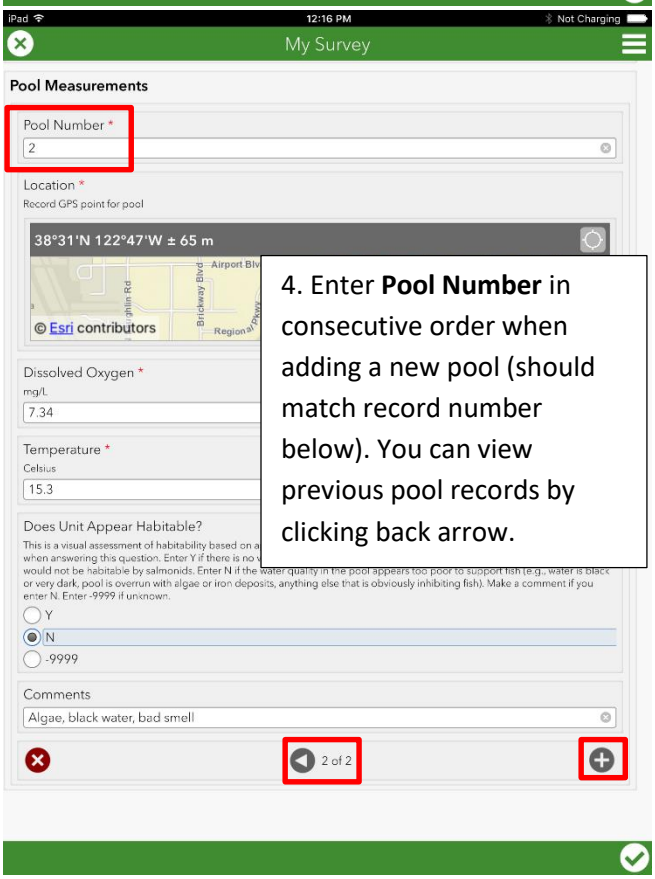
1. Navigate to the survey titled Wetted Habitat. Tap **Collect** at the bottom of the screen. To **edit, add to or check** existing records click outbox (see page 10)



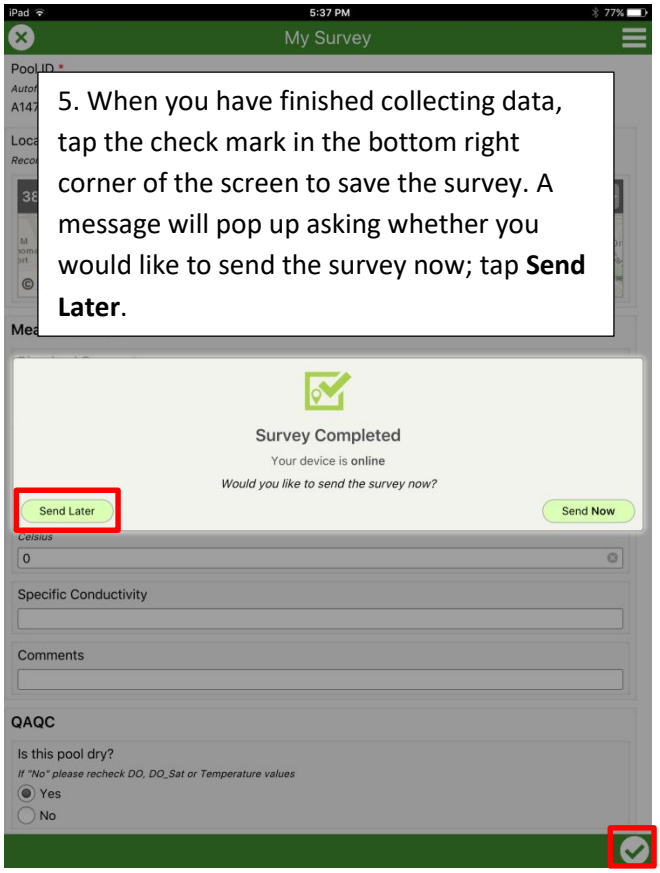
2. At the first pool, enter Trip information before scrolling down to enter pool measurements.



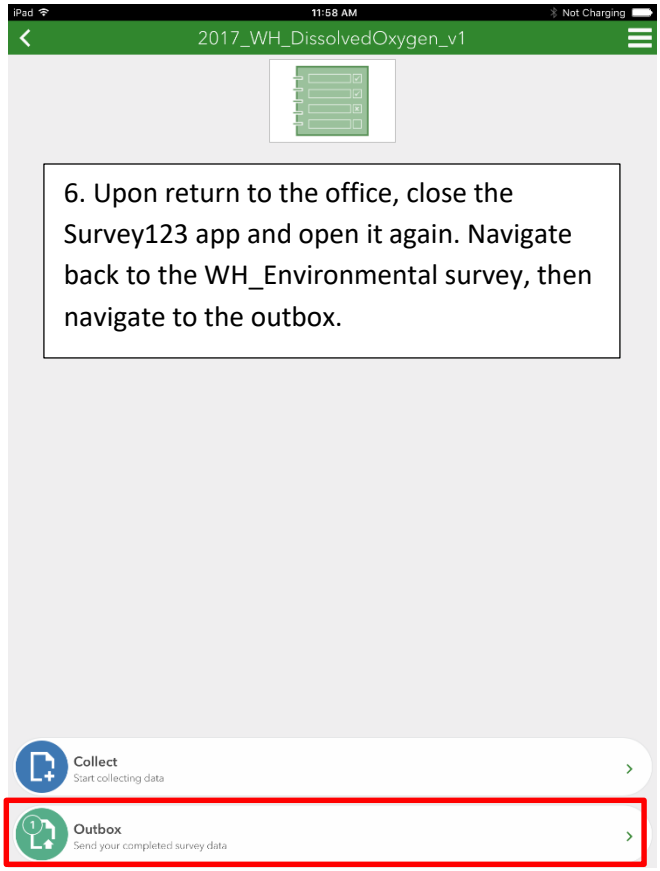
3. At every pool, enter pool number, take a location point, enter a temperature value and DO value, leave PTC value blank, and answer the habitable question. Include comments, if applicable. At next sample pool click **"+"** to add new pool.



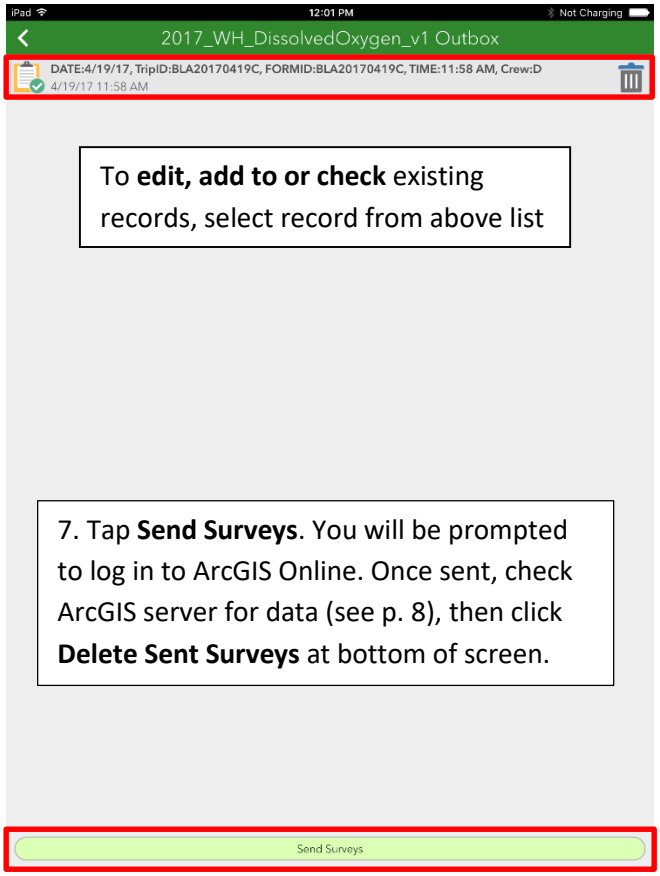
4. Enter **Pool Number** in consecutive order when adding a new pool (should match record number below). You can view previous pool records by clicking back arrow.



5. When you have finished collecting data, tap the check mark in the bottom right corner of the screen to save the survey. A message will pop up asking whether you would like to send the survey now; tap **Send Later**.



6. Upon return to the office, close the Survey123 app and open it again. Navigate back to the WH_Environmental survey, then navigate to the outbox.



To **edit, add to or check** existing records, select record from above list

7. Tap **Send Surveys**. You will be prompted to log in to ArcGIS Online. Once sent, check ArcGIS server for data (see p. 8), then click **Delete Sent Surveys** at bottom of screen.