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. Depending on stream-specific objectives, streams may be surveyed at biweekly intervals between May and October, opportunistically around changes in streamflow, or once at the driest point in the season.

Surveyors start at the mouth of the stream (or furthest downstream point of access) and use an ArcCollector application on a tablet to map surface flow conditions as they move upstream through a reach. Water temperature, dissolved oxygen (DO) and pool tail crest (PTC) depths are measured in pool units at 5-minute intervals. Each confluence point where a wet tributary meets the parent stream is marked with flagging on the initial survey (GPS points will be on the collector map for existing tributary mouth points, wet tributaries not on the map should be marked with a new GPS point), and tributary connectivity is documented on recurring surveys.

Segments of wet or dry streambed are characterized and recorded as lines. 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 (even if it is standing water).
- **Dry lines** are defined by **any disconnection** in surface water. Dry lines have no measureable water, even if the gravel appears wet.
- 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.
- A pool within a dry line should have a minimum length of 10’ and/or a minimum depth of 1.0’ in order to be “called out” as a wet line; in other words, small, uninhabitable puddles within a dry line do not constitute a wet line. Surveyors should use their best judgement to characterize anomalies.

Flow will be measured at a designated location within each reach with a Sontek FlowTracker.

Instructions

Before leaving the office:

Collect the following gear:

- Tablet or other data collection device paired with an external GPS device (Bad Elf or other) *unless tablet is cellular-enabled*, in which case no additional device is needed.
- DO meter (calibrate first; see *UC Sea Grant’s Dissolved Oxygen Sampling Protocol*) and extra batteries
- Dry backpack
- RCT depth measurement tool (modified micro stadia rod)
- SPOT safety tracking device
- First aid kit
- Clipboard with protocol, pencils and field notebook

- Hand pruners
- FlowTracker and associated gear

Open the ArcCollector and Survey123 apps on your device and ensure that you are signed-in. Follow the setup instructions on page 5 to ***confirm settings are correct***. In ArcCollector, confirm that you have downloaded "Field Map: Wetted Habitat". Check that all data from previous surveys have been uploaded; if there is a red badge with a number on it next to the **Sync** button on the Wetted Habitat Map, data have not yet been uploaded - press **Sync** (see page 7 for example). In Survey123, check that the most recent forms are downloaded to your device (WH_Environmental). Make sure that the Bad Elf (*or other external GPS device if tablet is not cellular-enabled*) is paired with the tablet via Bluetooth (settings > Bluetooth > select Bad Elf GPS from My Devices or Other Devices) *and that the Bad Elf GPS number matches the Serial Number of the device*. For more info on the Elfs, check the **Troubleshooting and Data Quality Section** below.

Field data collection:

At the beginning of the survey, *make sure that your DO logger is turned on, and that the sponge is wet,* so that it can warm up for 15 minutes prior to calibration to ensure an accurate reading. Open the ArcCollector app. Follow the steps below and the visual aids on pages 5-7. *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 application contact crew supervisors before using Garmin and paper datasheets (unless in a remote reach or prearranged with project leads).

Navigate to the Russian River 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 fields as follows.

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 been sampled for the current season. Check Google calendar on iPad, if needed
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 or the length displayed on the data feature window is clearly and significantly different than the actual line; *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
WHID: Leave Blank

Water temperature, DO and PTC depth are measured in pool units at 5-minute intervals. Before continuing with the survey, set the timer on the device for 5 minutes. When the timer goes off, take DO and temperature

readings in the current or next pool unit by following the steps in the ***Additional data collection section*** on pages 8-9.

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. Tap the **Use My Location** button, then tap **Start Streaming** or **Stream**. Put the tablet in sleep mode (button on back of top right) so you don't accidentally hit the screen and create a point. Walk upstream until the stream condition changes from wet to dry, or vice versa.

Note: If you stop in the middle of a wet/dry stretch to measure DO (or for any other reason), pause streaming on ArcCollector until you start walking again.

At the end of a wet/dry stretch:

Tap **Pause Streaming**, then tap the **Use My Location** button. For short lines only, if the length displayed on the data feature window is clearly and significantly different than the actual line, fill the **EstLenFT** field with a rough estimate of the length of the wet or dry stretch you just walked. *You do not want to do this unnecessarily, since that will become the default length and will need to be changed for each subsequent line*. Tap **Submit**. 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.

Note: GPS device accuracy ranges from 1-5m (in ideal conditions). For line segments under 5m, especially sections with multiple short wet/dry segments, it is important to scrutinize each line drawn in ArcCollector to minimize overlap with adjacent lines and to determine if the line has wandered too far from the surrounding survey lines. If this occurs, use the Delete Vertex button to remove the unwanted portion(s) of the line and redo.

You will be prompted to collect another feature. Select **Like the last one, new shape**. This will copy the attribute information from the previous line into a new line. Update the **Condition** field and *make sure that the EstLenFT field is either updated to reflect the estimated length of the current line or set to 0 for no estimate*.

Note: If you need to exit the stream where you do not have access, be sure to Pause Streaming, then tap the Use My Location button, and Submit prior to exiting the stream. Start a new line when you re-enter the stream.

Digitizing vs Streaming lines:

The **Streaming Feature** is a great tool for creating lines for long sections of uniform habitat conditions. Streaming works by taking a GPS point at a user-defined interval (15-30 seconds will work in this case) and connecting the points with line segments.

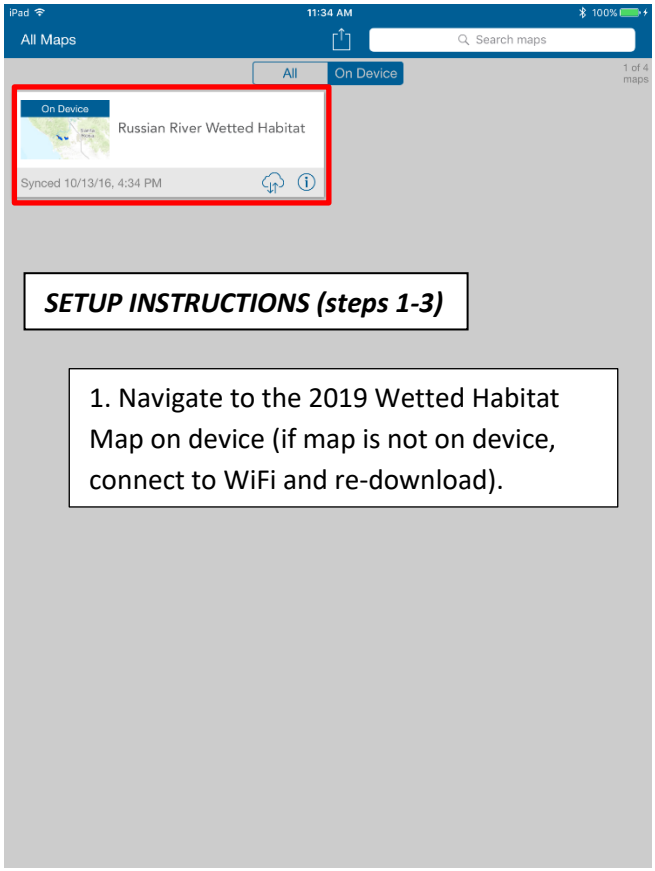
Note: Pause streaming to prevent overlapping line segments if the surveyor stops walking upstream for any reason (landowner interaction, log jam, etc.).

Digitizing Lines can also be used for long uniform habitat conditions, but is more useful for collecting data in areas of intermittency or when GPS signal is poor. To digitize a line, fill out the information associated with new feature, as usual. Tap the map at your current location to create your first point of the line. Start hiking. Survey up to the point where the stream condition changes and manually tap along the stream center line to generate points. Select **Submit**.

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."

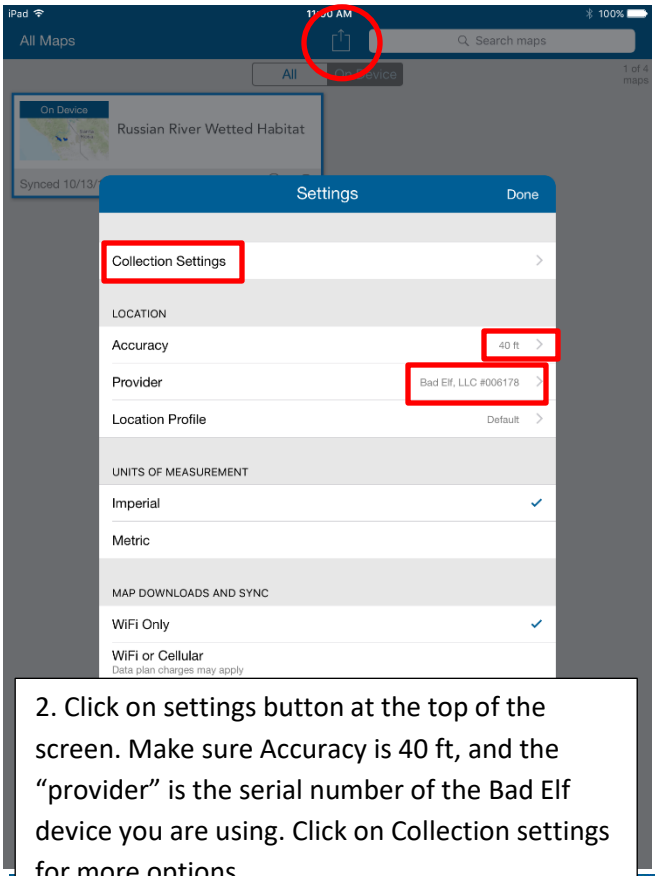
At the end of the survey:

Instead of collecting another feature, tap **Cancel** in the top left corner of the screen. 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.

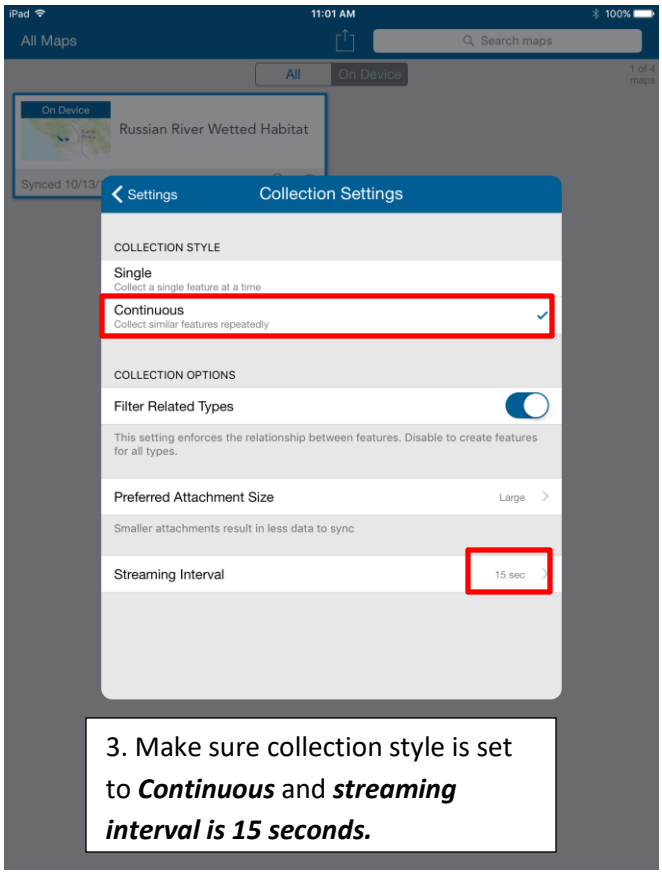


SETUP INSTRUCTIONS (steps 1-3)

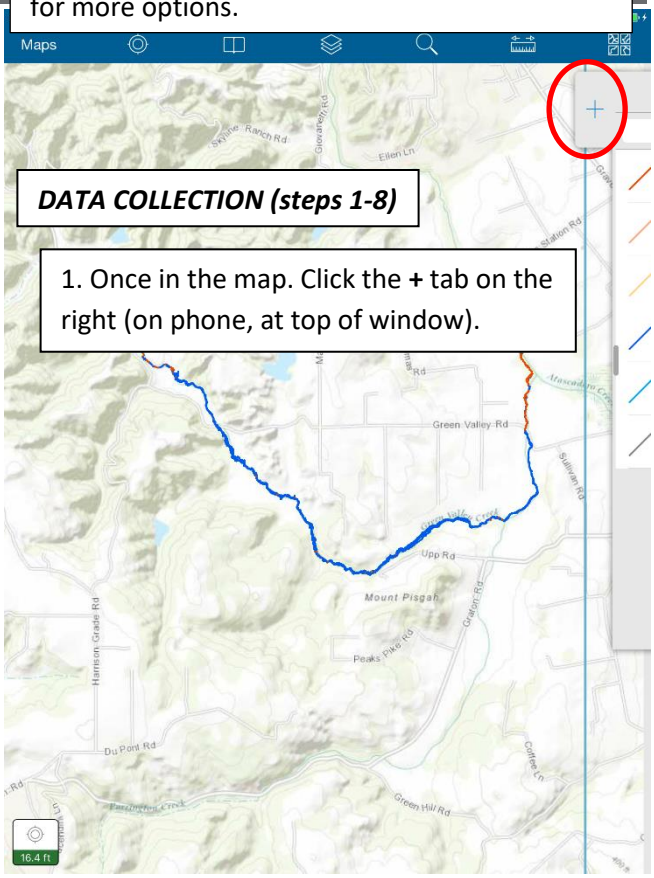
1. Navigate to the 2019 Wetted Habitat Map on device (if map is not on device, connect to WiFi and re-download).



2. Click on settings button at the top of the screen. Make sure Accuracy is 40 ft, and the "provider" is the serial number of the Bad Elf device you are using. Click on Collection settings for more options.

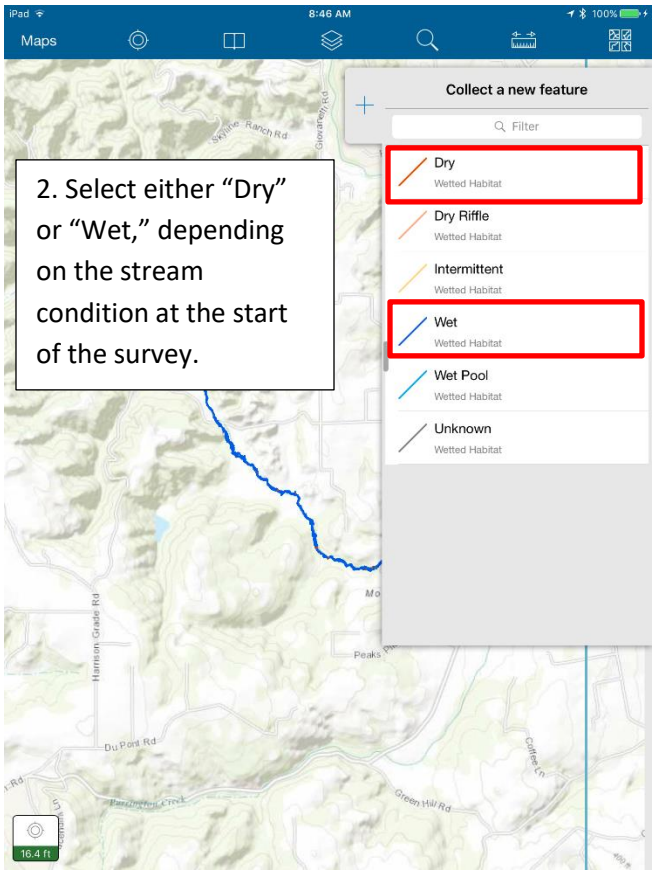


3. Make sure collection style is set to ***Continuous*** and ***streaming interval is 15 seconds.***

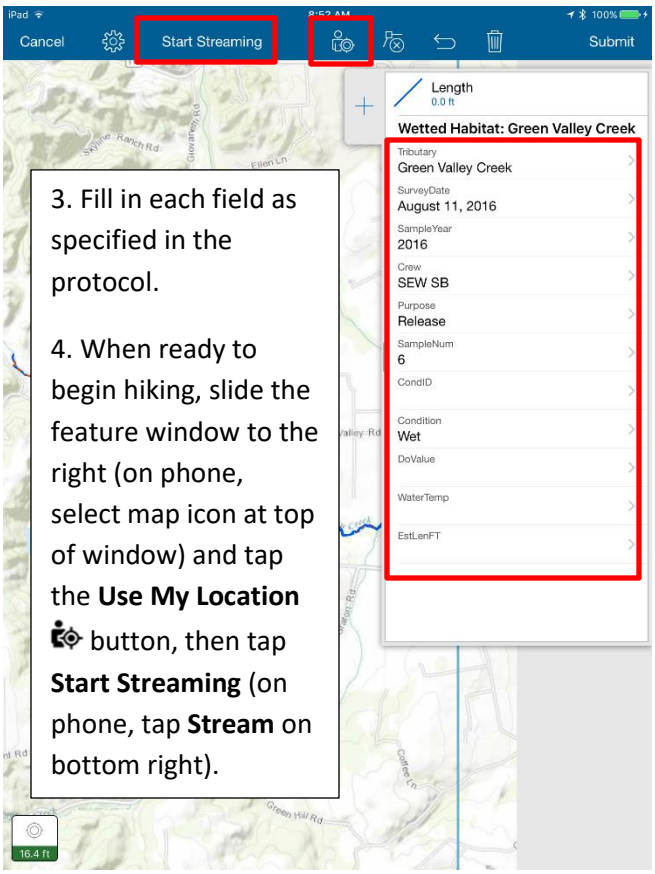


DATA COLLECTION (steps 1-8)

1. Once in the map. Click the **+** tab on the right (on phone, at top of window).

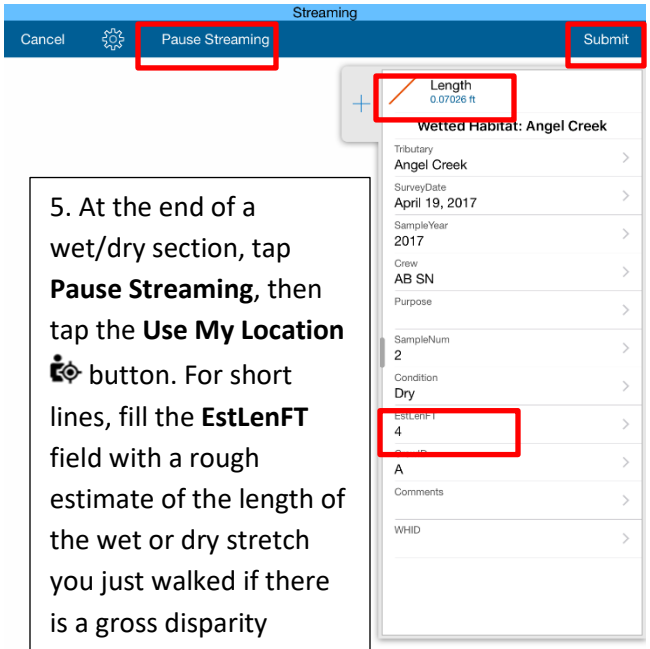


2. Select either “Dry” or “Wet,” depending on the stream condition at the start of the survey.

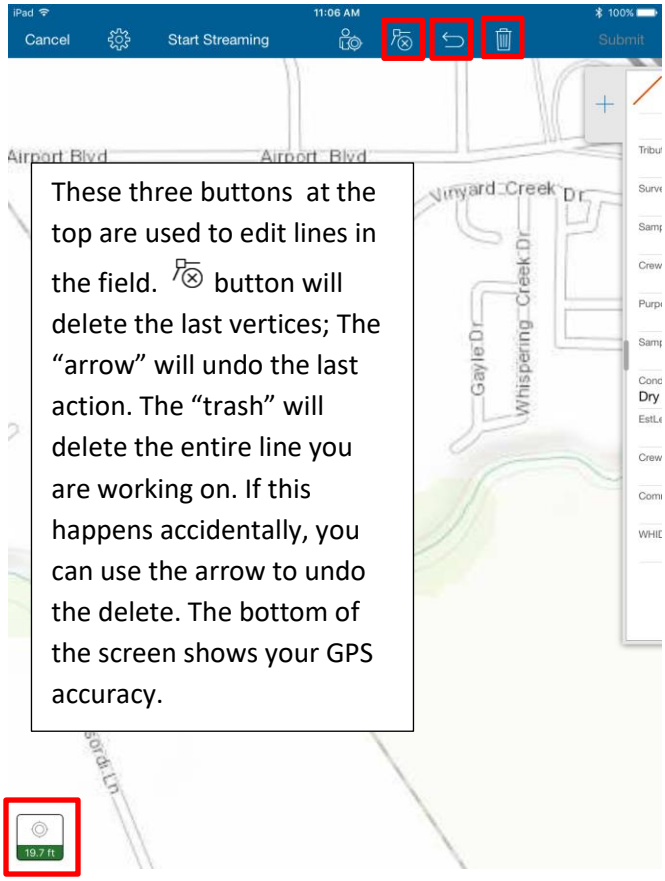


3. Fill in each field as specified in the protocol.

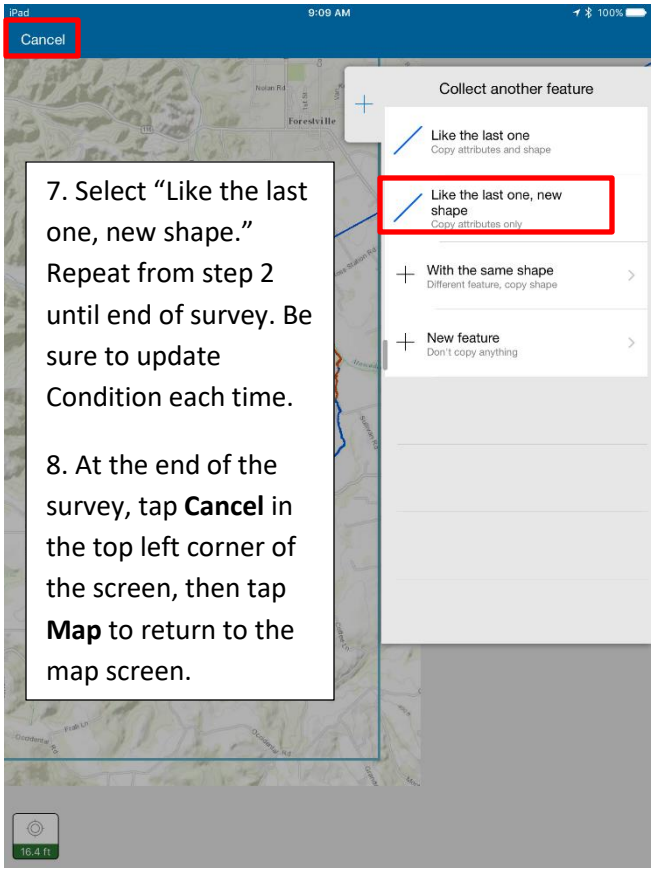
4. When ready to begin hiking, slide the feature window to the right (on phone, select map icon at top of window) and tap the **Use My Location** button, then tap **Start Streaming** (on phone, tap **Stream** on bottom right).



5. At the end of a wet/dry section, tap **Pause Streaming**, then tap the **Use My Location** button. For short lines, fill the **EstLenFT** field with a rough estimate of the length of the wet or dry stretch you just walked if there is a gross disparity between displayed and actual length. This will become the default value for all new features and will need to be updated each time – use 0 for no length estimate.

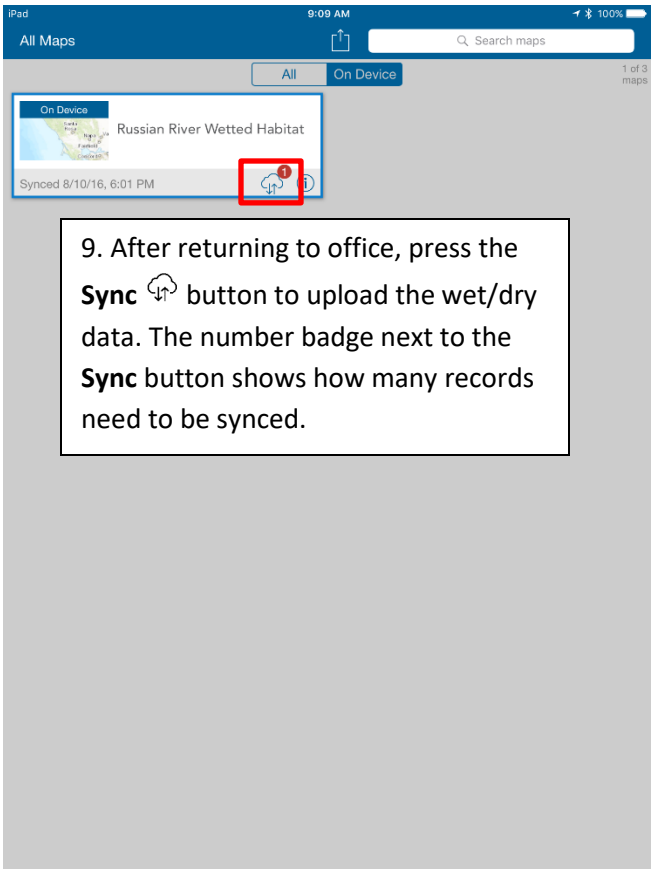


These three buttons at the top are used to edit lines in the field. button will delete the last vertices; The “arrow” will undo the last action. The “trash” will delete the entire line you are working on. If this happens accidentally, you can use the arrow to undo the delete. The bottom of the screen shows your GPS accuracy.



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.



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.

Troubleshooting and data quality tips:

- Be careful not to touch the screen while streaming, as it may create lines.
- If you stop in the middle of a wet/dry stretch to take a break or collect other data, pause streaming on ArcCollector until you start walking again.
- Be sure to always survey upstream. In the QAQC process, lines are connected to one another in the order they are created. It is important to make sure the features are in sequential order from bottom to top.
- If you forget to stop at a wet/dry transition and need to backtrack, use the **Delete Vertex** button to remove the unwanted portion of the line. *Only use if necessary; mistakes can lead to data loss.* Pause streaming, walk back to the transition, and tap **Delete Vertex** until the vertices beyond your current location have all been removed. The vertex shown in red is the next to be removed. From here, tap **Use My Location** to add a vertex at your current location, then tap **Submit** and continue on as usual.
- **If you are experiencing connection issues, check to make sure the Tablet is connected to the correct Bad Elf unit both via Bluetooth and in ArcCollector** (from Maps page, click upload icon > settings > Provider > select Bad Elf GPS *with the correct serial number* from the list of GPS Receivers). If connection is established but ArcCollector is having issues locating your position, restart the tablet and relaunch the applications.
- Record any issues with the Bad Elf's on the checkout sheet where they are stored.

Additional data collection:

DO and water temperature readings should be taken at 5-minute intervals, along with the pool tail crest (PTC) depth of the pool where DO is measured (*see diagram on page 9).* Data is recorded in the Survey123 WH_Environmental form. ***You will need to start a new data collection form at the beginning of each new GRTS reach. Reach boundaries are shown as blue dots on the ArcCollector map.***

When your 5-minute timer goes off, stop in the current pool (if in pool unit) or the next pool and measure DO and temperature *at the approximate max depth location* (if too deep to stand, take as close to max as possible) using the YSI handheld DO logger. Follow these steps to collect the data:

- **Make sure that your logger has been on for 15 minutes** to ensure that it has stabilized. If you are using the YSI 55D, *make sure that it is recording in mg/L*, or use the MODE button to change it.
- Stand in the deepest part of the primary scour point of the pool and hold the DO sensor tip approximately 0.8' below the water surface (at tape on cable).
- Wave the unit back and forth steadily at a rate of approximately 0.5' per second for the YSI 55D and 1.0' per second for the YSI Pro20. *Movement is to prevent stagnation at the sensor tip and should not significantly agitate the water*.
- **If units are connected, after 30 seconds** (*no need to wait for complete stabilization*), report water temperature and DO values to the person recording data, place the sensor in the travel compartment and **leave unit powered on.**
- **If units are disconnected, wait 60 seconds** before recording DO values**.**

While one person is measuring, the person recording data will open the Survey123 app, navigate to the survey titled **WH_Environmental** and ***follow the instructions on pages 11-12***. Fill out the survey fields as follows:

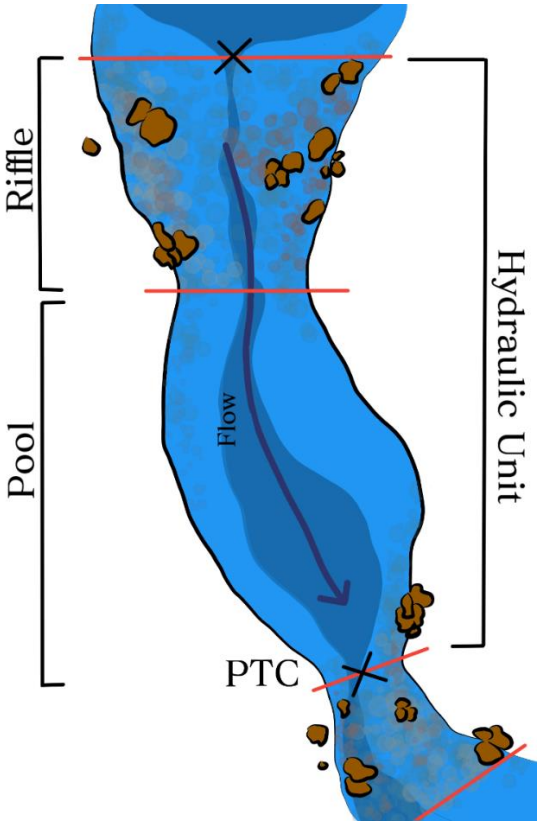
Date: Current date (should autofill)
Time: Current time (should autofill)
Crew: 2-3 letter initials of crew members in all caps, separated by a space (no commas)
Tributary: Select from list
GRTS Reach: Select from dropdown. ***Start a new data collection form at the beginning of each new GRTS reach. Reach boundaries are shown as blue dots on the ArcCollector map.***
ReachID: Select single option displayed
Crew ID: If only crew on stream, select **A**. Otherwise, label in ascending order from downstream (A) to upstream (D)

Pool Measurements:
Pool Number: Enter pool number in consecutive order, starting at 1
Is Pool Dry?: Select Yes or No. ****Note: if pool is dry, collect DO, temp, and PTC depth measurements in the next wet pool even if it does not fall on the 5-minute interval, then reset timer.***
Location: Press the location icon in the top right corner of the map to take a GPS point of current location, hold to improve accuracy. 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.***
Connected Downstream: Record whether surface water is connecting the pool unit to the downstream unit. Continuous water is considered connected, any dry points disconnected.

Pool Tail Crest: Measure depth of pool tail crest at the downstream end of the pool where DO is being measured to the nearest 0.01' ***using the RCT measurement tool***. Enter zero if dry. If the site is not suitable for measuring (e.g., there is no clear PTC or it is buried in debris), enter '-9999'.
Temperature (℃): Water temperature in °C
Dissolved Oxygen (mg/L): DO in mg/L
Connected Upstream: Record whether surface water is connecting the pool unit to the upstream unit. Continuous water is considered connected, any dry points disconnected.
Does unit appear habitable?: 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: Enter any relevant comments (e.g., salmonids observed gasping at surface)

Reset the timer for 5 minutes and return to ArcCollector to continue wetted habitat mapping.

Note: It is okay to switch between forms in Survey123. Completed or pending records are stored in "Outbox" for each survey form. Records in "Outbox" can be edited or continued.



The **pool tail crest (PTC)** is the hydraulic control point at the tail out of a pool unit. For the purposes of this survey, PTC will be measured at the pool in which DO is measured.

When walking upstream, the PTC will be encountered at the transition point between the downstream riffle and the lower end of the pool unit.

PTC should be measured at the thalweg (deepest point) of the lateral cross-section at the crest (the crest being the shallowest point longitudinally).

At each subsequent measurement pool:

If still in WH_Environmental form, Click **"+"** at the bottom of the form to enter additional pools. If not, reopen the WH_Environmental form and select "Outbox", then see above.

Marking tributaries:

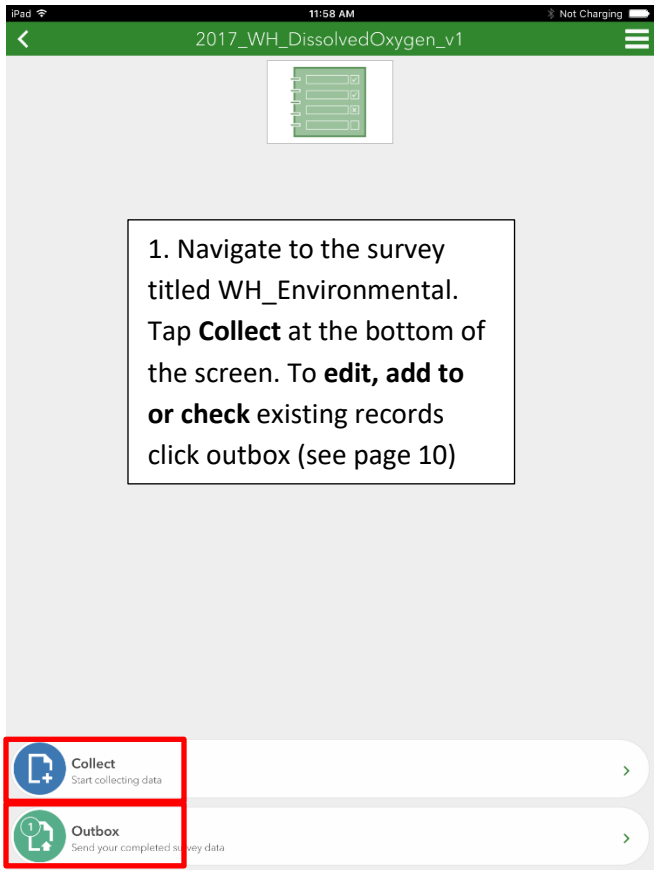
Tributaries marked and observed in earlier seasons will be revisited in 2019. Spatial data for the location of each tributary mouth is on the ArcCollector map, and a list of tributaries is available in a dropdown menu located in the tributary section of the Wetted Habitat form (see page 12). At each marked tributary, confirm the location and number, then record its status.

> **Tributary Number:** Enter tributary number in consecutive order, starting at 1 for each reach
> **Tributary Status:** Current condition of surface flow (flowing, intermittent, dry)
> **Location:** *Take only on the first survey of season if it is not already on the collector map*. Press the location icon in the top right corner of the map to take a GPS point of current location
> **Comments:** Enter any relevant comments (e.g., only a trickle of flow, reach dry upstream of tributary mouth)

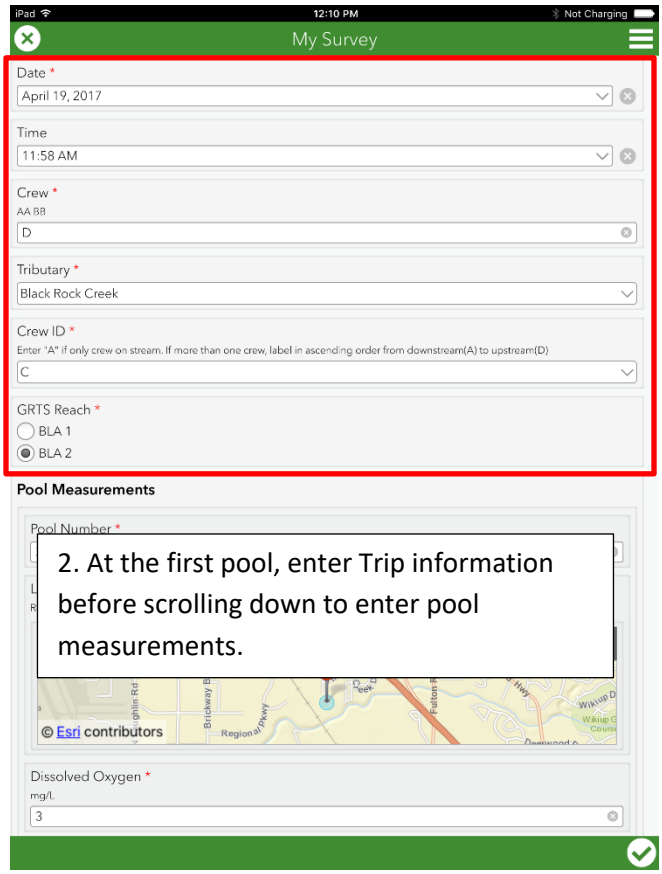
****Note: If a tributary is dry at the time of the first survey you DO NOT need to record any data. If the tributary is not on the map but connected than take a new GPS point.***

Saving data:

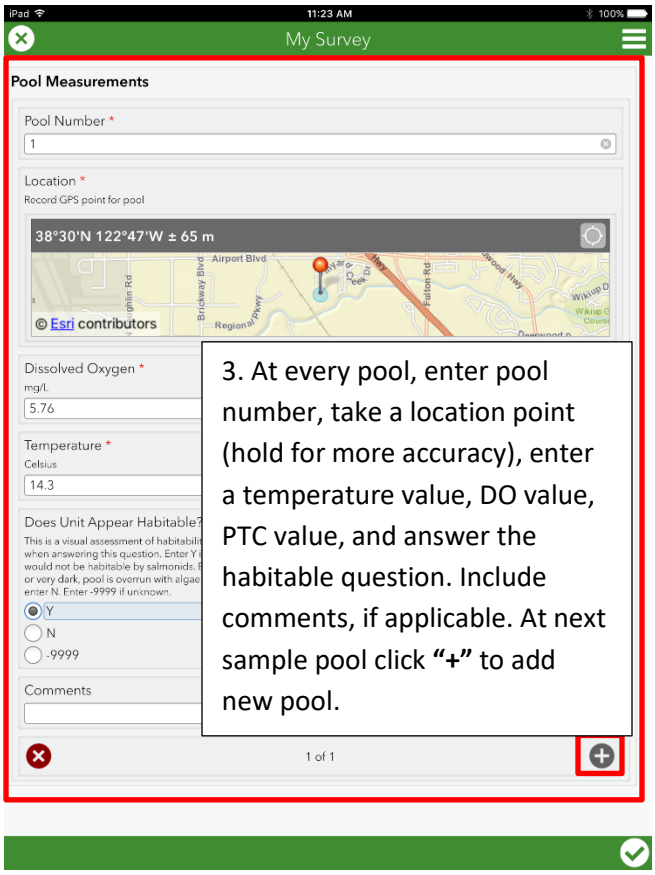
When you have finished collecting data, tap the check mark in the bottom right corner of the screen to save the survey. A message will pop up asking whether you would like to send the survey now; tap **Send Later**.



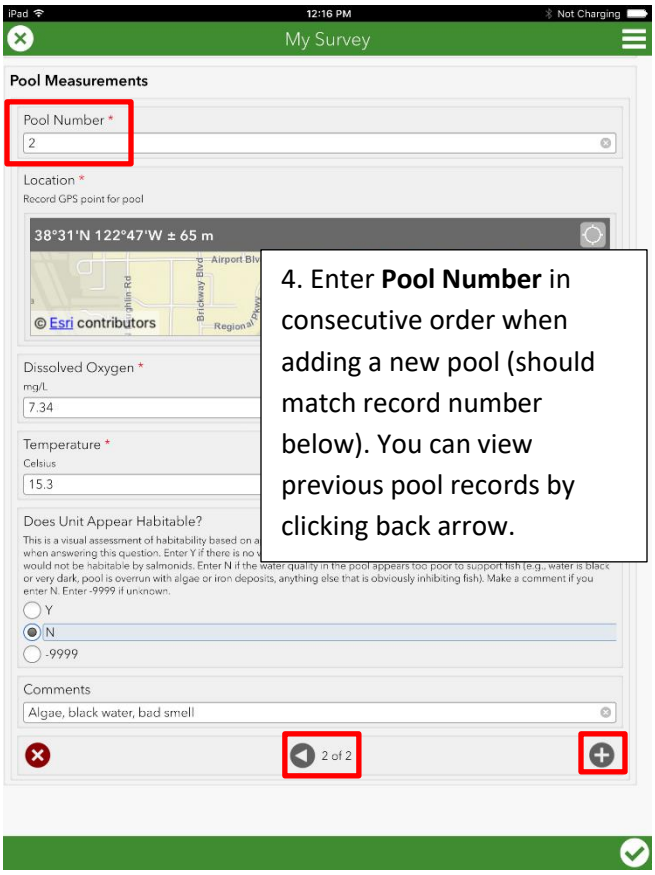
1. Navigate to the survey titled WH_Environmental. Tap **Collect** at the bottom of the screen. To **edit, add to or check** existing records click outbox (see page 10)



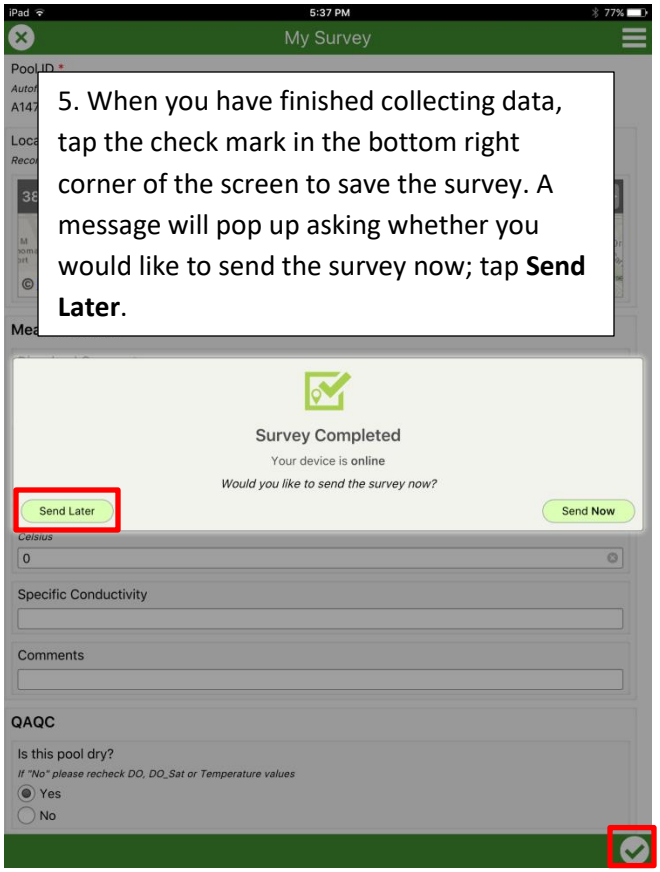
2. At the first pool, enter Trip information before scrolling down to enter pool measurements.



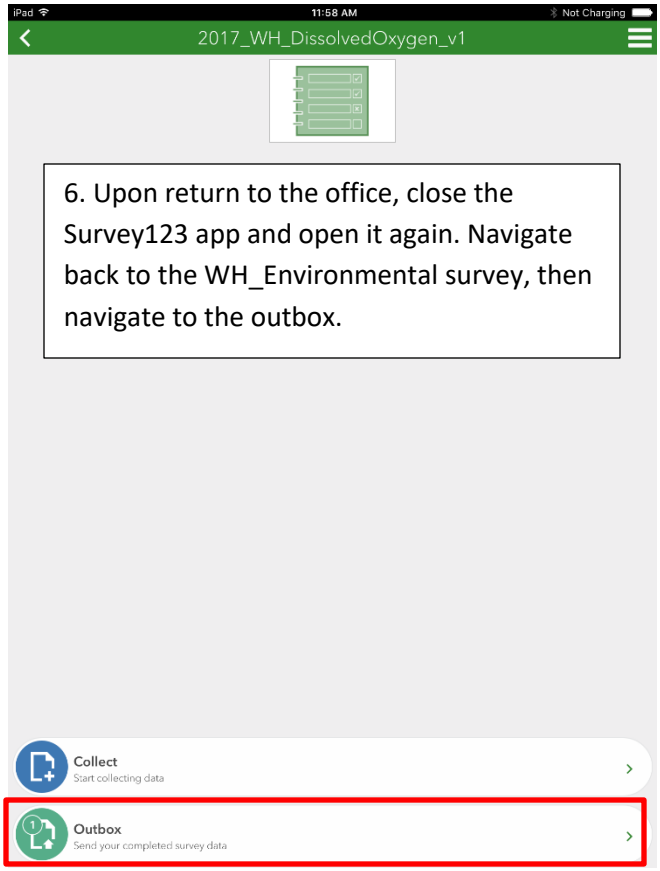
3. At every pool, enter pool number, take a location point (hold for more accuracy), enter a temperature value, DO value, PTC value, and answer the habitable question. Include comments, if applicable. At next sample pool click **"+"** to add new pool.



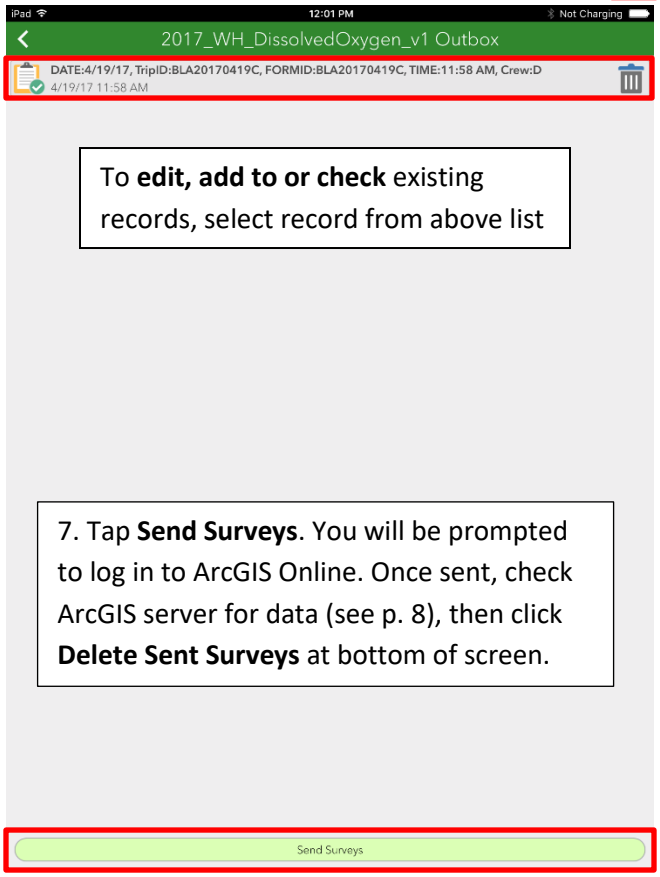
4. Enter **Pool Number** in consecutive order when adding a new pool (should match record number below). You can view previous pool records by clicking back arrow.



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**.

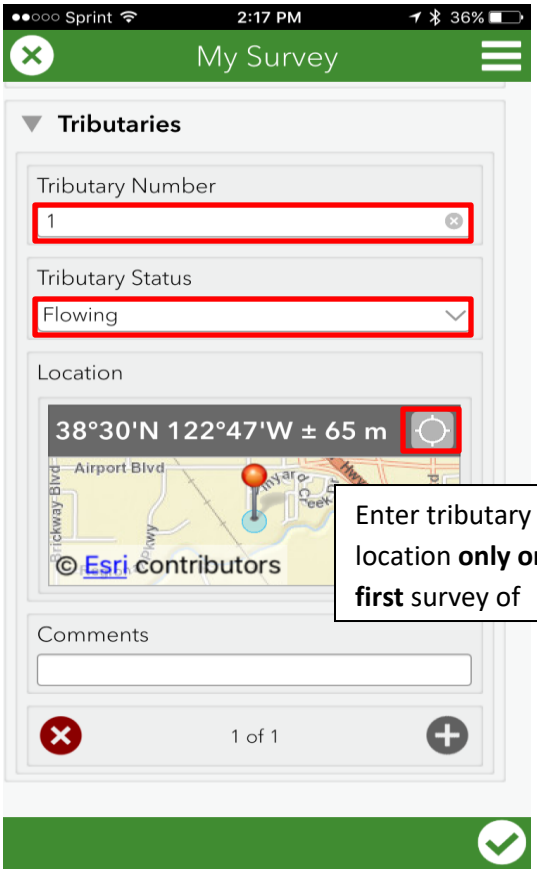


6. Upon return to the office, close the Survey123 app and open it again. Navigate back to the WH_Environmental survey, then navigate to the outbox.



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.



Enter tributary location **only on first** survey of

Upon return to the office:

Upload ArcCollector data:

Press the **Sync** button to upload the wet/dry data.

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

Download flow data:

Follow the ***Flow Tracker Download Protocol*** to download and QA/QC the data. Remove the battery cartridge from the handheld and charge or replace batteries as needed. Make sure unit is powered off.

Download Survey123 data:

Close the Survey123 app and open it again. Navigate back to the WH_Environmental survey, then navigate to the outbox and tap **Send Surveys**. Survey123 will prompt you to log in to ArcGIS Online. (If you encounter an error, make sure app has been completely closed before logging back in to Survey123.) Once data has been sent, open your Access database. From the switchboard, select **WH Environmental** in the survey drop down menu and click **Download Survey123** Data. Click **Yes** in the popup window. It will take a few minutes to download. When the **Download Successful** window pops up, click **OK** then select **View Survey Information**. Check to see that the resulting table includes the data you just uploaded and check all data for errors, using the **Edit** button to correct where needed. Click **Delete Sent Surveys** on bottom of Survey123 window on the tablet.

Place electronic devices on chargers.