

14" - 26" BY 2060

KING TIDES INITIATIVE



Citizen Science Guidebook

Contents

What is a King Tide? 3

What Can You Do? 3

King Tide Kit 6

King Tide Dates & Times 2018 6

Tidal Flooding Locations 8

How to Report Data 8

 Steps to Document Flooding: 11

 Using a refractometer to measure salinity in flood waters: 17

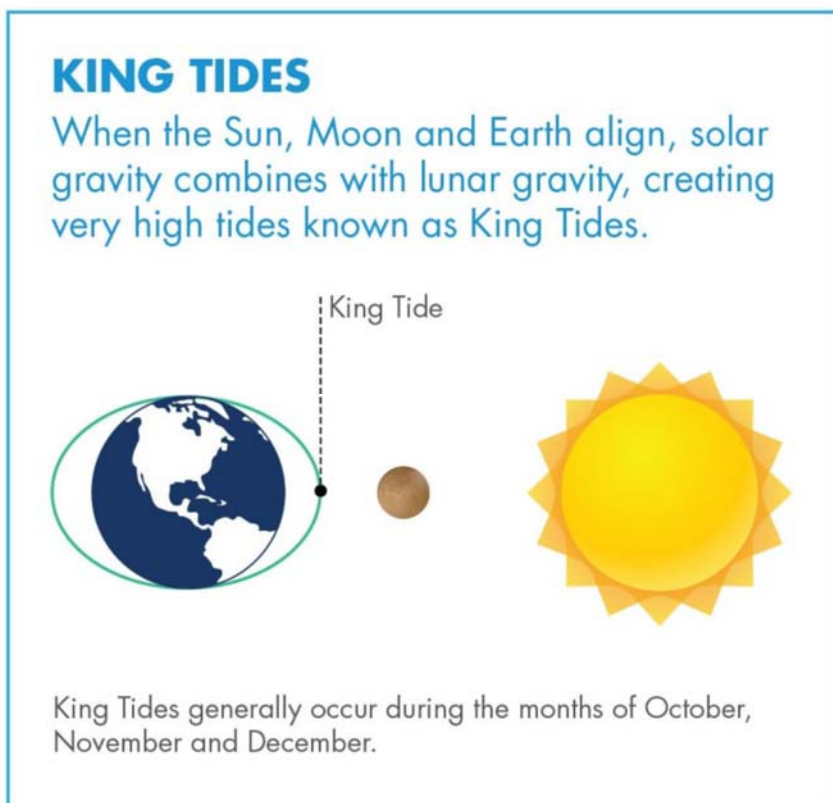
 Tips for Effective King Tides Photos: 18

 Photos of flooding are used in several ways to help people:..... 18

Classroom & Other Resources 19

What is a King Tide?

The King Tide is the highest predicted high tide of the year at a coastal location, produced by the orbits and alignments of the Earth, Moon and Sun. It is above the highest water level reached at high tide on an average day. In Broward County, the king tides usually occur during the months of September, October, and November. King tides are a glimpse of the water levels we will see in the years to come as the sea level continues to rise.



How frequently do King Tides happen?

King tides are a normal occurrence three to five times every year in coastal areas. In the United States, they are predicted by the [National Oceanic and Atmospheric Administration \(NOAA\)](#). The NOAA Tides and Currents station map can be used to locate stations that provide water levels, meteorological observations, and current observations (Sources: US Environmental Protection Agency). Low-lying coastal areas of Broward County can be impacted by flooding from high tide events. These often time occur during the fall (August-November) with the peak usually occurring the King Tide (Highest tide of year) in October. As sea level rises, the frequency of king tides is expected to increase to nearly 50 times per year by 2030 and over 200 times per year by 2045 (Dahl et al, 2017).

Why does flooding occur during King Tides?

King Tides have always occurred but did not always cause flooding. The change is that sea level today is higher than when neighborhoods were originally built. Since neighborhoods were designed based on historic tide ranges, they are not equipped to handle the higher high tides of today. Flooding occurs when seawater moves inland by flowing over seawalls or in through drainage pipes or openings and collects in low lying areas.

Property owners and local governments are creating and improving barriers to the incoming water. As a result, in some areas where flooding occurred last year, the ground may be dry because the barrier is effective at the current sea level and tidal conditions. In order to prepare for future sea level, higher tide levels and increased water levels during storms, our community needs to continue to find ways to reduce impacts from flooding.

What Can You Do?

- Do not drive through flooded areas, turn around and find another way. It can be a threat to your life as well as cause short and long term damage to your vehicle.
- Do not put yourself and others at risk of injury by walking or driving through flood water – six inches of fast flowing water can knock you off your feet and less than a meter of water can float a car.
- If you drive through tidal floods, wash the undercarriage of your car to remove the salt water. You can go through a car wash equipped with an undercarriage sprayer.
- Avoid coming into direct contact with flood water as it may be contaminated with sewage and other pollutants.
- Internal and external flooding can result in hazards below the surface you cannot see that could cause injury e.g. nails, broken glass, debris and displaced manhole covers.
- Do not allow children to play in or near flood water and encourage them to wash their hands regularly.
- If you are a boater, be aware that these high tides cause lower clearances under fixed bridges so check the tides before leaving the dock.
- If your landscape encounters salt water flooding, make sure the area is rinsed off and/or rained on thoroughly before adding fertilizer or pesticides.
- Participate in citizen science through the Broward County King Tides Initiative and help us document tidal flooding in the community!
- Educate yourself and peers on the causes of sea level rise and what you can do to reduced greenhouse gas emissions.

King Tide Kit

King Tide Kits are available for community groups to borrow to help track and report tidal flooding. Groups can sign up to monitor a location for either October or November. Group leaders are responsible for returning the refractometers to the Broward County Government Center at 115 South Andrews Avenue, Rm 329H, Fort Lauderdale, FL 33301.



Safety Precautions

- Participants should be wearing proper footwear (close-toed footwear i.e. sneakers, boots or rain boots). Do not trespass on private property. Stay out of deep or rushing water.
- Do NOT drive through flooded areas.
- Participants should wear closed toe shoes (not flip flops or sandals), preferably rain boots.
- Do NOT document tidal flooding during inclement weather.
- Be aware of your surroundings, stay together as a group.
- Avoid walking through flood waters, it is dangerous and can be a health hazard. Stay back a distance and take a photo to document flooding.
- Avoid driving, walking, or parking on private property.

King Tide Dates & Times

Date	Prediction (Feet NAVD)	Approximate Time
April 7-8	0.8	9:00 AM
May 7	1.1	9:30 AM
August 21-23	0.9	11:00 AM
September 15-21	1.4	9/19, 11:00 AM
October 15-19	1.6	10/17, 9:14 AM
November 14-17	1.5	11/15, 7:57 AM
December 13	1.1	6:49 AM

<https://www.broward.org/waterresources/Pages/KingTides.aspx>

Tidal Flooding Locations

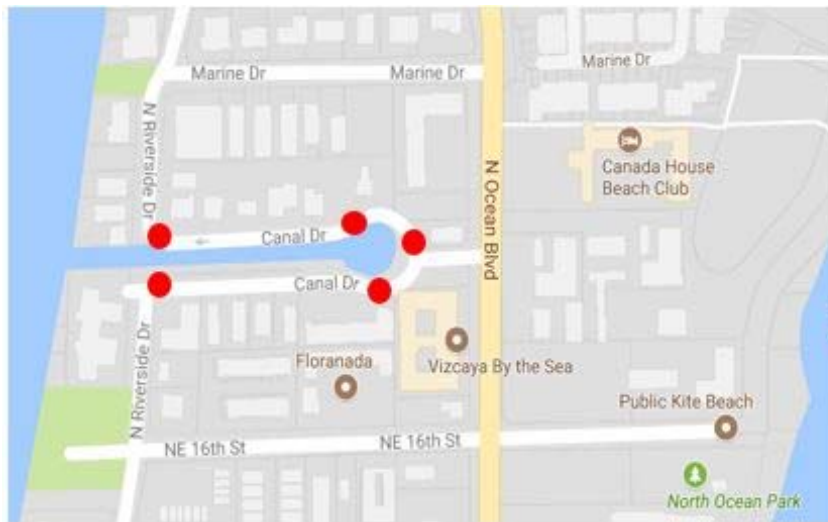
Groups can register to help document and record flood data for their choice of one of the six sites below. These sites commonly experience tidal flooding, and data on inundation levels should be recorded. These regions are expected to experience flooding; however, since flood levels and locations can vary, not all locations may be flooded. If there is flooding within the general vicinity, but not the exact location, that occurrence should be recorded.

Site 1: Pompano Beach

Canal Drive around loop to N Riverside Drive

Ideal for small group.

Input for GPS for driving directions: 1621 N Ocean Blvd, Pompano Beach, FL 33062



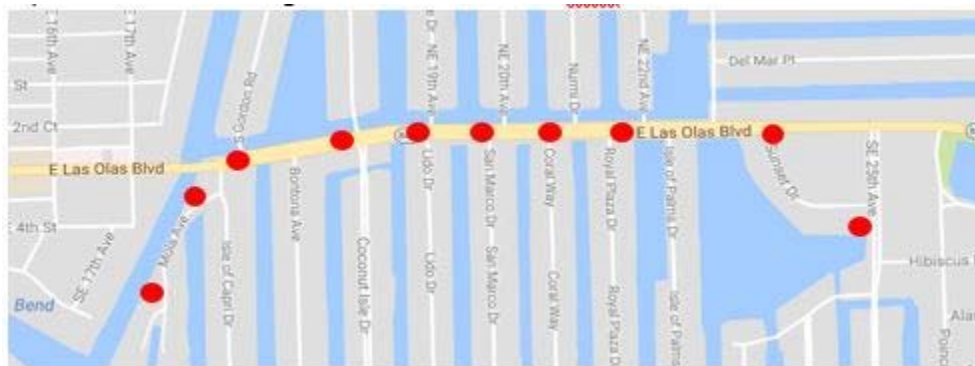
Prone to tidal flooding, group should record data in the vicinity of these areas

Site 2: Fort Lauderdale 1

E Las Olas Blvd from Isle of Capri to SE 25th Ave

Ideal for large group with ability to break out into smaller groups and walk.

Input for GPS for driving directions: 1750 E Las Olas Blvd, Fort Lauderdale, FL 33301



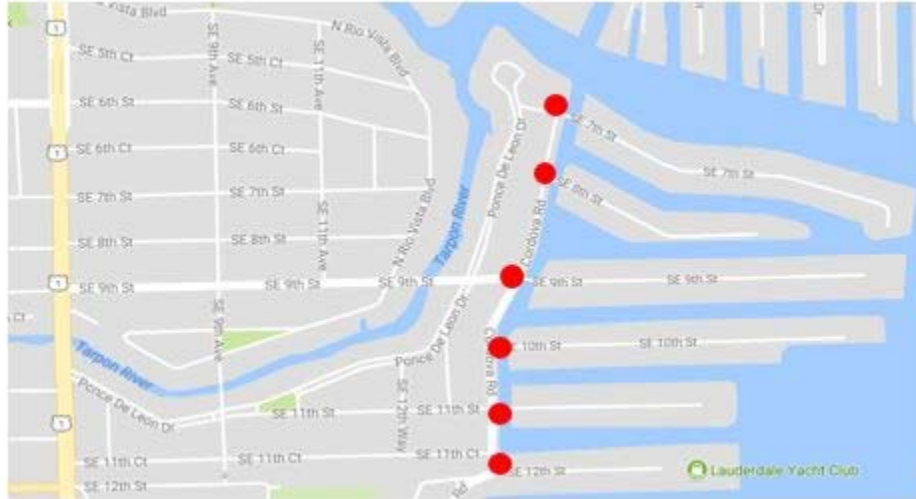
Prone to tidal flooding, group should record data in the vicinity of these areas

Site 3: Fort Lauderdale 2

Cordova Road from SE 7th St to SE 12th St

Ideal for medium group with the ability to walk.

Input for GPS for driving directions: 1414 SE 12th St, Fort Lauderdale, FL 33316



Prone to tidal flooding, group should record data in the vicinity of these areas

Site 4: Hollywood 1

N North Lake Drive and N Ocean Drive (at intersections)

Ideal for medium group with ability to break into two smaller groups, carpool, and walk.

Input for GPS for driving directions: 921 N North Lake Dr, Hollywood, FL 33019



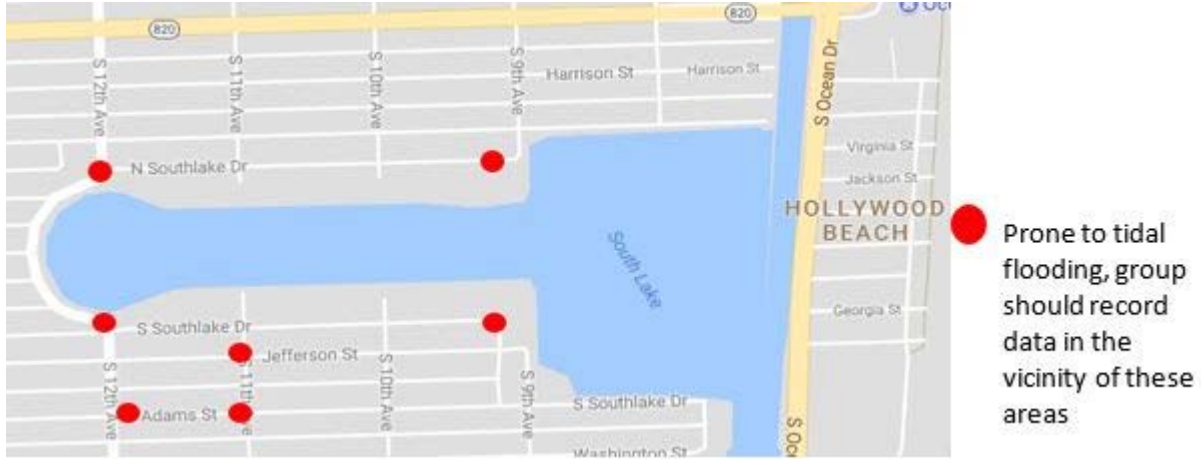
Prone to tidal flooding, group should record data in the vicinity of these areas

Site 5: Hollywood 2

S Southlake Drive down to Adams St

Ideal for medium group with ability to walk and possibly break into smaller groups.

Input for GPS for driving directions: 1230 South Southlake Drive, Hollywood, FL 33019



Site 6: Hallandale Beach

Golden Isles Drive

Ideal for small group with ability to walk.

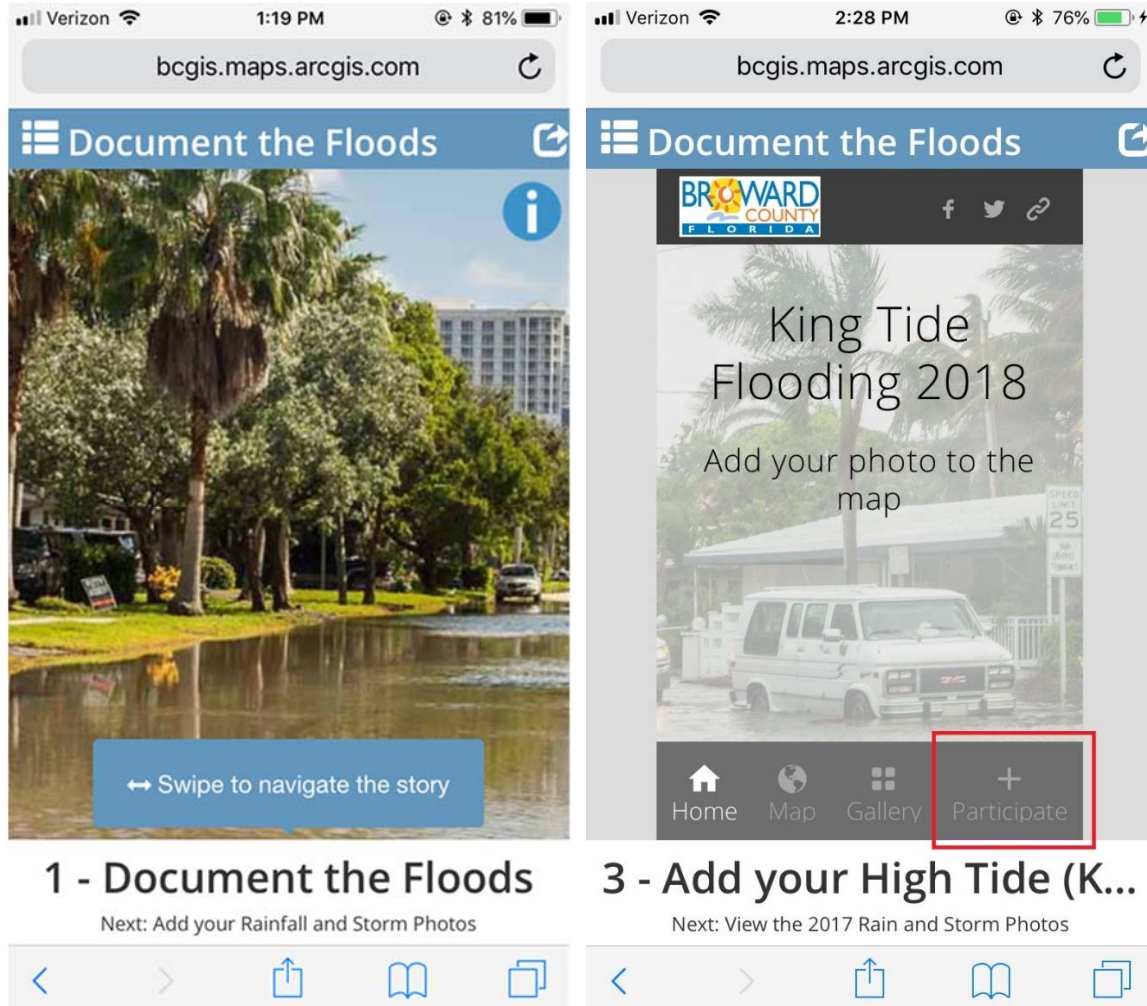
Input for GPS for driving directions: 1900 E Hallandale Beach Blvd, Hallandale Beach, FL 33009



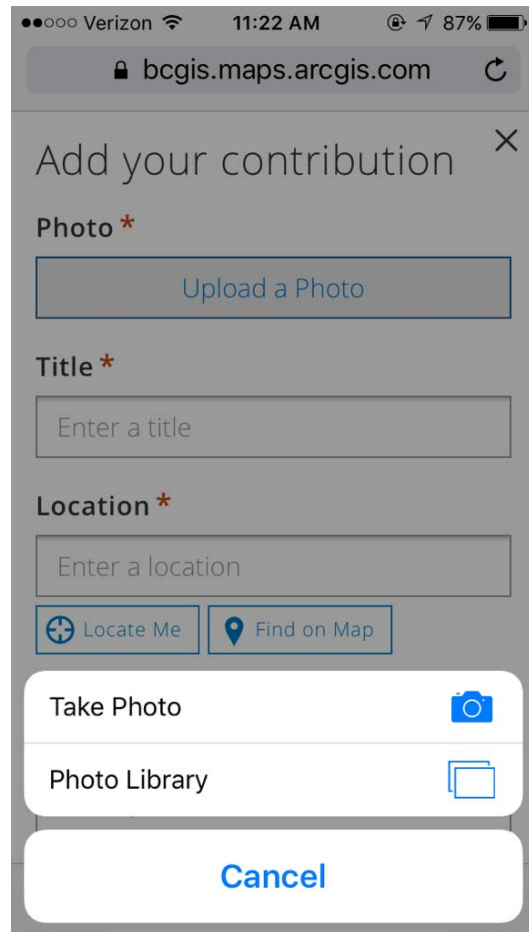
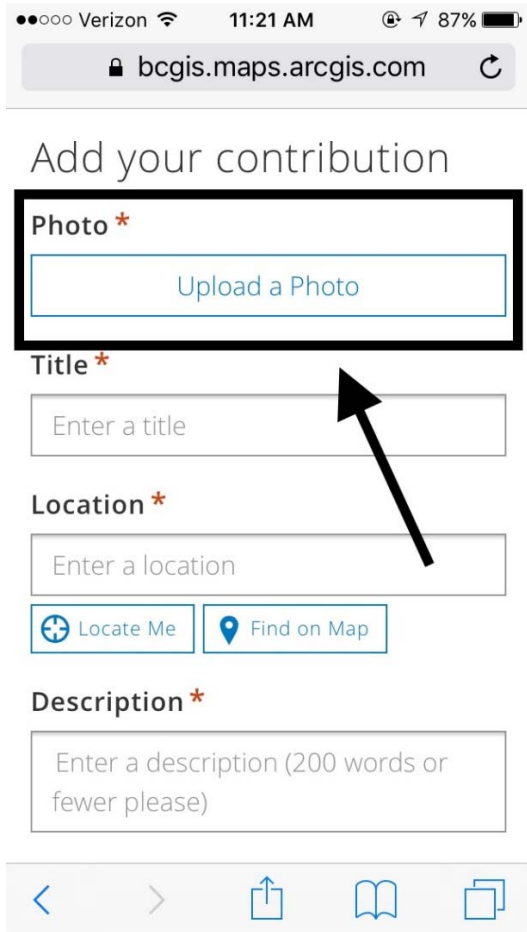
How to Report Data

Steps to Document Flooding:

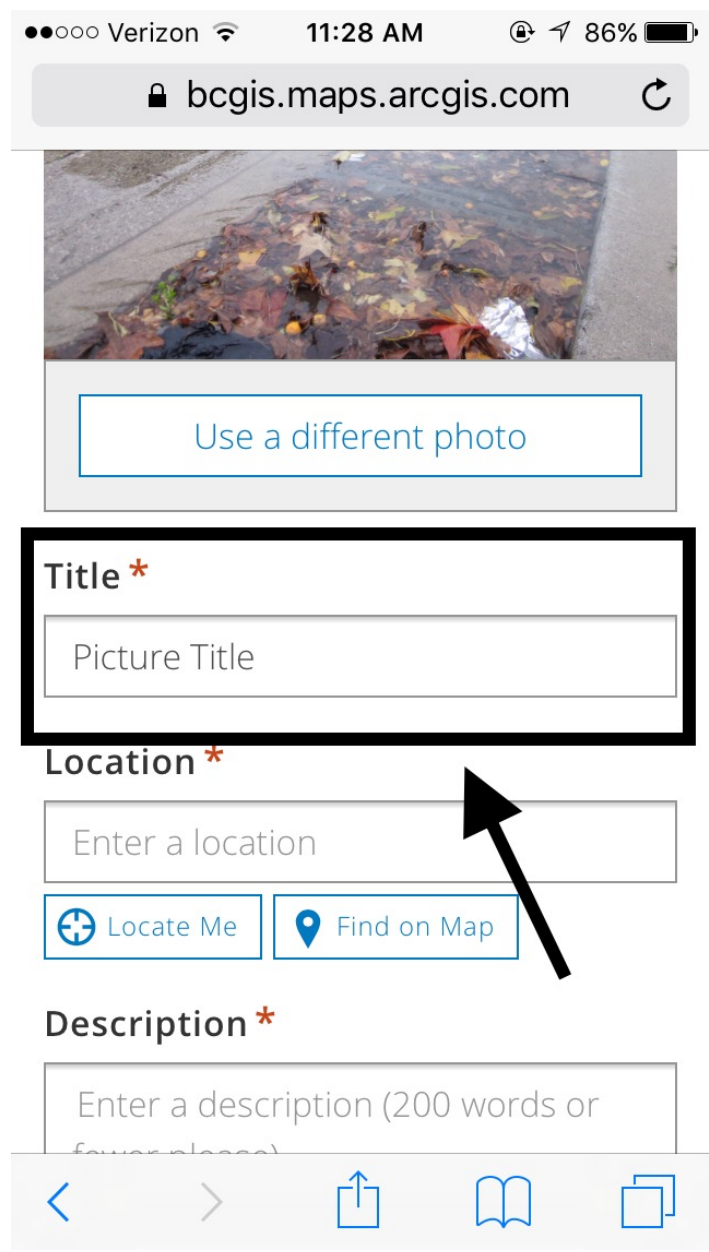
Step 1. On your smart phone's internet browser, go to <http://bcgis.maps.arcgis.com/apps/MapSeries/index.html?appid=23c002b9d6764d0297cb6c1ccf6d59b6>. Swipe left twice, so you see the King Tide Flooding 2018 screen. Press 'Participate' in the bottom right hand corner. *TIP: If you turn on location services for your internet browser app, uploading photos with the location will be easier.*



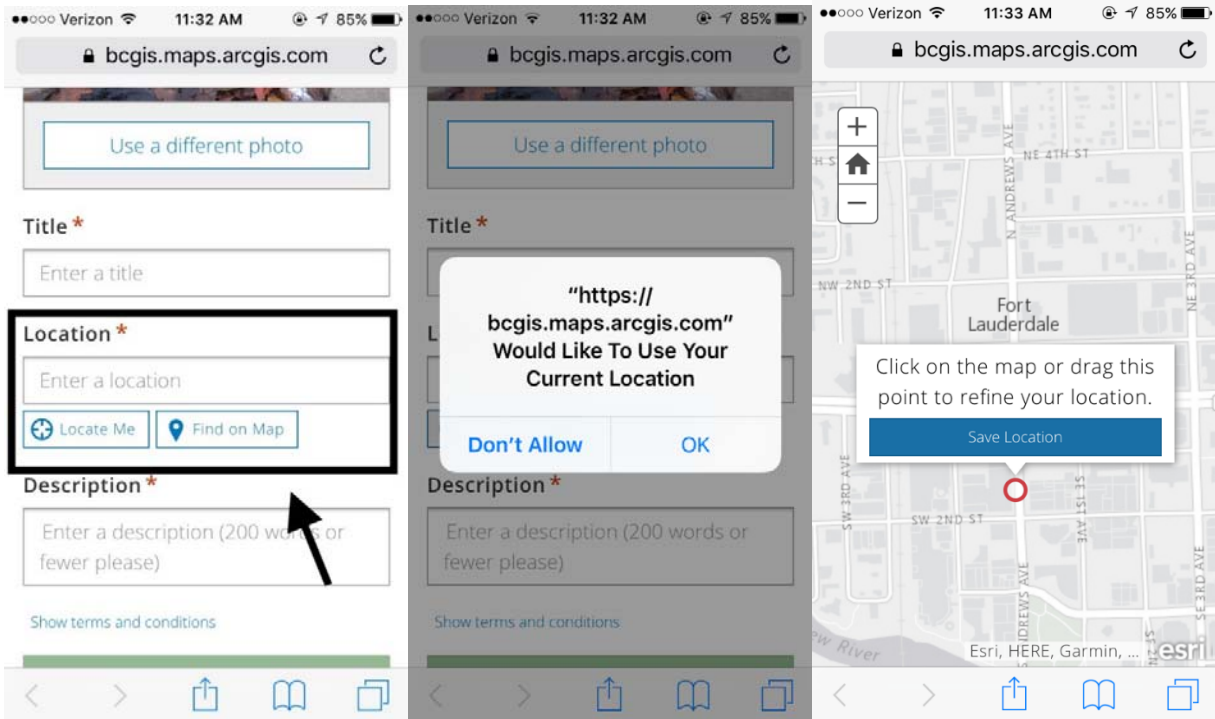
Step 2. Press 'Upload a Photo' to either take a picture of a flooded area or to upload a picture already in your photo library. If there is no flooding, take a photo of a dry area near a water source.



Step 3. Enter a title for the picture.



Step 4. Enter your location in the description box. If you do not know your exact location, click 'Locate Me' or 'Find on Map'. *NOTE: The 'Locate Me' button will only work if you enable location services for your internet browser app. This can be done in your phone settings.* These will ask to use your current location. Agreeing will allow the device to automatically pinpoint your location on the map. Once your pinpoint comes up on the map, select 'Save Location'.



Step 5. Provide a description (time, date, appearance, etc.). If you have access to a ruler and/or salinity measurement tool (such as a refractometer), use it to measure the depth flooding and/or salt content, then enter it in the description box. Depth should be noted in inches. Level of salinity should be noted in parts per million (ppm). *NOTE: You will need to calibrate the refractometer tool before you use it, see the instructions in the refractometer case. Instructions for taking a reading with the refractometer is on page 17 of this guide.*

Verizon 11:45 AM 84%

bcgis.maps.arcgis.com

Location *

38-64 N Andrews Ave, Fort Lauderdale

Locate Me Find on Map

Description *

Description

Show terms and conditions

Accept Terms and Submit

Close

* Required Fields

Step 6. Once all of these steps are completed, select 'Accept Terms and Submit'.

Verizon 12:02 PM 81%

bcgis.maps.arcgis.com

Location *

113-199 S Andrews Ave, Fort Lauderdale

Locate Me Find on Map

Description *

Description

Show terms and conditions

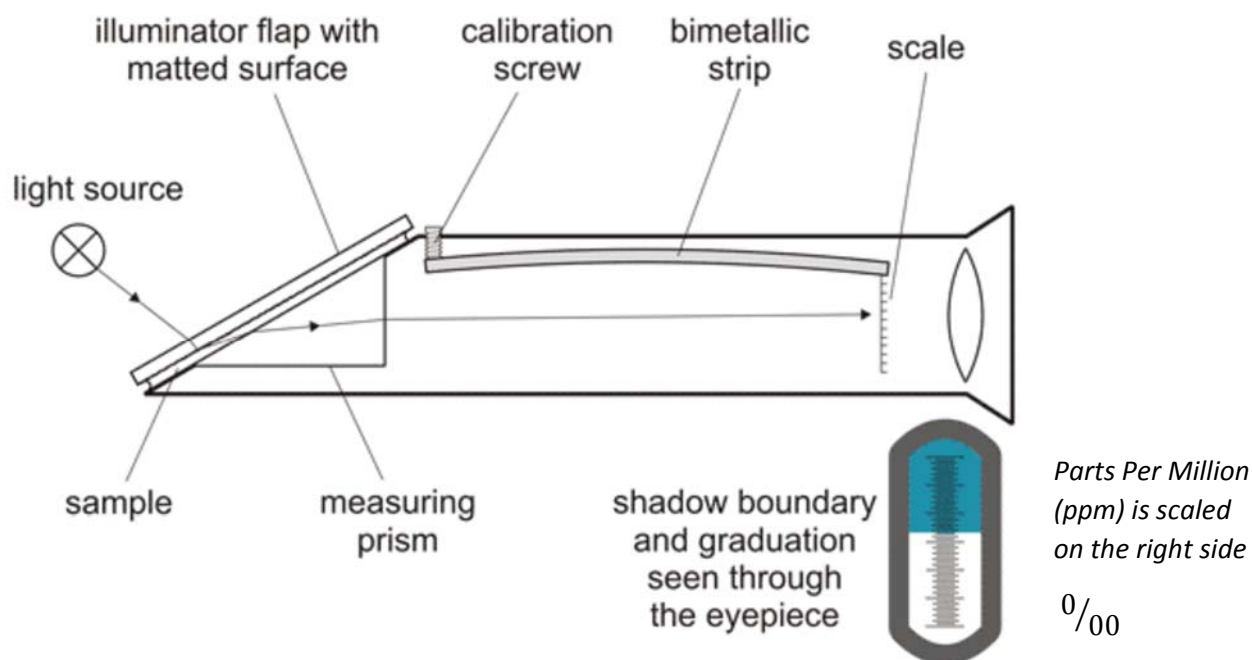
Accept Terms and Submit

Close

* Required Fields

Using a refractometer to measure salinity in flood waters:

1. Open the daylight plate and apply one or two drops of the sample solution using a pipette (or eyedropper) to the surface of the prism. Hold the refractometer at an angle, so the sample will not run off.
2. Gently close the daylight plate to avoid splashing. The sample solution should make a thin film over the entire surface of the prism. If the sample does not cover the entire prism, reapply the sample solution. If the prism is not completely covered or has bubbles it could result in inaccurate readings.
3. Look through the eyepiece. Focus the scale until it is sharp to your eyes by gently turning the eyepiece either clockwise or counterclockwise.
4. The upper field of view appears blue and the lower field will be white. The reading is taken at the line where the blue and white fields meet.
5. After taking a salinity reading, gently wipe the prism with a provided cloth.
6. You will need to calibrate your refractometer periodically. To calibrate it, take a reading using distilled water (provided in the white solution bottle in the kit). Turn the calibration screw with the included screwdriver (found in the refractometer case beneath the pipette) while looking through the eyepiece until the boundary line falls on "35 ppm".



Using the Refractometer:

- Be gentle with the instrument: do not drop it or handle it roughly.
- Do not use a rough or abrasive material to clean the prism.
- Do not hold the refractometer under water or splash it with water.

Tips for Effective King Tides Photos:

- Take pictures at or near peak high tide. You can track high tides and water levels in your area using NOAA's Tides and Currents page.
- Take pictures where the impact of tides can be gauged against familiar landmarks, such as buildings, roads, sidewalks, parking lots, jetties, bridges, sea walls, & shorelines.
- Take contrasting shots of peak high and low tides, to help show the tidal range/variation.
- Most importantly- be safe! Use good judgment when you are taking photos; stay away from dangerous situations – such as stormy conditions – and avoid taking risks.

Photos of flooding are used in several ways to help people:

- Document current flood risk in coastal areas
- Visualize the impacts of future sea level rise in their community
- Verify climate change models by comparing model predictions with the high-tide reality
- Serve as a living record of change for future generations

Photos may be used in presentations, exhibitions, websites and publications on sea level rise impacts, coastal initiatives and climate action. Photos may also be used by Broward County and its partners for research and planning to assess where coastline is most vulnerable, and to better predict future sea level rise.

Classroom & Other Resources

City of Fort Lauderdale

- King Tides: <http://www.fortlauderdale.gov/departments/city-manager-s-office/strategic-communications/king-tides>

Environmental Protection Agency (EPA)

- King Tides and Climate Change: <https://www.epa.gov/cre/king-tides-and-climate-change>
- Photography Tips for Citizen Scientists: <https://blog.epa.gov/blog/2015/10/photography-tips-for-citizen-scientists-capturing-the-2015-king-tide/>

National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce – Resources for students and teachers

- What is a King Tide? <https://oceanservice.noaa.gov/facts/kingtide.html>
- NOAA Education Website: <https://oceanservice.noaa.gov/education/>
- Direct link to “Tides” resources for students and teachers: https://oceanservice.noaa.gov/education/pd/tidescurrents/tidescurrents_tides.html

Video

- Eyes on the Rise Documentaries: <http://www.eyesontherise.org/documentaries/>
- Eyes on the Rise Web Series: <http://www.eyesontherise.org/seriespage/>
- CBS Miami, King Tide: <http://miami.cbslocal.com/tag/king-tide/>

Reference

- Dahl, K., Fitzpatrick, M., Spanger-Siegfried, E. 2017. Sea level rise drives increased tidal flooding frequency at tide gauges along the U.S. East and Gulf Coasts: Projections for 2030 and 2045. PLoS ONE 12(2) <https://doi.org/10.1371/journal.pone.0170949>