Miami-Dade County is a relatively modern municipality, having been founded in 1836 but predominantly developed in the 20th century. The Miami portrayed on postcards and TV shows is a city largely settled after the commodification of the automobile. In many ways, Miami is an icon of “the present”. Just over 100 years of rapid growth has led to a sprawling metropolitan area so extensive it practically requires having a car as a standard of living. With rapid development comes environmental impacts. The fast municipal development, encroachment into pristine natural surroundings, and extensive roadway systems are just facets of the ecological footprint Miami imposes on the environment. Today’s Miami is not the agricultural center it was founded to be in the 1800s. Most residents do not grow citrus—they work in modern jobs and enjoy amenities that make the hot Miami days tolerable, such as air conditioning and refrigeration. Even these abundant commodities come at a cost. The present in Miami is much like anywhere else in the world in that it both extracts heavily from the environment and returns more harm to the land and water through waste than it reimburses through conservation and rehabilitation. The Miami of today is the foundation for the Miami of tomorrow, so what legacy will be inherited by future generations of South Floridians?

This lesson plan accompanies the Miami Waterkeeper documentary Waves of Change Episode 2: “Present”. The materials provided are adaptable to several educational standards and can be adjusted for grade levels from middle to high school.
**MIAMI WATERKEEPER**

Miami Waterkeeper’s mission is to ensure swimmable, drinkable, fishable water for all.

Founded in 2010, Miami Waterkeeper defends everyone’s right to use and enjoy clean water. Our scope of work is diverse, with focus areas including clean water, ecosystem protection, and sea level rise readiness.

**TIMELINE**

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**FLORIDA STANDARDS:**

**SC.912.L.17.16:** Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.

**SC.912.L.17.17:** Assess the effectiveness of innovative methods of protecting the environment.

**SC.68.CS-PC.3.5:** Identify resources such as city, state, and federal government websites and explain that these resources can be used for communication between citizens and government.

**SC.7.E.6.6:** Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

**SC.7.C.2.3:** Experience the responsibilities of citizens at the local, state, or federal levels.

**SC.7.C.3.14:** Differentiate between local, state, and federal governments’ obligations and services.

**SC.7.L.17.3:** Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.

**STUDENTS BY THE END OF THE LESSON SHOULD BE ABLE TO:**

Analyze and discuss summative ideas from a film screening
Make correlations between local and global ideas
Recognize patterns and historic trends impacting environment and society
Discern interconnected systems, such as municipal water cycles
Assess personal resource usage and correlate their impact on the environment
Condense a range of statistical and historic information into a shareable design
Research additional information to support expository and persuasive arguments
Recognize systems of governance and the roles of representatives
Draft a correspondence or argumentative appeal to a community leader
BACKGROUND

Miami Waterkeeper’s documentary Waves of Change offers three episodes discussing South Florida’s relationship with the water. Each episode explores how the natural splendor is directly related to societal reliance on aquifers and aquaculture. The South Florida peninsula thrives on a codependency with its marine and land-based ecosystems. Over a century of industrialization, development, and widespread agriculture has impacted the natural resources that fuel society in the region, and without thoughtful attention and direct intervention the land and water will become inhospitable to residents. Waves of Change explores these facets of the water’s history in South Florida in three episodes: “Past”, “Present”, and “Our Vision of the Future”.

The following lesson plans are designed to accompany Waves of Change Episode 2: “Present”. The materials provided are adaptable to grades 6-12, using state educational standards for STEM and Social Sciences curriculum.

1. INTRODUCTION AND DOCUMENTARY PRE-SCREENING DISCUSSION

a. Suggested Icebreaker: Think/Pair/Share:
   i. **THINK**: Students should independently think about their answer to this question: What is your relationship with water?
      1. Have the students take several minutes to list all of the ways in which they use and encounter water on a daily basis. Suggest they think of their daily routine, starting with waking up and ending with bedtime. You may want to indicate that “encounter” does not mean “consume”- what are the other ways in which we engage with water (ex. Swimming, boating, fishing, running along the bay)?
   ii. **PAIR**: Students should then pair up with a partner to compare their lists.
      1. Instruct them to record their similarities and differences- they may want to design a Venn diagram or T-Chart to organize their observations. They should discuss their findings.
      2. Ask each pair to make the following correlation: Why is it important to recognize the extent of our relationship with water?
   iii. **SHARE**: Have each pair share these findings in class discussion:
      1. Provide a summary of their similarities and differences.
      2. Offer a statement they have drafted together and agreed upon that answers the prompt: Why is it important to recognize the extent of our relationship with water?

b. Documentary Lead-In Discussion Questions:
   i. How do you get access to the uses and encounters in your personal list?
   ii. What might be some challenges or threats to your water access?
   iii. How might you go about addressing and even preventing some of those possible threats?
   iv. Why might the phrase “Waves of Change” be relevant to your relationship with the water?
II. SCREEN WAVES OF CHANGE EPISODE 2: “PRESENT”  

ENCOURAGE NOTE-TAKING

III. DOCUMENTARY REVIEW AND DISCUSSION:

a. Open Discussion:
   i. Ask for first impressions or lasting impacts.
   ii. Ask if there are follow-up questions or needs for clarification.

b. Guided Discussion:
   i. What are our responsibilities in regards to water?
      1. How do we benefit the water?
      2. How might we harm it?
   ii. Which water quality and availability concerns addressed in the documentary do you think impact
       you most-directly?
   iii. Which of these concerns do you think you may play a role in perpetuating?
   iv. How could you go about addressing your concerns regarding the water?
      1. What would you say to inform others about these issues?
      2. What changes could you make in your routine to set an example for water responsibility?
      3. What actions can you take at a community or government level?
   v. How have organizations like Waterkeeper used the systems we have in place to address concerns
      regarding the water? What tools are available to advocate for change and preservation?

IV. WATER SYSTEMS WORKSHEET

a. Distribute the accompanying worksheet.
b. If possible, the images provided should be displayed on the class board.
c. Do not have students complete the sheet all at once- each section should be followed by discussion.
d. Grading for the worksheet is based on the teacher’s discretion.
e. This assignment should be completed in class.

V. PERSONAL IMPACT ACTIVITY

STUDENTS WILL NEED ACCESS TO THE INTERNET TO COMPLETE THESE ACTIVITIES

a. Have students link to the Miami Waterkeeper Clean Water Friendly Home web quiz: https://www.
   miamiwaterkeeper.org/clean_water_friendly_home
   i. Provide about 5 minutes to complete and have students take the following notes:
      1. Which answers were easy to provide?
      2. Which questions were you unable to answer?
      3. What might you have learned from taking this quiz?
   ii. Offer several minutes for discussion before moving on.

b. Have students link to the Footprint Calculator at https://www.watercalculator.org/
   i. Provide about 5 minutes to complete and have students provide the following notes:
      1. What have you learned from taking this quiz?
      2. How do your results provide insight on the outcome of your Clean Water Friendly Home quiz?

c. Ask students to do the following from their notes:
   i. Provide one personal statement: What do the results of your quizzes suggest about your relationship
      with the water?
   ii. Provide one persuasive statement: What advice should be shared with others regarding understanding
      our personal relationships with the water?
VI. FISH KILL AND ALGAE BLOOM ADVOCACY

a. Link the class to Miami Waterkeeper’s campaign website for Fish Kill Algae Bloom: https://www.miamiwaterkeeper.org/fish_kill
b. Read the situation report and background information provided on the page. Encourage students to explore the interactive map charting bloom sightings. Ask them if they had any encounters with algae blooms or fish kills.
c. Link to the “Why Did This Happen?” site and read as a class. Ask them to note 2-3 scientific details that are not common knowledge but are essential to understanding the situation.
d. Have them work in small groups to answer the following questions:
   1. How would you explain this situation to someone unfamiliar with the science or history behind algae blooms?
   2. What tools can you use to demonstrate why this is a concerning issue?
   3. Who could you reach out to if you wished to express your concerns with someone who can take control of the situation? Who would be the best audience for your argument?
   4. Draft an “Elevator Pitch”: Explain the significance of Algae Blooms and the need for action against them in a 30 second argument.

V. INFOGRAPHIC PROJECT

SEE THE ACCOMPANYING PROMPT SHEET FOR PROJECT REQUIREMENTS

A. This assignment should be completed in groups over the course of several days.
B. Project Includes:
   a. Research and analysis
   b. Graphic design and organization
   c. Recognition of patterns
   d. Clear communication to a broad audience
   e. Use of web sources for study, drafting, and publication
   f. Sample Infographics for reference
C. Timelines and rubrics for assessment are up to the teacher’s discretion.
WATER SYSTEMS WORKSHEET

Name: ____________________________ Date: ____________ Class: ________________

Complete the following prompts and activities based on your notes from Waves of Change Episode 2: “Present”. Each section will be used for class discussion.

A. **Map Study**: Compare the differences between the two maps of Florida, then answer the questions that follow.

![Map Study](image)

**Map Study Questions:**

1. What are the similarities and differences observable on these maps?
   
   a. Similarities:
   
   b. Differences:
2. **What are two possible reasons for the changes in water flow between the Historic Map and the Current Map?**
   
a. Reason 1:

   b. Reason 2:

3. **What evidence from the Current Map supports your analysis of the changes to water flow?**
   
a. Reason 1:

   b. Reason 2:

4. **What are two predictions you might make if you were to create a “Projected Future of Water Flow” Map? Provide a brief explanation of each prediction.**
   
a. Prediction 1:

   b. Prediction 2:

5. **In one or two sentences, what overall observation, lesson, or message might be made from comparing today’s South Florida water flow to its historic system?**
B. Water Systems Analysis: The three images below demonstrate natural water systems and the ways in which they are adapted to accommodate cities and living spaces. Study each image and then respond to the prompts provided.

Image A: Florida’s Aquifer and Water Services Systems

1. What natural systems and water cycles are evident in this illustration?

2. How is the Florida water system adapted for human consumption?

3. How might this illustration suggest that the Florida water system is a delicate balance?

4. What possible threats to that balance are suggested by this illustration?
1. Mark on this image all of the ways in which natural water systems are adapted to serve human activity.

2. Mark any components of this map that you see as directly-related to your daily routine.

3. Based on the illustration, describe three ways in which the water systems cities use are impacted in ways that may not be regularly easy to observe:
   a. Impact 1:
   b. Impact 2:
   c. Impact 3:

4. Correlate this image with the “Current Water Flow” map on page 1. What conclusions and predictions can be made regarding ongoing population sprawl in South Florida?
   a. Conclusion:
   b. Prediction:
Image C: Run Off, Algae Blooms, and Fish Kills: Aquatic and coastal ecosystems thrive on a delicate balance between oxygen levels, nutrient sources, and water quality. A risk of building cities is that our dependency on extracting and discarding water for sustenance and utility often disrupts the balance of aquatic ecosystems. The results can be devastating for natural systems, causing algae blooms and fish kills. Algae blooms happen when there are too many nutrients like nitrogen and phosphorus in the water. These nutrients can fuel algae in the water to bloom and can lead to the reduction of water clarity, fish die-offs, human health risks, and the loss of biodiversity. Use the diagram below to answer the following questions.

1. Explain the cycle demonstrated in the diagram above.

2. What common daily activities may be contributing to algae blooms and fish kills?

3. How might residents limit the risk of contributing to algae blooms and fish kills?

4. How might businesses limit the risk of contributing to algae blooms and fish kills?

5. What steps should cities and governments take to prevent algae blooms and improve water quality?
Student groups will design informative data graphics useful for displaying research, advocacy, and argumentation. Using digital drafting tools and online platforms, each group will be assigned one topic from the Waves of Change Documentary’s Episode 2: Present. The end product should be a comprehensive and accessible collection of information presenting research and argumentation addressing impacts on South Florida’s water systems.

Each group should be assigned one of the following topics:
- Algae Blooms and Fish Kills
- Sea Level Rise
- Historic Water Flow Disruption
- City Growth and Development Sprawl- Impacts on Water Access and Quality
- Sewage and Wastewater Contamination
- Dredging Impacts and Coral Reef Destruction
- Community Support and Advocacy Opportunities- How to Work with Government

Instructions:
Groups will conduct research into one of the above topics and design an Infographic that presents their findings in an accessible and persuasive manner. They must use content from the documentary and secondary research sources to collect information that will then be arranged on an engaging and educational display. Space must be allocated for citation of any research utilized.

Areas of focus for this information should include, but are not limited to:
- Statistical Data
- Historic Trends or Patterns
- Rules, Regulations, and Laws
- Orders of Operation or Organizing Flow Charts
- Maps and Diagrams
- Displays of Interconnected Systems
- Terms, Definitions, Slogans, or Phrases

This information should be displayed using:
- Text Boxes
- Icons, Graphics, and Logos
- Concise Phrases
- Interconnected Series of Information (ex. Boxes connected by lines to demonstrate order of operations or consistency of data)
- Graphs or Other Organizers for Data
- Multiple Colors to Indicate Differences in Data or Trends
- Clear Introduction and Conclusion Sections

Some Suggested Research Sources:
https://www.miamiwaterkeeper.org/
https://www.policymap.com/maps
https://coast.noaa.gov/slr/
https://www.miamidade.gov/global/home.page

Suggested Design Websites:
https://www.canva.com/
https://pixlr.com/
https://venngage.com/templates/infographic
SAMPLE INFOGRAPHICS

FlyEye Telescopes to Spot Asteroids

To hunt for threatening asteroids, astronomers use traditional telescopes with narrow fields of view – it’s a slow, tedious process.

ESA is developing new ‘FlyEye’ telescopes to conduct automated nightly sky surveys.

FlyEye telescopes combine multiple lenses, like a fly’s compound eye, giving an extra-wide field of view.

Up to four FlyEye telescopes will be located worldwide. Together with sightings from European and international astronomers, FlyEye data will be sent to the International Astronomical Union (IAU’s Minor Planet Center (MPC), the world’s central clearing house for all asteroid sightings.

In Europe, ESA’s Near Earth Object Detection System (NEODyS) will join & coordinate FlyEye observations, as well as perform asteroid sightings including those from the European Southern Observatory (ESO’s) Very Large Telescope.

At the NEODyS, the focal point for Europe’s contributions to the global asteroid hunt, experts download sighting data from the MPC and perform nightly accurate orbit computations.

ESA asteroid experts work with other space agencies and European civil protection authorities to devise mitigation measures. ESA also supports asteroid warning and risk assessment activities at the United Nations, in cooperation with experts from the IAU and worldwide.

ESA’s orbit computations are used to predict impact risks up to 100 years into the future.

If a known asteroid is predicted to hit Earth in the next 300 years, hundreds of thousands, however minor, unseen and uncharted asteroids become a concern.

#SaferSpace

Wikicommons- Graphic Designed by the European Space Agency http://www.esa.int/spaceinimages/Images/2018/06/Flyeye_telescopes_infographic