STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
GRANT WORK PLAN
DEP AGREEMENT NO.: R2118

ATTACHMENT 3

I. TITLE PAGE

1. PROJECT TITLE: Stormwater Outfall Invert Elevation Evaluation

2. GRANTEE Contact Information:

Organization Name: City of Naples
Name of Authorized Signer: Teresa Heitmann
Title: Mayor
Address: 735 Eighth Street South
City: Naples
Zip Code: 34102
Area Code and Telephone Number: 239-213-1000
E-mail Address: theitmann@naplesgov.com

3. GRANT MANAGER Contact Information:

Organization Name: City of Naples
Name: Stephanie Molloy
Title: Natural Resources Manager
Address: 295 Riverside Circle
City: Naples
Zip Code: 34102
Area Code and Telephone Number: 239-213-1031
E-mail Address: smolloy@naplesgov.com

4. FISCAL AGENT Contact Information:

Organization Name: City of Naples
Name: Gary Young
Title: Finance Director
Address: 735 Eighth Street South
City: Naples
Zip Code: 34102
Area Code and Telephone Number: 239-213-1815
E-mail Address: gyoung@naplesgov.com

5. FEID No. (a.k.a. Tax ID#): 59-6000382 **Seq No.** 003

6. WORK PERFORMED BY: (Select only one)

_____ Grantee ONLY
__X__ Subcontractor ONLY
_____ BOTH the Grantee & Sub-Contractor
_____ To Be Determined

7. SUBCONTRACTORS CONTACT INFORMATION: *(If applicable & known)*

Organization Name: AECOM Technical Services, Inc.

Name: Amy Eason

Title: Senior Project Manager

Address: 2090 Palm Beach Lakes Blvd, Suite 600

City: West Palm Beach

Zip Code: 33409

Area Code and Telephone Number: (561) 515-3925

E-mail Address: amy.eason@aecom.com

8. PROJECT LOCATION:

A. List of County(ies): Collier County

B. List of City(ies)/Town(s)/Village(s): City of Naples

C. State Lands Lease Agreement Number(s): N/A
Provide lease agreement number(s) for any work that will be performed on State Lands. If work will not be on any state lands, please indicate N/A.

Remainder of this page intentionally left blank.

II. WORK PLAN

9. **PROJECT SUMMARY:** The coastal City of Naples is at high risk from climate change impacts such as sea level rise and increased precipitation intensity. Delaying action is costlier than taking incremental actions now to mitigate and adapt for impacts. This project will develop an accurate inventory of stormwater outfall invert elevations for areas identified in the Climate Vulnerability Assessment as most vulnerable to climate change impacts. This will subsequently be input to update a hydrologic and hydraulic model of the stormwater management system utilizing sea level rise and precipitation projections to develop climate adaptation strategies.

10. **PROJECT DESCRIPTION:** The preliminary assessment of vulnerability of Naples' stormwater management system included in the 2018 Stormwater Master Plan update was primarily an exposure assessment and did not consider other aspects of vulnerability such as sensitivity and adaptive capacity. A Vulnerability Assessment of City infrastructure is currently taking place to evaluate sensitivity and adaptive capacity. **This proposed project will build on the vulnerability assessment by performing a more in-depth study of the stormwater management system's vulnerabilities in order to develop adaptation strategies to protect it against climate change impacts.**

    A crucial component of the City of Naples' Climate Adaptation and Mitigation Plan, this project will perform a detailed evaluation and inventory of outfall invert elevations for stormwater outfalls in areas identified in the Climate Vulnerability Assessment (currently underway) as being most vulnerable to flooding. These are the lowest points of the stormwater system and are particularly significant for gravity-drained networks. Understanding this elevation and how it relates to future sea level rise and precipitation projections is a critical piece of information for stormwater management and flood prevention. Once the invert elevation is exceeded, it is much more difficult for excess stormwater to drain and results in flooding. Outfalls that are below the future high tide or storm event elevations can be addressed with developed strategies (e.g., raising outfall, installing check valves, installing pumps, etc.) to improve stormwater discharge and minimize flooding to protect residents and infrastructure.

    This stormwater elevation information will be utilized in a larger City project of development of a Climate Adaptation and Mitigation Plan. Accurate stormwater outfall elevations are required to perform an updated Hydrologic and Hydraulic model ("H&H model") of the City's stormwater system to integrate projected changes in precipitation and rising sea levels. Sea level and precipitation projections will be input into a combined H&H model used to identify at-risk areas of the city that are unable to drain during storm events. The models typically use multiple rainfall events to consider extreme and moderate conditions in terms of rainfall intensity, duration, and frequency. Future sea levels are also used as a boundary condition to identify the timing and types of coincident conditions that may affect the overall capacity of the system. Results of the study will show expected inland ponding areas that are unable to drain efficiently and can be used to prioritize interventions.

11. **PROJECT NEED AND BENEFIT:**
    A. **Explain the demonstrated need, which the project addresses.** The City of Naples, Florida ("City") is a low-lying coastal area (elevation ranges from approximately 3'– 9'), located on the eastern Gulf of Mexico. There are two major inlets, Moorings Bay in the north of the city, and Naples Bay in the lower two-thirds of the city. The Florida Gulf Coast is, and will continue to be, susceptible to climate change impacts, including sea level rise, storm surge, extreme precipitation, extreme heat, and periodic drought. Sea level rise is already affecting the Gulf Coast and as a result, public infrastructure is at risk and in need of protection. At the front line of public infrastructure is the City's stormwater management system, which drains directly to the bays and the Gulf. The City's stormwater management system function is to effectively and efficiently regulate, manage and maintain stormwater drainage

infrastructure and surface water bodies to meet growth management goals of flood prevention, groundwater recharge, wetland preservation and water quality protection.

Tide gage records indicate that mean sea levels have risen approximately ten inches in the Naples area over the last century (Figure 1). The local historical sea level rise rate is faster than the global average rate. With global sea levels projected to continue to rise, public and private shoreline assets, including City stormwater infrastructure, will become more vulnerable to an increase in the frequency and magnitude of high tides and coastal flood events.

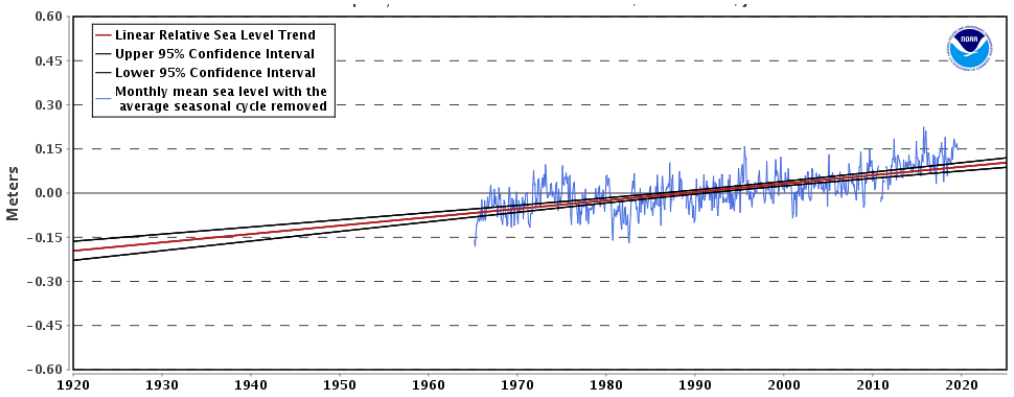

Figure 1. Regional Sea Level Rise Trends Observed at the Naples Tide Station.
(National Oceanic and Atmospheric Administration (NOAA) Sea Levels Online)

The projection of sea level rise in Naples by the year 2050 will reach to 11 inches over the course of 40 years[1]. King tide flooding increasingly affects coastal areas by reducing property values, lowering coastal infrastructure values, and increasing salinity levels, which kills coastal forests as well as contaminating freshwater supplies[2]. King tides typically occur during the fall months in south Florida. Although king tides typically only increase sea levels several inches above spring tide levels, they can cause flooding to low-lying coastlines, particularly if coinciding with a storm event or other oceanographic condition that elevates tides above normal levels. Global warming has progressively made sea level rise worse and the additional rise with a King Tide makes flooding in low level areas more severe.

High tide flood frequencies are expected to rapidly increase along the Gulf coastline. By 2050, annual high tide flood frequencies along the Eastern Gulf is anticipated to be 25 days/year under an Intermediate Low (0.5 m global rise by 2100) sea level rise projection, and 85 days/year under an Intermediate sea level projection (1.0 m global rise)[3]. By 2100 annual high tide flood frequencies are anticipated to be 200 days/year under an Intermediate Low (0.5 m global rise by 2100) sea level rise projection, and 265 days/year under an Intermediate sea level projection (1.0 m global rise)[3]. By 2100, high tide flooding will become or exceed on average 'every other day' flooding under the Intermediate Low scenario, and by 2100, high tide flooding will become 'daily' flooding under the Intermediate scenarios. Figure 2 shows King Tide "sunny day" flooding in Naples.

Observed water levels during king tide events may be higher than predicted astronomical tides due to additional factors such as precipitation, storm surge, and recent sea level rise that is not captured in the predicted tides. Coastal flooding is influenced by other dynamical processes, such as from waves and their effects, local rainfall, elevated groundwater tables and river runoff. The outcome of continued flooding includes beach erosion at a faster pace, road closures (risk to the elderly population for inability of emergency services access), sewage overflows, damage to homes (including historic structures), and negatively impacted intertidal reefs and mangrove estuaries.

Figure 2. Sunny Day Flooding in Naples (September 2019)

A rapid increase in the average temperature of the United States has occurred over the past decades. The increase in temperature could have major implications for natural and built systems further in the future. As the average temperature increases, we will start seeing record-breaking temperature years become a common thing. With increased temperatures comes more frequent and higher intensity storms, such as hurricanes. The number of Category 4 and 5 hurricanes has increased since the 1980s due to warmer sea surface temperatures. Warmer climates increase hurricane precipitation near the eye of the storm by 20% and the intensity of storms expect to increase by 2-11%. Sea level rise aids in the destruction hurricanes and other storms have on coastal communities. Flooding, infrastructure and community damage, and storm surges have increased in severity when hurricanes hit as a result of sea level rise[4].

The City of Naples' stormwater management system is at increased risk due to climate-related changes such as rising sea levels, extreme storms and storm surge, flooding from extreme precipitation, and extreme heat (Figure 3). The City's stormwater management system discharges to the Gulf of Mexico, Naples Bay and Moorings Bay. Public infrastructure assets need to be adapted to accommodate forecasted climate changes.

The City of Naples stormwater management system has approximately 100 miles of storm drain, 5 ponds/lakes (city-owned, however over 20 ponds/lakes have city easements and receive city drainage), 651 outfalls and 3 pump stations. Approximately 300 coastal outfalls discharge stormwater into tidal waters: 10 beach outfalls into the Gulf of Mexico, 97 outfalls discharge into Moorings Bay and connected bays, and 196 outfalls into Naples Bay. Coastal outfalls are vulnerable to sea level rise because they discharge into tidal waters. As mean sea level increases as a result of sea level rise, outfalls will become submerged by high tides a greater percentage of the time. This also increases the likelihood that heavy precipitation events will coincide with moderate to high tide levels and impede gravity drainage from the stormwater system.

Stormwater inlets can be a potential source of surface street flooding if they have open connections to tidal water bodies. High tides (such as king tides) can backflow into the storm drain system and temporarily flood low-lying areas if outfalls are not equipped with backflow prevention devices. Additionally, low-lying areas can be susceptible to elevated groundwater elevations, which can increase rates of infiltration into stormwater pipes.

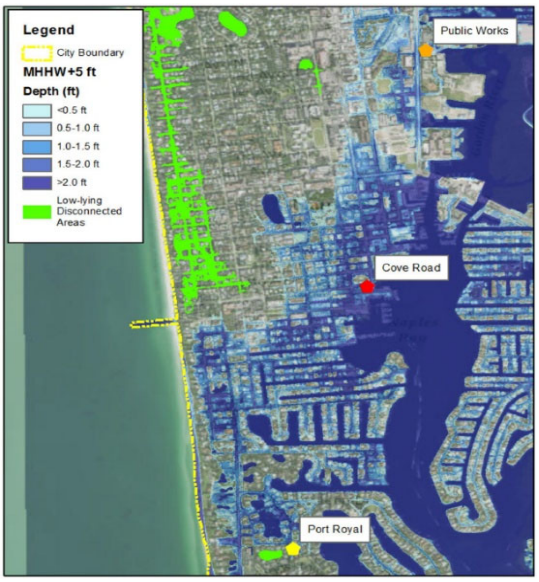

Figure 3. Sea Level Rise Exposure of Naples Stormwater Pump Stations. Area south of the pier shows predicted sea level rise associated flooding in historic Old Naples.
Note: Symbol color indicates timing of SLR exposure: MHHW + 3 ft SLR (red), MHHW + 4 ft SLR (orange), and MHHW + 5 ft SLR (yellow).
(City of Naples Stormwater Master Plan 2018)

Preliminary evaluations performed in the City's Stormwater Master Plan update (2018) did not consider the specific design and configuration of each pump station and were based simply on the adjacent ground surface elevation from the bare earth Lidar dataset. The Stormwater Master Plan identified several data gaps including the invert elevations of the coastal stormwater outfalls and stated that a more detailed evaluation of outfall vulnerability to sea level rise could be conducted by incorporating the outfall elevations relative to future tide levels. Also identified in the Plan was a need to conduct detailed stormwater system modeling to evaluate flood vulnerabilities associated with combined precipitation and high tides for existing and future conditions (with sea level rise), and to identify critical outfalls that may be responsible for allowing high tide waters to backflow into the stormwater system and cause surface street flooding through inlets. These outfalls could be prioritized for installation of backflow prevention.

This project will fill stormwater management system data gaps by performing a detailed evaluation and inventory of outfall invert elevations for stormwater outfalls in areas identified in the Climate Vulnerability Assessment (currently underway) as being most vulnerable to flooding. This will then allow a detailed assessment and development of adaptation strategies to mitigate flooding in these vulnerable areas.

References:
[1]Zervas, C. 2009. Sea Level Variations of the United States, 1854-2006, NOAA Technical Report NOS CO-OPS 053
[2]Climate Central, 2018. Rising Tides: How Near-Daily Flooding of America's Shorelines Could Become the Norm
[3]NOAA, 2018. Patterns and Projections of High Tide Flooding Along the U.S. Coastline Using a Common Impact Threshold. NOAA Technical Report NOS CO-OPS 086
[4]Bradford, N. 2019. Increased Hurricane Intensity. National Environmental Education Foundation. https://www.neefusa.org/nature/water/increased-hurricane-intensity

B. Explain how the proposed project meets the purpose of one or more of the Goals and Priorities for FRCP. This project will meet the purpose of Priority Areas 3 and 5 through the generation of accurate data for use in the development of the Stormwater Management System section of the Climate

Adaptation and Mitigation Plan for the City. A Climate Vulnerability Assessment is currently being conducted to retrieve reliable data on where effects of sea level rise occur in the city, who may be affected, and what infrastructures/populations are the focus. This project will continue the City's resiliency planning effort by building on the vulnerability assessment and allowing the City to enter the next phase of addressing potential impacts of sea level rise – the development of an adaptation plan which identifies specific strategies for adaptation to protect city infrastructure and thus its residents and visitors. The Climate Adaptation and Mitigation Plan will include stormwater management system adaptation strategies to prevent flooding in vulnerable areas. The City of Naples is taking an active role in the Blue Zones Project, a global movement inspiring people to live longer, more active lives. The City also encourages its residents and visitors to live healthy lives by increasing pedestrian and cycling opportunities in the city. Toward this goal, the City has developed a Pedestrian and Bicycle Master Plan. Flooding prevention is critical to sustain safe pedestrian and cycling opportunities, and safe evacuation and emergency responder access to vulnerable people.

C. Discuss how the project is feasible and can be completed by the grant period deadline. The project is feasible and will be completed by the grant deadline. Upon award status we will begin by engaging with a consultant to start a contract/agreement for an evaluation and agreement negotiations. The second task will involve the consultant mobilizing to determine each stormwater outfall invert per the agreement. The timeline portrays a manageable workload for all tasks to be finished by each specific deadline with limited overlapping to cause an overflow of work.

D. Explain how this project is addressing social vulnerability or vulnerability of historic resources or stormwater management systems. The City of Naples, Florida was founded in the late 1880s by former Confederate general and Kentucky U.S. Senator John Stuart Williams and his partner, Louisville businessman Walter N. Haldeman. The "Old Naples" neighborhood is a charming combination of old beach cottages and mansions resting among hundreds of tall mature coconut palms and banyan trees. Many of the beach cottages date back to the early 20th century.

One of the original landmarks of the historic Old Town is Palm Cottage which was built in 1895 and is on the National Register of Historic Places (Figure 4). Palm Cottage, built by one of Naples' founding residents, Walter N. Haldeman, is constructed of tabby mortar, a hand-made concrete consisting of sand, shells and water. It houses 3,500 square feet of original and donated artwork, furnishings and tools spanning back to 1895.

Figure 4. Palm Cottage, Naples FL

In the 1920's Tin City's location on the Gordon River was the transport and economic hub of Naples. It's "Old Florida" tin-topped buildings were home to clam shelling and oyster processing, as well as boat construction and maintenance. In the 1970's The Old Marine Marketplace was built in Tin City out of seven of the area's sturdy old buildings. Today Tin City retains its old Florida charm, preserving a small but very significant stretch of the Gordon River for future generations to enjoy, however its location directly on the waterfront on Naples Bay makes it vulnerable to climate change impacts such as severe storms and sea level. In 2017 Hurricane Irma ravaged the area and the roofs of Tin City were destroyed and they have since been replaced with similar tin roofs, protecting the original buildings underneath.

Old Naples is located in a low-lying area of the city and subjected to flooding during intense rainfall events (Figure 5).

Figure 5. Old Town Naples flooding, July 2017

Social vulnerability is associated with characteristics of certain populations that affect their capacity and resources to respond to hazards[1]. The Social Vulnerability Index for Disaster Management (SVI), developed by the U.S. Centers for Disease Control (CDC) using U.S. Census data, organizes social vulnerability into four domains: socioeconomic status, household composition, minority status, and housing and transportation. Elderly vulnerable population are those greater than 65 years of age and senior citizens living alone. The median age of Naples' population is 65.5 years, much higher than the median age of the US population which is 38 years; 51.5% of Naples' population is over 65 years old (U.S. Census Bureau). However, Naples' population at any one time may in fact be much older, as many residents are "snowbirds" i.e. largely elderly people who live in Naples for part of the year and thus are likely to have their data entered into their alternate resident state statistics.

Elderly people, especially those who live alone, are more vulnerable to climate change impacts in Florida such as sunny day flooding, extreme heat and hurricanes because they are less mobile and less connected e.g. may not be able to utilize technology to receive disaster information. The SVI can help public health officials and local planners better prepare for and respond to emergency events like hurricanes. The Vulnerability Assessment underway will identify the risk to critical streets for evacuation and emergency responder access to areas, and the SVI will show where these overlap with vulnerable communities. This project will provide critical accurate information required to develop the stormwater management system section of the Climate Adaptation Plan, which will identify strategies to protect those critical streets from climate change impacts, particularly for emergency responder access and/or the evacuation of people who have special needs, such as the elderly.

References:

[1]Berke, P., G. Newman, J. Lee, T. Combs, C. Kolosna & D. Salvesen (2015). Evaluation of Networks of Plans and Vulnerability to Hazards and Climate Change: A Resilience Scorecard. Journal of the American Planning Association, 81:4, 287-302,

12. **DESCRIPTION OF PROJECT OUTCOMES:** The outcomes directly from this part of Naples' Climate Adaptation and Mitigation Plan project are GIS layers showing accurate elevations of stormwater outfalls in areas of Naples identified by the Climate Vulnerability Assessment currently being performed as being most vulnerable to climate change impacts.

Outcomes of the larger Climate Adaptation and Mitigation Plan project include:

- an updated climate adaptation webpage educating residents and visitors on the City's risk to climate change impacts and its plans to adapt to and mitigate those
- a Climate Adaptation and Mitigation Plan that describes specific adaptation strategies to prevent negative impacts from climate change
- at least two public meetings during/after the development of the Climate Adaptation and Mitigation Plan to educate residents and engage community feedback on the plan

13. BUDGET SUMMARY: Allowable budget categories and form of payment with the costs for this project are listed in the table below.

BUDGET SUMMARY BREAKDOWN

Budget Categories	Payment	Task 1	Grant Amount Awarded
Salaries & Fringe	Fixed Price	$	$
Contractual Services*	Fixed Price	$75,000	$75,000
GRANT AGREEMENT TOTAL		**$75,000**	**$75,000**

A. Describe how the project costs was determined:
Project costs were determined based on available funds and estimated cost for GIS consultant services. Stormwater outfalls will be selected based on vulnerability ranking. An estimate for the accurate determination of all stormwater outfalls in Naples is estimated to cost $258,000 (Naples Stormwater Master Plan Update 2018). Naples has a large number of outfalls to coastal water compared to many coastal cities. This project will allow for the evaluation of the most critically impacted by sea level rise and increased precipitation as a result of climate change.

B. Contractual Services Selection*: Upon a selected Sub-Contractor(s) (if applicable), the Grantee will Provide a signed certification statement giving a description of the procurement process that was utilized for the selection of the sub-contractors. The description must include:

a. What procurement process was utilized
b. Justification as to how & why you made your final selection.
c. For competitively obtained Sub-Contractor also include:
   i. A list of all entities that you received bids/quotes from,
   ii. Names and addresses of those entities that provided bids/quotes,
   iii. Actual amounts of the bids/quotes that were submitted.

14. PROJECT TIMELINE: All tasks are to be completed and submitted no later than the task/deliverable due date listed in the table below. Requests for any change must be submitted prior to the current task/deliverable due date listed in the project timeline. Requests are to be sent via separate email to the Department's Grant Manager, with the details of the request being made and the reason for the request.

PROJECT TIMELINE

Task No.	Task Title	Deliverable Due Date	Task Amount
1	Stormwater Outfall Invert Elevation Evaluation	04/30/2021	$75,000
Total			**$75,000**

15. **PERFORMANCE MEASURES:** The Grantee will submit all deliverables for each task via **one pdf document** to the Department's Grant Manager on or before the Task/Deliverable Due Date listed in the Project Timeline. The Department's Grant Manager will review the task/deliverables to verify that they meet the specifications in the Grant Work Plan and this task description, to include any work being performed by any sub-contractor(s). Upon review and written acceptance by the Department's Grant Manager of all deliverables under this task, the Grantee may proceed with payment request submittal.

16. **CONSEQUENCES FOR NON-PERFORMANCE:** The Department will reduce each Task Funding Amount by 5% for every day that the task/deliverable(s) is not received on the specified due date in the most recent Project Timeline, for the Agreement. Should a Change Order or Amendment be requested on the date of or after the most current task/deliverable due date, the 5% reduction of that Task Funding Amount will be imposed until the date of the requested change is received, via email by the Department.

17. **PAYMENT REQUEST SCHEUDLE:** Grantee may submit a request for the Task Funding Amount to be paid using the Exhibit C, after all deliverables for that task have been approved by the Department. Request(s) for payment must include the Exhibit A showing 100% completion of that task and must be submitted within 45 days of the task/deliverable due date. Please refer to the website Grants page for "How to Request Payment", and "Checklist for Requesting Payment".

    Or

    Grantee may submit one request for the Grant Amount Awarded, by using the Exhibit C, after the project is 100% completed. The request for the Grant Amount Awarded, must include an Exhibit A showing 100% completion for all tasks, and must be submitted within 45 days of the last task/deliverable due date.

18. **FUNDING SOURCE:** Grantee agrees to include on all publications, printed reports, audiovisuals (including videos, slides, and websites except that unless required under special terms of this Agreement, this requirement does not apply to audiovisuals produced as research instruments or for documenting experimentation or findings and which are not intended for presentation to the general public) or similar materials must include the DEP logo (which can be found on the Department's website at https://floridadep.gov/resilience or by contacting the Department's Grant Manager for a copy) and the following statement on, the following language.

    "This work was funded in part through a grant agreement from the Florida Department of Environmental Protection, Florida Resilient Coastlines Program, by a grant provided by the Office of Resilience and Coastal Protection. The views, statements, findings, conclusions and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida or any of its subagencies."

    The next printed line shall identify the month and year of the publication.

III. TASKS & DELIVERABLES

Task #1

A. Title: Stormwater Outfall Invert Elevation Evaluation

B. Goal: Determine stormwater outfall invert elevations for critical areas determined through the Climate Vulnerability Assessment.

C. Description: Stormwater outfall invert elevations will be determined for critical areas determined through the Climate Vulnerability Assessment. An accurate stormwater outfall pipe invert elevation is necessary so flooding via backflow (e.g. from a king tide event) can be predicted and then the appropriate adaptation strategies (e.g. backflow prevention device or pump installation) can be developed. Consultant will physically locate and determine the outfall invert elevation for each stormwater outfall identified in the Climate Vulnerability Assessment as highest vulnerability to climate change impacts.

D. Deliverable: The Grantee will submit all deliverables for each task via **one pdf document** to the Department's Grant Manager on or before the Task/Deliverable Due Date listed in the Project Timeline.

Specific Purpose Survey showing the surveyed stormwater tidal outfall invert elevation data over an aerial background.