The Evolution of Master Planning: Integrated Planning for the City of St. Petersburg

Leisha L. Pica and Claude Tankersley

The City of St. Petersburg (city) is developing an integrated water resources master plan (IWRMP). The city is situated on a peninsula between the Gulf of Mexico and Tampa Bay. Recreational water quality is a vital component of the local economy, and as such, it's imperative the city ensures that the wastewater effluent and stormwater discharges to surface waters exceed water quality standards.

In addition to these challenges, the city experienced sewer overflows during tropical storm events in 2015 and 2016. These extreme rain events impaired the city's collection system, caused widespread flooding, and overloaded the capacity of treatment facilities. The intensity and duration of storm events also prompted concerns regarding climate science and the forecasted sea level rise (SLR) for the St. Petersburg and Tampa Bay areas. The city desires to develop a capital program that addresses the challenges it faces today, as well as those into the future—including utilizing stormwater as a resource.

City leadership requested a long-term strategy to address all community and infrastructure needs, including the following: protecting human health, improving water quality, managing stormwater as a resource, supporting economic benefits, supporting quality of life attributes, enhancing the vitality of communities, mitigating potential climate change impacts, and developing integrated water resources solutions. The IWRMP will address all capital needs for the city's public works department, including transportation, water supply, drinking water, wastewater, biosolids, reclaimed water, stormwater, and surface waters.

Methodology

The city is exploring innovative solutions that focus on sustainability and resiliency; capital improvement projects are no longer advanced without considering these important tenets. Today, individual projects must consider the following criteria before projects are advanced for funding:

1. *Community*. Potential community enhancements that can be coordinated with the project (such as lighting, drainage, and tree canopy).
2. *Infrastructure*. Adjacent infrastructure warranting repair or replacement (piping, manholes, hydrants, valves, etc.).
3. *Coordination*. Construction coordination with other investments (transit, roadway improvements, utilities, parks, greenways, blueways, and urban redevelopment corridors).
4. *Sustainability*. Long-term benefits with respect to urban heat islands, energy conservation, SLR, microburst weather, and extreme tropical events.

To fully adopt the city's vision, these considerations require an integrated planning methodology to ensure they are fully vetted at the capital improvement program (CIP) level versus individual discrete project requests. The integrated planning framework published by the U.S. Environmental Protection Agency (EPA) in 2012 was customized for the city to develop a plan that addresses both the short- and long-term needs listed in Table 1.

The IWRMP goes well beyond basic CIP forecasting, addressing local economic impacts and the community's quality of life. The seven tenants of integrated planning applied to the city's priorities are shown in Figure 1 and summarized in the following bullet points:

- *Protect Human Health*. Implementing an industry-standard asset management program will ensure that the city is able to provide the appropriate levels of service to its utility customers, while minimizing service outages, sewer overflows, and unauthorized discharges.

Leisha L. Pica. P.E., is a program manager at Jacobs Engineering Group in Tampa.
Claude Tankersley. P.E., is a public works administrator at City of St. Petersburg.

Table 1. Capital Improvement Program Considerations for Integrated Water Resources Master Plan

Short-Term Needs	Long-Term Needs
Comply with Consent Order	Prepare for Sea Level Rise
Mitigate Sewer Overflow Conditions	Address Private Sewer Laterals
Manage Extreme Weather	Incorporate Sustainability and Resiliency
Replace Aging Assets	Improve Recreational Water Quality

Figure 1. Anticipated Results of the City of St. Petersburg's Integrated Planning Methodology

- *Improve Water Quality.* Quantifying potential sources of impairment to local surface waters will assist with developing strategies for improving recreational water quality. The impact of low baseflow conditions, reclaimed water irrigation systems, and stormwater runoff will be determined so remedies can be incorporated into local and regional projects.
- *Manage Stormwater as a Resource.* The city desires to utilize stormwater that is historically discharged to local surface waters. Utilization strategies to be evaluated include stormwater reservoirs for water supply augmentation, rainwater harvesting opportunities, reclaimed water augmentation, surface water baseflow augmentation, aquifer storage recovery, and flood protection strategies.
- *Support Other Economic Benefits.* Areas and corridors for potential development and redevelopment will be evaluated to coordinate the ultimate sizing of infrastructure. An inventory of blighted properties will be reviewed to find suitable locations for future stormwater utilization systems.
- *Support Quality of Life Attributes.* Neighborhood plans will be reviewed to coordinate priority infrastructure improvements and reforestation corridors. Opportunities for improving the interconnectivity and functionality of greenways and blueways will also be considered.
- *Enhance Vitality of Communities.* Opportunities to coordinate infrastructure with improvements needed for natural systems including parks, recreation centers, and habitat-sensitive areas, will be assessed. As the IWRMP is being developed, new ways to engage and keep the public involved will be explored.
- *Integrated Water Resources Solutions.* Investments offering regional benefits will be considered with local stakeholders. The integrated solutions will optimize the connectivity of infrastructure and prioritize capital needs across all water resources divisions (potable water, wastewater collection, wastewater treatment, reclaimed water, stormwater, and surface water). Additionally, a baseline condition will be created to facilitate benchmarking performance, including the metrics to be monitored.

Approach

The approach for developing the IWRMP methodology is comprised of the five discrete tasks shown in Figure 2. A key component of the IWRMP process is acquiring complete knowledge of local issues, problems, and concerns from *all* stakeholders, including city staff, political leadership, regulatory agencies, county departments,

Contninued on page 10

Figure 2. Approach for Developing Integrated Water Resources Master Plan

Table 2. St. Petersburg's STAR Certification Final Score by Goal Area

Goal Area	Points Achieved	Points Missed	Points Available	Percent Achieved
Built Environment	65.6	34.4	100	66%
Climate & Energy	47.4	52.6	100	47%
Economy & Jobs	61.8	38.2	100	62%
Education, Arts & Community	53.9	16.1	70	77%
Equity & Empowerment	21.7	78.3	100	22%
Health & Safety	61.6	38.4	100	62%
Natural Systems	35.1	64.9	100	35%
Innovation & Process	34.8	15.2	50	70%
Totals	381.7	338.3	720	53%

Contninued from page 9
neighborhood associations, regional planning organizations, environmental groups, academic institutions, business districts, developers, wholesale customers, technical task forces, and city residents.

In order to address current and future challenges in a holistic manner, all challenges must be clearly identified and prioritized. The city advocates a strong public outreach program that extends beyond notifying people of activities. The city also desires to actively engage people with developing meaningful and lasting local solutions. Public engagement began with Task 1, as the public possesses critical information related to existing infrastructure problems and community expectations.

The information acquired from stakeholders will be combined with the results and recommendations from multiple concurrent city programs and initiatives to customize the integrated planning framework.

Sources for data compiled under Task 1 include the following:

- Institutional Knowledge
- City Departments
- Prior Technical Reports
- Flow Monitoring
- Rate Studies
- Financial Evaluations
- Literature Reviews
- Regulatory Permits
- Hydraulic Models
- Condition Assessments
- Asset Inspections
- Customer Complaints
- Stakeholder Feedback

The data-collection phase will determine opportunities to coordinate work for developing the IWRMP with other ongoing city initiatives, including but not limited to the following (details are provided for a few of these initiatives):

- Complete Streets Program
- Florida Department of Transportation CIP Program
- Sustainability Planning
- Resiliency Planning
- Envision Rating System
- STAR™ Community Rating
- Climate Science Modeling
- Pinellas County Wastewater/Stormwater Task Force Planning
- Pinellas County Sustainability Vulnerability Assessment
- Comprehensive Plan Updates
- Land Development Regulations
- State-Sponsored Stormwater Management Master Plan

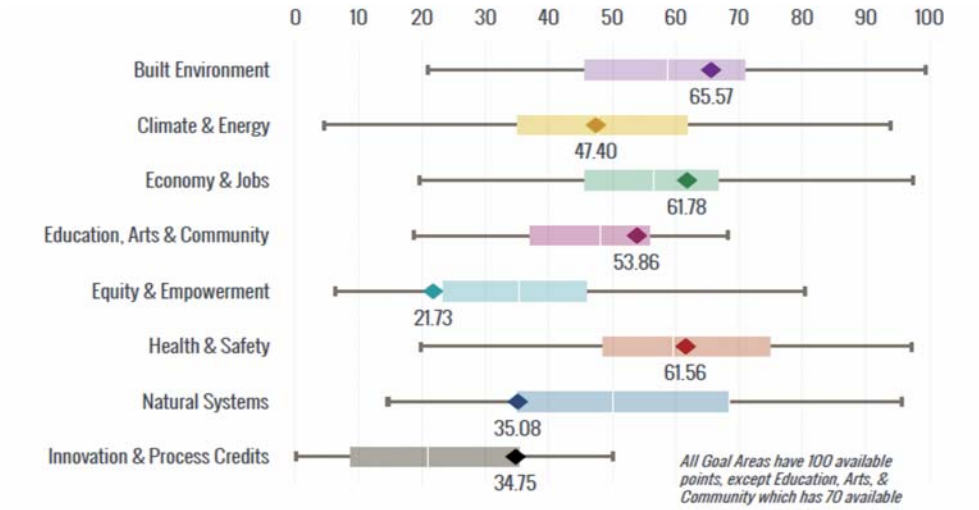

Figure 3. St. Petersburg's Comparison Ratings to Other STAR-Certified Communities

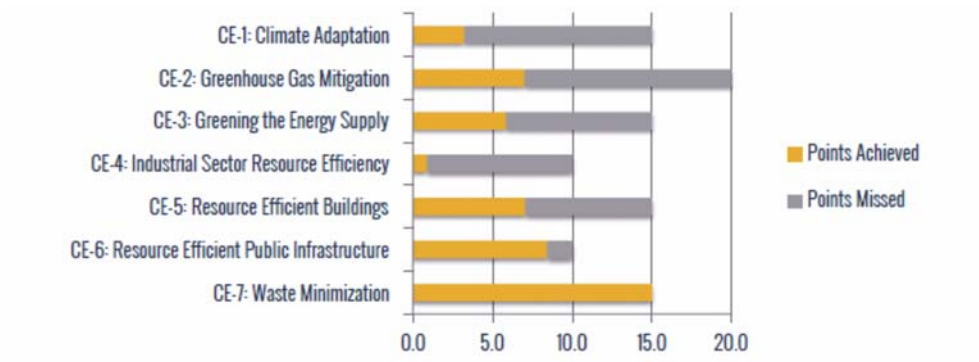

Figure 4. St. Petersburg's Climate and Energy Points Achieved

Resiliency Planning

The city is using the STAR Community Rating System certification process to baseline and track progress toward improving overall resiliency. A nationally recognized certification program for evaluating communitywide resiliency, STAR encompasses economic, environmental, and social performance measures. The city achieved 381 of the total 720 points, thereby receiving the certified 3-STAR community rating in December 2016 (Table 2).

A closer examination of the city's point totals in each goal area, compared to other certified communities, reveals areas of strong performance, as well as opportunities for improvement. Figure 3 illustrates how the city performed relative to the other 58 STAR-certified communities.

The city's scores are generally in the median ranges, with the greatest opportunity for improvement in the goal areas of natural systems and climate and energy. The climate and energy goal area is comprised of seven objectives (Figure 4), including climate adaptation, greenhouse gas mitigation, greening the energy supply, industrial sector resource efficiency, resource-efficient buildings, resource-efficient public infrastructure, and waste minimization. For the majority of these objectives, the city falls in the lower 50th percentile, as compared to other STAR-certified communities. This goal area aligns well with existing city programs and comprehensive plan elements focused on renewable energy, carbon footprint reduction, preparing for SLR, and mitigating urban head island impacts. These considerations will be incorporated into the IWRMP.

The IWRMP will help the city achieve its sustainability resiliency goals related to 50 percent green space, 100 percent clean energy, reduction of its carbon footprint, planning for SLR, and improving recreational water quality (Figure 5).

Climate Science Modeling

The city is surrounded on three sides by water, with 60 mi of coastal frontage, including Tampa Bay. The Tampa Bay region is known to be

vulnerable to wind damage, coastal flooding from storm surge and extreme rainfall events, and SLR. With approximately 48 percent of the city's population living less than 10 ft above sea level, these events create enormous risks to the safety, well-being, and property of the residents. The intent is for the entire city to be resilient, not just before and after acute weather events, but during the more gradual changes to the environment.

The University of South Florida is working with the National Oceanic and Atmospheric Administration (NOAA) to provide local SLR forecasts for the city. Historical data measured at the NOAA St. Petersburg tide station indicate that the city has already experienced a documented SLR of approximately 6.6 in., or approximately 1 in./decade (Figure 6).

Several groups have been actively studying climate for the Tampa Bay region, including the University of South Florida, Tampa Bay Climate Science Advisory Panel, and Florida Climate Institute. Experts agree that local governments need to begin making decisions about responding to climate science, including the impacts of SLR and changes in the frequency and intensity of short-term flooding events.

Local sea level changes are due to a variety of factors, including vertical land motion (subsidence or uplift), changes in estuarine and shelf hydrodynamics, regional oceanographic and atmospheric circulation patterns, and rainfall and river flow changes.

The regionally adjusted NOAA projections for SLR through 2100 (Figure 7) predict a rise ranging from 0.93 to 6.89 ft. Each of the four curves reflects varying degrees of information. Local studies remain ongoing by the city to determine which SLR forecast curve is most appropriate for the IWRMP.

The regionally adjusted SLR forecast scenarios suggest the city may face significant impacts to its infrastructure over time. Potential impacts may include:

- *Pipelines.* Existing pipeline corridors subject to salt water environments may warrant cathodic protection or relocation. Increased groundwater levels may impact infiltration and inflow into the city's sewer system.
- *Facilities.* Existing treatment facilities located in low-lying elevations may require relocation, sea wall protection, or grade and elevation adjustments.
- *Flood Control.* Innovative approaches may be warranted to develop flood control systems, as SLR compromises critical infrastructure and densely populated residential areas.
- *Natural Systems.* Freshwater habitats may be encroached upon by salt water, requiring species relocation or extensive protection of the existing natural habitat areas.

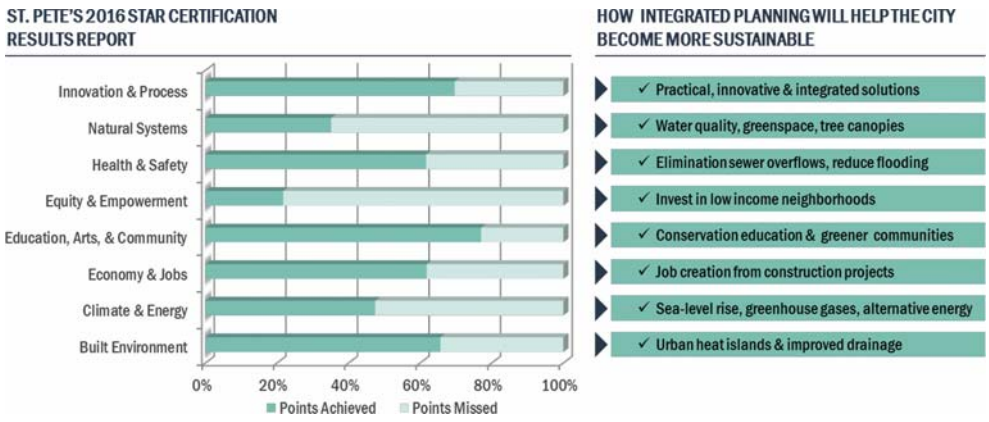

Figure 5. Overview: How Integrated Water Resources Master Plan Supports STAR Certification Program

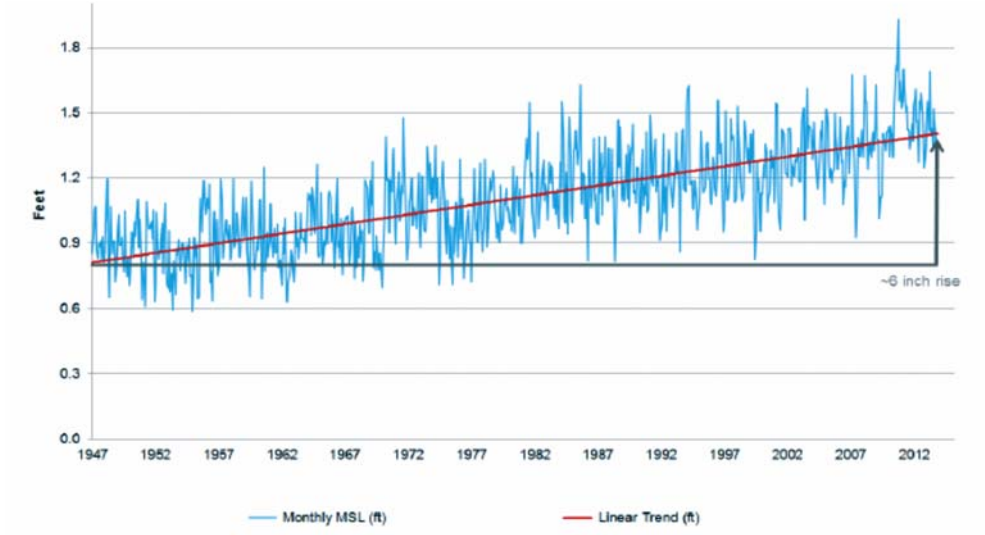

Figure 6. Mean Sea Level Trend in St. Petersburg at National Oceanic and Atmospheric Administration Tide Gauge

The IWRMP will include consideration of possible climate change, including storm intensity and frequency (as well as SLR), into its long-term capital planning efforts. Since approximately 48 percent of the city's population resides in special flood hazard areas prone to tropical weather events, the city must perform a vulnerability assessment and develop a climate change adaptation plan.

Putting It All Together Via Integrated Planning

The IWRMP will determine how the city can address the multiple concurrent and forward-looking capital needs in a holistic and reasonable manner. Innovation has the potential to reduce overall capital costs and provide a greater benefit sooner to ratepayers, as compared to traditional approaches for managing water resources assets. The IWRMP will consider innovative concepts once thought to be unattainable related to south Florida water resources. The roadmap for creating an IWRMP is a simple concept surrounded by well-orchestrated coordination efforts of long-term planning scenarios that utilities are likely to encounter (Figure 8).

Today

The activities performed under the "Today" category are related to documenting the current condition of assets, environmental issues, regulatory requirements, built systems, and com-

Contninued on page 12

Contninued from page 11

munity priorities. Under this category, technical evaluations will determine the level of capital investment to maintain the status quo for infrastructure for another 40 years.

- Comply with consent-order mandates.
- Inventory community needs and public priorities and expectations.
- Perform condition assessments and determine remaining useful life.
- Update hydraulic model to evaluate severe weather events.
- Assess areas for redevelopment, blight, and potential public beneficial use.
- Quantify infiltration and inflow priority basins.
- Review existing city policies, programs, and initiatives.
- Evaluate tidal influences on critical assets and utility systems.
- Coordinate planned capital investments with city, county, state, and federal agencies that may impact utility infrastructure.

Future

The activities performed under the "Future" category are related to evaluating the "what if" scenarios and determining the best strategies for mitigating multiple risks. Under this category, technical evaluations will determine how innovation can be applied across the city.

- Establish levels of service that policy makers desire for each utility asset class.
- Apply population forecasts to service area demands.
- Identify assets at risk of impact from SLR.
- Evaluate costs and benefits of constructing new systems versus replacement of existing assets with in-kind processes, units, and systems.
- Consider utility infrastructure that would be constructed in the absence of funding constraints
- Explore options for mitigating localized salt water intrusion impacts.
- Expand low-impact development and best management practices for managing stormwater with the goals of retaining flows and/or reusing stormwater.
- Identify corridors for expansion of reclaimed water distribution systems to new retail and wholesale customers.
- Consider the impact that pending or future regulatory requirements may have on utility infrastructure, particularly for the areas of greenhouse gas mitigation and nutrient reduction.

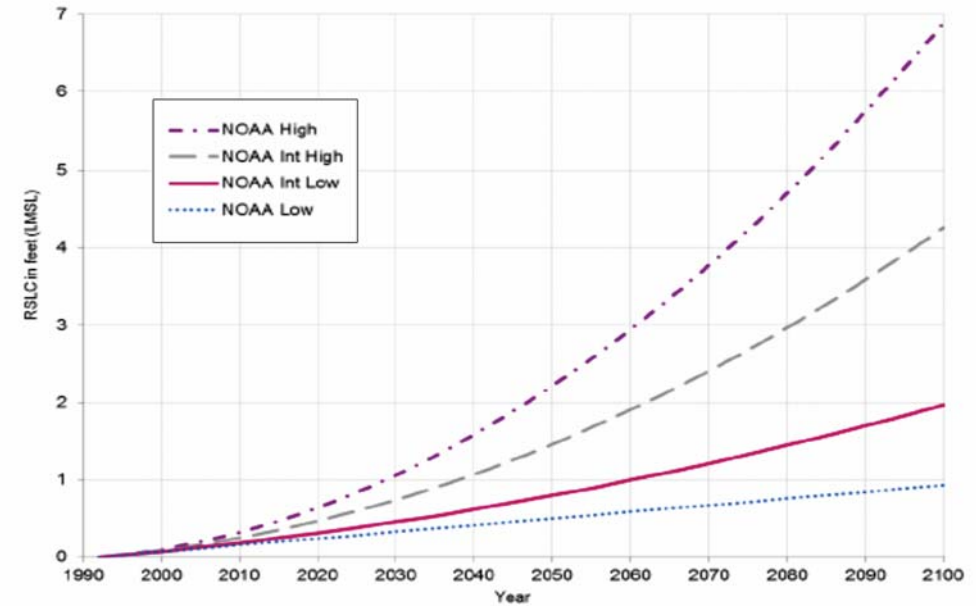

Figure 7. Relative Sea Level Change Scenarios for St. Petersburg at National Oceanic and Atmospheric Administration Tide Gauge

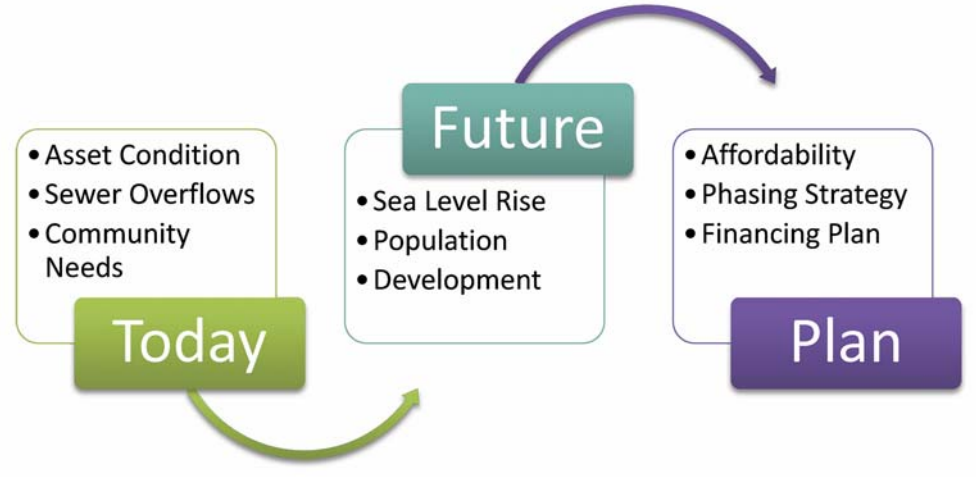

Figure 8. High-Level Roadmap for Integrated Water Resources Master Plan Development

Plan

The activities performed under the "Plan" category are related to developing a phasing and implementation plan for long-term capital improvements. Ratepayer affordability will dictate the total duration of the IWRMP.

- Calculate local ratepayer affordability in accordance with EPA guidelines for financial capability indicators.
- Conduct financial evaluations to determine the potential range of rate increases that would be required to fully implement the IWRMP. Identify potential revenue sources, in addition to capital funding sources, that would support the IWRMP.
- Identify opportunities for regional utility interconnects to improve the sustainability and resiliency of potable water and wastewater systems throughout the region.
- Use risk-based criteria for prioritizing and integrating projects into annual capital programs and consider sustainability and resiliency criteria for capital investments.
- Identify climate-science trends that may trigger strategic mitigation investments over time to ensure costs are not expended unless conditions begin to manifest as they were forecasted.
- Continue to engage members of the public regarding their expectations and priorities as related to long-term capital investments for the city.

Upon completion of the IWRMP, the city will have a process in place to prioritize needs and update the annual CIP based upon changed conditions. The implementation phase of the work includes equipping the city with the resources, staffing plan, software, and processes needed to fully implement the long-term IWRMP.

Conclusion

The city is tasked with the challenge of protecting the environment from human activity (built systems) and protecting the population from the naturally occurring activities (flooding, shoreline erosion, weather, and SLR). Extreme weather events spurred the need for developing approaches to ensure that the city and its utility infrastructure are sustainable and resilient.

Master planning has evolved from the traditional approach of developing a capital forecast for management of discrete utility assets to coordination of the asset needs with citywide programs, community needs, and forward-looking sustainability and resiliency planning criteria.

The IWRMP will require the city to rethink how capital priorities are set, as utility systems can no longer be considered in silos. A consolidated and integrated approach will result in cost savings from economies of scale, as well as regional collaboration opportunities. This is a sustainable approach to long-term utility planning that considers the potential impacts resulting from climate change and SLR for coastal communities. The information will provide a roadmap for other utilities and municipalities interested in implementing comprehensive integrated water resources planning.

References

- G. Mitchum, University of South Florida. August 2011. "Sea Level Changes in the Southeastern United States: Past, Present, and Future."
- United States Environmental Protection Agency. June 2012. “Memorandum: Integrated Municipal Stormwater and Wastewater Planning Approach Framework.”
- Tampa Bay Climate Science Advisory Panel. August 2015. "Recommended Projection of Sea Level Rise in the Tampa Bay Region."
- STAR Communities. December 2016. "STAR Certification Results Report, City of St. Petersburg, Florida, Certified 3-Star Community."
- Urban Land Institute Tampa Bay. April 2017. "Realizing Resiliency Social Equity + Economic Opportunity."