



Construction of the city of Quincy's Industrial Wastewater Reuse Facility



PUBLIC WORKS BOARD

Innovative Infrastructure Pilot Study

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Report to Legislature

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Public Works Board — Innovative Infrastructure Pilot Study

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Budget Proviso

2022 Capital Budget Proviso Section 7004

The Public Works Board created in RCW 43.155.030 shall develop:

"Recommendations for a program design and administration including but not limited to prioritization and selection criteria, operation, and funding structure and levels for the types of innovative infrastructure projects that conserve water and energy, reduce greenhouse gas emissions, or reduce pollution and waste with a focus on those projects that achieve multiple benefits.

In developing recommendations, the Public Works Board shall, at a minimum collaborate with the interagency, multijurisdictional system improvement team established by RCW 43.155.150, the Department of Commerce's State Energy Office, the industrial waste coordination program established by RCW 43.31.625, and local governments to evaluate barriers and gaps in incentives and funding for advancing innovative systems and technologies in public infrastructure that promote community and ecosystem resilience.

Examples of innovative project types that should be addressed by the program include: water reuse or reclaimed water systems, projects that integrate energy generation or water collection from waste products, and projects that reduce pollution discharges, treat or store water through green, or nature-based, infrastructure."

The Public Works Board shall provide recommendations to the Governor's Office, Office of Financial Management, the Senate Ways and Means Committee and the House Capital Budget Committee by October 1, 2022.

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Executive Summary

The Public Works Board (PWB) presents this study in response to the [2022 capital budget \(Section 7004, Substitute Senate Bill 5651\)](#). In collaboration with [SYNC](#), the [state energy office](#) and the industrial symbiosis program, the PWB identifies the barriers and gaps in incentives and funding for innovative systems and technologies. This report sets forth recommendations on program design and administration to incentivize systems and technologies that promote community and economic resilience.

This report examines the hypothesis that integrating science with innovative infrastructure technology and processes, coupled with flexible and responsive financing, makes possible replicable and scalable solutions to urgent and vexing environmental challenges. The recommendations, developed in collaboration with multiple stakeholder groups, aims to bring together science, technology and funding in an intentional and coordinated manner. Not all recommendations have budget implications. Some speak to opportunities to explore pliability of the regulatory environment. This is because the PWB seeks to integrate innovative infrastructure demonstration concepts with its existing statutory framework in ways that are complementary to traditional infrastructure funding priorities. This is not about choosing between the backlog of needs for infrastructure investment or new innovative projects, it is about aligning infrastructure investment with innovative technologies to achieve durable public health and safety and environmental outcomes.

This study engaged over 25 local governments, partner associations and higher education researchers across the state to understand challenges to implementing innovative systems and technologies that promote community and economic resilience. Results include findings and recommendations in the areas of access to capital, equity and environmental justice, lack of regulatory flexibility or guidance, administrative and technical capacity and risk tolerance.

The recommendations in this report marry funding, science and technology and support the practice of adaptive management.

Recommendation #1: Ensure flexible funding for an innovative infrastructure pilot program consistent with the PWB's statutory authorities.

Recommendation #2: Encourage strategic partnerships with public agencies and higher education institutions, tribal governments, special purpose districts, not-for profits and private industry.

Recommendation #3: Solicit subject matter expertise on project selection and to mentor and monitor pilot projects as needed.

Recommendation #4: Build on existing policy priorities for public health and safety, sustainability, economics and equity to develop outcome-based project selection criteria.

These four recommendations position the PWB to incentivize and support local governments and special purpose districts to build infrastructure that protects health and safety, restores and protects ecosystems, sustains economic development and promotes equity and community using the best technology and approaches available.

The report references the need for innovative infrastructure and how it links to building a circular economy, transitioning to clean energy, protecting ecosystems and conducting value-based infrastructure planning. With 90 percent of recent PWB funding applications addressing failed or failing systems, it is clear that existing systems are at a tipping point in their ability to meet demand. Despite the need, innovative solutions remain challenging to implement.

The next section documents barriers local governments experience and describes how the recommendations address the challenges faced. Three case studies offer examples of projects that demonstrate innovations, integrate equity with infrastructure development, and advance environmental outcomes that benefit economic growth through application of new technologies. There are likely other considerations in the realm of innovative infrastructure, and for this reason, the PWB intends to continue working on the policy and programmatic framework of this innovative infrastructure pilot program.

Recommendations

Recommendation #1

Ensure flexible funding for an innovative infrastructure pilot program consistent with the PWB's statutory authorities.

The PWB's statutory authority under RCW 43.155.060 is broad and can incorporate innovative infrastructure pilots. Furthermore, the PWB has the ability to leverage flexible loan terms, options to defer interest or principal payments or offer grants to incentivize project performance. The PWB will detail application process, selection criteria and eligibility through policy.

Recommendation #2

Encourage strategic partnerships with public agencies and higher education institutions, tribal governments, special purpose districts, not-for profits and private industry.

Applicants eligible for funding under this pilot program are encouraged to build broad partnerships with others seeking to implement and benefit from integrated infrastructure systems.

Recommendation #3

Solicit subject matter expertise on project selection and to mentor and monitor pilot projects as needed.

More work remains on how the PWB staff can best engage and integrate expertise and recommendations from higher education, environmental health, public safety and industry to link science, technology and funding to better identify replicable and scalable infrastructure solutions.

Recommendation #4

Build on existing policy priorities for public health and safety, sustainability, economics and equity to develop outcome-based project selection criteria.

Selection criteria would rank project outcomes by impact. High impact outcomes include:

Public health and safety: address failing systems or lack of services, enable safe resilience zones for growth.

Environmental health: accelerate recovery, remove contaminants, open fish passages, protect and restore habitat.

System performance: reduce or eliminate CO2 or non-renewable energy use, energy positive, use byproducts and waste products.

Growth and economic development: increase business opportunity, provide proof of concept for future scalability of technology.

Community and equity: equitable access to infrastructure service, evidence of community engagement where community is part of the infrastructure solution.

PWB Innovative Infrastructure Study Approach

The 2022 capital budget (Section 7004, Substitute Senate Bill 5651) required the PWB to evaluate the barriers and gaps in incentives and funding for innovative systems and technologies. The approach included holding listening sessions with over 25 key stakeholders, including local governments, partner agencies and associations, environmental organizations, and higher education and research institutions (participants listed in Table 1).

In interviews and discussions with key stakeholders the PWB asked: What are your biggest infrastructure challenges? What innovations in infrastructure do you want to see? What are the barriers you experience moving multi-system, integrated and green infrastructure projects forward? What is your ‘new idea or technology’ that could be a pilot project?

After reviewing these discussions, the PWB staff identified key themes related to common challenges, potential solutions and emerging pilot project concepts including: access to capital, equity and environmental justice, lack of regulatory flexibility and guidance, administrative and technical capacity and risk tolerance. Collaborative discussion with multiple partners to address these challenges shaped the recommended program design.

Table 1: Outreach and Listening Sessions Participants

Local Governments	
City of Yakima Public Works	North Olympic Peninsula Resource Conservation & Development Council
Community Engagement Specialist (Town of Twisp)	Seattle Public Utilities
Kittitas County	Snohomish County Public Works
Kitsap Public Utility District	
Partner Agencies	
Sync Partner Agencies	Department of Commerce
<ul style="list-style-type: none"> • Department of Commerce • Department of Ecology • Department of Health • Department of Transportation • Transportation Improvement Board 	<ul style="list-style-type: none"> • State Energy Office • Industrial Symbiosis Program • Growth Management Services; Climate Team
Puget Sound Partnership	Office of Equity
Partner Associations	
Association of Washington Cities	Washington Public Utility District Association
Center for Sustainable Infrastructure	Washington Association of Sewer and Water Districts
Environmental Organizations	
Green Infrastructure Summit of the Salish Sea Challenge Session	Council of Regions collaborative for salmon recovery across Washington state
The Nature Conservancy	
Research Institutions	
University of Washington	Washington State University
<ul style="list-style-type: none"> • EarthLab • Puget Sound Institute 	<ul style="list-style-type: none"> • Washington Stormwater Center
	Northwest Indian College

Why Consider Innovative Infrastructure?

Demand for infrastructure funding has outpaced funding available for decades, and many communities lack a rate-base that can afford to explore innovative approaches to solving climate-related challenges.

Water, wastewater, stormwater, roads, bridges and solid waste facilities represent long-lived infrastructure that provides a dedicated service often over several decades. Climate change tests the capacity and adequacy of infrastructure systems (IPCC 2022). Investment in innovative technologies and practices ensures that infrastructure investments will get the most 'bang for the buck'.

In Washington State, expected environmental challenges due to climate change include:

- Drought
- Wildfires
- Extreme heat events
- Acidifying marine waters
- Increased toxic runoff to freshwater
- Rising seas
- More heavy rain events
- Increasing flood risks
- Decreasing mountain snow pack
- Declining water availability in summer
- Reduced stream flows

Easy-to-access funding for conceptual development and implementation of innovative solutions will help local governments and utilities build momentum to try different approaches and technologies so that infrastructure will serve communities into the future.

Transition to a circular economy

Consideration of the waste streams that create valuable material for another is at the heart of a circular economy. This study engaged with the Department of Commerce industrial symbiosis program created in 2021 by [SB 5345](#) to ensure the PWB's innovative infrastructure pilot program design promotes infrastructure that supports a circular economy.

Transition to Clean Energy

Water and wastewater collection, distribution and treatment facilities often account for 30-40 percent of local government energy consumption. There are opportunities to improve energy use through leak prevention and high efficiency system operations. Water and wastewater facilities can create energy through anaerobic digestion, solar, hydropower, co-digestion, heat recovery, geothermal, algae biofuel, or thermal conversion (Kenway et al 2019; Conrad et al 2021). Retrofits or new designs can be energy neutral or positive (Lisk et al 2012).

The PWB innovative infrastructure pilot is poised to collaborate and share approaches with the state energy office related to project selection criteria, risk mitigation strategies, and expert review in project selection of innovative infrastructure projects that achieve clean energy outcomes within public works projects.

Ecosystem Protection

Ecosystems are fragile and undergoing additional stress due to human causes. Across our state, these affects vary yet all have profound impact on human and environmental health. Local governments struggle to fund many of the investments needed because they either lack a revenue base or struggle to partner across jurisdictions. Yet, there are innovative solutions that can provide ecosystem protections and improve human quality of life. They are needed quickly and at large scale to make an impact.

Value-Based Investment

Projects that maximize key values of economic, environmental, societal, political and cultural considerations are more likely to stand the test of time. Context varies by location and it is important that infrastructure investments serve the unique needs of a specific community. Value planning builds understanding and buy-in for community-driven strategies that identify local needs, values, known opportunities and key community assets.

Challenges to Incentivizing Innovative Infrastructure

Figure 1: Summary of key challenges and strategies

CHALLENGES	STRATEGIES
Access to Capital	Dedicated flexible funding for pilot projects
Equity & Environmental Justice	Community representation and co-governance requirements; wealth creation and local jobs
Lack of Regulatory Flexibility or Guidance	Regulatory and scientific expertise in project selection
Administrative & Technical Capacity	Prioritize planning efforts to support pilot concept or technical assistance
Risk Tolerance	Explore options for managing and accepting risk in partnership with community

Figure 1 summarizes the themes from discussions. Program design recommendations aim to address each of these challenges.

Access to Flexible Capital

Local governments burdened with aging infrastructure need cost-effective and sustainable solutions. A combination of grants and loans with a broad range of eligible uses help local governments and utility districts develop integrated solutions to upgrade or replace aging systems with innovative and sustainable tools.

This innovative infrastructure pilot program aims to use the PWB's broad authority to administer flexible funding for projects that incorporate innovative technologies or approaches to achieve multiple benefits.

Equity and Environmental Justice

Knowing how to best address equity and environmental justice in a meaningful way is uncharted territory that requires innovative approaches. A challenge to consider is the importance of building wealth through investment in infrastructure without displacing

low income communities. This is of keen concern when exploring innovative infrastructure investment in historically overburdened and under-invested communities. Possible solutions that require innovation and partnerships:

- Value capture, as an example of an innovative financing model that reduces community displacement.
- Use co-governance approaches to ensure that the community gets the benefits needed from the infrastructure.
- Ensure infrastructure projects include workforce development opportunities that benefit local community members.

The development of project selection criteria that embeds community and equity impact incentivizes using co-governance models to create community voice in infrastructure planning, design and construction.

Challenges to Incentivizing Innovative Infrastructure

Lack of Regulatory Flexibility or Guidance

Local governments and utilities said that it is extremely challenging to make progress with innovative pilot ideas when there is ambiguity or lack of regulatory guidance for the technology or approach. There needs to be a pathway to meet permitting requirements in collaboration with the scientific community and with regulators' interest and support. One strategy to solve this challenge is to solicit regulatory and scientific expertise during the project selection process, and then be available to mentor and monitor throughout the life of pilot projects.

More work remains on how the PWB staff can best engage and integrate expertise. Creating a platform to align state agencies, the scientific community and community-based equity practitioners may help incentivize, select and support innovative project concepts.

Administrative and Technical Capacity

There is often a lack of administrative and technical capacity to approach planning for pilot concepts. Prioritizing planning activities and encouraging multi-disciplinary technical assistance would help local cities and counties ask themselves, "How can we incorporate innovative infrastructure to fix our aging systems?"

One approach the PWB is exploring is to assist local jurisdictions with value planning in order to create broad benefit and high-value infrastructure investment strategies that incorporate innovative technologies and approaches where it makes sense.

Risk Tolerance

Innovation implies experimentation. Not all experiments work as planned, yet each offers learning. Risk under this pilot is acceptable and tolerated.

During the outreach and engagement phase of this project, local governments and utility districts expressed concern with accepting

risk. Community engagement specialist and local government leader based in rural eastern Washington emphasized that "if a community lacks the resources for managing aging and failing infrastructure systems, the first tool selected isn't going to be innovation." Yet it becomes an equity consideration if small, rural or at-risk communities that lack resources to accept risk are unable to partake in innovative solutions that may yield better results.

At larger utilities, conservatism remains a barrier for innovative investments. "Utilities can't afford to waste rate-payer money and want confidence in that what they are going to do is going to work. To find out what is going to work in an innovative way requires pilots. For the projects that work, you can scale. But because of the risk adverse nature, utilities don't want to put money toward that. Federal or state money that is dedicated to off-loading part of the risk would incentivize utilities to try innovative pilots."

To address this challenge, the pilot program supports risk tolerance by ensuring flexible funding is available and encouraging broad partnerships. Engaging subject matter expertise to provide technical review helps identify likely risk events and design mitigation strategies in the planning stages of a project. Community participation and buy-in also builds tolerance for risk. Finally, investing incrementally in a new approach lessens the financial burden of failure. This team-based approach for innovative infrastructure pilots aims to support communities taking bold steps to solve increasingly complex infrastructure challenges.

Innovative Examples and Case Study Overview

Examples of Innovative Infrastructure

The budget proviso directs that examples of innovative project types that should be addressed by the program be provided and include: water reuse or reclaimed water systems, projects that integrate energy generation or water collection from waste products, and projects that reduce pollution discharges, treat or store water through green, or nature-based, infrastructure.

Local governments provided examples of innovative pilot project ideas they are interested in pursuing, but struggle to get momentum on. The type of projects communities see as innovative include:

Conserve water and energy:

- Water reuse for irrigation and other non-potable uses

Reduce greenhouse gas emissions:

- Solar panels on public works facilities, irrigation ditches or reservoirs
- Thermal energy including heat recovery from sewer and other waste heat

Reduce pollution and waste:

- Biogas production at wastewater treatment facilities
- Decentralized treatment processes to replace septic systems or treat stormwater runoff
- Sustainable stormwater treatment, including structural soils with trees to control runoff and improve water quality

Achieve multiple benefits:

- Micro-turbines in water or wastewater systems
- Natural green infrastructure such as wetlands and swales that reduce nutrient load
- Artificial Intelligence (AI) and digital twin modeling of water, wastewater and stormwater systems to improve understanding of system performance

Case Study Overview

In seeking to answer the question about how projects actually play out, the PWB staff researched recent examples and offer three case studies for consideration and explanation of how innovative infrastructure pilot projects might advance.

- Kitsap Public Utility District (PUD) seeks to reuse water to reduce pollution discharges and recharge groundwater. The area experiences challenges due to urban growth area constraints in the Growth Management Act.
- City of Pasco integrates energy generation, uses waste products and reduces pollution discharges. The city engages multiple public and private partners in this effort.
- I-5 Rose Quarter Project in Portland, OR is an example of a transportation project that speaks to equity and environmental justice challenges. This example addresses stakeholder input asking for discussion and examples of innovative approaches to equity and environmental justice outcomes.

The three case studies are not exhaustive of the types of projects eligible in the proposed pilot program.

Case Study: Kitsap Public Utility District

Kitsap County aquifers recharge through rainfall. Different climate change scenarios highlight the need to be able to recharge the aquifer with reusable water from treatment plants. Cleaning up the Salish Sea is an added benefit.

The Indianola Spit is a stretch of land that extends from Indianola into the Puget Sound. There are just over 70 homes on the spit, all served with traditional septic systems. There are shellfish beds on both sides of the spit. Septic system failure jeopardizes the harvesting of these beds. The traditional model, where the waste is treated and the effluent is pumped to a large off-site drain field, or pumped to an off-site treatment facility is cost prohibitive in this situation.

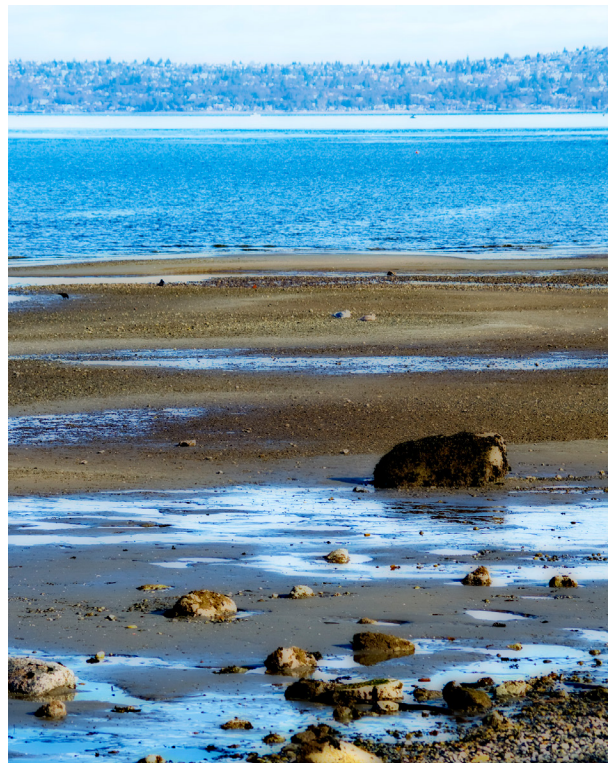
Kitsap PUD is exploring options to install a small membrane bioreactor (MBR) wastewater treatment facility to serve residents on Indianola Spit. A well-established technology such as a membrane bioreactor for wastewater treatment still faces challenges. In this case, the wastewater treatment would fall in an area outside the urban growth area (UGA) boundary. Other local jurisdictions described similar scenarios when seeking solutions to legacy development areas in need of sewer systems. Standard system development is cost prohibitive and the community falls outside the urban growth area.

The solution proposed by Kitsap PUD would treat effluent using a small MBR facility and return treated water back to each resident's drain field. The combination of the small drain fields add up to the required drain field size for the treatment plant.

This pilot project would help answer the following questions:

- Does the plant operate as expected?
- Do the drain fields work to dissipate the effluent?
- Is there a reduction of nitrogen in the surrounding Puget Sound?
- Is this an approach acceptable in other regions with wastewater needs outside an UGA?

If successful, areas where drain fields are failing and polluting receiving water bodies could use this model. Residents reusing the water for watering lawns would reduce the consumption of water. Additionally, water would return to the ground in the basin where it is used.



Low tide on a beach north of Kingston, WA

Case Study: City of Pasco

The city of Pasco is located in the heart of Washington's agriculture region. The region's food processors are an important and central part of the city's diversified and growing economy. The Process Water Reuse Facility (PWRF) treats the wastewater and applies it to nearly 1,900 acres of crops. Both the PWRF and the land application acreage are at their maximum capacity in terms of hydraulic constraints and equipment failures as well as saturation of nitrogen in land application.

The future of the PWRF includes three phases. Phase One deals with the addition of potable water and more electrical power. Phase Two addresses additional water storage ponds. Phase Three explores two innovative technologies. First, the addition of a low-rate anaerobic digester provides more comprehensive wastewater treatment and the opportunity to produce and capture methane gas from the treatment process of the wastewater. Second, the addition of biological nitrogen removal process using algae growth reduces nitrogen levels before sending wastewater to farm circles.

The low-rate anaerobic digester and the biological nitrogen removal projects' funding comes from a cost sharing arrangement between the Renewable Natural Gas (RNG) developer and processors and low interest loans and grant funds from state and federal sources.

The City of Pasco's PWRF investment in value planning combined with targeted investment in options analysis of a biological nitrogen removal process is an example of how targeted investments in innovative technologies can be the piece of the puzzle needed to implement win-win scenarios for sustainable economic development and job creation and retention.



Waste flow into retention pond that will be used to harvest algae

Case Study: I-5 Rose Quarter Project in Portland, OR

While the [I-5 Rose Quarter Improvement Project](#) is not in Washington State, the project spotlights how a transportation project can change its engagement and co-management practices to promote restorative justice. Partner associations requested centering equity and environmental justice when exploring innovative solutions that promote community and ecosystem resilience. The innovative nature of the I-5 Rose Quarter Improvement Project is a focused approach to gather community input and ensure that when rebuilding infrastructure the “community can build it, own it and benefit from it into the future.” The project included a highway cover which is significant in that it creates new community spaces for parks, buildings and reconnects streets separated by the interstate.

The techniques used in the Rose Quarter Improvement Project can apply to similar transportation and other infrastructure investments that shape or redesign a neighborhood. The project included an [environmental justice review](#) completed in 2017 to inform the project team of the history of the area and the community's expectation for the transportation improvement project. Later in the project an [independent assessment of highway cover options](#) created a process for reviewing the designs with consideration for the goals and objectives of stakeholders that experienced significant economic and environmental hardship when I-5 disrupted the homes and businesses of Portland's Black Historic Albina community. The goal was to find design solutions that reduce barriers created by the construction of a major transportation corridor through the middle of an existing neighborhood, generate more opportunities for wealth creation, create a healthier environment and support community cohesion.

The restorative justice techniques used aimed to be comprehensive and inclusive and included:

- A jobs creation program for disadvantaged business enterprise (DBE) firms with a focus on construction jobs

- Leveraging experiences gained by DBE firms to increase capacity for future construction projects
- Pre-apprenticeship and apprenticeship growth opportunities
- Establishing a community advisory committee with a legally binding agreement with local, state and regional government partners to oversee the design and construction of infrastructure projects. Community membership ensures:
 - Focus on the community outcomes of the project
 - Decision making power held by members of the community most impacted
 - Consultation on decisions around design, delivery and ongoing use and management of the infrastructure
 - Involvement in developing restorative justice goals
- Establishing an equity framework informed by an Equity Advisory Group. An equity framework guides each element of a program from planning and design to environmental review and community engagement. The [Interstate Bridge Replacement Program Equity Framework](#) is another example.

By incorporating these techniques, the project significantly shifted the balance of power to be genuinely inclusive of a community with a history of environmental injustice and mistrust. Examples gleaned from this project offer new approaches that incorporate restorative justice strategies into a project design.

The PWB pilot program design aims to center equity and community input in pilot projects to restore justice in areas with a legacy of injustice and to protect against developing infrastructure in a manner that continues to cause harm or health disparities.

Conclusion

The four recommendations in this report for an innovative infrastructure pilot program marry science, technology and funding and position the PWB to lean into equity and climate resilience challenges. The proposed program design will provide the space for local governments and utilities to work with state agencies, researchers and the PWB to plan, design and build infrastructure that protects health and safety, restores and protects ecosystems, sustains economic development and promotes equity and community using the best technology and approaches available. There remains more work to determine how the PWB will receive recommendations from subject matter experts and support more community engagement in infrastructure planning. Another challenge remains to ensure innovative infrastructure pilots integrate into the PWB's programming without exacerbating the backlog of traditional infrastructure funding needs.

The PWB submitted a \$50 million budget request in the 2021 supplemental budget targeting federal funding to support innovative infrastructure for clean and safe water pilots. In response, the 2022 capital budget, section 7004 Substitute Senate Bill 5651 directed the PWB to develop recommendations for program design and administration, prioritization and selection criteria, operation and funding structure. It also directed the PWB to evaluate, in collaboration with SYNC partner agencies, the industrial symbiosis program, state energy office and local governments, the barriers and gaps in incentives and funding for advancing innovative systems and technologies in public infrastructure that promote community and ecosystem resilience.

The PWB will continue to work on the policy and programmatic framework of an innovative infrastructure pilot program. This includes recommendations on funding, whether this should be a standalone program or incorporated into existing PWB authority, and next steps for implementation. The PWB is poised to take advantage of this opportune time to lead the state and local jurisdictions in incentivizing innovations in infrastructure funding that will support communities to meet future infrastructure needs.



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