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Urban Growth, Low Impact Development, and Seattle's Stormwater Management System

*Katherine E. Baals**

I. INTRODUCTION

Worldwide, cities are expanding at an unprecedented rate. This unprecedented urban growth has drastic implications for the environment. If improperly managed, growing cities compromise their surrounding environment and pollute, impede, and generally degrade their surrounding water sources. However, if properly managed, growing cities can grow in tandem, rather than in competition, with their surrounding environments. In some instances, well-managed urban growth can even improve the surrounding environment. These rare instances reveal that proper urban growth management must incorporate low-impact development (building practices that mimic natural drainage) and maintain comprehensive systems to manage stormwater.

From 2000 to 2010, the United State's urban population increased by 12.1%.¹ An urbanized area is defined as an area having a population of 50,000 or more.² Between 2000 and 2010, the urban population of the United States increased 12.1%.³ In 2010, there were 497 urbanized areas in the United States (including Puerto Rico).⁴ Overall, the total urban population of the United States increased from 79% in 2000 to 80.7% in 2010.⁵

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¹ *Growth in Urban Population Outpaces Rest of Nation*, Census Bureau Reports CB12-50, U.S. CENSUS BUREAU: NEWSROOM ARCHIVES (Mar. 26, 2012), https://www.census.gov/newsroom/releases/archives/2010_census/cb12-50.html [<https://perma.cc/778R-4M2S>].

² *See id.*

³ *Urban Area Facts*, U.S. CENSUS BUREAU, <https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/ua-facts.html> [<https://perma.cc/C3JS-FW9L>].

⁴ *Id.*

⁵ *Id.*

Consistent with this pattern of urban growth, Seattle consistently ranks among the fastest growing cities in the United States,⁶ with a total projected population growth of 1.76% in 2018.⁷ Every week, roughly 1,100 new residents move to the Seattle area.⁸ In 2019, migration accounted for 76% of Washington State's population growth, equating to roughly 90,000 people.⁹

The Seattle and U.S. rapid urbanization trend mirrors global urban migration statistics. While exact global estimates differ, experts agree that the global population is migrating to urban areas at exceptional rates. In 1950, roughly 30% of the world's population lived in urban areas,¹⁰ while an estimated 68% of the world's population is projected to live in urban environments by 2050.¹¹ Even though one half of urban residents live in small urban settlements with less than 500,000 inhabitants, currently 1 in 8 urban dwellers live in one of 33 current *megacities* with more than 10 million inhabitants.¹² There will be an estimated 43 megacities by 2030, with most of this urbanization projected to occur in India, China, and Nigeria.¹³

This rapid urbanization is fueled by industrialization and has the potential to result in improved access to healthcare, schools, and employment opportunities, along with an increase

⁶ *Census Bureau Reveals Fastest-Growing Large Cities*, U.S. CENSUS BUREAU (May 24, 2018), <https://www.census.gov/newsroom/press-releases/2018/estimates-cities.html> [<https://perma.cc/9FEF-DK5F>].

⁷ Samantha Sharf, *Full List: America's Fastest-Growing Cities 2018*, FORBES (Feb. 28, 2018) <https://www.forbes.com/sites/samanthasharf/2018/02/28/full-list-americas-fastest-growing-cities-2018/#6c7fe27e7feb> [<https://perma.cc/KJK8-AXWT>].

⁸ Ana Sofia Knauf, *More Than 1,000 People Are Moving to Seattle Every Week, Census Report Shows*, THE STRANGER (Mar. 27, 2017), <https://www.thestranger.com/slog/2017/03/27/25043201/more-than-1000-people-are-moving-to-seattle-every-week-census-report-shows> [<https://perma.cc/8PTH-ND7W>].

⁹ FORECASTING & RESEARCH DIVISION, OFFICE OF FIN. MGMT., 2019 POPULATION TRENDS, STATE OF WASH. (2019), https://www.ofm.wa.gov/sites/default/files/public/dataresearch/pop/april1/ofm_april1_poptrends.pdf [<https://perma.cc/AYV8-TXV6>].

¹⁰ *World Urbanization Prospects: The 2018 Revision*, UNITED NATIONS: DEP'T ECON. & SOC. AFFAIRS (2018), <https://population.un.org/wup/Publications/Files/WUP2018-KeyFacts.pdf> [<https://perma.cc/H675-DGHZ>].

¹¹ *68% of the World Population to Live in Urban Areas by 2050, says UN*, UNITED NATIONS: DEP'T ECON. & SOC. AFFAIRS (May 16, 2018), <https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html> [<https://perma.cc/H9V3-5YYH>].

¹² *Id.*

¹³ UNITED NATIONS, *supra* note 10.

in the overall standard of living.¹⁴ However, improperly managed rapid urbanization will inevitably lead to the degradation of local ecosystems and environments. Urban stormwater in the U.S. has long been the primary source of water quality impairment in roughly 13% of all rivers, 18% of all lakes, and 32% of all estuaries, even though urban areas cover less than 5% of landmass in the United States.¹⁵ Increased urban populations necessitate an increase in construction and buildings across the whole infrastructure spectrum (including public, private, commercial, and residential sectors). This increase in infrastructure leads to more impervious structures that replace permeable dirt with impermeable surfaces, which are water-resistant. These surfaces inhibit water's natural course and interrupts natural ecosystems and processes.

Improperly managed urban growth also leads to social inequity. While more affluent neighborhoods are aesthetically and sustainably developed, lower income and marginalized parts of the same city can be under or poorly developed, leaving residents excluded from the benefits of well-managed urbanization. Low-income and minority communities often receive disproportionately small allocations of park resources, green infrastructure, and other related features,¹⁶ and suffer the negative health effects of polluted air and water supplies. Indeed, "polluted waters are a health hazard as well as an eyesore, diminishing property values and detracting from community revitalization efforts. The adverse impact of these problems will only continue to grow as our world's population increases [and] urban dwelling becomes more concentrated."¹⁷

Robust and effective stormwater and low impact development (LID) practices are essential to mitigate the negative environmental impacts of unprecedented urbanization and to ensure that the benefits of urbanization and access to infrastructure, social services, and safe environments¹⁸ are readily available to everyone.

¹⁴ Josey O'Donnel, *What is Urbanization and What are the Positive and Negative Effects?*, CONSERVATION INST. (Apr. 30, 2018), <https://www.conservationinstitute.org/what-is-urbanization/> [<https://perma.cc/73LY-CBUY>].

¹⁵ G. Tracy Mehan, III, *A Symphonic Approach to Water Management: The Quest for New Models of Watershed Governance*, 26 J. LAND USE & ENVTL. L. 1, 12-13 (2010).

¹⁶ James Salzman, Craig Arnold, Robert Garcia, Keith Hirokawa, Kay Jowers, Jeffrey LeJava, Margaret Peloso & Lydia Olander, *The Most Important Current Research Questions in Urban Ecosystem Services*, 25 DUKE ENVTL. L. & POL'Y F. 1, 5 (2014).

¹⁷ Alexandra D. Dunn, *Siting Green Infrastructure: Legal and Policy Solutions to Alleviate Urban Poverty and Promote Healthy Communities*, 37 B.C. ENVTL. AFF. L. REV. 41, 42 (2010)

¹⁸ UNITED NATIONS, *supra* note 10.

II. THESIS

As cities grow, so too will their detrimental environmental impact. Municipalities cannot properly manage stormwater and mitigate the negative environmental impact of rapid urbanization without extensively incorporating LID practices and green infrastructure.

This note addresses Seattle's stormwater management system and how LID practices can fit in with Seattle's larger regulatory scheme. This note begins with an introduction to the Seattle stormwater management system, including the Seattle stormwater and low impact development codes. Next, this note addresses the broader regulatory system consisting of the Clean Water Act and the National Pollution Discharge Elimination System, as well as the Washington State Growth Management Act. This note then addresses the strengths and weaknesses of the Seattle stormwater system, including analysis of several specific instances where the Seattle system is insufficient and detrimental to the environment, such as the serious problem posed by Combined Sewer Overflows (CSOs). Finally, this note makes two comparisons to key programs in the Washington D.C. and Philadelphia stormwater management systems, therein highlighting other effective stormwater management practices that Seattle could readily replicate.

It is important to clarify that this note only considers a small part of the much larger question about how U.S. cities can be more sustainable. Key aspects of this issue were intentionally omitted. This is an American-centric analysis that does not analyze two of the fastest growing urban centers: India and Nigeria; nor does this analysis include China, which is simultaneously one of the fastest growing urban centers in the world and the largest contributor to global Co2 emissions¹⁹ because of its coal production, transportation, and consumption.²⁰ Furthermore, this note does not consider every

¹⁹ China creates roughly 26.83% of global Co2 emissions. Johannes Friedrich, *World's Top 10 Emitters and How They've Changed*, WORLD RESOURCES INSTITUTE (Apr. 11, 2017), <https://www.wri.org/blog/2017/04/interactive-chart-explains-worlds-top-10-emitters-and-how-theyve-changed> [<https://perma.cc/TX9J-ENNT>].

²⁰ China emitted 9056.8 million metric tons of carbon dioxide in 2015. *Each Country's Share of CO2 Emissions*, UNION OF CONCERNED SCIENTISTS (Oct. 10, 2019), <https://www.ucsusa.org/resources/each-countrys-share-co2-emissions> [<https://perma.cc/LV9D-HKMD>]. *Power Sector Reform in China*, INTERNATIONAL ENERGY AGENCY (Oct. 18, 2018), <https://webstore.iaea.org/insights-series-2018-power-sector-reform-in-china> [<https://perma.cc/C87F-549X>] (discussing how China is the largest power sector in the world).

systemic failure or solution. This note presents a more limited review of municipal sustainability measures and practices, and how several distinct, but by no means comprehensive, LID practices can improve the Seattle stormwater management system.

III. LOW IMPACT DEVELOPMENT AND THE SEATTLE STORMWATER MANAGEMENT SYSTEM

As urbanization continues, cities across the globe must ensure that their stormwater management systems provide effective and robust frameworks to create sustainable and environmentally conscientious population centers. Seattle is no exception. Even though Seattle has long been a leader in urban sustainability, there are numerous instances in which Seattle's multifaceted stormwater management system could further incorporate LID practices.

Some of the shortcomings with the Seattle stormwater management system are systemic: Seattle's current stormwater management system does not effectively prevent environmental hazards like CSOs, which have a serious and lasting impact on the water quality and residents' health. Seattle's response to CSOs has largely focused on expanding the sewer system, with only minimal progress toward incorporating LID practices.²¹ Seattle should focus on incorporating LID practices and *green infrastructure* to remedy the serious issue posed by CSOs, rather than merely increasing storage capacity and retroactive expansion.

Other issues with the Seattle stormwater management system are more practical: Seattle should more extensively implement LID practices in order to lessen the strain on its stormwater management system. However, Seattle faces legitimate geographic constraints, as well as other practical limitations, such as the heightened cost of LID practices and the need to balance sustainability with business interests.

The typical argument against incorporating LID practices in the Seattle stormwater management system is the misguided assumption that sustainability measures are unjustifiably expensive and place an unnecessary strain on local business. It is true that LID practices can be burdensome. Stormwater management and LID practices can be expensive,²² time

²¹ Seattle Public Utilities, *CSO Reduction Projects*, SEATTLE.GOV, <https://www.seattle.gov/utilities/environment-and-conservation/projects/sewage-overflow-prevention/cso-reduction-projects> [<https://perma.cc/E7RQ-UKKB>].

²² However, LID practices can be less expensive than their conventional stormwater management counterparts, because LID practices tend to use

consuming,²³ and oftentimes require cumbersome maintenance. Additionally, Seattle enjoys the benefits of economic growth in part because of behemoth companies like Boeing, Microsoft, and Amazon, each of which provides livelihoods for many Seattle residents. To hinder Seattle's innovative business community with environmental red tape could dissuade future business growth and investment in the city. However, many criticisms are founded on the incorrect assumption that environmental and economic interests are mutually exclusive and diametrically opposed, when actually, the two interests are symbiotic.

Seattle already has the legal framework in place to effectively manage stormwater runoff and implement LID practices. Seattle should further incorporate LID preventative practices into its preexisting system and embrace the philosophy that prevention is always better than remediation. In effect, LID practices absorb the stormwater that would otherwise drag pollutants into water sources. By further incorporating LID practices, Seattle can prevent pollutants from getting into our water sources in the first place, and also effectively limit the amount of water that enters the municipal combined sewer system, thereby lessening the chance of disastrous CSOs.

It is the purpose of this note to add to the growing conversation about how environmental and economic concerns are mutually supportive and oftentimes indistinguishable. A sustainable city is one in which profitable businesses, people, and the environment can collectively thrive.

IV. SEATTLE'S STORMWATER MANAGEMENT SYSTEM

The Washington State Department of Ecology defines stormwater as the "rain and snow melt that runs off rooftops, paved streets, highways, and parking lots."²⁴ As stormwater runs off these impervious surfaces, it picks up pollutants like "oil, fertilizers, pesticides, soil, trash, and animal manure"²⁵ as it

fewer below-ground infrastructures and offset the cost of retrofitting urban drainage. See SANTA BARBARA CHANNEL KEEPERS, REDUCING STORMWATER RUNOFF AND POLLUTION THROUGH LOW IMPACT DEVELOPMENT 3, https://www.sbck.org/pdf/Channelkeeper_LID_Report.pdf [<https://perma.cc/DTZ9-C2PB>].

²³ It is not uncommon for it to take over 20 years for a city to fully incorporate remedial LID practices into its failing sewer system. For example, the Big Pipe Project in Portland, Oregon, took 20 years to complete. *Infra* note 101.

²⁴ *Stormwater*, WASH. ST. DEP'T OF ECOLOGY, <https://ecology.wa.gov/Water-Shorelines/Water-quality/Runoff-pollution/Stormwater> [<https://perma.cc/D5LA-P988>].

²⁵ *Id.*

eventually makes its way into the streams, rivers, lakes, and the ocean in the Puget Sound Region. Once stormwater runs into our water sources, it damages salmon habitat, pollutes shellfish beds, contaminates groundwater, and degrades the overall water quality.²⁶

Even though the Seattle stormwater code (SMC) has undergone several revisions and reiterations, the central premise of the code remains the same: to regulate and reduce stormwater runoff.²⁷ The SMC provides for various stormwater management practices and is premised on protecting “life, property, and the environment.”²⁸ The backbone of the SMC is the general prohibition on discharge. The SMC states in part

No discharge from a site, real property, or drainage facility, directly or indirectly to a public drainage system, private drainage system, or a receiving water within or contiguous to Seattle city limits, may cause or contribute to a prohibited discharge or a known or likely violation of water quality standards in the receiving water of a known or likely violation of the City’s municipal stormwater NPDES permit.²⁹

The code prohibits discharges such as oil, chemicals, gravel, and pesticides,³⁰ but permits discharges that include potable water sources, swimming pools, lawn watering, and irrigation runoff.³¹

Even though the code is premised on environmentally protective ideals, there are many activities, sites, and practices are explicitly exempt from the code, including certain types of commercial agriculture³² and certain forest practices.³³ While a full discussion of the many exemptions embodied in the SMC is beyond the scope of this note, also exempted are the maintenance of underground or overhead utility facilities³⁴ and certain pavement maintenance practices.³⁵ Also exempted are

²⁶ *Id.*

²⁷ Seattle Public Utilities, *Stormwater Code*, SEATTLE.GOV, [hereinafter *Stormwater Code*] <https://www.seattle.gov/utilities/environment-and-conservation/projects/green-stormwater-infrastructure/stormwater-code> [<https://perma.cc/UL2G-3KZX>].

²⁸ SEATTLE MUN. CODE § 22.800.020(A)(1) (2009).

²⁹ SEATTLE MUN. CODE § 22.802.010(A) (2009).

³⁰ *See* SEATTLE MUN. CODE § 22.802.020 (2009).

³¹ *See* SEATTLE MUN. CODE § 22.802.030 (2009).

³² SEATTLE MUN. CODE § 22.800.040(A)(1)(a) (2009).

³³ SEATTLE MUN. CODE § 22.800.040(A)(1)(b) (2009).

³⁴ SEATTLE MUN. CODE § 22.800.040(A)(2)(a) (2009).

³⁵ SEATTLE MUN. CODE § 22.800.040(A)(2)(b) (2009).

practices such as pothole patching, overlay of existing asphalt or concrete that does not expand the area of coverage, shoulder grading, reshaping or regarding drainage ditches, crack sealing, and vegetation maintenance.³⁶

V. SEATTLE'S LOW IMPACT DEVELOPMENT CODE AND PRACTICES

LID practices, also called “green infrastructure,”³⁷ are water quality protection measures and design strategies that help manage stormwater by mimicking natural drainage and filtration processes. LID practices are beneficial for many land use areas,³⁸ but are most common in stormwater management models. Examples of LID practices include permeable pavement, rain gardens, overflow channels, bioswales, and curb chutes that lead water to bio-retention planters. These LID practices are in sharp contrast to traditional “gray infrastructure,” which include the gutters, sewers, and tunnels that cities traditionally use to manage stormwater.³⁹

LID mechanisms retain rainwater and allow that water to soak into the ground, where plants and soil then filter the rainwater naturally.⁴⁰ Rainwater retention reduces the amount of runoff generated by a rainstorm, which in turn limits the stormwater runoff,⁴¹ therein mitigating downstream erosion and habitat damage. LID practices sequester carbon and filter out pollutants, oils, sediments, and other debris that would otherwise end up in our waters.⁴² Green infrastructure also provides recreational opportunities and a sense of community and place, which can enhance human physical and psychological health.⁴³

Seattle has funded, implemented, and encouraged a number of LID features, especially through Seattle's Green Stormwater Infrastructure (GSI) code, which is “Seattle's term for the low impact developed-based stormwater management

³⁶ *Id.*

³⁷ This note, like most authorities, employs both terms interchangeably. *See, e.g.,* Jonathan Rosenbloom, *Fifty Shades of Gray Infrastructure: Land use and the Failure to Create Resilient Cities*, 93 Wash. L. Rev. 317, 379 (2018).

³⁸ *Id.*

³⁹ *Leaving the Gray Behind*, U.S. ENVTL. PROT. AGENCY (June 24, 2016), <https://www.epa.gov/sciencematters/leaving-gray-behind> [<https://perma.cc/Q68U-KMRV>].

⁴⁰ *Urban Runoff: Low Impact Development*, U.S. ENVTL. PROT. AGENCY (Aug. 6, 2018), <https://www.epa.gov/nps/urban-runoff-low-impact-development> [<https://perma.cc/Y3ER-BPM7>].

⁴¹ Rosenbloom, *supra* note 37, at 382.

⁴² *Id.* at 343.

⁴³ O'Donnel, *supra* note 14.

practices.”⁴⁴ The Seattle GSI code includes many LID practices aimed to reduce stormwater runoff by using “infiltration, evapotranspiration, [and] stormwater reuse,”⁴⁵ while providing additional stormwater management practices such as repurposing water and using green space.⁴⁶

Space limitations can make it impractical to implement LID mechanisms and to completely preserve uninterrupted habitat in urban environment.⁴⁷ Oftentimes stormwater management systems need the flexibility to implement LID practices on a smaller scale. One example is Seattle’s Street Edge Alternatives Program, which, as part of the GSI code, implements LID practices and features in local areas. Through the Street Edge Alternatives Program, Seattle incorporated LID practices to improve stormwater management on 2.3 acres (roughly 600 linear feet) of a continuous neighborhood street.⁴⁸ The project implemented roadside swales, added more than 1,100 new trees and shrubs,⁴⁹ and reduced impervious surface volume by 11%. Ultimately, the project decreased stormwater volume by 99%⁵⁰ and demonstrated the effectiveness of systems that “mimic” the natural environment.⁵¹

Again, it is no overstatement that Seattle has one of the most effective stormwater management systems in the United States. Seattle has constructed a comprehensive system that allows for local incorporation of LID practices and green infrastructure.⁵² However, Seattle should further incorporate and

⁴⁴ Seattle Public Utilities, *Low Impact Development*, SEATTLE.GOV, <https://www.seattle.gov/utilities/environment-and-conservation/projects/green-stormwater-infrastructure/low-impact-development> [https://perma.cc/T7H9-5URJ].

⁴⁵ *Stormwater Code*, *supra* note 27.

⁴⁶ *Id.*

⁴⁷ Margaret E. Byerly, *A Report to the IPCC on Research Connecting human Settlements, Infrastructure, and Climate Change*, 28 PACE ENVTL. L. REV. 936, 954 (2011).

⁴⁸ Seattle Public Utilities, *Drainage Improvements*, SEATTLE.GOV, <https://www.seattle.gov/utilities/environment-and-conservation/projects/green-stormwater-infrastructure/completed-gsi-projects/street-edge-alternatives/drainage-improvements> [https://perma.cc/LK8P-M6L6].

⁴⁹ Seattle Public Utilities, *Street Edge Alternatives*, SEATTLE.GOV, <https://www.seattle.gov/utilities/environment-and-conservation/projects/green-stormwater-infrastructure/completed-gsi-projects/street-edge-alternatives> [https://perma.cc/EM63-LAPF].

⁵⁰ *Id.*

⁵¹ *Street Edge Alternatives (SEA) Street Pilot, Seattle*, NAT’L ASSOC. OF CITY TRANSPORTATION OFFICIALS, <https://nacto.org/case-study/street-edge-alternatives-sea-street-pilot-seattle/> [https://perma.cc/PCZ5-2R4S].

⁵² This is especially true in the Seattle private housing sector, where the city has implemented and actively promoted such programs as the Stormwater Facility Credit Program (See Seattle Public Utilities, *Stormwater Facility Credit*, SEATTLE.GOV, <https://www.seattle.gov/utilities/businesses-and-key->

encourage LID practices to further protect our waters and accommodate the influx of people moving to Seattle.

VI. THE REGULATORY SYSTEM

A. The Clean Water Act and National Pollution Discharge Elimination System

The Seattle stormwater management system and LID practices do not exist in isolation, but are instead the cumulative and localized result of a much broader network of federal and state laws, policies, and objectives, all of which aim to manage and protect the waters of the United States. The Clean Water Act (CWA) and the National Pollution Discharge Elimination System (NPDES) permit program are the regulatory background for stormwater management in the United States.

The CWA is the backbone of United States' water law and is intended to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”⁵³ The central premise of the CWA is the general prohibition on discharge of any pollutant from a point source into navigable waters, except in accordance with specified provisions of the CWA.⁵⁴ A point source is “any discernible, confined and discrete conveyance . . . from which pollutants are or may be discharged.”⁵⁵ Alternatively, a nonpoint source is any source of water pollution that does not meet the standard definition of a point source under the CWA.⁵⁶ Nonpoint sources tend to be diffuse, widespread, and include runoff from agricultural land, construction, and

accounts/drainage-and-sewer/stormwater-facility-credit [https://perma.cc/FTT5-MSJ3]) and the Saving Water Partnership (*See* SAVING WATER PARTNERSHIP, savingwater.org [https://perma.cc/4TBL-RH7U]). These programs, and the many other residential LID initiatives that Seattle has all offer a financial motivation for the homeowner. For example, the RainWise program offers the homeowner who implements certain LID practices on their property an average rebate of \$4,800.00. *See Be RainWise!*, 700 MILLION GALLONS, <https://www.700milliongallons.org/rainwise/> [https://perma.cc/524T-TLTZ]).

⁵³ 33 U.S.C. § 1251(a) (2018).

⁵⁴ 33 U.S.C. § 1311(a) (2018) (stating “except as in compliance with this section and sections 1312, 1316, 1317, 1328, 1342, and 1344 of this title, the discharge of any pollutant by any person shall be unlawful”).

⁵⁵ 33 U.S.C § 1362(14) (2018).

⁵⁶ STEVEN A. DRESSING, D.W. MEALS, J.B. HARCUM & J. SPOONER, OVERVIEW OF THE NONPOINT SOURCE PROBLEM, U.S. ENVTL. PROT. AGENCY: MONITORING AND EVALUATING NONPOINT SOURCE WATERSHED PROJECTS 1-1 (2016), https://www.epa.gov/sites/production/files/2016-02/documents/chapter_1_draft_aug_2014.pdf [https://perma.cc/P8BW-5HLL].

contaminated ground water.⁵⁷ Nonpoint sources are more difficult to regulate, therein constituting practical limitations to Seattle's stormwater management system and why the SMC is not as broad as it could be.⁵⁸ Stormwater can be either a point source or nonpoint source pollutant.⁵⁹ While nonpoint source stormwater is beyond the scope of this article, the CWA regulates stormwater discharges from medium and large municipal separate storm sewer systems.

The Environmental Protection Agency (EPA) implemented the CWA requirements in two phases. Phase I began in 1990 and required permitting for large and medium municipal sewer systems, while Phase II began in 1999 and covered permits for small municipal sewers.⁶⁰ Because the CWA covers stormwater discharges from medium and large sewer systems, such discharges must comply with the NPDES permitting program.⁶¹

The NPDES program is an exception to the CWA's general prohibition on point source discharges. The NPDES program is a permitting scheme that specifies the conditions for permitted discharges under the CWA. NPDES permits limit discharges as necessary to satisfy both state and federal water quality standards and regulations.⁶² Any municipal, industrial, or commercial facility that discharges from a point source to a receiving water body must obtain a NPDES permit.

The EPA is vested with the authority to issue the NPDES permits. Because states are sovereign, the federal government cannot compel or commandeer state officials to implement federal objectives, so states voluntarily assume regulatory enforcement,⁶³ so states voluntarily assume regulatory enforcement of the NPDES. The EPA delegates NPDES authority to individual states, thereby allowing the states to administer and enforce the permits while the EPA retains

⁵⁷ *Basic Information About Nonpoint Source (NPS) Pollution*, U.S. ENVTL. PROT. AGENCY (Aug. 10, 2018), <https://www.epa.gov/nps/basic-information-about-nonpoint-source-nps-pollution> [<https://perma.cc/2TY4-7U74>].

⁵⁸ See SEATTLE MUN. CODE § 22.802.030, *supra* note 31.

⁵⁹ DRESSING ET AL., *supra* note 56.

⁶⁰ *Stormwater Discharges From Municipal Sources*, U.S. ENVTL. PROT. AGENCY (Sep. 11, 2019), <https://www.epa.gov/npdes/stormwater-discharges-municipal-sources> [<https://perma.cc/P4KM-5XT3>].

⁶¹ 33 U.S.C. § 1342(p)(2)(C)-(D) (2018).

⁶² 33 U.S.C. § 1311(b)(1)(C) (2018).

⁶³ U.S. CONST. amend. X (stating “the powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people”); *see also* *New York v. United States*, 505 U.S. 144, 174-75 (1992).

oversight responsibilities.⁶⁴ As in many other states, the EPA delegated authority to the Washington State Department of Ecology to implement the NPDES permit program in Washington.⁶⁵ The Washington State Department of Ecology may not issue a permit “if the conditions of the permit do not provide for compliance with the applicable requirements of CWA, or regulations promulgated under CWA [or] if the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States.”⁶⁶ Furthermore, NPDES permits must comply with state law and regulatory water quality standards,⁶⁷ and there “must be conditions so the discharges authorized will meet the water quality standards.”⁶⁸

The NPDES stormwater permit system regulates stormwater discharges from separate municipal storm sewer systems (which explicitly excludes combined sewers or sewage treatment plants), construction activities, and other industrial activities.

B. The Washington State Growth Management Act

Another important⁶⁹ but often overlooked part of the Washington State water quality standards and the Seattle stormwater management system is the Washington State Growth Management Act (GMA).⁷⁰ The GMA allows local control to achieve the goal of preserving and enhancing natural resource

⁶⁴ 33 U.S.C. § 1342(b) (2018); *see also National Pollution Discharge Elimination System*, U.S. ENVTL. PROT. AGENCY (Nov. 29, 2016), <https://www.epa.gov/npdes/about-npdes> [<https://Perma.Cc/LH4E-CWFW>].

⁶⁵ WASH. REV. CODE § 90.48.260(1) (2012).

⁶⁶ 40 C.F.R. § 122.4(a),(d) (2000).

⁶⁷ WASH. ADMIN. CODE § 173-220-130(1)(b)(i) (1993).

⁶⁸ WASH. ADMIN. CODE § 173-201A-501(1) (1993).

⁶⁹ Yet another important component of the Seattle stormwater management system is Seattle’s Green Factor Ordinance (SGF), which is a landscaping score-based code requirement that establishes minimum zoning requirements for qualified development and provides credits for various LID practices. The SGF sets out a “menu” of different LID features, all of which are assigned a relative score value. The code then outlines a minimum score required for qualifying projects. While the SGF codifies important LID practices for certain developments, the SGF has a limited scope of applicability and does not cover most industrial or downtown zones. The SGF is important to note in any comprehensive conversation about Seattle’s stormwater management system, but is ultimately too limited to be relevant to further discussions in this note. *See, e.g.,* Seattle Department of Planning and Development, *Seattle Green Factor*, SEATTLE.GOV, <https://www.seattle.gov/Documents/Departments/SPU/LeClergueGreenFactor.pdf> [<https://perma.cc/SSJ4-ATBU>]; SEATTLE MUN. CODE § 23.86.019 (2016).

⁷⁰ WASH. REV. CODE § 36.70A.010-904 (2019).

lands,⁷¹ including forestry, agriculture, fisheries, mining, and other critical areas,⁷² as well as other environmental protections.⁷³

Adopted in 1990, the Washington State GMA requires local governments to manage Washington's growth by identifying and protecting critical areas and natural resource lands, while also preparing and implementing comprehensive plans to accommodate growth and promulgate the Washington State water quality standards codified in WAC 173-201A-501(1). Washington State adopted the GMA because:

The legislature finds that uncoordinated and unplanned growth, together with a lack of common goals expressing the public's interest in the conservation and the wise use of our lands, pose a threat to the environment, sustainable economic development, and the health, safety, and high quality of life enjoyed by residents of this state.⁷⁴

The GMA is premised on what we have known for decades: improperly managed urban growth has disastrous environmental impacts.

The GMA outlines specific requirements for land use planning as part of a broader comprehensive plan to manage population growth. Counties subject to GMA coverage (either required by population size or by opting into coverage) must "fully plan" for population growth to ensure future county plans can accommodate projected population growth.⁷⁵

The GMA does not explicitly require LID practices be included as a means of stormwater management. However, the GMA does require counties and cities to use the best available science⁷⁶ when developing policies and growth regulations.⁷⁷ Accordingly, the GMA should be read to require the use of LID practices as part of the requisite reliance on best available science.

To determine what information constitutes the "best available science," a city should consider characteristics of a valid scientific process, including peer review, methods, logical conclusions and reasonable inferences, quantitative analysis,

⁷¹ WASH. REV. CODE § 36.70A.030(5) (2017).

⁷² *Id.*

⁷³ WASH. REV. CODE § 36.70A.020 (2002).

⁷⁴ WASH. REV. CODE § 36.70A.010 (1990).

⁷⁵ WASH. REV. CODE § 36.70A.020(1) (2002).

⁷⁶ WASH. ADMIN. CODE § 365.195 (2010).

⁷⁷ WASH. REV. CODE § 36.70A.030(5) (2017).

context, and reference, as well as common sources of scientific information.⁷⁸ LID practices should be considered a requisite part of the best available science analysis required under the GMA, because LID practices are routinely recognized as the preferred means for managing urban stormwater runoff.⁷⁹ Furthermore, the Washington State Pollution Control Board concluded that “based on the great weight of testimony, reference documents, and technical manuals, that low impact development represents AKART [all known, available and reasonable methods of prevention, control, and treatment] and is necessary to reduce pollutants in our state’s water to the maximum extent practicable, the federal standard.”⁸⁰

As a practical matter, LID practices should be incorporated more extensively into the GMA. For example, the GMA includes provisions for solar energy systems, another common practice in sustainable development.⁸¹ The GMA defines solar energy systems as “any device or combination of devices or elements which rely upon direct sunlight as an energy source.”⁸² The GMA further provides that the system may include “a solar energy element” related to the physical development within its jurisdiction.⁸³ Granted, the GMA does not extensively discuss solar energy plans, but if the GMA can include brief provisions allowing for the opportunity to use solar energy in sustainable development, it can and should do the same for LID practices. The GMA should specifically call for the inclusion of LID practices as an available means of reducing pollutants while achieving its stated purpose of accommodating Seattle’s population growth.

VII. COMBINED SEWER OVERFLOWS

Seattle, like many larger cities,⁸⁴ functions on an outdated combined sewer system that treats both traditional

⁷⁸ WASH. ADMIN. CODE § 365.195.905 (2000).

⁷⁹ CITY OF SEATTLE, ENVIRONMENTALLY CRITICAL AREAS: BEST AVAILABLE SCIENCE REVIEW, SEATTLE.GOV 11 (2015), http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/p2322335.pdf [<https://perma.cc/N5HA-B6RC>].

⁸⁰ *Id.*

⁸¹ *See, e.g., How Solar Energy Works*, UNION OF CONCERNED SCIENTISTS (Dec. 6, 2009), <https://www.ucsusa.org/resources/how-solar-energy-works> [<https://perma.cc/HB7G-SUL3>].

⁸² WASH. REV. CODE § 36.70.025 (1979).

⁸³ WASH. REV. CODE § 36.70.350(2) (1979).

⁸⁴ *Combined Sewer Overflows (CSOS)*, U.S. ENVTL. PROT. AGENCY (Aug. 30, 2018), <https://www.epa.gov/npdes/combined-sewer-overflows-csos> [<https://perma.cc/78Y5-Y8X9>] (stating CSOs are a “priority water pollution concern for nearly 860 U.S. cities”).

sewage (otherwise known as “black water”) and stormwater runoff in the same system and treatment facility.⁸⁵ The city’s entire volume of black water and stormwater (collectively referred to herein as “wastewater”) is treated in a single treatment facility and then discharged after treatment. Usually, in dry or low-rain events, a single system has the requisite capacity to contain and treat both the black water and the stormwater runoff.

In theory, a combined sewer seems like a logical system: it may be easier and more efficient to handle all of the city’s water at once, rather than in fragmented systems. However, combined sewer systems quickly break down in practice. During heavy-rain events, CSOs can occur, in which the system is overloaded and the combined stormwater and untreated black water overflows the combined sewer.⁸⁶ Rather than overflowing buildings and homes, the wastewater permeates our lakes, rivers, and other water sources.⁸⁷ These overflows of untreated sewage and stormwater can pose serious risks to human health as it floods our water sources with contaminants, including human feces, microbial pathogens, suspended solids, chemicals, trash, bacteria, and nutrients that deplete dissolved oxygen.⁸⁸

The United States Department of Health, Education, and Welfare concluded that CSOs were a significant part of the total water pollution problem.⁸⁹ For many of the cities that rely on

⁸⁵ WASH. REV. CODE § 35.67.010 (1997); WASH. REV. CODE § 35.67.331 (1969).

⁸⁶ WASH. ADMIN. CODE § 173-245-020 (2018) (defining ‘Combined sewer overflow (CSO)’ means (a) the event during which excess combined sewage flow caused by inflow is discharged from a combined sewer, rather than conveyed to the sewage treatment plant because the capacity of either the treatment plant or the combined sewer is exceeded); *see also* WASH. REV. CODE § 35.67.010 (1997) (defining, a ‘system of sewage’ means and may include any or all of the following ... (2) combined sanitary sewage disposal and storm or surface water sewers).

⁸⁷ *Wastewater Pollution*, PUGET SOUNDKEEPER ALLIANCE, <https://puget-soundkeeper.org/current-priorities/wastewater-pollution/> [<https://perma.cc/4N48-QHDN>].

⁸⁸ *NPDES Stormwater Program*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/npdes/npdes-stormwater-program> (Aug. 12, 2019) [<https://perma.cc/G6D4-LJN9>]; *see also* City of Seattle Pub. Util., *Sewer Overflow Prevention*, SEATTLE.GOV, <https://www.seattle.gov/utilities/environment-and-conservation/projects/sewage-overflow-prevention> [<https://perma.cc/S3UZ-FDXP>].

⁸⁹ National Service Centre For Environmental Publications (NSCEP), *Pollutional Effects of Stormwater and Overflows From Combined Sewer Systems*, U.S. ENVTL. PROT. AGENCY 33 (1964), <https://nepis.epa.gov/Exe/ZyPDF.cgi/9400401V.PDF?Dockey=9400401V.PDF> [<https://perma.cc/7WZT-LHUH>].

combined sewer systems, CSOs are one of the greatest challenges to meeting water quality standards.⁹⁰

The combined sewer system is based on an outdated presumption about human impact on the environment. Combined sewers were designed and implemented at the beginning of the twentieth century, at a time when lakes, rivers, and oceans were “viewed as appropriate depositories of raw waste [with] unlimited capacity to handle the waste loads without suffering any adverse effects.”⁹¹ Because CSOs are legally classified as “point sources” of pollution because of their specific, identifiable points, CSOs must adhere to the water quality standards promulgated by the CWA.

The City of Seattle has struggled with CSOs for at least the last 50 years, but has significantly reduced the chronic negative impact and frequency of CSOs. Since 1979, King County has reduced the number of CSOs in Seattle by 90%.⁹² However, there are still roughly 38 CSOs⁹³ in Seattle that continue to dump raw sewage and wastewater into our waterways during heavy-rain events.

In 2007, Seattle’s combined sewer system overflowed approximately 249 times, resulting in an estimated 1.94 billion gallons of untreated sewage and polluted runoff overflowing into the waters of the Puget Sound.⁹⁴ In 2008, in response to a litany of violations in Seattle’s wastewater discharge permit, the EPA issued a series of compliance orders that required the city to formulate a plan to address CSOs⁹⁵ by reducing the volume and frequency of overflows.⁹⁶ Historically, Seattle has always tried to remedy the CSO problem by adding storage capacity. While

⁹⁰ *Greening Cso Plans: Planning and Modeling Green Infrastructure for Combined Sewer Overflow (Cso) Control*, U.S. ENVTL. PROT. AGENCY, (March 2014), https://www.epa.gov/sites/production/files/2015-10/documents/greening_cso_plans_0.pdf [<https://perma.cc/9DMP-WDJD>].

⁹¹ Peter Crane Anderson, *The CSO Sleeping Giant: Combined Sewer Overflow or Congressional Stalling Objective*, 10 VA. ENVTL. L.J. 371, 375 (1991).

⁹² *King County is Protecting Our Waters*, KING COUNTY: WASTEWATER TREATMENT DIV. (Feb. 2, 2017), https://www.kingcounty.gov/services/environment/wastewater/~/_link.aspx?_id=6CD56060270848768F07536D751613CE&_z=z [<https://perma.cc/S2F2-PGVJ>].

⁹³ *Combined Sewer Overflows*, WASH. STATE DEP’T OF ECOLOGY, <https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Combined-Sewer-Overflows> [<https://perma.cc/8DPM-WJRX>].

⁹⁴ *Seattle and King County Agree to Step Up Efforts to Reduce Sewer Overflows to Puget Sound*, U.S. ENVTL. PROT. AGENCY (Aug. 26, 2009), https://archive.epa.gov/epapages/newsroom_archive/newsreleases/eabe4b202b37fc9b8525761e0067e36f.html [<https://perma.cc/U7TD-YDBN>].

⁹⁵ *Id.*

⁹⁶ *Id.*

Seattle has begun incorporating green infrastructure as a response to CSOs, Seattle's approach still prioritizes "optimiz[ing] existing CSO infrastructure."⁹⁷ Other remedial options may include treating the overflow directly through techniques such as microscreens, swirl concentrators, and filters. Another option is to completely separate the sewer systems, but an overhaul of the entire system would be astronomically expensive and could not effectively manage the increase of stormwater runoff and sewage caused by the ever-increasing Seattle populace.

Some may argue that CSOs should not be governed by the CWA, because CSOs do not fit the traditional standard for a "point source" in that CSO flow is not continuous and is dependent on storm events, which is more characteristic of a nonpoint source. Furthermore, critics will be quick to point out the huge financial burden that remedial measures put on municipalities.

Fortunately there are a variety of solutions and options for CSO remediation. These solutions tend to fall into one of four main categories: increasing storage capacity, improving retention, separating the sewer systems, or LID features.⁹⁸

Storage capacity solutions are just that: cities expand the size of their sewers to accommodate increased flows. Cities can also expand retention basins to capture excess overflow volume. Offline retention storage usually entails large storage tanks and pipes that contain excess CSO flows during storm events,⁹⁹ thereby increasing the system's storage capacity. Increasing storage capacity does not actually improve the outdated systems, but instead perpetuates the overflow problem. As Seattle expands to accommodate a rapidly increasing populace, the city's wastewater output will also increase. Expanding a system in roughly proportional growth to that of population increase won't resolve the CSO issue. Similar solutions aimed at improving retention also maintain the outdated system, but instead optimize how efficiently that system works.

⁹⁷ Seattle Public Utilities, *2010 Cso Reduction Plan Amendment*, SEATTLE.GOV (May 2010), <http://www.seattle.gov/Documents/Departments/SPU/EnvironmentConservation/2010CSOReductionPlanAmendment.pdf> [<https://perma.cc/2SZZ-55H4>].

⁹⁸ Martin Couture, William D. Sullivan & Daniel MacRitchie, *Solving CSO Problems*, WATER WORLD, (Sept. 1, 2003), <https://www.waterworld.com/international/wastewater/article/16200320/solving-cso-problems> [<https://perma.cc/26Y8-J3E7>].

⁹⁹ *Combined Sewer Overflow Technology Fact Sheet*, U.S. ENVTL. PROT. AGENCY: OFFICE OF WATER (Sept. 1999), <https://www3.epa.gov/npdes/pubs/csoretba.pdf> [<https://perma.cc/5T82-ALNS>].

Sewer system separation is possibly the most expensive CSO solution, as it involves building two separate sanitary systems, such that a city has one sewer system dedicated to stormwater, and another separate system dedicated to black water. The final typical solution is to implement LID practices to reduce the amount of stormwater that reaches the combined sewer system in the first place.

As an example of how a city can separate its sewer systems, the Big Pipe Project was Portland's response to its own CSO issues. The project took 20 years to complete,¹⁰⁰ and prior to completion in 2011, Portland had an average of 50 CSO events annually, which dumped billions of gallons of pollution and untreated sewage into the Willamette River and Columbia Slough.¹⁰¹ Rather than relying on green infrastructure, Portland built a separate sewer system that still allows for 25 active CSO outfalls annually,¹⁰² but has otherwise significantly reduced the occurrence and severity of CSOs. The Big Pipe Project was funded in part by taxpayers and will be paid off by approximately 2035.

Instead of increasing capacity and expanding the combined sewer system, Seattle should instead act in a more preventative manner and implement LID solutions, thereby mitigating a major strain on the city's outdated sewer system. The best solution to the CSO issue and to stormwater management in general is heavy reliance on LID practices, as showcased by Philadelphia.

VIII. PHILADELPHIA'S GREEN CITY, CLEAN WATER PROGRAM

Thriving cities accommodate mass urbanization and the immediate environmental impact by investing in robust LID and stormwater management practices. One such city is Philadelphia, which in the last decade has revolutionized its municipal environmental sustainability practices with its Green City, Clean Water program. Beginning in 2011, the 25-year project puts LID practices front and center.¹⁰³ The stated goal of

¹⁰⁰ City of Portland Environmental Services, *Combined Sewer Overflow Control (Big Pipe Project)*, PORTLANDOREGON.GOV, <https://www.portlandoregon.gov/bes/31030> [<https://perma.cc/75U5-BCV8>].

¹⁰¹ *Id.*

¹⁰² City of Portland Environmental Services, *Combined Sewer Overflow Information*, PORTLANDOREGON.GOV, <https://www.portlandoregon.gov/bes/article/565065> [<https://perma.cc/H4YC-HSA6>].

¹⁰³ Philadelphia Water Dep't, *Green City, Clean Waters*, PHILLY WATERSHEDS, <http://archive.phillywatersheds.org/>

Philadelphia's Green City, Clean Waters Program is to "reduce reliance on construction of additional underground infrastructure" by compensating with extensive LID practices.¹⁰⁴ The program is a radical departure from the typical municipal gray infrastructure approach and focuses on improving Philadelphia's economic, health, and social structures. Thus far the program has increased property values, improved aesthetics, and created viable habitats. Overall, the project is predicted to reduce overall stormwater pollution by 85%¹⁰⁵ and is expected to save the city approximately \$8 billion in lieu of the traditional grey infrastructure.¹⁰⁶

To fund the Green City, Clean Water program Philadelphia is using tax-exempt revenue bonds to finance large portions of the project. Prior to implementing the initial stages of the Green City, Clean Water Program, Philadelphia instated a policy structure to optimize funding leverage, thereby ensuring that the taxpayers are not funding the programs budget. The most significant source of leverage funding is through partnerships with local developers. Finally, Philadelphia also relies heavily on public and private contributions and partnerships in the form of grants, awards, and funding allocations.¹⁰⁷

Beginning in 2006, Philadelphia's stormwater regulations required that any development or redevelopment with any area of disturbance greater than 15,000 square feet must manage the first inch of runoff from the site, thereby accounting for approximately \$1 billion over the 25-year project span.¹⁰⁸ Philadelphia recognized that working with private interests is a far more cost-effective model than building

what_were_doing/documents_and_data/cso_long_term_control_plan
[<https://perma.cc/6PG5-76FM>].

¹⁰⁴ Anne Jefferson, *Combined Sewer Overflows: Solving a 19th Century Problem in the 21st Century*, HIGHLY ALLOCHTHONOUS (Mar. 12, 2013), <https://all-geo.org/highlyallochthonous/2013/03/combined-sewer-overflows-solving-a-19th-century-problem-in-the-21st-century/> [<https://perma.cc/695M-UEJJ>].

¹⁰⁵ Philadelphia Water Dep't, *supra* note 103.

¹⁰⁶ See Robert B. McKinstry Jr., David Prior, Jennifer E. Drust, Ana C. Montalban & Kimberly D. Magrini, *Unpave a Parking lot and put up a Paradise: Using Green Infrastructure and Ecosystem Services to Achieve Cost-Effective Compliance*, 42 ENVTL. L. REP. NEWS & ANALYSIS 10824 (2012).

¹⁰⁷ PHILADELPHIA WATER DEP'T, GREEN CITY CLEAN WATERS: THE CITY OF PHILADELPHIA'S PROGRAM FOR COMBINED SEWER OVERFLOW CONTROL, PHILLY WATERSHEDS 39 (June 1, 2011), http://archive.phillywatersheds.org/doc/GCCW_AmendedJune2011_LOWRES-web.pdf [<https://perma.cc/QZ2S-NEFS>].

¹⁰⁸ *Id.*

infrastructure on public property.¹⁰⁹ Philadelphia also imposes a surcharge for stormwater that is related to the amount of impervious surface on a property¹¹⁰ and a Parcel Based Billing program of stormwater credits,¹¹¹ which in turn funds public green infrastructure projects that further minimize stormwater runoff.

IX. WASHINGTON D.C.'S STORMWATER RETENTION CREDIT TRADING PROGRAM

Washington D.C.'s CSO response makes a slight nod to LID practices, but LID practices are not a central component of the city's Clean Rivers Project: a 20-year long, \$2.6 billion¹¹² project to fix their plagued combined sewer system. However, D.C. is an excellent example of an effective stormwater management, and has a remarkable mitigation program for new construction that is based on the simple yet practical idea of credit trading. Beginning in 2012, D.C.'s Stormwater Credit System,¹¹³ requires new development projects to retain higher levels of the stormwater runoff generated from the impervious surfaces used in their projects. Owners have the option of installing stormwater retention onsite or purchasing up to 50% of their stormwater management requirements offsite. By upgrading properties to include LID features, homeowners and developers can generate and then sell Stormwater Retention Credits to earn revenue for those development upgrades.¹¹⁴ Credits may then be sold to developers who cannot otherwise meet new development retention requirements. If a site or development cannot satisfy the water quality standards required by the system, there is built in flexibility within the D.C. stormwater credit system.

Private actors are incentivized to incorporate LID features and participate in the program, and the program relies

¹⁰⁹ *Id.*

¹¹⁰ *Id.*

¹¹¹ *Id.*

¹¹² Matthew T. Brown, George S. Hawkins & Mark T. Kim, *Approved FY 2018 Budgets*, DC WATER IS LIFE VII-52 (Dec. 1, 2016), https://www.dewater.com/sites/default/files/documents/approved_fy_2018_operating_and_capital_budgets_final.pdf [<https://perma.cc/354P-CUXU>].

¹¹³ Seattle has a similar, albeit less expansive, program called the Stormwater Facility Credit Program, which is the functional equivalent of the RainWise program for larger parcels of land. *See, e.g.*, Seattle Public Utilities, *Stormwater Facility Credit Program*, SEATTLE.GOV, <https://www.seattle.gov/Documents/Departments/SPU//SFCPFlyer.pdf> [<https://perma.cc/K3MX-UGLQ>].

¹¹⁴ *Stormwater Retention Credit Trading Program*, D.C.: DEP'T OF ENERGY & ENV'T, [doe.dc.gov/src](https://perma.cc/R6V5-DX7A) [<https://perma.cc/R6V5-DX7A>].

heavily on private partnerships. Like Philadelphia, D.C. has managed to foster private financial interest in stormwater management and LID practices. Private actors Prudential Financial and Encourage Capital provided the program with an initial \$1.7-million loan.¹¹⁵ The D.C. system is an excellent example of a market mechanism paired with a nature-based practicalities and solutions. Seattle could readily employ a similar market based program to incentivize LID practices and foster private equity investment. There are numerous practical, incentive-based initiatives that Seattle should encourage developers and homeowners to implement.¹¹⁶

X. CONCLUSION

In the Pacific Northwest, water is “the lifeblood for both native habitat and human settlement.”¹¹⁷ Seattle’s economy, history, and cultural identity are indistinguishably intertwined with water. Seattle’s population is projected to grow by 1.8 million people by 2050.¹¹⁸ As an unfortunate result this urbanization, the water quality in the Pacific Northwest has undergone drastic change and pollution, and will continue to worsen. Seattle may have one of the most proactive stormwater management programs in the United States, but Seattle cannot adequately protect its surrounding waters unless Seattle actively encourages, rather than just provide funding and direction for the use of LID practices. The ongoing threat to our waters is serious. Fortunately, we already know the best solution. Low impact development is the best means by which Seattle can manage its stormwater and mitigate any detrimental effect a growing population will have on the surrounding environment.

Incorporating low impact development is also the best way that Seattle can effectively resolve the problem with combined sewer overflows. Combined sewer overflows are perhaps the most poignant and direct examples of the failure of municipal environmental regulations. While effective CSO

¹¹⁵ Kat Friedrich, *D.C. Stormwater Credit Could Be a Role Model For Other Cities*, GREEN BIZ (Aug. 31, 2016), <https://www.greenbiz.com/article/dc-stormwater-credit-could-be-role-model-other-cities> [https://perma.cc/45GR-SAZ2].

¹¹⁶ See, e.g., *Encouraging Low Impact Development*, U.S. ENVTL. PROT. AGENCY (Dec. 2012), <https://www.epa.gov/sites/production/files/2015-09/documents/bbfs7encouraging.pdf> [https://perma.cc/UT5V-BTEH].

¹¹⁷ *Vision 2040: Regional Growth Strategy*, PUGET SOUND REGIONAL COUNCIL 15 (2017), https://www.psrc.org/sites/default/files/part_i_toward_a_sustainable_environment.pdf [https://perma.cc/3U4P-F4J6].

¹¹⁸ Carolyn Adolph, *Seattle Region will grow by 1.8 Million People by 2050*, KUOW (Jan. 26, 2018), <https://www.kuow.org/stories/seattle-region-will-grow-18-million-people-2050/> [https://perma.cc/P5FT-EPH5].

remedies are often multifaceted and uniquely tailored, the most efficient CSO remedies rely on LID practices to manage stormwater before it even gets into the combined sewer system. By viewing the Seattle stormwater management system through the paradigm of combined sewer overflows, we can see how even a shining example of sustainable development has serious shortcomings. Seattle will likely continue to lead the United States in stormwater management, but Seattle should also look to examples of other cities and their effective stormwater management practices. Seattle should extensively incorporate low impact development into its stormwater management system in order to effectively mitigate the negative environmental impacts of rapid urbanization.