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# Rained Out: Problems and Solutions for Managing Urban Stormwater Runoff

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# Rained Out: Problems and Solutions for Managing Urban Stormwater Runoff

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*The Clean Water Rule was the latest attempt by the Environmental Protection Agency and the Army Corps of Engineers to define "waters of the United States" under the Clean Water Act. While both politics and scholarship around this issue have typically centered on the jurisdictional status of rural waters, like ephemeral streams and vernal pools, the final Rule raised a less discussed issue of the jurisdictional status of urban waters. What was striking about the Rule's exemption of "stormwater control features" was not that it introduced this urban issue, but that it highlighted the more general challenges of regulating stormwater runoff under the Clean Water Act, particularly the difficulty of incentivizing multibenefit land use management given the Act's focus on pollution control. In this Note, I argue that urban stormwater runoff is more than a pollution-control problem. Its management also dramatically affects the intensity of urban water flow and floods, local groundwater recharge, and ecosystem health. In light of these impacts on communities and watersheds, I argue that the Clean Water Act, with its present limited pollution-control goal, is an inadequate regulatory driver to address multiple stormwater-management goals. I recommend advancing green infrastructure as a multibenefit solution and suggest that the best approach to accelerate its adoption is to develop decision-support tools for local government agencies to collaborate on green infrastructure projects.*

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## INTRODUCTION

On May 15, 2015, the Environmental Protection Agency (EPA) and the Army Corps of Engineers (the Corps) released the Clean Water Rule (the Rule) as an attempt to clarify the definition of "waters of the United States" under the Clean Water Act.[1] The Rule controversially addresses whether features like isolated wetlands and ephemeral streams fit into the new definition and thus trigger Clean Water Act requirements.[2] A less discussed aspect of the Rule, though, is the urban analogue, such as whether vegetated filter strips that occasionally fill with water from the street fall under the definition. Under closer inspection, the Rule introduces a general exemption of "stormwater control features," such as stormwater filter strips, from the definition.[3] Though



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1. The Clean Water Act defines "navigable waters" as "the waters of the United States, including the territorial seas." 33 U.S.C. § 1362(7) (2012). EPA and the Corps define "waters of the United States" in 33 C.F.R. § 328.3(a), *stayed*, *In re* EPA, 803 F.3d 804, 805 (6th Cir. 2015); *see infra* Part II.E; *see also* United States v. Riverside Bayview Homes, 474 U.S. 121, 130–131 (1985) (holding adjacent wetlands fall under the definition of "waters of the United States"); Solid Waste Agency of N. Cook Cty. v. U.S. Army Corps of Eng'rs, 531 U.S. 159, 171–172 (2001) (holding that the Corps could not use the presence of migratory birds to assert jurisdiction over "isolated" wetlands with no surface or hydrological connection to "navigable" waters); Rapanos v. United States, 547 U.S. 715, 767 (2006) (Kennedy, J., concurring) (limiting jurisdiction to those waters that have a "significant nexus" to a navigable waterway).

2. Coral Davenport, *Obama Plans New Rule to Limit Water Pollution*, N.Y. Times (May 22, 2015), http://www.nytimes.com/2015/05/23/us/politics/obama-set-to-strengthen-federal-role-in-clean-water-regulation.html.

3. Definition of Waters of the United States, 33 C.F.R. § 328.3(b)(6) (2015).

this urban exemption is somewhat secondary to the key rural controversies of the definition, the Rule's urban dimensions served as a starting point for researching and examining a broader urban environmental problem in this Note—urban stormwater runoff.

Urban development has significantly altered urban hydrology.[4] Cities have paved over natural green spaces to make way for streets, homes, and commercial developments. And when it rains, urban stormwater no longer has an opportunity to sink into the land and recharge groundwater basins.[5] Rather, it rushes and gushes over asphalt and concrete into complex conveyance and collection systems, eventually dumping into rivers and streams all at once and altering the flow regimes of the waterways.[6]

Because stormwater carries trash and other pollutants into these waterways,[7] the Clean Water Act regulates discharges from storm sewers that "contribute[] to a violation of a water quality standard or [are] a significant contributor of pollutants to waters of the United States."[8] More specifically, the National Pollutant Discharge Elimination System (NPDES) program regulates discharges of urban stormwater, along with discharges from industrial and wastewater treatment facilities.[9] But unlike water from an industrial factory—pollution that can be mitigated and regulated at the source—urban stormwater runoff begins as rain, picking up pollutants from many sources as it travels miles through the urban landscape before emptying into rivers and streams.[10] While it needs to be managed for pollution control from the moment the rain touches the ground, it also needs to be managed for many other purposes along its journey, including flood control, water supply, and habitat protection.

Limiting stormwater management to a single-purpose approach, such as pollution control, undermines these broader watershed needs. Especially given that communities experience many problems from urban stormwater runoff, including flooding, reduced groundwater levels, and flow regimes detrimental to ecosystem health, stormwater-management solutions must address a variety of management objectives.[11]

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4. *See* Nat'l Research Council, Urban Stormwater Management in the United States 5 (2009), http://www.nap.edu/catalog/12465/urban-stormwater-management-in-the-united-states.

5. U.S. Geological Survey, Evaluating the Effects of Urbanization and Land-Use Planning Using Ground-Water and Surface-Water Models (2001), https://pubs.usgs.gov/fs/2001/0102/report.pdf.

6. Nat'l Research Council, *supra* note 4, at 5.

7. *Id*. at 1, 5.

8. 33 U.S.C. § 1342(p)(2)(E) (2012).

9. § 1342(p) (stormwater permits required for the exceptions in § 1342(p)(2); wastewater treatment permits required in § 1311(b)(1)(B) (application of effluent limitations to "publicly owned treatment works")).

10. Cal. Reg'l Water Quality Control Bd., L.A. Region, Fact Sheet for Order No. R4-2012-0175 at 7 (2015), http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/la_ms4/2015/OrderR4-2012-0175-AttachmentFasamendedwithconformingchanges.pdf.

11. Christopher J. Walsh et al., *The Urban Stream Syndrome: Current Knowledge and the Search for a Cure*, 24 J. N. Am. Benthological Soc'y 706, 716 (2005).

Remarkably, solutions like green infrastructure or land use changes that mimic natural hydrology provide multiple benefits for a variety of management objectives. If implemented properly, they can reduce pollution, recharge groundwater, and control flow into rivers and streams.[12] The problem is that although the Clean Water Act can promote green infrastructure to an extent, it can only play a limited role in incentivizing it. The Clean Water Act's objective in this realm is to reduce pollution discharges from stormwater, so it is structured to incentivize source control or end-of-pipe treatment through technology requirements rather than multibenefit land use changes.[13] Although cities can innovate with local permits under the Clean Water Act to encourage green infrastructure, this mechanism will not likely have a meaningful impact in this area on its own.[14] As a complement to the local permitting power, I recommend that federal and state governments focus on arming local governments with the tools and data to build their capacity for collaboration, so they can implement green infrastructure more widely.[15]

In this Note, I first discuss the problems and challenges in managing urban stormwater and then argue that the Clean Water Act is limited in its ability to address those challenges. Lastly, I recommend building local capacity to collaborate on green infrastructure as a way to accelerate its adoption.

## I. URBAN STORMWATER RUNOFF

When it rains, it pours. But when it pours, rainwater hits the pavement and overwhelms the urban landscape. With few opportunities to sink into the ground, the water flows over concrete and asphalt, carrying oil, toxic chemicals, and garbage from the streets into a vast network of storm drains, pipes, and channels, eventually discharging into rivers, streams, and the ocean.

Managing stormwater runoff is a particular challenge in urban areas. Generally, cities quickly drain stormwater to keep it off roads and away from property.[16] Although this management approach mitigates flood risks, it generates problems for watershed health. For example, high-velocity stormwater discharges into rivers and streams over short periods significantly affect ecosystem processes.[17] The pollutants discharged into water bodies via stormwater also create health hazards for water recreationalists, fish, and

12. *Benefits of Green Infrastructure*, EPA, http://www.epa.gov/green-infrastructure/benefits-green-infrastructure (last updated Apr. 19, 2016).

13. *See generally infra* Part II.A.

14. *See generally infra* Part II.D.

15. This research is also focused on separate storm sewer systems rather than combined sewer system, and geographically focused on the western United States, specifically Los Angeles.

16. Juan B. Marco & Angel Cayuela, *Urban Flooding: The Flood-Planned City Concept*, *in* Coping with Floods 705, 706–07 (Giuseppe Rossi et al. ed., 1994).

17. Walsh et al., *supra* note 11, at 710.

wildlife.[18] Additionally, the lack of opportunities for stormwater to infiltrate the earth significantly reduces groundwater recharge.[19] Since climate change may cause more frequent and intense storms, these problems may worsen in the near future.[20]

Given stormwater's many impacts, it is a particularly challenging problem for cities to address. And because there are significant barriers to achieving multiple water-management goals,[21] local governments have generally managed urban stormwater for one purpose at a time. In this Part, I outline the historical development of stormwater management and how it led to the single-purpose management practices seen in many cities today. I then argue that urban stormwater runoff should be managed for multiple purposes in light of its numerous impacts on urban watersheds.

### *A. Urban Stormwater Runoff: Multiple Challenges*

Urban stormwater is generally out of sight and out of mind. It quickly drains from the streets and into underground storm sewers (urban drainage infrastructure), so the downstream impacts are not obvious to the casual observer. However, the way we manage stormwater significantly affects urban watersheds, fish and wildlife, human recreation, and local economies. EPA and environmental advocates often point to urban stormwater as a leading source of water pollution in the United States,[22] and rightfully so. However, urban stormwater runoff is more than a water pollution problem. The development of impervious surfaces in urban areas, coupled with the creation of storm sewers, has dramatically altered natural hydrology.[23] In addition, these changes have impaired chemical integrity and degraded urban watershed health, limiting the ability of people and wildlife to depend on rivers and streams.[24]

Unlike natural forests and open green spaces, which serve as sponges to absorb and filter stormwater, impervious urban surfaces prevent stormwater from absorbing.[25] To keep large volumes of urban stormwater runoff off the streets, cities have dense storm drains and sewer systems to quickly transport

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18. G. Allen Burton, Jr. & Robert E. Pitt, Stormwater Effects Handbook: A Toolbox for Watershed Managers, Scientists, and Engineers 17 (2001).

19. U.S. GEOLOGICAL SURVEY, *supra* note 5.

20. Alexandros A. Ntelekos et al., *Urbanization, Climate Change and Flood Policy in the United States*, 103 Climatic Change 597, 597–98 (2010).

21. Konstantinos Tzoulas et al., *Promoting Ecosystem and Human Health in Urban Areas Using Green Infrastructure: A Literature Review*, 81 Landscape & Urban Planning 167, 168 (2007).

22. The 2004 National Water Quality Inventory showed that urban runoff discharges contribute to the impairment of 22,559 miles of streams, 701,024 acres of lakes, and 867 square miles of estuaries in the U.S. EPA, National Water Quality Inventory: Report to Congress, 2004 Reporting Cycle 16, 19, 23 (2009), https://www.epa.gov/sites/production/files/2015-09/documents/2009_01_22_305b_2004report_2004_305breport.pdf.

23. *See infra* Part I.A.

24. *See id.*

25. Michael J. Paul & Judy L. Meyer, *Streams in the Urban Landscape*, 32 Ann. Rev. Ecology, Evolution & Systematics 333, 335 (2001).

stormwater from storm drains into water bodies.[26] This urban drainage infrastructure is efficient, so the travel time is short.[27] The problem is that the runoff flushes into water bodies at high speed, over a short time period, creating "a wholesale reorganization of the processes of runoff generation," and placing stressors on those ecosystems.[28] More specifically, impervious surfaces and efficient urban drainage systems cause stormwater to flow over a shorter period of time and at a higher magnitude during storms, thus reducing the base flow of water.[29] These create "radically different flow regimes" and higher peak flow rates for receiving waters, which contribute to stream bank erosion and channel incisions.[30] Further, these disturbances in aquatic ecosystems are episodic and chaotic.[31] Although the interactions between these multiple stressors depend on a number of organism-specific factors, conventional urban stormwater infrastructure causes changes in flow[32] that are closely linked to impacts on a variety of ecosystem processes, including water chemistry, habitat diversity, and nutrient cycling.[33] This process reflects a dramatically different urban hydrology than the natural state and operates to the detriment of watershed ecosystems and human health.

In addition to these changes in flow frequency and quantity, urban ecosystems experience stress from the pollution in urban stormwater. Chemicals from fertilization, leaks and wear from vehicles, litter, heavy metals, bacteria, and other waste discharges left on lawns, streets, and sidewalks flow with stormwater into drains and, eventually, into local waters. Unlike natural watersheds, which filter pollutants through soil and vegetation,[34] urban drainage infrastructure carries pollutants like sediment, excess nutrients, chlorides, trace metals, hydrocarbons, microbial pollution, and organic chemicals straight into urban waters.[35] These pollutants affect ecosystems in a

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26. *Id*.

27. *See* Nat'l Research Council, *supra* note 4, at 6.

28. *Polluted Runoff: Nonpoint Source Pollution*, EPA**,** http://water.epa.gov/polwaste/nps/urban_facts.cfm (last updated Feb. 22, 2016); A.E. Barbosa et al., *Key Issues for Sustainable Urban Stormwater Management*, 46 Water Res. 6787, 6789 (2012); *see* Nat'l Research Council, *supra* note 4, at 5 ("stormwater flows rapidly across the land surface and arrives at the stream channel in short, concentrated bursts of high discharge"); *see* Walsh et al., *supra* note 11, at 713.

29. Luna B. Leopold, Hydrology for Urban Land Planning: A Guidebook on the Hydrologic Effects of Urban land use, U.S. Geological Survey Circular 554, at 2 (1975); Walsh et al., *supra* note 11, at 707–08; Paul & Meyer, *supra* note 25, at 335.

30. Nat'l Research Council, *supra* note 4, at 129; Jason P. Julian & Raymond Torres, *Hydraulic Erosion of Cohesive Riverbanks*, 76 Geomorphology 193, 193 (2006).

31. G. Wayne Minshall, *Stream Ecosystem Theory: A Global Perspective*, 7 J. N. Am. Benthological Soc'y 263, 278 (1988).

32. Burton & Pitt, *supra* note 18, at 20–22.

33. Allison H. Roy et al., *Impediments and Solutions to Sustainable Watershed-Scale Urban Stormwater Management: Lessons from Australia and the United States*, 42 Envtl. Mgmt. 344, 345 (2008).

34. Chelsea J. Martin-Mikle et al., *Identifying Priority Sites for Low Impact Development (LID) in a Mixed-Use Watershed*, 140 Landscape & Urban Planning 29, 29 (2015).

35. Burton & Pitt, *supra* note 18, at 22.

variety of ways, depending on the watershed. For example, studies have linked the metals and toxic hydrocarbons in urban stormwater runoff to fish kills.[36] However, it is the cumulative impact of these pollutants—the sum total of thermal pollution, eutrophication (due to excess nutrients from fertilizers), and frequent, high volume flows—that alter ecosystem processes and health.[37]

Apart from impacting ecosystems, urban stormwater runoff can have disastrous effects on the built environment and the people who live there. Impervious surfaces create greater volumes of stormwater runoff, increasing flood risks and potential harm to people and property.[38] Although urban drainage infrastructure moves stormwater away from property quickly, it then deposits high volumes of fast-moving stormwater into local streams and rivers, which can then cause channel erosion and urban flooding downstream.[39] Further, scientists expect climate change to exacerbate these flood events in many cities, compromising the functional effectiveness of urban drainage.[40]

In addition to flooding, impervious surfaces reduce natural infiltration into groundwater aquifers.[41] Since many areas of California are going through or are just recovering from drought,[42] it is vitally important that rates of recharge for groundwater aquifers do not dip. In fact, Los Angeles and other cities that depend on imported water are now identifying stormwater as a wasted, critical water supply resource.[43]

From a public health perspective, pollution from urban stormwater runoff also affects the water that people drink and recreate in, and can also cause water-related illnesses.[44] Bacteria, *Giardia, Cryptosporidium,* and other microorganisms from urban stormwater enter water bodies and come into contact with people through drinking water, recreation, and seafood consumption, causing gastrointestinal and other problems.[45]

In sum, stormwater runoff impacts urban communities and watersheds in a variety of ways. Urbanization and conventional stormwater infrastructure not

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36. *See* Nat'l Research Council, *supra* note 4, at 162; Earl Shaver et al., Fundamentals of Urban Runoff Management: Technical and Institutional Issues 52–53 (2007), http://www.deq.state.ms.us/mdeq.nsf/pdf/NPS_FundamentalsofUrbanRunoffManagement/$File/Fundamentals_full_manual_lowres.pdf.

37. *See* Shaver et al., *supra* note 36, at 52–53, 106; S.T.A. Picket et al., *Urban Ecological Systems: Linking Terrestrial Ecological, Physical, and Socioeconomic Components of Metropolitan Areas*, 32 Ann. Rev. Ecology, Evolution & Systemics 127, 131 (2001).

38. *See infra* Part I.B.

39. *See* Paul & Meyer, *supra* note 25, at 335.

40. *See* Tony Matthews et al., *Reconceptualizing Green Infrastructure for Climate Change Adaptation: Barriers to Adoption and Drivers for Uptake by Spatial Planners*, 138 Landscape & Urban Planning 155, 155–56 (2015).

41. U.S. GEOLOGICAL SURVEY, *supra* note 5.

42. Office of the Gov. of Cal., Exec. Order No. B-29-15, https://www.gov.ca.gov/docs/4.1.15_Executive_Order.pdf.

43. L.A. Dep't of Water & Power, Stormwater Capture Master Plan, at ES-3 (2015).

44. *See* Stephen J. Gaffield et al., *Public Health Effects of Inadequately Managed Stormwater Runoff*, 93 Am. J. Pub. Health 1527, 1527 (2003).

45. *Id.*

only cause stormwater runoff to carry more pollutants, but they also facilitate higher volume and faster flow, amplify flood risks, and reduce groundwater reservoirs for local water supply, impacting human welfare and ecosystem health in the process. The following subpart describes how municipalities have historically managed stormwater for one purpose at a time. Cities have attempted to mitigate flood risks by building complex storm-sewer systems, but this urban-drainage infrastructure has exacerbated other urban stormwater runoff problems, such as those described above. This history sheds light on the problem of single-purpose management and suggests that a more integrated approach is needed.

### *B. Urban Stormwater Infrastructure Built to Drain: Local Responses to Urban Flooding*

The United States has a long history of catastrophic flooding—"[t]he average annual cost of floods in the United States has been estimated at about $2 billion."[46] As described above, when large storms bring heavy rainfall to natural landscapes, grasslands and forests naturally drain most of the water through their vegetation and soils. But in urbanized areas, rain falls on impervious streets, roofs, and sidewalks, blocking natural drainage systems and producing large amounts of fast-moving runoff.[47] In order to address this problem, cities have typically developed storm sewers.[48]

The first comprehensive management system for stormwater was built in Chicago in 1858, but extensive construction of municipal sewers did not begin until the 1880s, when the United States was rapidly urbanizing.[49] Cities that constructed these systems before the 1930s typically used single-piping systems for both urban stormwater runoff and sewage, called a combined sewer system (CSS).[50] Although it is initially cheaper to build a single combined system than to separate stormwater and sewage, CSSs often overflow during large rain events because they cannot handle the volume of both.[51] As more extensive wastewater treatment became necessary to protect public health, city officials realized that the volume of stormwater would overwhelm the proposed treatment systems for sewage, and newer cities began to build separate sewers for stormwater and sewage.[52] And as cities urbanized and began to experience catastrophic floods, federal, state, and local governments typically stepped in to

46. Ntelekoset al., *supra* note 20, at 597.
47. Leopold, *supra* note 29, at 2.
48. Marco & Cayuela, *supra* note 16, at 706, 708.
49. Steven J. Burian et al., The Historical Development of Wet-Weather Flow Management 7–8 (1999).
50. *Id*. at 8–9.
51. William L. Andreen, *The Evolution of Water Pollution Control in the United States-State, Local, and Federal Efforts, 1789–1972: Part I*, 22 Stan. Envtl. L.J. 145, 167, 200 n.8 (2003).
52. *Id.* at 166; Burian et al., *supra* note 49, at 9.

develop the infrastructure to handle those storms.[53] For example, Los Angeles experienced extensive property damage in 1914 from a devastating flood, so the state of California formed the Los Angeles County Flood Control District.[54] Under authority from the Federal Flood Control Act of 1936, the Corps lined the Los Angeles River with concrete and began to develop an underground drainage system.[55] Today, Los Angeles has a complex drainage system comprising "approximately 500 miles of open channel, 3500 miles of underground drains, and an estimated 88,000 catch basins."[56]

Current urban drainage systems were built to manage stormwater for this sole purpose: flood control. The networks, called municipal separate storm sewer systems (MS4), generally contain numerous systems, including open channels, catch basins, road-drainage systems, curbs, gutters, ditches, and underground storm drains.[57] Municipalities typically operate these systems to divert stormwater off of property and roads, collect and convey through a centralized system, and discharge into water bodies from dispersed outlets.[58]

Although MS4s have succeeded in reducing urban flood risks and protecting people and property, they have created a host of other problems. Rather than allowing rainwater to recharge groundwater aquifers, cities have engineered urban landscapes to send water straight into water bodies unused and all at once, dramatically and detrimentally altering flows for fish and wildlife habitat.[59] On a larger scale, by treating stormwater as a nuisance to move off the streets, MS4s funnel such a great volume of stormwater through centralized systems that it is too costly to treat, especially to accommodate only occasional large storm events.[60] Therefore, the water simply flows into rivers and streams untreated.[61]

53. *See, e.g.*, Edgar C. Kenyon, History of Ocean Outlets, Los Angeles Country Flood Control District 277 (1950), http://journals.tdl.org/icce/index.php/icce/article/viewFile/934/031_Kenyon.

54. *Id.*

55. Hillary Rosner, *Los Angeles River: From Concrete Ditch to Urban Oasis*, Nat'l Geographic (July 18, 2014), http://news.nationalgeographic.com/news/2014/07/140719-los-angeles-river-restoration-kayaking-greenway/; John Hogan, 100 Years of Runoff Management in Southern California 2–3 (2013), http://www.ascelasection.org/media/centennial/100_Years_of_Runoff_Management_v2.pdf.

56. CAL. REG'L WATER QUALITY CONTROL BD., L.A. REGION, ORDER NO. R4-2012-0175, NPDES PERMIT NO. CAS004001 AT 17 (2015).

57. EPA, Clean Water Rule Response to Comments—Topic 7: Features and Waters Not Jurisdictional 372 (2015) (noting catch basins are reservoirs or receptacles for collecting surface drainage or runoff).

58. *Id.* at 322–23.

59. *See* Nat'l Research Council, *supra* note 4, at 5–6.

60. *See, e.g.*, James E. Moore II et al., *Cost Analysis Methodology for Advanced Treatment of Stormwater: The Los Angeles Case*, 5 J. Construction Res. 149, 168 (2004) (finding that the costs of constructing a large network of collection and treatment plants "are almost certainly too high to justify remedying such infrequent [storm] events").

61. *NPDES Permits and Stormwater*, EPA, https://www3.epa.gov/region9/water/npdes/stormwater-feature.html (last updated Apr. 28, 2016) ("This type of pollution is significant because, unlike the water that goes down a sink or toilet in your home, stormwater is untreated and flows directly to a lake, river, or the ocean.").

Managing for a single flood-mitigation purpose has not only neglected, but exacerbated the other negative impacts of stormwater. In 1987 Congress finally addressed the water quality impacts of stormwater through the Clean Water Act, though not without a long and drawn-out debate.[62] In the next Part, I summarize the challenges Congress and EPA faced in establishing a regulatory framework for stormwater runoff. This history also sheds light on how MS4 managers, who originally operated the systems for urban drainage, have now also become responsible for stormwater pollution.

### *C. The Runoff Pollution Problem: Regulatory Mandates Under the Clean Water Act*

Congress passed the Clean Water Act in 1972 in order to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[63] But it was not until 1987 that the Act made urban stormwater runoff federally regulated under NPDES.[64] The NPDES program prohibits the addition of pollutants into "waters of the United States" from any "point source" unless authorized by a NPDES permit.[65] The Act also gives EPA the authority to issue those permits to dischargers so that they can comply with the Clean Water Act's effluent limitations.[66] The discharges from MS4s technically meet the definition of "point source" under the Act, since storm sewers discharge stormwater pollution into "waters of the United States" at discrete points.[67] However, EPA specifically exempted stormwater from NPDES requirements in its 1973 regulations.[68] EPA rationalized that runoff pollution was difficult to control and that it would be administratively infeasible to regulate thousands, or millions, of small stormwater ditches and outfalls.[69] From a policy standpoint, EPA contended that it would also be challenging to establish a precise effluent limitation for stormwater runoff or create an effective regulatory tool under the NPDES program.[70]

These justifications were challenged in 1977 when the D.C. Circuit held that EPA did not have the authority to exclude stormwater runoff, adding that "[w]ith time, experience, and technological development, more point sources in the categories that EPA has now classified as exempt may be amenable to national effluent limitations achieved through end-of-pipe technology or other

62. *See* Nat'l Research Council, *supra* note 4, at 47.

63. 33 U.S.C. § 1251(a) (2012).

64. Nat'l Research Council, *supra* note 4, at 1; *see* 33 U.S.C. § 1342(p) (2012).

65. §§ 1251(b), 1311(a), 1342(a).

66. § 1342(a).

67. 33 U.S.C. § 1362(14).

68. §1362(12) (defining point source as "discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged."); 40 C.F.R. § 125.4 (1975) (now repealed).

69. *See* Nat. Res. Def. Council v. Costle, 568 F.2d 1369, 1377 (D.C. Cir. 1977).

70. *See id.* at 1378.

means of pollution control."[71] After years of revisions and court battles between environmental, municipal, and industry groups, Congress passed amendments to the Clean Water Act in 1987, which established the current regulatory framework to reduce pollution in urban stormwater from the point-source discharges of MS4s.[72]

This history demonstrates the challenges of regulating stormwater under the NPDES program. Importantly, the existence of MS4 infrastructure was central to Congress's ability to regulate stormwater as a "point source." Now, municipal agencies—like flood control districts and transportation agencies—which were created to solve urban flooding through MS4s, are responsible for reducing water pollution. But unlike the D.C. Circuit's suggestion that end-of-pipe technology for stormwater pollution would become feasible, stormwater still remains untreated. More generally, the history of stormwater infrastructure and Clean Water Act regulation illustrates the development of the single-purpose approach to urban stormwater. It highlights an approach that has involved single-purpose regulation layered on top of single-purpose infrastructure. The result is that these municipalities have been relatively successful in controlling urban flooding, but that success has come at the expense of water quality, ecosystem health, human health, and groundwater supply.

### *D. A New Paradigm: Green Infrastructure and Managing Stormwater for Multiple Purposes*

Urban stormwater is both a challenge and a resource. The federal government regulates pollution from stormwater, and local governments manage stormwater to prevent flooding, but, conversely, nongovernmental organizations and some local governments see stormwater as a possible benefit—if managed properly—for ecosystem protection, potable water availability, and other reasons.[73] Climate change may amplify some of these needs.[74] Although past management has focused on one problem followed by another, the current stormwater paradigm must be driven by multiple objectives in order to minimize the negatives and maximize the positives of this valuable resource.

The reality is that urbanization has radically altered watersheds, and stormwater is one unifying resource that can restore watershed health, if properly managed. That said, the Clean Water Act's pollutant-focused approach will not, alone, result in rivers and streams that are habitable for fish and wildlife. Water quality is not just affected by pollution, but also by the

71. *See id.* at 1377 ("[T]he EPA Administrator does not have authority to exempt categories of point sources from the permit requirements of [33 U.S.C. § 1342].").
72. *See* Nat'l Research Council, *supra* note 4, at 1, 47.
73. *See* L.A. Dep't of Water & Power, *supra* note 43.
74. Matthews et al., *supra* note 40, at 155–56.

quantity, velocity, and timing of surface flow.[75] Slowing down and reducing flow, rather than focusing solely on pollution reduction, will ultimately allow municipalities to achieve a myriad of goals, thereby treating stormwater more as a resource than a liability. Specifically, a management tactic that mimics and restores natural hydrology is a promising method to slow down and reduce flow, as well as improve the condition of the entire watershed, including water quality, ecosystem health, and climate resiliency.[76]

Green infrastructure mimics and restores natural hydrology in just this way. It is referred to by a variety of names, including water-sensitive urban design and low-impact development.[77] Essentially, it is a water management approach that uses natural retention and treatment processes to both improve water quality and slow down or reduce the amount of water flowing into receiving waters.[78] Examples of green-infrastructure projects include rain gardens, permeable pavement, green roofs, floodplains, wetlands, and bioswales.[79] Green infrastructure benefits communities not only by improving water quality through its filtering of pollutants, but also by reducing the volume of stormwater being discharged, and therefore, minimizing damage to the biological, physical, and chemical integrity of receiving waters.[80]

Some of the central problems related to urban stormwater runoff, such as flooding, increased flow, and velocity of flow, are a direct result of the imperviousness of urban pavements.[81] Incorporating more green infrastructure into the urban landscape essentially reverses these trends and allows water to infiltrate the ground rather than flow quickly into receiving waters.[82] Green infrastructure also has benefits apart from stormwater management. For example, it helps prepare for drought, lowers building energy demands, reduces urban heat islands, manages floods, and even contributes to greater property values.[83]

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75. *See supra* Part I.A.

76. *Benefits of Green Infrastructure*, EPA, http://www.epa.gov/green-infrastructure/benefits-green-infrastructure (last updated Apr. 19, 2016).

77. A.H. Elliott et al., *A Review of Models for Low Impact Urban Stormwater Drainage*, 22 Envtl. Modelling & Software 394, 394 (2007).

78. Nell Green Nylen & Michael Kiparsky, Wheeler Inst. for Water Law & Pol'y, Accelerating Cost-Effective Green Stormwater Infrastructure: Learning from Local Implementation 1 (2015), https://www.law.berkeley.edu/files/CLEE/GSI_Report_Full_2015-02-25.pdf.

79. Robb Lukes & Christopher Kloss, Low Impact Development Center, Managing Wet Weather with Green Infrastructure: Municipal Handbook 2–3 (2008), https://www.epa.gov/sites/production/files/2015-10/documents/gi_munichandbook_green_streets_0.pdf.

80. *Benefits of Green Infrastructure*, EPA, http://www.epa.gov/green-infrastructure/benefits-green-infrastructure (last updated Apr. 19, 2016).

81. Leopold, *supra* note 29, at 2.

82. *Benefits of Green Infrastructure*, *supra* note 80.

83. City of Portland Bureau of Envtl. Servs., Portland's Green Infrastructure: Quantifying the Health, Energy, and Community Livability Benefits 2-2 tbl. 2.1 (2010), https://www.portlandoregon.gov/bes/article/298042; S. WISE ET AL., *Integrating Valuation Methods to Recognize Green Infrastructure's Multiple Benefits*, *in* LOW IMPACT DEVELOPMENT 2010: REDEFINING WATER IN THE CITY 1124–32 (Scott Struck & Keith Lichten eds., 2010) (finding green infrastructure provides evapotranspiration and

In sum, green infrastructure is a multipurpose solution to stormwater, but it is not currently being implemented at a large scale. The following Part discusses why the Clean Water Act has not incentivized multipurpose solutions like green infrastructure thus far.

## II. CLEAN WATER ACT: A TOOL TO CURB WATER POLLUTION BECOMES A CHALLENGE FOR MULTIPURPOSE STORMWATER MANAGEMENT

The Clean Water Act NPDES program is the key driver for local stormwater management. Despite its pollution focus and the challenges of fitting urban stormwater into a point-source framework, some cities have developed innovative ways to issue NPDES permits so that they meet multiple objectives. These approaches are certainly movements in the right direction, but it is also important that state and federal governments recognize that addressing urban stormwater through the Clean Water Act is a limited tool.

### *A. An Overview of the NPDES Program*

As mentioned above, EPA regulates municipal stormwater discharges from MS4s through the Clean Water Act NPDES program.[84] EPA implements this program through its Phase I and Phase II stormwater regulations, which contain permitting requirements for MS4s and industrial activities, including construction.[85] Phase I permits cover MS4s serving populations more than one hundred thousand, and Phase II permits cover smaller MS4s.[86]

Although EPA is the primary NPDES permitting authority, the Clean Water Act also authorizes EPA to delegate this authority to states if they establish permitting programs that are substantially equivalent to the federal program.[87] Congress affirmed the importance of state sovereignty in land and water management, declaring its intent to "recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, [and] to plan the development and use (including restoration,

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shade that reduces demand for energy for cooling and heating and provides cooling that reduces urban heat island effect, in turn reducing heat related health impacts. Green infrastructure also improves air quality, reduces building energy use, and decreases greenhouse gas emissions.); Tzoulas et al., *supra* note 21, at 169–70.

84. *See* 33 U.S.C. § 1342(p)(2) (2012) (The categories of stormwater that require a permit include: "(C) A discharge from a municipal separate storm sewer system serving a population of 250,000 or more. (D) A discharge from a municipal separate storm sewer system serving a population of 100,000 or more but less than 250,000. (E) A discharge for which the Administrator or the State, as the case may be, determines that the stormwater discharge contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States.").

85. 40 C.F.R. § 122.26; § 122.34.

86. *Storm Water Program*, CAL. St. Water Resources Control Bd., http://www.waterboards.ca.gov/water_issues/programs/stormwater/municipal.shtml (last updated June 23, 2014); *see* 33 U.S.C. §§ 1342(p)(2)(C)–(D) (2012).

87. § 1342(b); *see* Purpose and Scope, 40 C.F.R. § 123.1(c) (2015) (state program requirements).

preservation, and enhancement) of land and water resources."[88] Presently, forty-seven states are authorized to implement NPDES permit programs, and they are all in different stages of implementation.[89]

Unlike the specific technology-based standards that govern other, nonstormwater NPDES compliance, MS4s are required to reduce pollutants in stormwater discharges "to the maximum extent practicable," through "management practices, control techniques and system, design and engineering methods" because end-of-pipe treatment is not feasible.[90] Therefore, local agencies have some flexibility in the way they choose to manage stormwater through MS4 systems. Although EPA does not provide a clear definition of "maximum extent practicable," MS4s can comply with this requirement by implementing wide-ranging "Best Management Practices" (BMPs), which are detailed in EPA regulations.[91] For example, BMPs can include "treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage."[92] Nonstructural BMPs are solutions like ordinances or education programs encouraging landowners to use less fertilizer or reduce littering, while structural BMPs are construction projects like vegetated filter strips, pervious pavement, and other measures to reduce the impact of urban stormwater runoff.[93]

Another unique feature of MS4 permits is that they are general or system-wide, rather than for each point source. When multiple entities operate in an interconnected system discharging into the same surface waters, permitting authorities can issue MS4 permits on a "system- or jurisdiction-wide basis."[94] For example, the Los Angeles County permit includes eighty-four cities, a number of unincorporated cities, and the Los Angeles County Flood Control District.[95] Although the system contains numerous MS4 discharge points, which are each considered point sources, the permit covers the entire system rather than each individual discharge point.[96] Therefore, the permit requires

88. 33 U.S.C. § 1251(b) (2012).

89. *NPDES State Program Information*, EPA, https://www.epa.gov/npdes/npdes-state-program-information (last updated Feb. 19, 2016).

90. §§ 1342(p)(3)(B)(i)–(iii); *see* Jeffrey M. Gaba, *Generally Illegal: NPDES General Permits Under the Clean Water Act*, 31 Harv. Envtl. L. Rev. 409, 417 (2007).

91. Establishing Limitations, Standards, and Other Permit Conditions (Applicable to State NPDES Programs, See § 123.25), 40 C.F.R. § 122.44(k)(2) (2015).

92. Definitions, 40 C.F.R. § 122.2 2 (2015).

93. Michael D. Kaplowitz & Frank Lupi, *Stakeholder Preferences for Best Management Practices for Non-Point Source Pollution and Stormwater Control*, 104 Landscape & Urban Planning, 364, 364–65 (2012) (Structural BMPs may seek to control pollutants at the source, provide treatment for special wastes, prevent stream and river bank erosion, or keep runoff onsite. For example, vegetated filter strips are gently sloping areas covered in vegetation that receive stormwater runoff to minimize filter pollutants and collect sediment.)

94. 33 U.S.C. § 1342(p)(3)(B)(i).

95. Cal. Reg'l Water Quality Control Bd., *supra* note 56, at 13.

96. §§ 1342(p)(3), 1362(14); 40 CFR §122.26(b)(9).

BMPs throughout the system instead of end-of-pipe controls at each discharge point.

Between the "maximum extent practicable standard" and shared permittee responsibilities in system-wide permits, the NPDES program provides considerable flexibility in how MS4 managers reduce urban stormwater pollution. This is also administratively convenient for EPA and state authorities because they can issue a single permit to cover hundreds of discharges.[97] But the flexibility also compromises compliance. Because the permits cover so many municipalities, it is difficult to pin responsibility on any one actor. Further, BMPs are not necessarily reviewed or approved by the permit issuer, nor are they typically sufficient to protect water quality.[98] These are serious downsides that now impact the success of the NPDES program. But part of the reason for these regulatory constraints, such as a flexible technology standard and system-wide permit, are that stormwater is diffuse, and requires many parties and many localized strategies to clean it.

### *B. A Diffuse Source Regulated as Point Source Pollution*

Unlike a discrete, industrial discharger, which is easily identifiable as the origin of pollution, urban stormwater runoff contains pollutants from all over an urban landscape. In Los Angeles, the MS4 permit covers more than three thousand square miles.[99] The people who litter or drive leaky cars and the dog that defecates on the sidewalk are all responsible for urban stormwater-runoff pollution. But while the Clean Water Act can impose end-of-pipe, technology-based requirements on a factory to improve pollution control, the measures to effectively control urban stormwater-runoff pollution are much more complex. Despite the stark differences between urban stormwater runoff and an industrial discharge, the Clean Water Act's definition of a point source is sufficiently broad that EPA could have regulated them in the same way in its original 1973 regulations. The problem was that potentially millions of stormwater ditches and small municipal stormwater outfalls would have then been considered point sources.[100] Reasoning that this would be excessively administratively burdensome,[101] EPA exempted conveyances holding stormwater runoff from the NPDES system. Of course, as outlined above, Congress overturned this decision in 1987.[102] But it did strike a balance. Rather than regulating the

97. Gaba, *supra* note 90, at 433.

98. *Id.*; *see* Nat'l Research Council, *supra* note 4, at 1–2; Cal. St. Water Resources Control Bd., Order WQ 2015-0075, at 14 (2015) ("[A]n increasing body of monitoring data [in Los Angeles] indicates that many water quality standards are in fact not being met by many MS4s.").

99. Cal. Reg'l Water Quality Control Bd., *supra* note 56, at 15.

100. *See* Nat'l Research Council, *supra* note 4, at 66.

101. *See supra* Part II.A.

102. Nat'l Research Council, *supra* note 4, at 1.

"individual sources of runoff," like every church, school or residential property with a drainage ditch, Congress regulated runoff at the local municipal level.[103]

This history illustrates the challenge of bringing such a diffuse water source into the NPDES program. After dealing with the "first generation" of pollution management, characterized by wastewater and industrial discharge treatment, stormwater became "the second generation" of problems for Congress to address under the Clean Water Act.[104] But it was—and is—an entirely different problem. EPA estimates that the stormwater program has over five hundred thousand permittees, compared to the fewer than one hundred thousand nonstormwater permittees under the rest of the NPDES program.[105] Perhaps due in part to this large number of permittees, "achievement of water quality improvement as a result of the permit requirements has remained an elusive goal," and implementation has been slow.[106] Rain is also so pervasive that it renders every land use a source of pollution.[107] As reasoned by EPA when it originally exempted stormwater, "the owner of the discharge point . . . has no control over the quantity of the flow or the nature and amounts of the pollutants picked up by the runoff."[108] Stormwater is also "unpredictable because it results from the duration and intensity of the rainfall event, the topography, the type of ground cover and the saturation point of the land due to any previous rainfall."[109]

### *C. Missing the Point: A Pollution Control Statute's Limitations*

Ultimately, the point-source-discharge framework has been unsuccessful at improving water quality, and, further, at encouraging multipurpose stormwater management. Congress specifically regulates urban runoff "pollution" because it is an externality that often burdens other states and localities.[110] But from a broader water-quality standpoint, pollution is not the only, or maybe even the most important, negative externality for local governments to mitigate. For example, NPDES does not specifically incentivize other broader objectives, such as local water supply, climate change resiliency, and ecosystem health, which are all relevant goals for stormwater management.

103. *See, e.g.*, 131 Cong. Rec. 19,846, 19,850 (Jul. 22, 1985) (statement of Rep. Rowland) ("What we are talking about is potentially thousands of permits for churches, schools, residential property, runoff that poses no environmental threat.").

104. Ellen Hanak et al., Pub. Pol'y Inst. of Cal., Paying for Water in California 43 (2014), http://www.ppic.org/content/pubs/report/R_314EHR.pdf.

105. *See* Nat'l Research Council, *supra* note 4, at 36.

106. *Id.* at vii.

107. Daniel R. Mandelker, *Controlling Nonpoint Source Water Pollution Can It Be Done?*, 65 Chi.-Kent L. Rev. 479, 482 (1989).

108. *See* Nat. Res. Def. Council v. Costle, 568 F.2d 1369, 1377 (D.C. Cir. 1977).

109. *Id.* at 1377–78.

110. *See* Mandelker, *supra* note 107, at 479. ("Local governments do not have an incentive to adopt nonpoint source controls because their nonpoint pollution usually is exported elsewhere.").

Although land use changes are effective pollution controls for diffuse sources like stormwater, the federal government has backed away from mandating them.[111] Instead, BMPs provide flexibility to manage urban stormwater reactively through the MS4. This approach has arguably been ineffective, though, at even the singular goal of pollution control.[112] The ambiguity of the "maximum extent practicable" standard makes it challenging to implement and enforce.[113] Also, BMPs require design and construction expertise tailored to the local landscape.[114] Pollution control cannot be solved with extra street sweeping and storm drain grates. It requires changes in land use and infrastructure. However, the NPDES places responsibility on agencies like the Los Angeles County Flood Control District that have little expertise in comprehensive watershed planning and have limited planning, zoning, or land use authority.[115]

While some scholars and environmental groups consider strengthening enforcement as the solution,[116] I believe that continuing to hammer down on NPDES compliance will not necessarily get cities closer to healthier watersheds. The NPDES permitting program, which was originally designed to use technology-based requirements for end-of-pipe pollution control, does not reflect the multiple stormwater-management goals necessary for a healthier urban watershed. Stormwater runoff should instead be managed under a broader, watershed-based planning framework centered on green infrastructure and land use planning.

### *D. Putting Teeth into the Clean Water Act Stormwater Permits is a Limited Tool: Los Angeles as an Example*

Rather than looking for solutions beyond the NPDES program, government agencies and critics have suggested broadening stormwater NPDES permits so that they adopt a watershed approach. EPA has

111. Kenneth M. Murchison, *Learning from More Than Five-and-a-Half Decades of Federal Water Pollution Control Legislation: Twenty Lessons for the Future*, 32 B.C. Envtl. Aff. L. Rev. 527, 581 (2005) ("In the United States, pollution from nonpoint sources presents the most obvious example of this resistance to effective water pollution control. In part, the exclusion of nonpoint sources arises from the difficulty of controlling pollution that enters water bodies from diffuse rather than discrete sources, but the philosophical basis runs much deeper. United States environmental law has always backed away from direct federal control of land use, and land use controls are the basis for effective control of water pollution from nonpoint sources.").

112. B.J. D'Arcy & A. Frost, *The Role of Best Management Practices in Alleviating Water Quality Problems Associated with Diffuse Pollution*, 265 Sci. Total Envt. 359, 359–60 (2001).

113. *See* Nat'l Research Council, *supra* note 4, at 542.

114. *See, e.g.*, CREDIT VALLEY CONSERVATION, LOW IMPACT DEVELOPMENT CONSTRUCTION GUIDE 1 (2012), http://www.creditvalleyca.ca/wp-content/uploads/2013/03/CVC-LID-Construction-Guide-Book.pdf (finding design and construction flaws can compromise the performance of green infrastructure).

115. Cal. Reg'l Water Quality Control Bd., *supra* note 56, at 17.

116. *See* Clifford Rechtschaffen, *Enforcing the Clean Water Act in the Twenty-First Century: Harnessing the Power of the Public Spotlight*, 55 Ala. L. Rev. 775, 778–79 (2004).

recommended a "detailed, integrated and inclusive watershed planning process" as part of the NPDES process,[117] and, in 2012, Los Angeles County (L.A. County) developed a permit to attempt to do just that.

Although MS4 permits are not required to contain water quality-based effluent standards, the L.A. County permit includes a number of watershed-based Total Maximum Daily Loads (TMDLs),[118] as well as receiving water limitations,[119] pursuant to the California State Water Board requirements.[120] The State Water Board noted that it would "take years of technical efforts to achieve compliance with the receiving water limitations," so the Regional Board provided another path to compliance in the permit.[121] Specifically, permittees can either develop a watershed management program (WMP) or an enhanced watershed management program (EWMP). Each WMP must prioritize water quality issues; identify and implement strategies, control measures, and BMPs to achieve water quality-based effluent limitations and/or receiving water limitations; execute integrated monitoring and assessment; and modify strategies based on monitoring information.[122] To develop an EWMP, permittees must additionally collaborate on multibenefit regional projects that retain stormwater runoff,[123] and these projects can include green infrastructure development. By creating a WMP or EWMP and operating pursuant to it, permittees can effectively comply with the receiving water limitations and also achieve additional benefits by utilizing green infrastructure as a solution. While it is the ultimate goal for permittees to comply with water quality standards, this alternative compliance is attractive to permittees who cannot immediately comply with receiving water limitations, but are willing to participate in an iterative process and comply with interim milestones.[124]

Although this alternative compliance mechanism provides an innovative watershed approach, it is also controversial. Some environmentalists are unhappy that this watershed approach relieves local governments of achieving

117. EPA, Watershed-Based NPDES Permitting Policy Statement 1 (2003), http://archive.nacwa.org/getfile270e.pdf?fn=01-07-03watershed-mehan.pdf.

118. EPA, Implementing Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs), https://www.epa.gov/tmdl (last updated June 7, 2015) ("A TMDL is a pollution budget and includes a calculation of the maximum amount of a pollutant that can occur in a waterbody and allocates the necessary reductions to one or more pollutant sources.")

119. St. Water Resources Control Bd., Stormwater Program, http://www.waterboards.ca.gov/water_issues/programs/stormwater/smallms4faq.shtml (last updated Aug. 8, 2004), ("Receiving water limitations. . . are water quality based standards that may require additional controls beyond those that have been implemented to meet the [maximum extent practicable] standard.").

120. Cal. Reg'l Water Quality Control Bd., *supra* note 56, at 21–23.

121. CAL. REG'L WATER QUALITY CONTROL BD., L.A. REGION, ORDER WQ 2015-0075, NPDES PERMIT NO. CAS004001 AT 17 (2015).

122. Cal. Reg'l Water Quality Control Bd., *supra* note 56, at 47–50.

123. *Id.* ("EWMP provisions require that Permittees collaborate on multibenefit regional projects and, wherever feasible, retain all non-storm runoff, as well as all storm water runoff from the 85th percentile 24-hour storm event . . . for the drainage areas tributary to the projects.").

124. *Id.* at 33.

numerical receiving water limitations and effluent limitations.[125] For example, while the Natural Resources Defense Council supports green infrastructure and watershed-based planning approaches, it also wants to ensure that L.A. County addresses pollution concerns sooner rather than later.[126] Consistent with that policy goal, in 2008, the Natural Resources Defense Council and Santa Monica Baykeeper brought suit against the L.A. County Flood Control District, claiming that it was discharging polluted urban stormwater runoff into navigable waters in violation of receiving water limitations.[127] In response to this new permit's implementation, Natural Resources Defense Council and other partners have also petitioned against the conditional approvals of WMPs by the Los Angeles Regional Water Quality Control Board on the grounds that they fail to meet water quality standards.[128]

Although enhanced water quality is an essential goal, immediately enforcing receiving water limitations in NPDES permits is a shortsighted approach because it does not incentivize the widespread land use changes that are needed to restore watersheds for multipurpose stormwater management. Using litigation and advocacy to further hammer in water quality and pollutant requirements incentivizes shortsighted pollution control solutions and end-of-pipe technology. These measures have not worked in the past, and imposing immediate water quality standards will only result in rendering permittees out of compliance, at the expense of more creative, multipurpose solutions.

Although it is too soon to fully evaluate the L.A. County permit, the watershed approach is a step in the right direction. The permit, though, is likely limited in its effectiveness. As the State Water Board has recognized, there is always a challenge in providing a flexible watershed planning mechanism, while still ensuring that the permit provides baseline requirements and is enforceable.[129] Additionally, although the permit engages the regulated community through watershed planning,[130] it does not involve all of the stakeholders who should be involved in a watershed approach. For example,

125. *Id.* at 17.

126. Becky Hayat, *Now or Never: It's Time for the State Board to Require Stormwater Capture and Help California Mitigate the Drought*, NAT. RESOURCES DEF. COUNCIL (June 11, 2015), https://www.nrdc.org/experts/becky-hayat/now-or-never-its-time-state-board-require-stormwater-capture-and-help-california.

127. Nat. Res. Def. Council, Inc. v. Cty. of L.A., 725 F.3d 1194, 1200–01, 1210 (9th Cir. 2013) (finding liability based on the presence of pollutants above water quality standards in the receiving waters).

128. Nat. Res. Def. Council, Heal the Bay, and Los Angeles Waterkeeper, Petition for Review of Los Angeles Regional Water Quality Control Board Executive Officer's Action to Conditionally Approve Nine WMPS Pursuant to the L.A. County MS4 Permit (May 28, 2015), http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/watershed_management/Consideration_of_petition/NRDC%20LAWK%20HTB%20Petition%20to%20Reg%20and%20State%20Bd%20Conditional%20Approval%20of%20WMPs%20POS%20Email%2005-28-15%20FINAL.pdf.

129. St. Water Resources Control Bd., *supra* note 121, at 43.

130. *Stormwater Quality*, L.A. Dep't Pub. works, http://dpw.lacounty.gov/wmd/npdes/ (last visited Apr. 29, 2016).

the Los Angeles Department of Water and Power recently developed a report regarding stormwater capture for water supply,[131] but the Department is not part of the EWMP process. Although the watershed plans are meant to increase integration and coordination, they are only achieving integration among a proscribed group of regulated parties. Finally, the WMPs and EWMPs, though pursuing laudable watershed goals, are still focused on pollutant standards, to the exclusion of other important stormwater-management goals.

In sum, the L.A. County permit builds capacity for watershed planning, but it is not enough on its own to build the multipurpose stormwater-management system needed in the Los Angeles area. The problem is that a pollution-centered approach has not, as of yet, left room for the creative solutions needed to implement a successful, multipurpose stormwater system.

### *E. More Tension Between the Clean Water Act and Urban Stormwater Management: The Clean Water Rule Highlights a Problem*

Particularly against the context of local managers pursuing multibenefit land use solutions for stormwater management, the Clean Water Rule demonstrates federal regulators' attempts to reduce barriers to this management posed by the Clean Water Act. Counterintuitively, the Clean Water Act originally posed potential restrictions on land-use-driven management, such as green infrastructure, despite the fact that it is the primary federal law intended to incentivize controlling stormwater-caused pollution.

In May 2015 EPA and the Corps issued the Clean Water Rule to further clarify the scope of federal jurisdiction under the Clean Water Act.[132] For years, the meaning of the phrase "waters of the United States" had been controversial.[133] In an effort to clarify the scope of federal jurisdiction, the agencies developed a rule based on the statute, science, relevant Supreme Court decisions, and the agencies' experience and technical expertise.[134] The final Rule contained three categories of waters: waters that are always jurisdictional, waters that are never jurisdictional, and waters that require a case-by-case analysis under a "significant nexus" test.[135] The second category of waters—

131. *See generally* L.A. Dep't Water & Power, *supra* note 43.

132. Definition of Waters of the United States, 33 C.F.R. § 328.3 (2015), *stayed*, *In re* EPA, 803 F.3d 804, 805 (6th Cir. 2015).

133. Coral Davenport, *Obama Plans New Rule to Limit Water Pollution*, N.Y. Times (May 22, 2015), http://www.nytimes.com/2015/05/23/us/politics/obama-set-to-strengthen-federal-role-in-clean-water-regulation.html.

134. *See* United States v. Riverside Bayview Homes, 474 U.S. 121, 130–131 (1985); Solid Waste Agency of N. Cook Cty. v. U.S. Army Corps of Eng'rs, 531 U.S. 159, 171–172 (2001); Rapanos v. United States, 547 U.S. 715, 767 (2006) (Kennedy, J., concurring).

135. Definition of Waters of the United States, 33 C.F.R. § 328.3(a)(1)–(7), (b) (2015), *stayed*, *In re* EPA, 803 F.3d 804, 805 (6th Cir. 2015) ("Consistent with the significant nexus standard articulated in the Supreme Court opinions, waters are 'waters of the United States' if they significantly affect the chemical, physical, or biological integrity of traditional navigable waters, interstate waters, or the territorial seas. This determination will most typically be made on a water individually, but can, when

never jurisdictional—contains a new exemption: "stormwater control features constructed to convey, treat, or store stormwater that are created in dry land."[136]

Stakeholders had been concerned about the jurisdictional status of MS4s under the proposed Clean Water Rule, in which the agencies were silent on stormwater control features.[137] Stakeholders had argued that MS4s could fall under the definition of "tributary" and thus be considered jurisdictional.[138] If courts and the agencies interpreted the Rule to make MS4s jurisdictional waters, municipalities were worried they would have to comply with additional Clean Water Act provisions, particularly that they would need section 404 permits for every preventative maintenance or retrofitting project of an MS4 pipe or ditch.[139] Given that they were already regulated under NPDES MS4 permits, local governments viewed any additional permitting as excessive. Not only did they lack the funding to comply with additional provisions, but local governments also argued that this would significantly and unduly expand federal Clean Water Act jurisdiction over MS4 components, thus limiting municipalities' flexibility to manage their MS4s.[140] Reiterating that they were articulating the existing jurisdictional status of MS4s under Clean Water Act,[141] the agencies deemed the stormwater-control features nonjurisdictional under the final Rule,[142]

Stormwater managers in local governments also specifically called for clarity regarding green-infrastructure practices in the lead up to the Clean Water Rule's promulgation.[143] Before the final Rule, there was a risk that green infrastructure, like vegetated strips, could be considered "adjacent waters" or "tributaries" that would qualify as "waters of the United States." If municipalities had to get permits every time they did maintenance on green infrastructure, or had to monitor water quality and develop TMDLs for all of those projects, the Rule would have made existing green infrastructure burdensome and disincentivized building new green infrastructure. For example, local water managers would likely have been discouraged from developing a vegetated stormwater strip if it would then have become jurisdictional and subject to additional Clean Water Act provisions. However,

warranted, be made in combination with other waters where waters function together . . . . In this final rule, the agencies have identified by rule, five specific types of waters in specific regions that science demonstrates should be subject to a significant nexus analysis . . . . Prairie potholes, Carolina and Delmarva bays, pocosins, western vernal pools in California, and Texas coastal prairie wetlands." Clean Water Rule: Definition of "Waters of the United States," 80 Fed. Reg. 37054, 37059 (June 29, 2015).).

136. 33 C.F.R. § 328.3(b)(6).

137. EPA, *supra* note 57, at 324.

138. *Id.*

139. *Id.*

140. *Id.*

141. *Id.* at 325.

142. *Id.* (The Rule only exempts "stormwater control features constructed to convey, treat, or store stormwater that are created in dry land.").

143. *Id.*

EPA's final Rule exempted "stormwater control features," including green-infrastructure, and removed any potential disincentive to build green infrastructure.[144]

Interestingly, the controversy in drafting the Rule highlighted the tension between the Clean Water Act and local stormwater management, planning, and land use control. Typically, and especially under section 404, the Clean Water Act places restrictions on land use changes that negatively affect water quality.[145] Though the Clean Water Rule avoided this, any expansion of Clean Water Act jurisdiction over stormwater control features could have limited municipalities' control over land uses, even where it would have improved water quality through green infrastructure. Comments from municipalities illustrated that it was not originally clear to them that the Clean Water Act encouraged green-infrastructure. But the Rule clarified that green infrastructure is an issue on which local land use and federal pollution control goals converge.[146]

While this Part identified how the Clean Water Rule has reduced some of the Clean Water Act's tension with local, multibenefit management, it also outlined why the NPDES program is generally ill suited for a watershed-based approach for stormwater management. Environmental groups can continue to fight for stronger pollution control measures under the Clean Water Act, but permitting is no substitute for planning green-infrastructure projects.[147] Although the pollution control it mandates needs to be part of the solution, the Clean Water Act should not drive the urban stormwater agenda at the local level because this would undermine other multibenefit approaches. The next Part will outline why governments should focus on making green infrastructure more practicable, while also detailing how green infrastructure can help local governments develop capacity to plan at the watershed level.

144. Definition of Waters of the United States, 33 C.F.R. § 328.3(b)(6) (2015), *stayed*, *In re* EPA, 803 F.3d 804, 805 (6th Cir. 2015).

145. 33 U.S.C. § 1344 (2012); William F. Pedersen, *Using Federal Environmental Regulations to Bargain for Private Land Use Control,* 21 Yale J. on Reg. 1, 15 (2004) ("Section 404 of the Clean Water Act and the Endangered Species Act do impose real burdens on land use. However, both statutes avoid any reference to issues that imposing these burdens necessarily raises, such as regional land use priorities, federalism, or property rights.").

146. Clean Water Rule: Definition of "Waters of the United States," 80 Fed. Reg. 37054, 37100 (June 29, 2015).

147. Mary Jane Angelo, *Integrating Water Management and Land Use Planning: Uncovering the Missing Link in the Protection of Florida's Water Resources?*, 12 U. Fla. J.L. & Pub. Pol'y 223, 232 (2001).

## III. FOCUSING ON THE OBJECTIVE: MAKING MULTIPURPOSE MANAGEMENT MORE PRACTICABLE

### *A. Green Infrastructure as a Solution*

A multibenefit stormwater-management solution will require widespread land use changes that reduce the imperviousness of urban landscapes. Rather than focusing solely on water pollution or flooding, federal, state, and local governments should focus on incentivizing multipurpose solutions to the stormwater problem, specifically by making green infrastructure more practicable.

The best stormwater-management practices will address the impacts of stormwater on the entire watershed, including problems with flow, climate resiliency, and groundwater recharge. To that end, green infrastructure needs to be specifically designed and implemented to contribute to these multiple benefits.[148] EPA, environmental organizations, and stormwater managers are pointing to green infrastructure as a preventative measure that could greatly improve the ways that the urban landscape interacts with stormwater.[149]

However, there are a number of barriers to widespread implementation of green infrastructure. The Clean Water Act is the only regulatory tool for compelling local governments to pursue stormwater-management strategies. As argued above, though, it is a limited tool for deploying the use of green infrastructure because of its focus on pollutant loads.[150] EPA has aggressively promoted green infrastructure as a stormwater-management strategy.[151] Yet, in 2008, EPA Clean Watershed Needs Survey estimated that the costs of addressing stormwater runoff to meet regulatory and program goals would be over $42.3 billion per year.[152] There are a variety of barriers for local governments to secure these funds,[153] and, even if adequate funds were secured, green infrastructure might lose out to more immediately financially justifiable management tools and improvements. Green infrastructure is a cost-effective solution for pollution control and flooding,[154] and is even more cost effective in the long term when considering other benefits such as groundwater recharge and water quality.

148. Nylen & Kiparsky, *supra* note 78, at 4.

149. *Benefits of Green Infrastructure*, EPA, http://www.epa.gov/green-infrastructure/benefits-green-infrastructure (last updated Apr. 19, 2016).

150. *See supra* Part II.A.

151. EPA, Green Infrastructure Strategic Agenda 2013, at 2 (2013), https://www.epa.gov/sites/production/files/2015-10/documents/2013_gi_final_agenda_101713_0.pdf.

152. EPA, Clean Watersheds Needs Survey Report to Congress, at vii (2008), http://www.epa.gov/sites/production/files/2015-06/documents/cwns2008rtc.pdf.

153. *See* Hanak et al., *supra* note 104, at 9.

154. Martin Jaffe, *Reflections on Green Infrastructure Economics*, 12 Envtl. Practice 357, 364 (2011) ("[G]reen infrastructure is cost-effective in managing urban storm water when compared to conventional gray infrastructure under a number of development scenarios.").

### *B. Fragmented Water Governance: A Barrier to Green-Infrastructure Development*

Although some cities have implemented green-infrastructure pilot projects, many of them have not begun to implement green infrastructure widely. Negative attitudes toward innovation can impact willingness to adopt and implement new methods and technologies.[155] Despite growing interest, local entities face social, institutional, and procedural barriers to pursuing green infrastructure on a widespread scale.[156]

Given that green infrastructure has watershed-wide benefits, a primary barrier is the fragmentation of relevant responsibilities across local water and land management agencies.[157] Although there are benefits to this specialization, municipalities often manage floodwater, groundwater, wastewater, and drinking water separately.[158] Furthermore, these agencies are typically based on political boundaries, rather than watersheds, and receive funding from restricted sources with independent legal mandates.[159] This structure also siloes nonwater agencies with relevance to green infrastructure, including health and planning departments, soil and conservation districts, and environmental agencies.[160] The problem is that, in resource management, fragmented agencies may not be able to see the benefits to a holistic strategy to watershed management, and thus will solely pursue their own specific directive.[161] Even if fragmented agencies see the need for holistic management, they might decide against it because of administrability concerns or resource constraints.[162]

Second, local agencies have limited resources, with high transaction costs for collaboration. Even where there are higher levels of resources, the complexity of local governments' institutional frameworks can cause higher transaction costs for strategic planning, information sharing, and the coordination of management efforts. Specifically, having more actors can make it difficult to determine who should be responsible for respective management activities.[163] The agencies tasked with managing stormwater do not have the

155. Fanny Carlet, *Understanding Attitudes Toward Adoption of Green Infrastructure: A Case Study of US Municipal Officials*, 51 Envtl. Sci. & Pol'y 65, 65–66 (2015) (saying municipal officials' attitudes regarding innovation can limit the adoption of green infrastructure as a new practice, based on effects of perceived ease of use and perceived usefulness as well as the perceived internal adoption readiness and compatibility).

156. *Id.*

157. Roy et al., *supra* note 33, at 348–49.

158. Hanak et al., *supra* note 104, at 2.

159. Deborah Weinstein Bloome & Phoebe Lipkis, TreePeople, A New Vision for Water Management in the Los Angeles Region 14–15 (2015), https://www.treepeople.org/sites/default/files/pdf/publications/Moving%20Towards%20Collaboration_e-version.pdf.

160. *Id.* at 23–24, fig. G.

161. Roy et al., *supra* note 33, at 348–49.

162. *Id.*

163. Scott D. Hardya & Tomas M. Koontz, *Collaborative Watershed Partnerships in Urban and Rural Areas: Different Pathways to Success?*, 95 Landscape & Urban Planning 79, 79–80 (2010).

administrative or financial capacity to manage new requirements for green infrastructure.[164] The reality is also that stormwater may not be a priority, even in the agencies charged with managing it, as it is not as clearly solvable as road infrastructure or solid waste and often has to compete for general tax-based funds.[165] Often, municipalities do not even have the capacity to inspect and maintain existing stormwater facilities, so their capacity for new projects is extremely limited.[166] As a result, other public services take precedence over stormwater infrastructure.[167]

Finally, water managers may not provide the capital investment needed to install green infrastructure because they are uncertain about its economic benefits. Green infrastructure is still considered a new approach to stormwater management. Despite the abundance of green-infrastructure case studies, water managers do not have the long-term data on performance relevant to their specific soil and climatic conditions.[168] Furthermore, there are currently no studies demonstrating successful ecosystem protection through widespread implementation of green infrastructure.[169] Although green infrastructure is touted as more cost effective than traditional infrastructure, managers are also unsure how much ongoing maintenance will cost.[170] The perception that green infrastructure is expensive to build and maintain is hard to overcome, especially when its economic benefits to air quality, greenhouse gas emissions reductions, water quality, and local water supply have not been quantified.[171] Although there are models for general economic-benefit data, these models are generally only applicable to the specific region where they were developed.[172] In sum, local decision makers need more information about the multiple economic benefits of these projects in order to overcome the significant coordination and resource hurdles described above.[173]

Essentially, cities are interested in green infrastructure and the multiple benefits that come with it, but they are not motivated to implement it widely because the agencies responsible for water management are fragmented, have limited resources, and have little tolerance for risk in light of inadequate local data.

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164. *Id.*

165. Thomas N. Debo & Andrew Reese, Municipal Stormwater Management 8, 13–14 (2d ed. 2002).

166. *Overcoming Barriers to Green Infrastructure*, EPA, http://www.epa.gov/green-infrastructure/overcoming-barriers-green-infrastructure (last updated Dec. 30, 2015).

167. Debo & Reese, *supra* note 165, at 39.

168. V.M. Jayasooriya & A.W.M. Ng, *Tools for Modeling of Stormwater Management and Economics of Green Infrastructure Practices: A Review*, 225:2055 Water, Air & Soil Pollution 1, 1–2 (2014).

169. Roy et al., *supra* note 33, at 345.

170. *Overcoming Barriers to Green Infrastructure*, EPA, http://www.epa.gov/green-infrastructure/overcoming-barriers-green-infrastructure (last updated Dec. 30, 2015).

171. Clean Water Am. Alliance, Barriers and Gateways to Green Infrastructure 23 (2011).

172. Jayasooriya, *supra* note 170, at 8.

173. Clean Water Am. Alliance, *supra* note 171, at 24.

### *C. Making Green Infrastructure Practicable: Tools to Build Local Capacity and Collaboration*

Given the tremendous governance barriers to watershed planning, communities need opportunities to collaborate at the local level in order to realize the economic benefits of leveraging limited agency resources for widespread green-infrastructure development.

Problems like fragmentation and lack of coordination naturally point to a need for structured collaboration among water agencies, and there are multiple ways to achieve this. For example, integrated resource management is a collaborative decision-making process that could be useful for green-infrastructure planning.[174] Although there are certainly benefits to this model, collaboration is only part of the process of spreading innovative management techniques, especially when water managers do not have data to support their actions.[175] In addition, it is not clear that past integrated water-management programs have been successful.[176] California is currently undertaking a strategic planning process to make its Integrated Regional Water Management (IRWM) program more "integrated."[177]

A potential solution to the absence of data is to have EPA collect data from green-infrastructure projects. For example, EPA could encourage standardized monitoring and capture that information in a national database.[178] Though this approach would effectively collate local information regarding green infrastructure performance, it still might not be enough for local decision makers, who would ideally rely on local and regional data to make the decision to invest. There are existing economic modeling tools available, but they are typically regionally specific tools,[179] and they do not provide information about the respective benefits for various water-related agencies.

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174. *Integrated Regional Water Management: IRWM Grant Programs*, Cal. Dep't of Water Resources, http://www.water.ca.gov/irwm/grants/ (last updated May 29, 2015). ("Integrated Regional Water Management (IRWM) is a collaborative effort to manage all aspects of water resources in a region. IRWM crosses jurisdictional, watershed, and political boundaries; involves multiple agencies, stakeholders, individuals, and groups; and attempts to address the issues and differing perspectives of all the entities involved through mutually beneficial solutions.").

175. Carlet, *supra* note 155, at 65–66.

176. *See, e.g.,* Mark Lubell & Lucas Lippert, *Integrated Regional Water Management: A Study of Collaboration or Water Politics-as-Usual in California, USA*, 77 INT. REV. OF ADMIN. SCIENCES 76, 77 (2011) ("[T]he Bay Area IRWM appears to have only created incremental changes away from . . . fragmentation and conflict. Bay Area stakeholders who participate in IRWM generally have more negative views of Bay Area water policy, and do not believe IRWM has helped achieve water management goals, increased integration, or changed the nature of on-the-ground water projects. Water supply infrastructure stakeholders continue to be the most powerful actors—they have higher levels of collaboration, positive views of IRWM, and receive the most money from the state program.").

177. *See* e.g., California Department of Water Resources, Review of IRWM Planning and Implementation in California. (2015).

178. Nylen & Kiparsky, *supra* note 78, at 2.

179. Jayasooriya, *supra* note 170, at 8.

Purely collaborative and data driven solutions, although useful, may not necessarily eliminate barriers to widespread green-infrastructure deployment. Hence, federal and state governments should provide financial support to build community capacity and simultaneously support collaboration and data collection. Specifically, they should provide grants to communities to develop watershed-specific economic benefit models to guide collaborative investments in green infrastructure. By focusing on producing locally specific data relevant to a wide variety of stakeholders, local agencies can identify how green-infrastructure opportunities will benefit their specific sectors and how they can collaborate on opportunities. This data will build community knowledge about green-infrastructure lifecycle costs and benefits for local watersheds. In addition, it will create a greater understanding of how watershed managers can collaborate and share costs for green-infrastructure projects.

## CONCLUSION

Urban stormwater management must engage a variety of stakeholders and serve multiple purposes in order to be successful. Focusing on single-purpose management, like pollution control, has not worked thus far. Rather than determining how to enforce existing stormwater regulations, stormwater managers should focus on how to make multibenefit solutions like green infrastructure more practicable. Local governments are beginning to appreciate the need for multibenefit stormwater projects that address water quality, groundwater recharge, and climate resiliency through a watershed approach. However, these projects are still not being implemented widely. In order to build local capacity to plan in this new way, federal and state governments should invest resources in local governments to build knowledge, collect data, and create processes so that local agencies can collaborate on green-infrastructure planning. Investments such as regional economic modeling would reduce fragmentation and uncertainty around new approaches and help water managers plan for a healthier watershed.