No. 11-460

In The
Supreme Court of the United States

LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT,

Petitioner,

v.

NATURAL RESOURCES
DEFENSE COUNCIL, INC., et al.,

Respondents.

On Writ Of Certiorari To The United States Court Of Appeals For The Ninth Circuit

AMICUS CURIAE BRIEF OF DR. LINWOOD PENDLETON REGARDING ECONOMIC IMPACTS OF STORM WATER RUNOFF IN SUPPORT OF RESPONDENTS

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INTERESTS OF AMICUS

The amicus, Linwood Pendleton has studied and published on the economics of water quality and beach going for more than a decade.[1] Dr. Pendleton holds a Doctorate of Forestry and Environmental Science from Yale University, a Master of Public Administration from Harvard University, a Master of Art in Ecology, Evolution, and Behavior from Princeton University, and a Bachelor of Science in Biology from the College of William and Mary in Virginia.

He was formerly a tenured professor at the University of California Los Angeles. Currently, Dr. Pendleton is the Director of Ocean and Coastal Policy at Duke University's Nicholas Institute for Environmental Policy Solutions. Dr. Pendleton has not been employed by or been a consultant to the parties to this litigation on issues related to this case, although Dr. Pendleton did testify in the proceedings leading to the issuance of the Petitioner's NPDES permit that is the subject of this case. Dr. Pendleton is filing this brief solely as an individual and not on behalf of any institution.

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[1] All parties have consented to the filing of this brief, and the consent letters are on file with the Clerk in accordance with Supreme Court Rule 37.2(a). No counsel for a party authored this brief in whole or in part, and no counsel or party made a monetary contribution intended to fund the preparation or submission of this brief. No person other than the amicus, associated institutions, or his counsel made a monetary contribution to its preparation or submission.

Dr. Pendleton submits this brief to provide insights on the economic literature concerning economic impacts of polluted storm water. An economist's perspective may be helpful to the Court as it considers the impact of pollutants discharged to waters subject to the Clean Water Act.

SUMMARY OF ARGUMENT

Storm water runoff alters the chemical, physical, and biological integrity of surface waters. It alters hydrology, accelerates stream flow, adversely affects aquatic habitat, and conveys pollutants to adjacent waters. The Clean Water Act requires "owners and operators" of municipal separate storm sewer systems (MS4) to apply for and receive a National Pollutant Discharge Elimination System (NPDES) permit. The purpose of the permit is to reduce the adverse impacts from storm water.

The pollutants in storm water runoff can adversely affect public health by conveying large volumes of human pathogens into waters in which people recreate. Human pathogens cause disease or illness in people. Common human pathogens include bacteria that cause illnesses such as gastroenteritis, skin rashes, and eye, ear, and respiratory infections. The public health impacts from bacterial contamination have a substantial economic impact on individuals and communities. In Los Angeles and Orange Counties, between 579,000 and 1,224,000

cases of gastroenteritis were estimated to have been caused by bacterial contamination in beach water. A 2000 study estimated the cost of these illnesses to be between $14.2 and $35.1 million in Los Angeles County alone. Nationwide, illnesses caused by contact with water contaminated by human pathogens cost over $300 million annually. Improving water quality increases beach attendance and creates an economic benefit.

Declining water quality in general has a negative economic impact – estimated to be $20 billion across the nation from 1994 to 2000. Polluted storm water also affects housing values across the nation.

Polluted storm water has a significant economic effect.

ARGUMENT

I. POLLUTED STORM WATER HAS A SIGNIFICANT NEGATIVE ECONOMIC IMPACT.

A. The Clean Water Act requires NPDES permit holders to reduce pollutant loading from MS4s.

The Clean Water Act requires a permit for discharges of a pollutant from a point source to waters of the U.S. 33 U.S.C. §§ 1311(a), 1362(12). Petitioner operates a municipal separate storm sewer system (MS4) for which it applied and received a National Pollutant Discharge Elimination System (NPDES)

permit. NPDES permits restrict the "quantities, rates, and concentrations of chemical, physical, biological, and other constituents" discharged through an MS4. 33 U.S.C. §§ 1311(e), 1362(11). MS4s are conveyance systems for storm water, which has been identified as a leading cause of impaired waters in the United States. 64 Fed. Reg. 68,722, 68,726 (Dec. 8, 1999). *See also* E.P.A. 841-F-03-003, Protecting Urban Water Quality From Urban Runoff (Feb. 2003); National Water Quality Inventory: Report to Congress, 2004 Reporting cycle, 9-22 (available at http://water.epa.gov/lawsregs/guidance/cwa/305b/2004report_index.cf). The purpose of the NPDES permit for MS4s is to reduce polluted storm water discharged into waters of the U.S.

Both storm water volume and the pollutants conveyed by storm water adversely affect the chemical, physical, and biological integrity of surface waters. Storm water can adversely affect surface water hydrology, accelerate stream flows, adversely affect aquatic habitat and increase pollutant loadings. *See* 64 Fed. Reg. 68,722, 68,724 (Dec. 8, 1999). Polluted storm water can contain a variety of pollutants of concern, including human pathogens like pathogenic strains of the bacterium Escherichia coli (E. coli). Human pathogens are agents, including bacteria, which cause disease or illness in humans. Fecal indicator bacteria (e.g., fecal coliform) are useful indicators of water quality because these bacteria live in the intestinal tracts of warm-blooded animals, including humans. The presence of fecal indicator bacteria

indicates the likely presence of human pathogens like E. coli. Storm water polluted with human pathogens can adversely affect public health and the environment, thereby imposing direct and indirect costs on communities. In addition, storm water contaminated with bacteria, heavy metals, or other pollutants, has a substantial economic impact generally and on important economic values like housing prices.

B. Storm water polluted with human pathogens results in public health effects that have negative economic impacts on surrounding communities.

MS4s convey polluted storm water, including bacterial pollution, to adjacent waters. 64 Fed. Reg. at 68,725. It is important to note fecal indicator bacteria can be conveyed to surface water through mechanisms other than storm water runoff. For example, leaking sewage infrastructure and septic systems also contribute to poor water quality associated with bacterial contamination. Polluted storm water, however, is a significant source of bacterial contamination, the scope and scale of which varies based on any number of factors. Storm water contaminated with human pathogens results in documented public health impacts that have significant economic costs. For coastal communities, bacterial contamination constitutes a substantial economic impact because it adversely affects public health and causes

a loss of beach visitation and overall value to beachgoers.[2]

Coastal water contaminated by human pathogens poses a significant public health risk, causing such illnesses as gastroenteritis, skin rashes, and eye, ear, and respiratory infections.[3] Although beach

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[2] Robert W. Haile, et al., *The Health Effects of Swimming in Ocean Water Contaminated by Storm Drain Runoff*, 10 Epidemiology 355, 355-363 (1999) (storm water contributes to illness); Ryan H. Dwight, et al., *Estimating the Economic Burden from Illnesses Associated with Recreational Coastal Water Pollution – A Case Study in Orange County, California*, 76 J. Envtl. Mgmt. 95 (2005) (illness causes economic impact); Suzan Given, et al., *Regional Public Health Cost Estimates of Contaminated Coastal Waters: A Case Study of Gastroenteritis at Southern California Beaches*, 40 Envtl. Sci. Tech. 4851, 4851-4858 (2006).

[3] World Health Organization, Guidelines for Safe Recreational Water Environments (2003); Annette Pruss, *Review of Epidemiological Studies on Health Effects from Exposure to Recreational Water*, 27 Int. J. Epidemiology 1, 1-9 (1998); David Kay, et al., *Predicting Likelihood of Gastroenteritis from Sea Bathing: Results from Randomized Exposure*, 344 Lancet 904, 904-909 (1994); Victor J. Cabelli, et al., *Swimming Associated Gastroenteritis and Water Quality*, 115 Am. J. Epidemiology 606, 606-616 (1982); L. M. Alexander, et al., *Symptomatology of Children in Contact with Seawater Contaminated with Sewage*, 46 J. Epidemiological and Community Health 340, 340-344 (1992); Wing Sum Cheung, et al., *Health Effects of Beach Water Pollution in Hong Kong*, 105 J. Epidemiology and Infection 139, 139-162 (1990); Graham B. McBride, et al., *Health Effects of Marine Bathing in New Zealand*, 8 Int. J. Environ. Health Resources 173, 173-189 (1998); M.D. Prieto, et al., *Recreation in Coastal Waters: Health Risks Associated with Bathing in Sea Water*, 55 J. Epidemiology and Community Health 442, 442-447 (2001); Arie Havelaar, et al., *Guidelines: the Current Position in* Water

(Continued on following page)

closure policies attempt to keep beachgoers away from severely contaminated water, there are many days each year where fecal indicator bacteria levels are still high enough to cause illness, even though these levels are not high enough to trigger mandatory beach closures.[4]

Storm water has a measurable and strong impact on southern California water quality as measured by high concentrations of fecal indicator bacteria in the storm water runoff.[5] In Los Angeles and Orange counties, coastal waters contaminated with human pathogens cause gastroenteritis, stomach pain, and diarrhea, resulting in significant economic costs for those two counties.[6] Using two competing epidemiological models, a 2006 study estimated that beachgoers visiting Los Angeles and Orange County public beaches accounted for between 627,800 and 1,479,200 cases of gastroenteritis alone.[7] In the dry season (May

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Quality: Guidelines, Standards and Health (L. Fewtrell and J. Bartram eds. 2001); Haile, *supra* note 2.

[4] Given, et al., *supra* note 2; Linwood Pendleton, *The Economics of Using Ocean Observing Systems to Improve Beach Closure Policy*, 36 Coastal Mgmt. J. 165, 165-178 (2008).

[5] Liesl Tiefenthaler, et al., *Levels and Patterns of Fecal Indicator Bacteria in Stormwater Runoff from Homogenous Land Use Sites and Urban Watersheds*, 9 J. Water and Health 279 (2011); Rachel Noble, et al., *Storm Effects on Regional Beach Water Quality Along the Southern California Shoreline*, 1 J. Water Health 23 (2003) (finding that storms increase fecal bacteria loadings in areas adjacent to urban runoff outlets).

[6] Given, et al., *supra* note 2

[7] Given, et al., *supra* note 2.

through October) the study estimated that between 579,000 and 1,224,000 cases of gastroenteritis were caused by water contamination at Los Angeles County and Orange County beaches.

When bathers become ill with gastroenteritis, it may result in direct financial costs to them and to society. For instance, bathers may miss work if they get sick or their children become ill from exposure to contaminated water. Bathers may also visit their physician or an emergency room and they may have to buy medicine to treat their illness. In 2005, economists surveyed beachgoers who reported getting ill and found that those who reported suffering from gastroenteritis on average incurred economic costs of $33.35 in lost wages, doctor's fees, and related expenses.[8] Using this figure, the study estimated that gastroenteritis caused by waterborne bacteria and viruses in the beach waters of Los Angeles and Orange Counties cost beachgoers between $21 and $51 million in 2000 (depending on the epidemiological model used to estimate the incidence of gastroenteritis).[9] In Los Angeles County alone, these illnesses may have resulted in between $14.2 and $35.1 million during 2000 with a cost of between $13.1 million or $28.8 million occurring in the dry season alone. For Orange County, another study used data on illnesses, medical costs, and mean annual salaries of Orange County

[8] Dwight, et al., *supra* note 2.

[9] Given, et al., *supra* note 2.

residents to assess the economic impacts of exposure to polluted recreational marine waters contaminated by fecal bacteria.[10] The study estimated that the economic burden per person for various illnesses amounts to $36.58 for each gastrointestinal illness, $76.76 for each acute respiratory disease, $37.86 per ear ailment, and $27.31 per eye ailment. Further, it is estimated that exposure to polluted water at two Orange County beaches, Newport and Huntington, results in an average of 36,778 gastroenteritis cases per year, and an expected 38,000 cases of other illness types. This results in an estimated public health burden of $3.3 million per year for these two Orange County beaches alone.[11]

Extending this analysis to the nation as a whole by using swim advisories collected by the Environmental Protection Agency, economists found that each year over 5 million cases of gastroenteritis may be caused by swimming at contaminated beaches in the United States with a health care cost of over $300 million annually.[12]

Furthermore, water quality improvements increase beach attendance and the corresponding

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[10] Dwight, et al., *supra* note 2.

[11] Dwight, et al., *supra* note 2.

[12] Erin P. Ralston, et al., *An Estimate of the Cost of Acute Health Effects from Food- and Water-Borne Marine Pathogens and Toxins in the USA*, 9 J. Water and Health 680, 680-694 (2011).

economic benefit to individuals and communities, while contamination by bacteria decreases attendance and value of the beach. One method for estimating the effect of water quality contamination on beachgoer choices is to conduct a statistical analysis of how water quality and other factors determine which beaches beachgoers choose over the course of a year and how they trade off travel costs with better water quality. Researchers employed this method in Southern California and found that the number of beach visits decline when human pathogens and bacteria contaminate beach water.[13] These same researchers also found that beachgoers would have been willing to pay (if they had to) in order to prevent such contamination – a standard economic measure for economic harm. For example, if beach water quality at Zuma Beach in Los Angeles County declined to levels that would receive an F rating (on the Heal the Bay beach report card scale), it would have a negative economic impact of over $5 million on the economic wellbeing of beachgoers.[14] Furthermore, beachgoers elsewhere have been shown to be willing

[13] Michael Hanemann, et al., Welfare Estimates for Five Scenarios of Water Quality Change in Southern California (2005). A report prepared for NOAA's Southern California Beach Valuation Project (http://coastalsocioeconomics.noaa.gov/core/scbeach/welfare_estimates.pdf).

[14] *See id*.

to pay $28 just to have one fewer beach water contamination advisory annually.[15]

Coastal contamination by human pathogens has a significant adverse public health impact that has been estimated to be a significant cost to the beachgoer and to the adjacent communities.

C. Polluted storm water has a significant negative economic impact beyond coastal contamination.

Storm water conveys many types of pollutants to surface waters, including bacteria and heavy metals, and it adversely affects the chemical and physical integrity of surface water by, for example, lowering dissolved oxygen, altering pH, and increasing total suspended solids in those receiving waters. The decline in water quality from polluted storm water has a substantial economic impact. Economists looking generally at the U.S. Environmental Protection Agency's water quality ratings found a direct correlation

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[15] Chris Murray, et al., *Valuing Water Quality Advisories and Beach Amenities in the Great Lakes*, 37 Water Resources Res. 2583 (2001); Janne E. Vesterinen, et al., *Impacts of Changes in Water Quality on Recreation Behaviour and Benefits in Finland*, 91 J. Envtl. Mgmt. 984, 984-994 (2010); Hakan Eggert and Bjorn Olsson, *Valuing Multi-Attribute Marine Water Quality*, 33 Marine Pol'y 210, 210-216 (2009); and Nick Hanley, et al., *Valuing the Benefits of Coastal Water Quality Improvements Using Contingent and Real Behavior*, 24 Envtl. and Resource Econ. 273, 273-285 (2003). These studies find similar results for beachgoers in Europe.

between declining water quality and economic impact. The 2008 study found that water quality degradation in inland waters of the U.S. resulted in a loss of economic value of $20 billion from 1994 to 2000.[16]

The economic effects of polluted storm water on housing values have also been studied. A 2000 study, for example, found that higher levels of fecal coliform significantly depressed property values of waterfront homes. The study further found a change in fecal coliform bacteria count of 100 units/100 ml led to a change in average home value of between $5,000 and $10,000 for homes near the Chesapeake Bay in Anne Arundel County, Maryland.[17] A similar study found in 2004 that improvements in water clarity as a result of upstream storm water management could add 3-15% to the value of adjacent land.[18] These studies exemplify the varied economic consequences from polluted storm water and the types of economic benefits that may accrue from implementing storm water controls.

[16] W. Kip Viscusi, et al., *The Economic Value of Water Quality* 41 Envtl. Resource Econ. 169 (2008).

[17] Christopher G. Leggett and Nancy E. Bockstael, *Evidence of the Effects of Water Quality on Residential Land Prices*, 39 J. Envtl. Econ. Mgmt. 121 (2000).

[18] John B. Braden and Douglas M. Johnson, *Downstream Economic Benefits from Stormwater Management*, 130 J. Water Resources Plan. Mgmt. 498 (2004)

CONCLUSION

Polluted storm water is harmful to public health and imposes significant costs on a variety of sectors. The amicus believes that substantial economic costs may result from current pollutant loads, while reductions would decrease threats to public health and reduce negative economic impact.

Respectfully submitted,

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