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In Defense of Dirt: Applying Principles of Water and Natural Resources Law to Mississippi River Sediment Management

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I. INTRODUCTION

The Mississippi River is one of America's most astounding and powerful features, bifurcating the country as it flows 2,300 miles from its source in Minnesota before it ultimately empties from Louisiana into the Gulf of Mexico.[1] Its watershed extends far beyond its visible borders—which at some points can reach ten miles wide—incorporating waters from thirty-one states.[2] It is estimated that almost fifteen million people from over fifty cities rely on the Mississippi River for daily water supply.[3] However, a river is much more than just water. A river is the vegetation it sustains, the animals it contains, and the sediment it carries.

Sediment is as integral to a healthy river system as water.[4] However, the Mississippi River, the Mississippi Delta, and the country at large are experiencing a sediment deficiency primarily caused by human intervention in the natural processes of rivers.[5] Yet, current management schemes primarily regulate sediment as a waste product independent of the river and the wetlands the river supports.[6] Sediment as a material is crucial to developing the delta and surrounding environments.[7] This severe shortage has reached a critical level, thus

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1. Christine A. Klein & Sandra B. Zellmer, *Mississippi River Stories: Lessons from a Century of Unnatural Disasters*, 60 SMU L. REV. 1471, 1476 (2007).

2. *Id.*

3. *Mississippi River Facts*, NAT'L PARK SERV., https://www.nps.gov/miss/riverfacts.htm [https://perma.cc/L6ZE-LFZL] (Nov. 24, 2018).

4. *See generally* Richard Campanella, *Beneficial Use: Balancing America's (Sediment) Budget*, PLACES J. (Jan. 2013), https://doi.org/10.22269/130128 (discussing the important role sediment plays in major river systems).

5. *Id.* ("[M]any of our major river systems find themselves with too much sediment where we don't want it, and too little where we desperately need it."); *see, e.g.*, U.S. Army Corps of Eng'rs Kan. City Dist., *Missouri River Recovery Program Fact Sheet: Missouri River Sediment*, MO. STREAM TEAM, http://www.mostreamteam.org/Documents/Research/Big River/MissouriRiverSediment.pdf [https://perma.cc/RM6R-7TEK] (Sept. 2007) (noting that in 2007 the Missouri River only carried "20 to 25 percent of the pre-dam sediment load"). It is also noteworthy that the United States is not the only country confronting this ecological dilemma. Several countries, including South Africa, India, and Mexico, have experienced conflict due to a critical global sand shortage. Vince Beiser, *Why the World is Running Out of Sand*, BBC FUTURE (Nov. 17, 2019), https://www.bbc.com/future/article/20191108-why-the-world-is-running-out-of-sand [https://perma.cc/BXT8-8MPK].

6. *See* discussion *infra* Part III.

7. Daniel J. O'Toole, *Sediment Removal vs. Sediment Starvation: Is One Environmental Remedy Making Another Environmental Problem Worse*, EM, Apr. 2014, at 18, 19.

necessitating a reconception of existing sediment regulations. This Comment analyzes the applicability of principles from two fields of law to sediment management: water law and natural resources law.

Water law is distinctive from many other areas of law. First, it is unique because water, unlike most other independent focuses of the law, is a fundamental necessity for survival. Water's significance is not dictated by the ebbs and flows of economic markets or cultural trends. This means that, in the courtroom, the right to access and use water can simultaneously be both economically worthless and fundamentally priceless. Further, water law is unique because it attempts to impose societal limitations on nature. For example, much of water law is derived from property law principles.[8] Yet, water is not a plot of land—it is itinerant and transitory. Water is not simply an unruly neighbor—no amount of "no trespassing" signs will deter a river's flood. These nuances have influenced a complex evolution of water law over time in response to necessity and to societal demands.[9] However, water law presently fails to adequately incorporate the scientific developments that now inform our understanding of the geological and ecological aspects of water resources and river systems.[10]

Natural resources law is also complex and changing due to the deceptively controversial concept of what qualifies as a "natural resource."[11] Ostensibly commonsense inclusions or exclusions from the classification are ultimately a reflection of contextual value surrounding a given material. A resource's value can reflect extrinsic or intrinsic prioritizations. In other words, sometimes resources are valued due to their utility or impacts on production, and sometimes a resource's mere existence is deemed valuable.[12] Whether its value is due to consideration of economic worth or the result of a diminishing

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8. *See, e.g.*, Joseph W. Dellapenna, *Global Climate Disruption and Water Law Reform*, 15 WIDENER L. REV. 409, 413-15 (2010) (discussing how riparianism evolved with a view of water as common property while prior appropriation models understood water as private property).

9. Mark Davis, *A Toe in the Water: A Primer on Louisiana Riparian Law and Emerging Issues*, 56 ANN. INST. ON MIN. L. 261, 262 (2009).

10. *See, e.g.*, Robert Glennon, *The Disconnect Between Water Law and Hydrology*, *in* ARIZONA WATER POLICY 106, 106 (Bonnie G. Colby & Katharine L. Jacobs eds., 2007) (noting that many jurisdictions regard surface water and groundwater as separate entities instead of connected parts of a cohesive hydrologic cycle).

11. Tarek Majzoub & Fabienne Quilleré-Majzoub, *Is Water A Natural Resource in International Watercourses?*, 43 ENV'T L. REP. NEWS & ANALYSIS 10358, 10361 (2013).

12 Nick Hanley, *The Economic Value of Environmental Damage*, *in* ENVIRONMENTAL DAMAGE IN INTERNATIONAL AND COMPARATIVE LAW 27, 27 (Michael Bowman & Alan Boyle eds., 2002).

supply, a material's designation as a natural resource, and thus its treatment under the law, is anything but static. River sediment has not traditionally been considered a natural resource; rather, sediment was historically designated "spoil."[13] This nomenclature connotes a worthless waste material, illustrating the traditional value attributed to river sediment and the lens through which current regulations were drafted. However, the current ecological demand for sediment within rivers and along the coast has made it both ecologically and economically precious, rendering it deserving of reevaluation under the law.

The commentary from academics and scientists urges Louisiana and other states to revisit modern water law so that it better aligns with the present demands and the most current science.[14] This Comment proposes that sediment should be included in those discussions as an integral aspect of the river system. Further, as courtrooms are confronted with novel challenges in the face of unprecedented environmental issues, including Louisiana's disappearing coastline, traditional notions of natural resources law are adapting accordingly, albeit perhaps slowly.[15] This Comment proposes that river sediment and its increasing importance should also be considered as courts make decisions in this era of new environmental challenges. These proposals are largely independent of each other; the application of water and natural resources law to sediment management are connected in their objective to modernize sediment management through legal principles but are neither mutually exclusive nor necessarily linked in potential implementation. Further, under both areas of law, better sediment management can be read into existing law or integrated into new conceptions and applications.

Part II of this Comment provides an overview of the ecological role of sediment in the Mississippi River and its delta, the current status of these systems, and several impactful factors, both man-made and natural, that are responsible for sediment scarcity and deltaic land loss.

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13. *See* Oliver A. Houck, *Land Loss in Coastal Louisiana: Causes, Consequences, and Remedies*, 58 TUL. L. REV. 3, 31 (1983).

14. *See generally, e.g.*, Glennon, *supra* note 10, at 106 ("The failure to conform legal doctrine to hydrologic reality has profound and adverse consequences for river flows and riparian habitat . . . throughout the United States."); Davis, *supra* note 9, at 261 (urging lawmakers to bring water law into the twenty-first century in response to the environmental conditions of the Louisiana coastline and the reality of water as an increasingly scarce resource).

15. *See* discussion *infra* subpart V.B.2 (discussing recent developments in environmental standing and public trust law).

Part III examines the current system of sediment management applicable to the Mississippi River Basin and projects within it. Part IV explores the evolution and relevant nuances of water law, primarily the doctrine of riparianism, and proposes an application of such law to sediment management either through a change in interpretation or a change in the law itself. Finally, Part V discusses key policies and doctrines of natural resources law, with particular emphasis on recent case law developments and the government's authority and obligation to reassess river sediment's status and manage it accordingly.

II. THE ECOLOGICAL ROLE OF SEDIMENT IN THE MISSISSIPPI RIVER SYSTEM

The Mississippi River that is observable today represents just one iteration of the mighty, meandering river's myriad courses over the years.[16] While many believe the river's size, volume, and dynamic nature render it beyond containment, its perhaps inevitable future transformation does not prevent humans from trying to contain it.[17] For nearly 100 years, humans have attempted to restrict the powerful will of the river, primarily through feats of engineering and targeted policies.[18] Today, an intricate network of dams, levees, floodgates, and drainage canals facilitates a river system ostensibly subservient to human control.[19] However, as is frequently the case with early (and modern) efforts to solve one environmental problem, "successful control" of the Mississippi River has spawned a new problem: a serious disruption of the natural sediment transport system.[20]

Sediment plays a critical role in the ecological health of a river as well as the wildlife and wetlands it supports.[21] Suspended sediment within a stream directly determines the types of flora and fauna that are able to adapt and survive in that environment.[22] Further, sediment carried downstream is integral to preserving the nutrient composition

16. *Course Changes of the Mississippi River*, NAT'L PARK SERV., https://www.nps.gov/vick/learn/nature/river-course-changes.htm [https://perma.cc/N29Q-66T7] (May 30, 2018).

17. Houck, *supra* note 13, at 16.

18. Harley S. Winer, *Re-Engineering the Mississippi River as a Sediment Delivery System*, 2011 J. COASTAL RSCH. (SPECIAL ISSUE 59) 229, 230.

19. *Id.*

20. O'Toole, *supra* note 7, at 18-19.

21. *Id.* at 19.

22. *Id.*

necessary to sustain the water quality of marshes.[23] However, recognition of sediment importance is relatively new within the scientific community and thus not reflected in engineering or political controls of the river.[24]

This lack of recognition is poignantly demonstrated by dams. Reductions in sediment quality and quantity begin with sediment retention by dams erected throughout the Mississippi River Basin.[25] Dams represent one of "the greatest point source[s] of hydrologic disturbance to rivers. They alter the flow of water, sediment, nutrients, energy, and biota and also modify channel morphology, thereby interrupting and altering most of the river's important ecological processes."[26] Significant levels of silt, sand, and gravel that generally would naturally flow throughout a river system are often retained behind dams in reservoirs.[27] For perspective, the world's dams have collectively trapped "[b]illions of cubic yards of natural river-borne sediment."[28] Further, this is not an unintended consequence of dam construction but an explicit purpose of original dam designs.[29] This reflects the traditional belief that sediment is disruptive and not valuable. The sediment that accumulates behind dams should be sustainably managed, but instead, it is all too often pushed over the edge of the continental shelf to waters as deep as 4,000 meters.[30] At that point, not even the most advanced modern technology can reach this sediment.[31] Furthermore, streams, rivers, and wetlands downstream of dams are then deprived of sediment and the nutrients it provides.

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23. R. Eugene Turner & Nancy N. Rabalais, *Linking Landscape and Water Quality in the Mississippi River Basin for 200 Years*, 53 BIOSCIENCE 563, 569 (2003).

24. Jim Robbins, *Why the World's Rivers Are Losing Sediment and Why It Matters*, YALEENVIRONMENT360 (June 20, 2017), https://e360.yale.edu/features/why-the-worlds-rivers-are-losing-sediment-and-why-it-matters [https://perma.cc/SYZ5-PWX6].

25. Chris Paola et al., *Natural Processes in Delta Restoration: Application to the Mississippi Delta*, 3 ANN. REV. MARINE SCI. 67, 68 (2011).

26. GREGORY L. MORRIS & JIAHUA FAN, RESERVOIR SEDIMENTATION HANDBOOK 18.1 (1998) (citation omitted).

27. Robbins, *supra* note 24.

28. *Id.*

29. Winer, *supra* note 18, at 230. Although, trapped sediment is not ideal for reservoirs as it reduces storage "and eventually eliminates the capacity for flow regulation and with it all water supply and flood control benefits, plus those hydropower, navigation, recreation, and environmental benefits that depend on releases from storage." MORRIS & FAN, *supra* note 26, at 1.1. For more on reservoir-specific sediment management, see generally MORRIS & FAN, *supra* note 26.

30. Robert B. Spies et al., *An Overview of the Northern Gulf of Mexico Ecosystem*, 33 GULF MEX. SCI. 98, 99 (2016); Winer, *supra* note 18, at 231-32.

31. Winer, *supra* note 18, at 232.

The problem continues downstream with further human intervention. Even where the clear water released from dams harbors adequate power to generate new sediment through erosion, channelization prevents this process.[32] "[Channelization is] the group of engineering practices used to control flooding, drain wetlands, improve river channels for navigation, control stream-bank erosion and improve river alignment."[33] On the Mississippi River, channelization began in the early nineteenth century with levees intended to protect New Orleans from frequent flooding.[34] However, these early efforts were ultimately unsuccessful.[35] In 1937, catastrophic flooding throughout the Mississippi River Basin, including in New Orleans, left over one million people displaced.[36] Ten years earlier, Congress passed the Flood Control Act of 1928, and the construction of projects by the U.S. Army Corps of Engineers (USACE) to contain the river escalated.[37] By the mid-twentieth century, "a continuous wall extended along both sides of the river from above Baton Rouge to below New Orleans."[38] This pride of generations of engineers has rendered the Mississippi River more of "a superefficient pipeline channel" than a dynamic force of nature.[39] Although the walls and levees have served critical purposes over the years—namely preventing floods—they have also prevented the natural creation of new sediment through erosion.

Channelization disrupts not only the natural erosion processes of the river but also the natural deposition processes. What little sediment does enter the river funnels directly into large bodies of water, specifically the Gulf of Mexico.[40] In doing so, the sediment bypasses the wetlands that depend on deposition and also facilitates "the

32. O'Toole, *supra* note 7, at 19.

33. M. P. Brooker, *The Ecological Effects of Channelization*, 151 GEOGRAPHICAL J. 63, 63 (1985) (citation omitted).

34. Houck, *supra* note 13, at 18.

35. *See* Kristi Cheramie, *The Scale of Nature: Modeling the Mississippi River*, PLACES J. (Mar. 2011), https://doi.org/10.22269/110321 (describing the catastrophic flooding in New Orleans in 1937); Edward P. Richards, III, *The Hurricane Katrina Litigation Against the Corps of Engineers: Is Denial of Geology and Climate Change the Way to Save New Orleans?*, 40 U. ARK. LITTLE ROCK L. REV. 695, 703-05 (2018) (describing the levees' failure to prevent flooding during Hurricane Katrina).

36. Cheramie, *supra* note 35.

37. *Id.* ("It was as if the nation had declared war against the river: In the next decade, the Army Corps of Engineers built 29 dams and locks, hundreds of runoff channels, and over a thousand miles of new, higher levees.").

38. Houck, *supra* note 13, at 18.

39. Paola et al., *supra* note 25, at 68.

40. Houck, *supra* note 13, at 39.

development of algal blooms and declines in commercial and sport fish species" in the Gulf of Mexico.[41] When these algal blooms decompose, they consume oxygen, creating hypoxic or "dead zones" in the water that are unable to support marine life.[42] Furthermore, the type of algae that forms as a result of over-sedimentation in the Gulf produces toxins that can be harmful to human health through airborne exposure and shellfish consumption.[43]

The water quality and land loss problems caused by sediment deficiency and river manipulation are exacerbated by several man-made and natural influences beyond the complex river control system. For example, oil and gas industry activity has been a major contributor of deltaic land loss for decades.[44] Drilling operations along the Louisiana coast require the construction of "tens of thousands of access channels, navigation canals, pipeline ditches, spoil banks, borrow pits, levees, and subsurface extractions" throughout the delta.[45] An increase in canal surface area results in a direct loss of land in the deltaic plain.[46] The navigation industry provided pressure to prevent sediment accumulation in the riverbed because it can reduce access and clearance for vessels.[47] The navigation industry is also partially responsible for annihilation of the coast through the creation of canals and levee walls meant to maintain the river's course.[48]

Deltaic land loss is further accelerated by natural forces such as coastal subsidence and sea level rise.[49] Subsidence occurs naturally as the soft soils and peat that compose the Mississippi Delta shift and decay.[50] This process was historically counterbalanced by natural sediment accumulation through river deposition such that subsidence did not significantly contribute to deltaic land loss.[51] Today, dredging by the oil industry to form canals, as well as direct subsurface

41. *Id.*

42. *What Is a Dead Zone?*, NAT'L OCEAN SERV., https://oceanservice.noaa.gov/facts/deadzone.html [https://perma.cc/QP4U-5YKD] (Aug. 4, 2020).

43. *Gulf of Mexico/Florida: Harmful Algal Blooms*, NAT'L OCEAN SERV., https://oceanservice.noaa.gov/hazards/hab/gulf-mexico.html [https://perma.cc/X867-AL8K] (May 10, 2020).

44. Houck, *supra* note 13, at 24-71.

45. *Id.* at 24.

46. *Id.* at 33-34.

47. *See* MORRIS & FAN, *supra* note 26, at 1.1.

48. Houck, *supra* note 13, at 19, 22.

49. Although, today, subsidence and sea-level rise are both natural and man-made phenomena. *See id.* at 13.

50. *Id.*

51. *Id.*

extraction of oil and gas—and the water and earth that accompanies it—increases the rate of coastal subsidence beyond what would be sustainable even with an undisrupted sediment transport system.[52]

Finally, glacial melting and consequential sea level rise caused by global climate change has already converted, and will continue to convert, marsh into open water.[53] Ultimately, the culmination of these numerous causes is a sediment-starved river, a depleted sediment supply necessary for river health and shoreline reconstruction both within the Mississippi River watershed and beyond, and a deltaic plain disappearing at the rate of "an American football field every half hour."[54] "On maps, [Louisiana] may still resemble a boot. Really, though, the bottom of the boot is in tatters, missing not just a sole but also its heel and a good part of its instep."[55]

III. CURRENT MANAGEMENT OF RIVER SEDIMENT

It is perhaps unsurprising, though unfortunate, that the ecological importance of sediment seems to have little influence over current sediment management schemes. There is a well-acknowledged disconnect between the legal and scientific communities.[56] For example, water law in many jurisdictions regards surface water and groundwater as separate entities instead of connected parts of a cohesive hydrologic cycle.[57] Whether it is the consequence of this disconnect or not, in stark contrast with its liquid counterpart, the sedimentary component of a river is principally managed as a waste

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52. *Id.* at 55.

53. Michael D. Blum & Harry H. Roberts, *Drowning of the Mississippi Delta Due to Insufficient Sediment Supply and Global Sea-Level Rise*, 2 NATURE GEOSCIENCE 488, 489-90 (2009).

54. Winer, *supra* note 18, at 229.

55. Elizabeth Kolbert, *Louisiana's Disappearing Coast*, NEW YORKER (Mar. 25, 2019), https://www.newyorker.com/magazine/2019/04/01/louisianas-disappearing-coast [https://perma.cc/HAZ4-V43B].

56. *See generally, e.g.*, Hannah Reidenbaugh et al., The Disconnect Between Forensic Science and the Lawyers and Judges Who Represent It (2020) (Forensic Science and Law Program Graduate Student Research Poster, Duquesne University), https://dsc.duq.edu/cgi/viewcontent.cgi?article=1020&context=gsrs [https://perma.cc/6B9M-RT7Q] (providing support that forensic science is misrepresented in courtrooms due to a lack of understanding by lawyers and judges); Martin W. Doyle & Emily S. Bernhardt, *What Is A Stream?*, 45 ENV'T SCI. & TECH. 354, 358 (2011) ("The crux of the issue is that environmental policy and law depends on clearly defined boundaries that science cannot easily provide."); Kevin W. Saunders, *A Disconnect Between Law and Neuroscience: Modern Brain Science, Media Influences, and Juvenile Justice*, 2005 UTAH L. REV. 695 (discussing cases where judges reject the conclusions of modern neuroscience in assigning treatment of juvenile offenders).

57. Glennon, *supra* note 10, at 106.

material in accordance with the historical view that sediment is disruptive to the beneficial uses of a river.

River sediment is primarily regulated through federal statutes enforced by federal agencies. Dredging and sediment management are the responsibility of the USACE.[58] Traditionally, sediment whose removal was deemed necessary was simply disposed of in containment facilities.[59] More recently, there has been a movement to "use [dredged sediments] beneficially to deliver environmental, economic, and social benefits."[60] However, the Federal Standard for said "beneficial" management defined by the USACE is the disposal or placement alternative that is "the least costly."[61] In accordance with this standard, "[t]hree management alternatives for dredged material currently exist: open-water disposal, confined (diked) disposal, and beneficial use."[62] Of these three options, open-water disposal is usually considered the "least costly" method and thus is the most frequently utilized.[63] However, the evaluation that yields open-water disposal as the least costly option is short-sighted and embodies a narrow interpretation of "cost."

Financially, open-water disposal is a shortsighted option because it often results in the permanent loss of sediment over the edge of the

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58. BENEFICIAL USES OF DREDGED SEDIMENT, https://budm.el.erdc.dren.mil/ [https://perma.cc/66VP-VMLN] (last visited June 3, 2021).

59. *Id.*

60. *Id.*; *see also generally* M. C. Landin et al., *New Applications and Practices for Beneficial Uses of Dredged Materials*, *in* 1 DREDGING '94: PROCEEDINGS OF THE SECOND INTERNATIONAL CONFERENCE ON DREDGING AND DREDGED MATERIAL PLACEMENT 526 (E. Clark McNair, Jr. ed., 1994) (describing beneficial uses for dredged sediment).

61. U.S. ENV'T PROT. AGENCY & U.S. ARMY CORPS OF ENG'RS, EPA842-B-07-002, THE ROLE OF THE FEDERAL STANDARD IN THE BENEFICIAL USE OF DREDGED MATERIAL FROM U.S. ARMY CORPS OF ENGINEERS NEW AND MAINTENANCE NAVIGATION PROJECTS: BENEFICIAL USES OF DREDGED MATERIALS 2 (2007), https://www.epa.gov/sites/production/files/2015-08/documents/role_of_the_federal_standard_in_the_beneficial_use_of_dredged_material.pdf [https://perma.cc/8C8Z-VV6S].

62. SUSAN E. BAILEY ET AL., ERDC TN-DOER-D10, SUSTAINABLE CONFINED DISPOSAL FACILITIES FOR LONG-TERM MANAGEMENT OF DREDGED MATERIAL 1 (2010), https://erdc-library.erdc.dren.mil/jspui/bitstream/11681/8726/1/TN-DOER-D10.pdf [https://perma.cc/NX2Z-CHMS]. Open-water disposal describes the process of releasing dredged material into "riverine, lacustrine, estuarine, and marine environments [that] are basically bottom-surface areas with overlying volumes of water . . . by hydraulic pipeline, hopper, and mechanical dredges." U.S. ARMY CORPS OF ENGINEERS, DREDGING AND DREDGED MATERIAL MANAGEMENT 3-1 (2015). Confined disposal describes the process of hydraulically or mechanically placing dredged material in facilities specifically designed for its containment. *Id.* at 4-1. Beneficial use refers to a departure from "conventional placement practices" that aims to manage dredged material as a valuable resource. *Id.* at 5-1.

63. BAILEY ET AL., *supra* note 62, at 1.

continental shelf.[64] Even when it is deposited within reach for recollection, it is still a non-beneficial placement as the shallow waters of the Gulf of Mexico are not sediment deprived.[65] Meanwhile, coastal restoration projects cost millions of dollars, much of which can be attributed to dredging and transportation costs.[66] To illustrate, transporting sediment a mere five miles by pipeline can cost over $5 million in fuel alone.[67]

Therefore, the truly "least costly" method of sediment placement would be to anticipate the reuse of the dredged material and to beneficially utilize the sediment from the outset instead of disposing it in open water and later retrieving that same material or transporting material from a further distance at a higher cost because local sediment has been lost to irretrievable ocean depths. This is known as "dedicated dredging."[68] Dedicated dredging has proven to be successful at rebuilding shorelines in a cost-effective way.[69] For example, "in just a few months . . . , over 570 acres of new wetlands were created where previously stood three feet of salt water" as part of a dedicated dredging project located just downriver from New Orleans.[70]

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64. *See* discussion *supra* Part II.

65. *See* Campanella, *supra* note 4 ("Particles that once pulsated messily but beneficially from the continent's interior to its coasts now piled up uselessly behind locks and dams, or in the bedload of slackened currents. Or else they got jettisoned onto the continental shelf, sans any geomorphological or ecological benefit whatsoever.").

66. *See* F. RYAN CLARK ET AL., THE WATER INST. OF THE GULF, ASSESSING THE COST OF COASTAL LAND CREATION USING DREDGED MATERIAL 3 (2015), https://thewaterinstitute.org/assets/docs/reports/12_02_2016_Assessing-the-Cost-of-Coastal-Land-Creation-Using-Dredged-Material.pdf [https://perma.cc/3MAW-W38C]. However, dredging river sediment is not the only method for obtaining material for coastal restoration or other projects. Campanella, *supra* note 4. For example, dirt can be excavated from terrestrial surfaces; removed from borrow pits, road cuts, and channel or building excavations; and trapped in low-velocity riverbanks. *Id.* Nevertheless, all of these processes are expensive and require costly methods of transportation to deliver the necessary sediment to its final destination. *Id.*

67. CLARK ET AL., *supra* note 66, at 20. To move sediment longer distances, trucks, barges, and trains are utilized. Campanella, *supra* note 4.

68. Campanella, *supra* note 4.

69. *Id.*

70. *Id.* (describing the "federally funded, state administered Bayou Dupont Mississippi River Marsh Creation Project"). However, dedicated dredging is not an ultimate solution for increasing suspended river sediment levels or halting coastal land loss because it is only effective for the length of a specific project and "[a]ny long-term solution to the sediment budget problem cannot have a project end-date." *Id.* Nevertheless, dedicated dredging represents better sediment management and the least costly use of dredged material. Also, to clarify, this is an endorsement of directing sediment that would otherwise be disposed of to a sediment-deficient location, not removing sediment from an area where it is causing no disruption for the reconstruction of degrading shoreline or wetlands.

Dredged sediment dumping in the ocean is also federally regulated by the Marine Protection, Research, and Sanctuaries Act (MPRSA).[71] The MPRSA provides the USACE with the authority to "issue permits, after notice and opportunity for public hearings, for the transportation of dredged material for the purpose of dumping it into ocean waters, where . . . the dumping will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."[72] The determination of whether to issue a permit hinges on an assessment of the suitability of the disposal site.[73] The USACE considers factors such as the necessity of the dumping and the potential impact on humans, wildlife, and the disposal site.[74] This assessment is aimed at mitigating the impacts of dumping at an already selected site, not at finding the most beneficial location and method for dumping.[75]

Sediment treatment within the Mississippi River watershed is also federally regulated by the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), which prioritizes coastal wetlands conservation and restoration in Louisiana.[76] One of the authorized methods for restoration projects is "sediment and freshwater diversion."[77] Sediment diversion projects consist of opening a channel between a river and a degrading wetland to deliver sediment and nutrients.[78] However, due to dam retention and river channelization, the river water directed to the wetlands is starved of sediment. Therefore, modern sediment diversion projects, while beneficial to a point, do not mimic historic, natural processes and do not solve the baseline problem of sediment misuse and consequential deficiency.[79]

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71. 16 U.S.C. §§ 1431-45; 33 U.S.C. §§ 1401-45.

72. 33 U.S.C. § 1413(a).

73. *Id.*

74. *Id.* § 1412(a).

75. *Id.* §§ 1412(a), (c).

76. Coastal Wetlands Planning, Protection & Restoration Act, Pub. L. No. 101-646, §§ 303-04, 104 Stat. 4778, 4779-85 (1990) (amended 1996).

77. *Id.* § 302(6).

78. *Sediment Diversions*, RESTORE MISS. RIVER DELTA, http://mississippiriverdelta.org/restoration-solutions/sediment-diversions/ [https://perma.cc/69H8-N8EP] (last visited June 3, 2021).

79. *See* George Ricks, *Sediment Diversions Won't Save the Coast—And They'll Be Bad News for Fishermen*, LENS (Feb. 24, 2014), https://thelensnola.org/2014/02/24/sediment-diversions-wont-save-the-coast-and-theyll-be-bad-news-for-fishermen/ [https://perma.cc/2RDP-GZEB] ("Even if we could utilize every drop of the river's flow, we could only build . . . a quarter of what needs to be replaced just to break even. The problem . . . is that the river carries only a quarter of the sediment it had prior to the 1950s, and only half of that sediment gets past Baton Rouge.").

Despite the questionable effectiveness of sediment diversion projects, CWPPRA arguably remains a critical statute for protecting Louisiana's wetlands because of a single provision that extends the reach of the Act beyond Louisiana's borders. Section 303(d), "Consistency," mandates that:

> In implementing, maintaining, modifying, or rehabilitating navigation, flood control or irrigation projects, other than emergency actions, under other authorities, the Secretary [of the Army], in consultation with the Director [of the U.S. Fish and Wildlife Service] and the Administrator [of the Environmental Protection Agency], shall ensure that such actions are consistent with the purposes of the restoration plan submitted pursuant to this section.[80]

This section provides an actionable statutory directive that applies to any USACE project that could have impacts on Louisiana wetlands.[81] For example, it seemingly "require[s] that whatever permits [the USACE] might issue under 'other authorities' (presumably including the Clean Water Act) must also be consistent with the purposes of the coastal restoration plan."[82] It also demands collaboration between multiple agencies, which increases the possibility that the various important roles of sediment will be considered in project planning.[83] Thus, although CWPPRA is designed to conserve and restore wetlands specifically within Louisiana, the Consistency provision broadens the statute's scope and improves its effectiveness—at least in theory.

In practice, it is unclear what precisely is required by the Consistency provision of CWPPRA. First, because the section requires consistency with "the restoration plan submitted pursuant to this section,"[84] "one must . . . puzzle out what exactly constitutes said plan."[85] When CWPPRA was first enacted, this provision clearly referred to the restoration plan submitted annually by the CWPPRA-established Louisiana Coastal Wetlands Conservation and Restoration Task Force.[86] However, this annual practice ended in 1999.[87] Now, similar plans are instead developed in accordance with other acts such

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80. Coastal Wetlands Planning, Protection & Restoration Act § 303(d)(1).

81. Devin Lowell, Comment, *Ensuring Consistency: Louisiana Coastal Restoration Through the Lens of the RAM Terminal and the Mid-Barataria Sediment Diversion*, 27 TUL. ENV'T L.J. 299, 315-16 (2014).

82. *Id.*

83. *Id.* at 306-07.

84. Coastal Wetlands Planning, Protection & Restoration Act § 303(d)(1).

85. Lowell, *supra* note 81, at 316.

86. *Id.*

87. *Id.*

as the Water Resources Development Act of 2007 and the 2012 RESTORE Act.[88] To satisfy the objectives of CWPPRA, it would be ideal to require consistency with plans developed in accordance with both of these acts.[89] However, it is not explicitly clear that this is what CWPPRA actually mandates.

Further, CWPPRA provides very little guidance on what "consistency" entails.[90] Legal writing and case law on CWPPRA have done little to clarify this ambiguity.[91] The scale of projects affected by the Act has drastically increased since CWPPRA was enacted.[92] The ecological state of Louisiana's coast and wetlands has also drastically degraded since enactment. Thus, it is progressively more important that a definitive legal standard be established for parties to challenge USACE actions under the CWPPRA Consistency section. However, at this time, despite CWPPRA providing an enforceable statutory directive that would seemingly require better sediment management, its effectiveness in practice is questionable.

IV. THE RIGHT TO WATER OR THE RIGHT TO A RIVER?

A. The Evolution of American Water Law

Water law is generally understood as referring to the governance of freshwater use and control.[93] In the United States, there are two primary systems of water law: riparianism and prior appropriation.[94] Prior appropriation allocates rights in perpetuity to the first party to make an actual diversion of the water for beneficial use.[95] This doctrine is, at least in application, indifferent toward a user's impacts on others,

88. *Id.*; *see* Water Resources Development Act of 2007, Pub. L. No. 110-114, 121 Stat. 1041; RESTORE Act, Pub. L. No. 112-141, 126 Stat. 588 (2012).

89. Lowell, *supra* note 81, at 316.

90. *Id.* at 317.

91. *Id.* ("The law gives a tremendous lack of guidance when it comes to the definition of 'consistent.' Very little legal writing on the CWPPRA exists, and even fewer court decisions have occurred that might provide guidance on the interpretation of this consistency provision.").

92. *Id.*

93. Davis, *supra* note 9, at 261-62.

94. James M. Klebba, *Water Rights and Water Policy in Louisiana: Laissez Faire Riparianism, Market Based Approaches, or a New Managerialism?*, 53 LA. L. REV. 1779, 1785 (1993).

95. *Id.* at 1786.

even in cases of extreme drought.[96] Prior appropriation was primarily adopted by those drier states located west of the Mississippi River.[97]

For the historically water-rich states located east of the Mississippi River, water rights are based on the doctrine of riparianism.[98] Riparianism's roots run much deeper than prior appropriation, existing in some form as far back as Roman law.[99] However, even since its inception in American law, the doctrine has transformed several times. These evolutions were primarily influenced by necessity,[100] not by developments in hydrological understanding.[101]

The basic premise of riparianism is that the rights and privileges to use and enjoy water are "part and parcel" of land appurtenant to a natural body of water.[102] The doctrine draws heavily from property law[103] but differs by necessity due to water's fugitive nature and importance to so many aspects of human life.[104] American riparianism in its earliest form embodied what is known as the natural flow doctrine.[105] The natural flow doctrine allows for unlimited use and enjoyment of water by any riparian so long as that use does not disturb or diminish the natural flow of the watercourse.[106] Thus, the primary rationale behind traditional riparianism was conserving a standard of water quality and quantity within the stream or river.

However, the natural flow doctrine proved to be incompatible with industrialization, so riparianism evolved to a standard based on "reasonable use" of the water source.[107] The doctrine of reasonable use allows harm to the water, and accordingly to other riparian owners, so long as the harm is the result of a reasonable use.[108] The reasonableness

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96. *Id.*

97. *Id.* at 1785-86. *But see* Glennon, *supra* note 10, at 107 (noting that Arizona groundwater is governed by a riparian-based system).

98. Klebba, *supra* note 94, at 1785-86.

99. *Id.* at 1786.

100. Davis, *supra* note 9, at 261-62.

101. See discussion *supra* Part III regarding the disconnect between law and science.

102. Klebba, *supra* note 94, at 1788.

103. *See* Joseph W. Dellapenna, *The Evolution of Riparianism in the United States*, 95 MARQ. L. REV. 53, 53-54 (2011) (noting that many states integrated principles of community or public property to create systems of water law that better aligned with resource availability and uses).

104. Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445, 445-46 (2008).

105. Dellapenna, *supra* note 103, at 58.

106. Klebba, *supra* note 94, at 1788.

107. Davis, *supra* note 9, at 262.

108. RESTATEMENT (SECOND) OF TORTS § 850 (AM. L. INST. 1977). "Harm" in this instance is most frequently interference in "the right of a riparian proprietor to make a

of any given use is a discretionary determination influenced by several factors, including the purpose of the use, the economic value of the use, and the societal value of the use.[109] While there are not definitive categories of reasonable uses and unreasonable uses, courts have implemented a hierarchical system as well as a custom of acceptable reasonable uses. For example, natural uses are superior to artificial uses, and domestic uses, such as drinking and bathing, are superior to others.[110] Moreover, "fishing, swimming, recreation, and irrigation" are examples of recognized reasonable uses, albeit subordinate to domestic uses.[111] Another notable factor that influences the reasonableness of a use is the extent and amount of harm it causes.[112] Therefore, the evolution from natural flow riparianism to reasonable use riparianism preserved, although slightly diluted, the emphasis on protecting a certain standard of water quality and quantity for the benefit of other riparian owners.

Today, riparianism has been codified in most jurisdictions, representing another evolution of riparianism from common law reasonable use riparianism to regulated riparianism.[113] The key characteristic of regulated riparianism is the organization and enforcement of specific allocations and rights based on permit systems.[114] For example, the Louisiana Civil Code allows owners of estates that border water or through which water runs to "make use of" the water while it runs on or appurtenant to the estate.[115] While these statutes do not dictate any explicit restrictions on uses, they are nonetheless interpreted as being limited by a standard of reasonableness.[116]

B. Applying Principles of Water Law to Sediment Management

Water law's long history of evolution in response to necessity indicates its ability and imperative to evolve or to expand again. One consistent feature of riparianism, from the natural flow doctrine to the

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reasonable use of the water." *Id.* § 850 cmt. b. This interference can come in the form of a reduction in quantity or quality of the water. *Id.*

109. *Id.* § 850A.

110. Harris v. Brooks, 283 S.W.2d 129, 134 (Ark. 1955).

111. *Id.*

112. RESTATEMENT (SECOND) OF TORTS § 850A.

113. Dellapenna, *supra* note 103, at 85-86.

114. *Id.* at 60, 85-86.

115. LA. CIV. CODE art. 658 (2020); *see also id.* art. 657 (allowing an owner of land bordering on running water to "use it" for purposes such as watering his land).

116. Klebba, *supra* note 94, at 1798-99.

reasonable use standard to regulated riparianism, is a minimum standard of water quality and quantity associated with a riparian proprietor's use.[117] One reason water quality has persisted as a fundamental tenet of riparianism is because it is essential to support a river that can sustain a healthy ecosystem. Fishing, recreation, and enjoyment of natural scenery are all valuable benefits of a river recognized under American water law.[118] These uses all innately speak to rights and privileges beyond use of the water alone; the recognition of these benefits indicates that what a riparian is truly entitled to is a river, not just the water that flows between its banks.

Naturally then, sustainable sediment management is a necessary component to the preservation of riparian rights. Courts could apply this interpretation to existing riparian law to require responsible projects and river use. For instance, the anticipated levels of sediment retention for proposed dam construction or channelization could be required to meet a reasonableness standard based on the economic and societal value of the use, the harm of the use, and many other factors.[119] This application of water law to sediment management practices would not necessitate a radical reconceiving of riparianism but instead could be read into modern water law to align with the values ingrained in the reasonable use standard.

If the courts are unconvinced that current water law asserts a riparian right to a healthy river as opposed to just water of adequate quality, it does not eliminate the possibility for future inclusion of sediment standards in riparian rights. Because modern riparianism is predominantly codified, this method of water law application to sediment management would require legislative intervention.[120] Riparianism needs to adapt to modern scientific understandings and ecological realities. Though traditional riparianism may not have originally encompassed rights to a certain quality and quantity of river

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117. RESTATEMENT (SECOND) OF TORTS § 850A(e) (defining one factor for determining whether a water use is reasonable or unreasonable as "the extent and amount of the harm it causes"); Klebba, *supra* note 94, at 1788-89, 1798-99 (noting that the natural flow doctrine entitled riparian owners to an undiminished, unharmed stream and that, under Louisiana's current codified system of water regulation, courts have read in a standard of reasonableness that allows owners to withdraw what they need as long as it does not impede downstream owners).

118. Harris v. Brooks, 283 S.W.2d 129, 134 (Ark. 1955).

119. RESTATEMENT (SECOND) OF TORTS § 850A. Other relevant factors here include "the practicality of avoiding the harm by adjusting the use or method of use" and "the justice of requiring the user causing harm to bear the loss." *Id.* §§ 850A(f), (i).

120. Dellapenna, *supra* note 103, at 85-86.

sediment, it was conceived of during a time when environmental degradation was not as severe and many of the exacerbating causes of the sediment shortage were not as influential.[121] Now that scientific understanding has improved and the ecological backdrop has shifted, utilizing riparianism to require better sediment management would actually better align with the original application and values behind traditional, common law riparianism.

Riparianism is inherently an inclusive and communal doctrine that fosters cooperation. While the prior appropriation doctrine allows for the complete control of a quantity of water to the detriment of others, riparianism's principle of reasonable use is essentially a forced consideration of one user's impacts on others. The current management of sediment is shortsighted and uncollaborative. It prioritizes the removal of an immediate irritant without thought of how that removal will impact the rest of the river system or the value that unwanted sediment in one area could have somewhere else. Because sediment is an integral aspect of the river system, sediment management should reflect the foundational principles of riparianism instead of working against them.

V. A WASTE OR A RESOURCE?

A. What IS a "Natural Resource"?

In addition to the law that governs rights and privileges of riparian owners to use, enjoy, and control water as a commodity, water is also governed by federal natural resources laws, namely the National Environmental Policy Act (NEPA)[122] and the Clean Water Act (CWA).[123] NEPA is the preeminent law of natural resources protection in the United States, sometimes referred to as the "environmentalist Magna Carta."[124] One of NEPA's explicit purposes is "to enrich the understanding of the ecological systems and natural resources important to the Nation."[125] More specifically, NEPA established the Council on Environmental Quality "to develop and recommend to the President national policies to foster and promote the improvement of

121. *See* discussion *supra* Part II (discussing the significance of river containment efforts, the fossil fuel and navigation industries, and climate change to the unbalanced need for river sediment amidst an increasing national shortage).

122. 42 U.S.C. §§ 4321-70.

123. 33 U.S.C. §§ 1251-1376.

124. Citizens Against Burlington, Inc. v. Busey, 938 F.2d 190, 193 (D.C. Cir. 1991).

125. 42 U.S.C. § 4321.

environmental quality to meet the conservation, social, economic, health, and other requirements and goals of the Nation," among other duties.[126]

NEPA primarily imposes a procedural duty on federal agencies to develop an environmental impact statement (EIS) for all "major [f]ederal actions" that discusses alternate projects that will accomplish the intended purpose and plans to mitigate environmental harm.[127] However, because courts have interpreted NEPA as preventing substantive review of an EIS so long as the analysis is reasonable and meets the procedural prerequisites, there is no enforceable method of ensuring that a project is utilizing the most beneficial sediment management alternative.[128] As a result, many projects that have an impact on the natural river processes and affect proper sediment distribution hardly consider wider ecosystem impacts.[129] For example, the EIS for an action to enlarge "existing navigation channels in Atchafalaya River and Bayous Chene, Boeuf, and Black . . . to permit the passage of large offshore drilling rigs" only discussed the impact the project would have on salinity of the Atchafalaya Bay but said nothing of consequential subsidence, river water quality, or the natural distribution of sediment that is known to result from oil projects and operations.[130]

NEPA also stands apart in the law of natural resources because it is the only federal statute intended to regulate natural resources as a

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126. *Id.* §§ 4342, 4344(4). Additionally, within a year of signing NEPA, the President also called for the creation of the U.S. Environmental Protection Agency (EPA) to "enforce environmental protection standards" and to manage the nation's natural resources. Jack Lewis, *The Birth of EPA*, U.S. ENV'T PROT. AGENCY (Nov. 1985), https://archive.epa.gov/epa/aboutepa/birth-epa.html [https://perma.cc/6EQW-JAWC].

127. 42 U.S.C. § 4332(C); *see, e.g.*, Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 353 (1989) (noting that NEPA is primarily reliant "on procedural mechanisms—as opposed to substantive, result-based standards").

128. *Robertson*, 490 U.S. at 353 ("[I]t would be inconsistent with NEPA's reliance on procedural mechanisms—as opposed to substantive, result-based standards—to demand the presence of a fully developed mitigation plan . . . before an agency can act."); Strycker's Bay Neighborhood Council, Inc. v. Karlen, 444 U.S. 223, 227 (1980) (per curiam) ("NEPA, while establishing 'significant substantive goals for the Nation,' imposes upon agencies duties that are 'essentially procedural.' . . . NEPA was designed 'to insure a fully informed and well-considered decision,' but not necessarily 'a decision the . . . Court would have reached had they been members of the decisionmaking unit of the agency.'" (quoting Vt. Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 558 (1978))).

129. *See* U.S. Army Eng'r Dist., New Orleans, Environmental Statement: Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana 1, 14 (Jan. 1972) (draft environmental statement).

130. *Id.*

whole.[131] Otherwise, most natural resources are regulated by specialized statutes unique to the given resource.[132] For water, this is the CWA.[133] The CWA is actually a pollution control statute, as opposed to purely a natural resource conservation policy; however, the necessity for controlling the type of pollution regulated by the CWA stems from the recognition of fresh water as a valuable natural resource deserving of conservation and restoration.[134] The CWA is the framework for national water pollution control programs, establishing minimum water quality standards, requiring permits for the discharge of pollutants into waters of the United States, and outlining penalties for violators.[135] The corpus of the CWA is much more robust than NEPA, outlining measurable standards for effluent discharges and water quality.[136]

Yet, despite water's ostensibly obvious inclusion as a "natural resource" worthy of protection and management and sparking the development or application of these statutes, the classification is not as unequivocal as it may seem. Furthermore, water is not alone in provoking this ungrounded assumption, as the term "natural resource" seems to connote an indisputable meaning and material worth.[137] In fact, the very concept of a "natural resource" is in itself controversial.[138]

Much of the discord stems from "academic and semantic difficulties in defining 'resource,' and specifically 'natural resource.'"[139] For example, the Oil Pollution Act (OPA) defines "natural resources" as "land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States . . . , any State or local government or Indian tribe, or any foreign government."[140] This definition conditionalizes the classification of a material as a natural resource on its source of

131. *Natural Resources*, ENV'T L. INST., https://www.eli.org/keywords/natural-resources [https://perma.cc/8Y9K-Y3WJ] (last visited June 3, 2021).

132. *Id.* For example, timber is federally managed by the National Forest Management Act, and fisheries are managed by the Magnuson-Stevens Fishery Conservation Act. *Id.*

133. 33 U.S.C. §§ 1251-1376.

134. *See id.* § 1251(a) ("The objective of this [Act] is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.").

135. *See generally id.* §§ 1251-1376 (comprising the CWA).

136. *Id.*

137. Majzoub & Quilleré-Majzoub, *supra* note 11, at 10363.

138. *Id.* at 10359.

139. *Id.* at 10361.

140. 33 U.S.C. § 2701(20). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) similarly focuses on natural resources as a function of jurisdictional control. 42 U.S.C. § 9601(16).

governance. While many forms of water qualify as a natural resource under this definition, there are still many forms of water that are not subject to regulation by any jurisdiction, such as rainwater.[141] Thus, despite its explicit inclusion in OPA's definition, water is not invariably a natural resource according to this interpretation.

The legal community broadly defines a "natural resource" as "[a]ny material from nature having potential economic value or providing for the sustenance of life, such as timber, minerals, oil, water, and wildlife."[142] Here, a material's classification as a natural resource is intimately linked to its purposeful uses and potential benefit. However, purpose and benefit are influenced by cultural impressions and societal needs. Accordingly, a material's capacity to provide economic value or sustain life could transform over time. For instance, technological innovations can create demand for a material that did not previously carry economic value.[143]

Another way a material's value, economic or otherwise, could change is in response to a decline in supply. Consequently, the concept of scarcity is often associated with classifying natural resources. For example, the World Trade Organization (WTO) "define[s] natural resources as 'stocks of materials that exist in the natural environment that are both scarce and economically useful in production or consumption, either in their raw state or after a minimal amount of processing.'"[144] Thus, a diminishing supply of a material, such as the global sediment shortage, might demand a reevaluation of its classification as a natural resource.

The academic and semantic discourse prompts the conclusion that no material is innately a natural resource. Instead, natural resources are determined based on the value that is placed on them, influenced by context. Materials not previously classified as natural resources can become natural resources and vice versa. Ultimately, this classification is significant because, in addition to critical statutes such as NEPA and

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141. Although state ownership of rainwater has been discussed in Texas jurisprudence, it was ultimately rejected. Ross Crow, *Who Owns the Rain? Diffused Surface Water, State Water, and Rainwater Harvesting in Texas*, 49 TEX. ENV'T L.J. 1, 3-6 (2019).

142. *Natural Resource*, BLACK'S LAW DICTIONARY (11th ed. 2019).

143. For example, wind and solar energy were not monetizable until harnessing technology was developed.

144. Marc Bacchetta et al., World Trade Org. Secretariat, *World Trade Report 2010: Trade in Natural Resources* 46 (2010), https://www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report10_e.pdf [https://perma.cc/RH5F-WNL9].

the CWA, important doctrines are applied to natural resources that do not extend otherwise, including the public trust doctrine.

B. The Public Trust

1. Overview of the Public Trust, Equal Footing, and Paramount Interest Doctrines

The public trust doctrine represents a fundamental tenet of governmental authority and responsibility with roots in Roman civil law.[145] The doctrine imposes an inherent obligation on a sovereign to protect certain resources for public use.[146] The public trust doctrine is classically applied to ensure that tidal waters of the United States are secured for the public to use for navigation and fishing.[147] However, the public trust doctrine extends to resources beyond tidal or navigable waters, including "running water . . . [and] the seashore."[148] The public trust doctrine is also applied broadly to "essential natural resources."[149] Under this application, the sovereign's duty prohibits it from "depriving a future legislature of the natural resources necessary to provide for the well-being and survival of its citizens."[150] Most commonly, this means that the sovereign is restricted from conveying ownership of resources protected by the trust to private parties unless such ownership is conveyed subject to the trust.[151]

The public trust doctrine is often described as a matter of exclusively state law.[152] This notion likely stems from the fact that authority of navigable waters subject to the public trust were allocated to states according to the equal footing doctrine.[153] The equal footing doctrine describes the principle that governed the conveyance of land

145. PPL Mont., LLC v. Montana, 565 U.S. 576, 603 (2012).

146. Juliana v. United States, 217 F. Supp. 3d 1224, 1253 (D. Or. 2016), *rev'd*, 947 F.3d 1159 (9th Cir. 2020).

147. *PPL Mont., LLC.*, 565 U.S. at 603.

148. *Juliana*, 217 F. Supp. 3d at 1253 (quoting J. INST. 2.1.1 (J. B. Moyle trans., 4th ed. 1906)).

149. *Id.*

150. *Id.* (quoting Brief for Global Catholic Climate Movement & Leadership Council of Women Religious as Amici Curiae Supporting Plaintiffs at 3, *Juliana*, 217 F. Supp. 3d 1224 (No. 6:15-cv-01517-TC)).

151. *See, e.g.*, Ill. Cent. R.R. Co. v. Illinois, 146 U.S. 387, 460 (1892) (holding that "cession of the ownership and control of the State [of Illinois] in and over the submerged lands in Lake Michigan" would violate the duties imposed by the public trust doctrine); Glass v. Goeckel, 703 N.W.2d 58, 62 (Mich. 2005) (holding that a private owner's littoral rights to property abutting Lake Huron were necessarily conveyed subject to the public trust).

152. *PPL Mont., LLC.*, 565 U.S. at 603.

153. *Juliana*, 217 F. Supp. 3d at 1256.

from the federal government to all states except for the original thirteen.[154] The principle holds that the Constitution of the United States confers to each state "'the absolute right to all their navigable waters and the soils under them,' subject only to rights surrendered and powers granted by the Constitution to the Federal Government."[155] However, it is not always explicitly clear which rights were surrendered, which powers were granted, and which immunities may impact how such rights and powers may be exercised.

Additionally, a statement in the United States Supreme Court case *PPL Montana, LLC v. Montana* has been interpreted to designate public trust doctrine duties strictly to states.[156] The issue in that case was whether the state or federal government had title over specific riverbeds—a determination that hinged on the interpretation and application of the public trust and equal footing doctrines—because if title belonged to Montana, then the state was entitled to compensation for hydroelectric projects utilizing the rivers.[157] The Court stated that, "[u]nlike the equal footing doctrine, . . . which is the constitutional foundation for the navigability rule of riverbed title, the public trust doctrine remains a matter of state law, subject as well to the federal power to regulate vessels and navigation under the Commerce Clause and admiralty power."[158] This conception of the equal footing doctrine's influence on the public trust doctrine suggests immunity for the federal government or a limitation on liability for violating its duties to protect trust assets.

2. In the Courts: Contemporary Challenges to Protect the Public Trust

Two recent cases have transformed the character of government responsibility according to the public trust doctrine within the courts. First, in *Massachusetts v. EPA*, the Massachusetts alleged that the "[EPA] ha[d] abdicated its responsibility under the Clean Air Act to regulate the emissions of four greenhouse gases," predominantly through laxed emissions regulations.[159] The case became center stage for the hotly contested issue of environmental standing. On the first

154. *PPL Mont., LLC.*, 565 U.S. at 590-91.
155. *Id.* at 590 (quoting Martin v. Lessee of Waddell, 41 U.S. (16 Pet.) 367, 410 (1842)).
156. *Juliana*, 217 F. Supp. 3d at 1256-57; *PPL Mont., LLC.*, 565 U.S. at 603.
157. *PPL Mont., LLC.*, 565 U.S. at 580-81.
158. *Id.* at 603-04 (citations omitted).
159. 549 U.S. 497, 505 (2007).

element of standing, injury-in-fact, the State alleged that the "rising seas have already begun to swallow Massachusetts' coastal land."[160] Ultimately, the Court found that Massachusetts had standing to assert a claim against the EPA based on its alleged injury.[161] This is significant because the Court recognized a disappearing shoreline as an injury sufficient to establish standing, a hurdle that often prevents environmental cases from receiving a trial on the merits. A notable nuance of this case is that the Court decided that it was "of considerable relevance that the party seeking review . . . [was] a sovereign State and not . . . a private individual," ultimately giving Massachusetts a "special position and interest" for purposes of challenging the insufficiency of governmental regulations in court.[162]

More recently, in the groundbreaking youth climate change lawsuit *Juliana v. United States*, a collection of young environmental advocates alleged that the federal government violated its duties under the public trust doctrine by "permit[ting], encourag[ing], and otherwise enabl[ing] continued exploitation, production, and combustion of fossil fuels," consequently irreparably damaging the atmosphere.[163] The critical import of the *Juliana* case is twofold. First, the case, alleging violation of public trust duties, was brought against the federal government as opposed to a state.[164] While the defense attempted to refute the notion that public trust claims could be brought against the federal government, the district court concluded that the statement in *PPL Montana* was made in the vacuum of a case involving only state trust assets but did not necessarily preclude a federal obligation under the public trust doctrine in relation to federal trust assets.[165] This holding expands the possibility of challenges to inadequate management by the federal government of natural assets, including potentially river sediment.

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160. *Id.* at 522.

161. *Id.* at 526.

162. *Id.* at 518.

163. Juliana v. United States, 217 F. Supp. 3d 1224, 1233 (D. Or. 2016) (quoting First Amended Complaint for Declaratory & Injunctive Relief at 2, *Juliana*, 217 F. Supp. 3d 1224 (No. 6:15-cv-01517-TC)), *rev'd on other grounds*, 947 F.3d 1159 (9th Cir. 2020) (reversing for lack of Article III standing).

164. *Id.*

165. *Id.* at 1256-69; *see also* City of Alameda v. Todd Shipyards Corp., 635 F. Supp. 1447, 1450 (N.D. Cal. 1986) (restricting the federal government's ability to reject a trustee's interest in land when the federal government acquires the land by condemnation); United States v. 1.58 Acres of Land Situated in Bos., 523 F. Supp. 120, 124-25 (D. Mass. 1981) (stating that private citizens may still have an interest in land when the federal government takes their property).

Second, the *Juliana* case is just one of many recent cases alleging the government "violated their duties as trustees by nominally retaining control over trust assets while actually allowing their depletion and destruction, effectively . . . excluding the public from use and enjoyment of public resources."[166] Emerging environmental realities increasingly establish a heightened duty for the sovereign, be it a state or federal government, not just to maintain a level of proprietorship over trust resources but to conserve and ensure sustainable use of those resources such that they will persist for the benefit of future generations. However, if nominal retention is insufficient control of trust assets, the question becomes, what affirmative obligation is required by the public trust doctrine?

The answer is contained in the paramount interest doctrine, which asserts that a sovereign must administer the trust "in furtherance of that trust and . . . not block the advancement of . . . paramount interests."[167] Of course, the concept of "paramount interests" is indefinable and is essentially a reflection of contextual values in the same way that "natural resource" is semantically meaningless without a backdrop of cultural and societal influences.[168] At the very least, the use of navigable waters for commerce, travel, recreation, and the enjoyment of scenic beauty have all been found to be of paramount interest.[169] Additionally,

166. *Juliana*, 217 F. Supp. 3d at 1254; *see, e.g.*, Alec L. v. Jackson, 863 F. Supp. 2d 11, 12 (D.D.C. 2012) ("seeking declaratory and injunctive relief for [the EPA's] alleged failure to reduce greenhouse gas emissions" as a violation of its "fiduciary duties to preserve and protect the atmosphere as a commonly shared public trust resource under the public trust doctrine"), *aff'd*, 561 Fed. App'x 7 (D.C. Cir. 2014); Sanders-Reed *ex rel.* Sanders-Reed v. Martinez, 2015-NMCA-063, ¶ 1, 350 P.3d 1221, 1222 ("seeking a judgment declaring, among other things, that the common law public trust doctrine imposes a duty on the State to regulate greenhouse gas emissions in New Mexico"); Kanuk *ex rel.* Kanuk v. State, Dep't of Nat. Res., 335 P.3d 1088, 1090 (Alaska 2014) ("claim[ing] that the State has violated its duties under the Alaska Constitution and the public trust doctrine by failing to take steps to protect the atmosphere in the face of significant and potentially disastrous climate change"); Chernaik v. Kitzhaber, 328 P.3d 799 (Or. Ct. App. 2014) (seeking "a declaration that [the State of Oregon and Oregon's governor] 'have violated their duties to uphold the public trust and protect the State's atmosphere as well as the water, land, fishery, and wildlife resources from the impacts of climate change'").

167. Village of Menomonee Falls v. Wis. Dep't of Nat. Res., 412 N.W.2d 505, 514-16 (Wis. Ct. App. 1987).

168. *See* discussion *supra* subpart V.B.

169. Melissa Kwaterski Scanlan, *The Evolution of the Public Trust Doctrine and the Degradation of Trust Resources: Courts, Trustees and Political Power in Wisconsin*, 27 ECOLOGY L.Q. 135, 153, 159 (2000).

maintaining the ecological integrity of a public trust resource has been held as a right within the public trust doctrine.[170]

C. Applying Principles of Natural Resources Law to Sediment Management

The distinction between waste and resource is not black and white. For example, consider methane, colloquially known as natural gas, released during oil extraction.[171] This environmentally harmful gas is simultaneously a waste material as well as a valuable resource, which, in many states, is the direct objective of extraction processes such as fracking.[172] In an effort to manage this byproduct of oil extraction, methane is frequently burned in a process known as flaring, which converts the gas to carbon dioxide, a less harmful but still incredibly damaging greenhouse gas.[173] It is estimated that more than $30 billion of natural gas that could otherwise be captured and sold is lost to flares annually.[174] While shocking, this destructive and seemingly impetuous disposal of a valuable commodity illustrates the fine line between waste and resource, thus mirroring the current imprudent management of river sediment.

River sediment should be considered a natural resource for purposes of law and protected as a public trust asset. These conclusions are intimately connected and slightly cyclical in formation. This is to say, several natural resources laws in the United States emphasize classification as a public trust asset as a critical factor in the determination of a natural resource.[175] Yet, the public trust can also be broadly construed as protecting essential natural resources.[176] Thus, the argument could also be made that sustainable sediment management is necessary for the government to fulfill its duties under the public trust

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170. *See, e.g.*, Sterlingworth Condo. Ass'n v. State, Dep't of Nat. Res., 556 N.W.2d 791, 794-95, 797 (Wis. Ct. App. 1996) (second alteration in original) (holding that activity that "adversely impact[ed] water quality . . . by disturbing sedimentation and increased turbidity" such that local flora and fauna would be damaged in a bay violated the rights of the public).

171. Barry Rabe et al., *Taxing Flaring and the Politics of State Methane Release Policy*, 36 REV. POL'Y RSCH. 6, 7 (2020).

172. *Id.*

173. *Id.* (noting that methane "possesses between 28 and 36 times the global warming potential of carbon dioxide per molecule during its first century in the atmosphere").

174. *Id.*

175. *See* discussion *supra* Part IV.

176. Juliana v. United States, 217 F. Supp. 3d 1224, 1253 (D. Or. 2016), *rev'd*, 947 F.3d 1159 (9th Cir. 2020).

doctrine, indicating that sediment meets the standards for classification as a natural resource.

Ultimately, the determination is a question of necessity and value. As previously discussed, river sediment is an increasingly scarce commodity.[177] This is true within the river's flow, along the shoreline, and outside of the Mississippi River watershed altogether. As the WTO's definition of a natural resource illuminates, scarcity can be a dispositive factor in a material's classification.[178]

Moreover, river sediment is valuable in many senses. It is ecologically valuable to the water quality of the Mississippi River and to the formation and health of the related wetlands and Louisiana coast.[179] Further, it is becoming more ecologically valuable every day as the river becomes more starved of sediment and the rate of deltaic land loss increases. Sediment is also economically valuable because it is costly to transport sediment for shore and wetlands restoration projects.[180]

Even if the law is hesitant to broadly accept sediment as a natural resource or public trust asset, treatment of sediment specifically in the Mississippi River watershed should still be managed by the government under its public trust duties because of sediment's inherent connection to the seashore.[181] The seashore is one of only a few explicitly mentioned assets that have always been considered within the domain of the public trust.[182] Documentation of the astounding rate at which the Louisiana coast is disappearing has been available for years with few affirmative changes to sediment management by the government.[183] This is a violation of the government's inherent responsibility as sovereign to protect the seashore for present and future beneficial use by the public.[184]

One barrier to applying natural resources law to sediment management is that present regulatory schemes are primarily

177. *See* discussion *supra* Part II.

178. Bacchetta et al., *supra* note 144, at 46.

179. *See* discussion *supra* Part II.

180. CLARK ET AL., *supra* note 66, at 20.

181. *See* discussion *supra* Part II (discussing the role of river sediment in the health and development of wetlands and the coastline).

182. Juliana v. United States, 217 F. Supp. 3d 1224, 1253 (D. Or. 2016) (quoting J. INST. 2.1.1 (J. B. Moyle trans., 4th ed. 1906)), *rev'd*, 947 F.3d 1159 (9th Cir. 2020).

183. *See generally* Houck, *supra* note 13 (discussing causes, consequences, and remedies for coastal land loss in Louisiana in the early 1980s); discussion *supra* Part III (discussing the current management of river sediment).

184. *See Juliana*, 217 F. Supp. 3d at 1253.

disseminated and enforced by the federal government.[185] Thus, the State could take affirmative action to restore the seashore or allow a more natural flow of sediment throughout the river in accordance with public trust duties, but, without changes to federal regulation, these efforts would likely be inconsequential or perhaps even preempted. Not to mention, the Mississippi River watershed extends far beyond just Louisiana, and therefore this problem cannot be adequately resolved through purely single-state intervention.

However, the holdings in recent environmental cases, such as *Juliana*, confirming that the federal government also bears public trust responsibilities hold promise and suggest that necessary action should begin at the federal level. However, the *Juliana* case was recently overturned, albeit on a basis independent of the ability to assert a public trust claim against the federal government.[186] Nonetheless, this development is problematic for private parties asserting public trust violations against the federal government. However, Louisiana could also challenge the USACE Federal Standard and current sediment management practices as a sovereign. Based on the precedent set in *Massachusetts*, a challenge by the State might avoid legal barriers that private parties or organizations may not be able to overcome.[187]

Improved sediment management could occur under both NEPA and the CWA. Under NEPA, the impacts of projects on the natural processes of sediment erosion, dispersal, and ultimate deposition should be a required area of discussion in EISes. Although courts could not mandate that a particular alternative is utilized (e.g., disposal method of dredged material),[188] they could require expanded analysis of impacts and require a showing of reasonableness within the decision. Of course, NEPA only applies to federal agency actions.[189] Thus, any action by the USACE would fall under this requirement, but activity

185. *See, e.g.*, 33 U.S.C. §§ 1251-1376; 42 U.S.C. §§ 4321-70; Costal Wetlands Planning, Protection, & Restoration Act, Pub. L. 101-646, 104 Stat. 4778 (1990) (amended 1996).

186. *Juliana*, 947 F.3d at 1165. The United States Court of Appeals for the Ninth Circuit held that the plaintiffs' claims lacked the possibility for adequate redressability necessary to establish Article III standing. *Id.* Instead, the court suggested that the plaintiffs alleged injuries were legitimate and serious but demanding of legislative, as opposed to judicial, action. *Id.* at 1175. One might argue that redressability would similarly present a challenging obstacle in any public trust claim against the federal government and therefore represents an immunity against liability despite a violation of its duties.

187. *See* 549 U.S. 497, 518 (2007).

188. Strycker's Bay Neighborhood Council, Inc. v. Karlen, 444 U.S. 223, 227 (1980) (per curiam).

189. 42 U.S.C. § 4332.

by private oil and gas companies, for instance, would not. However, oil and gas leases and permits are typically administered by the USACE, and that action would also have to meet NEPA procedural requirements.[190]

There is a strong argument that better sediment management would fit seamlessly into the CWA because there are already provisions requiring reasonable use of dredged material.[191] Section 404 of the CWA vests the authority to authorize permits "for the discharge of dredged or fill material" with the USACE.[192] These permits could be contingent upon the reasonable and beneficial use of dredged sediment (and accordingly responsible dredging projects to begin with) in keeping with the USACE's Federal Standard.

VI. CONCLUSION

The current sediment deficiency and rate of deltaic land loss within the Mississippi River Basin does more than encourage a reconsideration of sediment management law; it demands it. There are several potential policy or engineering approaches to solving this issue, but the treatment of river sediment under the law can and should be reevaluated. Water and natural resources are still heavily governed by court-created principles of law such as riparianism and the public trust doctrine. Thus, the courts are in a unique position of power to influence sediment management through either or both of these areas of law and consequently the ongoing health of the ecosystems sustained by the Mississippi River.

It would perhaps be shocking to discuss the long-term effects to the natural and human ecosystems that rely on the Mississippi River and Delta for survival if no changes to sediment management are made, but the present realities and short-term effects are pressing enough that there is no need for such predictions. The river is starved of sediment, the Gulf is hosting toxic algae blooms, and the delta is disappearing. People are losing their homes and species are going extinct while

190. *See, e.g.*, NRDC v. Morton, 458 F.2d 827, 830, 834 (D.C. Cir. 1972) (holding that a NEPA EIS that includes a "discussion of the environmental consequences of the suggested alternative" is required for the sale of oil and gas leases by the government (quoting Defendant's Memorandum of Points & Authorities at 8, *NRDC*, 458 F.2d 827 (No. 71-2031)).

191. *See* Houck, *supra* note 13, at 128 ("The one federal program most adapted for the problem in its scope, in its process, and in the types of considerations required by Congress, is the regulation of dredging and filling in 'waters of the United States' under section 404 of the [CWA].").

192. 33 U.S.C. §§ 1344(a), (d).

engineers and lawmakers scramble in reaction to the consequences of shortsighted regulations without addressing the underlying issue. Proper sediment management is not a political issue. It is the right of riparian landowners. It is an obligation of the government. It is a matter of survival for a rich ecosystem and the people who call coastal Louisiana home. It is the least that must be done to ensure these same rights for future generations.