DAM REMOVAL AS CLIMATE CHANGE POLICY: HOW SUPPLEMENTAL ENVIRONMENTAL PROJECTS COULD BE USED TO REDUCE METHANE EMISSIONS

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I. INTRODUCTION

As many in the scientific community have been predicting for decades, significant climatic changes are occurring around the globe. These changes are compelling local communities to continue the process of building resilience in preparation for more intense weather events and shifts in water availability and growing seasons. While many of these changes will continue to intensify regardless of whether policy is enacted to reduce greenhouse gas emissions, efforts are underway at the domestic and international level to reduce total emissions. Most of these efforts are focused on the energy and transportation sectors, as these make up a large portion of the world's greenhouse gas contributions.[1] However, creative solutions to this pressing problem must include a wide array of options.

This article seeks to add to this list by proposing the systematic removal of small, non-energy producing dams and obstructions using existing programs implemented by the federal government. The removal of methane-producing structures, by violators of Clean Air Act regulations, could be done using the current U.S. Environmental Protection Agency's Supplemental Environmental Project (SEP) structure. While energy-producing hydroelectric dams can and should continue to be used and improved as sources of relatively clean power to continue the transition away from fossil fuels, thousands of small dams and artificial obstructions located on rivers and streams throughout the country are emitting greenhouse gases without providing a significant amount of local benefit.

This article seeks to first discuss the role of methane in the context of global climate change. After discussing the impacts of

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1. ENVTL. PROT. AGENCY, CLIMATE CHANGE INDICATORS: GLOBAL GREENHOUSE GAS EMISSIONS (last updated May 2014), http://www3.epa.gov/climatechange/science/indicators/ghg/global-ghg-emissions.html.

methane, a connection between methane emissions and dams will be made using scientific literature. This will be followed by a discussion, using case studies, of the likelihood of future increases in methane releases from dams in areas expected to experience significant shifts in the quantity and type of precipitation falling. In order to provide some background context, a brief overview of EPA's SEP policies will then be discussed, including examples of implementation. Connections are then made between certain Clean Air Act violations and SEPs that could be used as tools for dam removal. This is followed by a brief discussion of areas of the country that could benefit from such SEP implementation.

II. METHANE AND CLIMATE CHANGE

The greenhouse gas that the general populace most often first identifies is carbon dioxide, as domestic leaders have villainized it[2] and it is the subject of many international agreements.[3] While carbon dioxide is a substantial source of manmade climate change, many other gases are also significant contributors, including carbon monoxide, nitrous oxide, and sulfur hexafluoride.[4] Methane is another critical greenhouse gas that is seldom mentioned in policy discussions.[5] Incrementally, methane is "a much more effective greenhouse gas than" carbon dioxide, and it is emitted from a wide

2. Coral Davenport & Peter Baker, *Taking Page from Health Care Act, Obama Climate Plan Relies on States*, N.Y. TIMES (June 2, 2014), http://www.nytimes.com/2014/06/03/us/politics/obama-epa-rule-coal-carbon-pollution-power-plants.html.

3. U.N. Framework Convention on Climate Change, Background on the UNFCCC: The International Response to Climate Change, http://unfccc.int/essential_background/items/6031.php (last visited Mar. 30, 2016).

4. Philippe Ciais et al., *Carbon and Other Biogeochemical Cycles*, *in* CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS 467 (2013), http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter06_FINAL.pdf.

5. E. Nisbet, *Climate Change and Methane*, 347 NATURE 23 (1990).

range of sources.[6] Significant research is being performed to identify ways in which methane can be captured.[7]

Methane is the second most prevalent greenhouse gas emitted in the United States, and "account[s] for about 11 percent of all U.S. greenhouse gas emissions from human activities."[8] "Methane's lifetime in the atmosphere is much shorter than carbon dioxide," but "[p]ound for pound, the comparative impact of [methane] on climate change is more than 25 times greater than [carbon dioxide] over a 100-year period."[9] Methane is emitted from a variety of industrial, agricultural, and waste management activities, including natural gas production and generation during the decomposition of waste in landfills.[10]

Similar to other greenhouse gases, methane acts as a metaphorical umbrella over the planet. When sun's rays hit the Earth's atmosphere, approximately 70 percent of the sun's energy penetrates and remains on the planet, while the other 30 percent is reflected by clouds and other reflective surfaces.[11] The 70 percent that remains eventually begins to radiate back toward space, some of which is absorbed by greenhouse gases like methane.[12] After these gases absorb the energy, they emit it as heat, keeping the planet warmer than its surrounding environment.[13] This is what is commonly known as "the greenhouse effect." While the green-

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6. *Id.*

7. NIGEL KEY & STACY SNEERINGER, CLIMATE CHANGE POLICY AND THE ADOPTION OF METHANE DIGESTERS ON LIVESTOCK OPERATIONS, USDA ECON. RES. REP. 111, 1 (Feb. 2011).

8. ENVTL. PROT. AGENCY, OVERVIEW OF GREENHOUSE GASES: METHANE, http://www3.epa.gov/climatechange/ghgemissions/gases/ch4.html (last visited Mar. 26, 2015).

9. *Id.*

10. *Id.*

11. *See* ULRICH CASBASCH ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], *Introduction*, *in* CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS 126 (Yihui Ding et al. eds., 2013), http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter01_FINAL.pdf.

12. *Id.*

13. *Id.*

house effect is the reason why Earth is habitable, the steady increase of the amount of these gases in the atmosphere has resulted in rising global temperatures and significant changes in weather extremes.[14]

Human-induced climate change is a pressing problem that must be addressed swiftly. Lowering methane emissions is a critical step towards solving this global crisis. Because it comes from a variety of sources, complex and creative solutions to lowering total methane emissions are required.

III. METHANE RELEASE FROM DAMS

Although dams are often elevated as a useful solution to the issues related to power-production systems emitting high amounts of greenhouse gases, dams are rarely discussed as a contributor to man-made global climate change. These perspectives and opinions have some legitimacy, as hydroelectric power generation could and should continue to be considered a "cleaner" source of energy than coal, oil, and natural gas. Despite being a less substantial contributor to global greenhouse gas emissions than other sectors, the contributions that dams make to this global problem should not be overlooked. Peer-reviewed scientific literature links increased sedimentation behind dams and other freshwater obstructions to higher rates of methane release. This research emphasizes the value and importance of recognizing dams as a source of greenhouse gas emissions.

Inland waters are significant sources of both carbon dioxide and methane, as microbial degradation of organic matter in toxic sediments produce primarily carbon dioxide, and anaerobic pathways produce primarily methane.[15] Researchers have identified two factors as the primary reasons that reservoirs and storage behind obstructions in freshwater bodies emit significant amounts of methane to the atmosphere.[16] The first factor is the continuous

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14. *Id.* at 134.

15. Andreas Maeck et al., *Sediment Trapping by Dams Creates Methane Emission Hot Spots*, 47 ENVTL. SCI. & TECH. 8130 (2013).

16. *Id.*

trapping of both allochthonous and autochthonous organic materials in reservoirs.[17] Autochthonous organic material stems from primary producers that create their own energy (through photosynthesis for example), and allochthonous microorganisms get energy from outside sources.[18] Obstructions, such as dams, do not allow the natural flow of the system to move these materials downstream to normal deposit areas. As such, a large collection of these materials begins to build behind the obstruction.

The second factor at play is the anaerobic degradation of organic carbon that occurs in reservoir sediments.[19] In reservoirs, rapid sedimentation can occur, which leads to anaerobic environments that are ideal for methanogenesis if the organic substrate is available.[20] The first factor, where the organic material is trapped, gives rise to the organic substrate necessary for the methanogenesis process.[21] Methanogenesis is the bacterial conversion of methanogenic substrates into methane and carbon dioxide, which is the process contributing to greenhouse gas emissions from reservoirs.[22] In small reservoirs the accumulation of sediment is often much higher than large reservoirs, making the concern of methane emissions stemming from obstructions and small dams in riverine systems sometimes even higher than larger dam projects.[23] The figure below illustrates how methane is created and released at dam sites.

17. *Id.*

18. *Id.*

19. *Id.*

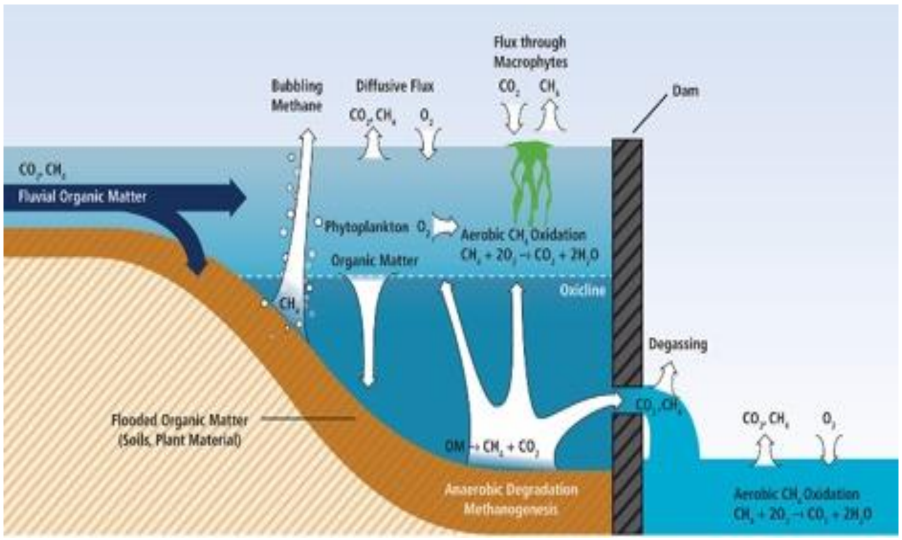
20. *Id.*

21. Maeck et al., *supra* note 15, at 8130.

22. *Methanogenesis*, BOUNDLESS, https://www.boundless.com/microbiology/textbooks/boundless-microbiology-textbook/microbial-metabolism-5/anaerobic-respiration-49/methanogenesis-316-7648/ (last visited Sept. 20, 2016).

23. Maeck et al., *supra* note 15, at 8131.

Figure 1[24]



A particularly useful recent study was performed in the Saar River in France and Germany.[25] It will be used to outline some of the recent developments in the scientific literature regarding methane emissions in small reservoirs. In the Saar River, six dams were built for shipping purposes, and this increased the minimum depth to at least four meters within the main channel for the lower 96 kilometers of the channel.[26] As is common with virtually all impoundments, these projects led to elongated water residence times, lower flow velocities, and increased water depths in the system.[27] Despite efforts to improve water quality parameters in the basin, extremely low oxygen levels were seen in the small reservoirs—low

24. Edgar G. Hertwich, *Addressing Biogenic Greenhouse Gas Emissions from Hydropower in LCA*, 47 ENVTL. SCI. & TECH. 9604, 9606 (2013).

25. *See generally* Jeremy Wilkinson et al., *Continuous Seasonal River Ebullition Measurements Linked to Sediment Methane Formation*, 49 ENVTL. SCI. & TECH. 13,121–13,129 (2015).

26. *Id.* at 13,122.

27. *Id.*

oxygen levels are a primary contributor to the microbial activity that leads to methanogenesis.[28]

The first component of the research provided that the net sediment accumulation occurring in the reservoir areas of the Saar River was significant.[29] The porewater found in reservoir sediment buildup was supersaturated with methane, especially when compared to sediment found in other portions of the waterway.[30] Dissolved methane volume was also clearly correlative with the location of reservoirs, as these amounts were extremely low in the tailwaters of the dams relative to the amount found in the reservoirs immediately behind the dams.[31] A high volume of this dissolved methane accumulating behind the dams was found to be released into the atmosphere.[32] Despite covering a much smaller surface area relative to the entire river, the emissions stemming from these areas directly behind the dams were much higher than the remainder of the river system.[33] These areas are known as "methane emission hot spots,"[34] and they should be particularly relevant to policy makers when considering the impacts of methane emissions on global climate change.

The seasonal ebullition measurements are also of particular relevance. In this study, ebullition rates, which are the amount of methane bubbles being released into the atmosphere, show that increases occur during warmer months relative to occurrences during colder times of the year.[35] This intuitively could be related solely to temperature, or could also be a result of drawdowns during warmer months as a result of lower precipitation patterns and increases in evapotranspiration.

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28. *Id.* at 13,126.

29. *Id.* at 13,125.

30. *Id.*

31. Wilkinson et al., *supra* note 25, at 13,125.

32. *Id.* at 13,122.

33. *Id.*

34. *See generally* Maeck et al., *supra* note 15.

35. *See* Wilkinson et al., *supra* note 25, at 13,125–26.

Generally, the conclusions from this study are extremely applicable to the subject of this article, as they indicate that impoundments and dams contribute significantly to total methane emissions coming from a waterbody. In the Saar River, sediment accumulation accounts for large amounts of methane emissions, which are primarily a result of sediment accumulation combined with high amounts of organic matter.[36] While this is but one study, similar findings can be seen elsewhere.

In a much more general study from a global perspective, one peer-reviewed publication indicates that large dams release about 104 million metric tons of methane each year.[37] This research also suggests that methane capture technology for energy production from dams and impoundments should be developed similar to technology that exists in landfills.[38] This type of global research shows the scope of methane releases from dams, and why efforts are needed to develop policies and designs that mitigate these releases in a systematic and thorough manner.

In one of the first studies examining greenhouse gas emissions stemming from reservoirs, a group of researchers quantified methane outputs from a tropical reservoir located in French Guiana known as Petit Saut.[39] Importantly, immediately following the construction of the impoundment, dissolved methane levels spiked considerably relative to pre-reservoir levels.[40] In addition, as will be discussed later in this article,[41] significant fluctuations were seen between different times of the year related to the amount of

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36. *Id.* at 13,122.

37. Ivan B.T. Lima et al., *Methane Emissions from Large Dams as Renewable Energy Resources: A Developing Nation Perspective*, 13 MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE 193, 201 (2008).

38. *Id.* at 194.

39. Corinne Galy-Lacaux et al., *Long-term Greenhouse Gas Emissions from Hydroelectric Reservoirs in Tropical Forest Regions*, 13 GLOBAL BIOGEOCHEMICAL CYCLES 503 (1999).

40. *Id.* at 506.

41. *See infra* Section V.

emissions.[42] During low flow events, which occurred during midwinter, maximum methane emissions were seen.[43] Additionally, a clear correlation occurred between high flow events and low methane emissions at this site.[44] This demonstrates that freshwater impoundments lead to methane buildup and correlatively high atmospheric releases of methane occur when water levels are relatively low.

It is clear from the above commentary that dams, impoundments, and obstructions are a significant source of methane releases into the atmosphere. One study from the United States indicates, "Harsha Lake, a large reservoir near Cincinnati, Ohio, emitted as much methane in 2012 as roughly 5,800 dairy cows would have emitted over an entire year."[45] In addition to the general conclusion that dams are methane emission "hotspots," it is important to emphasize the correlation between flow and increases in methane release. As flows decrease, methane emissions seem to increase in these reservoir areas.[46] These general conclusions are critically important for policy makers and provide a framework from which policy can be crafted to attempt to lower total methane emissions from these sites.

IV. LIKELY FUTURE RESERVOIR DRAWDOWNS

In order to combat the looming threats of global climate change, efforts should be made to mitigate the causes of methane emissions from dams. Making such mitigation difficult, however, is the likely future increase in reservoir drawdowns. As discussed above, scientific research seems to indicate that lower depths in reservoirs behind obstructions leads to higher rates of methane emissions. This section seeks to analyze scientific literature, which suggests that because of already shifting climate patterns, reservoir drawdowns are becoming more frequent, thereby likely leading to an increase in methane emissions from these areas. Similar

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42. Galy-Lacaux et al., *supra* note 39, at 509.

43. *Id.* at 504.

44. *Id.* at 506–07.

45. Bobby Magill, *Methane Emissions May Swell from Behind Dams*, SCIENTIFIC AMERICAN, Oct. 29, 2014, http://www.scientificamerican.com/article/methane-emissions-may-swell-from-behind-dams/.

to the feedback mechanisms in the Arctic, where climate change has increased permafrost melting and methane emissions (which lead to more rapid permafrost melt) reservoir drawdowns from climatic changes are potentially leading to more methane release. Such events likely lead to more reservoir drawdowns. This cycle can result in "runaway" climate change.[47]

A. Great Plains Region

The connection between reservoir drawdowns and climate change is relatively complex, with different areas of the country experiencing drawdowns for different reasons. The Great Plains region of the central United States is a good place to start with this assessment, as the heavy use of reservoirs and groundwater in the area for irrigated agriculture make it particularly vulnerable to a shifting climate. One study focused upon four reservoirs under federal control in western Kansas: Cedar Bluff, Keith Sebelius, Webster, and Kirwin.[48] These reservoirs are good indications of the type of problems facing this region of the United States. When reservoirs are drawn down, it often is a result of low streamflows. In western Kansas, models show within 95 percent confidence that more than a 50 percent decline in surface water resources will occur between 2007 and 2050.[49] In fact, in some of these reservoirs, evapotranspiration rates are higher than inflow rates, leading to a wildly inefficient and ineffective system.[50]

Other factors in western Kansas, such as increased groundwater usage and increasing general irrigation rates, have caused some of the lower-than-historically normal streamflows.[51] However, regulations in the 1980s began to stem the tide, meaning that

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47. Catriona McKinnon, *Runaway Climate Change: A Justice-Based Case for Precautions*, 40 J. OF SOC. PHIL. 187 (2009).

48. T.H. Brikowski, *Doomed Reservoirs in Kansas, USA? Climate Change and Groundwater Mining on the Great Plains Lead to Unsustainable Surface Water Storage*, 354 J. OF HYDROLOGY 90 (2008).

49. *Id.* at 90.

50. *Id.* at 94.

51. *Id.*

climatic shifts are likely the largest cause of the decline.[52] The models created from this research indicated clear trends moving forward, with substantial drawdowns occurring into the near future throughout the Great Plains.[53] Thus, connecting these conclusions with previous assumptions made regarding the impacts on methane emissions from reservoir drawdowns, it can be inferred that reservoirs throughout the Great Plains will likely see an increase in methane emissions as climate change continues to negatively influence total streamflow.

B. Western United States

A case study from the Puget Sound region of Washington will be used as a tool to describe climate change's impacts, both past and future, on reservoir management in many western systems that rely upon snowmelt as their natural hydrological regime.[54] In areas like the Puget Sound a large portion of the water supply needed to fulfill industrial, municipal, agricultural, fish and wildlife, and recreation needs comes from the snow storage developed during the winter months.[55] The majority of the year's precipitation falls as snow, and in the mountain ranges surrounding the region this snow remains in temperatures well below freezing until the melt begins to occur during the spring.[56] While the Puget Sound is not known for having arid summer months, many other western watersheds are extremely arid during the summer, including the Columbia River Basin. Thus as temperatures begin to increase during the drier period of the year, the snow begins to melt and provides necessary flow for the region's streams until the snowpack begins to build again during the winter.[57] This phenomenon stands in contrast to the Great Plains hydrological system mentioned earlier, which relies upon a combination of groundwater

52. *Id.*

53. *Id.* at 98.

54. Julie A. Vano et al., *Climate Change Impacts on Water Management in the Puget Sound Region, Washington, USA*, 102 CLIMATIC CHANGE 261 (2010).

55. *Id.* at 262.

56. *Id.*

57. *Id.*

and precipitation falling as rain throughout the year to sustain in-stream flows.

In order to keep this spring snowmelt available throughout the arid summers, most of these western systems, including those contained within the Puget Sound region of Washington, rely heavily upon man-made impoundments to create reservoirs.[58] While not always managed as a cohesive unit, these series of reservoirs work to help meet the energy needs of the region.[59] In this particular case study, snowfall in the Cascade Mountains provides the vast majority of the water needed for reservoir inflow for the cities of Seattle, Tacoma, Bellevue, and Everett.[60] As such, the system is critically important and is heavily managed and researched.

As a direct result of climate change, the amount of precipitation historically falling as snow has begun to fall as rain throughout the western United States, including in the Cascade Mountains.[61] These rain events do not allow storage to be built in the mountains necessary to sustain the region throughout the more arid months.[62] This is extremely problematic as the reservoirs and the individuals that manage streamflow for other uses, such as flood control, have to release some of this rainfall during the time of year when it is not as needed.[63] As a result, total storage in these reservoirs is smaller.[64]

Additionally, climate models consulted during this research indicate that these trends will continue to worsen, with increases in rainfall during the winter months leading to substantially

58. *Id.*

59. *Id.*

60. Vano et al., *supra* note 54, at 264.

61. *Id.* at 268.

62. *Id.* at 271.

63. *Id.* at 271–72.

64. *Id.* at 272.

smaller storage in reservoirs throughout the region.[65] This research also takes into account increasing water needs within the Puget Sound region, with substantial population increases alongside industrial needs requiring higher volumes of water.[66] Combining impacts from climatic shifts in the form of precipitation alongside the increased anthropocentric needs in the region will very likely result in decreased storage in reservoirs throughout the western United States. Applying the logic that reservoir drawdowns lead to increases in methane emissions prompts the conclusion that many of the reservoirs throughout the West will contribute much higher volumes of methane emissions in years to come.

C. Southeast United States

In addition to the central and western United States, the southeastern portion of the country is likely not insulated from climatic shifts influencing hydrological systems. In research analyzing the hydrological impacts of climate change in the Apalachicola River Basin, general conclusions indicate that overall precipitation levels will not be significantly impacted in the relative near future.[67] However, research indicates that the Basin will see an increase in extreme rain events leading to flooding and an increase in extreme droughts.[68] In addition to the issues related to consistent storage in reservoirs, these types of extreme weather events can lead to increased sedimentation issues.[69]

The Apalachicola River system is often viewed and managed as part of a larger system along with the Flint and Chattahoochee Rivers (collectively the ACF Basin).[70] Numerous reservoirs are found in the ACF Basin for lots of different purposes, and these reservoirs will very likely be impacted by this shift in hydrologic

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65. *Id.*

66. Vano et al., *supra* note 54, at 280.

67. Xi Chen et al., *Climate Change Impact on Runoff and Sediment Loads to the Apalachicola River at Seasonal and Event Scales*, 68 J. OF COASTAL RES. 35, 38–39 (2014).

68. *Id.* at 35.

69. *Id.* at 36.

70. *See, e.g.,* CHRISTOPHER J. MARTINEZ, UNIVERSITY OF FLORIDA EXTENSION, HOW ARE THE RESERVOIRS MANAGED IN THE APALACHICOLA-FLINT-CHATTAHOOCHEE RIVER BASIN MANAGED? (2013), http://edis.ifas.ufl.edu/pdffiles/AE/AE49700.pdf.

patterns.[71] If the projections mentioned above are correct, increased organic matter from sedimentation deposits could be seen during flooding, and during the increased drought events, the reservoirs will be drawn down. Methane emissions will likely increase from basins throughout the southeastern United States that contain reservoirs as part of water resource management.

D. Other factors

In addition to climate change's direct contribution to reservoir drawdowns throughout the country, indirect impacts are also important. The first indirect impact (and arguably the most impactful in the western United States) is the effect of low flows on fish. Water temperature is a critically important parameter in determining aquatic health, especially for cold-water fish species like salmon and trout.[72] As flows decrease because of changing hydrological systems (due to climate change and rising air temperatures) stream temperatures increase to levels dangerous for aquatic health.[73] Many of the fish that are vulnerable to these types of shifts are found in western flows such as the Columbia River.[74] Recent events that have led to high stream temperatures have caused citizens' groups and natural resource managers to call for changes in reservoir management to protect these species.[75] According to one estimate, up to "96 percent of endangered Snake River sockeye died before ever making it to Lower Granite Dam in 2015."[76] It is highly likely that future managers will be forced, either legally or morally, to manage reservoirs for downstream impacts to fish. This will likely lead to more reservoir drawdowns, as increased flows

71. *See id.*

72. Michael N. Gooseff et al., *Modeling the Potential Effects of Climate Change on Water Temperature Downstream of a Shallow Reservoir, Lower Madison River, MT*, 68 CLIMATIC CHANGE 331, 331–32 (2005).

73. *Id.* at 346.

74. George Plaven, *Groups Seek Salmon Protections in Warming Columbia, Snake Rivers*, MAIL TRIBUNE (Feb. 25, 2016), http://www.mailtribune.com/article/20160225/NEWS/160229706.

75. *Id.*

76. *Id.*

will be required during arid periods of the year, lowering storage behind the reservoirs. Such increased drawdowns will lead to increased exposure to organic material causing increased methane emissions.

Another likely indirect cause of increased drawdowns is ever-increasing floodplain development, which, along with shifting precipitation patterns, is leading to changes in how reservoirs are managed.[77] Even in the face of a nearly six-fold increase in flood damages over the past century—despite billions of investments dollars in flood control measures—floodplain development continues to rapidly grow throughout the United States.[78] "Over the past 50 years," an increase in federal programs for "flood control, disaster assistance, and tax incentives that encourage and subsidize floodplain occupation and development" has occurred.[79] While it is a complex subject, FEMA's National Flood Insurance Program has arguably promoted floodplain development and allowed local communities to become "financially disconnected from the consequences and impacts of their land use decisions."[80]

As more economic development occurs in areas historically allowed to flood, less flexible flood risk management becomes necessary.[81] Lack of flexibility becomes an ever-present factor because water storage capacity must be reserved to ensure that future high–flow events can be managed in order to avoid flooding.[82] Unavoidably, increased storage means lower reserve levels and therefore greater exposure of the organic material that causes methane emissions. Combined with the shifting precipitation patterns mentioned above, reservoirs must release higher volumes of water during times of the year when it may not be as useful. Droughts and arid times of the year often follow the release of water, which leads

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77. ASSOCIATION OF STATE FLOODPLAIN MANAGERS, NO ADVERSE IMPACT FLOODPLAIN MANAGEMENT 1 (2008), http://www.floods.org/index.asp?menuID=349&first-levelmenuID=187&siteID=1.

78. *Id.*

79. *Id.*

80. *Id.*

81. *Id.*

82. *Id.*

to further drawdowns. As a result, increased floodplain development is arguably indirectly contributing to methane emission releases from reservoir projects.

As can be seen throughout this section, reservoir drawdowns have increased in frequency and will very likely continue to increase in the near future as a result of climate change. This context is critically important as considerations are made as to whether Supplemental Environmental Projects (SEPs) can be used to remove dams for Clean Air Act violations. Urgent action is necessary because methane emissions are likely to continue increasing as reservoirs continue to be drawn down—exasperating the global climate crisis.

V. SUPPLEMENTAL ENVIRONMENTAL PROJECTS

SEPs should be utilized to address the pressing problem of methane emissions. Through settlement negotiations, SEPs provide existing opportunities for violators of environmental statutes to voluntarily agree to undertake an environmentally beneficial project related to the violation in exchange for mitigation of an applicable penalty. Many federal statutes clearly authorize federal agencies such as the U.S. Environmental Protection Agency (EPA) to seek injunctive and monetary relief for statutory and regulatory violations. Though there are certainly exceptions, the vast majority of EPA's actions to penalize a violating entity end in a settlement agreement between the parties.[83]

When the settlement involves a monetary payment the United States Treasury takes receipt of all the payments in accordance with the Miscellaneous Records Act.[84] While these payments may act as a deterrence for the violating party against future violations and the ensuing penalties, they seemingly do very little to produce an actual response to the environmental harms incurred: the money disappears into the depths of a large agency instead of being

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83. *See generally* Jeffrey M. Gaba, *Informal Rulemaking by Settlement Agreement*, 73 GEO. L. J. 1241 (1985); ROBERT PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 949 (5th ed. 2006).

84. *See* 31 U.S.C. § 3302(b) (2014) ("[A]n official or agent of the Government receiving money for the Government from any source shall deposit the money in the Treasury as soon as practicable without deduction for any charge or claim.").

spent on mitigating the harm. There is seemingly no correlation between these penalties paid and the improvement of programs or regulations seeking to mitigate future harms.

In addition to the traditional remedies, the EPA first officially discussed SEPs as a creative mechanism in 1991.[85] At that time, the agency sought to provide an opportunity for violators to remedy past harm through environmental projects that would directly offset some of the problems that led to the negotiations.[86] While perhaps more complicated and technically difficult to implement than assigning monetary damages, the environmental outcome is substantive: violators improve public relations by engaging with local communities to find meaningful ways to improve or repair the environment.

A. Nexus

SEP implementation requires a relationship between the underlying violation and the human health or environmental benefits that will result from the SEP.[87] In other words, the EPA's discretion to settle enforcement actions does not extend to the inclusion of SEPs that do not have a nexus to the violations being resolved.[88] The enforcement settlements may contain "terms and undertakings that go beyond those remedies specifically" identified in the statute being enforced.[89] However, the EPA's settlement authority

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85. ENVTL. PROT. AGENCY, POLICY ON THE USE OF SUPPLEMENTAL ENFORCEMENT PROJECTS IN EPA SETTLEMENTS (Feb. 12, 1991) *superseded by* ENVTL. PROT. AGENCY, U.S. ENVIRONMENTAL PROTECTION AGENCY SUPPLEMENTAL ENVIRONMENTAL PROJECTS POLICY 2015 UPDATE (Mar. 1, 2015).

86. *Id.*

87. ENVTL. PROT. AGENCY, U.S. ENVIRONMENTAL PROTECTION AGENCY SUPPLEMENTAL ENVIRONMENTAL PROJECTS POLICY 2015 UPDATE, 7 (Mar. 1, 2015) [hereinafter EPA].

88. *Id.*

89. THE COMPTROLLER GEN. OF THE U.S., 1983 WL 197623, B-210210, MATTER OF: COMMODITY FUTURES TRADING COMMISSION – DONATIONS UNDER SETTLEMENT AGREEMENTS (Sept. 14, 1983).

should be limited to "statutorily authorized prosecutorial objectives[:] correction or termination of a condition or practice, punishment, and deterrence."[90]

This nexus requires that the project demonstrate, "that it is designed to reduce: a. The likelihood that similar violations will occur in the future; b. The adverse impact to public health and/or the environment to which the violation at issue contributes; or, c. The overall risk to public health and/or the environment potentially affected by the violation at issue."[91] "SEPs may have nexus even if they address a different pollutant in a different medium, provided the project relates to the underlying violation[]."[92]

B. "Environmentally beneficial"

Additionally, a SEP must be "environmentally beneficial," which means that it must "improve, protect, or reduce risks to public health or the environment."[93] While the project may also provide the violator with certain benefits, the overlying purpose of the project must be to positively influence public health, the environment, or both.[94] A settlement negotiation involving the EPA and a polluter is intended to contribute in a positively substantive manner to the local community and environment. However, it is important to note that the polluter could have some level of autonomy in identifying and implementing a SEP that is beneficial to them as well. Public relations opportunities in particular seem to be present and available for violators to restore a more desirable public perception.

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90. THE COMPTROLLER GEN. OF THE U.S., 1990 WL 293769, B-238419, MATTER OF: NUCLEAR REGULATORY COMMISSION'S AUTHORITY TO MITIGATE CIVIL PENALTIES (Oct. 9, 1990).

91. EPA, *supra* note 87, at 8.

92. *Id.*

93. *Id.* at 6.

94. *Id.*

C. "Not otherwise legally required to perform"

The EPA seeks to distinguish SEPs from injunctive relief by clearly articulating that the SEP must be undertaken in settlement of an enforcement action as a project that the violator is not otherwise legally required to perform.[95] Accordingly, the SEP's "project or activity [cannot be] required by any federal, state, or local law or regulation . . . ."[96] Moreover, SEPs cannot include actions which would likely be required by: "injunctive relief, including [] a mitigation project[;] . . . injunctive relief in another legal action the EPA, or another regulatory agency, could bring; . . . part of an existing settlement or order in another legal action; or . . . any other federal, state or local requirement."[97] It is also important to note that "performance of a SEP does not alter a defendant's obligation to remedy a violation expeditiously and return to compliance."[98] Actions performed by violators that reflect standard industry practices are generally not acceptable to satisfy a SEP.[99]

D. Categories of SEPs

While significant flexibility does exist among types of projects that can be implemented as a SEP, the EPA outlines projects that have been implemented in the past in an effort to clearly provide the types and scope of projects likely to be approved.[100] In order for the reader to gain a better understanding of the range of possibilities for implementation, these topics will be briefly mentioned, with further exploration available through EPA resources.

A SEP may involve public health issues, which could include examining residents in a community to determine if anyone has experienced any health problems because of the company's violations.[101] SEPs could also entail changes enabling the company to

95. *Id.*

96. *Id.*

97. EPA, *supra* note 87, at 6–7 (omitting footnote notations).

98. *Id.* at 7.

99. *Id.*

100. *See id.* at 11–17.

101. *Id.* at 12.

eliminate generation of some form of pollution, assuming that there are not already regulations in place limiting this type of pollution and the action taking place is not already industry standard.[102] A company could also provide better treatment and disposal of a pollutant in an effort to reduce the amount of danger presented.[103] Environmental restoration or protection efforts can also be included in SEPs, assuming that they improve the condition of the land, air or water in the area damaged by the violation.[104] If a violator fails to fulfill certain types of EPA obligations, emergency planning and preparedness assistance may be available as a SEP, including the purchase of equipment or training for this purpose.[105] Audits that go beyond business practice and environmental compliance training for other companies are also options for SEPs.[106] These diverse project options provide violators with a host of creative solutions to remedy damage caused by their violations.

E. Climate Change Priorities

In addition to these general opportunities, the EPA recently released its policy priorities for future SEPs.[107] The EPA's top priorities include "protecting children's health, ensuring environmental justice, promoting pollution prevention, encouraging the development of innovative technologies that protect human health and the environment, and addressing climate change."[108]

The last priority listed—addressing climate change—is the most relevant to this article's premise. The EPA explicitly indicates that projects that address the causes of climate change and reduce or prevent emissions of greenhouse gases, such as carbon dioxide and methane, may qualify as SEPs.[109] This suggests that reduction

102. *Id.* at 12–13.

103. EPA, *supra* note 87, at 13.

104. *Id.* at 13–14.

105. *Id.* at 14–17.

106. *Id.*

107. *Id.* at 3.

108. *Id.* at 3.

109. EPA, *supra* note 87, at 5.

of methane emissions through dam removal operations could easily qualify.

VI. CLEAN AIR ACT AND DAM REMOVAL CONNECTIVITY

An attempt has been made to make a clear, unequivocal connection between freshwater obstructions such as dams to methane emissions, which is a much more impactful greenhouse gas than carbon dioxide. Additionally, as shifting precipitation patterns continue to impact hydrologic systems due to global climate change, methane emissions will likely continue to increase throughout the country. Within the scope of the Clean Air Act, EPA could promote the reduction of methane emission by allowing violators to participate in small-scale dam removal projects through the SEP process. In addition to further widening the scope of project options with positive public relations coverage for private entities, these efforts would be "environmentally beneficial" and could very likely provide the type of nexus between the violation and the project required to meet the legal requirements of the SEP.

A. EPA Authority to Regulate Greenhouse Gas Emissions

Over the past 20 years, increasing legal and political debate has surrounded the appropriate mechanisms for attempting to mitigate climate change. This policy debate began in earnest in 1999, when twenty organizations filed a rulemaking petition asking EPA to regulate greenhouse gases under the motor vehicle provision of the Clean Air Act.[110] EPA declined to do so, relying on a 2000 Supreme Court decision where the majority "caution[ed] agencies against using broadly worded statutory authority to regulate in areas raising unusually significant economic and political issues."[111] Working within this background of caution, the EPA concluded

110. Petition for Rulemaking and Collateral Relief Seeking the Regulation of Greenhouse Gas Emissions from New Motor Vehicles Under § 202 of the Clean Air Act, Int'l Ctr. for Tech. Assessment v. Browner, EPA Docket No. a-2000-04 (Oct. 20, 1999) (held before the Administrator of the EPA).

111. Control of Emissions from New Highway Vehicles and Engines, 68 Fed. Reg. 52,922 (Sept. 8, 2003) (relying on Food & Drug Admin. v. Brown & Williamson, 529 U.S. 120 (2000)).

that Congress had not intended the Clean Air Act to reach greenhouse gases.[112]

In response, a group of states, local governments, and private organizations challenged the EPA's failure to regulate greenhouse gases, which led to a groundbreaking decision in 2007 by the Supreme Court.[113] The Court supplied a finding foundational to the regulation of greenhouse gases: that greenhouse gases are "unambiguously" an "air pollutant" under the Clean Air Act.[114] In particular, the Court found that the Act does not merely reach only those "local" pollutants, but that its "capacious," "sweeping" definition of "air pollutant" "embraces all airborne compounds of whatever stripe."[115] The Court found that Congress had unambiguously included greenhouse gases as an air pollutant that could be regulated under the Clean Air Act.[116] The court found that EPA had been "arbitrary, capricious . . . or otherwise not in accordance with law" when it declined the petition for rulemaking on the basis that it lacked authority to regulate greenhouse gases.[117]

In 2009, the EPA responded by making an endangerment finding pursuant to § 202(a) of the Clean Air Act for six greenhouse gases—carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—on the basis that these gases are changing the climate and that climate change endangers human health and welfare.[118] EPA followed its finding by

112. *Id.*

113. Massachusetts v. EPA, 549 U.S. 497 (2007).

114. *Id.* at 528–29.

115. *Id.* at 529.

116. *Id.* at 534.

117. *Id.*

118. Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496, 66,499 (Dec. 15, 2009).

establishing standards for greenhouse gas emissions from new motor vehicles.[119] In addition to standards for motor vehicle emissions, the endangerment finding caused the Prevention of Significant Deterioration (PSD) program to expand to reach small stationary sources emitting greenhouse gases.[120]

This decision was later challenged and upheld by the D.C. Circuit Court of Appeals, which held that stationary sources that emit given levels of greenhouse gases trigger permitting requirements under the PSD program.[121] The lower court's decision was partially overturned by the U.S. Supreme Court in 2014. [122] The Court said the EPA can regulate greenhouse gas emissions from industries already required to get permits for other air pollutants, which are generally the largest power plants, refineries, and other industrial facilities responsible for most such emissions.[123] As a result of the evolution of legal and policy doctrine regarding EPA authority to regulate greenhouse gas emissions under the Clean Air Act, it is clear that EPA has and will continue to have the power to regulate greenhouse gases.

B. Opportunity for SEPs

As this authority continues to play out in the form of agency regulatory activity, violations have occurred and inevitably will continue to occur. When these violations take place, opportunities may arise to develop SEPs that will provide violators with an ability to remedy past harm through environmental projects that will directly offset some of the problems that led to the need for a settlement negotiation with the agency. As has been discussed at length above, removal of non-energy producing dams could be an

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119. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, Final Rule, 75 Fed. Reg. 25,324, 25,398 (May 7, 2010).

120. 42 U.S.C §§ 7470–79 (1955).

121. Coal. for Responsible Regulation, Inc. v. EPA, 684 F.3d 102, 132–33 (D.C. Cir. 2012), *aff'd in part, rev'd in part sub nom.,* Util. Air Regulatory Grp. v. EPA, 134 S. Ct. 2427 (2014), *and amended sub nom.,* Coal. for Responsible Regulation, Inc. v. EPA, 606 F. App'x 6 (D.C. Cir. 2015).

122. Util. Air Regulatory Grp. v. EPA, 134 S.Ct. 2427 (2014).

123. *Id.*

appropriate SEP, as a voluntary environmentally beneficial mechanism, that could help to offset the harm caused by the polluter.

As was briefly discussed in a previous section, these types of projects have the potential to provide ecological benefits in addition to the opportunity for positive public relations for the violating entity.[124] Rather than a penalty being paid (only to disappear into the depths of the United States Treasury) SEPs provide for substantive ecologically beneficial projects to offset the harm.[125] Dam removal projects certainly fit within this purpose, and would promote positive public perception for violating entities in communities seeking the removal of unsightly or unproductive dams or freshwater obstructions.[126] The sort of partnerships that could be built from these projects could have long-term positive social and economic benefits.

C. Other Benefits

Besides the clear nexus between climate change mitigation and dam removal, there are also other potential benefits from such projects.

The first, and perhaps most obvious, are the aquatic health benefits. Myriad research exists indicating the impacts of freshwater obstructions and dams on migratory fish. This article is not the space to rehash these discussions. However, a recognition of the value of dam removal as a SEP for aquatic biological and chemical health should not be understated. The cultural, social, environmental, and economic benefits of a healthier, more robust migratory fish population would be significant, and would be a secondary benefit of allowing dam removal under the Clean Air Act SEP's.

In addition, the outdoor recreation industry is growing,[127] and unimpeded streams increase opportunities for water recreation sports. While not directly related to the nexus for a SEP, this could

124. *See supra* Section IV.

125. *See supra* Section IV.

126. *See supra* Section IV.

127. *See The Outdoor Recreation Economy*, OUTDOOR INDUSTRY ASSOCIATION (2012), https://www.asla.org/uploaded-Files/CMS/Government_Affairs/Federal_Government_Affairs/OIA_OutdoorRecEconomyReport2012.pdf.

help to stimulate growth in the tourism or recreation economy. Other secondary benefits from small-scale dam removal exist as well, leading to positive and substantive ecological, economic, and social growth in local communities.

Through decades of policy discussions and litigation, the EPA has a clear role and responsibility to regulate greenhouse gas emissions within the parameters set out in the Clean Air Act. Within this regulated field, violators have emerged and will continue to emerge, leading to a need for the development of sound solutions that mitigate the harm while avoiding future climatic catastrophe. With a likely sufficient nexus between dam removal and Clean Air Act violations related to greenhouse gases, it seems that dam removal would and should be considered as an appropriate SEP for violating entities to consider. While obviously coming within the framework of a settlement negotiation between two amicable parties, this sort of effort should be encouraged by the EPA throughout the country. Beyond just the benefit to reducing greenhouse gases, small-scale dam removal projects funded through SEPs could provide further benefits for local socio-ecological communities.

VII. POTENTIAL AREAS OF THE COUNTRY THAT COULD BENEFIT

In order for a dam removal project to be effectively applied as a SEP, a few components must align: First, and perhaps most importantly, is the recognition that dams that produce energy are almost certainly cleaner and produce less greenhouse gases than energy production systems that rely upon fossil fuels. As such, these types of facilities, barring gross inefficiency or problems with structural integrity, should remain in production and not part of the SEP program. Beyond the relatively clean power that is produced, the sheer size of the typical energy producing dam would make the cost of removal prohibitive for the typical SEP for a Clean Air Act violation. Thus, lowhead dams and other small obstructions located in areas with shifting hydrologic patterns should be prioritized. Dam removal projects identified for purposes of SEPs should be thoughtful and realistic.

As mentioned, incorporation of removal of energy-producing dams in the context of SEPs for Clean Air Act should be a rare endeavor. In the context of attempting to mitigate the impacts of global climate change, hydroelectric dams are a critically important and relatively "clean" source of energy production. Even small-scale hydro facilities can provide important sources of power that allow for communities and utility companies to stray from the use of more greenhouse gas-intensive fossil fuels.[128] In fact, almost six percent of the energy produced in the United States in 2015 was from hydropower, while providing a particularly significant source of power in areas like the Pacific Northwest with over 70 percent of the region's energy.[129] While recognition of the ecological and spiritual harm to indigenous populations resulting from these facilities is critically important, the relatively clean power that dams can provide should provide hesitation for using SEPs to remove these types of facilities.

In addition to considering the benefits of certain types of facilities, cost is also an important factor when analyzing the potential for incorporating dam removal projects into the Clean Air Act SEP program. One of the more high-profile dam removal projects in recent years occurred on the Elwha River on the Olympic Peninsula in Washington.[130] This project involved the removal of the Elwha and Glines Canyon Dams after more than a century of migratory fish obstruction.[131] The dams were energy producing for the local mill, but due to a variety of social, ecological, and economic reasons, removal began in 2011.[132] The removal of the dams was estimated at $26.9 million, with the entire restoration of the system costing close to $325 million.[133] This has been considered the largest dam removal in United States history, as the Elwha Dam was 105 feet tall, and the Glines Canyon Dam was 210 feet tall.[134] While this

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128. *See* Claudio Monteiro et al., *Short-term forecasting model for electric power production of small-hydro power plants*, 50 RENEWABLE ENERGY 387 (2013).

129. U.S. ENERGY INFO. ADMIN., MONTHLY ENERGY REVIEW: TABLE 7.2A ELECTRICITY NET GENERATION: TOTAL (ALL SECTORS) (2015), http://www.eia.gov/totalenergy/data/monthly/pdf/sec7_5.pdf*; The Role of Hydropower in the Northwest*, PACIFIC NORTHWEST WATERWAYS ASSOCIATION (2016), http://www.pnwa.net/new/Articles/Hydropower.pdf.

130. *See* NAT'L PARK SERV., FREQUENTLY ASKED QUESTIONS (2016), http://www.nps.gov/olym/learn/nature/elwha-faq.htm.

131. *Id.*

132. *See id.*

133. *Id.*

134. *The History of Elwha Dam*, LOWER ELWHA KLALLAM TRIBE, http://www.elwha.org/elwhariverrestoration.html (last visited Sept. 20, 2016).

project was important for a variety of reasons and was widely supported in the community, it is unlikely that dam removal at this scale would be appropriate for a Clean Air Act SEP due to the sheer cost.

By contrast, most dam removal projects that have occurred in the United States are on small dams less than 50 feet tall.[135] While the costs and benefits of each dam removal project should be considered prior to moving forward with implementation,[136] identifying small obstructions and dams seems to be a more realistic proposition. While a bit outdated, research comparing various dam sizes and the subsequent costs required for removal does exist.[137] Converted into 2016 dollars, removal of the 24 foot tall Edwards Dam in Maine cost approximately $3 million.[138] By comparison, removal of the 20 foot tall Colfax Dam in Wisconsin cost about $354,000.[139] Another example of relatively successful dam removal occurred on the Harpeth River in Tennessee.[140] This removal cost approximately $350,000, and involved removal of a six-foot tall lowhead dam that allowed the stream to be completely free flowing.[141] This indicates that while variance exists from impoundment to impoundment, costs for small-scale dam removal can realistically fall within the wide spectrum of appropriate penalties for Clean Air Act violations.

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135. Keishi Tanimoto, *Cost Allocation in Dam Removal Project*, 4 IEEE INT'L CONFERENCE ON SYS., MAN AND CYBERNERTICS, 3308, 3308 (2003) http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1244400.

136. *See generally* Pearl Q. Zheng & Benjamin F. Hobbs, *Multiobjective Portfolio Analysis of Dam Removals Addressing Dam Safety, Fish Populations, and Cost*, 139 J. WATER RESOURCES PLAN. & MGMT., no. 1, 2013, at 65.

137. *See Dam Removal Costs*, UNIVERSITY OF RHODE ISLAND, http://www.edc.uri.edu/restoration/html/tech_sci/socio/costable3.htm (last visited Mar. 30, 2016).

138. *Id.*

139. *Id.*

140. *Lowhead Dam Removal and River Restoration Project on the Harpeth River in Franklin*, HARPETH RIVER WATERSHED ASSOCIATION, http://www.harpethriver.org/programs/water-old/dam/lowhead-dam-removal-and-river-restoration-project-on-the-harpeth-river-in-franklin.652444 (last accessed Sept. 15, 2016).

141. *Id.*

In addition to cost considerations, priority should be given to impoundments or dams that have public safety concerns or are aging to a point of disrepair. The Association of Dam Safety Officials estimates that 4,400 dams are susceptible to failure due to structural deficiencies.[142] With over 85,000 dams in the United States that average over fifty-one years old, the number of dams in this unsafe category will steadily increase.[143] The Federal Emergency Management Agency's (FEMA) National Dam Safety Program could also be consulted during the identification of aging structures in need of removal.[144]

Other considerations for determining appropriate and likely successful SEPs dam removal projects include: prioritization of areas with shifting hydrology leading to increased reservoir drawdowns, zones where obstructions are causing ecological harm needing to be mitigated, and regions where local community support is high for dam removal on a particular stream.[145] These factors, when combined with the issues considered in the section above, will allow for the maximum benefit to the agency, the community, and to the violating entity participating in the SEP.

Similar to any other type of project identified as a Clean Air Act SEP, dam removal projects must be thoroughly examined and researched to ensure that it is beneficial ecologically, economically, and socially. While removal of energy-producing dams may work against the greenhouse gas-reduction responsibilities held by EPA, removal of small dams with undesirable characteristics may allow for the type of nexus necessary to qualify as SEPs for certain Clean Air Act violations.

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142. Henry Fountain, *Danger is Pent up Behind Aging Dams*, N.Y. TIMES, Feb. 21, 2011, http://www.nytimes.com/2011/02/22/science/22dam.html?pagewanted=all.

143. *Id.*

144. Water Resources Development Act of 1996, Pub. L. No. 104-303, § 215, 110 Stat. 3658 (codified at 33 U.S.C. § 467 (2015)). The program's purpose is to reduce the risks to life and property from dam failure in the United States through the establishment and maintenance of an effective national dam safety program to bring together the expertise and resources of the federal and non-federal communities in achieving national dam safety hazard reduction.

145. *See generally* Michael G. Gangloff, *Taxonomic and Ecological Tradeoffs Associated with Small Dam Removals*, 23 AQUATIC CONSERVATION: MARINE AND FRESHWATER ECOSYSTEMS 475 (2013).

VIII. CONCLUSION

Supplemental Environmental Projects are a creative way to allow violating entities to work with EPA through settlement, in order to rebuild their public image, remedy environmental harm, and avoid paying penalties that may not be directed at mitigating the underlying harm that caused the violation. As has been clearly identified by EPA, efforts to reduce greenhouse gas emissions are a top priority within the scope of projects identified through SEPs. Relatedly, one of the most detrimental greenhouse gases –methane– is emitting from dams and obstructions located within freshwater streams as a result of buildup of organic matter and other factors. As climate change continues to impact hydrologic systems, reservoirs will likely be drawn down, causing higher rates of methane emissions. Legal and policy decisions clearly provide EPA the ability and responsibility to regulate greenhouse gas emissions, inevitably leading to violating entities. If a dam or obstruction is ineffective, inefficient, and is located in a community that supports its removal, removal should be considered as a SEP for an entity violating the Clean Air Act. Supporting these efforts will help to mitigate a small but meaningful contributor to global climate change, and has the potential to improve local, socio-ecological systems throughout the United States.