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EFFECTS OF THE CRAFT BEER BOOM IN VIRGINIA: HOW BREWERIES, REGULATORS, AND THE PUBLIC CAN COLLABORATE TO MITIGATE ENVIRONMENTAL IMPACTS

HANNAH FISH*

INTRODUCTION

The craft beer industry has the potential to be extremely energy- and resource-intensive, yet craft brewers have favored a more sustainable approach. Renewed support from both state and local legislatures paired with brewers' preference towards sustainable best practices, has placed Virginia in a position to become a leader in the growing sustainable craft beer industry.

Craft breweries in America are defined as “small, independent, and traditional”: a craft brewery operation generally produces six million barrels of beer or less annually, is not primarily owned or controlled by an alcoholic beverage industry member that is not itself a craft brewer, and combines traditional and non-traditional ingredients with innovative fermentation and brewing techniques.¹ In mid-2014, the number of craft breweries in the United States topped 3,000, likely the first time the United States has reached this number since the early 1870s.² In September of 2015, the number of active breweries surpassed 4,000.³ This means that the majority of Americans now live within ten miles of a local, independently owned craft brewery, and “with almost 2,000 planning breweries

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¹ *Craft Brewer Defined*, BREWERS ASSOC., <http://www.brewersassociation.org/statistics/craft-brewer-defined/> [<http://www.perma.cc/26XC-UXKV>] (last visited Oct. 26, 2015).

² Bart Watson, *U.S. Brewery Count Tops 3,000*, BREWERS ASSOC. (July 9, 2014), <http://www.brewersassociation.org/insights/us-brewery-count-tops-3000/> [<http://perma.cc/K58K-C5AA>]. The Internal Revenue Department counted 4,131 ale and lager breweries in operation in 1873. *Id.*

³ See Meghan Storey, *U.S. Brewery Count Surpasses 4,000*, CRAFTBEER (Sept. 29, 2015), http://www.craftbeer.com/brewers_banter/u-s-brewery-count-surpasses-4000 [<http://perma.cc/429K-ED85>].

in the [Brewers Association] database, that percentage is only going to climb in the coming years.”⁴

American brewing operations have a storied, patriotic history dating back to the early sixteenth century.⁵ In new American settlements, early colonists often constructed brewery buildings first because beer provided a safer alternative to polluted and diseased water supplies.⁶ Temperate regions as far south as Virginia also provided the optimal climate and soil to grow hops.⁷ By the nineteenth century, the United States Department of Agriculture had published scientific research documenting hops culture in the United States and abroad, and nationwide the number of active breweries had surpassed 4,000.⁸

Influential American leaders also notably led the charge in pioneering craft brews. In 1757, Virginia native George Washington documented a “small beer” recipe made with bran hops, yeast, and molasses.⁹ In his first craft beer recipe, Virginian Thomas Jefferson used malt purchased from neighbor William Meriweather and locally sourced hops.¹⁰ In 1794, Jefferson started growing hops in his garden at Monticello, and by 1814, Monticello had its own brewery and Jefferson had begun malting his own barley grain.¹¹ President Barack Obama, who started brewing small batch beers in the White House using local honey from the beehive on the White House’s South Lawn, is the most recent American President to take up sustainable small batch brewing.¹²

⁴ *Id.* The Brewers Association is a trade organization of brewers, wholesalers, retailers, and other individuals whose purpose is to promote and protect American craft brewers, their beers, and the community of brewing enthusiasts. *Id.*

⁵ Stan Hieronymus, *Timeline of Craft Beer History*, CRAFTBEER.COM, <http://www.craftbeer.com/the-beverage/history-of-beer/timeline> [<http://perma.cc/B6DY-A6KX>] (last visited Oct. 26, 2015).

⁶ Peter A. Kopp, *The Global Hop: An Agricultural Overview of the Brewer’s Gold*, in *THE GEOGRAPHY OF BEER* 81 (Patterson & Pullen eds. 2014); see also Jennifer McDonald, *Beer is King in Colonial Virginia!*, VA. CRAFT BEER (Aug. 10, 2014), <http://virginiacraftbeer.com/beer-is-king-in-colonial-virginia/> [<http://perma.cc/8HWE-NNR3>].

⁷ Kopp, *supra* note 6, at 81.

⁸ *Id.* at 84; Watson, *supra* note 2.

⁹ George Washington, *To Make Small Beer*, GEORGE WASHINGTON PAPERS MANUSCRIPTS & ARCHIVES DIV. OF THE N.Y. PUB. LIB., <http://nypl.org/locations/tid/36/node/40921> [<http://perma.cc/XF34-5XQE>] (last visited Oct. 26, 2015).

¹⁰ Ann Lucas, *Beer*, THOMAS JEFFERSON’S MONTICELLO (1995), <http://www.monticello.org/site/research-and-collections/beer> [<http://perma.cc/QGA6-3BMP>] (William Meriweather, uncle to Meriweather Lewis of the famed Lewis & Clark expedition).

¹¹ *Id.*

¹² See Sam Kass, *Ale to the Chief: White House Beer Recipe*, THE WHITE HOUSE (Sept. 01, 2012), <http://www.whitehouse.gov/blog/2012/09/01/ale-chief-white-house-beer-recipe> [<http://perma.cc/T65Y-MQCV>].

Modern-day Virginia legislators are following in the footsteps of the founding fathers, both at the federal and state levels. Current Senator Mark Warner is a member of the Senate Bipartisan Small Brewers Caucus, and current and retired House members Bobby Scott (VA-03), Robert Hurt (VA-05), Dave Brat (VA-07) and Jim Moran (VA-08) are members of the House Small Brewers Caucus.¹³ Current Virginia Governor Terry McAuliffe not only convinced one of the nation's top craft brewers to construct a new brewery, restaurant, garden, and retail store in Virginia's capital, but also serves local craft beer out of a Kegerator in his mansion during receptions.¹⁴ State legislators have shown their support for Virginia's craft breweries by passing House Joint Resolution No. 522, commending the Virginia Craft Brewers Guild for supporting local economies through the purchase of locally sourced barley and hops, the donation of spent hops for use as animal food, and the sale of locally brewed craft beer itself.¹⁵

The recent increase of craft breweries in Virginia is attributable in large part to SB 604, a 2012 law that permits breweries to sell beer for onsite consumption.¹⁶ Breweries that did not have full-service restaurants were previously limited to offering free samples and selling beer to go.¹⁷ Since Virginia lawmakers passed SB 604 in 2012, the number of craft breweries in Virginia has grown around seventy-five percent with a resulting economic impact of \$623 million.¹⁸ The total number of breweries in Virginia has risen past 100, with an additional fifteen to twenty

¹³ *Senate Bipartisan Small Brewers Caucus Members*, BREWERS ASSOC. (June 12, 2014), <http://www.brewersassociation.org/government-affairs/senate-small-brewers-caucus/senate-caucus-members/> [<http://perma.cc/PP4T-BSLQ>]; *House Small Brewers Caucus Members*, BREWERS ASSOC. (Oct. 22, 2014), <http://www.brewersassociation.org/government-affairs/house-small-brewers-caucus/house-caucus-members/> [<http://perma.cc/4W7R-9DBN>].

¹⁴ Laura Vozzella, *McAuliffe and Stone Brewing Co. toast craft beer deal*, WASH. POST (Oct. 10, 2014), https://www.washingtonpost.com/local/virginia-politics/mcauliffe-and-stone-brewing-co-toast-craft-beer-deal/2014/10/10/3136f300-501e-11e4-aa5e-7153e466a02d_story.html [<http://perma.cc/8MR3-GS5U>]; Press Release, Governor Terry McAuliffe, Governor McAuliffe Announces Stone Brewing Co. to Establish Operation in the City of Richmond (Oct. 9, 2014), <https://governor.virginia.gov/newsroom/newsarticle?articleId=6814> [<https://perma.cc/2BLB-W6Q4>].

¹⁵ H.R.J. Res. 522 (VA. 2012).

¹⁶ Caitlin Gibson, *'A rising tide' of craft breweries in Loudoun and beyond*, WASH. POST, July 14, 2014, http://www.washingtonpost.com/local/a-rising-tide-of-craft-breweries-in-loudoun-and-beyond/2014/07/08/30d08c0c-0611-11e4-bbf1-cc51275e7f8f_story.html [<http://perma.cc/K4SP-CNKG>]; Eric McKay, *SB 604 Has Passed! What this Means for Virginia Beer*, HARDYWOOD PARK CRAFT BREWERY (Mar. 5, 2012), <http://www.hardywood.com/content/sb-604-has-passed-what-means-virginia-beer> [<http://perma.cc/5EUA-WN6C>].

¹⁷ McKay, *supra* note 16.

¹⁸ Gibson, *supra* note 16.

breweries planned statewide.¹⁹ Two California-based breweries, Green Flash Brewing Company and Stone Brewing Company, are building breweries in Virginia Beach and Richmond and will potentially quadruple craft beer production in Virginia.²⁰

This Note seeks to identify environmental issues posed by the recent increase in craft breweries nationwide and in Virginia and proposes a combination of industry best practices and regulations that will help Virginia become a leader in the sustainable craft beer industry.²¹ Part I discusses the environmental issues and regulations breweries may come across, including water acquisition and use, wastewater disposal, solid waste disposal, and energy and climate change issues. Part II discusses recommended best practices for sustainable breweries based on industry innovators and recommends specific actions that Virginia craft breweries, legislators, and the public can take to mitigate resulting environmental impacts.

I. ENVIRONMENTAL ISSUES POSED BY BREWERIES

Large-scale brewing operations have traditionally been at odds with environmentalism: brewing is water and energy intensive, adds a number of different materials to the waste stream, and has a relatively large carbon footprint.²² While the basic recipe for beer is relatively

¹⁹ Sarah Kleiner Varble, *Craft brewing locally, statewide shows heady growth*, THE VIRGINIAN-PILOT (Oct. 14, 2014), <http://hamptonroads.com/2014/10/craft-brewing-locally-statewide-shows-heady-growth> [<http://perma.cc/93XZ-5M2W>]; Cassidy Rasnick, *Virginia is now home to over 100 craft breweries*, VA. CRAFT BREWERS GUILD (Jan. 21, 2015), <http://virginiacraftbrewers.org/post/Virginia-is-now-home-to-over-100-craft-breweries.aspx> [<http://perma.cc/Y8KP-Z4GN>].

²⁰ Kleiner Varble, *supra* note 19.

²¹ Many smaller craft breweries that are also brewpubs (breweries inside restaurants) are subject to the same compliance laws and regulations as restaurants, and breweries also fall under the purview of certain environmental laws as they expand their annual production volume. Email from Chuck Skypeck, Technical Brewing Projects Coordinator, Brewers Association, to author (Feb. 09, 2015) (on file with author). However this Note looks broadly at environmental issues that craft breweries might face.

²² Nancy Hoalst-Pullen, Mark W. Patterson, Rebecca Anna Mattord & Michael D. Vest, *Sustainability Trends in the Regional Craft Beer Industry*, in THE GEOGRAPHY OF BEER 109 (Patterson & Pullen eds. 2014); James McWilliams, *The Ecological Creed of Craft Beer*, UNIV. OF WASH. CONSERVATION MAG., Mar. 14, 2014, available at <http://conservationmagazine.org/2014/03/sustainable-practices-in-craft-brewing/> [<http://perma.cc/VZ9J-W4L7>]; Mikala Reasbeck, *Craft Beer Industry Boldly Brews With Sustainability in Mind*, MINTPRESS NEWS, Apr. 1, 2015, <http://www.mintpressnews.com/craft-beer-industry-boldly-brews-with-sustainability-in-mind/203850/> [<http://perma.cc/EFW4-CPVX>].

simple—water, hops, barley, and yeast—it is the acquisition, processing, and ultimate conversion of those ingredients into a consumable product dispersed to the public that presents unique environmental issues.

Prior to the 1990s when smaller craft breweries began to proliferate, large brewing operations utilized natural resources in a seemingly “boundless and expendable” way.²³ For example, behemoth Coors Brewing Company illegally dumped industrial solvents into Colorado waters, was accused of violating the federal Clean Air and Clean Water Acts 240 times between 1986 and 1991, and in 1991 paid a \$700,000 fine for violating hazardous waste laws.²⁴

In contrast, the craft beer industry posits itself as inherently sustainable through local ingredient sourcing, production, and distribution.²⁵ Accompanying the inherently local nature of sustainable craft brewing are local environmental laws.²⁶ While water, waste, energy, and climate laws are written broadly at the federal level, states and municipalities interpret and enforce those laws differently throughout the country.

A. *Water Quality and Quantity*

Clean water is a necessary resource for quality craft beer production. Craft brewers are currently facing, and will continue to face, issues pertaining to both the quality and quantity of water available.²⁷

²³ McWilliams, *supra* note 22.

²⁴ *Id.*; see also Porter et al., *Recent Developments in Energy Resources Law*, 30 TORT & INS. L.J. 340, 341 (1995) (discussing the \$1.05 million penalty the Colorado Department of Health assessed against Adolph Coors Brewing Company (“Coors”) “for uncontrolled emissions of volatile organic compounds [“VOCs”] in violation of the state air pollution control law.”); Michael Parrish, *EPA Cites Coors in Pollution of Ground Water at Brewery*, L.A. TIMES, June 20, 1990, http://articles.latimes.com/1990-06-20/business/fi-324_1_adolph-coors [<http://perma.cc/WT6U-6WJE>].

²⁵ Hoalst-Pullen et al., *supra* note 22, at 109. One definition of sustainable craft brewing, developed by New Belgium Brewery, involves “making business decisions based on minimizing environmental impact, encouraging the growth of . . . employee owners, and being a socially responsible contributor to [the] community.” Matt Lyman, *Craft Beer Buzz Words: Episode II—Sustainable*, AM. CRAFT BEER (Sept. 12, 2012), <http://americancraftbeer.com/item/craft-beer-buzz-words-episode-ii-sustainable.html> [<http://perma.cc/Q7Q8-CWKF>].

²⁶ Marcus Powers, *Turning Water into Beer: The Impact of Federal, State, & Local Laws on Craft Breweries*, UNIV. OF NEB.—LINCOLN NEB. WATER CTR. (Nov. 14, 2014), available at http://watercenter.unl.edu/WaterLawConf2012/downloads/powers_marcus.pdf [<http://perma.cc/73GK-8HMG>].

²⁷ *Brewing Up Commitment to Clean Water*, COLO. WATER TRUST (Apr. 29, 2014), <http://www.coloradowatertrust.org/newsroom/brewing-up-commitment-to-clean-water> [<http://perma.cc/MD26-XTGP>].

1. Water Quality Issues

Historically, primary considerations for brewery site selection centered on direct access to a water source that both facilitated the brewing process and produced a high quality beer.²⁸ Modern-day breweries are just as selective about water quality, tailoring brewing operations conjointly with the quality of the local water source.²⁹ Trace minerals can affect “the chemistry of the mash, the flavor of the beer, how hops are received, and the softness and roundness of the beer.”³⁰ Additionally, water characteristics such as pH, alkalinity, and hardness, which tend to vary by region, “contribute to the taste and aroma of beer.”³¹ These local water quality characteristics are integral in creating a beer’s unique flavor, and brewers often favor different sources of water depending on how they contribute to the taste of the beer.³² For example, water quality concerns played a significant role in Sierra Nevada Brewing Company’s expansion, because Sierra Nevada’s corporate brand is “closely linked to the perceived quality of streams fed by melting snow packs atop the Sierra Nevada Mountains.”³³ By emphasizing the connection between the brewing process and specific regional geography, breweries can leverage these local ties to both protect water quality and remain competitive in regional markets.³⁴

There is a two-tiered approach to water quality regulation depending on whether surface and groundwater sources,³⁵ or municipal water sources, are being utilized. At the federal level, the Clean Water Act primarily governs the water quality of surface and groundwater resources.³⁶ The objective of the Clean Water Act is to “restore and maintain the chemical, physical, and biological integrity of the nation’s

²⁸ Jay D. Gatrell, David J. Nemeth, & Charles D. Yeager, *Sweetwater, Mountain Springs, and Great Lakes: A Hydro-Geography of Beer Brands*, in *THE GEOGRAPHY OF BEER* 91 (Patterson & Pullen eds. 2014).

²⁹ Mason Adams, *Craft brewers join the fight against natural gas pipelines*, GRIST (Oct. 22, 2014), <http://grist.org/climate-energy/craft-brewers-join-the-fight-against-natural-gas-pipelines/> [<http://perma.cc/87X8-P5FY>].

³⁰ *Id.*

³¹ Gatrell et al., *supra* note 28, at 93.

³² Alastair Bland, *California Brewers Fear Drought Could Leave Bad Taste In Your Beer*, NPR (Feb. 20, 2014), <http://www.npr.org/sections/thesalt/2014/02/19/279627234/california-brewers-fear-drought-could-leave-bad-taste-in-your-beer> [<http://perma.cc/8LEW-H2Y4>].

³³ Gatrell et al., *supra* note 28, at 92.

³⁴ *Id.* at 93–94.

³⁵ Examples of surface and groundwater sources can include rivers, lakes, reservoirs, springs, and ground water wells. See *Safe Drinking Water Act*, *infra* note 39.

³⁶ 33 U.S.C. § 1251(a).

waters.³⁷ Most importantly, the Clean Water Act helps to ensure the availability of clean water for an industry in which water contamination can have devastating effects.³⁸

In contrast, municipal water treatment is governed by the Safe Drinking Water Act (“SDWA”). Unlike the Clean Water Act, SDWA regulations require municipalities to take affirmative actions to remove certain water contaminants.³⁹ Importantly, however, the municipal water process can possibly strip the water of minerals desired by breweries in the process.⁴⁰ Although the SDWA directly governs municipal water treatment, the Clean Water Act still plays an indirect role in municipal treatment, because municipal action is predicated upon the initial quality of water obtained from surrounding rivers, lakes, reservoirs, springs, and ground water wells.⁴¹ The less municipalities need to treat the water, the fewer resources brewers need to prepare the water for the brewing process.⁴²

2. Water Acquisition & Quantity Issues

Water composes anywhere from eighty-five to ninety-five percent of many beers;⁴³ the average water use ratio for a commercial brewery is around seven barrels of water to one barrel of beer.⁴⁴ In contrast, many

³⁷ *Id.*

³⁸ Jessica Schmonsky, *How Craft Beer Can Save the World*, VOICES FOR BIODIVERSITY (June 13, 2013), <http://voicesforbiodiversity.org/articles/how-craft-beer-can-save-the-world> [<http://perma.cc/228W-XM7X>].

³⁹ *Safe Drinking Water Act*, EPA, <http://water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm> [<http://perma.cc/9FNG-N9PB>] (last visited Oct. 26, 2015).

⁴⁰ Brewers for Clean Water, *How Protecting Streams and Wetlands Makes for Great Beer*, NAT. RES. DEF. COUNCIL, <http://www.nrdc.org/water/brewers-for-clean-water/making-great-beer.asp> [<http://perma.cc/85KU-UF3G>] (last visited Oct. 26, 2015).

⁴¹ *Safe Drinking Water Act*, *supra* note 39.

⁴² Brewers for Clean Water, *supra* note 40.

⁴³ Reshard Alexander, *Sustainable Craft Brewing: The Legal Challenges*, TRIPLE PUNDIT (June 6, 2012), <http://www.triplepundit.com/2012/06/legal-issues-in-beer-brewing/> [<http://perma.cc/9UHM-XU3M>]; *see also* Chris Bentley, *Midwest breweries lead environmental group's charge to fortify water laws*, WBEZ 91.5 CHIC. (Apr. 12, 2013), <http://www.wbez.org/blogs/chris-bentley/2013-04/midwest-breweries-lead-environmental-groups-charge-fortify-water-laws> [<http://perma.cc/9DJV-723F>].

⁴⁴ BREWERS ASSOC., WATER AND WASTEWATER: TREATMENT/VOLUME REDUCTION MANUAL 5 [hereinafter WATER AND WASTEWATER MANUAL], *available at* http://www.brewersassociation.org/attachments/0001/1517/Sustainability_-_Water_Wastewater.pdf [<http://perma.cc/JYG9-Y2J8>]; *see also* Keith Gribbins, *The growing challenges of brewery wastewater systems*, CRAFT BREWING BUS. (Sept. 6, 2013), <http://www.craftbrewingbusiness.com>

craft brewers have a water use ratio of around three barrels of water to one barrel of beer, far below the industry average.⁴⁵ Municipalities mainly facilitate and regulate breweries' water consumption; many craft breweries receive their water from municipal suppliers, and then municipal treatment plants treat about seventy percent of the returned wastewater.⁴⁶

Water rights acquisition schemes for securing surface water and groundwater, an alternative to acquiring water from a municipal water source, vary throughout the United States. California, with the largest number of craft breweries in the nation at 550 as of early 2015,⁴⁷ operates under a prior appropriations water rights system that encumbers water rights transfers and disincentivizes water conservation.⁴⁸ However, droughts in the United States are currently affecting the quantity and quality of water that is available.⁴⁹ Where some California craft breweries previously used river water to make their beer, possible mandatory water use restrictions are forcing brewers to consider the switch to well water, which would mean modifying water treatment processes or recipes altogether.⁵⁰

Virginia breweries have two options for water acquisition. The first option is to purchase water from an existing municipal or other regulated waterworks operation. Unlike California, Virginia is not currently struggling with droughts. However, Virginia municipalities must still submit water supply plans to the State Water Control Board to ensure the longevity of the Commonwealth's water resources.⁵¹ Under the water supply planning regulations, a municipality must include a statement of

/equipment-systems/growing-challenges-wastewater-control-craft-brewing/ [http://perma.cc/YH6Q-NH64].

⁴⁵ WATER AND WASTEWATER MANUAL, *supra* note 44, at 5.

⁴⁶ *Id.*

⁴⁷ John Verive, *Craft beer is now a \$6.5-billion industry in California*, L.A. TIMES (May 6, 2015), <http://www.latimes.com/food/dailydish/la-dd-california-craft-brewers-impact-20150506-story.html> [http://perma.cc/5DHJ-7CFM].

⁴⁸ Alexander, *supra* note 43 (discussing the unsustainable nature of a prior appropriations water rights system, in that it "gives water use preference to the first owner in the area and then requires that the landowner consume the same amount of prescribed water every year whether he/she needs to use it or not.").

⁴⁹ McWilliams, *supra* note 22.

⁵⁰ The head brewer at Lagunitas Brewing Company, Jeremy Marshall, stated that switching from Russian River water to a groundwater resource "would be like brewing with Alka-Seltzer." Bland, *supra* note 32.

⁵¹ 9 VA. ADMIN. CODE § 25-780-20 (2015); *Water Supply Planning Program*, VA. DEP'T OF ENVTL. QUALITY, <http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/WaterSupplyPlanning.aspx> [http://perma.cc/NKY7-B8V8] (last visited Oct. 26, 2015).

need based on the adequacy of existing water sources to meet current and projected water demand over a thirty- to fifty-year planning horizon.⁵²

The second water acquisition option for Virginia breweries is for a brewery to secure its own source of water, either through a surface or groundwater withdrawal. Depending on the volume and location of a surface or groundwater withdrawal, Virginia's Department of Environmental Quality ("DEQ") Water Withdrawal Permitting Program requirements may apply.⁵³ Surface water withdrawals from a nontidal water body will trigger permitting requirements when withdrawals are greater than or equal to 10,000 gallons per day.⁵⁴ Surface water withdrawals from a tidal water body will trigger permitting requirements when withdrawals are greater than or equal to two million gallons per day.⁵⁵ Finally, groundwater withdrawals located within either the Eastern Virginia or Eastern Shore Ground Water Management Areas trigger permitting requirements when withdrawals are greater than or equal to 300,000 gallons in any one month.⁵⁶

The amount of water utilized by a brewery can vary depending on several brewery activities.⁵⁷ In addition to use in the actual beer itself, water is also used for cleaning brewing equipment, pasteurization, and in the packaging process.⁵⁸ American courts have recognized the importance of water for use in all steps of the brewing process dating back as far as 1889.⁵⁹ The court in *Sedalia Brewing Co. v. Sedalia Waterworks Co.* noted that implied in a brewery contract for water was the amount of water required for "everything in the brewing process: from 'cleaning the

⁵² *Water Supply Planning Program*, *supra* note 51.

⁵³ *Water Supply Planning Program—Annual Water Withdrawal Reporting*, VA. DEP'T OF ENVTL. QUALITY, <http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/WaterSupplyPlanning/AnnualWaterWithdrawalReporting.aspx> [<http://perma.cc/ARR2-HULD>] (last visited Oct. 26, 2015).

⁵⁴ *Id.*

⁵⁵ *Withdrawing Surface Water in Virginia*, VA. DEP'T OF ENVTL. QUALITY, http://offices.ext.vt.edu/rockingham/programs/anr/Crops/crop_videos/deq-withdrawing-surface-water-va.pdf [<http://perma.cc/LAR4-57HV>] (last visited Oct. 26, 2015).

⁵⁶ 9 VA. ADMIN. CODE §§ 25-600-20, -610-50 (2015); *Groundwater Withdrawal Permitting Program*, VA. DEP'T OF ENVTL. QUALITY, <http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterPermitting.aspx> [<http://perma.cc/U8UZ-2EVU>] (last visited Oct. 26, 2015).

⁵⁷ Donoghue et al., *The Environmental Performance of the European Brewing Sector*, BREWERS OF EUR. 15 (2012), available at http://www.brewersofeurope.org/uploads/mycms-files/documents/archives/publications/2012/envi_report_2012_web.pdf [<http://perma.cc/JT3W-NPLB>].

⁵⁸ *Id.*

⁵⁹ Heather Coe-Smith, *Drink Beer, Conserve Water*, 2 ARIZ. J. ENVTL. L. & POL'Y 1, 1 (2012).

brewery, for use in the boiler, washing out vats, beer-barrels, tubs, kettles, and other things connected with the brewery.”⁶⁰

In 2010, craft breweries only accounted for around five percent of water use resulting from the sale of seven trillion gallons of beer.⁶¹ However, the proliferation of craft breweries means this percentage is only likely to increase in the future.

B. Wastewater

The most visible environmental issue facing craft brewers is the processing and disposal of brewery wastewater.⁶² Brewery wastewater includes solid wastes such as spent grains, yeast, and spent hops that can weigh up to fifty pounds per barrel of beer produced.⁶³ If disposed into rivers or other public waters untreated, brewery wastewater would facilitate plant, algae, and bacteria growth, leading to reduced oxygen levels detrimental to fish and other aquatic life.⁶⁴ The Clean Water Act establishes a regulatory structure for discharging pollutants into the waters of the United States.⁶⁵ The National Pollutant Discharge Elimination System (“NPDES”) Permit Program is a key component of the Clean Water Act and requires that dischargers of pollutants into the waters of the United States obtain a permit to discharge.⁶⁶ The NPDES program consists of various regulations that might impact breweries, including the General Pretreatment Regulations under the National Pretreatment Program and effluent limitations guidelines.⁶⁷ The National Pretreatment Program addresses indirect discharges from industries to publicly owned treatment works (“POTWs”), or municipal water treatment plants.⁶⁸

⁶⁰ *Id.* (citing *Sedalia Brewing Co. v. Sedalia Waterworks Co.*, 34 Mo. App. 49, 56 (1889)).

⁶¹ Powers, *supra* note 26, at 1.

⁶² Gribbins, *supra* note 44.

⁶³ Reasbeck, *supra* note 22.

⁶⁴ John Mercer, *Wastewater Opportunities for the Craft Brewer: Successful examples of real world craft brewery wastewater solutions*, BREWERYWASTEWATER.COM, <http://brewerywastewater.com/wp-content/uploads/2013/10/MBAA-Talk.pdf> [<http://perma.cc/9DVY-D38F>] (last visited Oct. 26, 2015); *What is a dead zone?*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN., <http://oceanservice.noaa.gov/facts/deadzone.html> [<http://perma.cc/CCY4-8X95>] (last visited Oct. 26, 2015).

⁶⁵ 33 U.S.C. § 1251 (2012).

⁶⁶ *Introduction to the National Pretreatment Program*, EPA, at iii (2011), available at http://water.epa.gov/polwaste/npdes/pretreatment/upload/pretreatment_program_intro_2011.pdf [<http://perma.cc/6KF4-4BM4>].

⁶⁷ WATER AND WASTEWATER MANUAL, *supra* note 44, at 9.

⁶⁸ *Id.*

POTWs generally treat domestic sewage, however they also receive wastewater from industrial users, including breweries.⁶⁹ The General Pretreatment Regulations of the National Pretreatment Program delineate responsibilities of governments and industrial users to “control pollutants from the industrial users which may pass through or interfere with POTW treatment processes.”⁷⁰

Relative to regular domestic wastewater that most POTWs or municipal water treatment plants were designed to deal with, brewery wastewater is “high in sugar, high in alcohol, potentially high in solids, high temperature, [and] low pH.”⁷¹ Types of pollution accounted for, and limited, in federal, state, and municipal wastewater regulations that may affect breweries include biochemical oxygen demand (“BOD”), chemical oxygen demand (“COD”), total suspended solids (“TSS”), total dissolved solids (“TDS”), and pH.⁷² Respective state departments of environmental quality or protection generally regulate wastewater pH discharge limits through state NPDES programs.⁷³ Other wastewater characteristics, such as temperature, are generally regulated at the municipal level according to standards set by the respective state’s environmental quality agency.⁷⁴

Virginia brewers may also be indirectly impacted by requirements in section 303(d) of the Clean Water Act, which requires that states develop lists of impaired waters that are too polluted or otherwise degraded to meet water quality standards.⁷⁵ States that have impaired waters must

⁶⁹ *Pretreatment*, EPA, <http://water.epa.gov/polwaste/npdes/pretreatment/> [<http://perma.cc/7FB3-TRHF>] (last visited Oct. 26, 2015).

⁷⁰ *Id.*

⁷¹ John Mercer, *Brewery Wastewater 101 Introduction*, BREWERYWASTEWATER.COM, <http://brewerywastewater.com/the-nature-of-brewery-wastewater/brewery-wastewater-101-introduction/> [<http://perma.cc/BE6T-X6CB>] (last visited Oct. 26, 2015).

⁷² See WATER AND WASTEWATER MANUAL, *supra* note 44, at 17; Whalen Insurance Brewery Safety Program, *Safety, Environmental and Alcohol Loss Control Program Offered Free of Charge to Brewpubs and Microbreweries*, WHALEN INS. AGENCY 5-2 (2004), available at <http://www.whaleninsurance.com/brewery/library/BEVTAP%20Manual/whalen%20manual%20BEVTAP%20manual%20chap%205%20v2.pdf> [<http://perma.cc/RR79-JF46>].

⁷³ John Mercer, *Brewery Wastewater 101 pH Control*, BREWERYWASTEWATER.COM, <http://brewerywastewater.com/the-nature-of-brewery-wastewater/brewery-wastewater-101-ph-control/> [<http://perma.cc/GZ2H-WQL6>] (last visited Oct. 26, 2015).

⁷⁴ John Mercer, *Brewery Wastewater 101 Solids and Temperature Control*, BREWERYWASTEWATER.COM, <http://brewerywastewater.com/the-nature-of-brewery-wastewater/brewery-wastewater-101-solids-temperature-control/> [<http://perma.cc/VMU6-HLW6>] (last visited Oct. 26, 2015).

⁷⁵ *Impaired Waters and Total Maximum Daily Loads*, EPA, <http://water.epa.gov/lawsregs/lawguidance/cwa/tmdl/> [<http://perma.cc/PNZ3-HTUF>] (last visited Oct. 26, 2015).

develop a Total Maximum Daily Load (“TMDL”), or calculation of the maximum amount of a pollutant that the impaired waters can receive and still safely meet water quality standards.⁷⁶ Virginia’s Chesapeake Bay TMDL addresses nitrogen, phosphorus, and sediment, the three main pollutants responsible for the impaired water designation of the Bay.⁷⁷ Wastewater is one major source category regulated in Chesapeake Bay localities in an attempt to meet water quality goals under the Clean Water Act.⁷⁸

Therefore, in states like Virginia, which are mandated under federal and state law to reduce wastewater impacts, breweries must remain cognizant of how their wastewater is processed and disposed.⁷⁹

C. *Solid Waste Disposal*

Brewers do not have the same control over waste produced at the brewery and post-consumer packaging waste once the final product has left the brewery. Additionally, solid waste disposal and recycling regulations often govern municipalities generally rather than the breweries specifically.⁸⁰ However, brewers often establish their own corporate recycling programs, in addition to implementing recycling education programs in local communities, to help mitigate impacts to the solid waste stream.

Breweries generally produce four types of solid waste: brewing process wastes, packaging wastes, food service wastes, and wastes generated during special events.⁸¹ Hauling this trash to landfills by front-loading garbage truck—the traditional method of solid waste disposal—has a relatively large environmental impact, because landfills are increasingly located further away from populated areas which results in an increased travel footprint.⁸² The trucks and trains used to transport solid waste also generate diesel exhaust, which contains nearly forty toxic substances that together have been classified as a probable or potential human carcinogen by the Environmental Protection Agency (“EPA”).⁸³ Finally, the landfills

⁷⁶ *Id.*

⁷⁷ *Chesapeake Bay TMDL*, VA. DEP’T OF ENVTL. QUALITY, <http://www.deq.virginia.gov/Programs/Water/ChesapeakeBay/ChesapeakeBayTMDL.aspx> [<http://perma.cc/N5TB-JLZR>] (last visited Oct. 26, 2015).

⁷⁸ *Id.*

⁷⁹ *Id.*

⁸⁰ BREWERS ASSOC., SOLID WASTE REDUCTION MANUAL 6 [hereinafter SOLID WASTE REDUCTION MANUAL], available at http://www.brewersassociation.org/attachments/0001/1529/Sustainability_Manual_Solid_waste.pdf [<http://perma.cc/5BHX-MMMP>].

⁸¹ *Id.*

⁸² *Id.* at 5.

⁸³ Dan Kulpinski, *Human Footprint: Where Does All the Stuff Go?*, NAT’L GEO., available

themselves disturb a significant amount of earth and can introduce wastewater into the environment that adversely affects surrounding waters.⁸⁴ Brewers are voluntarily working to significantly reduce waste generated and increase the use of recyclable materials, which results in both a reduced carbon footprint and fewer natural resource impacts.⁸⁵

The availability of municipal recycling programs varies as mandatory recycling and waste minimization requirements are generally established at the local or regional level.⁸⁶ In Virginia, the General Assembly sets recycling rates for localities and mandates that cities, towns, or regional authorities establish recycling programs that meet or exceed a recycling goal of twenty-five percent of its municipal solid waste generation.⁸⁷ The Virginia Waste Management Board's Solid Waste Planning and Recycling Regulations direct that the order of priority for solid waste management strategies is source reduction, reuse, recycling, resource recovery, incineration, and lastly landfilling.⁸⁸ Further, the planning requirements state that solid waste management plans shall include economic growth and development data and analysis, and possible markets for the reuse and recycling of materials.⁸⁹ Compared to the national recycling rate of 34.5% in 2012,⁹⁰ in 2013 Virginia recorded a recycling rate of 41.2%, with the highest recycling rates experienced by programs in urban areas of Virginia.⁹¹

D. *Climate Change Impacts*

Climate change will negatively impact many brewery operations by impacting breweries' water consumption, recycling, and solid waste

at <http://channel.nationalgeographic.com/channel/human-footprint/trash-talk2.html> [<http://perma.cc/U5Q6-JNN8>] (last visited Oct. 26, 2015).

⁸⁴ *Sector L: Landfills and Land Application Sites, Industrial Stormwater Fact Sheet Series*, EPA (Dec. 2006), http://water.epa.gov/polwaste/npdes/stormwater/upload/sector_l_landfills.pdf [<http://perma.cc/3V8G-CU4F>].

⁸⁵ SOLID WASTE REDUCTION MANUAL, *supra* note 80, at 5.

⁸⁶ *Id.* at 7.

⁸⁷ *Mandatory Recycling Rates for Localities*, VA. DEP'T OF ENVTL. QUALITY, <http://www.deq.virginia.gov/Programs/LandProtectionRevitalization/RecyclingandLitterPreventionPrograms/MandatoryRecyclingRates.aspx> [<http://perma.cc/D9PV-UJZE>] (last visited Oct. 26, 2015).

⁸⁸ 9 VA. ADMIN. CODE § 20-130-120(A)(2) (2015).

⁸⁹ *Id.* § 20-130-120(C)(2)–(3) (2015).

⁹⁰ *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012*, EPA (Feb. 2014), http://www.epa.gov/osw/nonhaz/municipal/pubs/2012_msw_fs.pdf [<http://perma.cc/C97U-P2M8>].

⁹¹ *Mandatory Recycling Rates for Localities*, *supra* note 87.

disposal methods.⁹² Changes in temperature, precipitation, sea level, and the frequency and severity of extreme events will impact both future energy consumption and the availability of energy sources.⁹³ Additionally, the quality of beer itself will be impacted as increasing temperatures and rainfall variability will change the growing geographies of hops and barley.⁹⁴ Hops and barley, two crops that are highly dependent on specific growing conditions, will be more difficult to grow and harvest in light of a changing climate.⁹⁵

1. Climate Change Impacts to Energy

While large brewing operations may need to address their emissions under the Clean Air Act, small craft brewers only address energy use and greenhouse gas emissions as a function of cost and the sustainable ethos of craft brewing.⁹⁶ Generally, the brewing process utilizes natural gas to generate hot water and steam, while all equipment is powered by electrical energy.⁹⁷ Production and use of energy accounts for more than eighty percent of the United States' greenhouse gas emissions, and the resulting increase in temperature from climate fluctuations will likely

⁹² Current water risks that breweries are facing, including "water shortages and reliability, . . . increasing water costs, and supply chain interruptions," will be magnified in the face of increasing global temperatures and more frequent extreme weather events. WATER AND WASTEWATER MANUAL, *supra* note 44, at 36. Traditional solid waste management, including incinerators and landfills, will continue to emit greenhouse gases as waste burns or decomposes. *Climate Change and Municipal Solid Waste Fact Sheet*, EPA, <http://www.epa.gov/osw/conserve/tools/payt/tools/factfin.htm> [<http://perma.cc/XC2V-ZYTL>] (last visited Oct. 26, 2015).

⁹³ *Climate Impacts on Energy*, EPA, <http://www.epa.gov/climatechange/impacts-adaptation/energy.html> [<http://perma.cc/YS9J-Y28J>] (last visited Oct. 26, 2015).

⁹⁴ Stephen Yool & Andrew Comrie, *A Taste of Place: Environmental Geographies of the Classic Beer Styles*, in *THE GEOGRAPHY OF BEER* 106 (Patterson & Pullen eds. 2014).

⁹⁵ *Climate Impacts on Agriculture and Food Supply*, EPA, <http://www.epa.gov/climatechange/impacts-adaptation/agriculture.html> [<http://perma.cc/DCZ3-76RC>] (last visited Oct. 26, 2015).

⁹⁶ BREWERS ASSOC., ENERGY USAGE, GHG REDUCTION, EFFICIENCY AND LOAD MANAGEMENT MANUAL 6 [hereinafter ENERGY USAGE MANAGEMENT MANUAL], available at https://www.brewersassociation.org/attachments/0001/1530/Sustainability_Energy_Manual.pdf [<https://perma.cc/5LK3-TYJ5>]. The EPA regulates emissions from specific industries that directly emit 25,000 metric tons of carbon dioxide equivalent or more per year under its Greenhouse Gas Reporting Program ("GHGRP"). *Id.* For a typical craft brewery that produces roughly 125 barrels of beer per metric ton of carbon dioxide emitted, the GHGRP would likely not apply. *Id.* However, that might change if EPA changed the threshold for regulation.

⁹⁷ Natural gas is responsible for an average of 70% of the energy consumed in a brewery. ENERGY USAGE MANAGEMENT MANUAL, *supra* note 96, at 6.

affect energy consumption as well as the ability to produce and reliably deliver it.⁹⁸ Therefore, breweries are considering alternative energy sources, including solar power, wind power, biomass, and biogas, to mitigate environmental impacts.⁹⁹

The inability to produce and reliably deliver energy is already impacting craft breweries, by no fault of the breweries themselves. In 2013, Michigan's Bell's Brewery filed a lawsuit against energy company Enbridge after an Enbridge pipeline broke and spilled an estimated 843,000 gallons of oil into the Kalamazoo River.¹⁰⁰ The lawsuit arose from Enbridge's subsequent cleanup efforts mandated by EPA, which included dredging the Kalamazoo River where the oil spill occurred.¹⁰¹ Bell's Brewery alleged that planned dredging of the river would "release pollution, hazardous substances, odor, dust and particulate" which could negatively impact brewery operations.¹⁰² The Enbridge pipeline carries diluted bitumen oil, which sinks into river sediment and cannot be skimmed off the surface of a waterway like most oil.¹⁰³ The proposed Keystone XL pipeline will carry the same type of oil, and similar accidents could result in thousands of gallons of oil stuck in river bottom sediment.¹⁰⁴

2. Climate Change Impacts to Agriculture

Hops and barley, two crops that are highly dependent on specific climate conditions, are currently and will continue to be more difficult

⁹⁸ *Climate Impacts on Energy*, *supra* note 93.

⁹⁹ ENERGY USAGE MANAGEMENT MANUAL, *supra* note 96, at 43; Chris O'Brien, *Beer and Climate Change*, BEER ACTIVIST (2008), <http://beeractivist.com/2008/07/18/beer-and-climate-change/> [<http://perma.cc/G6GX-XPSV>]. There are many steps in the brewing process that taken together generate greenhouse gas emissions where alternative energy sources might be utilized. For example, the total carbon footprint of a 60-case pallet of beer is over one metric ton of greenhouse gases.

¹⁰⁰ Tina Casey, *New Beer Lawsuit Could Spell Trouble for Keystone XL Pipeline*, CLEAN TECHNICA (July 26, 2013), <http://cleantechnica.com/2013/07/26/new-beer-lawsuit-could-spell-trouble-for-keystone-xl-pipeline/> [<http://perma.cc/WQ9N-4FKY>].

¹⁰¹ *Id.*

¹⁰² Ursula Zerilli, *Bell's Brewery files lawsuit against Enbridge and Comstock Commerce Park developer over dredging plans*, MLIVE.COM (July 24, 2013), http://www.mlive.com/news/kalamazoo/index.ssf/2013/07/bells_brewery_files_case_again.html [<http://perma.cc/E93A-R4XS>]; Nate Schweber, *Conserving Water: The Fight to Protect Beer's Main Ingredient*, ALLABOUT BEERMAG. (Nov. 24, 2013), <http://allaboutbeer.com/article/brewers-for-clean-water/> [<http://perma.cc/E4SF-SWFK>].

¹⁰³ Casey, *supra* note 100.

¹⁰⁴ *Id.*

to grow and harvest in light of a changing climate.¹⁰⁵ Growing hops requires “deep, loose, and fertile soils,” and specific hop quality is extremely geography-dependent.¹⁰⁶ Hops and barley are sensitive plants and the tastes of both are determined by a number of environmental factors; decreasing precipitation and increasing air temperatures in hop growing regions have already resulted in decreased hop yield and quality.¹⁰⁷

The majority of barley produced in the United States is grown in just a few states, and changing climate conditions are currently negatively impacting crops.¹⁰⁸ Recently, heavy rain damaged harvests in Montana, North Dakota, and Idaho.¹⁰⁹ Canada, one of the largest exporters of barley, also recently harvested its smallest barley crop since 1968 after experiencing snow and freezing temperatures.¹¹⁰ Brewers and consumers will face increasing prices in the coming years as a result of these climate change impacts; agricultural losses due to extreme weather events will ultimately be reflected in the price of beer.¹¹¹ Additionally, craft brewers will feel these quality and price impacts more so than large, non-craft brewers because craft beers use four times more barley per barrel of beer compared with their corporate beer counterparts.¹¹²

¹⁰⁵ Yool & Comrie, *supra* note 94, at 106; Ryan Koronowski, *Three Ways Climate Change is Going to Ruin Your Beer*, CLIMATE PROGRESS (June 7, 2014), <http://thinkprogress.org/climate/2014/06/07/3446248/climate-change-beer-water/> [<http://perma.cc/WN5X-GUZ8>].

¹⁰⁶ Kopp, *supra* note 6, at 78. The hop plant grows best in temperate regions within latitudes 30–55 degrees on either side of the equator, and requires “winter frosts for required dormancy, wet springs to initiate rapid growth, and dry summers to stave off pests and diseases.”

¹⁰⁷ Yool & Comrie, *supra* note 94, at 107.

¹⁰⁸ Deena Shanker, *Organic beer: Here to stay, or barley there?*, GRIST (May 28, 2013), <http://grist.org/food/organic-beer-here-to-stay-or-barley-there/> [<http://perma.cc/4WZU-U2FN>].

¹⁰⁹ Allie Goolrick, *Beer Prices Likely to be Impacted by Rain Damage to Malt Barley Crop in Montana, North Dakota and Idaho*, THE WEATHER CHANNEL (Sept. 13, 2014), <http://www.weather.com/news/rain-damages-malt-barley-crop-20140913> [<http://perma.cc/2N2H-PNZP>].

¹¹⁰ Chris Crowell, *Bad news about this year's barley crop*, CRAFT BREWING BUS. (Sept. 30, 2014), <http://www.craftbrewingbusiness.com/ingredients-supplies/bad-news-years-barley-crop/> [<http://perma.cc/5VXG-TLCL>].

¹¹¹ Yool & Comrie, *supra* note 94, at 107; Goolrick, *supra* note 109.

¹¹² Tom Philpott, *Craft Beer Uses 4 Times As Much Barley As Corporate Brew*, MOTHER JONES (Jan. 20, 2015), <http://www.motherjones.com/tom-philpott/2015/01/corporate-beer-it-really-watered-down> [<http://perma.cc/QFQ8-C5J4>]; Bond et al., *Boutique Brews, Barley, and the Balance Sheet: Changes in malt barley industrial use require an updated forecasting approach*, U.S. DEP'T OF AGRIC. ECON. RESEARCH SERV. (Jan. 14, 2015), http://www.ers.usda.gov/media/1736895/fds_15a_sa.pdf [<http://perma.cc/BEG9-J9XC>].

II. RECOMMENDATIONS

Craft breweries themselves exhibit some of the best examples of sustainable best practices that Virginia breweries can implement to ensure minimal impacts on water, waste, and energy resources. Virginia breweries can look to other parts of the country, and even other parts of the world, to stay ahead of the curve with regard to new sustainable brewing techniques.¹¹³ In their own right, Virginia craft breweries have already taken action to both ensure sustainable brewing operations and influence legislation that works to benefit the breweries themselves, the state government, and the environment.

A. *Mitigating Water Quality & Quantity Impacts*

Water is arguably the most important part of the beer brewing process and accordingly, craft brewers are active in protecting both the quality of available water as well as the quantity. Craft breweries are joining with environmental organizations (for example, the Natural Resources Defense Council's "Brewers for Clean Water" campaign) to raise awareness of the importance of water quality in the brewing process and to lobby on water issues.¹¹⁴ EPA has accordingly been responsive to brewer's concerns.¹¹⁵ Two recent Supreme Court cases, *Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers* and *Rapanos v. United States*, have led EPA to promulgate the Clean Water Rule, a regulation to amend the definition of "waters of the United States" under the Clean Water Act.¹¹⁶ Absent any Congressional challenge, the recently enacted rule gives EPA regulatory authority over certain upland headwaters including streams, tributaries, and wetlands.¹¹⁷ Many independent brewers support the rule because if "[brewers'] source of water is at risk, so is [their] business."¹¹⁸

¹¹³ See *infra* Section II.A.

¹¹⁴ Adams, *supra* note 29; Natasha Geiling, *Craft Beer Company to Congress: We Need The EPA's Clean Water Rule*, THINK PROGRESS (May 19, 2015), <http://thinkprogress.org/climate/2015/05/19/3660492/epa-water-rules-new-belgium-brewery/> [<http://perma.cc/7PWV-GNVR>].

¹¹⁵ EPA (@EPA), TWITTER (May 26, 2015, 1:25 PM), <https://twitter.com/EPA/status/603295817257066497> [<http://perma.cc/V3KD-B873>]; Geiling, *supra* note 114.

¹¹⁶ See generally *Solid Waste Agency of N. Cook Cnty. ("SWANCC") v. U.S. Army Corps of Eng'rs*, 531 U.S. 159 (2001); *Rapanos v. United States*, 547 U.S. 715 (2006).

¹¹⁷ Geiling, *supra* note 114.

¹¹⁸ Peter Egleston, *Another View—Peter Egleston: As a local craft brewer, I support the EPA's new Clean Water Rule*, UNION LEADER (June 18, 2015), <http://www.unionleader.com/article/20150619/OPINION02/150618930/0/FRONTPAGE> [<http://perma.cc/XP9R-C7EA>]; Tim

There are also a number of water use mitigation strategies that breweries implement and continue to recommend as best practices.¹¹⁹ Required compliance in meeting wastewater effluent regulations is generally the greatest driver of water reduction strategies.¹²⁰ Reducing the quantity of water needed for the brewing process is beneficial in terms of both environmental impact and cost; breweries are charged for wastewater based on both the incoming water purchases as well as on the strength of the effluent.¹²¹ Breweries can also reduce water consumption by recovering water throughout the brewing process to be used in cleaning processes that do not require high quality water.¹²² For example, Aspen Brewing Company recycles the water used to cool beer before it ferments by storing the warm water in an insulated tank to be used in the next brewing cycle.¹²³

Additionally, breweries partner with non-profit organizations to reduce water quantity impacts; for example, Widmer Brothers Brewing partnered with the Bonneville Environmental Foundation to offset nine million gallons of water.¹²⁴ Breweries can purchase water restoration certificates that restore water to streams pursuant to criteria that guarantees water quality, the survivability of native fish and wildlife populations, and aesthetic and recreational improvements for those streams.¹²⁵ Similarly, SweetWater Brewing Company has been partnering with the non-profits Chattahoochee Riverkeeper and the Waterkeeper Alliance for more than a decade and in 2011 created the Waterkeeper Hefeweizen, a summer beer that encourages citizen advocacy on pollution issues that impact southern waterways.¹²⁶ SweetWater is now connected to nine

Devaney, *Beer fight brewing over EPA rule*, THE HILL (Sept. 19, 2014), <http://thehill.com/regulation/energy-environment/218249-beer-fight-brewing-over-epa-rule> [<http://perma.cc/GK87-4MPS>].

¹¹⁹ See generally WATER AND WASTEWATER MANUAL, *supra* note 44.

¹²⁰ *Id.* at 13.

¹²¹ *Id.*

¹²² Donoghue et al., *supra* note 57, at 13.

¹²³ Reasbeck, *supra* note 22.

¹²⁴ CRAFT BREW ALLIANCE, 2013 ANNUAL SUSTAINABILITY REPORT 4 (2014) [hereinafter CBA ANNUAL SUSTAINABILITY REPORT], available at http://craftbrew.com/files/2014/04/CBA_Sustainability_Report_2014.pdf [<http://perma.cc/BF9R-XW6H>].

¹²⁵ *Water Restoration Certificates*, BONNEVILLE ENVIRONMENTAL FOUNDATION, <http://www.b-e-f.org/our-solutions/water/water-restoration-certificates/why-wrcs/> [<http://perma.cc/AB5P-HTXV>] (last visited Oct. 26, 2015).

¹²⁶ Deidre Schipani, *SweetWater's Waterkeeper Hefeweizen helps raise money for Waterkeeper Alliance*, THE POST & COURIER (Aug. 13, 2014), <http://www.postandcourier.com/article/20140813/PC1206/140819822> [<http://perma.cc/TTG9-YP78>].

Waterkeeper campaigns in different states throughout the southeast that address issues ranging from harmful nutrient runoff to leaching coal ash retention ponds.¹²⁷

Virginia breweries are already active in supporting water quality programs throughout the state. Each purchase of Devil's Backbone Striped Bass Pale Ale donates money to the non-profit Chesapeake Bay Foundation that works to protect the health of the Bay.¹²⁸ Smartmouth Brewing Company in Norfolk donates proceeds to organizations that help rebuild local oyster populations, in addition to donating to organizations like the Elizabeth River Fund that work to improve local water quality.¹²⁹ Finally, Virginia breweries participating in the Natural Resources Defense Council's Brewers for Clean Water campaign are active in voicing their opinions regarding the proposed Atlantic Coast Pipeline that would carry natural gas through Virginia.¹³⁰ Virginia's Blue Mountain Brewery is part of an activist group opposing construction of the pipeline because of its potential to negatively impact water quality.¹³¹

By being proactive in local programs to protect water quality and availability, as well as lobbying on water issues important to the beer community, Virginia brewers are continuing to set an example for sustainable water use.

B. Mitigating Wastewater Impacts

Mitigating wastewater impacts is the next step to close the loop in a breweries' sustainable approach towards utilizing water resources. Implementing onsite effluent pretreatment systems is necessary in some localities under the NPDES Permit Program, but also results in water quality improvements for wastewater discharged to municipal treatment

¹²⁷ *Waterkeeper Campaigns*, SWEETWATER BREWING COMP., available at <http://waterkeeperbrew.org/campaigns/> [<http://perma.cc/K44L-ENGJ>] (last visited Oct. 26, 2015).

¹²⁸ Adams, *supra* note 29; *Great Beer Demands Great Water*, CHESAPEAKE BAY FOUND., <http://www.cbf.org/striped-bass-pale-ale> [<http://perma.cc/V9K7-WRUR>] (last visited Oct. 26, 2015).

¹²⁹ Michael Roberts, #72—*Smartmouth Brewing Company in Norfolk, VA*, BREWS TRAVELERS 365 (Mar. 20, 2014), <http://brewstravelers365.com/2014/03/20/72-smartmouth-brewing-company-in-norfolk-va/> [<http://perma.cc/GV45-4ZTM>].

¹³⁰ Rachael Smith, *Pipeline raises water concerns; Dominion says it will protect waterways*, RICHMOND TIMES-DISPATCH (Dec. 11, 2014), http://www.richmond.com/news/virginia/article_3616c54f-e444-5867-ab2b-bfe939a10787.html [<http://perma.cc/8R9A-X2MZ>].

¹³¹ *Id.*

plants.¹³² For example, New Belgium Brewery utilizes microbes to consume residual brewing biomass by pumping untreated wastewater into an on-site anaerobic digester.¹³³ The microbes produce methane, which is then collected and converted into electricity used to brew beer.¹³⁴ The leftover water is sent through an aerobic digestion process that “leaves behind water so clean that New Belgium could, if it wished, legally discharge it into the local Poudre River.”¹³⁵

Other localities are also looking into innovative methods to mitigate wastewater impacts. In Oregon, Clean Water Services, a company that operates four wastewater treatment plants, has developed an advanced treatment process that can turn sewage into drinking water.¹³⁶ Clean Water Services is seeking to demonstrate the efficacy of its advanced treatment process by turning recycled wastewater into beer.¹³⁷ While the state of Oregon currently does not allow humans to consume treated wastewater, the Oregon Health Authority and Oregon Environmental Quality Commission may ultimately sign off on the project after a public hearing, additional state approvals, and an amended Recycled Water Reuse Plan.¹³⁸

Virginia localities have already started to incorporate incentives for breweries in their wastewater management schemes with resulting positive environmental impacts.¹³⁹ The City of Richmond is one locality that has to manage discharged brewery wastewater; however, the city and breweries have partnered to benefit both themselves and the Chesapeake Bay.¹⁴⁰ Nitrogen is one of two nutrients responsible for the declining water quality in the Chesapeake Bay and its tributaries, and the state of Virginia and its localities are mandated to reduce nitrogen levels through the Chesapeake Bay TMDL.¹⁴¹ Nitrogen enters wastewater

¹³² WATER AND WASTEWATER MANUAL, *supra* note 44, at 5.

¹³³ McWilliams, *supra* note 22.

¹³⁴ *Id.*

¹³⁵ *Id.*

¹³⁶ Cassandra Profita, *Why Dump Treated Wastewater When You Could Make Beer With It?*, NPR (Jan. 28, 2015), <http://www.npr.org/blogs/thesalt/2015/01/28/381920192/why-dump-treated-wastewater-when-you-could-make-beer-with-it> [<http://perma.cc/3JJ2-47D8>].

¹³⁷ *Id.*

¹³⁸ *Id.*

¹³⁹ Michael Martz, *Richmond breweries get a break on sewage bill because of Stone project*, RICHMOND TIMES-DISPATCH (Oct. 29, 2014), http://www.timesdispatch.com/news/local/city-of-richmond/richmond-breweries-get-a-break-on-sewage-bill-because-of/article_3473c6b8-2d19-55fe-b217-44b9fed63683.html [<http://perma.cc/M19Y-7J4C>].

¹⁴⁰ *Id.*

¹⁴¹ *Id.*

treatment plants through human and animal waste and fuels the algae growth that diminishes water quality.¹⁴² However, the City of Richmond must also add nitrogen in the wastewater filtering process to remove excess ammonia.¹⁴³ A large amount of methanol is required to remove the excess nitrogen before the treated water is discharged into rivers and streams.¹⁴⁴ Brewery effluent sent to wastewater treatment systems contains the methanol required to reduce harmful nitrogen levels in the treated water.¹⁴⁵

In October 2014, as a result of Stone Brewing Company's impending arrival in Virginia, the Richmond City Council adopted an ordinance that lowers a utility surcharge on all Richmond breweries' disposed wastewater.¹⁴⁶ Because the brewery effluent contains enough methanol to reduce harmful nitrogen levels in the wastewater, the City of Richmond has to spend less on purchasing chemicals to treat the water.¹⁴⁷ Richmond currently spends \$1.2 million on purchasing chemical methanol each year, however discharged brewery effluent will save an estimated \$140,000 for every 100,000 barrels of beer produced.¹⁴⁸

Virginia localities housing craft brewing operations can incorporate Richmond's utility tax break into their municipal wastewater treatment schemes. Richmond's Ordinance No. 2014-215-196 can act as a model ordinance for localities looking to cut chemical costs for treating wastewater while chemical waste from the brewing process is recycled to improve the health of Virginia's waters. Finally, while Virginia breweries have not lobbied to turn treated wastewater into beer, developing innovative wastewater treatment methods is a necessary step in mitigating wastewater impacts.

C. *Mitigating Solid Waste Impacts*

Breweries solid waste disposal impacts can be mitigated by both resource conservation and recycling.¹⁴⁹ Breweries looking to mitigate these

¹⁴² *Id.*

¹⁴³ *Id.*

¹⁴⁴ *Ord. No. 2014-215-196, City Council Meeting Recap—October 27, 2014*, RVAGOV.COM (Nov. 6, 2014), <http://www.rvagov.com/#!/City-Council-Meeting-Recap-October-27-2014/c1xwg/B07930DA-675A-4DFE-ADE2-46F921C4F891> [<http://perma.cc/4S8X-UNX3>].

¹⁴⁵ Martz, *supra* note 139.

¹⁴⁶ *Id.*; *Ord. No. 2014-215-196, supra* note 144.

¹⁴⁷ Martz, *supra* note 139.

¹⁴⁸ *Id.*; *Ord. No. 2014-215-196, supra* note 144.

¹⁴⁹ *See generally* SOLID WASTE REDUCTION MANUAL, *supra* note 80.

impacts can examine their own resource use in the form of pre-consumer waste. Although breweries cannot directly mitigate post-consumer waste impacts, they can and do look to influence the method by which the public disposes of bottles and cans.

1. Brewery Waste

Recycling brewery waste is a sustainable tradition dating back to the first breweries in the 1800s when Adolphus Busch, founder of Anheuser-Busch, started selling spent grains as cattle feed.¹⁵⁰ Spent grains, byproducts of the brewing process and the largest source of waste for most brewery operations,¹⁵¹ can be utilized by businesses and individuals in various ways. Breweries today sell or donate spent grain to local farmers and livestock owners to be used as animal feed or compost, which results in less waste sent to a landfill and more sustainable local agricultural businesses.¹⁵² Although the United States has seen an increase in spent grain suppliers as a result of the increase in ethanol plants,¹⁵³ the burgeoning sustainable agriculture movement supports the system of local farms buying from local breweries.¹⁵⁴ Sierra Nevada keeps its own herd of cattle to supply beef to its restaurant, and the cattle are fed spent grain and hops from the brewery.¹⁵⁵ Spent grain can also be used as a main ingredient in bread, cookies, and even dog biscuits.¹⁵⁶

Recycling other materials used in the brewing and packaging processes, including cardboard, wood, plastics, aluminum, and glass, can also result in fewer environmental impacts. In 2013, Widmer Brothers Brewing diverted 99.4% of its solid waste from landfills by recycling spent grains, yeast, and hops through nearby dairy farms, and by recycling bottle caps and malt sacks.¹⁵⁷ Redhook Brewery in Portsmouth, New Hampshire sends brewery recyclables to a nearby manufacturing partner that turns 100% of plastic recyclables into products such as carpeting, clothing, and shoes.¹⁵⁸ In 2012, Sierra Nevada only sent 0.2%

¹⁵⁰ Reasbeck, *supra* note 22.

¹⁵¹ SOLID WASTE REDUCTION MANUAL, *supra* note 80, at 16.

¹⁵² *Id.*

¹⁵³ *Id.*

¹⁵⁴ Shelby Pope, *Going Against The Grain: FDA Threatens Brewers' Feed for Farmers*, NPR (June 20, 2014), <http://www.npr.org/blogs/thesalt/2014/06/20/323957894/going-against-the-grain-fda-threatens-brewers-feed-for-farmers> [<http://perma.cc/JX33-N6SY>].

¹⁵⁵ BIENNIAL SUSTAINABILITY REPORT 2012, SIERRA NEVADA BREWING CO. 7 (2012).

¹⁵⁶ SOLID WASTE REDUCTION MANUAL, *supra* note 80, at 16.

¹⁵⁷ CBA ANNUAL SUSTAINABILITY REPORT, *supra* note 124.

¹⁵⁸ *Id.*

of the brewery's solid waste to a landfill.¹⁵⁹ Boulevard Brewing Company adopted its zero landfill policy in 2010 and has since started profiting from selling its recycled materials.¹⁶⁰ Finally, other incentives for breweries to reduce solid waste include public recognition in the form of certifications or awards, such as with the Waste Reduction Awards Program in California.¹⁶¹

2. Post-Consumer Waste

Beer cans and bottles can be recycled an infinite number of times, and therefore increasing the national recycling rate would have an extremely substantial positive environmental impact.¹⁶² Eleven states (not including Virginia) have beverage container deposit laws, commonly known as bottle bills, which are a deposit-refund system for beverage containers and are designed to reduce litter and promote recycling.¹⁶³ Because bottle bills put a cash value on each container that is recycled, states with bottle bills have much higher recycling rates for those containers than states without.¹⁶⁴ Courts have deemed state bottle bills to be "a legitimate and valid exercise of a state's police powers to provide a clean, aesthetic environment for its citizens and for the conservation of energy and natural resources."¹⁶⁵ Bottle bills are significantly increasing the amount of recycled containers in American states that implement them; states that have implemented bottle bills reduced container litter anywhere from sixty-nine to eighty-four percent and reduced total litter by

¹⁵⁹ McWilliams, *supra* note 22.

¹⁶⁰ Sara Harper, *Boulevard Brewing talks about its zero waste company mission*, CRAFT BREWING BUSINESS (May 7, 2015), <http://www.craftbrewingbusiness.com/business-market-ing/boulevard-brewing-zero-waste/> [<http://perma.cc/2EEH-UMG9>].

¹⁶¹ SOLID WASTE REDUCTION MANUAL, *supra* note 80, at 8.

¹⁶² *Responsibility in Packaging*, NEW BELGIUM, <http://www.newbelgium.com/Sustainability/Sourcing/Packaging.aspx> [<http://perma.cc/MT5Q-7TFB>] (last visited Oct. 26, 2015).

¹⁶³ Jennifer Schultz & Brooke Oleen, *State Beverage Container Deposit Laws*, NAT'L CONF. OF STATE LEGISLATURES (Dec. 15, 2014), <http://www.ncsl.org/research/environment-and-natural-resources/state-beverage-container-laws.aspx> [<http://perma.cc/9HK5-2J6Y>].

¹⁶⁴ *Bottle Bill FAQ*, STATE OF CONN. DEP'T OF ENERGY & ENVTL. PROT., http://www.ct.gov/deep/cwp/view.asp?a=2714&q=324834&depNav_GID=1645 [<http://perma.cc/2FY5-6SBB>] (last visited Oct. 26, 2015); *see also* JENNY GITLITZ & PAT FRANKLIN, *THE 10¢ INCENTIVE TO RECYCLE 1* (Container Recycling Institute, 4th ed. 2006).

¹⁶⁵ Ethan S. Williams, *Last Call for the Pike Test? The Constitutionality of State Unique-Mark Requirements on Beverage Containers Under the Commerce Clause*, 6 J. MARSHALL L.J. 283, 296 (2012).

thirty-four to sixty-four percent.¹⁶⁶ While bottle bills are not universally popular throughout the beverage industry,¹⁶⁷ brewers are supporting the similar concept of Extended Producer Responsibility, or EPR.¹⁶⁸ EPR is a legal framework that “shifts responsibility for waste management from general taxpayers to producers and users,”¹⁶⁹ which results in innovative waste reduction programs that lead the craft beer industry towards more sustainable “end of life” packaging.

American craft brewers and the public can also look abroad for innovative sustainable best practices for solid waste management. One substantial difference in packaging trends in Europe versus the United States is the use of returnable glass bottles and metal kegs.¹⁷⁰ A 2012 study commissioned by the Brewers of Europe, a trade confederation representing the EU, Croatia, Norway, Switzerland, and Turkey, noted the substantial difference in packaging trends between the United States and European brewing sectors.¹⁷¹ Breweries in the United States support a system of returning and reusing metal kegs, however “returnable bottles are a negligible part of the beer industry in the U.S. today, and it would take significant retailer and distributor agreement to resuscitate this practice.”¹⁷² Despite this, the increasing popularity in the United States of reusable growlers—a big jug made popular by homebrewers that can be filled and refilled with beer—significantly decreases packaging wastes while emphasizing local beer consumption.¹⁷³ Brewers are encouraging customers to refill growlers at local breweries, and there are an increasing number of growler options for consumers that wish to have a sturdier, easier-to-use container.¹⁷⁴ There are also an increasing number of beverage options for

¹⁶⁶ GITLITZ & FRANKLIN, *supra* note 164.

¹⁶⁷ Williams, *supra* note 165.

¹⁶⁸ Jenn Orgolini, *The Sustainable Craft Brewery of the Future*, THE NEW BREWER 56 (Mar./Apr. 2011), http://www.newbelgium.com/files/New%20Brewer_NBB%20Orgolini%20Article.2011.pdf [<http://perma.cc/9ZC7-Y93X>].

¹⁶⁹ *Id.*

¹⁷⁰ SOLID WASTE REDUCTION MANUAL, *supra* note 80, at 7.

¹⁷¹ Donoghue et al., *supra* note 57.

¹⁷² *Id.* at 32. Returnable glass bottles accounted for approximately 24.5% of packaging used by European breweries in 2010. Although reusable glass bottles reduce environmental impacts in the manufacturing process, the reusable bottles must be heavier and an infrastructure for bottle collection and thorough cleaning systems must be established.

¹⁷³ Bethany Sherwin, *Sustainable Beer 101: A Guide to Growlers*, CREATIVE LOAFING (Aug. 10, 2009), <http://cltampa.com/dailyloaf/archives/2009/08/10/sustainable-beer-101-a-guide-to-growlers> [<http://perma.cc/7W3Q-J5HF>].

¹⁷⁴ Margaret Badore, *Why is a metal growler better than a glass one?*, TREEHUGGER (Aug. 22, 2014), <http://www.treehugger.com/sustainable-product-design/klean-kanteen-now-offers-shatter-proof-growlers.html> [<http://perma.cc/22Q7-XSYI>].

consumers that want to refill their growlers; there are almost thirty growler refill stations in the Richmond, Virginia area alone.¹⁷⁵

The Virginia Waste Management Board's Solid Waste Planning and Recycling Regulations mandate that localities include a strategy for public education and information on source reduction, reuse, and recycling in their basic planning elements submitted to the state.¹⁷⁶ This is one category in which brewers and localities can come together to educate the public about smart recycling strategies. For example, Boulevard Brewing Company, the country's twelfth largest craft brewery, conducted an audit of Kansas City's solid waste use in an effort to both protect the environment and promote sustainable business practices.¹⁷⁷ Boulevard Brewing Company found that over the span of one year, Kansas City residents threw away 150 million pounds of glass, including ten million empty Boulevard beer bottles.¹⁷⁸ Because glass is not recycled in Kansas City curbside recycling programs, Boulevard Brewing became involved in starting the company Ripple Glass, which allows Kansas City and other local residents to recycle glass bottles.¹⁷⁹ In 2011, Ripple Glass collected and recycled enough glass bottles to produce almost 100 million new Boulevard beer bottles.¹⁸⁰

Compared to the nationwide average, Virginia has a relatively robust recycling program; however, the amount of solid waste sent to landfills is still relatively high.¹⁸¹ Virginia breweries, localities, and the public should work together to combat post-consumer solid waste management issues and improve the state's recycling rate.

D. *Mitigating Energy & Climate Change Impacts*

Implementing energy conservation methods, in addition to utilizing alternative energy resources, are two methods by which craft brewers can ensure the sustainability of their brewing operations. Increasing reliance on alternative energy sources helps to mitigate larger climate change

¹⁷⁵ *Richmond Craft Beer Growler Refill Stations*, VISIT RICHMOND VA., <http://www.visitrichmondva.com/things-to-do/craftbeer/-growler/> [<http://perma.cc/AVY7-F89A>] (last visited Oct. 26, 2015).

¹⁷⁶ 9 VA. ADMIN. CODE § 20-130-120(A)(6) (2015).

¹⁷⁷ *Sustainability*, BOULEVARD BREWING CO., <http://www.boulevard.com/brewery/sustainability/> [<http://perma.cc/5E8Q-7YU9>] (last visited Oct. 26, 2015).

¹⁷⁸ *Id.*

¹⁷⁹ *Id.*

¹⁸⁰ *Id.*

¹⁸¹ *Facts and Figures for 2012*, *supra* note 90; *Mandatory Recycling Rates for Localities*, *supra* note 87.

impacts, which ensures the sustainability of critical craft beer resources such as hops, barley, and water. The Brewery Climate Declaration, a nonbinding declaration signed by over fifty craft breweries, pledges a coordinated effort on brewers' behalf to combat climate change impacts.¹⁸² Measuring greenhouse gas emissions, using renewable energy, cutting energy use by recycling steam, capturing methane, cutting transportation emissions, and becoming LEED Certified are just some of the actions that craft breweries are taking to reduce their environmental impacts.¹⁸³

1. Mitigating Energy Impacts

Breweries are addressing energy impacts by both mitigating energy use at the brewery, in addition to remaining active advocates in the regulatory process. Reclaiming heat, water, and carbon dioxide commonly lost during the brewing process, as well as implementing LEED building measures when building new breweries, are examples of strategies that breweries use to combat rising energy costs and mitigate environmental impacts.¹⁸⁴ In 2013, members of the Craft Brewers Alliance reduced the amount of natural gas used to produce a barrel of beer by 6.3% and reduced the amount of electricity used to produce a barrel of beer by 7.9%, through measures such as repairing compressed air leaks and upgrading inefficient lights.¹⁸⁵ In addition to conserving energy, breweries are looking to alternative energy sources to reduce environmental impacts. Kona Brewing Company provides fifty percent of its electricity needs through a photovoltaic solar panel system, and 100% of Widmer Brewery Pub's electricity is sourced from renewable wind power through Pacific Power's Blue Sky program.¹⁸⁶ Sierra Nevada has one of the largest privately owned photovoltaic systems in the country and is producing so much of its own alternative energy onsite that it may soon be able to sell the surplus.¹⁸⁷ Brewers are also active in reducing carbon emissions after their product has left the brewery; for example, Guinness partnered with the U.S. EPA SmartWay program that works with transportation carriers

¹⁸² *Brewery Climate Declaration*, CERES, <http://www.ceres.org/declaration/about/climate-declaration-campaigns/brewery> [<http://perma.cc/67U5-XRM6>] (last visited Oct. 26, 2015).

¹⁸³ *Id.*

¹⁸⁴ Alexander, *supra* note 43.

¹⁸⁵ CBA ANNUAL SUSTAINABILITY REPORT, *supra* note 124, at 3.

¹⁸⁶ *Id.* at 3, 5.

¹⁸⁷ *Protecting Our Land, Preserving Our Resources*, BEER INST., available at http://www.beerinstitute.org/assets/uploads/temp_file_Environmental_Brochure1.pdf [<https://perma.cc/ET2Q-KAXM>] (last visited Oct. 26, 2015); Reasbeck, *supra* note 22.

to improve fuel efficiency and the environmental performance of the goods movement supply chains.¹⁸⁸

Voluntary inventories of energy usage and cost are also likely to positively impact energy reduction efforts both in-house and in the local community.¹⁸⁹ For example, in 1998, New Belgium Brewery conducted an environmental audit and discovered that “the biggest contributor the brewery’s carbon footprint was the [Fort Collins, Colorado] coal-fired power plant.”¹⁹⁰ In its earliest stages of operation, New Belgium Brewery employees voted to cut their own bonus checks and subscribe to the Fort Collins Utilities Wind Power Program.¹⁹¹ More recently, New Belgium levied a per-kilowatt hour tax on itself for electricity purchased from the city.¹⁹² Further, New Belgium’s methane-producing wastewater treatment system, mentioned above, converts enough energy into electricity to offset forty to fifty percent of its overall electrical needs during peak energy demand and reduces the brewery’s entire fossil fuel consumption by fourteen to fifteen percent.¹⁹³

The Sierra Club has also brought breweries together to support the EPA’s Clean Power Plan to reduce the impacts of global warming that threaten the cost, and even taste, of beer.¹⁹⁴ The EPA’s proposed rule gives states the responsibility to come up with plans for limiting greenhouse gas emissions from existing power plants, the single largest source of greenhouse gas emissions in the United States.¹⁹⁵ The Clean Power Plan is important for brewers because it not only supports businesses that are already working towards cleaner energy resources, but also protects the natural resources that brewers rely on to make beer.¹⁹⁶ Additionally

¹⁸⁸ Although Guinness does not fall under the definition of a craft brewery, this is just one example of a method to reduce transportation impacts that can be applied industry-wide. Chris Crowell, *Eight ways breweries are helping the environment*, CRAFT BREWING BUS. (Mar. 12, 2015), <http://www.craftbrewingbusiness.com/business-marketing/8-ways-breweries-helping-environment/> [<http://perma.cc/7QJY-WRJ4>]; *About SmartWay*, EPA, <http://www.epa.gov/smartway/about/index.htm> [<http://perma.cc/8S3W-A9CD>] (last visited Oct. 26, 2015).

¹⁸⁹ ENERGY USAGE MANAGEMENT MANUAL, *supra* note 96, at 7.

¹⁹⁰ McWilliams, *supra* note 22.

¹⁹¹ *Id.*

¹⁹² *Id.*

¹⁹³ *Id.*

¹⁹⁴ Jacob Barker, *Environmental, political leaders warn of climate risk to brewers*, ST. LOUIS POST-DISPATCH (June 25, 2014), http://www.stltoday.com/business/local/environmental-political-leaders-warn-of-climate-risk-to-brewers/article_331854ab-f3ee-57a3-97fe-88246a98cee8.html [<http://perma.cc/WNJ7-5KBM>].

¹⁹⁵ *Clean Power Plan Proposed Rule*, EPA, <http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule> [<http://perma.cc/5QAX-5DAH>] (last visited Oct. 26, 2015).

¹⁹⁶ Jenn Vervier, *Tackling climate change for the future of beer*, THE PUEBLO CHIEFTAIN

at the heart of the clean energy debate are energy sources like hydraulic fracturing, which is cleaner burning than traditional fossil fuels but environmentally damaging in other ways.¹⁹⁷ Hydraulic fracturing is a contentious topic among brewers because the arguably cleaner energy comes with the price of a potentially contaminated water supply.¹⁹⁸

European breweries have successfully demonstrated that it is possible to reduce greenhouse gas emissions in an otherwise energy-intensive production process.¹⁹⁹ From a period between 2008 and 2010, European breweries managed a 7.1% drop in greenhouse gas emissions per hectoliter of beer (slightly more than one barrel of beer), in some part because of the ability to trade Green Certificates that certify electricity is generated using renewable energy sources.²⁰⁰ EPA's Renewable Energy Certificates could provide brewers with a similar domestic program to ensure the availability of future energy resources, provide price stability, and reduce greenhouse gas emissions.²⁰¹

Finally, breweries have started to reduce their carbon footprint by bottling beer in cans and lighter glass bottles.²⁰² This is particularly apt in Virginia, which sold the first canned beer in the United States in 1935.²⁰³ However, it is still unclear whether cans or lighter glass bottles

(Sept. 13, 2014), <http://www.chieftain.com/opinion/2844425-120/energy-climate-clean-hops> [<http://perma.cc/U6TG-5BHQ>].

¹⁹⁷ Seamus McGraw, *Is Fracking Safe? The 10 Most Controversial Claims About Natural Gas Drilling*, POPULAR MECHANICS, <http://www.popularmechanics.com/science/energy/g161/top-10-myths-about-natural-gas-drilling-6386593/> [<http://perma.cc/FJ3Q-7XR8>] (last visited Oct. 26, 2015).

¹⁹⁸ Deena Shanker, *Beyond the pale ale: A guide to sustainable beer*, GRIST (May 7, 2013), <http://grist.org/food/beyond-the-pale-ale-a-guide-to-sustainable-beer/> [<http://perma.cc/VB72-4XRU>]. See above for a discussion of breweries' opposition to natural gas because of the potential to damage water supplies.

¹⁹⁹ Donoghue et al., *supra* note 57, at 17.

²⁰⁰ *Id.*

²⁰¹ *Renewable Energy Certificates*, EPA, <http://www.epa.gov/greenpower/gpmarket/rec.htm> [<http://perma.cc/D44F-M64Z>] (last visited Oct. 26, 2015).

²⁰² Kona Brewing Company eliminated 2,718 tons of carbon dioxide from the atmosphere by bottling beer in lighter glass bottles. CBA ANNUAL SUSTAINABILITY REPORT, *supra* note 124, at 4. Ryan Gavrick, *Four Things to Know About Cans and Bottles*, WIRTZ CRAFT BEER (2014), <http://www.wirtzcrafter.com/four-things-know-cans-bottles/> [<http://perma.cc/29EA-7MDS>].

²⁰³ The Gottfried Krueger Brewing Company, based in New Jersey, test marketed canned Krueger's Cream Ale and Krueger's Finest Beer in Richmond, Virginia "in case the can concept was a bust." Diane Catanzaro & Chris Jones, *First Cans Sold in Richmond*, VA. CRAFT BEER (June 5, 2014), <http://virginiacrafter.com/first-cans-sold-in-richmond/> [<http://perma.cc/6BTY-WSZZ>].

have the lesser environmental impact. Cans are significantly lighter than bottles, which means that shipping and transport to retail stores—the latter part of the life cycle—results in a smaller carbon footprint.²⁰⁴ In contrast, the beginning of the life cycle of a glass bottle is less impactful because cans require the mining of bauxite and smelting of aluminum.²⁰⁵ Nevertheless, it is the consumer's responsibility to ensure both cans and bottles are sustainably disposed because both aluminum and glass can be recycled an infinite number of times.²⁰⁶ The EPA estimates that increasing the national recycling rate from the current twenty-seven to thirty-five percent would reduce greenhouse gas emissions by 11.4 million metric tons over sending the same amount of solid waste to a landfill.²⁰⁷

2. Mitigating Climate Change Impacts to Agriculture

Hop growers have long been aware of the potential for climate change impacts to hops farming.²⁰⁸ In recent responses to the projected impacts, some brewers have been urged to order malt barley and hops in bulk to protect against uncontrollable weather and volatile supply and demand.²⁰⁹ However, that does not address the larger climate change issue.²¹⁰ While the most recent hop acreage report from the U.S. Department of Agriculture shows a strong increase in the number of hop acres planted in the Pacific Northwest, it is too early to tell the poundage of hops that crop will actually yield.²¹¹

Geneticists are currently looking for genes in barley that could help the plant survive droughts and other extreme weather events.²¹² In a seed bank in the European Union, scientists are keeping over 20,000 varieties of barley seeds frozen to be able to select for climate-change

²⁰⁴ Gavrick, *supra* note 202.

²⁰⁵ *Responsibility in Packaging*, *supra* note 162.

²⁰⁶ *Id.*

²⁰⁷ Climate Change and Municipal Solid Waste Fact Sheet, *supra* note 92.

²⁰⁸ Rex Dalton, *Climate troubles brewing for beer makers*, NATURE (May 2, 2008), <http://www.nature.com/news/2008/080502/full/news.2008.799.html> [<http://perma.cc/2LE7-QBRA>].

²⁰⁹ Crowell, *supra* note 110.

²¹⁰ Bart Watson, *June Hop Acreage Report*, BREWERS ASSOC. (June 16, 2015), <https://www.brewersassociation.org/insights/hop-acreage-report/> [<https://perma.cc/4NF7-HMDS>].

²¹¹ *Id.*

²¹² Tim McDonnell, *How Droughts Could Choke the Global Beer Supply (Video)*, SLATE (Oct. 15, 2013), http://www.slate.com/articles/health_and_science/climate_desk/2013/10/barley_drought_shortage_german_scientists_search_barley_genome_to_help_it.html [<http://perma.cc/XHX4-HDNQ>].

resistant traits in the future.²¹³ German scientist Nils Stein is growing thousands of barley breeds in a greenhouse under different climates to mimic future possible climate conditions, not just to solve the malt barley problem for brewers, but for those countries that rely on barley as a main food resource.²¹⁴ Finally, brewers are also active in working to mitigate the impacts of hops growing on other natural resources. Both New Belgium Brewery and Deschutes Brewery have partnered with the non-profit organization Salmon Safe to ensure that hops farms on the West Coast are practicing the best land management practices “to better ensure healthy watersheds for native salmon.”²¹⁵

Virginia’s own burgeoning hops growing operations offer local craft brewers an alternative to purchasing from the Midwest, which results in fewer direct and indirect transportation impacts. While local or seasonal ingredients are not imperative to all craft beers, “there is a movement towards brewing beer with local ingredients where it can be sourced.”²¹⁶ Currently, Virginia only accounts for twenty-five out of the 35,000 acres in the country used for growing hops; however Virginia has seen over forty growers and interested growers emerge within the past five years.²¹⁷ The soils lab at the Virginia Polytechnic Institute and State University has even offered to start soil testing for hops in order to determine proper fertilization levels for Virginia soils.²¹⁸ While today Virginia doesn’t fall within the prime horticultural latitudes for growing dry hops, farming and using wet hops to brew beer is becoming increasingly popular.²¹⁹ The result is Virginia brewers turning to local farmers to provide the wet hops

²¹³ *Id.*

²¹⁴ *Id.*

²¹⁵ *Let’s stop and talk Salmon Safe hops*, NEW BELGIUM BREWING (Jan. 21, 2014), <http://www.newbelgium.com/Community/Blog/15-01-21/Let-s-stop-and-talk-Salmon-Safe-hops.aspx> [<http://perma.cc/P8S3-UZZ6>]; Keith Gribbins, *Craft beer saves salmon: Deschutes Brewery, Columbia Distributing support Salmon-Safe*, CRAFT BREWING BUS. (May 26, 2015), <http://www.craftbrewingbusiness.com/news/deschutes-brewery-columbia-distributing-salmon-safe/> [<http://perma.cc/F5F9-PALV>].

²¹⁶ Shanker, *supra* note 198.

²¹⁷ Laura Peters, *The pursuit of hoppiness*, NEWS LEADER (Oct. 18, 2014), <http://www.newsleader.com/longform/news/local/2014/10/18/pursuit-hoppiness/17530205/> [<http://perma.cc/JD35-FV46>].

²¹⁸ *Id.*

²¹⁹ *Id.*; Jason Morgan, *Local hop farming trend grows into Virginia*, CRAFT BREWING BUS. (Sept. 27, 2013), <http://www.craftbrewingbusiness.com/ingredients-supplies/local-hop-farming-trend-grows-virginia/> [<http://perma.cc/5E6R-PHDT>]; Joshua M. Bernstein, *Why You Need to Drink Wet-Hopped Beer Right Now*, BON APPETIT (Sept. 29, 2014), <http://www.bonappetit.com/drinks/beer/article/fresh-hops> [<http://perma.cc/4WKX-CYQU>].

for their beers.²²⁰ A new commercial hops processing facility in Loudoun County, Black Hops Farm LLC, could be critical in motivating other Virginia farmers to start growing their own hops; Black Hops Farm made a commitment to source “at least 3,500 pounds, [or sixty] percent of its hops, from Virginia producers during the next three years.”²²¹ To accompany the increase in hops growing operations, Virginia breweries could support a program similar to the Salmon Safe program mentioned above to ensure best management practices from new hops growers to protect the health of the Chesapeake Bay.

Finally, Virginia’s Green Wineries & Breweries program is a self-certifying program in which facilities verify they are practicing a number of sustainable activities.²²² Currently, breweries apply as “Attractions” and must meet standards like recycling, minimizing the use of disposable food service products, setting in place plans to reduce solid waste, conserve energy, and use water efficiently, and offering an environmentally friendly events package if they host events.²²³ Virginia should place a heavier emphasis on new breweries self-certifying under this program to ensure that breweries and brewpubs are conducting sustainable practices in their facilities.

CONCLUSION

As the craft beer industry continues to grow, craft brewers themselves are extremely proactive in implementing sustainable brewing methods. Brewers are coordinating with state and local governments to ensure the continued existence of an industry that includes environmental sustainability as a foundational principle. Consumers are placing increasing value on knowing where products come from and how they are made, and reinforcing breweries’ use of sustainable best practices can be as simple as purchasing a local craft beer. Virginia’s craft brewers can

²²⁰ Ariel Young, *Lost Rhino Debuts Hop Shove-it Wet Hop Ale*, N. VA. MAG. (Oct. 1, 2014), <http://www.northernvirginiamag.com/gut-check/2014/10/01/in-a-sea-of-pumpkin-lost-rhino-offers-a-local-hop-beer-hop-shove-it-wet-hop-ale-debuts-today/> [<http://perma.cc/N68Y-VCM6>].

²²¹ *Virginia Business: Hops processing facility expected to boost craft beer industry*, VA. CRAFT BREWERS GUILD (Nov. 21, 2014), <http://virginiacraftbrewers.org/post/Virginia-Business-Hops-processing-facility-expected-to-boost-craft-beer-industry.aspx> [<http://perma.cc/CWB4-X39T>].

²²² *Virginia Green Wineries & Breweries*, VA. DEP’T OF ENVTL. QUALITY, <http://www.deq.virginia.gov/Programs/PollutionPrevention/VirginiaGreen/GreenWineriesBreweries.aspx> [<http://perma.cc/WK6A=JQTD>] (last visited Oct. 26, 2015).

²²³ *Id.*

ensure sustainable best practices while promoting Virginia's burgeoning craft beer industry by both protecting and capitalizing on local natural resources as well as continuing to remain cognizant of their impact on the environment. Therefore, the impact of the craft beer boom becomes less about its environmental effects but rather how craft breweries are demonstrating that an entire industry can effectively mitigate its environmental impact.