water

MDPI

Article

Newspaper Coverage of Potable Water Recycling at Orange County Water District's Groundwater Replenishment System, 2000–2016

Kerri Jean Ormerod * and Leann Silvia

Department of Geography, University of Nevada, Reno, NV 89557, USA; lsilvia@nevada.unr.edu
* Correspondence: kormerod@unr.edu; Tel.: +1-775-784-6347

Received: 31 October 2017; Accepted: 11 December 2017; Published: 16 December 2017

Abstract: Water planners in water-strapped communities in the western United States and beyond increasingly consider potable water recycling an important water management strategy. Although potable water recycling can increase an otherwise limited urban water supply, the threat of public or political opposition often looms large. This paper examines newspaper coverage of the most widely celebrated potable water reuse project in the world—the Groundwater Replenishment System (GWRS) in Orange County, California, USA. The case study examines the coverage of GWRS contained in local, national, and international newspapers during an era of significant investment and repeated expansion. Despite the potential controversy associated with drinking recycled wastewater, there was no negative newspaper coverage of GWRS from 2000–2016. Much of the coverage was mundane, however several articles embraced infrastructure and technology as key to developing new water resources while protecting public and environmental health. Although potable water recycling is presented as an innovative solution capable of solving several problems at once, a close analysis reveals that recycled water may not fulfill the promise of an uninterruptible urban water supply.

Keywords: indirect potable reuse; media narratives; recycled water; water reuse

1. Introduction

Potable water recycling is a management strategy that is increasingly being considered by water planners in regions where rapid economic and population growth is threatened by water availability [1]. Non-potable water recycling, for example using recycled water for irrigation purposes, is a rather non-controversial form of reuse. In order to enhance urban water sustainability, recycling wastewater for potable purposes is emerging as an attractive alternative, either for immediate or future use [2,3]. The success of potable water recycling projects varies between cities and increasingly requires public approval and political support [3,4]. While many potable reuse projects have been proposed, some have been halted due to public opposition and flat-out refusal to drink what was once sewage water, as was the case in San Diego County, California, United States (US). Given the possibility of public upset, the success of the Groundwater Replenishment System (GWRS) in Orange County, California, US has emerged as the international model for potable water recycling [3,5].

In practice, water recycling helps to mitigate water supply challenges and wastewater disposal problems in areas with established water and sanitation systems. Municipal water recycling captures wastewater that would otherwise be discharged into surface waters and, in the case of potable reuse, applies advanced treatment in order to supplement drinking water supplies [2]. Recycling for potable reuse necessitates centralized water and wastewater treatment networks as a prerequisite [6].

Potable water recycling is categorized into three types: de facto, indirect, or direct. De facto reuse is unplanned. For example, when an upstream community discharges treated effluent in a river or tributary that serves as the water supply for downstream communities, this is a form of de facto

potable water recycling. Indirect potable reuse (IPR) relies on so-called environmental buffers, such as groundwater aquifers or reservoirs, to blend recycled water with traditional water supplies before re-treatment and delivery to customers' taps. Direct potable water recycling (DPR) projects deliver highly treated recycled water from the treatment facilities to the water distribution system without the use of intermediate environmental buffers [2]. The most prevalent potable water recycling schemes are IPR projects. Water planners have long relied on environmental buffers to blend recycled water with traditional water sources, such as an aquifer or lake, which was considered necessary to facilitate public acceptance [6]. Nevertheless, DPR is an option that is gaining traction in the water industry [7,8].

The prospect for potable water recycling to expand to municipal water supplies has garnered national and international attention [9,10]. In 1998, the US National Research Council (NRC) appointed a committee to evaluate the viability of potable reuse that recommended that potable water recycling should remain an option of last resort, implemented only after other alternative measures have been considered and determined to be either economically or technically infeasible [11]. However, in 2012 another NRC assembled panel gathered to address the potential to expand the nation's water supply through water reuse. This time the committee concluded that highly treated recycled water supplies were as safe as, if not safer than, conventionally sourced water supplies. This shift was due, in part, to the application of technically innovative treatment processes such as microfiltration, reverse osmosis, and advanced oxidation [2].

Planning for potable water recycling has become steadily institutionalized over time, however its application is highly uneven [2,6,12]. Scholars and water industry professionals recognize that acceptance of potable reuse is shaped specific to context, including lack of public trust [10,13,14] or lack of confidence in science or historical management [15], however, the predominant explanation for public objection is the so-called "yuck factor" [16–18]. While sometimes contentious [10], potable water recycling is an everyday occurrence in select locations around the world including South Africa, Namibia, Singapore, and the US [1,2,9,10], and has been seriously considered in several other locations, particularly Australia [10,19]. The majority of operational potable water recycling projects worldwide are concentrated in southern California [2].

While California is the clear leader on potable water recycling with the most and the largest IPR systems, it still falls short of statewide water recycling goals [20]. In 2001, the California legislature passed Assembly Bill (AB) 331, which directed the Department of Water Resources to establish a California Recycled Water Task Force in order to achieve the statewide goal for increased recycled water use (California Recycled Water Task Force 2003). In 2010, Senate Bill (SB) 918 required the Department of Public Health to form an expert panel and develop uniform criteria for IPR and to investigate the feasibility of developing regulations for DPR (Recycled Water Study 2012). In 2013, two additional bills relating to recycled water passed. AB 803 introduced changes to the California Code of Regulations in order to facilitate greater use of recycled water resources [21] and SB 322 reiterated the need for statewide regulation outlined in SB 918, passed in 2010, and went further by mandating the State Water Resources Control Board participate with the Department of Health in developing appropriate regulations for DPR [22]. Notably, GWRS treatment processes serve as the "benchmark on which California regulations were based and which other IPR facilities are measured against" [23] (p. 1).

In 2014, California voters approved Prop 1 (The Water Quality, Supply and Infrastructure Improvement Act of 2014), a $7.5 billion general obligation bond to fund water quality, supply, and infrastructure improvement, which allocated $725 million to water recycling and advanced treatment technology projects [24]. While stumping for Prop 1, California Governor Jerry Brown visited Orange County and cheerfully drank recycled water produced at GWRS [25] as the ultimate exemplary of IPR success and technical achievement in the industry.

In 2016, the California legislature passed another bill to help promote water recycling. Assembly Bill 2022 (AB 2022) allows potable water recycling facilities, such as GWRS, to bottle purified wastewater for demonstration and educational purposes [26].

Under normal conditions, urban water systems operate in semi-obscurity [27] (p. 45), however, proposals for potable water recycling projects can be—and often are—frustrated by lack of political support and public skepticism during the planning process [3,5]. Although potable reuse is not new, it is an adaptation that planners recognize requires rebranding, engagement, and demonstration projects, which are directed at elected officials, opinion leaders, as well as the general public [4,28].

Print journalism represents a key source of information about potable water recycling projects, technologies, or policies [29]. Popular media, such as newspapers, also play a role in agenda setting, or "telling us what to think about" [30] (p. 682) and impact and influence how problems are understood by the public [31]. Furthermore, scholars recognize "print media as a conduit for risk communication" [32] (p. 216) and a primary source of information about environmental risks [33]. In turn, representations in popular media influence and shape public perceptions of the environment, water resources, and water reuse [13,29,33–35].

In this paper we trace newspaper coverage from 2000 to 2016 and analyze how newspapers describe operations at Orange County Water District (OCWD) during a time of ongoing expansion, public engagement, and new laws and policies governing potable water recycling at the statewide level. Newspaper coverage is considered by scholars to be an appropriate proxy for a topic's prominence in society [35]. Recognizing newspapers as critical conduits of public information, we focus exclusively on operations at OCWD because it is "considered best practice in the potable water reuse community" [3] (p. 7554) in "one of the very few regions worldwide where this technology is becoming common practice" [5] (p. 249).

2. Background: Orange County's History with Planned Potable Water Recycling

IPR has taken place for over 50 years in the US, and over 40 years in Orange County, California, where recycled water is used to augment coastal aquifers [2]. Orange County is an urban area south of Los Angeles County and north of San Diego County in southern California. It is California's third most populous and second densest county [36]. OCWD is a special district formed by the state, which currently provides water to 28 water retailers who collectively serve millions of southern California residents. OCWD's water supplies are sourced from the Santa Ana River, local groundwater, imported water from the Colorado River, imported water from northern California, and recycled water [37]. Neighboring Orange County Sanitation District provides effluent used for recycling.

In 1976 Orange County was home to one of the first IPR facilities established in the US: Water Factory 21, named for its 21st century technology. Water Factory 21 applied additional water treatment processes in order to treat effluent for potable purposes, including lime clarification, ammonia stripping, recarbonation, multimedia filtration, granular activated carbon adsorption, and chlorination. The facilities produced 56,780 m^3 (15 million gallons) of recycled water a day, which was directly injected into aquifers that serve as one of the sources of local drinking water. The injection of recycled water into local aquifers provided a seawater barrier that prevented saltwater intrusion, which threatened to compromise local drinking water supplies. Water Factory 21 was a pioneer in more ways than one. It was the first facility to use reverse osmosis (RO) to purify wastewater in 1976 and the first to use microfiltration as a pretreatment to RO in 1993 [38]. Despite the plant's success, at the close of the 20th century, the water district continued to face problems with saltwater intrusion due to groundwater overdraft. In face of the worsening overdraft and reoccurring drought, OCWD officials deemed an expansion necessary.

In 2002, after successful operation for decades, OCWD decided to replace and expand upon Water Factory 21 with the construction of GWRS. The updated GWRS facilities sought to increase the system capacity from 56,780 m^3 to 265,000 m^3 (15 to 70 million gallons) per day and substitute membrane processes for the physical and chemical processes at Water Factory 21. The GWRS expansion added groundwater recharge via spreading basins in addition to direct injection of local aquifers [39]. GWRS was a favorable project among officials because it was anticipated to help diversify the district's water supply, sustain the population growth, and provide a reliable and dependable source of water.

Construction on the GWRS project began in 2007, which was jointly funded by OCWD and the Orange County Sanitation District and subsidized by regional, state, and federal agencies. The OCWD strove to develop a reliable supply of high-quality water while taking into consideration the condition of the environment. Like Water Factory 21 before it, GWRS produced potable quality water, which is used to recharge aquifers in Anaheim. Augmenting groundwater with recycled water provides a seawater barrier, but also helps to reduce the amount of effluent that is discharged to the Pacific Ocean [9]. In order to ensure that water is highly treated before being delivered to residents, water goes through a multi-step treatment process at the GWRS, which includes microfiltration, RO, and high intensity ultraviolet light with hydrogen peroxide [40].

The GWRS was initially designed to produce 265,000 m^3 daily (70 million gallons) of potable quality recycled, or enough water to satisfy the needs of 600,000 residents in Orange County [41]. In 2011, OCWD proposed an expansion that would create an additional 3560 m^3 daily (30 million gallons) and raise the plant's capacity to 379,000 m^3 daily (100 million gallons). As construction was completed in June 2015, California was in the midst of a significant drought. In response, the GWRS Final Expansion Project was announced to increase treatment capacity to 492,000 m^3 (130 million gallons) per day for an additional $350 million dollars. Construction on the final expansion is anticipated to start in 2019 and is expected to be completed in 2023 [42].

For water planners, public opposition is a potential obstacle that must be overcome before initiating potable water reuse projects [4,23]. In order to facilitate project success, the OCWD invested heavily in public education and outreach to the community. For example, in 2013 alone OCWD provided 192 plant tours for a total of 3408 guests [43]. OCWD also provides extensive "Groundwater Adventure Tours", which start at the GWRS facilities but move on from there to explore the larger system components including a 91.5 m (300 foot) inflatable rubber dam in the Anaheim Forebay, wetlands in the Prado Basin, and recharge basins in Anaheim. It is a free all-day affair that includes breakfast, lunch, and a comfortable private bus to ferry tourists to all of the sites [40].

During the building of GWRS, OCWD's sophisticated website provided time-elapsed videos of the construction of the microfiltration and reverse osmosis facilities, as well as links to an online learning center, and other educational resources. For several years the website included a 36 page press kit, which expanded to 60 pages in 2016. The homepage for GWRS also includes a real-time calculator illustrating the total gallons produced by the system, which was 233,748,906,704 gallons (884,835,865 m^3) when we last checked (30 October 2017 at 10:45 a.m.) [40].

The success of GWRS demonstrates the potential of technology to produce high-quality drinking water from sewage. Today, GWRS is a recognized leader in the industry and represents "standard design replicated by new potable reuse facilities worldwide" [44] (p. 79). A benefit of recycled water noted by scholars and water professionals is its ability to 'drought proof' supply and therefore aid cities in developing more sustainable and resilient water supplies in the face of increased competition, reoccurring drought, and future climate change [20].

3. Materials and Methods

Since public understanding of complex issues is shaped by news media, we elected to examine the newspaper coverage of Water Factory 21 and GWRS, from 1 January 2000 to 31 December 2016. The time period represents an era of increasing interest and acceptance of water recycling for potable purposes from utilities and related experts in California, the US, and abroad [2,39]. The articles were sourced from local, national, and international English-language newspapers and were retrieved from the Lexis-Nexis database using the search terms "Groundwater Replenishment System" or "Water Factory 21". Duplicate articles, subscription trade journals, and newswires were excluded from the analyses. Ten articles were excluded based on these criteria. In total, 158 articles were analyzed.

For the analyses, the articles were coded based on the journalist's descriptions of either Water Factory 21 or GWRS. Coding of the narrative and content was semantic and iterative. The first level of analyses included basic variables: publisher, article title, article type and section (e.g., news,

commentary), coverage (i.e., local, national, international), people quoted, comments related to public opinion, and references to peer-reviewed research. Next, the stance and general tone of the articles were coded as positive, neutral, or negative based on the descriptive terms used to portray Water Factory 21, GWRS, or potable water recycling. Newspaper articles were considered positive if the author chose to use terms such as beneficial, drought-proof, or safe. Articles were considered negative if descriptors such as dangerous or risky were used, or if they included a cause for concern. Articles were coded neutral when they recounted events without descriptive terms, or used positive and negative descriptions evenly. This classification is in line with previous studies [5]. The third level of analyses identified patterns and emergent themes in the reporting, which are discussed below. Although newspaper coverage is an acceptable proxy for the prominence of GWRS, there are limitations to our approach. For example, we did not measure reader's response to the media framing contained in newspaper reporting.

4. Results

The results highlight the tone of the coverage of the GWRS and provide insight into newspapers as sources of information on potable water recycling. The analysis included a total of 158 articles: 14 published in the international press, six in the national press, and 138 articles appeared in local newspapers. Generally speaking, the reporting was largely local and banal. In total, 114 articles were neutral in their coverage (72%), 44 articles were classified as positive (28%), and none were classified as negative (0%); the distribution of coverage is illustrated in Table 1.

Table 1. Type, number, and tone of articles covering Water Factory 21 or GWRS, 2000–2016.

Type	No. Neutral	No. Positive	No. Negative	Total
Local, *Orange County Register*	90	25	0	115
Local, other	16	7	0	23
National	5	1	0	6
International	3	11	0	14
Total	**114**	**44**	**0**	**158**

The local coverage included 138 of the 158 articles (87%) published from 2000–2016, of which 115 appeared in *The Orange County Register*, representing 73% of all articles analyzed. *The Orange County Register* is a daily paper that is part of the influential Southern California News Group (comprised of 11 local newspapers). It is available in print, on their website, smart phone apps, Amazon Kindle products, and/or via optional email subscriptions. An additional 23 articles were published in other local newspapers such *as San Jose Mercury News* (CA), *Daily Pilot* (CA), *St. Petersburg Times* (FL), *Daily News of Los Angeles* (CA), and others.

Articles appearing in the *New York Times*, *Los Angeles Times*, and *Christian Science Monitor* were categorized as national based on their audience and circulation. National newspaper coverage accounted for just 4% of the reporting.

International coverage in Singapore, India, Australia, and others accounted for 9% of the reporting, which appeared in publications such as *Business Times Singapore*, *India Energy News*, *The Sydney Morning Herald*, *The Arab News*, *The International Herald Tribune*, and others.

The length of the articles varied by source. The average article that appeared in *The Orange County Register* was 551 words, other local newspapers averaged 777 words, national coverage was most in-depth with an average of 1309 words, and the international coverage averaged 730 words.

None of the analyzed articles referenced peer-reviewed papers and only one referred to scientific research. The majority of the factual details included in the articles could be found in the "Groundwater Replenishment System Facts and Figures" document provided on the GWRS website [40]. This document provides an overview of the processes utilized at the plant and describes the treatment steps taken in order to ensure the quality of the water being delivered to residents.

Journalists covering GWRS often presented details by interviewing officials or, less often, public citizens. References to these types of data were found in 32% of the analyzed articles (51 articles). The most frequently quoted sources were Michael Markus, the general manager of OCWD, Ron Wildermuth, the former spokesman for the water district, and Gina DePinto, the current spokeswoman for water district.

From 2000 to 2016, GWRS received the most coverage in 2008—the year it began operations. A breakdown of the number of articles written per year along with GWRS milestones is included in Figure 1. Spikes in coverage in 2007, 2008, 2011, and 2014–2015 coincide with announced GWRS system expansions. The GWRS expansions and newspaper coverage also coincides with regional droughts, which occurred most recently in 2007–2010 and December 2011–March 2017 [45].

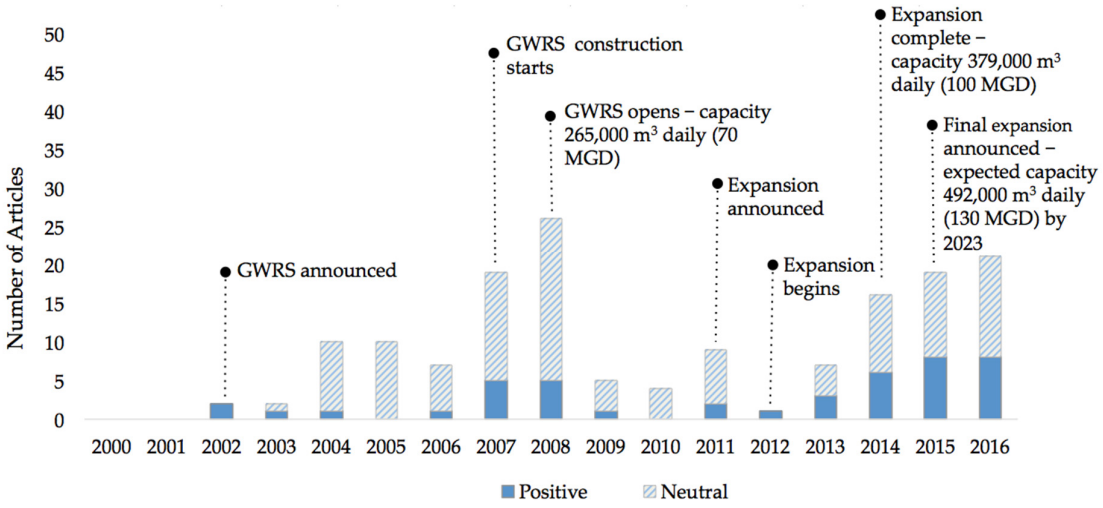

Figure 1. Number and tone of articles published per year with GWRS milestones, 2000–2016.

4.1. Neutral Coverage

Overall, 72% of the coverage was either banal or neutral—meaning journalists simply recounted facts and/or weighed the costs and benefits without attaching positive or negative descriptions (e.g., beneficial, safe, dangerous, risky).

The majority of the articles that appeared in *The Orange County Register* described unexciting, day-to-day details such as traffic delays due to the ongoing construction associated with GWRS, however the local coverage frequently discussed GWRS in relation to ongoing drought and possible water shortages. The costs of the project, including issues such as customer rates, subsidies, expansion expenses, or related financial details were often reported, as was the impact of the project on water security, independence, or water reliability. In a few instances, the newspaper reports included concerns about the potential for GWRS to sustain urban sprawl, however this reporting also noted the various benefits of GWRS.

Journalists most often highlight that recycled water solves several issues for municipal utilities at once by, (1) helping meet demand during times of shortages (e.g., seasonal, long-term, economic), and, (2) helping to meet wastewater discharge limitations (i.e., restrictions imposed on water quality or quantity). For example, OCWD's general manager (Virginia Grebbien), is quoted in *The Orange County Register*,

> Rather than focusing solely to the outside to deliver to us—imported water supply—we are doing our share by developing local supplies also . . . Day in, day out, year in, year out, we know we can make it, no matter what, . . . We know the source water—sewer water—is going to be there [46].

In a separate article, the Orange County Sanitation District's General Manager (Blake Anderson), is quoted in *The Orange County Register* claiming,

> By using wastewater that otherwise would be discharged into the ocean, the system eliminates the need for another ocean outfall pipe. The discharge from an existing pipe off Huntington's [a neighboring community] coast was suspected of contributing to high bacteria levels and beach closures before pressure from activists led to more thorough treatment . . . It turns out that the cost is a push between building a new outfall pipe and wasting the water out to the ocean or providing the benefit of water in a coastal desert. It's a pretty easy (call) [41].

In local, national, and international press, journalists provide the contextual details that help to explain why IPR is a sensible solution for utilities in Orange County, as reported in *The New York Times*:

> Factor in Southern California's near chronic drought, the county's projected growth (another 300,000 to 500,000 thirsty people by 2020) and the rising cost of importing water from the Colorado River and from Northern California (the county pays $530 per acre-foot of imported water, versus $520 per acre-foot of reclaimed water), and rebranding effluent as a valuable resource became a no-brainer [47].

Yet, potential pitfalls or concerns are also reported. For example, as outlined in the same *The New York Times* article,

> The process isn't risk free. Some scientists are concerned that dangerous compounds or undetectable viruses will escape the multiple physical and chemical filters of the plant. And others suggest that the potential for human error or mechanical failure—clogged filters or torn membranes that let pathogens through, for example—is too great to risk something as basic to public health as drinking water [47].

While the language used by journalists was largely neutral, the most favorable coverage quotes proponents who present the facts in a way that frames infrastructure and technology as key to developing new water resources while protecting public and environmental health.

4.2. Positive Coverage

Roughly one quarter (28%) of the newspaper coverage was positive in tone, meaning the author of the article described GWRS in positive terms (e.g., sustainable, beneficial, and providing a reliable water resource). The success of GWRS and its ability to withstand shortages were prominent themes in the positive coverage. In particular, the reporting from 2014–2016 frequently put the success of GWRS within the context of drought.

The Orange County Register published commentary (opinion) articles that supported GWRS: one from the then-mayor of Huntington Beach, whose constituents rely on water proved by OCWD, and another from the executive director of Orange County Coastkeepers, a nonprofit environmental group.

Both the local and international press published articles on the successes and awards bestowed on GWRS or OCWD.

The increased independence in water supply was another benefit of GWRS reported in the local, national print, and international press.

The environmental benefits of GWRS were also detailed in the local, national, international reporting. For example, recycled water helps to protect the local beaches thanks to decreased wastewater discharge. In addition, greater reliance on recycled water reduces dependency on imported water from northern California, thus providing upstream benefits for the Sacramento Delta and the endangered delta smelt (a protected fish species and icon of contentious water politics).

Though fewer articles were published in international press overall, the coverage was largely positive. Water Factory 21 and GWRS were identified model facilities, which were emulated in Singapore, Australia, and other states in the western US.

The international press also noted the success of GWRS and the ability of recycled water to overcome shortages, in particular providing greater water security and reliability. For example, the *Singapore Times* quotes Associate General Manager of Water Factory 21 (Michael Wehner), who opined,

> So, replenishing groundwater gives the region an important political advantage—it is reliable and we control it, giving us greater water independence, especially during droughts . . . Reclaimed water is vital for our security because we can get it every day of the year [48].

As the quote above illustrates, the most positive coverage presents OCWD as a politically savvy innovator who is responsibly developing a drought-proof water supply.

4.3. Negative Coverage

While newspaper coverage of other projects in other places have been found to be critical, highlighting public upset or scientific uncertainty [49,50], the coverage of GWRS is notable in its utter lack of negative coverage. None of the reporting, whether local, national, or international, was critical in its description of GWRS or portrayed the process of potable water recycling in a negative light. Despite difficulties in other cases, the lack of negative coverage of GWRS construction or expansion is an indication of public acquiescence to potable water recycling in this case.

4.4. Recycled Water Resources, Drought, and Demand Management

Recently, California regulators initiated conservation mandates in response to the extended and extreme drought, however, residents in Orange County were able to dodge this directive because household water conservation reduces the availability of recycled water. As reported in the *Daily Pilot* (Costa Mesa, CA, USA),

> State water officials . . . indicated that some water districts could apply to have their conservation goals reduced based on population growth, warmer-than-average weather in certain areas and "significant investments" in "drought-resilient" water sources. . . . The state reduced conservation targets for several Orange County water districts, partly because many of them receive a large portion of their supply from the Orange County Water District's groundwater replenishment system, [51] . . .

The municipal efforts to side-step conservation mandates highlight that whenever less water is being consumed, less water can be recycled. In essence, you need steady rates of water consumption *and waste* in order to obtain reliable recycled water supplies.

By claiming that conservation undermined the state policy that favors water recycling, water suppliers in Orange County were not equally burdened with the water use restrictions imposed by the state. In this respect, it buffered the residents from the coercive conservation mandates that resulted from the drought.

5. Discussion

The tone of the newspaper coverage of GWRS was mostly mundane or, alternately, flattering. The majority of the analyzed articles held a neutral stance towards the expansion of potable water recycling (72%). The remaining articles (28%) had a positive stance. The lack of negative coverage suggests potable water recycling is acceptable, or rather not contested, in Orange County. This is despite the fact that the total volume of potable-quality recycled water increased significantly during the study period (2000–2016). When the final expansion is complete, the GWRS facility is expected to produce 492,000 m^3 daily (130 million gallons)—eight times the amount of recycled water produced at Water Factory 21. To put this number in perspective, the total volume of water recycled for potable purposes in 2010 in the US was estimated to be 1,325,000 m^3 daily (335 million gallons) [2].

The 2015 expansion allowed GWRS to provide 75% of the water supply for all cities north of the City of Irvine in Orange County, an unusually high percentage. If the second expansion goes through it would enable the plant to supply 80% of the necessary water for cities north of Irvine [42]. This, too, is remarkable. Nevertheless, the character of the newspaper media coverage in this study reveals that GWRS is noncontroversial, which is unlike other projects [10,15,50].

Most of the newspaper reporting on GWRS was day-to-day local coverage. The results are consistent with previous findings that highlight GWRS as a model for establishing the legitimacy of potable water recycling as a pragmatic, accepted, and 'taken-for-granted' practice [3].

Conspicuously, none of the local, national, or international press articles on GWRS 2000–2016 were categorized as negative in their consideration of potable reuse, Water Factory 21, or GWRS. The lack of negative newspaper coverage also supports the premise that potable water recycling in Orange County is routine, and therefore not considered otherwise newsworthy by the local media [3]. The lack of outrage in the coverage also suggests that GWRS, and by extension potable water recycling, is rather unexceptional and accepted in the local community [3]. Nevertheless, it is a geographically specific legitimacy that does not extend to potable water recycling projects in other nations, states, regions, or cities—many of which have witnessed vocal anti-water-reuse responses from the local communities [3,5,10].

While water industry professionals accept GWRS as a model for the world, in many respects, it is unparalleled in terms of publicity, political and public support, and favorable news coverage. As previous scholars have pointed out, OCWD "employed a comprehensive portfolio of legitimation strategies, both deliberately and by chance, which fostered public trust in the utility and in the practice of potable reuse" [3] (p. 7558). The history of neighboring San Diego County proves that drinking recycled water is not necessarily accepted everywhere. The water utility tried to implement an IPR project twice, in 1993 and 2011, but failed both times due to swift public opposition. The officials in San Diego are undeterred—the city is planning on opening an IPR facility, which they expect will be operational as soon as 2021 [52]. It is notable that when previous projects were proposed, San Diego saw editorial opposition [49], whereas Orange County saw editorial acceptance.

The reporting also highlights that the construction of the GWRS facilities represents a substantial public works investment—one of the largest in the US. The first phase of construction for GWRS totaled $480 million to produce 265,000 m^3 (70 million gallons) of recycled water daily. In 2011, OCWD proposed an additional expansion to raise capacity to 379,000 m^3 daily (100 million gallons) at a cost of $143 million. After it was completed in mid-2015, the GWRS Final Expansion Project was announced, which will increase GWRS treatment capacity to 492,000 m^3 daily (130 million gallons) for an additional $350 million dollars [42]. Thus, the total estimated cost of GWRS construction is $973 million, however, this cost is offset by over $90 million dollars in subsidies from various agencies, including the California Department of Water Resources, the Environmental Protection Agency, Metropolitan Water District of Southern California, and others [53]. As a result, the cost of water produced at GWRS is $525 per 1233 m^3 (1 acre foot) with subsidies versus $850 per 1233 m^3 (1 acre foot) without subsidies [40].

In the case of Orange County, increased recycled water use has a minimal effect on water rates. The residents in the service area are willing to bear the substantial costs associated with treating, storing, and delivering potable quality recycled water supplies in part, because OCWD already relies heavily on expensive long-distance imports from northern California and the Colorado River. Given that recycled water reuse is cost-effective compared to importing water or desalination technology, recycled water appears as a favorable alternative in Orange County. While this may be the case, it should not be assumed, or expected, that this water source will fix water scarcity problems or that it will be equally viable in other locations, particularly those that are less affluent.

Although celebrated in the academic and popular press as a constant, reliable, and resilient water management strategy, a close read of the newspaper coverage also illustrates that recycled water supplies might not be quite as drought proof as advertised, since any reduction in indoor household use results in decreased sewer flows, which serve as the recycled water supply. In fact, it was reported that since the 1990s sewage streams in Orange County have declined by 25%, falling from 757,080 m^3

to 567,810 m^3 daily (200 to 150 million gallons) [54]. Despite declining sewer flows, the expansion of GWRS has only intensified.

In terms of water resources management, the ability to circumvent state mandated conservation measures meant OCWD was able to drought-proof their customer's water supply, in a manner of speaking. In addition, it is in-line with their management practices. OCWD is an institution that has always favored supply-side solutions over demand-side management (i.e., conservation). The district has historically been able to meet demand by developing new water resources, including recycled water. The planned rise in recycled water production at GWRS is a testament to this commitment.

If long-term sustainability is the goal, the conflict between conservation and water recycling might be a real cause for concern. Consider the environmental ethos of Reuse, Reduce, Recycle as a simple example. Reusing household water is a form of conservation that consumes less water and, therefore, negatively impacts sewer flows and the amount of water that is available to recycle. Similarly, reducing water use, for example by taking shorter showers, also minimizes recycled water flows. Reusing and reducing conserves water and also saves energy since a significant amount of energy is expended to treat, deliver, and sanitize municipal water resources. By prioritizing water recycling, planners in Orange County are continuing in the tradition of supply-side solutions to reduce water resource scarcity. The advantages of potable water recycling and the commitment to a centralized supply-side approach may be shortsighted given future climate change, ongoing operations and maintenance costs, energy demands, and the pressure that household conservation may put on recycled water resources.

6. Conclusions

The newspaper coverage of the expansion of potable water recycling operations in Orange County, California, 2000–2016, was largely neutral, less often positive, and never negative. Orange County was an early pioneer of planned potable water reuse and continues to serve as a concrete example of success. While not every project is the same, GWRS is proof of the technical feasibility of IPR and serves as a source of inspiration for other cities considering implementing a potable water recycling facility. Although the analysis of the coverage of GWRS showed tacit support towards potable reuse, the findings do not imply there will be equally favorable newspaper coverage or public support elsewhere.

Facing drought, a warming climate, and a growing population, additional sources of water are limited and more cities are beginning to turn to potable-quality recycled water as an alternative water source for immediate or future use. With this in mind, potable water recycling is often presented as an urban water solution where GWRS serves as the prime exemplar. The crux of the praise for GWRS is the ability to grow water supplies in the face of a rising population, increasing competition, and future climatic change. While the newspaper articles represent GWRS as a symbol of potable water recycling success, when read closely, they also provide a more cautionary tale by exposing recycled water as a contingent water resource that is not quite 'drought-proof'.

Acknowledgments: The University of Nevada, Reno provided the research funding to cover the costs of this research, including funds to support the research assistant (L.S.) and the open access publication fees.

Author Contributions: Kerri Jean Ormerod conceived of and designed the study; Kerri Jean Ormerod and Leann Silvia retrieved and cleaned the data; Leann Silvia performed the data coding; Kerri Jean Ormerod and Leann Silvia analyzed the data and wrote the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Rodriguez, C.; Van Buynder, P.; Lugg, R.; Blair, P.; Devine, B.; Cook, A.; Weinstein, P. Indirect potable reuse: A sustainable water supply alternative. *Int. J. Environ. Res. Public Health* **2009**, *6*, 1174–1209. [CrossRef] [PubMed]
2. National Research Council, U.S. (NRC). *Water Reuse: Potential for Expanding the Nations Water Supply through Reuse of Municipal Wastewater*; National Academies Press: Washington, DC, USA, 2012.
3. Harris-Lovett, S.R.; Binz, C.; Sedlak, D.L.; Kiparsky, M.; Truffer, B. Beyond user acceptance: A legitimacy framework for potable water reuse in California. *Environ. Sci. Technol.* **2015**, *49*, 7552. [CrossRef] [PubMed]

4. Duong, K.; Saphores, J.-D.M. Obstacles to wastewater reuse: An overview. *Wiley Interdiscip. Rev. Water* **2015**, *2*, 199–214. [CrossRef]
5. Binz, C.; Harris-Lovett, S.; Kiparsky, M.; Sedlak, D.L.; Truffer, B. The thorny road to technology legitimation—Institutional work for potable water reuse in California. *Technol. Forecast. Soc. Chang.* **2016**, *103*, 249–263. [CrossRef]
6. Ormerod, K.J. Illuminating elimination: Public perception and the production of potable water reuse. *Wiley Interdiscip. Rev. Water* **2016**, *3*, 537–547. [CrossRef]
7. Leverenz, H.L.; Tchobanoglous, G.; Asano, T. Direct potable reuse: A future imperative. *J. Water Reuse Desalin.* **2011**, *1*, 2. [CrossRef]
8. Binz, C.; Razavian, N.B.; Kiparsky, M. Of dreamliners and drinking water: Developing risk regulation and a safety culture for direct potable reuse. *Water Resour. Manag.* **2017**, 1–15. [CrossRef]
9. Dhal, R. Advanced thinking: Potable reuse gaining traction. *Environ. Health Perspect.* **2014**, *122*, A332–A335. [CrossRef] [PubMed]
10. Meehan, K.; Ormerod, K.J.; Moore, S. Remaking waste as water: The governance of recycled effluent for potable water supply. *Water Altern.* **2013**, *6*, 67–85.
11. National Research Council, U.S. (NRC). *Issues in Potable Reuse: The Viability of Augmenting Drinking Water Supplies with Reclaimed Water*; National Academy Press: Washington, DC, USA, 1998.
12. Colebatch, H.K. Governing the use of water: The institutional context. *Desalination* **2006**, *187*, 17–27. [CrossRef]
13. Goodwin, D.; Raffin, M.; Jeffrey, P.; Smith, H.M. Evaluating media framing and public reactions in the context of a water reuse proposal. *Int. J. Water Resour. Dev.* **2017**, 1–21. [CrossRef]
14. Ormerod, K.J.; Scott, C.A. Drinking wastewater: Public trust in potable reuse. *Sci. Technol. Hum. Values* **2013**, *38*, 351–373. [CrossRef]
15. Lejano, R.P.; Leong, C. A hermeneutic approach to explaining and understanding public controversies. *J. Public Adm. Res. Theory* **2012**, *22*, 793–814. [CrossRef]
16. Russell, S.; Lux, C. Getting over yuck: Moving from psychological to cultural and sociotechnical analyses of responses to water recycling. *Water Policy* **2009**, *11*, 21–35. [CrossRef]
17. Tennyson, P.A.; Millan, M.; Metz, D. Getting past the "Yuck factor": Public opinion research provides guidance for successful potable reuse outreach. *Am. Water Works Assoc.* **2015**, *107*, 58–62. [CrossRef]
18. Leong, C. The role of emotions in drinking recycled water. *Water* **2016**, *8*, 548. [CrossRef]
19. Apostolidis, N.; Hertle, C.; Young, R. Water recycling in Australia. *Water* **2011**, *3*, 869–881. [CrossRef]
20. Bischel, H.N.; Simon, G.L.; Frisby, T.M.; Luthy, R.G. Management experiences and trends for water reuse implementation in Northern California. *Environ. Sci. Technol.* **2012**, *46*, 180–188. [CrossRef] [PubMed]
21. California Legislative Information. AB-803 Water Recycling Act of 2013. 2013. Available online: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB803 (accessed on 14 December 2017).
22. California Legislative Information. Senate Bill No. 322. 2013. Available online: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB322 (accessed on 15 December 2017).
23. Wetterau, G.; Chalmers, R.; Liu, P.; Pearce, W. Advancing indirect potable reuse in California. *Water Pract. Technol.* **2013**, *8*, 275–285. [CrossRef]
24. *California Water Plan Update 2013 Volume 3—Resource Management Strategies*; State of California, Natural Resources Agency, Department of Water Resources: Sacramento, CA, USA, 2013.
25. Brown Visits OCWD (Speech 28 October 2014). OCWD Water News: You Tube. 2014. Available online: https://www.youtube.com/watch?v=s82eixFmcRM (accessed on 27 September 2017).
26. California Legislative Information. AB-2022 Advanced Purified Demonstration Water. 2016. Available online: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB2022 (accessed on 15 December 2017).
27. Bell, S. Urban water systems in transition. *Emerg. Complex. Organ.* **2012**, *14*, 45.
28. Frijns, J.; Smith, H.M.; Brouwer, S.; Garnett, K.; Elelman, R.; Jeffrey, P. How governance regimes shape the implementation of water reuse schemes. *Water* **2016**, *8*, 605. [CrossRef]
29. Hurlimann, A.; Dolnicar, S. Newspaper coverage of water issues in australia. *Water Res.* **2012**, *46*, 6497–6507. [CrossRef] [PubMed]
30. Mazur, A.; Lee, J. Sounding the global alarm: Environmental issues in the US national news. *Soc. Stud. Sci.* **1993**, *23*, 681–720. [CrossRef]

31. Wolfe, M.; Jones, B.D.; Baumgartner, F.R. A failure to communicate: Agenda setting in media and policy studies. *Political Commun.* **2013**, *30*, 175–192. [CrossRef]
32. Wakefield, S.E.; Elliott, S.J. Constructing the news: The role of local newspapers in environmental risk communication. *Prof. Geogr.* **2003**, *55*, 216–226.
33. Boykoff, M.T. We speak for the trees: Media reporting on the environment. *Annu. Rev. Environ. Resour.* **2009**, *34*, 431–457. [CrossRef]
34. Leong, C. Eliminating 'yuck': A simple exposition of media and social change in water reuse policies. *Int. J. Water Resour. Dev.* **2010**, *26*, 111–124.
35. Quesnel, K.; Ajami, N. Changes in water consumption linked to heavy news media coverage of extreme climatic events. *Sci. Adv.* **2017**, *3*, e1700784. [CrossRef] [PubMed]
36. Census Bureau. U.S. Quick Facts: Orange County, California. Available online: https://www.Census.Gov/quickfacts/geo/chart/orangecountycalifornia/pst040216 (accessed on 27 September 2017).
37. Grebbien, V. Some new approaches at the Orange County Water District 55. In *Water and Sustainable Development Opportunities for the Chemical Sciences: A Workshop Report to the Chemical Sciences Roundtable*; Norling, P., Wood-Black, F.K., Masciangioli, T.M., National Research Council Chemical Sciences Roundtable, Eds.; National Academies Press: Washington, DC, USA, 2004; pp. 55–59.
38. Law, I.B. Advanced reuse—From Windhoek to Singapore and beyond. *Water (J. Aust. Water Assoc.)* **2003**, *30*, 31–36.
39. Drewes, J.E.; Khan, S.J. Water reuse for drinking water augmentation. In *Water Quality and Treatment a Handbook on Drinking Water*; Edzwald, J.K., American Water Works Association, Eds.; McGraw-Hill: New York, NY, USA, 2012; pp. 16.11–17.11.
40. Orange County Water District. Groundwater Replenishment System. Available online: http://gwrsystem.com/ (accessed on 31 October 2017).
41. Overley, J. From flush to fresh; groundwater replenishment will turn sewer water into fresh drinking water by 2007. *The Orange County Register (California)*, 11 August 2005.
42. Williams, L.O.C. Water district moves forward with expansion of recycling operation. *The Orange County Register (California)*, 22 September 2016.
43. Orange County Water District. OCWD water news hydrospectives. *OCWD Newsletter*, January 2014.
44. Luthy, R.G.; Sedlak, D.L. Urban water-supply reinvention. *Daedalus* **2015**, *144*, 72–82. [CrossRef]
45. United States Geological Survey (USGS). California Water Science Center. California Drought. Available online: https://ca.Water.Usgs.Gov/data/drought/ (accessed on 30 October 2017).
46. Brennan, P. Ambitious water revival; the water district's construction of a $487 million wastewater system continues to snake upriver. *The Orange County Register (California)*, 9 August 2004.
47. Royte, E. A tall, cool drink of . . . Sewage? *New York Times Magazine*, 8 August 2008.
48. Nathan, D. Tried and tested in the us; in California, it was the most cost-effective alternative and, in Virginia, the cleanest. Both states are spending millions to expand water-reclamation plants to add to their drinking-water supplies. The public utilities board looked at both places before deciding to go ahead with newater. *The Straits Times (Singapore)*, 18 July 2002.
49. Hartley, T.W. Public perception and participation in water reuse. *Desalination* **2006**, *187*, 115–126. [CrossRef]
50. Hurlimann, A.; Dolnicar, S. When public opposition defeats alternative water projects—The case of Toowoomba Australia. *Water Res.* **2010**, *44*, 287–297. [CrossRef] [PubMed]
51. Money, L. Newport meets softened water-use reduction target, city says. *Daily Pilot (Costa Mesa California)*, 8 April 2016.
52. City of San Diego. Pure Water San Diego. Available online: https://www.sandiego.gov/water/purewater/purewatersd (accessed on 30 October 2017).
53. Orange County Water District. Examining the Cost of Building and Operating a Water Purification System to Provide a New Source of Water for an Arid Region. Available online: https://www.ocwd.com/media/1854/white-paper-cost-of-gwrs.pdf (accessed on 24 November 2017).
54. Hidek, J. A look at California weathering the drought. *Star-News (Wilmington, NC)*, 28 September 2015.