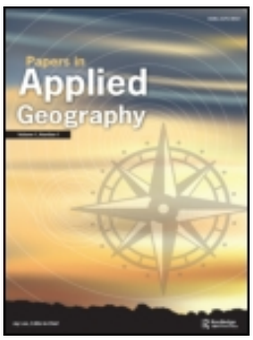

Papers in Applied Geography

ISSN: 2375-4931 (Print) 2375-494X (Online) Journal homepage: http://www.tandfonline.com/loi/rpag20

Addressing the Sustainability of Austin, Texas, Water Policy

Rebecca Brady David & Graham A. Tobin

To cite this article: Rebecca Brady David & Graham A. Tobin (2016) Addressing the Sustainability of Austin, Texas, Water Policy, Papers in Applied Geography, 2:1, 96-104, DOI: 10.1080/23754931.2015.1107617

To link to this article: http://dx.doi.org/10.1080/23754931.2015.1107617

Application Article

Addressing the Sustainability of Austin, Texas, Water Policy

Rebecca Brady David and Graham A. Tobin
University of South Florida

This research looks at sustainability of water policies using Austin, Texas, as a case study. Austin has been classified by Sustainability Tools for Assessing & Rating Communities, the League of Cities—Sustainable Cities Institute, and Popular Science 2008—America's Greenest Cities as one of the most sustainable cities in the United States. With water being an integral part of sustainable practices, one might expect its water policy to reflect that status. To test this assumption, water policy was examined using a sustainability framework that incorporated concerns of social equity, economic stability, and environmental protection. Results indicate that Austin's water policy focuses primarily on protecting human health and reducing water pollutants, while limited attention is devoted to the other sustainability topics. The findings suggest that Austin's water policy could be better integrated with sustainability concepts. **Keywords: Austin, Texas, sustainability, water policy.**

The question driving this research is what forms a sustainable water policy. General concepts of sustainability have been an integral part of the policy agenda since the 1987 Brundtland Commission (Weber-Blaschke, Mosandl, and Faulstich 2005) and sustainable practices have received increasing attention. It would stand to reason that some of these ideas have been incorporated into water policies and adopted by agencies, organizations, and cities. Thus, it is pertinent to examine policy to determine if there are standards for sustainability in water policy.

The framework through which sustainability is understood has been the focus of much debate (e.g., Brown *et al.* 1987; Gleick 1998; Simonovic 2001). Brown *et al.* (1987) suggested there were three pillars of sustainability: social, environmental, and economical. In a social context, basic human needs must be satisfied to lead to the satisfaction of the other levels of Maslow's (1943) hierarchy of needs. Maslow's hierarchy of needs states that humans must meet the most fundamental and "primary" needs first to realize more complex goals, such as self-actualization or achievement. Thus, social sustainability is, typically, more concerned with the individual's self-actualization than environments or gross domestic product. Ecologically, sustainability often focuses on the functioning of natural biological processes and the conservation of biological diversity, all important parameters when addressing ecosystem viability. Economically, sustainability can be somewhat confounding, balancing continued (or limited) growth against resource scarcity (Brown *et al.* 1987). Nevertheless, all three pillars are inherent to sound, sustainable policies as seen in Chapters 8 and 18 of the UN Agenda 21 (Harmancioglu, Barbaros, and Cetinkaya 2013). Similarly, Simonovic (2001) stated that "any assessment of sustainability would be incomplete if it did not address all three facets." Furthermore, the definition has moved beyond the original Brundtland understanding, which suggested that only the needs of the current generation be met without jeopardizing future generations to meet their own (Weber-Blaschke, Mosandl, and Faulstich 2005).

Sustainable water policy, then, is about ensuring that water resources are available for all users, that it addresses the three pillars, and protects citizenry from the devastating effects of floods and other hazards (Postel 2005). Thus the focus of this research, what makes a sustainable water policy, is on how water policies address sustainability.

Austin, Texas

To analyze water policy for sustainability, the research looked at Austin, Texas, a city that was classified as sustainable—denoted by its inclusion in lists of the most sustainable cities in the United States. Austin was selected because it scored highly on three of the five lists (it was not listed by the Corporate Knights or Green City Index):

1. Sustainability Tools for Assessing & Rating Communities (STAR) Rankings.
2. National League of Cities Sustainable Cities Institute.
3. Popular Science 2008 America's Greenest Cities.
4. Corporate Knights 2013, North American Sustainable Cities Scorecard.
5. Siemens AG 2013, Green City Index.

In these lists, Austin was one of the most frequently cited of the sustainable cities with a population under 2 million in the country. The city was a pilot community for the STAR program, receiving high marks in the "Water in the Environment" section. Austin earned full credit based on its EPA 305(b) biological

integrity rating as well as the overall usability of non-industrial water bodies, awarded when the body of water is swimmable and fishable for 90 percent of the past year (STAR Communities 2015). The STAR network also considers actions that each city takes toward sustainability. Austin received full points for eight programs: watershed management, water quality regulations, partnerships to address nonpoint source water pollution, education campaigns about water quality and restoration, incentives for residents and developers to protect and restore critical watershed areas, restoration projects for critical water quality zones, water conservation programs, and partnering with a group that monitors the "biological, chemical, and hydrological integrity" of water bodies (STAR Communities 2015). Austin is also part of the National League of Cities Sustainable Cities Institute. The Institute acknowledged the city for its water quality protection program. Additionally, Austin's watershed protection ordinances were listed as one of the key sustainability initiatives of the city (National League of Cities 2015). The inclusion of Austin in Popular Science's America's 50 Greenest Cities listing reveals a broader perspective of sustainability with rankings based on electricity, transportation, green living, and recycling and green perspectives. Austin scored tenth overall with 4.9 out of 5 points in the Green Perspectives category, showing that Austin's citizens consider environmental issues very important (Svoboda 2008).

Austin has six policies that involve the water system within the city, two main documents and four manuals. The city government created the four manuals to ensure precise application of the Land Development Code (LDC). Indeed, the rules in the manuals were designed to be administered to promote clarity and stability within the development regulations. All these documents discuss the water systems as well as other city-wide development concerns.

- *LDC*: These are regulations for development of the city, specifically related to planning and zoning jurisdiction. The LDC includes chapters on zoning, site plans, transportation, drainage, environment, water and wastewater, sign regulations, and building permits.
- *Environmental Criteria Manual (ECM)*: This manual is used to address issues of water quality, landscaping, preservation of trees and natural areas, hazardous materials, and construction in city parks.
- *Utilities Criteria Manual (UCM)*: This manual is used to assist engineers and the public in the design and construction of water, reclaimed water, and wastewater facilities.
- *Environmental Control and Conservation Manual (ECCM)*: This manual is used to provide guidance and direction for topics ranging from air quality, hazardous materials, trees and vegetation, water quality, and energy conservation, to coal tar pavement products.
- *Drainage Criteria Manual (DCM)*: This manual is used to establish a standard for practices related to the design and construction of drainage systems within Austin and surrounding areas.
- *Utility Profile and Water Conservation Plan (UPWCP)*: This policy is required by the Texas Commission on Environmental Quality and includes information about the water utilities system and plans for water conservation at the municipal and wholesale level.

Method

Procedure

The analysis of the sustainability of Austin's water policy was addressed in three steps: (1) collection of current water policy documents; (2) the creation and maintenance of an index for each policy where the sustainable themes of that policy were identified and catalogued, and (3) analysis of individual policies based on the presence or absence of the theme.

The first step ensured that all of Austin's policies were the most current. Once assembled, the second step involved reading and analyzing documents using the matrix described later. The purpose of this component was to establish if the policy included the sustainability themes, not if they were implemented and acted on or were merely token phrases used to feign support. If the theme was there it received a YES and if not, a NO. Finally, a tally was kept for each time the theme was found within each policy to get an indication of the most frequently cited sustainability themes.

Previous work by scholars in this field has included various conceptions of sustainability that should be present in water policy for that policy to be sustainable (Brown *et al.* 1987; Goodland 1995; Gleick 1998; Sen, 2001; Sedjo 2008; Shabman, 2008; Feldman 2010; Kuhlman and John 2010; Meindl 2011). These main pillars—social, economics, and environment—were compiled into one index with each concept split into subsections. Therefore, "social" was broken into quality of life, democratic water decisions, and pricing; "economic" was divided into scarcity of resources and government approach; and "environment" was separated into reduced human impact and ecosystem function. Finally, these subsections were further dissected into themes to ensure that all aspects of sustainability were represented. It is important to note that some categories overlap with one another, as when discussing sustainability. However, to best understand the results, themes were arranged by the most predominant characteristic. The final pillars, subsections, and themes are described in Table 1. To use these data in a meaningful way, the themes were expanded into metrics and definitions or examples. Each policy was reviewed using these metrics, derived from the literature, to determine if the theme was present in the policy.

Table 1 *Sustainability themes*

Social	Economic	Environmental
Quality of life	*Scarcity of resources*	*Ecosystem function*
- Meet basic human need	- Conservation	- Restore/maintain healthy ecosystem function
- Maintain human safety	- Reuse	- Protect potential natural resources
- Maintain human health	- Anticipate future needs	- Restore/maintain river flow and lake level
- Reliable service	*Government approach*	*Reduce human impact*
Democratic water decisions	- Coordinate surface/ groundwater management systems	- Restricted groundwater pumping
- Government participation	- Institutional organization to prevent/solve water conflicts	- Relaxed control of waterways
- Community participation	- Nontraditional water sources	- Reduced pollutant impact
- Available data resources		
Pricing		
- Equitable distribution		
- Socially just		

Pillar I: Social

Social sustainability was divided into three subsections—quality of life, democratic water decisions, and pricing (Table 2). Quality of life included concepts of meeting basic human needs, maintaining human safety and human health, and reliability of service. Many scholars have discussed the importance of meeting humanity's water needs (Brown *et al.* 1987) and maintaining human health (Gleick 1998). Sen (2001) expanded on these thoughts, suggesting that social sustainability should increase quality of life as it relates to health and safety. Reliability of service makes sense for water systems and it is an element of integrated water resources management (IWRM; see Cap-Net United Nations Development Program 2005).

The second subsection, democratic water decisions, included three themes: government participation, community participation, and available data resources. Government participation was discussed in Sen's (2001) work and is an important element found in IWRM, as well, whereas community participation is vital for sustainability as advocated in Gleick's (1998), Sedjo's (2008), and Goodland's (1995) work. These two themes were divided to show the differences between the two thoughts. Government participation includes concepts involving interagency collaboration and communication, whereas community participation relates specifically to the involvement of the citizens within the government process. The final theme refers to

Table 2 *Social sustainability*

Metric		Description and example
	Quality of life	
Meet basic human need	50 to 100 liters of water, per person, per day	Sufficient water for basic need; Gleick (1998) suggested a minimum of 50 liters per person, per day
Maintain human safety	Planned steps in case of purification failure or water shortage	Examples: failure plan, secondary water source, backup, emergency supply
Maintain human health	Additional water quality standards above national regulations	Sustainability policy will also include standards specific to the region.
	Standards for separate uses including potable, nonpotable, and ecological	Policy should develop lower water quality criteria for industrial, commercial, or landscaping purposes as well as water criteria for ecological water use
Reliable service	Reliability understood as system that allows for basic needs	Examples: diverse water source, supply portfolio, reliability
	Democratic water decisions	
Government participation	Integrated decision making from all pertinent staff and government agencies	Holistic decision making is key to long-term sustainability; examples: intergovernment, interagency cooperation
Community participation	Public participation in government	Examples: public meeting, open discussion, hearing, democratic
Available data resources	Data resources accessible to the public in a timely manner	Examples: database access, research request, data collection report
	Pricing	
Equitable distribution	Water for domestic, urban, industrial, or agricultural use is allocated proportionately and allows for basic need to be met	Examples: equitable, apportionment, priority use, distribution
Socially just	Water systems available to citizens of all economic standing and the system does not put undue stress on individuals	Examples: accessibility, affordability, socially fitting

Table 3 *Economic sustainability*

	Metric	Description and example
	Scarcity of resources	
Conservation	Reduced water use to ensure the renewability of water resources	Examples: reduced use, conservation, water use management
Reuse	Requirements for reuse of water in agriculture, industry, business, and residential setting where applicable	Examples: reuse, repurpose, reinvest, remodel water systems, overpumping
Anticipate future needs	Understanding of water as a limited resource and the long-term viability of the current system	Examples: future water resources, additional resource supply
	Government approach	
Coordinate surface/groundwater management and storage systems	Enhanced coordination of ground and surface water systems	Examples: holistic, coordinated management, coordinated use, combined yield
Institutional organization to prevent/solve water conflict	Plan or action items to create a government agency to prevent or resolve water conflict	Examples: treaty management, oversight, committee, conflict resolution
Nontraditional water sources	The finding, management, and use of water sources that reduce pressure on traditional supply	Example: source evaluation, source feasibility, technology advancement, nontraditional

available data resources. Gleick (1998) stipulated that data on water resources availability, use, and quality should be made available to inform the public.

The final subsection under social sustainability is pricing and includes two themes: equitable distribution and socially just pricing. The concept of equitable distribution of resources is found in Sedjo (2008) and Sen (2001). Both suggested that equity is essential to sustainability as water is a universal need. Finally, socially just pricing was discussed by Meindl (2011). He raised important points regarding how paying for water impacts the middle and lower class and how those who pay for expansions of services are not necessarily the ones who benefit from associated increasing economic growth.

Pillar II: Economic

Economic sustainability was split into two subsections: scarcity of resources and government approach (Table 3). Scarcity of resources was then subdivided into three themes: conservation, reuse, and anticipating future needs. Conservation and reuse are an essential part of sustainable water use and long-term economic viability of a system. Kuhlman and John (2010), for example, suggested that to ensure longevity of resources, the conservation and reuse of water is required. Governments should also anticipate the city's future needs in tandem with conserving and reusing water. Meadowcroft (2009) made this point as one of the necessary features of a sustainable water policy because water is a finite resource and, as city populations increase, governments have the responsibility to ensure adequate long-term supply.

The other subsection, government approach, was separated into three themes based on the work of Sedjo (2008) and Gleick (1998). Sedjo (2008) advocated the coordination of surface and groundwater management to ensure that all water is treated with equal care. Gleick (1998) encouraged the creation of an institutional mechanism specifically to prevent or resolve water conflicts. As with anticipating future needs, water is finite and governments need to be prepared for any controversies. The final theme looked at finding nontraditional water sources in an effort to reduce strain on traditional supply. This theme was represented in Sedjo's (2008) work as part of making sure that the water supply stays economically viable.

Pillar III: Environmental

The final pillar, environmental sustainability, contained two subsections: ecosystem function and reducing human impacts (Table 4). Finding a balance between humanity's and an ecosystem's needs for water is essential to longevity for both parties. Thus, the first subsection, ecosystem function, was divided into three themes used to illustrate the need for policy that respects both human and ecosystem water needs. The first, restoring or maintaining healthy ecosystem function, was suggested in Gleick's (1998) writings, as he contended that human action should not impair long-term renewability of systems. The second is to protect potential natural resources. This concept was considered by Sedjo (2008) and Gleick (1998): As more people continue to depend on city water systems, the government must be able to tap into additional resources. Therefore, even though a water body is not used for drinking water now, that does not mean that it might not be necessary for future use and that potential should be protected. The final theme in this subsection is to restore or maintain river

Table 4 *Environmental sustainability*

	Metric	Description and example
	Reduce human impact	
Restricted groundwater pumping	Begins or continues to reduce drawdown of groundwater	Examples: reduced groundwater use, permit, permit evaluation process, administrative permit
Relaxed control of waterways	Removing, reducing use, or minimizing manmade impacts on waterways	Examples: dredging, dam, reclamation, sedimentation, canal
Reduced pollutant impact	Water systems are not significantly impacted by additional materials in the water system	Examples: discharge, runoff, fertilizer, damaged
	Ecosystem function	
Restores/maintains healthy ecosystem function	Plans to restore or maintain human-impacted ecosystems; includes restoration programs and springs management plans	Examples: preserve, wetland protection, riparian protection, restoration plan, reduced social/human activity
Protect potential natural resources	Works to protect current and prospective resources	Examples: resource management, species protection, resource vulnerability
Maintain/restore river flow and lake levels	Rules that ensure that water bodies receive a minimum amount of water to meet basic needs of the ecosystem	Examples: minimum flow requirements, adaptive modeling for human need and climate variation, seasonal fluctuation

flows and lake levels. Sedjo's (2008) article addresses this need, as did Shabman (2008), who took a more universal approach by calling for the maintenance or restoration of flow for all surface waters.

The second subsection of this pillar focuses on reducing human impact on the environment, which was entirely represented in Shabman's (2008) work. The pillar is characterized by three themes: restricting groundwater pumping, relaxed control of waterways, and reduced pollutant impacts. Shabman described the need for restricted groundwater pumping to maintain sufficient resources for ecosystem function. Additionally, relaxing human control on waterways is a way to reduce undue impacts on river and lake systems. Finally, human pollutants are a significant problem for the ecosystem and governments must work toward reducing that impact.

Results and Discussion

Pillar I: Social

Austin's policies show that the government is attentive to its citizens, as every sustainability theme in this division was present in at least one policy. This theme is divided into three subcategories: quality of life, democratic water decisions, and pricing. In total there were eighty-four mentions of this theme, with the majority found in the quality of life subcategory, as shown in Table 5.

Subsection: Quality of Life

The most frequently cited subcategory was maintaining human health, with water quality the most referenced. There were three aspects to water quality that appeared in the policy. The first related to construction and the

Table 5 *Social sustainability matrix results*

	Land Development Code	Environmental Criteria Manual	Environmental Control & Conservation Manual	Utilities Criteria Manual	Drainage Criteria Manual	Utility Profile & Water Conservation Plan	Total Frequency
Quality of life							
Meets basic human need	Y (1)	N	N	Y (5)	N	N	6
Maintain human safety	Y (4)	Y (3)	N	N	Y (1)	N	8
Maintain human health	Y (16)	Y (7)	Y (2)	Y (2)	N	Y (4)	31
Reliable service	Y (1)	N	N	N	N	Y (1)	2
Democratic water decisions							
Government participation	Y (3)	N	N	N	N	Y (3)	6
Community participation	Y (1)	N	N	N	N	Y (3)	4
Available data resources	Y (3)	Y (3)	N	N	Y (1)	Y (1)	8
Pricing							
Equitable distribution	Y (1)	N	N	N	Y (1)	Y (7)	9
Socially just	Y (10)	N	N	N	N	N	10

Note: Y/N states if the theme was present in the policy; number in parentheses is the frequency of each theme mentioned in the policy.

need to ensure that water quality does not deteriorate as the city develops. The second aspect to water quality involved water quality zones. The ECM mandated that all critical water areas be a part of a water quality zone where the city enforces more rigorous rules than in other areas. These water quality zones include the entire Barton Springs watershed and areas where impervious surfaces are greater than 20 percent in rural areas and greater than 5,000 square feet in urban districts. The final facet of water quality is drinking water quality. Remarkably, in all policy documents analyzed, there were only two references to drinking water and public health, both of which were found in the ECCM. The first stated that facilities that supply drinking water must meet Texas water standards. The second stated that if the drinking water is sourced from underground it must be treated per the standards of the Texas Commission on Environmental Quality, but, if drinking water comes from "an open body of water," it must automatically be assumed polluted and treated as such.

The final aspect of quality of life discussed maintaining human safety, stating that policy should have plans in place in case of a purification failure or water shortage. However, on review, Austin implemented this concept differently, where, in almost every instance, the policy reflected safety from water instead of the safety of water. Although not the way that previous scholars had articulated sustainability, each example presented a clear instance where human health and water were interconnected. Austin's policy appears to be more reactionary, involving short-term concerns rather than potentially long-term problems.

Democratic Water Decisions

This subsection included government and community participation, which were part of the LDC and Conservation Plan. Government participation required that decision making comes from all pertinent staff and government agencies within the given region. Long-term sustainability required a holistic understanding of the water resources, which is only achieved when all parties are responsible for decision making. Only two of the policies researched included any mention of complete government participation in decision making, the LDC and the UPWCP. The LDC's cases instruct the city manager to ensure that voices within various departments are heard. For example, the city manager must send applications for water services or development requests to those city divisions that have a pertinent interest, including Parks and Recreation, Urban Transportation Commission, Water and Wastewater commission, and the Environmental Board. The Conservation Plan includes government participation in ways that differ from the LDC. Instead of ensuring that applications, petitions, and requests are viewed by different departments, the UPWCP incorporated the founding of the Water Wise Newsletter, which is issued to all government departments in addition to the citizens of Austin.

Community participation is important to the success of water policy, as it is the community that must follow any rules. Nevertheless, only the LCD and the Conservation Plan included any mention of community involvement in the water process. The LDC included a required study to assess current and future transportation of pollution in and through the city via the Barton Springs Edwards Aquifer and other streams. This study must be completed with citizen input.

The Conservation Plan included more traditional views of community participation. The plan incorporated goals to encourage water conservation and used public education, community outreach, and citizen participation as ways to achieve that goal. According to the plan, education and outreach build awareness and encourage participation. Austin Water also advertises the availability of water conservation and programs, in addition to sending staff members to speak on conservation topics at local events.

Pricing

The final subsection of this pillar provided a look at the more conventional approach to governance as the

Table 6 *Economic sustainability matrix results*

	Land Development Code	Environmental Criteria Manual	Environmental Control & Conservation Manual	Utilities Criteria Manual	Drainage Criteria Manual	Utility Profile & Water Conservation Plan	Total Frequency
Scarcity of resources							
Conservation	N	Y (6)	Y (13)	N	N	Y (11)	30
Reuse	N	Y (4)	N	N	N	Y (4)	8
Anticipate Future Need	N	N	N	N	N	Y (3)	3
Government approach							
Coordinate surface /groundwater management	Y (4)	Y (3)	N	N	N	Y (1)	8
Organizations for water conflict	N	N	N	N	N	N	0
Nontraditional water sources	N	N	N	N	N	N	0

Note: Y/N states if the theme was present in the policy; number in parentheses is the frequency of each theme mentioned in the policy.

themes of equitable distribution and pricing were only discussed in terms of permits and fees. The water rate structure in Austin is five-tiered and is used to discourage residential users from excess water use and to encourage commercial and multifamily users (e.g., apartment complexes) to conserve. Additionally, there are variable rates for different services throughout the city—single-family, multifamily, commercial, wholesale, and large-volume industrial. All these are ways to ensure that the water distribution is equitable, as costs are based on type of service instead of a standard pricing system. Socially just distribution of water was also considered in monetary terms, where impact fees were waived for special circumstances or payment plans for those where economic hardship prevents lump-sum payment.

Pillar II: Economic

This pillar encompassed fewer matching themes than social or environmental sustainability. Indeed, the UCM and the DCM contained no mention of any of the themes from this division and the ECCM only covered points relating to conservation. There were two subsections in this theme, scarcity of resources and government approach, where resource scarcity was the more represented of the two. The complete results from this pillar are found in Table 6.

Scarcity of Resources

Points matching the scarcity of resources theme were found almost exclusively as conservation requirements with little attention paid to the reuse of water or anticipating future water needs. Again, this seems to suggest a reactionary instead of forward-thinking policy. The UPWCP self-evidently includes information about conservation, although the points are geared more toward the abstract or "big picture." The ECM and the ECCM include more concrete examples of conservation measures. The ECM notes that conservation is easier and less expensive than restoration of the resource and suggests that rainwater on commercial property can be harvested and used to irrigate landscapes or as cooling water—however, residential properties are not allowed to participate in rainwater harvesting.

Other regulations were found in the ECCM, which had many specific requirements for water conservation; for example, restaurants may not provide water to a customer unless a glass is requested, or businesses that provide lodging must provide a towel and linen reuse program, and all new commercial developments must connect to reclaimed water hookups. Finally, the ECCM also included restrictions during droughts. The city manager can order these water use restrictions, separated into four stages, based on severity of drought throughout the city. Although not frequently mentioned, the Conservation Plan did include one very important assertion regarding Austin's future water need. The City has already entered into an agreement with the Lower Colorado River Authority for an additional 250,000 acre-feet per year to be purchased, incrementally, for future use.

Government Approach

This subsection was scarcely found in the policies. Austin policy barely addressed the government's approach to water, with information on surface and groundwater management, and there was no mention in any policy as to an institutional organization to prevent or solve water conflict or the need for nontraditional water resources. Both of these are essential if Austin is to plan for long-term viability of water resources if and when water becomes scarcer in the region.

Pillar III: Environmental

The third pillar of sustainability involved the environment and it contained two of the most frequently cited themes: reduce pollutant impact and restore and maintain healthy ecosystem function. The pillar has two

Table 7 *Environmental sustainability matrix results*

	Land Development Code	Environmental Criteria Manual	Environmental Control & Conservation Manual	Utilities Criteria Manual	Drainage Criteria Manual	Utility Profile & Water Conservation Plan	Total Frequency
Ecosystem function							
Restore/maintain healthy function	Y (17)	Y (18)	N	N	Y (6)	N	41
Protect potential natural resources	Y (1)	Y (4)	N	N	N	N	5
Maintain/restore river flow and lake levels	Y (5)	Y (4)	N	N	N	N	9
Reduce human impact							
Restrict groundwater pumping	N	N	N	N	N	N	0
Relax control of waterways	Y (1)	Y (1)	N	N	N	N	2
Reduce pollutant impacts	Y (19)	Y (38)	Y (1)	N	Y (2)	Y (1)	61

Note: Y/N states if the theme was present in the policy; number in parenthesis is the frequency of each theme mentioned in the policy.

subsections: ecosystem function and reducing human impact. During review of the policies, this pillar was recurrently cited in conjunction with protecting human health found in the social section. What might be most intriguing in this review is not the cited requirements found, but rather, what was missing. The Conservation Plan contained only one reference to any environmental protection and does not describe the conservation of water as a benefit to the ecosystem or required for protecting local habitats, but instead only discusses the need to conserve in monetary terms. The overall findings for this pillar are compiled in Table 7.

Ecosystem Function

According to the matrix, this theme includes plans to restore or maintain human-impacted ecosystems within or surrounding the city. This would include concepts like restoration management programs, springs management plans, and wetland preservation projects. The LDC speaks to maintaining healthy ecosystem function in broad strokes with big ideas, whereas the ECM and DCM describe practical applications to ensure healthy ecosystem function.

The LDC included the required creation of the Watershed Protection and Development Review Department, which ensures that all development complies with codes while still being environmentally responsible and cost effective. The director of this board is appointed by the city manager. In addition to the development of this department, the LDC also established the Save Our Springs Initiative, where additional requirements were enacted for development within the Barton Springs watershed, from increased sedimentation reduction procedures to annual permits involving continued water quality testing.

Research showed only five instances within the documents that advocated protecting potential resources. The ECM stated that all development adjacent to the Colorado River must list all drainage within 150 feet. This provides safeguards that current development will not jeopardize the future water purchase that Austin has already established. The LDC requires an Environmental Resource Inventory for any development over karst aquifers, within an area that drains into a karst aquifer, a floodplain or a hill with greater than a 15 percent gradient. This also works toward long-term water quality needs as it is established to protect aquifer recharge zones.

To be sustainable, water bodies need a minimum amount of water to meet the basic requirements of an ecosystem and, hence, a concern for maintaining or restoring river flows and lake levels would seem pertinent. Although the policies did not give a numerical requirement for this theme, riparian corridor protection was a prerequisite. The LDC also included rules stating that the obstruction of waterways is prohibited and that the person in control of that property is responsible for a clear waterway—any standing water is considered a nuisance and is a fineable offense. Additionally, development may not divert storm water from one watershed to another unless the diversion is authorized. Although these are necessary to guarantee the long-term viability of rivers and lakes, they do not directly meet the theme's suggested description.

Reduce Human Impact

Austin policy discussed the importance of pollution reduction in terms of maintaining healthy citizens and ecosystems. Policies included many specific references to reducing or avoiding pollution during development and construction, to avoid increased pollution due to storm water runoff, or to avoid erosion and sedimentation. Only one instance included pollution by an individual citizen by forbidding a person from discharging, directly or indirectly, garbage, litter, sewage, or other waste or substance that could cause water pollution. Every other instance of pollution reduction was discussed in terms of development and construction.

The majority of the LDC includes specific ordinances. The main rule relating to pollution is Section 25-8-514, which stated that required water controls must ensure that there is no increase in the annual pollutant load. The regulations under this section and in this code include everything from erosion zone requirements to operating permits. The ECM also involved many specific requirements for pollution prevention. These relate to limiting discharge of sediment into waterways during construction and during storm water runoff, as well as requirements revolving around the need to reduce erosion and sedimentation. The ECM also stated, rather more emphatically than typical of policy language, that erosion and sedimentation control is only effective when permanent and must be the last step in construction. Otherwise, exposed or disturbed soil might erode, stream banks might become unstable, and sedimentation will occur in streams and lakes. The ECM continues by stating that development, and the resulting increased impervious cover, leads to a higher frequency of full bank river and stream conditions that lead to increased erosion, increased stream bank failure, loss of property, increased clogging of downstream systems, increased maintenance of pump systems, and decreased water quality.

Conclusion

Although Austin is considered one of the most sustainable cities in the United States, it appears that its water policy can improve on that standing. The city does include many sustainability ideals in its policies, and it still views the concept of sustainability predominantly in monetary terms. This is evident in the city's depiction of conservation as a monetary benefit without discussing the clear ecological interest, or in the need to reduce pollution for anthropocentric needs like recreation and property protection. It is also noticeable in

the almost nonexistent economic stability theme that there was no inclusion of, or apparent recognition for, the need to prevent or solve water conflict, to restrict groundwater pumping, to coordinate surface and groundwater management, or to anticipate future needs of the citizens. Indeed, the only mention for future water use is in the purchase of water from the Colorado River, which does not have a large amount of excess resources available and has many people and organizations for which water is already committed.

As discussed, sustainability scholars advise that the themes compiled in this matrix are essential to long-term sustainability. This research shows that the city is considered sustainable but it still needs to better integrate all the pillars of sustainability—social, economic, and environmental—to successfully balance the basics of all three. The city government is involved in all aspects of city life where water is only one part of that concern. However, most of the policies are written for development, growth, and construction of the city. It is apparent that this perspective needs to change to one of maintaining, understanding, and working with the city, its citizens, and its environment. Although Austin's policies ranked lower on the matrix than expected for a frequently cited sustainable city of its size, the city should be able to make the adjustments necessary to adjust the overall results of this report.

Gleick (1998) contended that past goals of water policy were to support increased economic development and figure out ways to meet increasing fresh water demands. Excluded from these policies were considerations of ecological need and the role of community. He concluded the article stating that until "discussions about the sustainable use of water become an integral part of long-term water planning, the world will be faced with continued unsustainable water use and threats to both human and ecological survival" (Gleick 1998, 578). Although these themes appear to be emerging in policies of Austin, Gleick's warning, two decades past, still rings true. There is still much more to do.

References

Brown, B. J., M. E. Hanson, D. M. Liverman, J. Merideth, and W. Robert. 1987. Global sustainability: Toward definition. *Environmental Management*, *11*(6): 713–19.

Cap-Net United Nations Development Program. 2005. *Integrated water resources management plans: Training manual and operational guide*. Rio de Janeiro: Cap-Net UNDP.

Feldman, D. 2010. *Water policy for sustainable development*. Baltimore: Johns Hopkins University Press.

Gleick, P. 1998. Water in crisis: Paths to sustainable water use. *Ecological Applications*, *8*(3): 571–79.

Goodland, R. 1995. The concept of environmental sustainability. *Annual Review of Ecological Systems*, *26*: 1–4.

Harmancioglu, N., F. Barbaros, and C. Cetinkaya. 2013. Sustainability issues in water management. *Water Resources Management*, *27*(6): 1867–91.

Kuhlman, T., and F. John. 2010. What is sustainability? *Sustainability*, *2*(11): 3436–48.

Maslow, A. H. 1943. A theory of human motivation. *Psychological Review*, *50*: 370–96.

Meadowcroft, J. 2009. What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sciences*, *42*(4): 323–40.

Meindl, C. F. 2011. Water, water, everywhere? Toward a critical water geography of the south. *Southeastern Geographer*, *51*(4): 615–40.

National League of Cities. 2015. Austin, Texas. Washington, DC: National League of Cities. http://www.sustainablecitiesinstitute.org/cities/austin-texas. Accessed June 9, 2015.

Postel, S. 2005. From the headwaters to the sea. *Environment*, *47*(10): 8–21.

Sedjo, R. A. 2008. *Perspectives on sustainable resources in America: Resources for the future*. Washington, DC: RFF Press.

Sen, A. 2001. *Development as freedom*. New York: Oxford University Press.

Shabman, L. 2008. Water resources management and the challenge of sustainability. In *Perspectives on sustainable resources in America* (pp. 104–132), ed. R. Sedjo. Washington, DC: RFF Press.

Simonovic, S. P. 2001. *Measures of sustainability and their utilization in practical water management planning*. Paper presented at the Regional Management of Water Resources conference, Mazslricht, The Netherlands.

STAR Communities. 2015. Austin, Texas. Washington, DC: STAR Communities. https://reporting.starcommunities.org/communities/5-texas-austin. Accessed June 9, 2015.

Svoboda, E. 2008. America's 50 greenest cities. *Popular Science*. http://www.popsci.com/environment/article/2008–02/americas-50-greenest-cities?page=1. Accessed June 9, 2015.

Weber-Blaschke, G., R. Mosandl, and M. Faulstich. 2005. History and mandate of sustainability: From local forestry to global policy. In *Global sustainability: The impact of local cultures* (pp. 5–19), ed. P. A. Wilderer, E. D. Schroeder and H. Kopp. Weinheim, Germany: Wiley.

REBECCA BRADY DAVID is a graduate student in the School of Geosciences at the University of South Florida, 4202 East Fowler Ave., Tampa, FL 33620. E-mail: rdavid@mail.usf.edu. Her research interests include sustainable water policy.

GRAHAM A. TOBIN is Professor in the School of Geosciences at the University of South Florida, 4202 East Fowler Ave., Tampa, FL 33620. E-mail: gtobin@usf.edu. His research interests include natural hazards and water resources.