

## Article

# A Participatory Approach to Assess Social Demand and Value of Urban Waterscapes: A Case Study in San Marcos, Texas, USA

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**Abstract:** Waterscapes can have meaningful benefits for people's wellbeing and mental health by helping them feel calmer and more connected to nature, especially in times of stress such as the COVID-19 pandemic. The waterscapes along the San Marcos River (Texas, USA) provide economic, social, environmental, and emotional benefits to the surrounding community. To assess the social demand for and emotional experiences in these blue spaces, we used a new framework called Blue Index that collects noncontact data from photo stations. From 10 photo stations across different waterscapes, we collected and analyzed 565 volunteer assessments from May 2021 to March 2022—during the COVID-19 pandemic and following the reopening of riverside parks. Most respondents (57%) indicated they spend more time at the river than they did before the onset of the pandemic. Moreover, 93% of respondents agreed that the waterscape they were visiting represented a refuge from stress and isolation caused by COVID-19. Overall, people valued waterscapes for ecological benefits and relationships with the place, rather than for recreation and tourism. Emotions experienced at all 10 waterscapes were overwhelmingly positive. Statistical tests revealed that higher positive emotions were significantly associated with biophysical perceptions of flow, cleanliness, and naturalness. Our results demonstrate that the benefits of blue spaces derive from an interrelated combination of ecosystem and mental health. The new Blue Index approach presented here promotes participatory land management through noncontact community engagement and knowledge coproduction.

**Keywords:** urban blue space; relational values; community science; COVID-19; participatory research; social–ecological systems; mixed methods; emotional experiences

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## 1. Introduction

Aquatic ecosystems are being degraded at an alarming rate [1,2]. A range of threats to freshwater ecosystems including climate change, land-use change, groundwater pumping, and impoundments resulted in an 83% loss of overall freshwater biodiversity from 1970 to 2014 [2,3]. This degradation of aquatic ecosystem health along with the ecosystem services they provide has negative consequences (direct and indirect) on human health [4,5]. Commonly cited negative consequences include wildlife habitat destruction, impaired water quality, flooding, reduced recreation, and loss of tourism; however, the health and appearance of aquatic ecosystems can also impact mental health and overall human wellbeing [6–8]. The focus of this article is on this less-studied, psychological aspect of aquatic ecosystems.

Rivers, lakes, and wetlands are freshwater ecosystems but can also be conceptualized as blue spaces or waterscapes. Blue spaces are defined as “health-enabling places and spaces, where water is at the center of a range of environments with identifiable potential

for the promotion of human wellbeing” [9]. Maintaining healthy blue spaces promotes positive feedback between environmental health and public health [8]. The waterscape refers to visual and nonvisual elements of the landscape, much like the term riverscape has been used in the literature [10]. Waterscape is broader than riverscape because it also includes lakes and wetlands, which are present in this case study. Blue spaces and waterscapes are synonymous [11], and we use the terms interchangeably depending on the context of the relevant literature.

The benefits of blue spaces and waterscapes are particularly needed in cities with heightened stresses from urban heat islands, poor air quality, traffic, noises, and technological worries. Urban waterscapes can also promote community health and ensure equitable access to ecosystem services within a city [5,7,9]. While several studies have documented the mental and physical benefits of waterscapes [6,12], cultural and emotional aspects of human interaction with water are rarely quantified and even less frequently incorporated into meaningful action or policy [13–16]. These aspects of interaction, however, are meaningful and can guide the sustainable management of urban waterscapes [17].

Understanding relationships between people and nature is essential to the sustainable management of social–ecological systems (SESs) [7,13,18,19]. SESs refer to the systems formed through complex and dynamic interactions and interrelations between people and nature [19,20]. Studying the social demand of SESs (i.e., social actors’ reasons for visiting/behaviors, preferences, perceptions, and values) can inform those managing tradeoffs or aiming to incorporate community/stakeholder knowledge in policy [20]. SES research often collects data through stakeholder perspectives that influence their interactions with the landscape [21–23].

The connections people have with places, especially natural places, can have measurable effects on people’s overall wellbeing. A greater spatial extent of urban green space within a city and proximity of residency to green space has been shown to increase the restorative potential of landscapes and reduce negative emotional experiences [15,23–25]. The relationship between exposure to nature and emotional wellbeing has been widely researched, although its mediators (e.g., type of activity and restorative experience) are less documented [26]. Most research on nature and health has investigated the role of green spaces [27]. However, multiple studies have concluded that people prefer blue spaces to green spaces when seeking relaxation or restoration [28–30]. Nichols [6] (p. 20) described the unique ability of water to provide relaxation, peace, or higher cognitive functions collectively as “Blue Mind”. “Blue Mind” refers to these mental benefits of water, while “Red Mind” refers to stress, fear, or anxiety around water. The ability of waterscapes to produce “Blue Mind” may be dependent on waterscape features, SES values, and personal meanings. Several studies investigating the role of blue spaces on wellbeing found that the therapeutic benefits of place are variable and subjective and are largely determined by the symbolic meaning of place [31–33]. Numerous therapy initiatives are centered around interaction with blue spaces [33–36].

Rivers as SESs provide a diverse combination of ecosystem services, including social–cultural benefits [4,21]. A review of cultural ecosystem service measurement techniques found that spiritual and cultural symbolism and meaning of place are often underrepresented in ecosystem services valuations [37]. Furthermore, laypeople and scientists often have different conceptions of ecosystem services and the framework of evaluation [38–40]. These limitations to the application of the ecosystem services framework have led many, especially cultural geographers, to consider expanding the scope of information that is considered in nature–human relationships [41,42].

Ecosystem values do a better job of uncovering social–ecological dynamics of waterscapes [7]. Because values usually rely on interaction with others, we use the term “SES values” to capture how values for waterscapes are based both on nature–human and social relationships. The literature regarding SES values often gets stuck in a dichotomy of intrinsic vs. utilitarian values [42]. Utilitarian values are those assigned to an ecosystem for a specific means to an end and are derived from human-centered motivations for using or

visiting a place. Intrinsic values are biospheric and value the ecosystem in itself. This dichotomy has led to a “discourse of battle” in conservation between benefits to people vs. benefits to nature [38,43]. This divide, however, is not reflective of the ways humans make decisions and interact with the world [44,45]. Relational values highlight the restorative nature and responsibilities that exist in SES through relationships and modes of interaction with place [13] and have been introduced as a “third class of values” alongside intrinsic and utilitarian values [46].

Relational value statements depend on aspects of identity, kin, emotions, responsibility, community, health, or a combination of these factors [38]. Depending on the type of statement used (or emotion considered), different meanings of relational values may be expressed. Relational values go beyond traditional monetary quantification and are essential to capture non-Western conceptions of nature–human relationships [47]. Relational values tend to situate personal relationships within a subjective framework of meaning, rather than through a strict definition [17,31].

Blue spaces represent opportunities to promote relational values and “urban commons” by encouraging shared responsibilities, stewardship, and equitable access to waterscapes [7,8,48,49]. Measuring subjective experiences and SES values may reveal cultural and subjective meanings, which are valuable insights for land-use and water resources planning. There is an increasing social demand for interaction with waterscapes and the ecosystem services they provide, but this increased demand includes necessary tradeoffs between different stakeholders and various bundles of ecosystem services [40,50–52]. Taking into account these complex dimensions of blue space SESs, Jeffery and Davidson [53] introduced the Blue Index framework to increase public participation in urban waterscape management. The Blue Index assessment quantifies the effect of waterscapes on emotional health to guide the design of public waterscapes and coproduce solutions for tradeoffs in water management. The framework uses spatiotemporal photos to document changes over time and represent relationships with waterscapes. Other studies have also shown that photo databases embody cultural aspects of SES values and relationships with place [54,55]. Here, we expand on the Blue Index participatory framework and its use of photo stations to assess emotional experiences in response to waterscapes, social demand for these waterscapes, and broader SES dynamics.

The coronavirus pandemic (COVID-19) has provided researchers with a unique opportunity to make observations about the ways people interact in nature to cope with stressful events, particularly when normal opportunities/practices are removed or unavailable. The literature published on how much time spent in nature in response to COVID-19 has produced mixed results. While the frequency of outdoor excursions and distance traveled to experience the outdoors has declined in some places because of COVID-19 restrictions [56], some studies have shown that the visitation of local urban greenspaces has increased [57]. When studying urban green spaces and emotions in the context of the COVID-19 pandemic, Samus et al. [58] found that the degree to which people felt connected to nature predicted their positive emotions during COVID-19 lockdowns. Two international surveys found that there is a global increase in the frequency of using blue/green spaces and an increased appreciation for these spaces during and after COVID-19 lockdowns [59,60].

This study used mixed methods and an SES framework to quantify and characterize urban waterscape interrelationships. The guiding research question was the following: “How do people feel, perceive, value, and interact with waterscapes, and what biophysical differences influence these experiences?” This question was investigated through a “Blue Index” assessment on social demand for and emotional experiences in response to waterscapes. Because of the unique challenges presented by COVID-19 and the need for spatially explicit data, assessments were administered remotely through strategically placed stations with quick response (QR) codes along an urban waterscape consisting of rivers, wetlands, and a spring-fed lake. Participants also submitted photos (taken from the

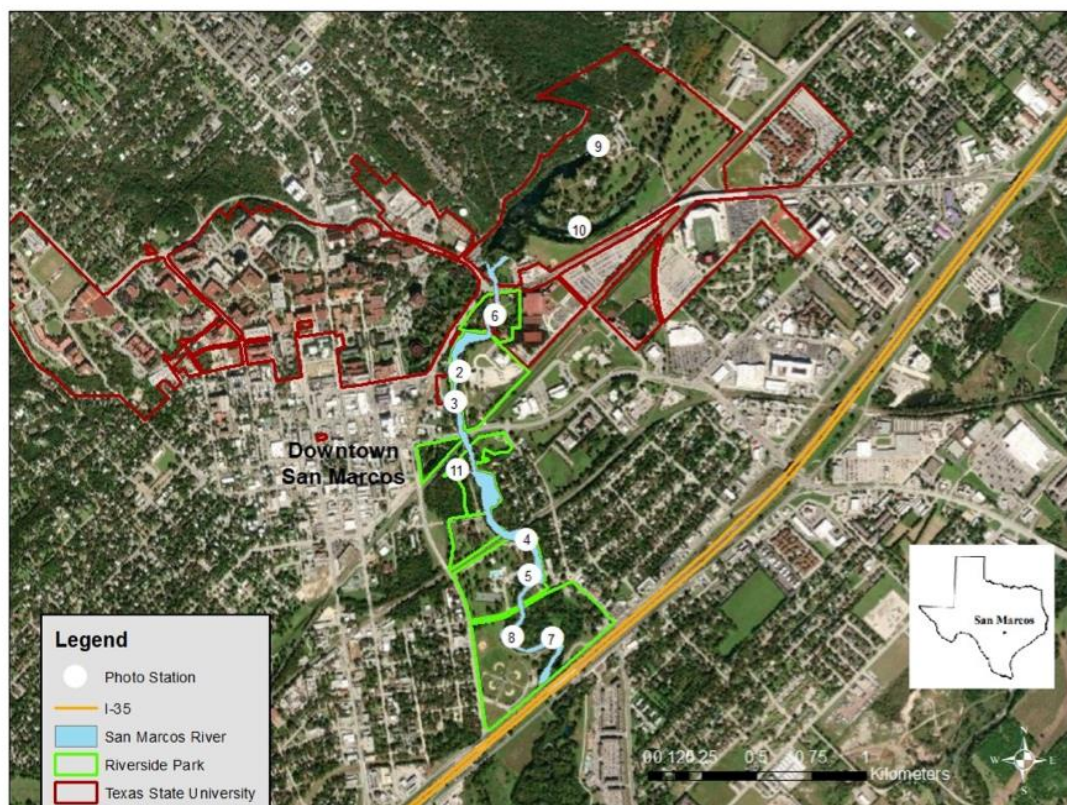
same distance, perspective, and angle) with their assessments to ensure responses were spatially accurate and to create a waterscape photo database.

## 2. Materials and Methods

### 2.1. Study Area

Hays County in Texas (USA) grew by 55% from 2000 to 2010 [61] and by another 54% from 2010 to 2020 [62], making it the fastest growing county in the nation (by percent) over this period with a minimum population of 100,000. San Marcos—the county seat—has been one of the fastest growing cities in the nation (by percent) over the past decade with an ~8% annual population increase in recent years [63]. This rapid population increase at the city and county levels has been accompanied by intense development and enhanced urban stresses. Over this period, the city of San Marcos and its river have also become a major regional, national, and even international tourist destination [8,64,65].

The San Marcos River (SMR) along with its tributaries, wetlands, and lake are centrally located within the city of San Marcos (Figure 1) and represent a social–ecological system (SES). These waterscapes provide a multitude of ecosystem services that benefit the surrounding communities [7,8]. The spring-fed river ecosystem is a habitat for several endangered species and possesses important biodiversity [64,66]. In the coming years, the San Marcos River SES will be challenged by tradeoffs between ecosystem health and development [7]. These future tradeoffs make San Marcos a valuable case study for measuring social demand of urban blue spaces and community preferences for future land and water management. An analysis of community SES values and mental health is necessary to provide reflexive decision making in these tradeoff scenarios. The data collection for this study took place at 10 sites along the San Marcos River, its headwaters and wetlands at Spring Lake, and one of its tributaries. See Appendix A for site descriptions of these 10 waterscapes.



**Figure 1.** Study area map displaying locations of numbered Blue Index photo stations at waterscapes in San Marcos, Texas, USA. Each numbered site is described in Appendix A.

## 2.2. Data Collection

The social demand and emotional experiences of waterscapes in San Marcos were measured through volunteer assessments (also known as questionnaire surveys) and photos at various sites along the San Marcos River, including its headwaters, which form Spring Lake, and its adjacent wetland ecosystems (Figure 1). Assessment stations were spatially distributed to capture multiple degrees of different waterscape characteristics, including extent of development and optical water quality, to conduct a natural experiment across different waterscapes.

Data were collected over a 10 month period (29 May 2021 to 4 March 2022) using 10 Blue Index photo stations. Each station consisted of an L-shaped frame attached to an existing bridge or post and an acrylic sign (15 cm × 15 cm) with instructions for submitting photos and participating in the assessment. This structure forms a fixed photo station where a participant can place their cell phone and submit a photo of the waterscape they are visiting (Figure 2). Participants accessed the assessment through a quick response (QR) code posted on the acrylic sign. Participants were required to have a cell phone and access to cellular data to use the Internet, as almost all of the study sites were in public parks without free Wi-Fi.



**Figure 2.** Blue Index photo station (left) attached to existing bridge at City Park (Site #3, right).

## 2.3. Assessment Design

The assessment was designed on the basis of previous research from and in collaboration with the Blue Index project [53] (<https://blueindex.org/> accessed on 10 May 2023). No risks were anticipated as a result of participation in this study (IRB #7792). All subjects gave their informed consent and permission to use their photo before they participated in the assessment. The assessment consisted of 18 questions and a photo submission. Photos were collected to track landscape characteristics over time and to complement the information provided in assessment. Questions in the assessment consisted of (1) reported emotional experiences at the waterscape, (2) perceptions of waterscape characteristics including cleanliness, naturalness, accessibility, and flow, (3) perceptions of relaxation and refuge, (4) values based on which river function was deemed most important, (5) types of activity and frequency of visits, (6) relationships with waterscapes before and after the

onset of COVID-19, and (7) demographics of participants including permanent and temporary residency. The full assessment is in Appendix B. All assessment responses were self-reported and based on perceptions and personal experience. Measures of emotional experience were collected on a five-point Likert scale for six emotions that represent a diverse subset of Plutchik's [67] Wheel of Emotions: joy, serenity, fear, disgust, sadness, and amazement. These emotions represent different "spokes" on the wheel of emotions and were selected to represent general categories of emotions that participants potentially experienced. Participants had the opportunity to write in any emotions they experienced that were not represented by these six choices. Participants had several opportunities to provide their own responses including additional emotions they felt or additional comments about each waterscape.

#### 2.4. Analyses and Techniques

Assessments were distributed and archived using the Qualtrics online survey platform. We analyzed data using Excel statistics and R Studio. Data were compared among four types of waterscapes (lake, wetland, perennial river, and intermittent tributary) to determine how relationships with waterscapes varied with biophysical settings. These four primary locations had large and comparable assessment sample sizes. We conducted a secondary analysis using all 10 sites and acknowledge that these statistical tests with smaller sample sizes are less meaningful. We used Kruskal–Wallis, pairwise Wilcoxon ranked sum, and Spearman's rho, all nonparametric statistical tests, to analyze how emotions and perceptions were influenced by waterscape type and values. Kruskal–Wallis tests analyzed variance between groups in the nonparametric dataset, pairwise Wilcoxon tests identified which groups were different, and Spearman's rho measured the strength of correlation between variables. Nonparametric statistics were utilized due to the non-normal distribution of the data. Thirdly, we performed a qualitative text mining analysis of additional comments to complement statistical conclusions and provide information about relationships with waterscapes that went uncaptured by closed, quantitative questions.

### 3. Results

#### 3.1. Social Demand and Emotional Experiences of Waterscapes

Data collection took place from 29 May 2021 to 4 March 2022. There were a total of 870 responses. After removing entries that did not answer the questions about emotions and/or uploaded a photo, 565 responses remained viable for analyses. Across the 10 sites, response counts ranged from 12 to 98 usable assessments at each site.

Descriptive statistics across sites, as well as a breakdown of demographic characteristics for the entire sample, revealed a wide range of social actors that visit the San Marcos River social–ecological system (SES) (Table A1). Most river visitors were young college students who identified as residents, but more than one-quarter of respondents were older than 35. More than half of respondents were not permanent residents, meaning they were likely a tourist/visitor or a nonresident student. Most of the river visitors frequented the SES at least monthly, with one-third visiting it at least weekly (Table A1). Over 9% of participants at the tributary visited daily, likely because of the photo station's position on a walking path.

When asked about what they valued most about the waterscape, almost half of the respondents chose relational values (45.7%) while a similar percentage chose intrinsic values (44.6%). Only 9.6% of participants chose utilitarian values as the most important. Overall, positive emotions were ranked as more intense than negative emotions (Figure 3). Results about how COVID-19 has impacted relationships with waterscapes revealed that the pandemic has shifted perceptions and visitation patterns. Over half (56.8%) of respondents indicated that they spent more time at the river at the time of the assessment than they did before the onset of the pandemic. Furthermore, 93% of respondents agreed

that the waterscape they were visiting represented a refuge from stress and isolation caused by COVID-19. We did not find any statistically significant differences in social demand among participants based on sociodemographic information.

We conducted statistical tests with SES value as the independent variable. Those that expressed a utilitarian value reported significantly lower average intensity of joy, serenity, and relaxation (Table 1). Pairwise Wilcoxon tests revealed that perceptions of flow, cleanliness, naturalness, and feelings of refuge were significantly associated with expressed SES value (Table 2).

**Table 1.** Average scores for dependent variables for all sites organized by SES value.

	Joy	Serenity	Disgust	Fear	Sadness	Amazement	Relax	Access	Flow	Clean	Natural	Refuge
Overall	3.80	4.23	0.40	0.35	0.49	3.52	4.08	4.44	4.12	4.08	4.29	4.38
Intrinsic (n = 227)	3.80	4.34	0.36	0.33	0.52	3.58	4.15	4.47	3.91	3.87	4.39	4.40
Relational (n = 233)	3.90	4.28	0.37	0.34	0.47	3.49	4.15	4.49	4.37	4.28	4.40	4.48
Utilitarian (n = 49)	3.38	3.61	0.53	0.28	0.36	3.25	3.73	4.14	4.31	4.37	3.41	3.98

**Table 2.** Results of Kruskal–Wallis and Wilcoxon post-tests (all 10 sites) investigating emotional experiences and perceptions as a function of SES value: intrinsic (I), utilitarian (U), and relational (R). Bold values were significant at an alpha of 0.05.

Dependent Variable	p-Value of Kruskal–Wallis Test	p-Values of Pairwise Wilcoxon Test by SES Value			Summary of Significant Differences
			I	R	
Joy	<b>0.009</b>				Utilitarian lower than relational or intrinsic
		R	0.35	-	
		U	<b>0.05</b>	<b>0.01</b>	
Serenity	<b>0.009</b>		I	R	Utilitarian lower than relational or intrinsic
		R	0.59	-	
		U	<b>0.003</b>	<b>0.006</b>	
Disgust	0.57		I	R	Utilitarian higher than relational or intrinsic
		R	0.35	-	
		U	<b>0.05</b>	<b>0.01</b>	
Fear	0.81		I	R	
		R	0.67	-	
		U	0.74	0.56	
Sadness	0.98		I	R	
		R	1	-	
		U	0.86	0.85	
Amazement	0.45		I	R	
		R	0.43	-	
		U	0.25	0.46	
Relaxation	<b>0.04</b>		I	R	Utilitarian lower than relational or intrinsic
		R	0.41	-	
		U	<b>0.03</b>	<b>0.02</b>	
Access	0.12		I	R	Utilitarian lower than relational
		R	1	-	
		U	0.06	<b>0.05</b>	
Flow	<b>&lt;0.001</b>		I	R	Intrinsic lower than relational
		R	<b>&lt;0.001</b>	-	
		U	0.06	0.62	
Clean	<b>0.002</b>		I	R	Intrinsic lower than relational or utilitarian
		R	<b>&lt;0.001</b>	-	
		U	<b>0.03</b>	0.79	

Natural	<0.001		I	R	Utilitarian lower than intrinsic or relational
		R	0.7	-	
		U	<0.001	<0.001	
Refuge	0.009		I	R	Utilitarian lower than intrinsic or relational
		R	0.17	-	
		U	0.03	0.002	

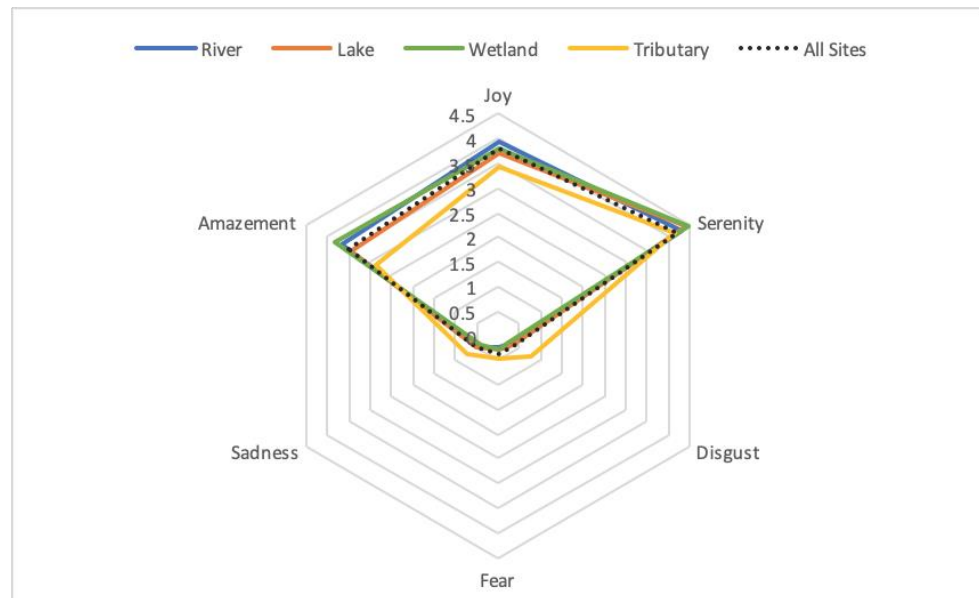


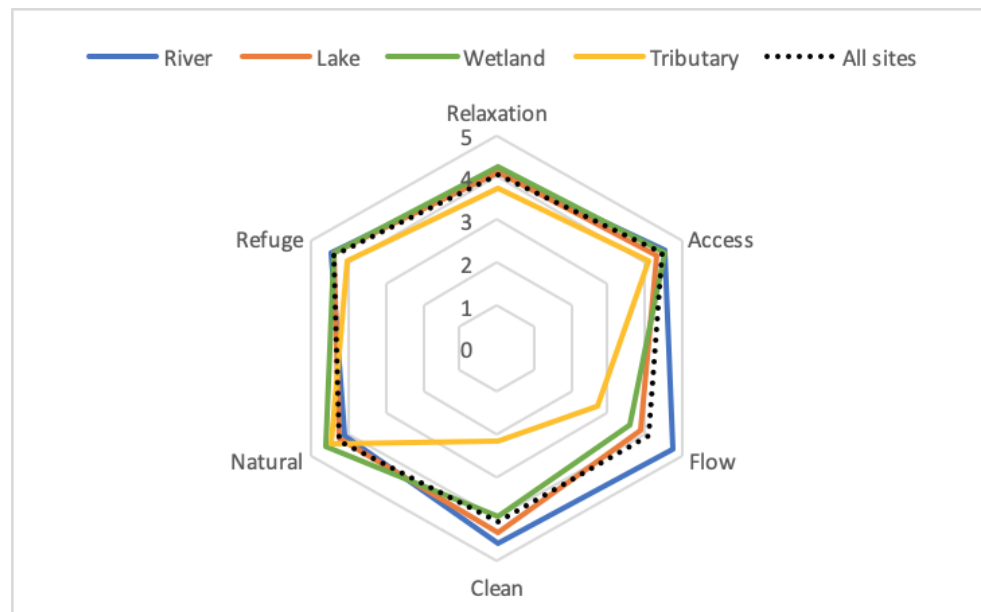
Figure 3. Distribution of mean emotional experiences across waterscape settings.

### 3.2. Differences among Waterscape Biophysical Settings

There were key differences in social demand and emotional experiences among waterscape biophysical settings: lake, wetland, perennial river, and intermittent tributary. We chose one of the seven river settings (Sewell Park) to represent the river as it had a similar sample size to the other three settings. Kruskal–Wallis tests were conducted to determine whether statistically significant differences exist between waterscape settings (Table 3). Several variables were found to vary with setting, with the intermittent Purgatory Creek (Tributary) typically being the most distinct from other settings. Disgust was higher, but amazement and perceptions of refuge were lower for Purgatory Creek than other settings (Figure 3). Participants at the wetland demonstrated significantly higher reports of joy and serenity than those at the tributary. The tributary sight also produced higher sadness than the lake and wetland.

All four settings had significantly different perceptions of flow (Table 3, Figure 4). Participants perceived the intermittent tributary setting (Site #11) as less flowing, less clean, and more natural than all other settings. The tributary setting also had a significantly lower relaxation and refuge effect (Table 3). Reasons for visiting varied across settings, but common reasons for visiting showed that ecosystem functioning and relationships with place were prioritized over recreation, with frequent reasons for visiting including relaxing/stress relief/meditation and wildlife viewing/exploring nature (Table 4). An important note is that Spring Lake and its adjacent wetlands are protected ecosystems where public swimming and fishing are not permitted. The intermittent tributary does allow swimming and fishing, but its conditions for these activities are not ideal.





**Figure 4.** Distribution of mean perceptions of waterscape characteristics across waterscape settings.

**Table 3.** Relationships between emotions/perceptions and waterscape setting: San Marcos River (R), Spring Lake (L), Spring Lake Wetlands (W), and Purgatory Creek tributary (T). Bold values were significant at an alpha of 0.05.

Dependent Variable	p-Value of Kruskal–Wallis Test	p-Values of Pairwise Wilcoxon Tests			Summary of Significant Differences by Waterscape	
		R	L	W		
Joy	0.01		R	L	Joy was higher at wetland than tributary	
		L	0.16	-		-
		W	0.78	0.22		-
		T	0.73	0.27		0.04
Serenity	<0.001		R	L	Serenity was higher at the wetland than the tributary	
		L	0.36	-		-
		W	0.27	0.82		-
		T	0.46	0.10		<b>0.07</b>
Sadness	0.078		R	L	Higher at tributary than lake or wetland	
		L	0.70	-		-
		W	0.84	0.85		-
		T	0.06	<b>0.03</b>		<b>0.04</b>
Amazement	0.009		R	L	Lowest at tributary	
		L	0.91	-		-
		W	0.39	0.33		-
		T	<b>0.01</b>	<b>0.01</b>		<b>0.001</b>
Disgust	<0.001		R	L	Highest at tributary	
		L	0.35	-		-
		W	0.95	0.38		-
		T	<b>&lt;0.001</b>	<b>0.001</b>		<b>&lt;0.001</b>
Fear	0.283		R	L	Higher at tributary than river	
		L	0.25	-		-
		W	0.71	0.44		-
		T	<b>0.02</b>	0.23		0.06
Flow	<0.001		R	L	River higher than all; lake higher than wetland and tributary; wetland higher than tributary; tributary lower than all	
		L	<b>&lt;0.001</b>	-		-
		W	<b>&lt;0.001</b>	<b>0.12</b>		-
		T	<b>&lt;0.001</b>	<b>&lt;0.001</b>		<b>&lt;0.001</b>
Clean	<0.001		R	L	W	

		L	<b>0.001</b>	-	-	River higher than all others; lake higher than wetland; wetland higher than tributary; tributary lower than all others
		W	<b>&lt;0.001</b>	<b>0.01</b>	-	
		T	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	
Natural	<b>&lt;0.001</b>		R	L	W	Wetland and tributary higher than river and lake setting
		L	0.73	-	-	
		W	<b>&lt;0.001</b>	<b>0.003</b>	-	
Refuge	<b>&lt;0.001</b>		R	L	W	Tributary lower than all other settings
		L	0.80	-	-	
		W	0.92	0.78	-	
Access	0.09		R	L	W	Tributary lower than river
		L	0.18	-	-	
		W	0.32	0.65	-	
Relative restoration (relaxation)	<b>&lt;0.001</b>		R	L	W	Tributary lower than all other settings
		L	0.11	-	-	
		W	0.76	0.19	-	
		T	<b>&lt;0.001</b>	<b>0.01</b>	<b>&lt;0.001</b>	

**Table 4.** Reasons for visiting across four waterscape settings. The three most common reasons for visiting each setting are shaded.

Reason for Visiting	River (n = 91)	Lake (n = 98)	Wetland (n = 89)	Tributary (n = 82)	All Settings (n = 565)
Art/photography	10	6	9	0	38
Community event/music event/special occasion	3	6	1	1	29
Commuting	5	1	1	2	10
Dog walking	19	3	5	9	45
Exercising	28	7	16	33	45
Family outing/date/socializing	4	30	37	23	182
Fishing	5	0	0	0	8
Relaxing/stress relief/meditating	40	20	30	33	199
Solitude	21	5	15	14	90
Water sport/tubing	20	2	2	2	54
Wildlife viewing/exploring nature	35	35	47	19	207
Work/school	43	37	24	10	188

### 3.3. Comparative Analysis of Sites along the Perennial Mainstem San Marcos River

We compared seven stations along the perennial mainstem San Marcos River (Sites #2–8) to hold waterscape setting (and flow) as a constant and test the effect of other variables on social demand. Other than site 6 (Sewell Park), the data from these river stations were not included in Section 3.1 due to small sample sizes. While this section is a relatively short segment of the river, it is diverse in its degree of maintenance, development, geomorphology, and ecological features (Figure 1). Several public parks offer river access points, but these also vary in their degree of accessibility and visitation frequency.

The seven perennial river sites varied in aspects of emotional experience, SES values, and perceptions (Table 5). The variability in reasons for visiting waterscapes reflected the diverse settings of the San Marcos River (Table 6). While relational values were the most

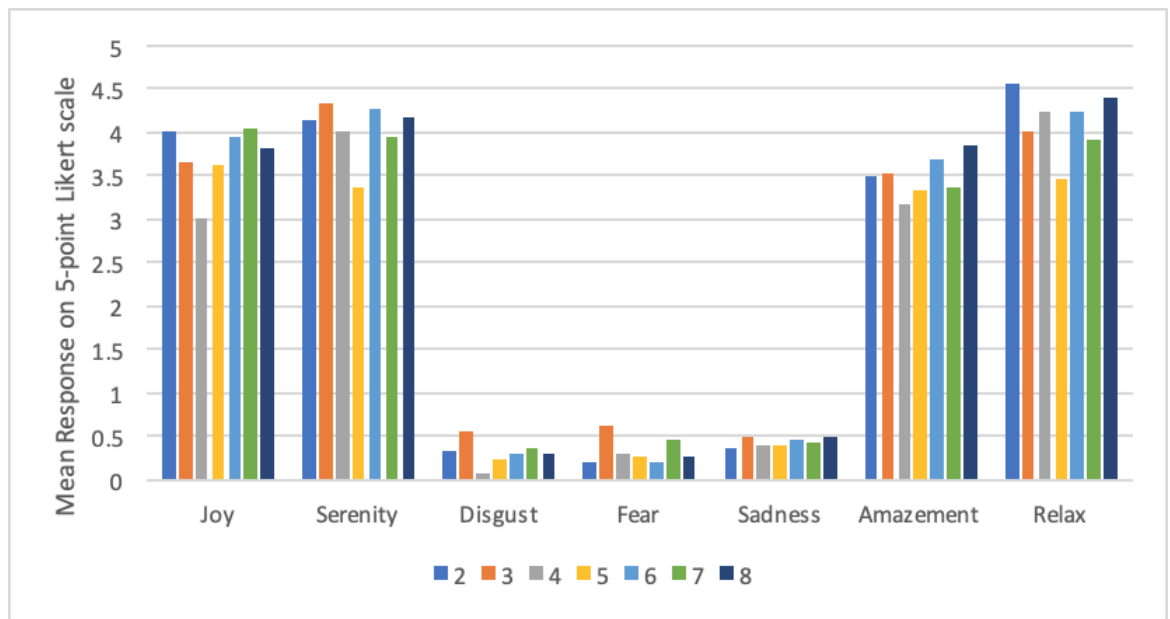
frequent SES value across all river sites, the distribution of values varied according to site. Again, positive emotions were experienced to a greater extent than negative emotions across sites (Figure 5), and negative emotions were often qualified with a concern for the river's ecological integrity. It is worth noting that the two sites where fear was ranked the highest (#3 and #7) were both located on bridges.

**Table 5.** Comparative analysis of perennial river sites along the upper San Marcos River (SMR).

	City Park (#2)	City Park Bridge (#3)	Rio Vista Is- land (#4)	Rio Vista Park near Rapids (#5)	Sewell Park (#6)	Ramon Lu- cio Park (#7)	Wilderness Park (#8)
# of Responses	32	48	12	26	91	59	27
Mean emotional scores where 5 represents the highest rating							
Joy	4.03	3.65	3.00	3.62	3.96	4.05	3.81
Serenity	4.16	4.33	4.00	3.38	4.29	3.97	4.18
Disgust	0.33	0.58	0.09	0.24	0.32	0.36	0.32
Fear	0.20	0.64	0.30	0.27	0.22	0.46	0.29
Sadness	0.37	0.49	0.42	0.42	0.46	0.43	0.50
Amazement	3.5	3.53	3.17	3.35	3.68	3.36	3.85
Mean score of perceptions of waterscape characteristics where 5 represents the highest rating							
Relaxation	4.55	4.00	4.25	3.46	4.24	3.91	4.41
Access	4.71	4.46	4.27	4.39	4.55	4.54	4.67
Flow	4.81	4.54	4.64	4.78	4.91	4.57	4.96
Clean	4.94	4.15	4.82	4.83	4.65	4.31	4.89
Natural	4.16	4.52	4.18	3.35	3.94	4.26	4.59
Refuge	4.68	4.35	4.73	4.26	4.50	4.30	4.63
SES value frequency							
Intrinsic	9	19	2	3	24	19	7
Relational	19	24	8	5	51	31	17
Utilitarian	3	4	1	13	11	2	2

**Table 6.** Reasons for visiting across all sites along the San Marcos River (SMR).

	City Park (#2)	City Park Bridge (#3)	Rio Vista Island (#4)	Rio Vista Park near Rapids (#5)	Sewell Park (#6)	Ramon Lucio Park (#7)	Wilderness Park (#8)
Art/photography	4	5	0	1	10	4	4
Community event/music event/spe- cial occasion	3	3	0	4	3	1	0
Commuting	1	1	0	0	5	1	0
Dog walking	2	5	0	2	19	9	5
Exercising	13	11	0	6	28	17	10
Family outing/date/socializing	14	17	1	3	4	21	8
Fishing	1	1	0	0	5	2	0
Relaxing/stress relief/meditating	16	16	1	5	40	24	14
Solitude	8	8	1	3	21	8	7
Water sport/tubing	8	8		4	20	1	6
Wildlife viewing/exploring nature	12	15	1	5	35	25	15
Work/school	13	12	8	17	43	12	12



**Figure 5.** Average intensity of emotional experiences across perennial sites along the San Marcos River. Chart legend: City Park (2), City Park on Bridge (3), Rio Vista Island (4), Rio Vista Park (5), Sewell Park (6), Ramon Lucio Park (7), and Wilderness Park (8).

Ranked correlation and Spearman’s Rho revealed that waterscape characteristics were significantly associated with emotions (Table 7). Flow, cleanliness, and naturalness had a positive association with joy, serenity, amazement, and relaxation. Perceptions of cleanliness and whether the waterscape is a refuge were significantly associated with all emotions. Perceptions of flow significantly predicted joy, serenity, sadness, fear, and amazement (Table 7). Access only had a significant association with relaxation, meaning higher perceptions of access were not associated with higher intensity of emotional experiences.

**Table 7.** Results of Spearman’s rho ( $\rho$ ) ranked correlation test. Bolded variables were significantly associated with the dependent variable at the 0.05 alpha level.

Dependent Variable	Predictor Variables	Spearman’s rho	p-Value
Joy	Access	0.10	0.11
	<b>Flow</b>	0.18	0.003
	<b>Clean</b>	0.28	<0.001
	<b>Natural</b>	0.24	<0.001
	<b>Refuge</b>	0.38	<0.001
Serenity	Access	0.05	0.43
	<b>Flow</b>	0.20	<0.001
	<b>Clean</b>	0.21	<0.001
	<b>Natural</b>	0.22	<0.001
	<b>Refuge</b>	0.42	<0.001
Disgust	Access	-0.10	0.14
	Flow	-0.10	0.15
	<b>Clean</b>	-0.22	<0.001
	Natural	-0.11	0.11
	<b>Refuge</b>	-0.15	0.02
Fear	Access	-0.02	0.78
	<b>Flow</b>	-0.18	0.008
	<b>Clean</b>	-0.17	0.009

	Natural	−0.11	0.10
	<b>Refuge</b>	−0.21	0.001
Sadness	Access	−0.03	0.60
	Flow	−0.06	0.39
	<b>Clean</b>	−0.17	0.008
	<b>Natural</b>	−0.16	0.01
	<b>Refuge</b>	−0.18	0.005
Amazement	Access	0.10	0.10
	<b>Flow</b>	0.16	0.010
	<b>Clean</b>	0.25	<0.001
	<b>Natural</b>	0.20	0.001
	<b>Refuge</b>	0.39	<0.001
Relaxation	<b>Access</b>	0.18	0.003
	<b>Flow</b>	0.23	<0.001
	<b>Clean</b>	0.31	<0.001
	<b>Natural</b>	0.22	<0.001
	<b>Refuge</b>	0.50	<0.001

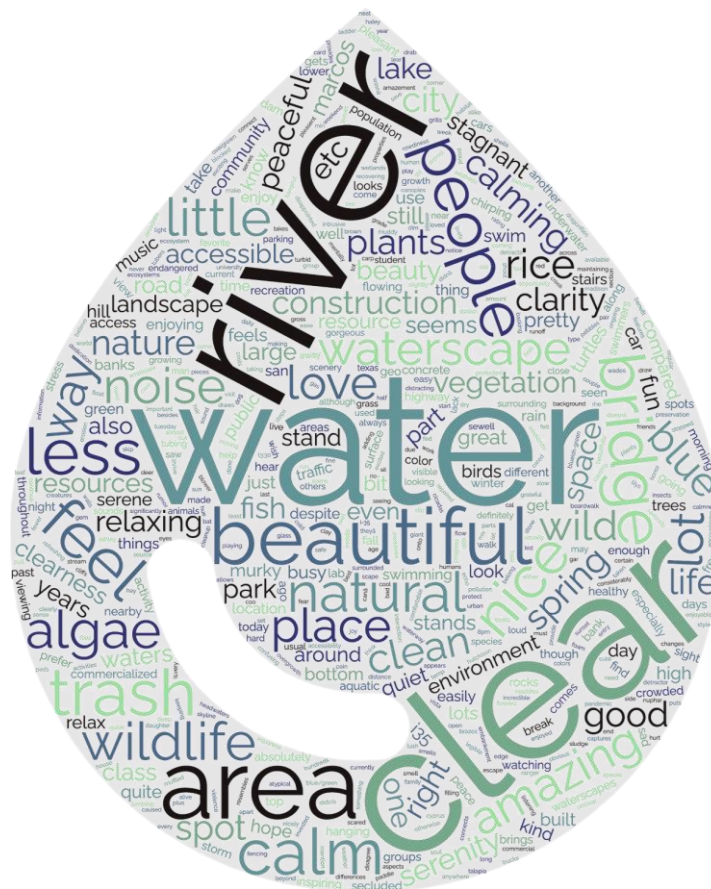
### 3.4. Qualitative Text Mining Analysis

The qualitative analysis was based on text mining of optional comments left by participants and additional emotional experiences mentioned in the assessment (see Appendix D for all comments). In addition to the six emotions included, the participants could write in their own emotions and rank their intensity. Common additional emotions mentioned included nostalgia, happiness, and peace (Table 8).

Participants could also leave additional comments at the end of the assessment. The most common keywords in these additional comments were related to water clarity, degree of naturalness, the interaction of people and landscapes, and noise (Table 9). A word cloud shows the most common words from comments (Figure 6). Most comments were positive, although some people expressed negative emotions that stemmed from disapproval of how others treat the waterscape. Several people correctly identified species by sight. Others commented on seasonal or other temporal changes to optical water quality, vegetation density, and shoreline composition (e.g., “I feel the water color has been impacted by ongoing construction and winter time”; “My favorite time to come here is in the fall or winter when there are less people in the water which causes the water and sediment to be less disturbed”). One comment mentioned the fact that the river has been inhabited by humans for over 12,000 years. Another noteworthy comment was the following: “We find the waters of the SM river to have a certain magic to them—the history, the color, the constant temp—it’s spiritual.”

**Table 8.** Most mentioned additional emotions listed in the assessment.

Emotion	Number of Times Mentioned
Peace/peaceful	9
Happy/happiness	6
Nostalgic/nostalgia	6
Love	3
Wonder	3
Relaxation/relaxing	3
Appreciation	2
Excitement	2
Hope	2
Pride	2



**Figure 6.** Word cloud showing the frequency of key words from additional comments left by participants across all settings.

**Table 9.** Keywords with the highest frequency from additional comments left by participants at each site.

Setting	Most common keywords
River setting (Sewell Park)	<ol style="list-style-type: none"> <li>1. Water</li> <li>2. River</li> <li>3. Rice</li> <li>4. Wild</li> <li>5. Clear</li> </ol>
Lake setting	<ol style="list-style-type: none"> <li>1. Water</li> <li>2. Clear</li> <li>3. Beautiful</li> <li>4. Lake</li> <li>5. Blue</li> </ol>
Wetland setting	<ol style="list-style-type: none"> <li>1. Clear</li> <li>2. Noise</li> <li>3. Water</li> <li>4. Natural</li> <li>5. Wildlife</li> </ol>
Tributary setting	<ol style="list-style-type: none"> <li>1. Water</li> <li>2. Beautiful</li> <li>3. Stagnant</li> <li>4. Algae</li> </ol>

	5. Area
	1. Water
	2. River
Across all settings	3. Clear
	4. Beautiful
	5. People

#### 4. Discussion

##### 4.1. Nature–Human Relationships and SES Values in Blue Spaces

Our results show that San Marcos waterscapes, for most visitors, are valued more for their habitat provision or opportunities for connection with nature than for recreation or development opportunities. The locals and nonlocals alike expressed a reverence for the wildlife, optical water quality, and educational opportunities that the river ecosystem accommodates. Statistical tests demonstrated that perceptions of biophysical and social characteristics of waterscapes are significantly associated with emotional experiences. The degree of perceived cleanliness and naturalness had a positive association with higher positive emotions. This supports the finding that the benefits of blue spaces are in part determined by visual landscape features [39,68].

Additionally, Wilcoxon tests revealed that both emotional experiences and waterscape perceptions varied as a function of SES value. Those expressing a utilitarian value experienced significantly lower levels of joy, serenity, and relaxation, and they reported significantly higher levels of disgust. SES values were also significant in predicting perceptions of flow, naturalness, accessibility, cleanliness, and whether the blue space represented a refuge from stress. Those that expressed utilitarian values often saw places as less natural and less of a refuge.

Comparative analyses of sites along the San Marcos River (SMR) revealed patterns of interaction and SES values. The SMR sites exhibited varying degrees of development, recreational opportunities, and traffic noise. These factors were often reflected in comments, SES values, and reported reasons for visiting. For example, Sewell Park is located on Texas State University campus and caters to social and recreational activities. Relational values were most common here, and the most common reason for visiting was relaxing/stress relief/meditation. This reflects the intended scene of Sewell Park, which is an on-campus blue space and refuge from the stresses of urban living or attending school [8]. The presence of healthy blue spaces on university campuses and visiting them for just 10 min a day can significantly improve the mental health outcomes of college students [69,70].

Wilderness Park (#8) is a more isolated and less developed location. Because of its position off the main trail among a grove of trees, Wilderness Park is not visible from the road or any parking lots, and requires walking a fair distance from parking. The noise from traffic and crowds is negligible, making it an ideal location for those seeking solitude, relaxation, or wildlife viewing. Wilderness Park responses reflected this situation, with relational values ranking highest and the most common reason for visiting being wildlife viewing/exploring nature. These findings support our hypothesis that the most common reasons for visiting reflect the SES value expressed at that waterscape.

Values often reflected reason for visiting waterscapes, although the frequency of reasons given was not always reflective of typical activities at each site. For example, Rio Vista sees thousands of tubers pass through the park every year, but only a handful of people indicated they were visiting for tubing. However, the prominence of utilitarian values at Rio Vista should be considered, especially since utilitarian values were so rarely cited across the entire study area. Rio Vista is catered toward recreation activities such as kayaking and tubing down the river rapids. This result may imply that value orientations are dependent on visual or social waterscape features, and values vary more according to setting than individual experience or perceptions. While aspects of social demand for blue

spaces did not vary significantly among SMR sites, the range of responses reflects the myriad of activities and diversity of experiences that take place in these waterscapes every day.

#### 4.2. Quantifying Emotional Experiences as a Measure of Restorative Potential of Waterscapes

The findings described in the previous section support the idea that emotional experiences are mediated through the symbolic meaning of place [9,17]. Those that demonstrated an intrinsic or relational value may feel a deeper sense of connection to blue spaces, which can increase the benefits to mental and physical health associated with exposure to blue spaces [6,58]. Logically, the reasons we perceive a place as important or valuable influence the ways those places affect us emotionally [9,71]. Thus, blue spaces impact our mood, and longitudinal exposure to blue spaces can result in positive outcomes for community health [15]. Positive emotions were experienced at waterscapes significantly more often and to a higher degree than negative emotions, reflecting the potential for waterscapes to provide community health benefits and restoration from stress [6].

Quantifying emotions can bring to light what seems obvious; the San Marcos River SES is a source of pleasure, education, and enlightenment for community members and visitors alike. Momentary affect may help reveal implications for community wellbeing [6]. Rather than a purely quantitative approach, the framework of this study was targeted toward community engagement and communication of stakeholder perspectives; thus, a mixed-methods analysis was needed to capture holistic relationships with urban waterscapes [46,72]. These data help water managers identify areas of need, i.e., where maintenance, environmental monitoring, or increased enforcement of regulations would be beneficial.

Ranked correlations revealed that lower perceptions of flow, cleanliness, and naturalness resulted in a lower intensity of positive emotions (joy, serenity, and amazement). These results provide evidence that experiences of urban waterscapes likely depend on the biophysical aspects of those waterscapes. While the statistical analysis did not support our hypothesis that waterscape perceptions would significantly predict negative emotions, it did reveal that waterscape perceptions, especially biophysical perceptions, influence positive emotional experiences. This shows that it is not aesthetics alone, but perceptions of SES function that mediate experiences with waterscapes. Less positive emotional experiences at the intermittent tributary site support conclusions from Cottet et al. [73] that intermittent streams are often devalued due to stakeholder perceptions and lack of meaningful interaction with these streams.

The concept of *nature* is complex and contested [74]. The San Marcos River, like most urban waterways, is an altered and intensively managed ecosystem that is problematic to claim as natural. Rather than assigning the label of natural to any of the waterscapes, we based our analyses on perceptions of naturalness—using ranked values to look for associations between perceptions and behaviors. This allowed participants to define natural for themselves and reflect on how they assign that attribute to an urban landscape. Different people will have different ideas of what naturalness is, and some participants commented on this, with one stating the following: “Natural seems like a problematic adjective. I feel like it’s a beautiful place either way but there’s clearly anthropogenic influences, like there are in any landscape in one way or another.”

Interactions with blue spaces can produce happiness, relaxation, and reflection, and they contribute to physical and mental wellbeing in the long term [12,15,58,69,75]. Blue spaces can also provide opportunities for social interaction, education, and restoration [15,17,76], which can promote positive health outcomes and foster a sense of place that promotes waterscape stewardship [7]. San Marcos, Texas is a community that protects and cherishes its river, and the positive emotions experienced across sites reflect this culture of stewardship [7,8].



#### 4.3. Using Relational Values to Examine Interactions and Perceptions of Waterscapes

Relational values move beyond traditional ecosystem services to represent relationships with and responsibility to place [42]. Measuring relational values of waterscapes allows water managers to view nature–human relationships through expressions of SES values and meanings [7]. As part of social–ecological systems (SES), humans change and are changed by their place attachments. In our study, intrinsic and relational values were balanced but much more common than utilitarian values. Those representing a relational value had more positive emotional experiences than those with a utilitarian value and had the highest perception of waterscapes as a “refuge”.

Relational values aim to represent the complex and dynamic ways that people can relate to and feel about nature [14,38]. The mental health benefits provided by blue spaces are mediated and negotiated through our experiences, perceptions, and beliefs [31,58]. Therefore, relationships may represent symbolic meaning of place, and that meaning can change or be reinforced through new experiences [6]. Qualitative analysis of comments left by participants revealed the dynamic ways in which characteristics of blue spaces can negotiate emotional reactions, perceptions, and relationships with place. Relational values were expressed as nuanced relationships with waterscapes that represent responsibilities and attachments to these places, as well as personal emotional experience, such as “nostalgia” expressed by many in the comments (Table 9).

The different meanings of place and the complexity of factors that influence that meaning are partly captured through a survey of relational values; however, to understand what relational values represent to different people, qualitative analysis is crucial. A cost–benefit analysis of ecosystem services in the traditional empirical sense would fail to account for these types of relationships and experiences [47]. For many people, buy in for supporting ecosystems increases when they are coproducers of knowledge [22]. Managers face tradeoffs when planning urban blue and green spaces and may benefit from a relational values approach. By using a participatory approach such as ours, policy can reflect human experiences with blue spaces rather than just a quantification of the monetary or anthropocentric benefits they provide.

#### 4.4. Emerging Effects of COVID-19 on Nature–Human Interactions

In line with previous literature, we found that 90% of participants perceived waterscapes as a refuge from the stress and isolation caused by the COVID-19 pandemic. About half of participants reported spending more time at urban waterscapes than they did before the pandemic, while the other half indicated spending less time or the same amount of time. These results reflect the complex conditions of the pandemic that has simultaneously made people more isolated and more curious about exploring nature [57].

The pandemic increased feelings of negativity, stress, grief, and economic loss [77,78]. Medical research has called for interventions that offer preventative care to reduce the potential for negative mental health symptoms amplified by the pandemic [79]. Collective stressful events can provide opportunities for landscapes and waterscapes to act in a transformative way. Connectedness to nature can lead to mobilization that promotes collective action [80] and may lead communities to hold refuge opportunities in higher regard [58]. The framework presented in this study is also a starting point for designing new landscape monitoring or environmental education programs that foster connections with nature while maintaining social distancing and other COVID-19-related safety measures. The data collection period for this study took place from May 2021 to March 2022. At this time, city parks had been reopened for 8 months after they had been closed from March to September 2020. While our results do not reflect relationships with urban waterscapes during lockdown, they show how waterscapes were a refuge in a time of great uncertainty and isolation.

#### 4.5. Qualitative Analysis of Photos and Comments

In San Marcos, there is a cultural and social norm of reverence and protection for Spring Lake and the San Marcos River [7]. During our time installing or replacing stations at various sites, we had conversations with community members that possessed extensive knowledge of the ecological conditions and wildlife of the San Marcos River, including endangered species and the history of protection that partly stems from their presence. Over 300 people left additional comments expanding on their answers or providing unsolicited information.

From text mining the additional comments, we found many of the same keywords used across the sites (Table 9). For example, many participants wrote “clear” in additional comments, and commented on how optical water quality was a draw to the river, lake, or wetland. The wetland was unique, however, in that it was the only site where “wildlife” was mentioned in the top five keywords. It is likely that some respondents observed wildlife in this rich habitat, but there was also the perception of wildlife because this site was considered the most “natural” among the different waterscapes (Figure 4). It is also likely that the educational signage along the wetland boardwalk gave the perception of wildlife. The third most mentioned word at the intermittent tributary was “stagnant” (Table 9), reinforcing the finding that perceptions and beliefs mediate personal experiences with waterscapes [7–9].

Qualitative analyses of comments also reflected respondents’ environmental concerns for the integrity of the river. Negative comments were often accompanied by a concern for perceived misuse or degradation of the river ecosystem. Ten comments mentioned trash or pollution of the river. One participant remarked the following: “Green algae from fertilizer must be stopped. City ordinance to prohibit its use is the only way. Trash in the bends of river is gross. Must fine offenders through camera evidence.” This concern for the river may not have been captured in a purely quantitative analysis of social demand.

Many comments showed a deep knowledge of the ecosystem composition, history, and functions of the San Marcos River. On several occasions, species were identified correctly by name. People commented on the coverage and health of the Texas wild rice (*Zizania texana*; Figure 7) over time, and it was the third most mentioned word at the perennial river site. One participant pointed out the ways the pandemic and lack of visitors to the river had been helpful in restoring wild rice populations. Participants also expressed appreciation for the symbolic or environmental significance of the ecosystem. As one participant phrased it, the river has “a certain magic... it’s spiritual”.

Many people in San Marcos have pursued or been exposed to environmental education about the river system. The Meadows Center for Water and the Environment located next to Spring Lake is committed to educating people about the ecosystems and history of the spring-fed lake and river system. Knowledge about specific ecosystem functions or species may create a heightened sense of responsibility to monitor and protect those things [8]. One participant even stated this directly: “Having waterscapes like this in my community makes me more invested in maintaining their health and conserving their ecosystems.” See Appendix B for all comments.

In addition to documenting nature–human relationships as functions of SES values and perceptions, this project resulted in a temporal and spatial database of participant-submitted photos. Photos taken from the same angle of the same place over a 10 month period provide visual data of landscape variability and change over time. Time-stamped photo databases provide insight into the ways that extreme weather events or land-use practices including recreation affect San Marcos waterscapes. On one occasion in October 2021, the San Marcos River experienced a major flood and became quite turbid. Participants submitted photos in the aftermath of the storm that may help reveal the timing and duration of hydrologic responses to extreme flood events (Figure 8).



**Figure 7.** Texas wild rice (*Zizania texana*) in Sewell Park (Site #6). Photo by M. Wade.



**Figure 8.** Receding floodwaters on 18 October 2021 at City Park (Site #3). Photo by anonymous respondent.

Photo submissions documenting changes and extreme events promote this collective value [54,55]. Providing photos and their experiences and emotions allows stakeholders to take ownership of their role in the production of knowledge and the protection of the ecosystem [22,23,80]. The mixed-methods approach allowed for nuanced experiences to be incorporated with quantitative data analysis to provide holistic representations of relationships with place. Without the qualitative approach, these perspectives would not have been considered.

#### 4.6. Limitations to Study

There was an inherently spatial limitation to this study that created a selection bias. Only those that are physically visiting the river and willing to engage with a cell phone application were participants in the study. Therefore, this analysis missed an opportunity to assess perceptions in populations that have limited access to blue spaces or technology. The locations of our photo stations may have also created a spatial bias. The site at Rio Vista Island, for example, was not prominent along a heavily trafficked trail and, thus, had a very small sample size ( $n = 12$ ). As with all survey data, these data were subject to errors from humans either rushing through the assessment or giving intentional false information.

Another limitation of the assessment was the question asking if people spent more or less time at waterscapes than they did before the beginning of the pandemic. City parks were closed due to COVID-19 for over 6 months prior to the beginning of the assessment period, which could have led to confusion about what the question meant by “since before the pandemic”. This wording may also have been confusing for those who moved to the area during the pandemic. Emotional variables likely faced ceiling effects, as a majority of people ranked positive emotions 4 or 5 out of 5. A more effective method may be to ask about specific emotional reactions to place and rank these emotions, rather than placing them on an intensity Likert scale.

### 5. Conclusions

The benefits of blue spaces are influenced by visual biophysical characteristics but are also shaped by unseen emotional experiences. In sum, blue spaces (or waterscapes) have profound and measurable benefits to overall wellbeing, especially in urban settings where stressors are typically more intense and ubiquitous. Maintaining healthy blue spaces is a cost-effective way to mitigate negative mental health effects from these stressors. In central Texas, unique blue spaces are held in high regard and are seen as a symbol of the cultural, social, and environmental history of the region. The community of San Marcos, including resources managers, is faced with determining the future of their waterscapes in terms of access versus protection. Community surveys such as ours can ensure that different perspectives are considered in assessments of potential tradeoffs in water resource management.

Understanding and considering diverse stakeholder perspectives is essential to the sustainable management of blue spaces. In this regard, relational values are an emerging framework to appreciate the interdependent relationships between people and nature as part of a social–ecological system (SES). Our results show that people in San Marcos, Texas (USA) uphold waterscapes mostly for their intrinsic and relational values, more so than utilitarian values. Waterscapes produced positive emotional experiences, which were dependent on perceptions of flow, cleanliness, and naturalness. Waterscapes were perceived as a refuge from stress in general, and from the stress caused by the COVID-19 pandemic.

Documenting photos and relationships with waterscapes, as we did with this project, provides insight into relevant waterscape changes and SES values. Future research could use geotagged photos as a qualitative expression of cultural relationships with place and to track changes to waterscapes over time.

Planning green and blue spaces in urban settings often comes with difficult tradeoffs and can be influenced by push–pull factors from competing or contrasting interests within

the community. By collecting perspectives from stakeholders that go unseen and unheard, this project promotes the equitable consideration of stakeholder interests when considering tradeoffs between community interests in blue space management.

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## Appendix A. Waterscape Site Descriptions[all photos from anonymous respondents]

### City Park (#2)

City Park is one of the more popular river access points for community members and tourists. City Park is connected to two parking lots on either side of the river and has access points on both sides (Figure A1). Typical of San Marcos parks, river access points are lined with large concrete blocks on the west side. The other side is paved and has steps leading from the parking lot to the river. The east side of the park features the Lions Club Tube Rental facility, where tens of thousands of people rent tubes each year to begin their float down the river. While City Park is a popular tubing hub, the most common reason for visiting cited by participants was family event/date/socializing, which reflects the fact that City Park is a frequent destination of families or friends for picnics, birthday parties, or swimming at the river. The most common value expressed was relational. This reflects the fact that City Park is designed and maintained through human alterations to facilitate access to and interaction with the river.



**Figure A1.** View from Blue Index station #2: City Park.

### *City Park on Bridge (#3)*

Station 3 was attached to an existing bridge that connects sidewalks on either side of City Park (Figure A2). While located just downstream of the river access points at City Park, the view and types of activities seen on or from the bridge are slightly different, as there are fewer river access points in view. The bridge connects the larger greenbelt system that connects city parks along the stretch of the San Marcos. The most common value expressed at City Park Bridge was relational. The most cited reason for visiting was family outing/date/socializing.



**Figure A2.** View from Blue Index station #3: City Park on Bridge.

### *Rio Vista Park (#4 and #5)*

Located about half a mile downstream from City Park, Rio Vista Park is a popular endpoint for most tubing activities, and it features the rapids that draw thousands of tubers each year. Two study sites were installed at Rio Vista Park at varying levels of accessibility and different stretches (Figures A3 and A4). Station #4 was installed on an existing post on Rio Vista Island, an island that sits in the middle of the river as it meanders around toward the rapids. The most common value stated here was relational, and the most common reason for visiting was work/school as one small group of students attended the Blue Index photo station as part of an assignment for class. This station had the lowest response rate.

Station #5 was installed on a T-post near the rapids. The sign faced Ivar's River Pub, a restaurant directly on the bank of the SMR. This is one of the busiest areas for recreation activities along the river. The site is unique because it is the only site that features a view of a building directly adjacent to the riverbank. Historically, development has not taken place along the banks of the San Marcos, but Ivar's River Pub, which has existed at the park since 1996, sets a precedent for riverbank development along the SMR. The most expressed value at site #5 was utilitarian, the only site in which this value ranked first. This value orientation reflects the typical activity of the river, as Rio Vista is a major destination for tourists and community members for outdoor recreation and water sports. The most cited reason for visiting at site #5 was work/school, as a group of students visited the site as part of a class assignment. The second most cited reason for visiting was exercising.



**Figure A3.** View from Blue Index station #4: Rio Vista Island.



**Figure A4.** View from Blue Index station #5: Rio Vista Park.

#### *Sewell Park (#6)*

Sewell Park is located on Texas State University campus and is a popular destination for education and leisure for Texas State University students and staff (Figure A5). A typical afternoon at Sewell sees hundreds of students sunbathing, swimming, tubing, and kayaking along the river. While the park is specifically designated for students and staff of the University, hundreds of tourists and community members visit Sewell Park to swim or begin their water sports activities. Most participants at this site were students in the 18–24 age range. Student participants reported frequent use of the SMR at Sewell Park, with over half of the participants visiting the park weekly or monthly. The banks of the SMR at Sewell Park are paved, and the park represents an intersection of natural and designed systems. As one participant put it, “half of it is for nature and the other half is available for humans to use for recreational purposes”. This mixed-use space produced results that

showed a preference for the relational values experienced at the park. The most cited use was relaxing/stress relief/meditating.



**Figure A5.** View from Blue Index station #6: Sewell Park.

#### *Ramon Lucio Park (#7)*

Ramon Lucio Park is located adjacent to I-35 and is the last park on the San Marcos River stretch on the West side of I-35. The park features several river access points lined with concrete blocks. The photo station was installed on an existing bridge over the river at the park, facing I-35 (Figure A6). This park is frequented by groups of friends playing music, having picnics, or swimming. River entrance points are less accessible than City Park. Ramon Lucio Park is located at a turn in the river and is up to 10 feet deep in some areas. The most expressed value at this site was relational. The most cited use was wildlife viewing/exploring nature, but relaxing/stress relief/meditation was the second most cited use.



**Figure A6.** View from Blue Index station #7: Ramon Lucio Park.

#### *Wilderness Park (#8)*

Wilderness Park, also known as Crook Park and sometimes referred to as Girl Scout Park, is located between Rio Vista Park and Ramon Lucio Park (Figure A7). Wilderness



Park has several river access points, but no part of the park or riverbank is paved. The most commonly expressed value at Wilderness Park was relational, meaning the opportunity for connection was held in the highest regard. The most cited use from results at this site was wildlife viewing/exploring nature.



**Figure A7.** View from Blue Index station #8: Wilderness Park.

#### *Spring Lake near Meadows Center (#9)*

Spring Lake is spring-fed from the Edwards Aquifer and forms the headwaters of the San Marcos River. Station #9 is located at Spring Lake near the Meadows Center with a view of the glass-bottom boats (Figure A8). Spring Lake is not accessible to swimmers or water recreators but is explorable via a tour of the lake on a glass-bottom boat. The most expressed value at this site was intrinsic, and the most common use was work/school, followed closely by wildlife viewing/exploring nature.



**Figure A8.** View from Blue Index station #9: Spring Lake near Meadows Center.

#### *Meadows Center Wetland Boardwalk (#10)*

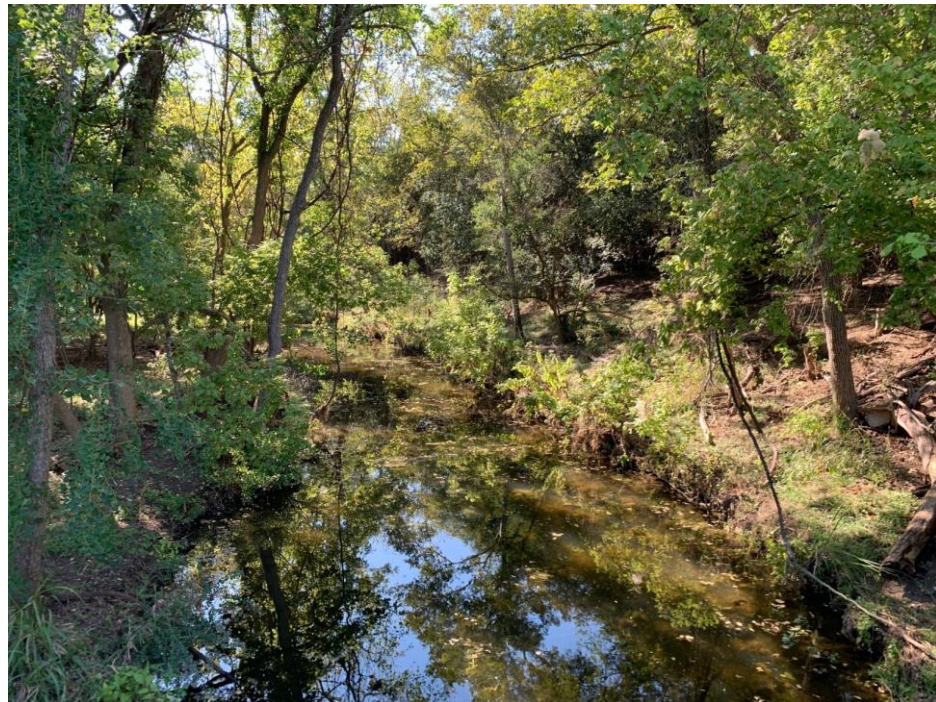
Station #10 was installed on existing rails along the Meadows Center Wetlands Boardwalk (Figure A9). The boardwalk is maintained and managed by the Meadows Center, and there are several informational stations along the boardwalk that provide facts about the wetland ecosystem, endangered species, and non-native species that live in the wetland. The wetlands at Spring Lake are adjacent to Aquarena Springs, a busy street that connects Texas State University campus to the larger San Marcos area. The most cited SES value at this site was intrinsic, and the most frequent use was wildlife viewing/exploring nature.



**Figure A9.** View from Blue Index station #10: Meadows Center Wetland Boardwalk.

#### *Purgatory Creek at Bicentennial Park (#11)*

Station #11 was attached to an existing bridge that crosses Purgatory Creek, an intermittent tributary of the San Marcos River that is usually stagnant because of the backwater effect from the mainstem river. The bridge is located at Bicentennial Park, a frequent destination for walkers, bikers, swimmers, and tubers. The photo station featured an upstream view of Purgatory Creek, which has unpaved banks and is lined by trees on either side (Figure A10). The most expressed ecosystem value at this site was intrinsic, and the most common uses were exercising and relaxing/stress relief/meditation.



**Figure A10.** View from Blue Index station #11: Purgatory Creek at Bicentennial Park.

### Appendix B. Blue Index Assessment

1. By selecting “I Acknowledge” below, you acknowledge that “I grant permission to the researchers for the use of my uploaded waterscape photograph in any presentation or product of this research. I understand that I am entering a Creative Commons Attributions Noncommercial No Derivatives license. My photo will not be changed or sold. It will be used to share knowledge of San Marcos waterscapes with the public and park managers.”

2. Take a photo of the waterscape in front of you if you have not already. Upload your photo of the waterscape from your photo storage folder.

3. Take 10–20 s to observe the waterscape in front of you. Which feeling(s) best describe your experience? Drag your finger on the sliders to rate the intensity of what you are feeling. A higher rating means more intense emotion. You must touch each slider even if your response is 0 (no emotion). joy; serenity; disgust; fear; sadness; amazement; other (blank text box).

4. Compared to my usual sources of relaxation, this waterscape is: (Likert scale) considerably less relaxing; somewhat less relaxing; neither less or more relaxing; somewhat more relaxing; considerably more relaxing.

5. How much do you agree or disagree with the following statements: (Likert scale) completely disagree; somewhat disagree; neutral; somewhat agree; completely agree. This waterscape has flowing water; this waterscape was easily accessible; this waterscape is clean enough to touch or swim in; this waterscape represents a natural environment; this waterscape is a refuge from stress.

6. Optional: Please use this space to describe what stands out most to you about this waterscape or elaborate on any of your above responses: open text response box; 500 characters max.

7. I came to this waterscape for: (mark all that apply) community event/music event/special occasion; commuting; dog walking; exercising; family outing/date/socializing; fishing; art/photography; relaxing/stress relief/meditating; solitude; water sport/tubing; wildlife viewing/exploring nature; work/school; prefer not to answer.

8. This waterscape is most important because: (choose one) it provides ecosystem functions such as wildlife habitat (intrinsic value); it provides useful benefits to society

such as recreation and tourism (utilitarian value); it provides an opportunity for the community to connect with a natural environment (relational value).

9. Thinking back to before the beginning of the pandemic in March 2020, do you spend more or less time around waterscapes like this one now? (Likert scale): considerably less time; somewhat less time; neither less or more time; somewhat more time; considerably more time.

10. To what extent would you agree with the following statement: “Spending time around waterscapes like this one helps me cope with the isolation or stress of the pandemic”? (Likert scale): completely disagree; somewhat disagree; neutral; somewhat agree; completely agree.

11. My permanent zip code is: open text response box.

12. Are you currently a resident of San Marcos or do you reside in San Marcos for the majority of the year? Options: yes; no.

13. What is your age range? Options: less than 18 years (these responses were deleted); 18 to 24 years; 25 to 34 years; 35 to 44 years; 45 to 54 years; 55 to 64 years; 65+ years.

14. How do you describe yourself? (Check one): female; male; nonbinary; prefer not to answer.

15. Please indicate your level of education. (Check one): less than high school; high-school graduate; some college (currently in college at Texas State University); some college (currently in college at another institution); some college (not currently enrolled); 2 year degree; 4 year degree; master’s/professional degree; doctorate.

16. I traveled to this waterscape by: (mark all that apply) foot; bike; car; bus; train; boat; plane; other; prefer not to answer.

17. Is this your first time visiting this waterscape? Options: yes; no.

18a. (If yes on 17) How often do you come to this waterscape? Options: daily; weekly; monthly; a few times a year or less.

18b. (If no on 17) Would you return to this waterscape? Options: yes; no.

### Appendix C. Participant Demographics and Waterscape Site Descriptions

**Table A1.** Demographic characteristics of participants across all sites. Photo station numbers (in parentheses) can be located in Figure 1.

	All Waterscapes (#2)	City Park Bridge (#3)	City Park Island (#4)	Rio Vista Park (#5)	Rio Vista Park (#5)	Sewell Park (#6)	Ramon Lucio Park (#7)	Wilderness Park (#8)	Spring Lake (#9)	Wetlands at Spring Lake (#10)	Purgatory Creek (#11)
Age (all units % of total responses at each site)											
18 to 24 years	51.3	70.0	55.6	72.7	81.0	62.4	41.2	65.4	44.6	39.0	38.2
25 to 34 years	20.5	6.7	24.4	18.2	9.5	21.2	27.5	15.4	24.3	20.7	19.1
35 to 44 years	13.4	13.3	2.2	9.1	9.5	7.1	11.8	7.7	17.6	24.4	16.2
45 to 54 years	10.1	6.7	15.6	0	0	9.4	9.8	11.5	8.1	14.6	10.3
55 to 64 years	3.2	3.3	2.2	0	0	0	7.8	0	2.7	1.2	10.3
65+ years	1.4	0	0	0	0	0	2.0	0	2.7	0	5.9
Education (all units % of total responses)											
Less than high school	0.2	0	0	0	0	0	2.0	0	0	0	0
High-school graduate	3.7	3.3	6.8	0	4.8	0	5.9	0	0	2.4	11.8
Some college—Texas State student	37.6	50.0	43.2	72.7	66.7	49.4	27.5	46.2	33.8	26.8	20.6
Some college—other institution	4.7	0	2.3	0	4.8	2.4	3.9	3.8	10.8	4.9	5.9
Some college—not currently enrolled	4.5	0	6.8	0	4.8	1.2	3.9	11.5	5.4	4.9	5.9
2 year degree	3.5	0	4.5	0	4.8	2.4	3.9	3.8	2.7	6.1	2.9
4 year degree	23.6	10.0	15.9	18.2	14.3	20	27.5	23.1	21.6	35.4	27.9

Master's/professional degree	17.9	33.3	15.9	9.1	0	0	19.6	11.5	17.6	17.1	19.1
Doctorate	4.5	3.3	4.5	0	0	0	5.9	0	8.1	2.4	5.9
Gender of Participants (all units % of total responses)											
Female	64	66.7	68.9	63.6	71.4	60.2	60.8	61.5	59.4	71.2	59.7
Male	33.1	30	26.7	36.4	28.6	32.5	35.3	38.5	37.8	26.2	38.8
Nonbinary	2.9	3.3	2.2	0	0	7.23	7.2	0	2.7	2.5	1.5
Residency Status (all units % of total responses)											
Self-described resident	63.2	70	62.2	81.8	81	71.8	60.8	65.3	54.1	56.6	60.3
Self-described nonresident	36.8	30	37.8	18.2	19	28.2	39.2	34.6	49.9	43.4	39.7
78666 permanent zip code	42.7	55.6	42.9	30	38.1	47	46.7	42.3	32.4	39.5	47.6
Other permanent zip code	57.3	44.4	57.1	70	61.9	53	53.3	57.7	67.6	60.5	52.4
Frequency of Visit (all units % of total responses)											
Daily	6.4	8.3	3.2	0	0	3.9	18.8	0	5.3	6.5	9.8
Weekly	28.8	37.5	29	0	17.6	38.2	25	53.3	10.5	15.2	41.5
Monthly	24.5	33.3	38.1	57.1	29.4	27.6	21.9	26.7	10.5	13.0	22.0
A few times a year or less	40.4	20.8	29	42.9	52.9	30.3	34.4	20	73.7	65.2	26.8

### Appendix D. Additional Comments

**Table A2.** Additional comments left by participants during the assessment.

Comment	Site
After coming back from Houston for winter break, this is the perfect spot to relax and unwind.	City Park (#2)
All the different plants and trees along the water.	City Park (#2)
Calm.	City Park (#2)
Clear, some wild rice. Considerably less due to recreation.	City Park (#2)
Fun, exciting, a place to hang out with friends.	City Park (#2)
Great station location! Nice water entry points here.	City Park (#2)
I came to the river to destress after my run. The river calms me down and allows me to take a deep breath and obtain the much needed break from school, work, and negative things going on in my life. I love how nature can have an extreme impact on our mood.	City Park (#2)
I love how accessible it is. It's a nice place to be connected to nature and other people.	City Park (#2)
I love how blocked off this area is from the road. You can still hear road noise, but I feel like I'm tucked away in a little escape. And even the built environment around this section of the river looks really nice.	City Park (#2)
I swim here at down at least 3 days a week. I am disabled and use the metal stairs. During sights and sounds, the city removes my access and forces me to use the more dangerous and difficult stone stairs on the other bank. In the water, I am part nature.	
It represents gratitude for the gem that it is for its beauty, community connector, and healing source for humans for over 14,000 years, not to mention all its wildlife with the same properties. Thank you for all is done for conservation & preservation of this amazing natural resource!	City Park (#2)
Grateful SMTX Resident	
People kayaking.	City Park (#2)
The lush green scenery really stands out to me, plus the calm look of the river.	City Park (#2)
The river is beautiful and a space I come to relax at. The swimmers are a bit loud, making it slightly unpleasant. The water is very clean.	City Park (#2)
the traffic here in all aspects is significantly less than the last location.	City Park (#2)
The water in this area is more calm and very clear.	City Park (#2)
The wild rice stand population and trees on the bank stand out the most to me about this waterscape.	City Park (#2)
This part of the river has plenty of space and is much quieter and relaxing.	City Park (#2)
This waterscape is more quiet in comparison to Sewell Park. There is much less noise here.	City Park (#2)
Water clarity.	City Park (#2)

What stands out to me most about this waterscape is the broadness of it. Just upstream at the previous waterscape, the river seems more narrow and windy. This waterscape resembles a pool to me.	City Park (#2)
Beautiful to see families and groups of friends from many backgrounds enjoying the river. Accessibility is important for all. Keeping Texas rivers clean is so important.	City Park on Bridge (#3)
Calm, quiet, a bit of trash.	City Park on Bridge (#3)
Clear water, safe space for people and animals.	City Park on Bridge (#3)
Endangered wild rice growing.	City Park on Bridge (#3)
I like that the riparian environment is being repaired and replanted, it's nice to see new plants and wildflowers growing in the area.	City Park on Bridge (#3)
I loved watching the sea grass wave like hair in the water.	City Park on Bridge (#3)
I've never seen it this murky I'm scared to float in it, I assume it's because of the recent rain.	City Park on Bridge (#3)
It's a beautiful place to see the beauty of nature and human architecture together with the bridge you can see. It may not be as swimmable with the reeds in the water, but it's a beautiful place to see the natural habitats of the river and animal life like the turtles.	City Park on Bridge (#3)
Large source of water is easily visible.	City Park on Bridge (#3)
My family and I enjoyed the visit to the beautiful landscape.	City Park on Bridge (#3)
Nowhere to get in.	City Park on Bridge (#3)
Peaceful reprieve in the city.	City Park on Bridge (#3)
Seems to be more natural than other spots on this river.	City Park on Bridge (#3)
Someone built this place thoughtfully so that others may heal. Too bad the shadows of hatred, violence, loneliness, and pain echo throughout the surrounding region.	City Park on Bridge (#3)
The clarity of the water is peaceful to look at. I think there would be more fear if the water was murky. I did not feel fear.	City Park on Bridge (#3)
The clarity of water and lack of pollution from an intrusive gas pipeline or other intrusive things.	City Park on Bridge (#3)
The clear waters are very pretty, I can even see fish in the water. And I kind of really like the style of bridge that you can see in the distance. It's kind of industrial which is really pretty paired with the natural environment.	City Park on Bridge (#3)
The Texas wild rice is always captivating, relaxing, and mesmerizing to me. My favorite time to come here is in the fall or winter when there are less people in the water which causes the water and sediment to be less disturbed.	City Park on Bridge (#3)
The vegetation is very visible and appears to be healthy.	City Park on Bridge (#3)
This is my favorite view of the river, the long strands of wild rice flowing with the river is so calming to watch.	City Park on Bridge (#3)
Trees.	City Park on Bridge (#3)
We find the waters of the SM river to have a certain magic to them—the history, the color, the constant temp—it's spiritual.	City Park on Bridge (#3)
What stand out most to me about this watershed is the plants in the water.	City Park on Bridge (#3)
You can't access the water from this specific part of the bridge.	City Park Bridge (#3)
I feel the water color has been impacted by ongoing construction and winter time.	Upper Rio Vista Island (#4)
A lot of human activity right by the river, dam presence, manmade and natural canal construction.	Rio Vista Park (#5)
Good.	Rio Vista Park (#5)
I felt a bit of sadness because I used to come to this park during a rough time in my life, but it is still beautiful.	Rio Vista Park (#5)
I saw a large duck swimming in the water.	Rio Vista Park (#5)
The Cyprus tread and the blue/green flowing water create a unique and beautiful landscape that elicits feelings of both fun and peace.	Rio Vista Park (#5)
the little ecosystems around the area stand out the most. although hundreds of people swim in this river they're still thriving.	Rio Vista Park (#5)
The river shoot that is toward the end of the stream.	Rio Vista Park (#5)
This part of the river is definitely more populated and noisy.	Rio Vista Park (#5)
This point of the river is currently being used for various recreation activities—tubing, paddle boarding, swimming, and hanging out. It is surprisingly quiet, despite about 20 people at the park. There is quite a bit of construction going on, along with fencing around the river, which concerns me. I know this park gets incredibly busy on weekends with good weather and there is a restaurant across the river that draws in even more. It is also the final stretch of a commercial tubing operation.	Rio Vista Park (#5)

As a San Marcos River Ranger, it's an honor to serve.	Sewell Park (#6)
At beautiful as the water is, the construction, leaf blower/grade mowing, and car traffic sound caused the loss of the serenity completely.	Sewell Park (#6)
Beautiful wild rice and clear blue water.	Sewell Park (#6)
Besides the water, there are a lot of distractions, but focusing on the water is almost hypnotizing.	Sewell Park (#6)
Brown water from flood!	Sewell Park (#6)
Calm, less crowded than usual.	Sewell Park (#6)
Clarity, cleanliness, mystical.	Sewell Park (#6)
Clean, quiet, a way to connect with nature in the middle of a busy community.	Sewell Park (#6)
Clear beautiful water.	Sewell Park (#6)
Clear spring-fed water	Sewell Park (#6)
I absolutely love this space, but I do believe there is a problem of trash that needs to be addressed. Tubers, swimmers, etc. visit and leave their trash and it sinks to the bottom. I've collected many pieces of glass that for those without shoes could seriously hurt them.	Sewell Park (#6)
There should also be more easily accessible stairs, either by adding a lower edge or ladder below the stairs. Even if the water is high, it takes a lot of effort to pull yourself up and out onto the stairs.	
I always feel rejuvenated after a swim in the San Marcos River.	Sewell Park (#6)
I like how half of it is for nature and the other half is available for humans to use for recreational purposes. It's a nice blend compared to other natural areas.	Sewell Park (#6)
I love how the forced quarantine resulted in the river recovering so nicely. It's fun that people play in it but I also like the changes.	Sewell Park (#6)
It remains a very natural environment despite many people using it. It is a very alive river compared to many other commercialized areas. It's nice that there is part of the river for people to swim and also an area where water plants can thrive.	Sewell Park (#6)
Its openness.	Sewell Park (#6)
Lack of calmness or serenity comes from being on campus (rowdiness, stress, etc.).	Sewell Park (#6)
Love the water.	Sewell Park (#6)
Moderate activity and swimming happening at around 8 p.m. Clean surroundings.	Sewell Park (#6)
River rice.	Sewell Park (#6)
Recreation, wild rice, clear water.	Sewell Park (#6)
Road noise is overwhelming and mashed it tough to enjoy. Beautiful water though, even at night.	Sewell Park (#6)
Storm runoff. Atypical.	Sewell Park (#6)
The amazement of the waters' clarity stands out. It is mentally refreshing to see the pebbles at the bottom of the river and see the wild rice dancing in the water.	Sewell Park (#6)
The clarity of the water. I'm from the Waco area and the Brazos is very pretty but always muddy. There are obvious differences between this portion of the San Marcos River and the Brazos, but it's really nice to see water that's so clean and clear. The other thing that I can't help but notice is all the concrete. It makes everything accessible which is really nice but it's a little drab looking.	Sewell Park (#6)
The clear spring water makes Sewell Park a magical place to relax. The wild rice flowing in the current brings me peace and is a beautiful sight to behold.	Sewell Park (#6)
The clear water and recovering population of wild rice since before the pandemic.	Sewell Park (#6)
The clearness and the wild rice.	Sewell Park (#6)
The concrete banks stand out to me the most.	Sewell Park (#6)
The dedication to the naturalization of the area and preservation of endangered species is amazing and inspiring.	Sewell Park (#6)
The growth of vegetation in the river is definitely striking.	Sewell Park (#6)
The large amount of vegetation in the water. The clarity of the water is also extremely nice. It's a place where it feels clean to swim.	Sewell Park (#6)
The moving water.	Sewell Park (#6)
The park is busy but paying attention to the river puts me at ease.	Sewell Park (#6)
The road nearby created a lot of noise and distraction.	Sewell Park (#6)
The things that stand out most to me in this waterscape in front of me is the clearness of the water. Most water sources that I have surrounded myself with (usually throughout Texas) are murky and not as opaque as this river. It makes me feel very serene and calm as I look at the slow running that runs through it.	Sewell Park (#6)

The vast improvement in the native vegetation over the past decade.	Sewell Park (#6)
The waterscape captures the aquatic vegetation and urban landscape at the same time.	Sewell Park (#6)
The wild grass growth!	Sewell Park (#6)
There is vegetation growing in the river that looks healthy. The water is very clear and is obviously in a protected area.	Sewell Park (#6)
Today is concerning; it's very high, turbid, brown color, has a foam, and has a smell that's acidic.	Sewell Park (#6)
Water necessary for diverse/strong ecosystem with wild rice, different fish species, turtles, dragonflies.	Sewell Park (#6)
We love being so close to endangered species—I would love more information about them and what the scientists are doing to help! Parking was confusing, but the river environment is so incredible.	Sewell Park (#6)
Wild rice is looking healthy. Another algae cleanup would do it well. Tetras above bridge inspire re-research ideas and the hope of encountering a nice pair of sunglasses or a <i>Macrobrachium</i> is enough to justify a swim on any day.	Sewell Park (#6)
Despite a highway being right across the view, you don't really hear or notice. It's so calm and you feel a certain sense of clarity.	Ramon Lucio Park (#7)
A little oasis despite being so close to a busy highway.	Ramon Lucio Park (#7)
Beauty clear water.	Ramon Lucio Park (#7)
Clarity of the water.	Ramon Lucio Park (#7)
Great use of our tax dollars! Ty! But could you turn off the noise from I-35? :-)	Ramon Lucio Park (#7)
Green algae from fertilizer must be stopped. City ordinance to prohibit its use is the only way. Trash in the bends of river is gross. Must fine offenders through camera evidence.	Ramon Lucio Park (#7)
Having waterscapes like this in my community makes me more invested in maintaining their health and conserving their ecosystems.	Ramon Lucio Park (#7)
How clear the water is and how it flows.	Ramon Lucio Park (#7)
How relaxing the place is compared to other parts of the water.	Ramon Lucio Park (#7)
I love how natural with the overgrowth of the banks this part of the river is but the sounds of I-35 make it less enjoyable.	Ramon Lucio Park (#7)
I saw a deer and a few ducks. It was cute.	Ramon Lucio Park (#7)
It was amazing and calming.	Ramon Lucio Park (#7)
It's a beautiful place. Although there's other people here, it's not too crowded, and they're playing good tunes, so that helps.	Ramon Lucio Park (#7)
It's fall and at 11 a.m. The water is very clear you can see down to the bottom.	Ramon Lucio Park (#7)
Live here just walking my dog after a few days of rain nice area to walk considering all other trails are muddy. No swimming today but it's usually clean.	Ramon Lucio Park (#7)
Lots of people uprooting the aquatic plants while swimming.	Ramon Lucio Park (#7)
Right off the bat there were peers of my age soaking up the sun and basking in the water. It stood out how clean the water was enough to enjoy.	Ramon Lucio Park (#7)
So blue.	Ramon Lucio Park (#7)
The blueish-green hue draws the eyes and envelopes me in a sense of serenity and closeness to nature as the soft-touch breeze invites me to observe the ripples on the surface and beckons me to sit on the bridge and stare undisturbed by the more material world around me. I feel not in a bustling city but in the vastness of the natural world.	Ramon Lucio Park (#7)
The bridge and the steps. Very calming.	Ramon Lucio Park (#7)
The bridge overlooking the water!	Ramon Lucio Park (#7)
The clarity of the water, and the number of people enjoying themselves with upbeat but not harsh music playing.	Ramon Lucio Park (#7)
The clear water.	Ramon Lucio Park (#7)
The cold river.	Ramon Lucio Park (#7)
The serenity and nature of this scene is very calming and a pleasant sight. It's easy to forget I-35 is so close and how busy the city is.	Ramon Lucio Park (#7)
The smell here is a little pungent. This is a busier area of the river and with more people comes more smells.	Ramon Lucio Park (#7)
The water after the rain.	Ramon Lucio Park (#7)
The water and scenery are amazing, but the amount of trash I consistently see is disheartening. So sad to see such a natural beauty disrespected.	Ramon Lucio Park (#7)



The water appears to be murky and unclear today and I'm wondering if it is from the construction at Rio Vista. :(	Ramon Lucio Park (#7)
The water clarity is amazing.	Ramon Lucio Park (#7)
There is a highway in the background.	Ramon Lucio Park (#7)
There was a group of about 15 people hanging out and enjoying the river. Given that it's a Tuesday afternoon, I imagine that it's a regular thing. I prefer to hear the water, birds, etc., so no music, but at least their music wasn't terrible. There's a large concrete slab beneath the bridge and I don't really know what its purpose is, but it serves as an area for this group to hangout, although it detracts from the natural beauty of the river. There is also nearby construction noise.	Ramon Lucio Park (#7)
Water is more turbid than usual, but I am filling this out on a Sunday evening.	Ramon Lucio Park (#7)
Water is murky from rain, but the scene is peaceful and serene with birds chirping in the background. The only detractor is the noise from I-35 (nothing we can do about that).	Ramon Lucio Park (#7)
Water is very blue and clear. Bridge was very nice and vegetation as well. Really just a great little spot to chill at; nice and shady and relaxing.	Ramon Lucio Park (#7)
Besides the road noise, the calmness and silence in this area are very relaxing.	Wilderness Park (#8)
Clean and green.	Wilderness Park (#8)
Enjoying a beautiful morning at the clear, wonderful river.	Wilderness Park (#8)
It's so clean and has beautiful colors and is so relaxing I love it.	Wilderness Park (#8)
San Marcos river is paradise.	Wilderness Park (#8)
Secluded and nice.	Wilderness Park (#8)
The clear water that seems to be clear of debris and waste.	Wilderness Park (#8)
The clearness of the water in the winter and the ease of access are a few of the things that draw me to this location.	Wilderness Park (#8)
The erosion on the embankment causing 5–7 trees to fall into the water over the last 4 years right here.	Wilderness Park (#8)
The water color is gorgeous. The light catches the water really beautifully. It feels like a little unknown pocket even though It's a public park. The shade is really nice and it's to see the underwater plants and rocks. Makes me want to jump in.	Wilderness Park (#8)
The water is clean and moving and easily accessible for a quick dip.	Wilderness Park (#8)
There are lots of small pieces of trash which makes me sad. I wish people cared more to take care of this beautiful waterway which brings so much joy and recreation opportunity to students and those alike.	Wilderness Park (#8)
This part of the river feels more quiet and secluded, which is nice. Sometimes it's hard to find a good spot on the river that's not too busy.	Wilderness Park (#8)
This waterscape is much more serene than the one before (#7). While there's still a bit of noise from construction and traffic, it's muffled off in the distance. You can hear the wind rustling the leaves and birds chirping. It was slightly less accessible than #7, but still very accessible in my book with less than 5 min walk from the car. There are people enjoying this waterscape as well, but in smaller, quieter groups of 1–2.	Wilderness Park (#8)
Traffic noise is only thing bringing lower rating.	Wilderness Park (#8)
Water current.	Wilderness Park (#8)
Water was very blue, much more than I expected. Also, park was a bit hard to get to because of construction near Sewell.*	Wilderness Park (#8)
* This participant was likely referring to construction at Rio Vista Park.	
Clear water and reflection of the sun. A lot of vegetation and creatures.	Spring Lake near Meadows Discovery Center (#9)
Amazement at the spring-fed lake and its incredible beauty and all the fascinating creatures that live in the lake.	Spring Lake near Meadows Discovery Center (#9)
Beautiful origin of the start of the river.	Spring Lake near Meadows Discovery Center (#9)
Calming way to start the day. Meditative.	Spring Lake near Meadows Discovery Center (#9)
Clear water.	Spring Lake near Meadows Discovery Center (#9)
Horizon scenery.	Spring Lake near Meadows Discovery Center (#9)

How clean the water is you can see fish at the bottom on the banks.	Spring Lake near Meadows Discovery Center (#9)
How clear the water is, very nice to see all that is in the water.	Spring Lake near Meadows Discovery Center (#9)
I love how you can see the algae/vegetation. It's clear enough to also see the fish and turtles in the water. I love the type of sand they use for this waterscape! I wish it didn't have a fence around it but I understand it's for the environment! I was curious though because I saw an employee throw something inside the water.	Spring Lake near Meadows Discovery Center (#9)
It feels very relaxing and idyllic. "Natural" seems like a problematic adjective, I feel like it's a beautiful place either way but there are clearly anthropogenic influences, like there are in any landscape in one way or another, I especially liked seeing the Nuphar plants.	Spring Lake near Meadows Discovery Center (#9)
It's an amazing natural water space with lots of opportunity to see wildlife, but it is not easily accessible because of university parking.	Spring Lake near Meadows Discovery Center (#9)
Listening to all the birds and insects around the headwaters and the occasional jumping fish. This place is good for my soul.	Spring Lake near Meadows Discovery Center (#9)
Quite different from the surrounding water areas. It's standing and gross.	Spring Lake near Meadows Discovery Center (#9)
Serenity.	Spring Lake near Meadows Discovery Center (#9)
Spring Lake is absolutely gorgeous. I am so grateful this resource is available to the public.	Spring Lake near Meadows Discovery Center (#9)
The beautiful skyline and serene calm water.	Spring Lake near Meadows Discovery Center (#9)
The calm water stands out the most to me. And the boats!	Spring Lake near Meadows Discovery Center (#9)
The clear spring waters, the protected wetlands, the plants and animals.	Spring Lake near Meadows Discovery Center (#9)
The clear water.	Spring Lake near Meadows Discovery Center (#9)
The clear water and greenery below.	Spring Lake near Meadows Discovery Center (#9)
The clearness of the river and the high possibility of seeing wildlife.	Spring Lake near Meadows Discovery Center (#9)
The glass bottom boats stand out most to me.	Spring Lake near Meadows Discovery Center (#9)
The lake.	Spring Lake near Meadows Discovery Center (#9)
The super clear blue water.	Spring Lake near Meadows Discovery Center (#9)
The water is blue and calm.	Spring Lake near Meadows Discovery Center (#9)
The water is very clear.	Spring Lake near Meadows Discovery Center (#9)
This seems to be a very clean and well-balanced ecosystem.	Spring Lake near Meadows Discovery Center (#9)
Water is still, feel closer to nature, beautiful nature scape, welcoming, easy to access.	Spring Lake near Meadows Discovery Center (#9)
What stands out is how blue the water is in the parts that aren't covered in seaweed sludge on the surface.	Spring Lake near Meadows Discovery Center (#9)
Amazing, verdant, peaceful, free.	Meadows Center Wetland Boardwalk (#10)
Beautiful natural area with great wildlife viewing, but not easily accessible because of university parking.	Meadows Center Wetland Boardwalk (#10)
Beauty of nature. I hope we can save it for future generations.	Meadows Center Wetland Boardwalk (#10)

Birds and fish and flowers.	Meadows Center Wetland Boardwalk (#10)
Cal, relaxing, educational, inspiring, stress reducing. Distracting due to road noise.	Meadows Center Wetland Boardwalk (#10)
Great habitat for birds. Road noise. Loved the walkways.	Meadows Center Wetland Boardwalk (#10)
Healthy fish, turtles, fauna, and clear water. So thankful for it all!	Meadows Center Wetland Boardwalk (#10)
How can I get involved?	Meadows Center Wetland Boardwalk (#10)
How naturally and peaceful this place is even though we are surrounded by man made things, like cars, streets, etc.	Meadows Center Wetland Boardwalk (#10)
I have not seen a waterscape before, very cool. :)	Meadows Center Wetland Boardwalk (#10)
I live in urban San Antonio, and most of our waterways have been converted to commercialized or aesthetic spaces, taking away from the natural beauty of these areas. The Meadows Center Boardwalk was a great example of how to make a waterscape accessible to tourists while maintaining the natural landscape of it.	Meadows Center Wetland Boardwalk (#10)
I love how comfortable the wildlife is in this environment.	Meadows Center Wetland Boardwalk (#10)
I love the river and I hope we can continue to protect it. It would devastate me if all this current construction and influx of people destroyed our river. It's a sacred land and we need to protect and provide for it at all costs!!	Meadows Center Wetland Boardwalk (#10)
I love the spices in reserve and the way it's taking care of the turtles and plants.	Meadows Center Wetland Boardwalk (#10)
It's so beautiful.	Meadows Center Wetland Boardwalk (#10)
Just beautiful.	Meadows Center Wetland Boardwalk (#10)
Lily pads and algae.	Meadows Center Wetland Boardwalk (#10)
Loud with cars and trucks. Cicadas are loud too but they belong here.	Meadows Center Wetland Boardwalk (#10)
Natural, ecologically mindful.	Meadows Center Wetland Boardwalk (#10)
Noise is a downfall of location, but the wetlands are calming and relaxing.	Meadows Center Wetland Boardwalk (#10)
Not polluted.	Meadows Center Wetland Boardwalk (#10)
The accessibility of the boardwalk stands out most to me.	Meadows Center Wetland Boardwalk (#10)
The beauty of it and easy viewing of wildlife.	Meadows Center Wetland Boardwalk (#10)
The clear water and absence of trash is remarkable. We could see the different fish nesting and a multitude of turtles. The children were excited to spot so many large gar, and the cichlids had amazing colors that I have not seen anywhere else.	Meadows Center Wetland Boardwalk (#10)
The clear water definitely has a lot of life from underwater life to plants.	Meadows Center Wetland Boardwalk (#10)
The only thing that detracts is the noise from I-35.	Meadows Center Wetland Boardwalk (#10)
The water lilies have taken over Aquarena Springs!	Meadows Center Wetland Boardwalk (#10)
The wetland like landscape.	Meadows Center Wetland Boardwalk (#10)
This is one of my favorite spots. There are not a lot of people which I really enjoy. The only thing that takes away from it is the highway. (I wish it wasn't built).	Meadows Center Wetland Boardwalk (#10)

Unfortunately, there is a lot of noise pollution in this area.	Meadows Center Wetland Boardwalk (#10)
Very relaxing but the car sounds from nearby roads/highway diminish effect on this side of the spring lake.	Meadows Center Wetland Boardwalk (#10)
Water is so clear!! Some plants and algae obscure water but that's natural for the animals. It's really clear and pretty and calm.	Meadows Center Wetland Boardwalk (#10)
What stands out most is how clear the waterscape is. Despite the depth, the algae and grass allow for a very serene waterscape.	Meadows Center Wetland Boardwalk (#10)
White people used slaves to build a dam here and impede the free flow state of the river, fuck you.	Meadows Center Wetland Boardwalk (#10)
Wildlife.	Meadows Center Wetland Boardwalk (#10)
Wildlife is evident but traffic noise is distracting.	Meadows Center Wetland Boardwalk (#10)
Algae.	Purgatory Creek at Bicentennial Park (#11)
Aquatic plant life.	Purgatory Creek at Bicentennial Park (#11)
I like the hill scape beyond the river. The area between the road and the river is a bit overgrown and could benefit from some tending to allow for better interaction with the landscape.	Purgatory Creek at Bicentennial Park (#11)
I love jogging through here with my boyfriend, as well as tubing up stream.	Purgatory Creek at Bicentennial Park (#11)
I really like watching the water runoff from the rain mix in with the clear(er) water.	Purgatory Creek at Bicentennial Park (#11)
It's cool.	Purgatory Creek at Bicentennial Park (#11)
It is just a beautiful place.	Purgatory Creek at Bicentennial Park (#11)
It is still because it seems to be an offshoot and not have much flow.	Purgatory Creek at Bicentennial Park (#11)
It's a little stagnant and murky.	Purgatory Creek at Bicentennial Park (#11)
It's beautiful in that a public access bridge is above it and it connects to the river, which is visible from here, and it's flowing and beautiful.	Purgatory Creek at Bicentennial Park (#11)
Looking great but a bunch of green algae is forming at the banks on the surface.	Purgatory Creek at Bicentennial Park (#11)
Lots of large carp and tilapia today.	Purgatory Creek at Bicentennial Park (#11)
Nice day.	Purgatory Creek at Bicentennial Park (#11)
Other than non-native plants, this is a very lively and natural spot. Others may disagree, as it has more aquatic growth than many people prefer.	Purgatory Creek at Bicentennial Park (#11)
Sessom Creek* looks cleaner than usual. Less algae, making it more appealing *This participant typed Sessom Creek, but was visiting Purgatory Creek.	Purgatory Creek at Bicentennial Park (#11)
Some trash.	Purgatory Creek at Bicentennial Park (#11)
The fish eating off the top of the water was the best.	Purgatory Creek at Bicentennial Park (#11)
The red flowers near it.	Purgatory Creek at Bicentennial Park (#11)
There are many beautiful shades of green and signs of wildlife. The water is clear enough to see the bottom, rocks, fish, flora, and other detritus. There are dragon flies and other insects that are very pleasant. I do see some trash and that is why I am a little disgusted.	Purgatory Creek at Bicentennial Park (#11)
This area doesn't feel very safe, and the water is stagnant. The bridge is pretty, but the surrounding features have large piping, and it looks somewhat like a work in progress with the pipes and large cut stones. It's quite dim at night.	Purgatory Creek at Bicentennial Park (#11)

This area seems more stagnant than others. but it is gorgeous and feels very set apart from the city.	Purgatory Creek at Bicentennial Park (#11)
Trash in the water and it seemed still. Otherwise very nice part of our park walk.	Purgatory Creek at Bicentennial Park (#11)
Very quiet and nice. I've seen deer at this location before and stand and look out once and a while.	Purgatory Creek at Bicentennial Park (#11)
Very quiet and peaceful, but the water seems stagnant and there is a scum on the surface.	Purgatory Creek at Bicentennial Park (#11)

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