APPENDIX H: COLORADO RIVER LAND ANALYSIS EVALUATION

H.1. Austin Water's Wildlands

Austin Water currently protects over 48,000 acres of land through its Balcones Canyonlands Preserve (BCP) and Water Quality Protection Lands (WQPL) programs. Managed by the Wildland Conservation Division, these lands protect portions of the Lake Austin and Lake Travis watersheds for endangered species habitat, and areas over the Edwards Aquifer recharge and contributing zones for the long-term resilience of the Barton Springs segment of the Edwards Aquifer.

Since its inception in 1998, the Water Quality Protection Lands program has been bolstered by five voter-approved bonds, totaling around $230 million, with an additional $24 million from partnerships. As part of this initiative to protect its source water, the City of Austin set a goal to keep overall impervious cover below 10% within the Source Water Protection Area, which includes the Barton Springs Edwards Aquifer Recharge and Contributing Zones. To help achieve this goal, it is estimated that the City of Austin would need to permanently protect approximately 100,000 acres of land. As of 2024, the City of Austin has been able to acquire permanent protections on over 45,000 acres in this area, the majority of which are managed by Austin Water's Wildland Conservation Division.

Austin Water will continue to protect current and future water supplies through the active management of these Wildlands. Austin Water will also continue to pursue further additions to the Water Quality Protection Lands and Balcones Canyonlands Preserve which includes prioritizing the Barton Springs Edwards Aquifer Recharge and Contributing Zones. While the Colorado River Land Analysis focuses on watersheds upstream of Lake Austin, protecting groundwater from the Edwards Aquifer and inflows to Lady Bird Lake remains integral for Austin's climate and drought resilient future water supply options.

H.2. Colorado River Land Analysis

Austin's drinking water supply has benefited from a landscape of rural, largely working lands throughout the Highland Lakes' watershed. However, land use in Texas is changing rapidly as the state's population grows. According to Texas A&M Natural Resources Institute, the 20 counties in the lower Colorado basin have seen an 87% increase in population and the loss of over 108,000 acres of working lands since 1997. The working lands that remain are increasingly being subdivided into smaller and smaller parcels. These trends are likely to continue, emphasizing the need to plan for upstream water quality protection.

Source Water Protection refers to the management of areas through which water travels and the regulation of activities on these lands to prevent pollution and contaminants from entering public drinking water sources. The quality and quantity of a city's drinking water supply, as well as other water bodies used for recreational, environmental, and drainage purposes, can be influenced by both natural and human activities. One of the most effective ways to protect source water is to acquire land over which the water flows or to restrict development on such land through conservation easements or other mechanisms. These protections allow the land to continue acting as a natural filtration system for water as it nears water sources, preventing

additional contaminants from development activities.

H.3. Methodology

To determine areas that contribute meaningfully to the water quality and quantity of the City of Austin's source water, a geographic information system (GIS)-based raster analysis was completed to identify conservation priorities. Ten water supply and environmental factors were evaluated and are described below. For each factor, respective values were converted to weighted "scores" on a unified scale to represent desirability for conservation. Scores for each raster pixel were then added, with higher total scores representing greater conservation priorities.

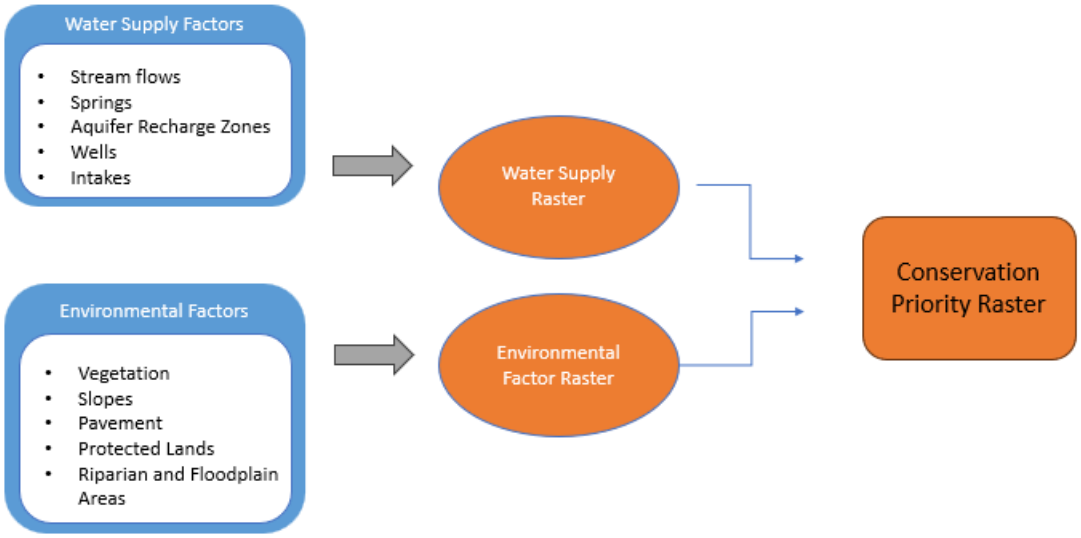


Figure H - 1 Development of conservation priority raster

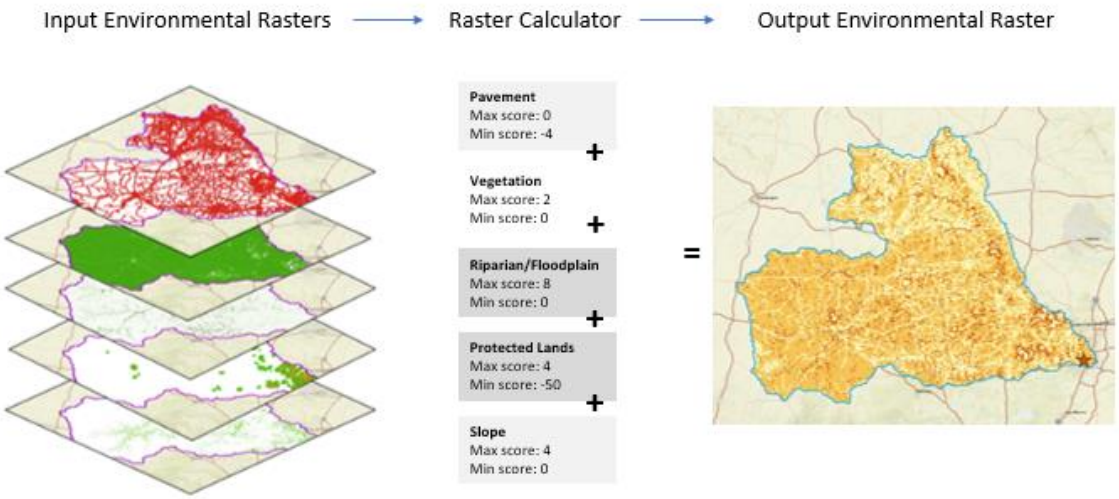


Figure H - 2 Visualization of steps to produce overall environmental factor raster

H.4. Study Area

The geographic focus of this analysis was the land within the drainage basin of the lower Colorado River and the Highland Lakes. The Highland Lakes are six freshwater reservoirs that include Lake Buchanan, Inks Lake, Lake LBJ, Lake Marble Falls, Lake Travis, and Lake Austin.

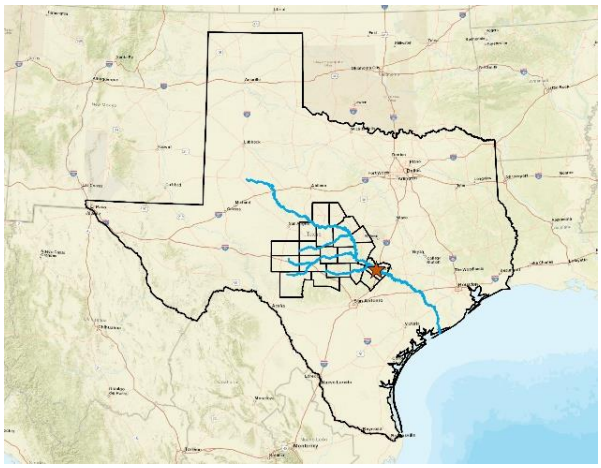


Figure H - 3 Counties in Texas in the Colorado River watershed upstream of Austin

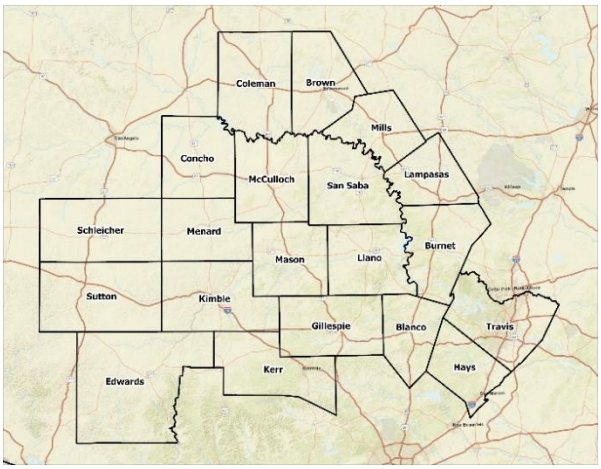


Figure H - 4 Detailed view of counties

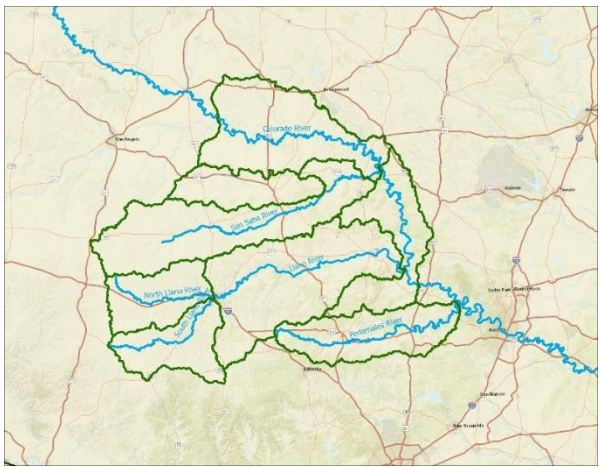


Figure H - 5 River basins

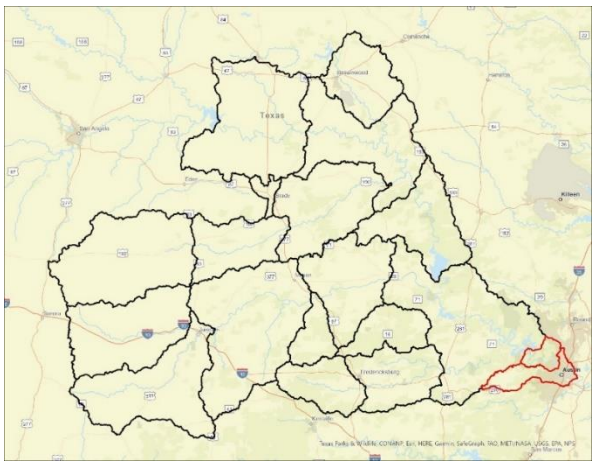
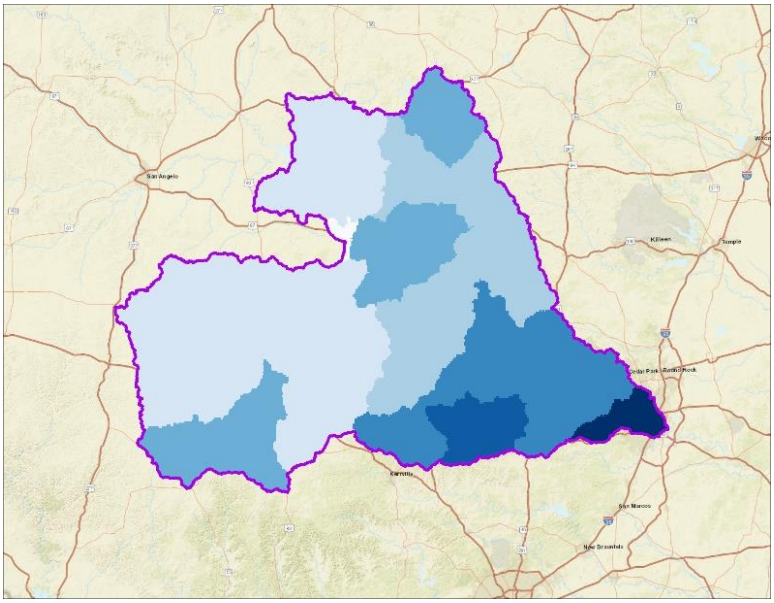


*Figure H - 6 Watershed segments**

**Watershed segments were identified based on the location of USGS gauges, so that the streamflow measurements from those gauges could be correctly attributed to those areas.*

H.5. Factors

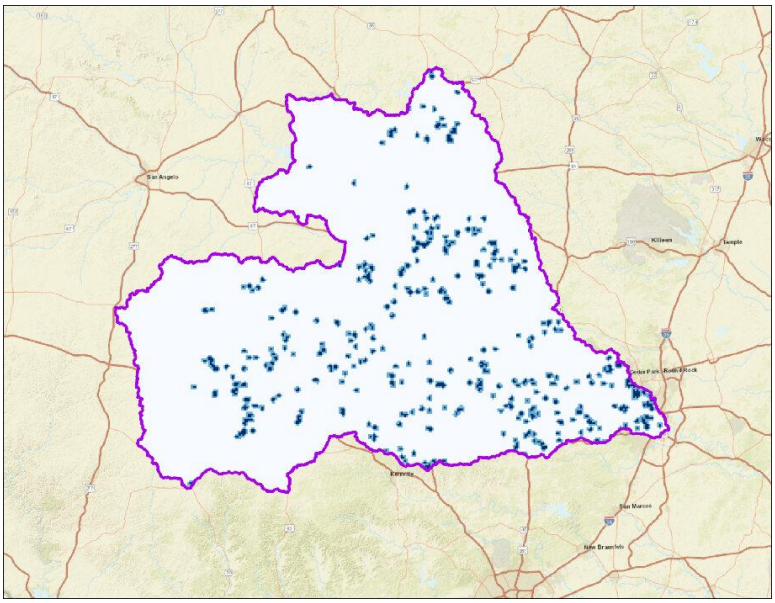
Factor	Data layer	Scoring Summary
Water factors		
Stream flows	Watershed segments scored based on streamflow from USGS gauges, WAM values	Higher streamflows receive higher scores
Springs	0.5-mile and 1-mile buffers around springs	Areas within 1 mile of a spring receive a higher score, and those within 0.5-mile receive the highest
Recharge zones	Aquifer zones distinguished by tiers	Areas in an aquifer receive a higher score, and those in a tier 1 (major) aquifer receive the highest score
Wells	Wells distinguished by type	Areas within 1 mile of undesirable wells receive a low negative score, and those within 0.5-mile receive a lower negative score
Environmental Factors		
Slope	% slope	Areas with higher slope receive a higher score
Vegetation	USGS land cover, classifying several different types of land such as grassland, forest, cultivated, barren, open water, etc.	Areas receive high scores if the land is neither developed nor vegetated (e.g., barren or cultivated), and highest scores if they are open water or vegetated (forest or grassland)
Pavement	USGS land cover, with 0.5-mile buffer around pavement	Areas receive a negative score if they are classified as within 0.5 mile or 1 mile of pavement land cover types
Riparian/Floodplain	Ecological Mapping Systems of Texas	Areas classified as riparian were scored higher, and areas classified as floodplain were scored highest
Protected lands	Protected Areas Database of the United States	Areas within existing protected lands were excluded. Areas within 0.5-mile and 1 mile of the boundary of those lands were given higher scores



H.5.1. Stream Flow

Stream flow was chosen as a water supply factor to identify areas that contributed the most to water supply in the river basin. Watershed segments were identified by combining USGS-defined watershed segments that were upstream of the same USGS streamflow gauge. Watershed segments were then assigned a score of 0-8 based on a classification of incremental stream flow values per square mile.

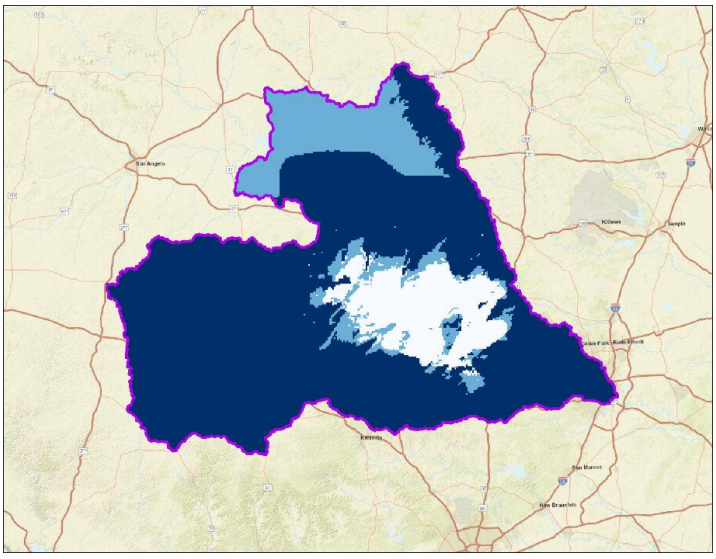
Figure H - 7 Stream Flow



H.5.2. Springs

Springs have been classified as sensitive environmental areas due to their contribution to tributaries and are often determinants of high environmental quality. Under drier conditions, flow production shifts towards areas fed by spring flow. Known spring locations were mapped and areas within a 0.5 mile and 1-mile buffer received scores of 8 and 4, respectively.

Figure H - 8 Springs



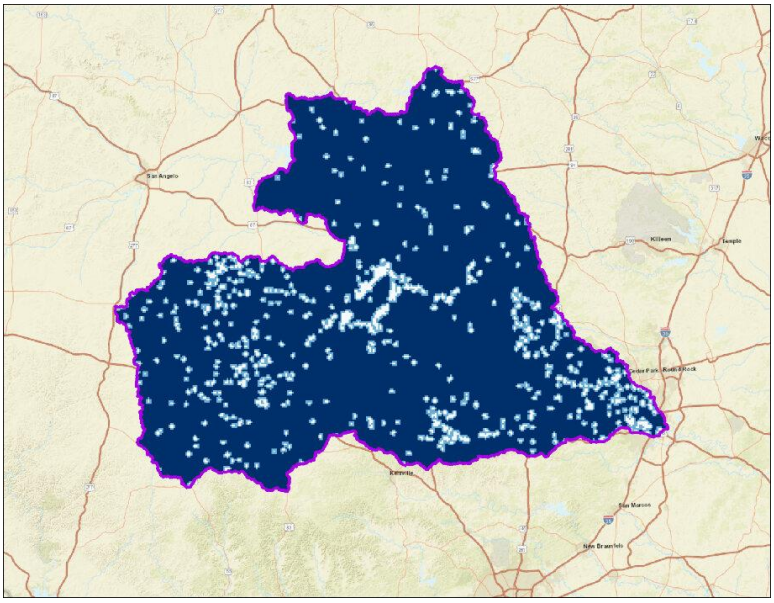
H.5.3. Aquifer Recharge Zones

Aquifers provide significant water storage within the lower Colorado River basin of Central Texas and the baseflow supplied by aquifers sustains water supply through droughts. Aquifers were separated into ”Tier 1” and ”Tier 2” aquifers that received prioritization scores as shown in Table H - 1.

Figure H - 9 Aquifer Recharge Zones

Table H - 1 Aquifer Tiers

Tier 1	Tier 2
Edwards, Edwards – Trinity, Trinity, Ellenburger – San Saba, Marble Falls	Cross Timbers, Hickory, Lipan



H.5.4. Wells

Wells are a factor because they can negatively impact water supply and surrounding conservation measures. Wells which were classified as undesirable, including aquaculture, commercial, de-watering, industrial, irrigation, mining, public supply, and oil and gas were mapped, and 0.5-mile and 1-mile buffers applied. Areas within these buffers received negative scores.

Figure H - 10 Wells

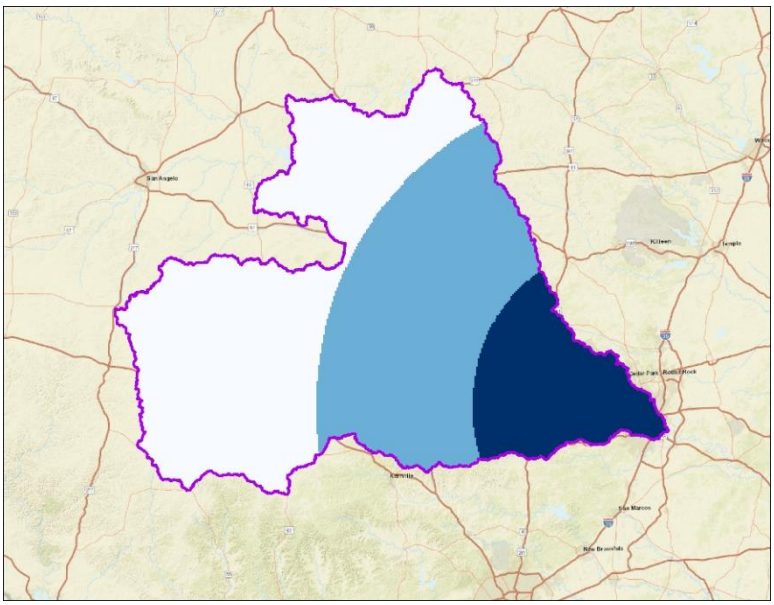


Figure H - 11 Intakes

H.5.5. Intakes

Protection of land closer to water supply intakes can have a greater effect on water treatment by limiting negative inputs (e.g. sediments and nutrients). Existing water intakes were mapped and 50-mile and 100-mile buffers were applied.

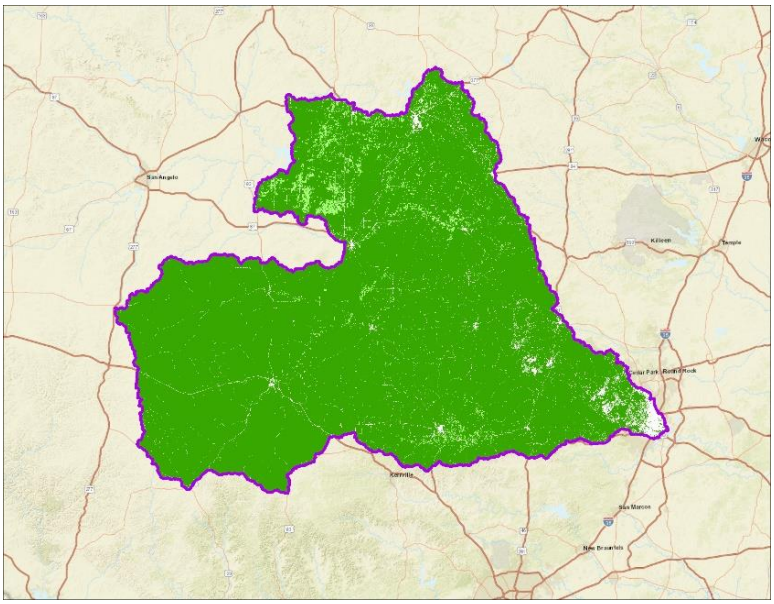
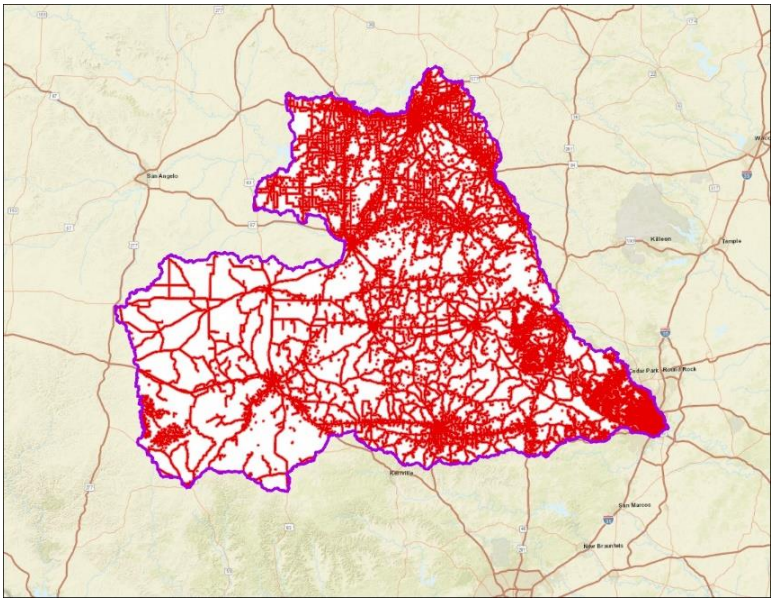


Figure H - 12 Vegetation

H.5.6. Vegetation

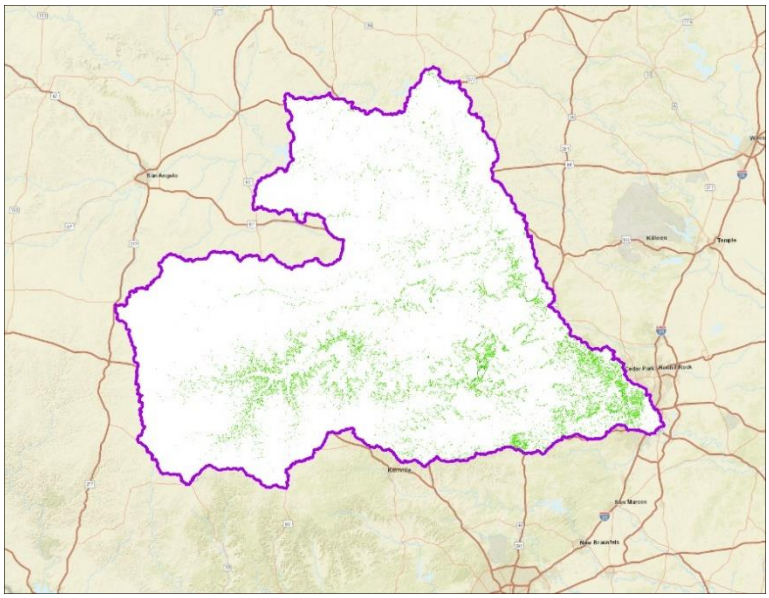
Land cover data was used to distinguish areas that would be suitable for conservation (vegetated areas) from areas that are already developed, cultivated, or barren.



H.5.7. Pavement

Pavement is included as a factor since roads disrupt continuous habitat, and proximity to development in general is also undesirable for habitat as well as water quality protection. Land cover data was used to identify pavement, and areas within 0.5-mile and 1-mile of this land cover type received negative scores.

Figure H - 13 Pavement



H.5.8. Slope

Steep slopes are prone to erosion. While this is less desirable for development, these slopes can provide the conditions that are most suitable for certain types of wildlife and vegetation. Steep slopes can also indicate higher runoff contribution to nearby drainage basins. Slopes greater than 15% received prioritization scores.

Figure H - 14 Steep Slopes

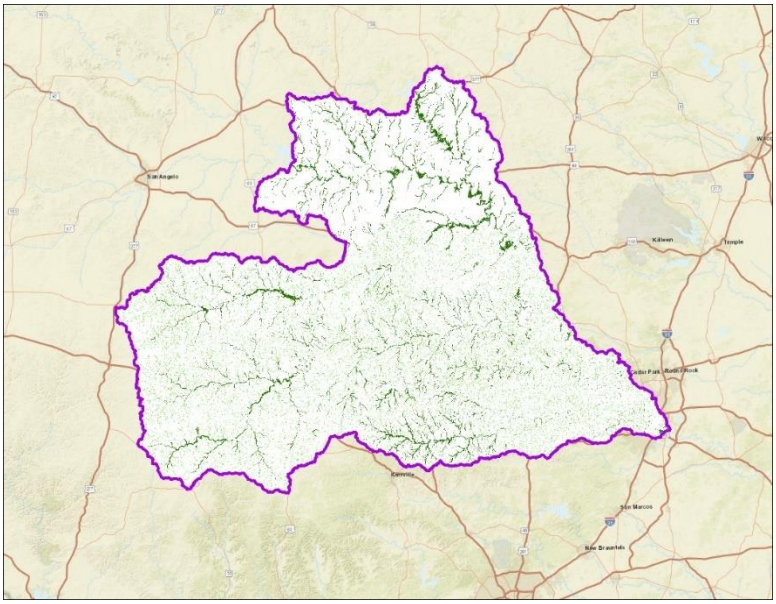


Figure H - 15 Riparian Areas/Floodplain

H.5.9. Riparian Areas and Floodplain

Riparian areas and floodplains were included as factors because protecting these areas is valuable for protecting water quality. Ecological Mapping Systems of Texas data was used to identify and score riparian areas.

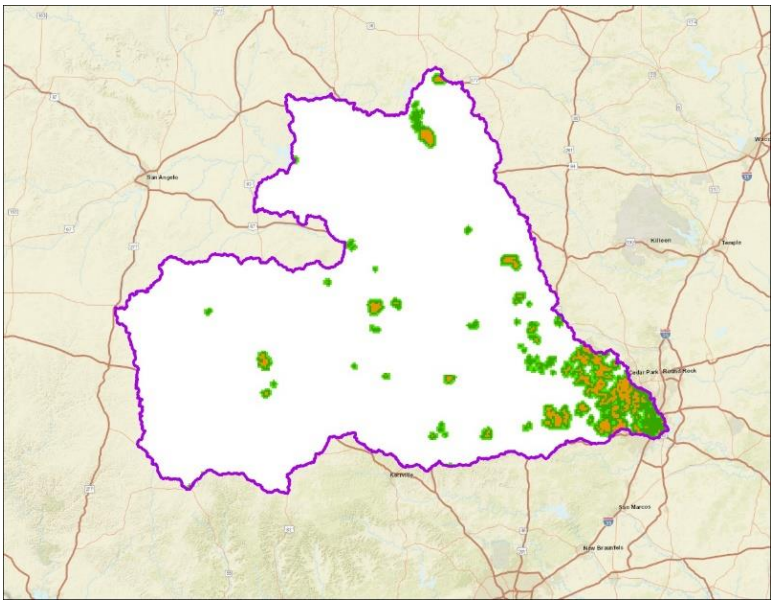


Figure H - 16 Protected Lands

H.5.10. Protected Lands

Protected lands data was included in order to exclude existing protected lands from the analysis and prioritize areas that are close to those lands. Areas that border other protected lands are more valuable because they increase continuous habitat. Areas within protected lands received a high negative score. Areas within 0.5-mile and 1-mile of those lands received 4 points and 2 points, respectively.

H.6. Final Analysis and Output

Figure H - 17 highlights the relative scoring applied to each factor. Values for each pixel across all factors were then added to get a total raster score.

	Water Factors					Environmental Factors					
	Watershed Segments	Aquifers	Springs	Intakes	Wells	Vegetation	Pavement	Slopes	Riparian and Floodplain Vegetation	Protected Lands	
	High	High	High	Moderate	Low	Low	High	Moderate	High	Moderate	
8	Highest flow	First tier aquifers	within 1/2 mile						Floodplain (main stem)		8
7											7
6											6
5											5
4		Second tier aquifers	within 1 mile	within 50 mile				> 55%	Riparian (tributary)	within 1/2 mile	4
3											3
2				within 100 mile		All other aka Veg.		15% - 55%		1/2 mile - 1 mile	2
1	Lowest flow					Bare / Cultivated					1
0		No aquifer	outside 1 mile	outside 100 mile	outside 1 mile	neither	outside 1 mile	< 15%	neither	outside 1 mile	0
-1					within 1 mile						-1
-2					within 1/2 mile		within 1 mile				-2
-3											-3
-4							within 1/2 mile				-4
-5											-5
-6											-6
-7											-7
-8											-8
-999										inside protected land	-50

Figure H - 17 Factors analyzed with associated scores

Figure H - 18, Figure H - 19, and Figure H - 20 below highlight the combined scores for all water supply factors, all environmental factors, and all factors combined.

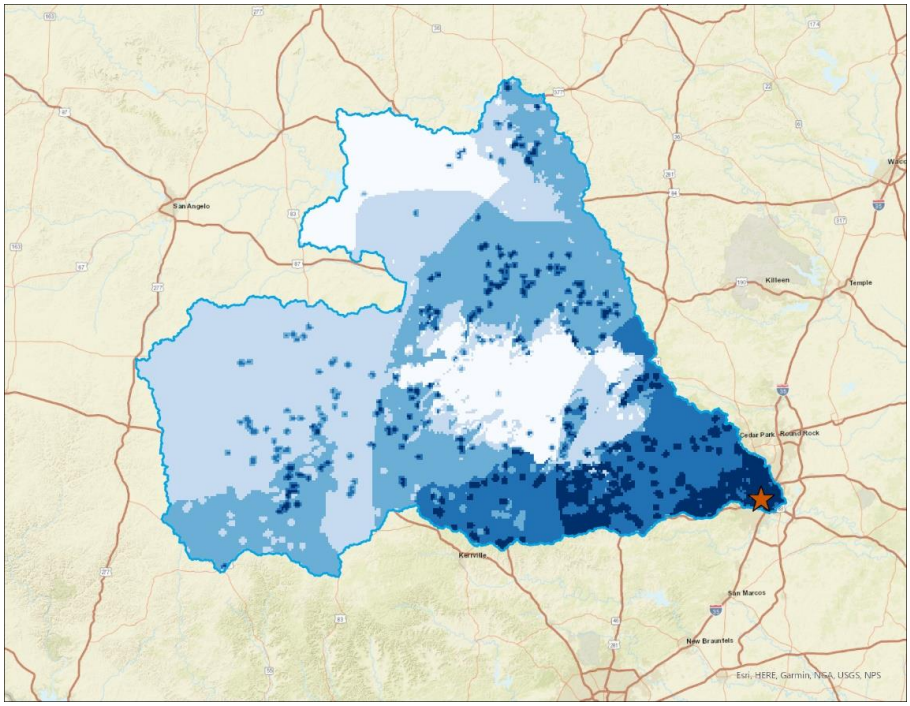


Figure H - 18 Combined scores for water supply factors

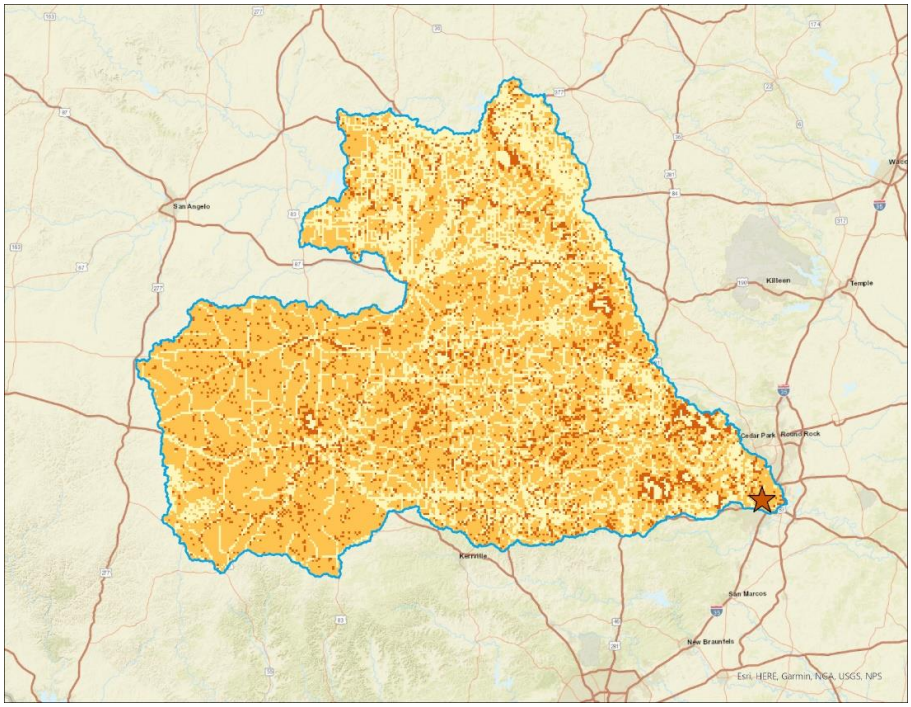


Figure H - 19 Combined scores for environmental factors

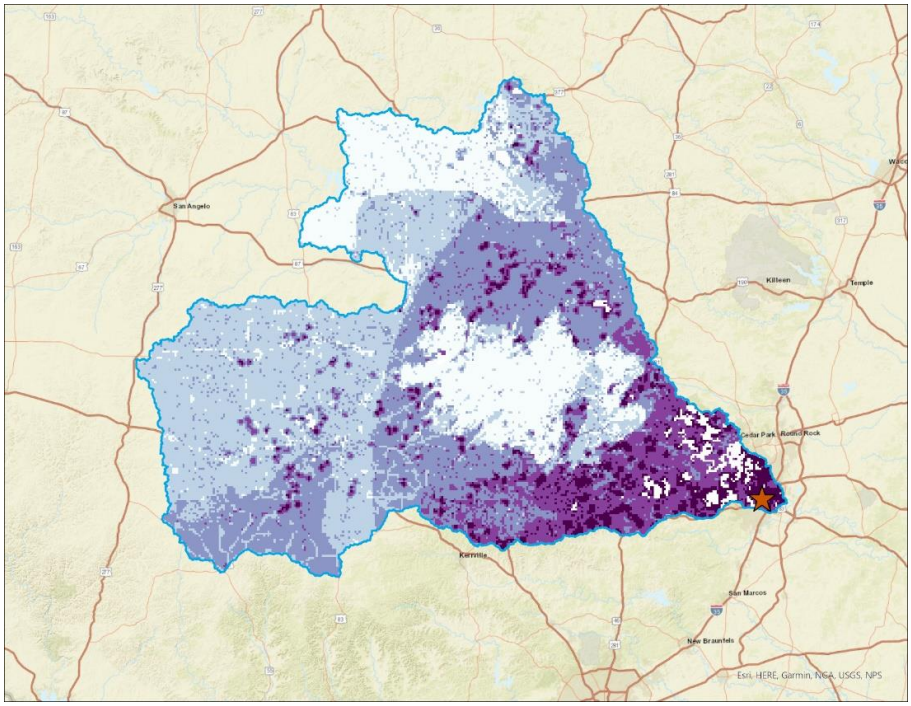


Figure H - 20 Final conservation priority raster

H.7. Land Conservation Strategies

The following conservation strategies are being considered by Austin Water to help protect the City's water supply in the lower Colorado River basin.

H.7.1. Fee-simple Purchase

Austin Water will consider purchasing some of these land areas outright. While this will allow Austin Water to have complete control of a property, it is also the most expensive option due to the cost of the land and yearly costs to manage the property to protect the natural resources.

H.7.2. Conservation Easements

For some land areas, Austin Water will consider purchasing conservation easements. A conservation easement is a strategy where the utility purchases the development rights to a property from the landowner, preventing future development of the property while allowing for continued ranching or other land uses by the landowner. This strategy is less costly than purchasing the land outright, but Austin Water would still have responsibility for overseeing and enforcing the associated development restrictions. Sometimes, the City can partner with a non-profit organization to manage the conservation easement. There is less Austin Water cost associated with these partnerships if the partner takes the lead on monitoring the property for compliance with the terms of the easement.

H.7.3. Direct Payments to Landowners

Similar to a conservation easement, the City may also elect to pay some landowners directly to manage their property for environmental or water supply and quality outcomes. In this strategy, rather than purchasing the development rights, the City would pay the property owner to manage the property in accordance with the terms of the agreement. This strategy would require additional staffing resources to advertise funding opportunities, manage payments to landowners, monitor properties for compliance, and evaluate program outcomes. Because this strategy does not result in permanent protection of land for water supply, this strategy would be used sparingly and only when other more permanent strategies are not available for properties that are deemed to be extremely critical and productive for water quality and/or water supply.

H.7.4. Landowner Outreach and Education

Austin Water will also continue public education and outreach to landowners on land management best practices. While this strategy may cost the least, the cost can vary depending on how many engagement activities are created by Austin Water. Using creative and interactive ways to educate the public about land conservation and stewardship, source water protection, stream bank protection, native plants, watershed protection, and flood response and preparedness will help foster personal connections to landowners and local community organizations working to protect their natural resources.

Austin Water will continue to engage the public and community regarding these land conservation strategies, considering combinations of the strategies in different priority areas, and will continue the important work of protecting the natural environment and our water supply sources.

H.8. Possible Funding Mechanisms

A number of different funding strategies have been utilized in other communities for source water protection. The funding sources include voter approved bonds, voter approved propositions such as taxes, utility revenue bonds, “green bonds”, utility rate charges, stormwater drainage fees, grants, and loans.

Opportunities for grants or loans are available in Texas through multiple programs with the Natural Resource Conservation Service (NRCS), the USDA Forest Service, the Bureau of Land Management, National Fish and Wildlife Foundation, and the U.S. Fish and Wildlife Service. These programs include the NRCS Regional Conservation Partnership Program and the Land and Water Conservation Fund. Recent federal laws such as the Bipartisan Infrastructure Act and the Inflation Reduction Act have created new funding opportunities. There are also potential state funding sources through EPA’s delegation to the Texas Water Development Board for the Clean Water State Revolving Fund and Drinking Water State Revolving Fund.

Austin Water will continue to evaluate the most appropriate funding levels and mechanisms to meet identified land protection goals. Today, Austin Water stewards a network of wildlands that reflect an investment of over $275 million over 20+ years, using a variety of sources, primarily from voter approved bonds.

H.9. Next Steps

The Water Forward 2024 Colorado River Land Analysis was an initial review of key environmental and water supply factors and provides preliminary direction on the geographic scope and extent of future land protection priorities. Additional analyses will be conducted to further refine these priorities based on feasibility, equity, affordability, impact, potential to leverage partnerships, and other factors. The organizations we have met with so far are listed in Appendix A. Analysis next steps will include the following:

- Further refinement of conservation prioritization model. Further analysis and engagement is necessary to define specific conservation priorities and levels of investment for Colorado River protection. Austin Water will engage community stakeholders, the Watershed Protection Department, and other partners in further refining the analysis described above. This may include adding additional factors, refining assigned weightings, or other adjustments to define broad conservation priorities.
- Narrow conservation priorities based on feasibility and impact. Austin Water will work with stakeholders and other City, governmental, and conservation partners to identify more discrete conservation priorities using a weighted analysis of economic and equity factors, available partnerships, environmental and water supply impact, and other considerations.
- Develop a menu of feasible conservation strategies. Austin Water staff will then define preferred land protection strategies, program designs, and levels of investment that will build off Austin Water’s existing successful land protection programs and maximize land protection in these priority areas. This will involve an analysis of how Austin Water investments can make the greatest positive impact on water quality and quantity.

Austin Water staff will use this information to develop a suitable mix of land protection strategies and to begin to develop suitable funding mechanisms and amounts. This will also require further engagement with the public, key stakeholders, and other City departments. As described previously, Austin Water will continue to define its land protection priorities for the water supply watershed and determine appropriate land protection strategies in different priority areas. Given the geographic extent, significant opportunities exist to collaborate with other governmental, civic, and land conservation partners. These partnerships open opportunities to leverage City resources, expand the geographic scope of our work, and more effectively promote land management practices.

Program development next steps will include the following:

- Continue to fund existing Austin Water land protection programs and acquire lands as necessary and feasible to meet program goals.
- Further develop Colorado River land protection priorities as outlined above.
- Based upon land protection priorities, identify an effective and cost-efficient mix of land protection strategies to protect source water quality and quantity.
- Work with partners and stakeholders so that future Austin Water investments leverage partnerships, outside funding opportunities, and other opportunities that can maximize land protection outcomes.
- Develop feasible funding strategies, funding levels, and operational support to meet Colorado River land protection goals.