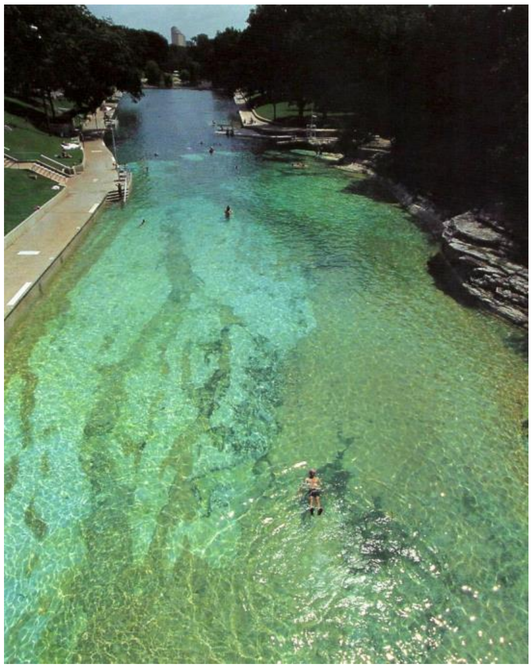
Save Our City:

A Case study of the SOS Ordinance and the Barton Creek Zone impact on

local development and rising Flood Plains throughout Austin



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CE394K Fall 2016
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Introduction:

Former Mayor of Austin and current State Senator Kirk Watson is fond of telling stories about his time as Mayor, and many of his stories start with this disclaimer: “The thing you need to know about Austin in the 90’s is: we had two city birds, the first is the endangered Golden Cheeked Warbler, and the second is the Construction Crane.” I have heard him say this several times and it perfectly sums up the competing narratives about Austin, where the environmental community and low income communities came together to fight for environmental justice against the powerful development interests driving Austin’s growth.

By the 1990’s, the population of Austin had doubled from 250,000 in 1970 to 500,000 in 1994. Today we are on track to top 1 million in the early 2020s.[1] With this population growth, came massive expansion of Austin’s physical boundaries; growth in the construction of new neighborhoods, planned unit developments and suburbs, built on previously open land; and the redevelopment of urban areas with intensive infill development.

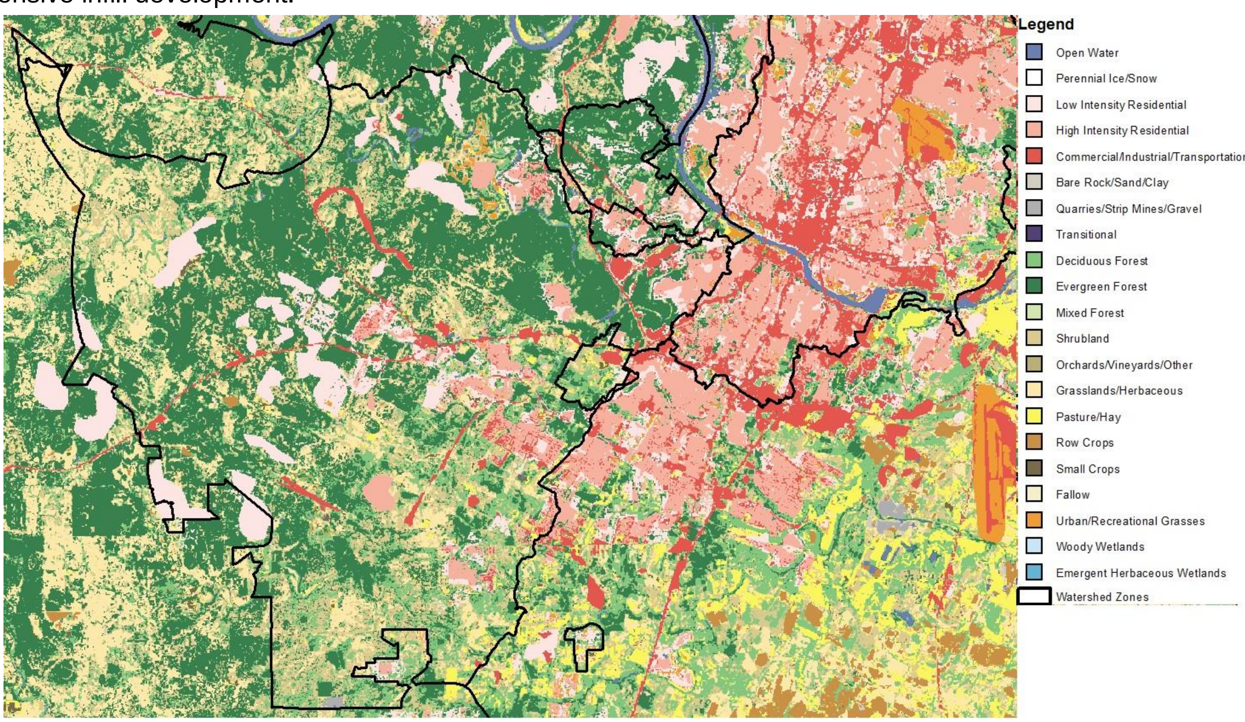


Figure 1: National Land Cover Database 1992[2] : With the Barton Springs Zone[3]

[1] Robinson, R., “Demographic Data | Planning and Zoning | AustinTexas.gov - The Official Website of the City of Austin,”

[2] Vogelmann, J.E.,et. al. “ Completion of the 1990's National Land Cover Data Set for the conterminous United States,”

[3] Drescher, Aubrey. "Watershed Regulation Areas | Open Data."

This Growth and development lead to increasing contamination of local watering hole Barton Springs in the 1990s. Increasing development over the Barton Creek watershed was reducing both the volume and the quality of the water flowing into and out of Barton Springs. In response, the community organized against previously unfettered and unrestricted development within the watershed. The result of political organizing and confrontations with developers and city staff was a compromise solution-Austin would maintain a development corridor that would promote growth and development in parts of the city outside of the new Barton Springs Recharge Zone while development inside the Barton Springs Recharge zone would be limited in the amount of impervious cover that could be constructed over the watershed. Additionally, much higher hurdles were established for development variances, the means to change a development restriction, in the Recharge zone, base use and zoning impervious cover allowances were reduced. Future Land Use Maps were changed to reflect reduced density and intensity over the Recharge Zone. The 1992 Save Our Springs Ordinance—and the decades spent defending and expanding the ordinance—has reduced the amount of development in the Recharge Zone compared to the rest of the city.[4] This ordinance creates a natural experiment to observe the impacts of development rates in the city of Austin, by comparing the Barton Springs Zone (BSZ) to the parts of Austin outside of the BSZ.

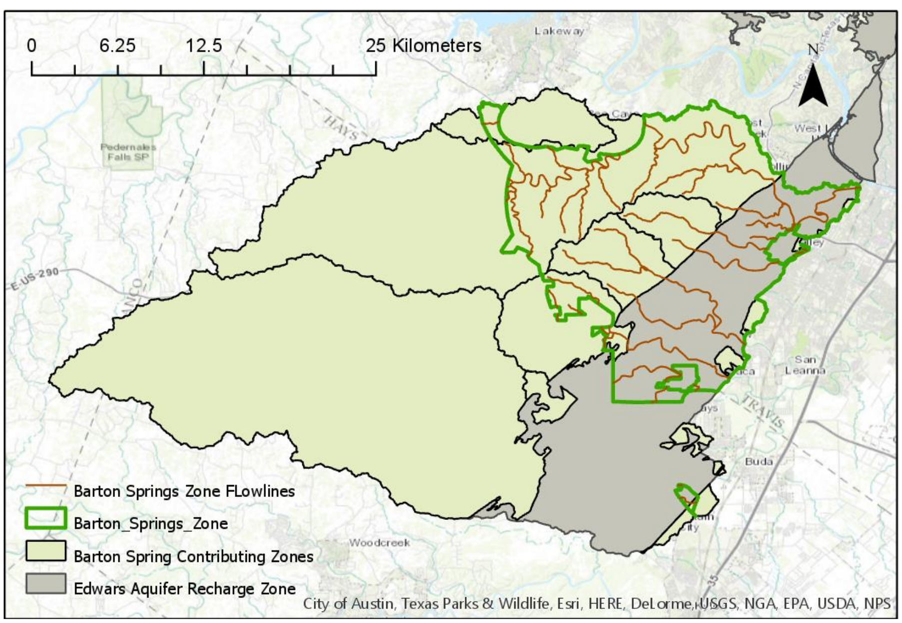


Figure 2: Barton Springs Areas of Edwards Aquifer Recharge, including the City designated Barton Springs Development Zone.

[4] Fri., Aug 9, and 2002, "The Battle for the Springs: A Chronology,"

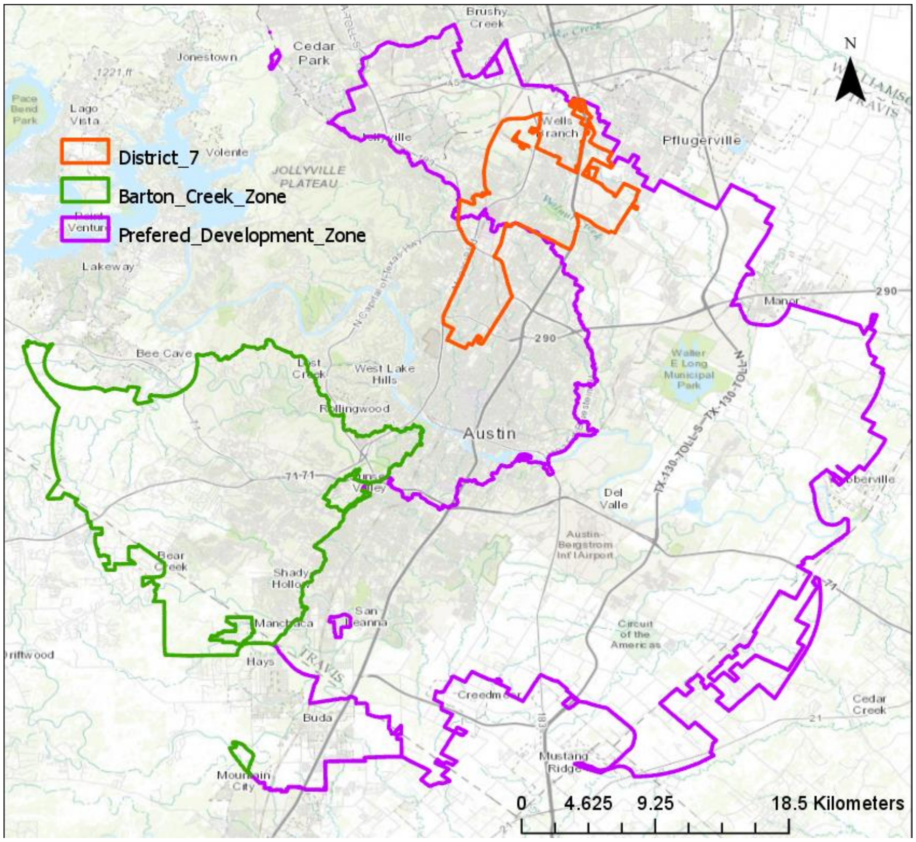
As Figure 2 shows watersheds, recharge zones for aquifers, catchments and stream flow lines do not follow political boundaries defined boundaries. When the Barton Springs Zone was created by the City of Austin, it could not protect the entire land area that impacts the water quality and flow of Barton Creek leading into Barton Springs. The border is along catchment lines in some place but has to deal with political designations like the Town of Sunset Valley, is cut out of the BSZ, but sits directly in the critical recharge zone for the Edwards Aquifer. Barton Springs is part of the Edwards Aquifer system, which has a unique contributing zone that covers about 155 square miles. Barton Spring's portion of the Edwards Aquifer complex is divided into essentially 4 hydro zones: Contributing, Recharge, Confined, and Saline Zones.[5] For the purpose of my investigation I am looking at the development change in political jurisdictions. Instead of looking specifically at the watershed I am interested in considering how the development throughout the city and varies from development within the more restricted BCZ zone. The Save our Springs movement was the first time that activists had created a political agenda around environmental issues in Austin. The Save our Springs Coalition and the SOS Ordinance showed that the public has an interest in protecting and using development restrictions to promote environmental solutions. As the city continues to grow, this lesson will need to be examined because factors like climate change, impacting the amount and consistency of rain, and the knowledge that growth and impervious cover can change the water quality, that is crucial to the city water supply, and increase the amount of runoff leading to great damage during flood stage events.

During Save Our Springs negations, the city created both the BCZ and a Preferred Development Zone (PDZ) where it lowered restrictions and allowed for streamlining of the development process for projects. We can compare these two development zones growth and development over time. Since each zone is vastly different in size I will make comparisons to overall percentage change in my analysis. The City of Austin has also designated the downtown watershed zone and two northwestern zones and established different rules in each. However, in the interest of simplicity I am going to focus on the preferred zone, the Barton Springs Zone and not the downtown or northwestern watershed. I live in the City Council District 7 and work for Council Member Pool, I have chosen for comparison against the BSZ.

[5] Smith, B. A., and B. B. Hunt. "Evaluation of Sustainable Yield of the Barton Springs Aquifer.

District 7 contains the watersheds of Walnut Creek, Shoal Creek and Dry Creek have not received substantial investments in flood abatement and storm runoff projects.

Figure 3: Subject Areas[6]



There is a scientific consensus that development and impervious cover have negative consequences on water quality in urban and suburban watersheds.[7] Using open data assets of the city of Austin, including the development of new neighborhoods and apartment complexes we can examine the rate of growth as a result of the implementation of city ordinances and development policy that will impact the hydrographic landscape of Austin.

[6] Drescher, Aubrey. "Watershed Regulation Areas | Open Data."

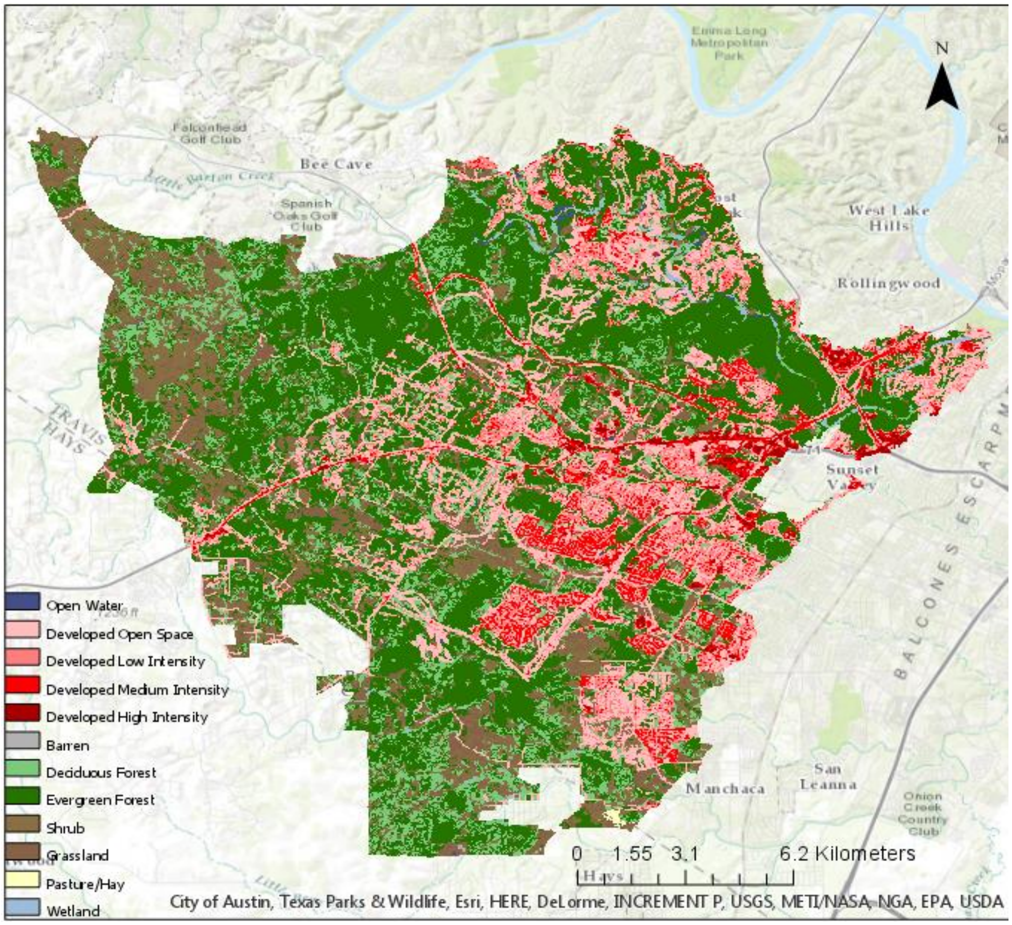
[7] Booth, Hartley, and Jackson, "Forest Cover, Impervious-Surface Area, and the Mitigation of Stormwater Impacts.",
Beck, McHale, and Hess, "Beyond Impervious."
Kadish and Netusil, "Valuing Vegetation in an Urban Watershed."

Methods:

To explore the development growth in each of these study areas, shapefiles for each zone were isolated and then used to extract data from the National Land Cover Databases for 2001 and 2011. Land cover types were then exported to excel for analysis.

Figures are provided for visual reference of each area and are presented in large scale.

Figure 4: Barton Creek Zone,[8] 2001 NLCD.[9]

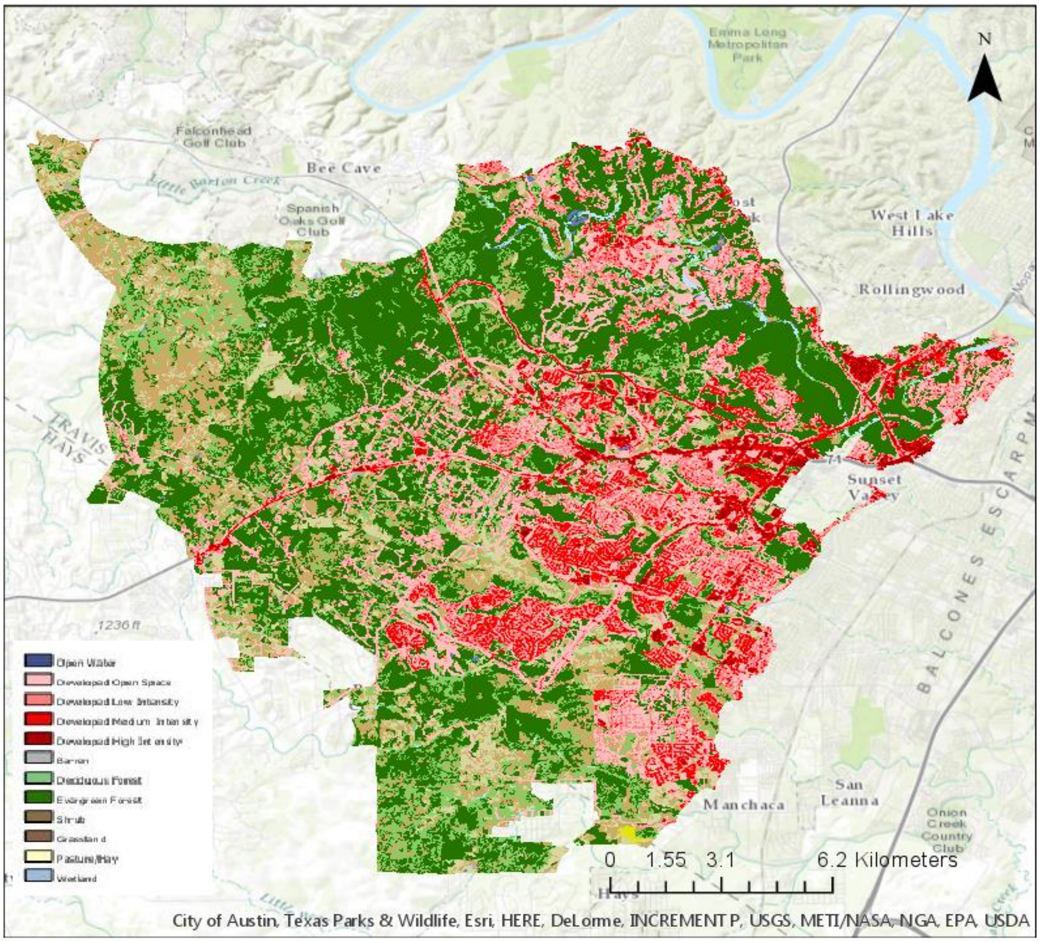


Barton Creek Zone 2001	Value	Count	Percent
Open Water	11	548	0.18137347
Developed Open Space	21	45609	15.09537
Developed Low Intensity	22	23334	7.72293547
Developed Medium Intensity	23	13980	4.62700942
Developed High Intensity	24	3527	1.16734351
Barren	31	284	0.09399647
Deciduous Forest	41	37472	12.4022387
Evergreen Forest	42	119305	39.4867925
Mixed Forest	43	0	0
Shrub	52	38752	12.8258848
Grassland	71	17400	5.75893877
Pasture/Hay	81	168	0.05560355
Cultivated Crops	82	0	0
Wetland	90	1760	0.58251335
Herbaceous Wetland	95	0	0
Total		**302139**	**100**

[8] Drescher, Aubrey. "Watershed Regulation Areas | Open Data."

[9] Homer, C., et. al. "Completion of the 2001 National Land Cover Database for the Conterminous United States."

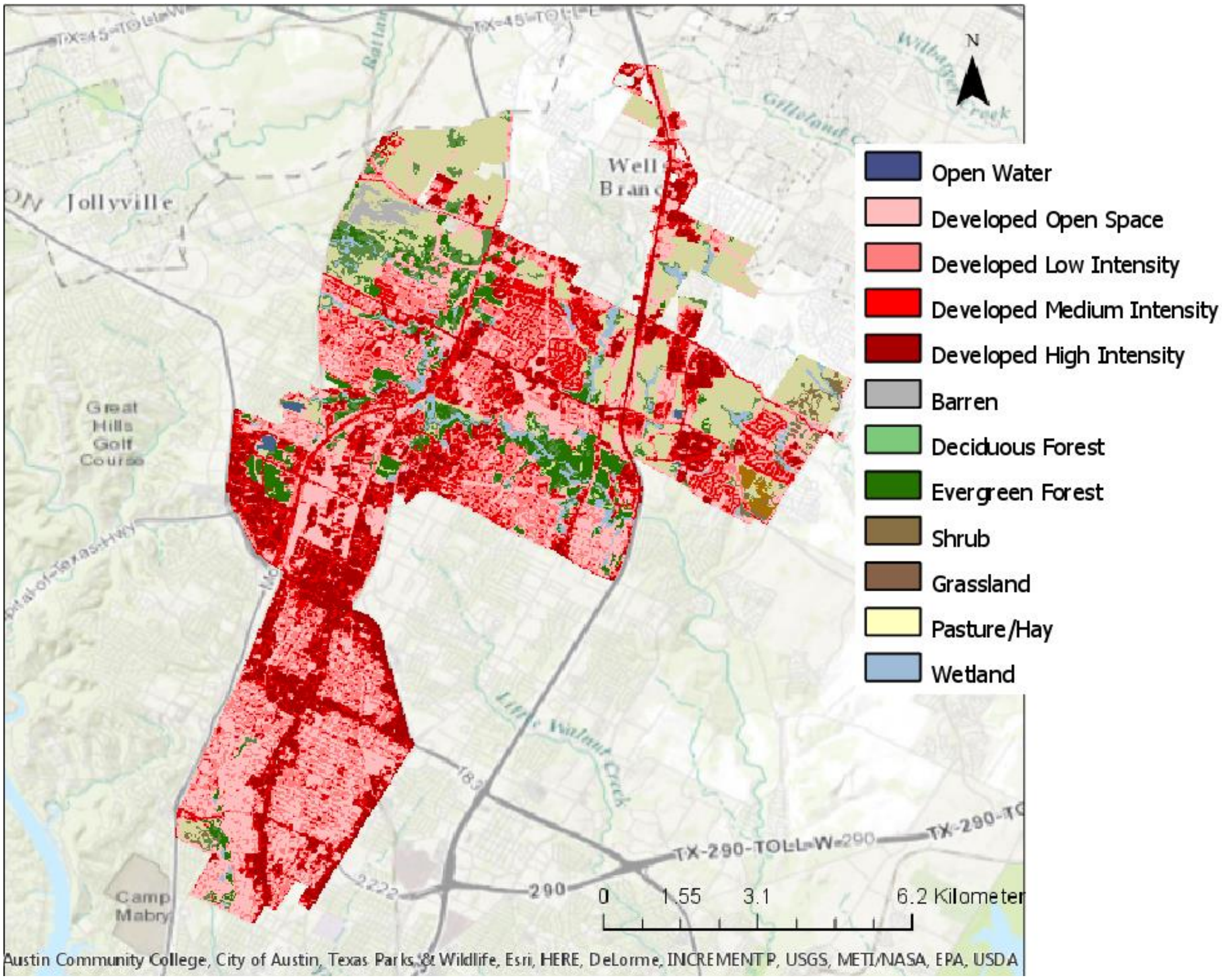
Figure 5: Barton Creek Zone: NLCD 2011[10]: Here we can see the most recent data on land use and the growth in development over the Baton Creek Recharge Zone.



Barton Creek Zone 2011	Value	Count	Percent	Change
Open Water	11	545	0.180381	-0.00099
Developed Open Space	21	46286	15.31944	0.224069
Developed Low Intensity	22	27765	9.189479	1.466544
Developed Medium Intensity	23	20454	6.769732	2.142722
Developed High Intensity	24	4920	1.62839	0.461046
Barren	31	429	0.141988	0.047991
Deciduous Forest	41	34358	11.37159	-1.03065
Evergreen Forest	42	109883	36.36836	-3.11843
Mixed Forest	43	0	0	0
Shrub	52	37417	12.38404	-0.44185
Grassland	71	18197	6.022725	0.263786
Pasture/Hay	81	168	0.055604	0
Cultivated Crops	82	0	0	0
Wetland	90	1717	0.568281	-0.01423
Herbaceous Wetland	95	0	0	0
Total		**302139**	**100**	

10 Homer, C., et. al. "Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information." & Drescher, Aubrey. "Watershed Regulation Areas | Open Data."

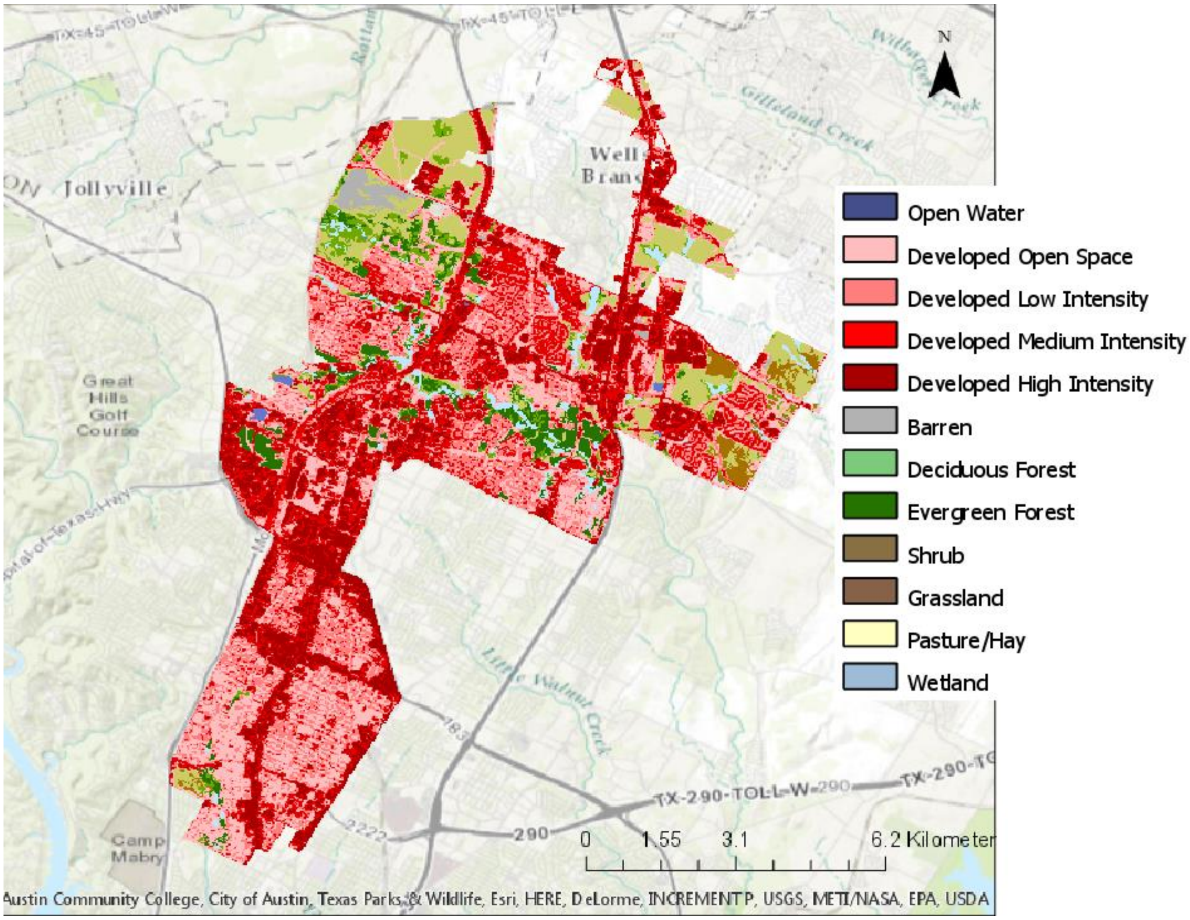
Figure 6: Austin City Council District 7: NLCD 2001[11]



District 7 2001	Value	Count	Percent
Open Water	11	185	0.2289859
Developed Open Space	21	17901	22.157171
Developed Low Intensity	22	17374	21.5048706
Developed Medium Intensity	23	13717	16.9783763
Developed High Intensity	24	10286	12.7316161
Barren	31	541	0.66962904
Deciduous Forest	41	2835	3.50905423
Evergreen Forest	42	3944	4.88173188
Mixed Forest	43	0	0
Shrub	52	532	0.65848919
Grassland	71	11057	13.6859304
Pasture/Hay	81	0	0
Cultivated Crops	82	312	0.38618163
Wetland	90	2107	2.60796376
Herbaceous Wetland	95	0	0
Total		**80791**	**100**

[11]Homer, C., et. al. "Completion of the 2001 National Land Cover Database for the Conterminous United States."

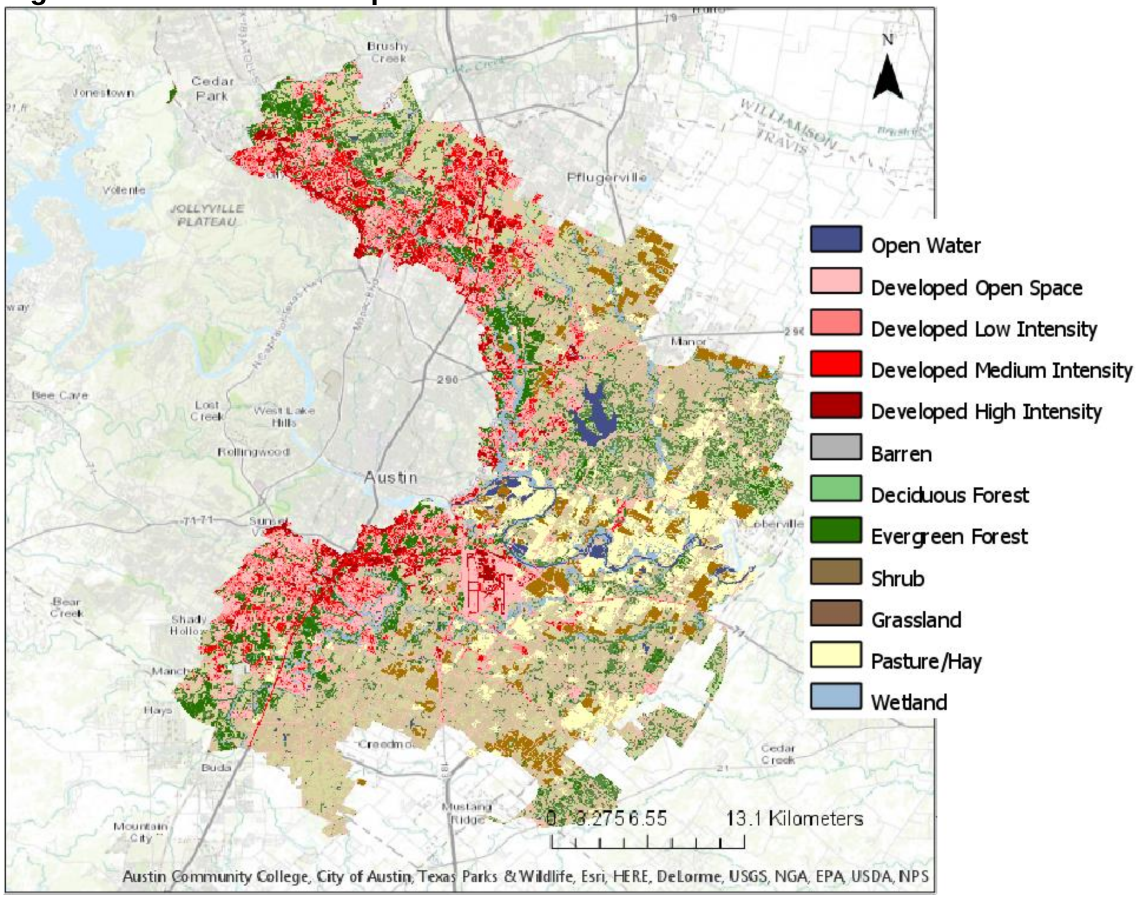
Figure 7: District 7, NLCD 2011.[12]



District 7, 2011	Value	Count	Percent	Change
Open Water	11	175	0.216608	-0.01238
Developed Open Space	21	15440	19.11104	-3.04613
Developed Low Intensity	22	16893	20.90951	-0.59536
Developed Medium Intensity	23	17538	21.70786	4.729487
Developed High Intensity	24	13450	16.64789	3.916278
Barren	31	850	1.052097	0.382468
Deciduous Forest	41	2360	2.921117	-0.58794
Evergreen Forest	42	3397	4.204676	-0.67706
Mixed Forest	43	0	0	0
Shrub	52	503	0.622594	-0.0359
Grassland	71	7728	9.565422	-4.12051
Pasture/Hay	81	0	0	0
Cultivated Crops	82	608	0.752559	0.366377
Wetland	90	1849	2.288621	-0.31934
Herbaceous Wetland	95	0	0	0
Total		**80791**	**100**	

[12] Homer, C., et. al. “Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information.”

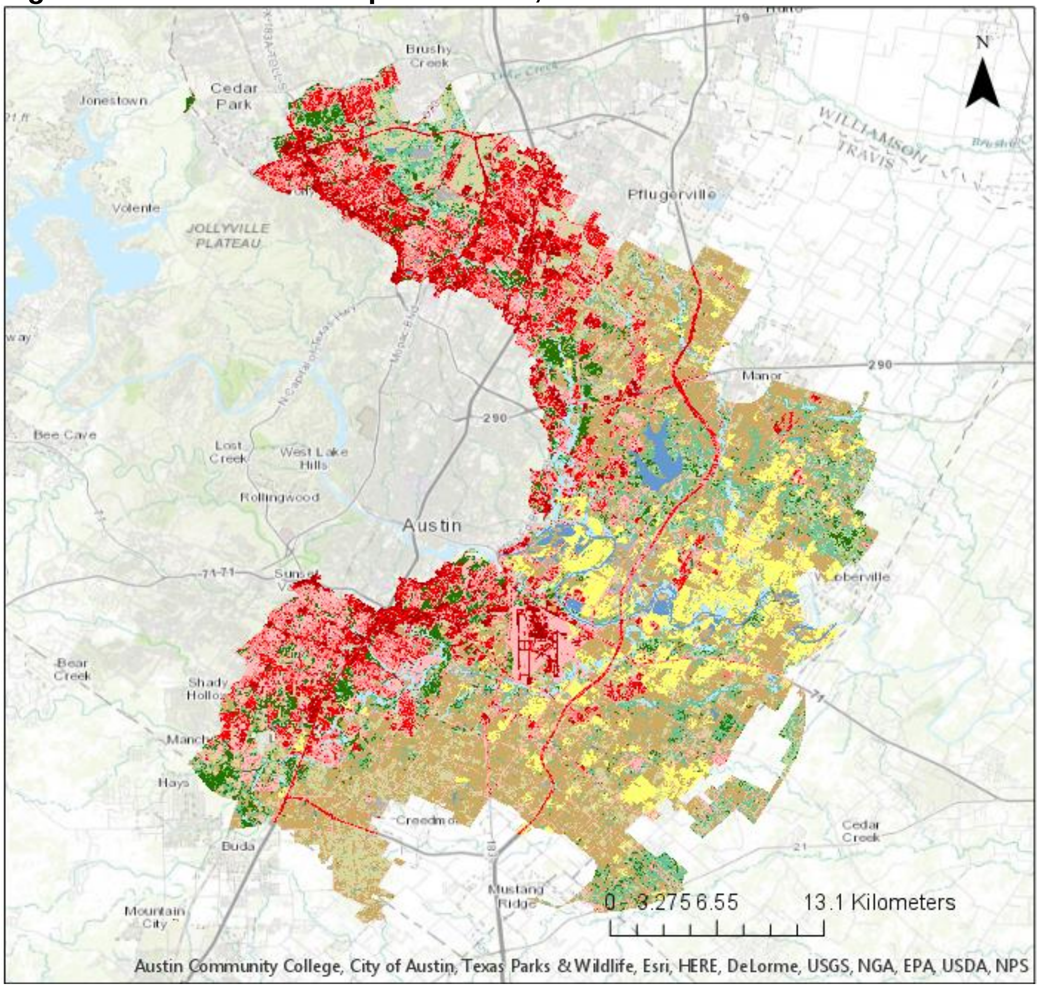
Figure 8: Preferred Development Zone[13]: NLCD 2001.



Preferred Development 2001	Value	Count	Percent
Open Water	11	15584	1.57626061
Developed Open Space	21	122898	12.4306517
Developed Low Intensity	22	67037	6.78053019
Developed Medium Intensity	23	47981	4.85309037
Developed High Intensity	24	25003	2.5289556
Barren	31	2278	0.23041078
Deciduous Forest	41	92893	9.3957634
Evergreen Forest	42	60736	6.1432087
Mixed Forest	43	19037	1.92551804
Shrub	52	244501	24.7303192
Grassland	71	128648	13.0122417
Pasture/Hay	81	80033	8.09502473
Cultivated Crops	82	46234	4.67638815
Wetland	90	35739	3.61485998
Herbaceous Wetland	95	67	0.00677679
Total		**988669**	**100**

[13] Homer, C., et. al. “Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information.” & Drescher, Aubrey. "Watershed Regulation Areas | Open Data."

Figure 9: Preferred Development Zone, NLCD 2011.[14]



Prefered Development Zone 2011	Value	Count	Percent	Change
Open Water	11	15925	1.610751	0.034491
Developed Open Space	21	122241	12.3642	-0.06645
Developed Low Intensity	22	79271	8.017951	1.237421
Developed Medium Intensity	23	81521	8.24553	3.39244
Developed High Intensity	24	39326	3.977671	1.448715
Barren	31	9473	0.958157	0.727746
Deciduous Forest	41	81734	8.267074	-1.12869
Evergreen Forest	42	50333	5.090986	-1.05222
Mixed Forest	43	17768	1.797164	-0.12835
Shrub	52	212732	21.51701	-3.21331
Grassland	71	113254	11.4552	-1.55704
Pasture/Hay	81	80073	8.099071	0.004046
Cultivated Crops	82	50621	5.120116	0.443728
Wetland	90	33804	3.419142	-0.19572
Herbaceous Wetland	95	593	0.05998	0.053203
Total		**988669**	**100**	

[14] Homer, C., et. al. “Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information.” & Drescher, Aubrey. "Watershed Regulation Areas | Open Data."

	2001	2011	Change	Rate
Barton	28.61	32.91	4.29	0.43
D7	73.37	78.38	5.00	0.50
Preferred	26.59	32.61	6.01	0.60

Table 1: The Share of each study area of Developed land cover as a percentage of total area in the political designation.

	2001	2011	Change	Rate
D7	53.3502	56.9889	3.6387	0.36387
Barton	77.805	89.4825	11.6775	1.16775
Preferred	236.6271	290.1231	53.496	5.3496

Table 2: For Table two I converted the grid cells to square Kilometers.

The goal of this analysis is test the hypothesis that the Save our Springs Ordinance and the development restrictions have lowered the rate of impervious cover and new development in the Barton Creek Recharge Zone compared to other watershed zones. In Table 1, the growth rates for each study area are shown, to compliment the visual depictions in the figures above. The cumulative developed land, Open, Low, Medium and High Intensity, as a percentage of the total percentage study area. Table 2 converts the raster layers into square kilometers to represent the real areas. District 7 has the highest area already developed as a percentage of its area around 78%, and roughly 57 square kilometers. This can be compared to the lower amounts of 33% already developed, for the Barton Springs Zone and 32.6% in the Preferred Development Zone. Represented as percentage of total area increased, the BSZ had the lowest growth rate at .43% per year, with D7 coming in second at .5% per year and the Preferred Zone was fastest at .6% per year. This is what we would expect to see if the assumptions about the city ordinances are true. Barton Springs Zone has reduced development area growth compared which is .2% points lower rate than the Preferred Zone. When examined as square kilometers land developed D7 had the least development growth at .36 square Kilometers per year, which is also to be expected as D7 area is smaller than both the BSZ and PDZ. Followed by Barton Springs Zone at 1.16 Square Kilometers developed growth per year. The Preferred Development zone grows the fastest at 5.34 square kilometers per year.

From the map images there is clear visual growth from 1992 to 2011 in the Barton Springs Zone, while we cannot rely on the data from 1992 for analytical comparison. The growth of development in the

Barton Springs zones is markedly slower than the preferred development zone and the District 7 study area.

Conclusions:

City ordinances have the desired effect on the expansion of development in the various study areas. Based on literature exploration, development and impervious cover have a demonstrated negative impact on water quality in urban and suburban waterways. As my analysis has also shown there is increasing development across the city of Austin and that growth and expansion of impervious development of the watershed is leading to changes in the characteristics in urban watersheds. The experience of recent flooding events indicates that the watersheds that have stricter limitations on development and public movements to prevent extensive construction projects, fared better than watersheds that have experienced high levels of development, infill and construction. As the city continues to grow, land use regulators and policymakers will have to explore the use of more restrictive zoning in urban watersheds as a tool to prevent damage and protect property in extreme flood events.

The increase in urban density and impervious cover will continue to grow unless checked, but what this analysis shows is that the development tools, both permitting development in certain areas and restricting in others has the desired effect of limiting the growth of the impervious cover in urban areas. This can be applied to the increasing risks of increasingly dense urban watershed and flood potential in those urban areas. Recently the Austin Flood Mitigation Task force identified over $1.1 Billion in urban watershed projects that are currently unfunded, and will become increasingly important as the Fully developed flood plain is revamped to reflect the impact of increasing impervious cover. It will become important for residents and their representatives to push for development policy that includes watersheds and flood potential including limiting the use of variances and further limiting the allowable impervious cover in the upstream portions of Austin creeks and streams.

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