



Land Development Code Revision: Analysis of Proposed Impervious Cover Entitlements

November 1, 2019

Introduction

Impervious cover is any hard surface, such as a road, parking lot, or building, that prevents the infiltration of water into the ground. When rainwater falls on impervious surfaces, the increased volume and velocity of runoff from these surfaces can contribute to erosion and flooding and impair water quality by carrying contaminants such as sediment, bacteria, and nutrients into Austin's aquifer and creeks. Impervious cover also displaces soils, trees, and other plants, increasing ambient temperatures and reducing stream baseflows and natural habitat. To minimize these negative effects, the Land Development Code (LDC) places restrictions on impervious cover.

The LDC has two sets of impervious cover limits: zoning limits and watershed limits. Zoning limits are set by the zoning code for each zoning district. Watershed limits are set by the water quality code for each watershed classification: Urban, Suburban, Water Supply Suburban, Water Supply Rural, and Barton Springs Zone (see map on p.5). For all one- and two-unit development, eligible missing middle projects, and all other types of development within the Urban watersheds, impervious cover is set exclusively by zoning. For other types of development in the rest of the city, the impervious cover limit is governed by the lower (i.e., more protective) of the two requirements. The Watershed Protection Department uses the maximum impervious cover allowed by the code to model and map floodplains as well as to design upgrades to drainage infrastructure.

City Council's May 2nd Policy Direction stated that "the revised Code text and map should result in reduced allowable city-wide impervious cover" and "reductions in impervious cover city-wide should either decrease allowable impervious cover for, or make no change to, each individual watershed (relative to current code)." Watershed Protection staff performed an analysis to compare the maximum impervious cover allowed by current code to the maximum impervious cover allowed by the LDC Revision's draft code and zoning map.

Methodology

The analysis was performed using an Excel spreadsheet to calculate and summarize processed Geographic Information Systems (GIS) data. For every parcel within the City's full and limited purpose jurisdictions, citywide geospatial datasets were aggregated and processed to provide the following values:

- *Zoning*. The current and proposed base zoning district (not including combining districts and overlays).
- *Watershed Classification / Recharge Zone*. The watershed classification area and whether the parcel is located within the Edwards Aquifer Recharge Zone. This information informs the watershed impervious cover limit that governs in non-Urban watersheds.
- *Current Max. Impervious Cover*. The maximum amount and percent of impervious cover allowed under the current code, considering both zoning and watershed regulations.
- *Proposed Max. Impervious Cover*. The maximum amount and percent of impervious cover allowed under the proposed LDC Revision, considering both zoning and watershed regulations.

Staff then summed the maximum amounts of impervious cover allowed per parcel to calculate the total maximum allowable impervious cover citywide and in each watershed under current code and the proposed LDC Revision. The difference between the maximum allowed under the proposed LDC Revision and the maximum allowed under current code was then divided by the total zoned area to calculate the percent change citywide and by watershed. Finally, the maximum amounts of impervious cover allowed per parcel under the current and proposed codes were then compared using a paired t-test to determine whether there is a statistically significant change, either positive or negative, in allowed maximum impervious cover under the proposed LDC Revision.

This analysis provides a conservative estimate of the maximum amount of impervious cover each property could theoretically reach based on its zoning or watershed limit. While comparing current versus proposed maximums is the best available measure of how the draft code and map may impact citywide impervious cover, it is important to note that these maximums are only theoretical. The analysis is designed to detect change due to zoning and mapping decisions rather than predict the likely maximum impervious cover. For the purposes of this analysis, the key results to evaluate are the differences between the current and proposed maximums, rather than the percentages themselves.

To maximize the analysis' sensitivity to change driven by zoning and mapping decisions, several assumptions were made regarding zones and special planning areas for which impervious cover is governed by site-specific regulations rather than an established impervious cover limit (e.g., Public, Parkland, Planned Unit Developments, East Riverside Corridor, North Burnet/Gateway, Transit Oriented Development, etc.). The analysis used either the average percent impervious cover of existing uses where available or the most conservative estimate of maximum impervious cover for these zones. For some zones, the maximum allowed impervious cover was assumed to be equivalent for both scenarios due to the nature of these zones. For example, the impervious cover limit for a parcel zoned F25 was assumed to be equivalent to its current maximum allowable impervious cover, as this zone is intended to be equivalent to current zoning.

It is important to note that many other code provisions and unique site features influence the maximum impervious cover buildout for a parcel, and this analysis does not attempt to quantify the impact of these elements. For example, zoning combining districts, overlays, and setbacks, as well as floodplains, creek buffers, steep slope standards, and tree protections, may limit the amount of impervious cover that could be developed on a particular parcel. The analysis also does not account for other code requirements that mitigate the impacts of impervious cover, such as existing drainage regulations, the proposed "greenfield standard" that requires redevelopment projects to contribute to flood risk reduction, and existing water quality capture and treatment standards. Finally, the analysis does not consider the likelihood or timing of redevelopment under the current or proposed code.

Although the analysis does attempt to track impervious cover maximums at the parcel scale, there is an unavoidable potential for error inherent in an analysis that combines multiple citywide datasets that have been maintained over long periods of time. As existing zoning reflects the aggregation of decades of zoning decisions, it may not accurately reflect actual land use or potential impervious cover for properties with atypical development patterns (e.g., churches, golf courses, schools, federal or state-owned property, utilities, etc.). In such situations, even as the proposed zones have been consolidated to be more coherent and consistent, the difference between the current and proposed zones for these properties may not be meaningful. The number of discrete geospatial datasets also introduces spatial and data inaccuracies. Staff has attempted to identify and account for variability that does not reflect the impact of mapping or code changes, but it is not possible to eliminate all potential inaccuracies and erroneous comparisons.

Results

The analysis showed that the draft code and map result in a very small, nominal increase (0.20 percent) in the maximum amount of impervious cover allowed citywide. On an individual watershed basis, 36 of the City's 68 watersheds had either a slight decrease or no change in allowable impervious cover. Twenty-four watersheds had an increase of less than 0.5 percent, six had an increase between 0.5 and 1 percent, and two had an increase of more than 1 percent (Johnson Creek and Waller Creek, which increased 1.5 and 1.1 percent, respectively).

This methodology has enabled staff to identify even very small changes in impervious cover maximums. The citywide increase of 0.20 percent—one-fifth of one percent—is very small in the context of the city's total land area: approximately 345 acres of additional impervious cover over an area of 176,390 acres, or about 276 square miles. Staff does not believe that this is a meaningful change in impervious cover from a watershed impact perspective. The draft code and map balance Council's direction to maintain existing impervious cover entitlements with the direction to increase housing capacity and provide missing middle housing.

LDC Revision: Impervious Cover Analysis

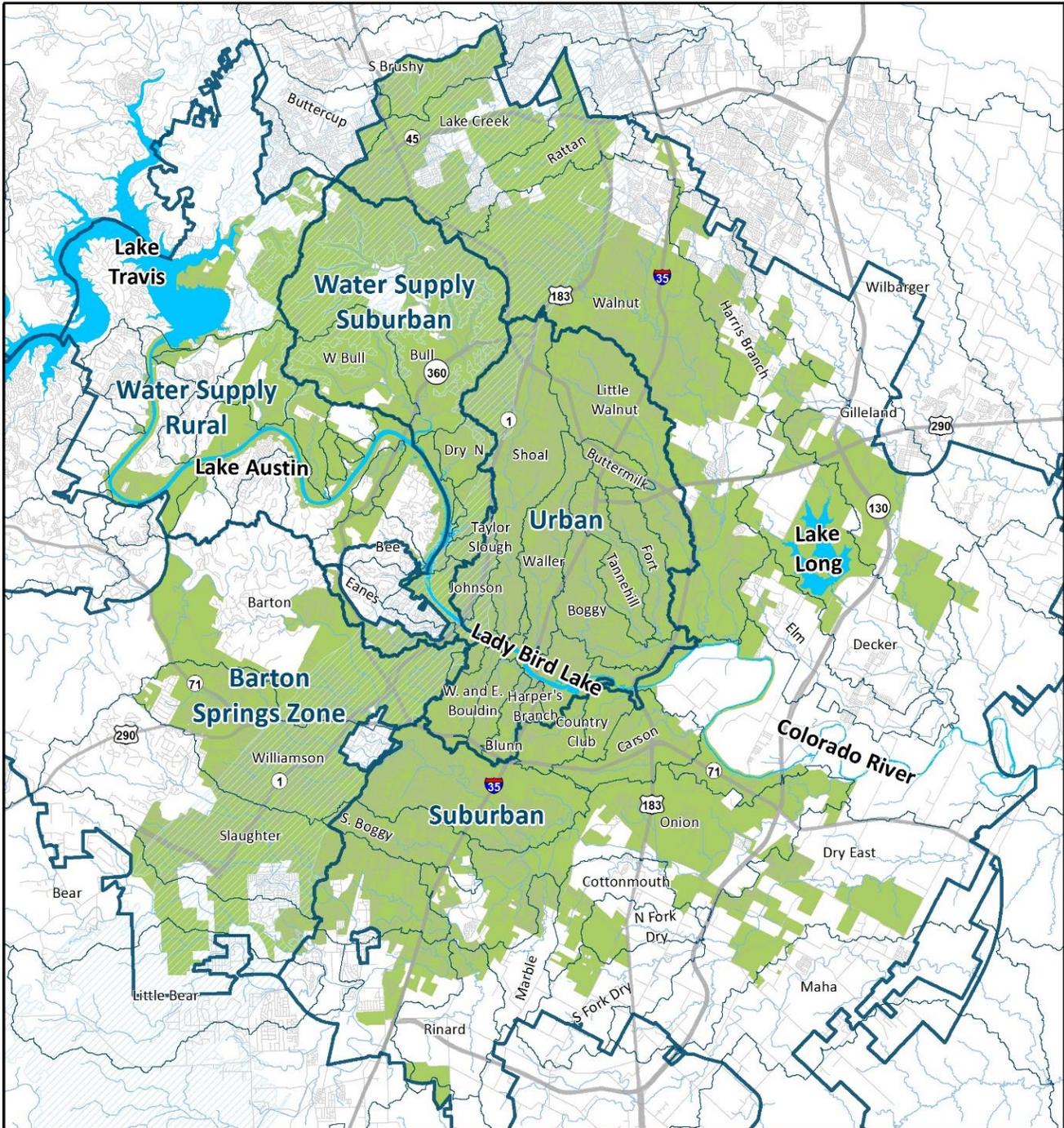
The table below provides the results of staff’s impervious cover analysis as well as descriptive statistics (the mean difference and standard deviation) that help describe patterns in parcel-level impervious cover changes. The mean difference column reflects the average parcel-level change in impervious cover change throughout a watershed. Mean differences with an asterisk are significantly different than zero, or “statistically significant” (paired t-test, p-value <0.05). This means that parcels within the watershed generally have a change in allowable impervious cover that is moving in the same direction (i.e., most parcels have an increase, or most parcels have a decrease). Watersheds with statistically insignificant results (i.e., no asterisk) and small standard deviations imply that most parcels have a very small change; the increase or decrease in allowable impervious cover is close to zero. Watersheds with insignificant results and large standard deviations likely have some parcels with decreased allowable impervious cover and others with increased allowable impervious cover, but that the changes generally cancel each other out on a watershed level. (Significance testing was not performed for watersheds with no observed difference in maximum allowed impervious cover.)

Watershed	Total Acres within City Limits	Existing Impervious Cover (percent)	Allowed Maximum Impervious Cover (percent)		Difference between Current and Proposed Entitlements		Mean Difference (sq. ft. of impervious cover per parcel)	Standard Deviation (sq. ft. of impervious cover per parcel)
			Current Land Development Code	Proposed Land Development Code	Percent	Acres of impervious cover		
Barton Creek	9,133	12.7%	13.2%	13.2%	0.03%	3.0	37	1,444
Buttercup Creek	359	33.4%	58.7%	58.5%	-0.15%	-0.6	-561	3,865
Bee Creek	559	9.8%	11.5%	11.5%	0%	0.0	0	0
Bear Creek	2,389	9.4%	14.7%	14.7%	0.07%	1.6	29 *	203
Blunn Creek	744	43.6%	60.5%	60.7%	0.14%	1.0	39	2,477
Buttermilk Branch	826	55.8%	69.1%	68.8%	-0.30%	-2.5	-55	1,815
Boggy Creek	3,031	40.1%	57.8%	58.6%	0.80%	24.1	117 *	1,281
Bohls Hollow	2	0.0%	5.0%	5.0%	0%	0.0	0	0
Brushy Creek	2	38.1%	65.0%	65.0%	0%	0.0	0	0
Bear Creek West	246	9.5%	19.0%	19.0%	0%	0.0	0	0
Bull Creek	12,623	18.4%	26.8%	26.9%	0.14%	18.1	54 *	264
Carson Creek	2,746	33.8%	68.1%	68.4%	0.34%	9.5	180 *	2,330
Country Club East	1,064	24.1%	56.3%	56.6%	0.30%	3.2	118	2,102
Country Club West	1,499	41.7%	60.0%	60.2%	0.25%	3.7	121 *	1,937
Cedar Hollow	14	0.0%	5.0%	5.0%	0%	0.0	0	0
Commons Ford Creek	298	4.1%	17.8%	17.8%	0%	0.0	0	0
Connors Creek	377	2.7%	13.8%	13.8%	0.01%	0.0	21	122
Colorado River	2,956	17.3%	56.8%	56.7%	-0.08%	-2.2	-82 *	854
Cuernavaca Creek	52	14.3%	15.1%	15.1%	0%	0.0	0	0
Cottonmouth Creek	842	3.7%	75.4%	75.4%	0%	0.0	18	773
Coldwater Creek	161	3.9%	13.6%	13.6%	0%	0.0	0	0
Decker Creek	3,432	6.3%	31.4%	31.4%	0%	0.0	0	0
Dry Creek East	4,266	11.5%	63.2%	63.1%	-0.03%	-1.3	-10	1,064
Dry Creek North	1,156	25.5%	27.9%	27.9%	0.02%	0.2	6 *	110
Eanes Creek	918	30.9%	31.8%	32.0%	0.18%	1.6	50 *	220
East Bouldin Creek	910	50.2%	59.4%	60.2%	0.88%	8.0	106 *	1,473
Elm Creek	686	17.5%	40.5%	40.6%	0.13%	0.9	0	0
Fort Branch	1,771	34.0%	53.3%	54.3%	0.99%	17.4	150 *	2,292
Gilleland Creek	5,474	5.4%	72.9%	72.8%	-0.01%	-0.8	-15	980
Honey Creek	24	0.6%	15.0%	15.0%	0%	0.0	0	0
Hog Pen Creek	177	12.3%	15.3%	15.3%	0%	0.0	0	0
Harrison Hollow	39	4.2%	13.2%	13.2%	0%	0.0	0	0
Harper's Branch	235	47.8%	59.0%	59.3%	0.29%	0.7	24	1,600
Harris Branch	3,245	17.7%	70.7%	70.6%	-0.11%	-3.5	-56	3,437
Huck's Slough	93	26.7%	31.3%	31.3%	0%	0.0	0	0

Watershed	Total Acres within City Limits	Existing Impervious Cover (percent)	Allowed Maximum Impervious Cover (percent)		Difference between Current and Proposed Entitlements		Mean Difference (sq. ft. of impervious cover per parcel)	Standard Deviation (sq. ft. of impervious cover per parcel)
			Current Land Development Code	Proposed Land Development Code	Percent	Acres of impervious cover		
Johnson Creek	788	43.8%	44.0%	45.5%	1.53%	12.1	188 *	765
Little Bee Creek	57	16.6%	15.9%	15.9%	0%	0.0	0	0
Lady Bird Lake	3,073	40.8%	48.6%	48.6%	-0.03%	-0.8	-2	1,336
Little Bear Creek	907	0.7%	12.3%	12.3%	0%	0.0	0	0
Lake Austin	5,572	11.2%	15.9%	15.9%	0.02%	1.0	11 *	170
Lake Creek	5,852	28.6%	57.6%	57.5%	-0.04%	-2.3	-16	734
Lake Travis	2,854	9.7%	11.2%	11.3%	0.07%	2.1	75 *	220
Little Walnut Creek	5,943	46.6%	62.4%	62.5%	0.07%	3.9	17	1,590
Maha Creek	83	27.3%	60.0%	60.0%	0%	0.0	0	0
Marble Creek	587	14.8%	50.9%	50.8%	-0.11%	-0.6	-19 *	291
North Fork Dry Creek	900	0.8%	80.0%	80.0%	0%	0.0	0	0
Onion Creek	12,825	15.8%	63.3%	63.3%	0.06%	8.0	39	2,204
Panther Hollow	2,236	7.1%	10.8%	10.8%	0%	0.0	0	0
Plum Creek	159	0.2%	65.4%	65.4%	0%	0.0	0	0
Rattan Creek	3,127	13.8%	63.6%	63.7%	0.11%	3.3	148 *	578
Running Deer Creek	20	14.2%	15.1%	15.1%	0%	0.0	0	0
Rinard Creek	818	5.9%	59.9%	59.9%	-0.02%	-0.2	-9	286
South Boggy Creek	2,319	28.1%	52.1%	52.6%	0.51%	11.8	87 *	1,140
South Brushy Creek	2,116	24.2%	61.5%	61.5%	0%	0.0	0	0
South Fork Dry Creek	624	0.3%	80.0%	80.0%	0%	0.0	0	0
Shoal Creek	6,331	50.5%	58.2%	58.6%	0.42%	26.7	66 *	1,608
Slaughter Creek	9,328	22.5%	28.2%	28.5%	0.24%	22.2	58 *	641
Steiner Creek	37	0.0%	7.4%	7.4%	0%	0.0	0	0
St. Stephens Creek	494	22.8%	19.1%	19.2%	0.06%	0.3	56 *	183
Tannehill Branch	2,088	41.1%	61.6%	61.3%	-0.29%	-6.1	-45 *	1,446
Turkey Creek	1,228	7.2%	15.2%	15.2%	0%	0.0	0	0
Taylor Slough North	813	29.4%	30.3%	30.5%	0.23%	1.9	74 *	527
Taylor Slough South	354	37.7%	26.4%	27.3%	0.89%	3.1	198 *	606
West Bull Creek	3,971	8.2%	18.2%	18.2%	-0.06%	-2.5	-85 *	978
West Bouldin Creek	1,349	45.4%	58.6%	58.8%	0.23%	3.1	33	1,413
Walnut Creek	19,407	28.5%	60.0%	60.4%	0.35%	68.7	122 *	2,610
Waller Creek	2,709	54.8%	50.9%	52.0%	1.11%	30.1	125 *	820
Williamson Creek	15,075	30.9%	37.7%	38.2%	0.51%	77.4	107 *	4,122
Total	176,390	23.8%	45.5%	45.7%	0.20%	345.2	64 *	2,072

Note: This analysis does not include impervious cover within street rights-of-way, as it is focused on the zoned area of the city. Additionally, zoned area within lakes and the Colorado River was excluded.

Map of Watersheds and Watershed Classifications



Watersheds and Watershed Classifications

-  Watershed Boundaries
-  Lakes & Rivers
-  Watershed Classifications
-  City Limits
-  Edwards Aquifer Recharge Zone
-  Creeks

