City of University City
Storm Water Commission
6801 Delmar Boulevard, University City, Missouri 63130,
Phone: (314) 505-8560, Fax: (314) 862-0694

MINUTES OF THE STORMWATER COMMISSION – AD-HOC SUB-COMMITTEE TO REVIEW UNIVERSITY CITY MUNICIPAL CODE REVISIONS PROPOSED BY THE UNIVERSITY HEIGHTS FLOOD TASK FORCE
April 30, 2024

Call to Order. The subcommittee listed above was called to order at 5:05 PM by Eric Karch.

1. **Attendance-Roll Call.** The following Commission members were present virtually via zoom: Susan Armstrong, Garry Aronberg, and Eric Karch. City representative Mirela Celaj attended as well. This was a non-quorum meeting, as allowed by our bylaws.

   Agenda. To discuss revisions to the proposed code language, and specifically the matrix of eight (8) proposed Green Infrastructure for Storwmater (GISW) techniques presented by the University Heights Association Flood Task Force (version dated 11/10/2023 Impervious Surfaces Draft Bill). This meeting is being held in response to an action item from the 11/14 Ad-Hoc Subcommittee meeting and is a continuation of topics discussed on 11/14/2022, 11/30/2023, 1/18/2024, 1/24/2024, 2/20/2024, 2/29/2024, 3/19/2024, and 3/26/2024.

2. **Old Business**

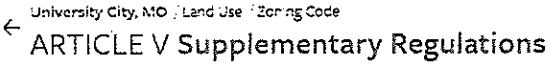
   2.1 Flatwork permit

   2.1.1 Mirela provided:
   - 2.1.1.1 DRAFT 1-page permit application
   - 2.1.1.2 DRAFT memo to commission explaining the need for flatwork permit
   - 2.1.1.3 Flatwork is any paving outside of the right-of-way and not attached to another permit. It would include any paving, pavers, or any other impervious material and if a permit is required, a fee would need to accompany the application. Flatwork is for any work that will not be encompassed in any other permit, is not an additional permit. If someone is simply replacing the exact footprint of a driveway or patio, i.e. not increasing the square footage, no flatwork permit would be required

   2.1.2 Suggestion to the City is to add on the back of the permit the definitions/examples of Impervious Surfaces (paved driveway, pool, etc); and Green Infrastructure for Stormwater Management (tree, rain garden, french drain, etc).

   2.1.3 Required for outside of City right of way. This is different than a GISW ordinance since rooftops would be impervious but not flatwork, for example. However, a GISW ordinance should apply to flatwork permit as well.

   2.1.4 Good location in ordinance is under https://ecode360.com/28293615#28293615

   2.1.5 City website section on all city permits (as reference) https://app.mygov.us/pi/citizen/download_forms.php?limit=0&&citiesID=362

   2.1.6 On 3/19/2024, Agreed that the same threshold area should be used for both the Flatwork Permit and the GISW ordinance.

   2.1.7 On 3/26/2024 – Mirela offered to draft ordinance language for the flatwork permit.

   2.1.8 On 4/30/20204 – Discussed need for flatwork permit separate from green infrastructure ordinance. Putting the flatwork permit under Zoning Section 400.15 allows this to be listed with the other permits, and to clarify for City administration. Mirela made her best estimation on where this belongs. City attorney Mulligan will have a chance to review and might have a different opinion.

2.2 Definition of Impervious Area

2.2.1 Suggest that the ordinance just use the term impervious. U City permits and guidelines is the best place to define impervious area.

2.2.2 One possible definition is in the Kirkwood Guidelines for Stormwater Management. Page 1 (Background and Purpose), 1st paragraph, second sentence "Impervious cover or areas are man-made areas that cannot absorb water from rain or snow. Driveways, rooftops, patios, sport courts, tennis courts, and pools, for example, are considered impervious; surfaces such as decks, lawn, or gardens, where the rainwater is allowed to soak into the ground, are not considered impervious. Impervious area increases the amount of rainwater runoff and can cause flooding."

2.2.3 Question to U Heights Flood Task Force. Should a wood deck be considered impervious? Kirkwood does not. It stands to reason that a wood deck with planks butted tightly together (<1/8 inch gap) could act similarly to concrete pavement and would be considered impervious

2.3 Avoiding potential conflict between MSD permit requirements and U City matrix

2.3.1 Ordinance should state that the matrix applies when a MSD permit is not required.

2.3.2 This helps address the fact that:

2.3.2.1 MSD occasionally does regulate new land disturbance and impervious area < 1 acre in size

2.3.2.2 Techniques being considered in the matrix are not all acceptable to MSD (e.g. dry wells)

2.3.3 When does the City submit plans to MSD for review?

2.3.3.1 Mirela provided a check list of 12 items that is a guide. *(See Attachment 1)*

2.3.3.2 In addition, Mirela suggested that she contacts MSD when size is > 1 acre at a minimum, but also (per item #12) whenever she is unsure of whether MSD needs to be contacted or not.

2.4 How to make sure a GISW item remains in place in subsequent years? Options include:

2.4.1 Tie to occupancy permit

2.4.2 Easement area recorded on the legal plat document

2.4.3 Annual self-inspection, where property owner submits signed document that the matrix item is still in place and provides a photo as proof.

2.4.4 We recommend that City staff develop procedure for this, with preference for annual self-inspection since this has a lower cost burden on City staff. This procedure could also allow for the potential to adjust/change GISWs.

2.5 Storm/Volume on which matrix items will be based

2.5.1 Base this on 1.14 inches (1-yr 40 min storm or 2-year 30 min storm). This is consistent with MSD and Missouri Botanical Garden.

2.5.2 The goal clarified by the U Heights Flood Task Force at the 11/14/2023 meeting was:

2.5.2.1 Improve U City code which does not currently regulate new impervious area less than 1 acre. Improvement should be as close as you can get to zero increase in stormwater runoff.

2.5.3 Differential rainfall runoff – The offsets discussed to date (on 11/30/2023, 1/18/2024, and 1/25/2024) have been based on using a differential rainfall runoff increase. The understanding is that turfgrass itself creates a certain amount of rainfall runoff. A development to change turfgrass to impervious would generate more rainfall runoff. The matrix items would then be sized to handle these differential runoff increases. In doing so,

the U Heights goal for no increase would be met.

2.6 Matrix Item #1 – Plant native plants, such as grass and herbaceous vegetation

2.6.1 Decided to base this on 1.14 inches (1-yr 40 min storm or 2-year 30 min storm).

2.1 Matrix Item #2 – Amended soil ~~Direct new impervious surface runoff to permeable areas~~

2.1.1 Decided to base this on Kirkwood's design guidance, which correlates well to Garry's calculations. This is a 1:1 ratio assuming a 12-inch deep amended soil.

2.2 Matrix Item #3 – install tree cover

(BELOW IS ACCUMULATED FROM PREVIOUS MEETINGS)

2.2.1 Decided to account for two different tree sizes: overstory (biggest trees) and understory (smaller trees). 1 mature overstory tree (e.g. oak) can be used to offset 500 SF of new impervious area. 1 mature understory tree (e.g. dogwood or eastern redbud) can be used to offset 100 SF of new impervious area. Require using only trees native to Missouri. Yield to City Forester to provide further guidance to City staff for administering the matrix.

2.2.2 Decided how to implement item #3:

2.2.2.1 Require U City Arborist approval of the developer's tree planting plan. This would help address the following possible complications. Planting trees too close together would compromise the tree's health. Planting trees too close to a house or utility (e.g. power line or sanitary lateral) should be avoided.

2.3 Matrix Item 4 – Install permeable pavement

2.3.1 Decided to defer to Kirkwood manual on permeable pavers (page 31)

2.3.2 100 SF of new impervious requires 40 SF of 6-inch deep permeable pavement, for example.

2.4 Matrix Item 5 – Aerate lawns

2.4.1 Deleted this due to maintenance difficulties.

2.5 Matrix Item 5 – Green roof

2.5.1 Discussed that offset should be same as item #1 since it is essentially creating a native planting area. This is appropriate for a sloped roof

2.5.2 Should there be a different offset for a flat roof ?

2.5.3 Evapotranspiration - this benefit is real, but should not be used as a design parameter since evapotranspiration benefit is on the year, but the ordinance is attempting to deal with a single storm event.

2.5.4 Discussed re-visit the offset to go from a runoff coefficient of 0.95 (impervious area) to a runoff coefficient of 0.1 (natives)

2.5.5 Mirela indicated that Brentwood does not include a green roof in their guideline.

2.5.6 Discussed that an engineered design will likely be required for a green roof due to structural considerations and the City's requirement for International Building Code (IBC) design.

2.5.7 Susan and Mirela shared:

2.5.7.1 Examples of local green rooms (New City School, Sheetmetal Workers Union, Children's Hospital, Missouri S&T, etc). All were flat roofs.

2.5.7.2 Local experts (greenroofs.com, Kelly Luckett owner of Green Roof Blocks).

2.5.7.3 Feels that the green roof would act like a detention basin, and that we should consider flat roofs not sloped roofs.

2.5.7.4 Missouri S&T shows that green roofs reduce runoff by 60%. That means 40%

detention, which would act like native planting, which is a 1:1 compensation.

2.5.8 All agreed to a 5:1 offset assuming flat green roof.

2.6 Matrix Item 6 – Rain barrel / rain cisterns

2.6.1 State that these features must be emptied between rain events to be functional.

2.6.2 After some discussion of various offsets, the value of 1 SF : 0.6 gallons was accepted. This roughly equates to 100 SF of new impervious area requiring (1) 55-gallon rain barrel. This more than offsets the increase in runoff from grass to impervious which is actually only 38 gallons. This is also roughly in line with the MO Botanical Gardens, which shows that 100 SF requires 73 gallons of rain barrel.

2.7 Matrix Item 7 – Install infiltration basins such as rain gardens and bioswales

2.7.1 Decided to defer to the MO Botanical Garden rule of thumb (5:1), which respects Garry's calculations based on differential runoff, with some accommodation of sloped ground and berm. This ratio of 5 impervious area : 1 rain garden ponding area is based on a 6 inch deep rain garden. Require applicant to demonstrate adequate ponding area for depths that vary from 6 inches.
https://www.missouribotanicalgarden.org/sustainability/sustainability/sustainability/sustainable-solutions-for-you/rainscaping-guide/design-and-build-a-rain-garden/determine-rain-garden-size-and-depth

2.8 Matrix Item 8 – French Drain ~~Detention basin~~

2.8.1 Discussed that for the size of development that is being targeted by the ordinance/matrix, a detention basin is effectively the same as a rain garden.

2.8.2 Decided to replace item 8 with French Drains

2.8.2.1 They are listed in Kirkwood's design guidance as the similar Dry Wells (page 15)

2.8.2.2 They are included in the USGBC LEED manual
https://www.usgbc.org/credits/homes/v2008/ssc4

2.8.2.3 City (Mirela) says that a French Drain was one of the most popular BMPs used in Crestwood to mitigate new impervious area

2.8.3 Design basis – decided to use the same volume as rain garden, but divide by 0.4 (accounts for void spaces between gravel), which yields an offset of 12:1.

2.8.4 Require that the surface is grass - consistent with Kirkwood, and U Heights will likely prefer it.

2.9 Ordinance location for GISW matrix is Chapter 405 Subdivision and Land Development Regulations

2.9.1 City (Mirela) suggests the best location is to add it to Code Chapter 405.510.

2.9.1.1 City (Mirela) provided "Section 405.510 Revised Ucity code 2-29-2024.docx"

2.9.1.2 Suggested item c (in red) is a good location to call for the new ordinance. The group discussed that the wording suggested by Mirela is different than what we've been discussed. Agreed that it needs to be reworded and needs work to call for threshold limit of impervious and new matrix.

2.9.1.3 On 3/19/2024, we revisited this. We agreed that a version of the matrix table should be included in the ordinance, but possibly without the references column. The reason is that the links in the reference column might not stand the test of time. The full matrix, with references should be included a version of the table that the City cold share to educate residents, and the references could more easily be periodically updated by DPW.

2.9.1.4 On 3/26/2024, we discussed a draft of the ordinance. All were in agreement with the language as written. This includes statements to address possible credit for pre-existing matrix items and the suggestion to address maintenance.

2.9.2 Discussion about trigger threshold for new impervious. Previous discussions have been based on 100 SF. City (Mirela) suggested that this might be too low and maybe 200 SF would be more appropriate. Group decided to list 100 SF for initial draft.

2.9.2.1 On 3/20/2024, we revisited this discussion. Agreed that the same threshold area should be used for both the Flatwork Permit and the GISW ordinance. Discussed that the Brentwood trigger is 200 SF and the Kirkwood trigger is 1,000 SF. Agreed to state that the trigger in U City is 100 SF and allow further discussion outside the Stormwater Commission between the City Council, City DPW, City Legal, and the U Heights Flood Task Force. This trigger is tied to the workload of City staff.

2.9.3 The new GISW ordinance is in line with City Code Chapter 405.490 Utilities, including the following excerpts:

2.9.3.1 405.490.C.2 "Every development shall be designed to control storm water runoff. All storm sewers, storm sewer connections, detention/retention facilities, and other storm drainage improvements shall comply with MSD design standards and design standards established by the Director of Public Works and Parks. In instances where there are differences between MSD standards and those established by the Director of Public Works and Parks, the most restrictive standard shall apply."

2.9.3.2 405.490.C.5 "In single-lot developments, drainage detention facilities, or other storm drainage facilities that will not be maintained by MSD shall be maintained by the property owner.

2.9.3.3 405.490.C.6 "...The rate of discharge of surface water shall be in accordance with the requirements of MSD, except that the Director of Public Works and Parks may require a more restrictive discharge rate in areas where flash flooding, bank erosion, or other chronic storm water drainage problems exist."

2.10 Status

2.10.1 The Ad-Hoc committee's revisions to the University Heights proposed ordinance changes are complete and involve two City ordinances.

2.10.1.1 *See Attachments 2* – 400.15_Rev00.docx – revision to code for a new flatwork permit

2.10.1.2 *See Attachment 3* – Flatwork Permit Application

2.10.1.3 *See Attachment 4* – 405.51_Rev00.docx – revision to code calling for:

2.10.1.3.1 No improvements shall increase storm water runoff onto adjacent properties

2.10.1.3.2 Green Infrastructure to offset New Impervious Development

2.10.2 See item 2.11 for remaining work.

2.11 Subjects raised, but not yet fully addressed

2.11.1 Organize a presentation at a regular meeting of the Stormwater Commission to explain the finalized version of the Ad-Hoc committee's revisions to the University Heights proposed ordinance changes.

2.12 References

The following are a list of references reviewed.

2.12.1 Cityof Kirkwood, MO – Stormwater Management Guidance; Green Infrastructure Techniques

for Stormwater Management (January 2022)
https://www.kirkwoodmo.org/home/showpublisheddocument/7847/637854587558070000

2.12.2 Local communities listed in the HR Green report to City (Feb 8, 2023): Town & Country/Olivette/etc

2.12.3 Dubuque, IA - Bee Branch Watershed Flood Mitigation Project

2.12.4 Tulsa, OK – From Harm's Way; Flood Mitigation in Tulsa, OK (1993)

2.12.5 Springfield MO on Fassnight Creek Stormwater Improvement Project

2.12.6 City of Brentwood "Brentwood Practices for Stormwater Control"
https://www.brentwoodmo.org/DocumentCenter/View/28005/Stormwater-Control-Best-Management-Practices

2.12.7 EPA 430-S-18-001 Estimating the Environmental Effects of Green Roofs: A Case Study in Kansas City, Missouri (August, 2018).
https://www.epa.gov/sites/default/files/2018-09/documents/greenroofs_casestudy_kansascity.pdf

2.13 Grants

2.13.1 Susan asked if the City was aware of any grants that could help incentivize implementation of the GISW.

2.13.2 Mirela suggested that the City could refer property owners to the MSD small and large scale grants program. The first link is the general program. The second and third links are maps showing the geographic areas where the grants are available.

2.13.2.1 https://msdprojectclear.org/what-we-do/rainscaping/

2.13.2.2 https://stlmsd.maps.arcgis.com/apps/webappviewer/index.html?id=1dc144bdb9b2484b82cfe73cc8a3c8d1

2.13.2.3 https://stlmsd.maps.arcgis.com/apps/webappviewer/index.html?id=59ce6f7bc688469ea37423f969889fc7

2.13.3 MO DNR Clean Water State Revolving Fund (CWSRF) Green Project Reserve

2.13.3.1 https://dnr.mo.gov/print/document-search/pub3055

2.13.4 Fastnight Creek presentation shared some funding sources

Funding

Missouri Department of Conservation – Community Conservation Grant
- native plantings to restore urban wildlife habitat

Environmental Protection Agency Section 319 Grant Funds administered by James River Basin Partnership
- modifications of impervious hardscapes to pervious naturalized channel

Missouri Department of Natural Resources Stormwater grant program
- Naturalized channel construction/stream restoration
- ¼-cent capital improvement funds

3 **Next meeting** – Business was not completed. Net meeting date is TBD.

4 **Adjournment.** Adjourned at 6:30 PM.

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6801 Delmar Boulevard, University City, Missouri 63130,
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Minutes Preparation. The minutes were prepared by Eric Karch.

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ATTACHMENT 1

MSD Plan Review and Permitting Required Instances:

1.) MSD has identified a stormwater or sanitary project on the parcel or in the nearby area

2.) Sites where there are downstream storm water problems, flooding, erosion, seepage

3.) Overland flow issues, contours indicate a possible overland flow path, the site is in a "valley" area or low spot, there has never been a house on this lot previously

4.) Lots near low spots/dips in the road

5.) Proposed development is in close proximity to existing sewer facilities and/or easements, the sewer/easement is within a 1:1 zone of influence of the proposed building/footing, there has never been a house on this lot previously

6.) If there are any known issues with shared sewer laterals or sewer laterals that are crossing other properties

7.) There is no public sanitary sewer adjacent/available to directly serve the lot being developed ("directly" means that a sanitary lateral connection can be made to the public sewer without the lateral crossing another property)

8.) Development in or near possible sinkhole areas, or development that will affect or is tributary to sinkhole areas

9.) Any project that disturbs one acre or more

10.) Any project where property line changes are proposed

11.) Other items/instances as determined by the City and/or MSD

12.) If unsure, please contact MSD Development Review, East or West Team depending on which side of the map Watershed Boundary Line the site is located on, as follows:

For East Team projects, Mark Kuelker 314-335-2064 or mkuelker@stlmsd.com

For West Team projects, Bob Miller 314-335-2053 or ramill@stlmsd.com

4.040.03 Waterway Alignment

The bridged waterway will be aligned to result in the least obstruction to stream flow, except that for natural streams consideration will be given to future realignment and improvement of the channel.

4.040.04 Erosion Protection

To preclude failure by scouring, abutment and pier footings will usually be placed either to a depth of not less than five (5) feet below the anticipated depth of scour, or on firm rock if such is encountered at a higher elevation. Large multispan structures crossing alluvial streams may require extensive pile foundations. To protect the channel, revetment on channel sides and/or bottom, consisting of concrete or grouted rock blanket should be placed as required. The governing authority should be contacted regarding their design requirements.

4.050 Outlet Erosion Protection

If outlet velocities exceed 5 fps, an appropriate erosion protection must be provided. Erosion protection may be required at outlets where velocities are less than 5 fps if soil conditions warrant.

For paved channels a cutoff wall will be required at the termini with appropriate protection. The cutoff wall shall extend a minimum depth of four (4) feet into the existing ground line.

4.060 General Performance Criteria for Stormwater Management for Development and Redevelopment Projects

4.060.01 When Required

1. The requirements of stormwater quantity and quality management shall be evaluated for all projects submitted to the District for review and approval. Stormwater management facilities shall be provided and designed in accordance with the requirements of this section. If another local jurisdiction requires more stringent design standards, then they shall govern in that locale. A Stormwater Management Facilities (BMP) Operation and Maintenance Design Report and Plan, including specific continuing resources, procedures and schedules to be used, shall be submitted for approval. If required and approved, the Plan shall be included in a recorded Maintenance Agreement by reference.

2. Stormwater quality and quantity management requirements shall be evaluated, and specifically, will be required for projects including:

   a. For MS4 Permit stormwater quality compliance (primarily in the separate storm sewer area); all new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than 1 acre that are part of a larger common parcel or project that is greater than one acre.

   b. For stormwater quantity compliance; projects which have a differential runoff of 2 cfs or greater for the 15-year, 20-minute event (separate sewer areas) or for the 20-year, 20 minute event (combined sewer areas). The differential runoff is calculated by the Rational Method using PI factors. For areas tributary to downstream stormwater problems, an undeveloped existing condition shall be assumed for calculating differential runoff, unless directed otherwise by the District. Existence of downstream stormwater problems may require quantity management on the proposed site, even where less than 2 cfs differential is proposed.

      Subsequent development or redevelopment of sites <u>without</u> prior stormwater detention shall provide detention or retention, when cumulative differential increase, since January 15, 2000, equals 2 cfs or greater. Projects <u>with</u> prior detention shall provide additional

detention or retention for increasing runoff irrespective of the 2 cfs threshold. The degree of commonality between subsequent or concurrent projects, sites or parcels within same watershed shall be as determined by the District for purposes of this section.

All project plans shall include a note on the cover sheet indicating disturbance and runoff differential as follows:

Project Disturbance = *Acres*
Project Runoff Differential = *CFS*
Any future land disturbance and/or increase in impervious area on this site may require additional stormwater management per MSD regulations in place at that time (including total land disturbance and/or imperviousness added on this plan).

3. When existing stormwater management facilities are going to be used to accommodate additional site disturbance and/or additional runoff from building or parking lot expansions or subdivision additions, the facilities shall be retrofitted to meet the current stormwater management requirements for the drainage area served by the facility. Projects which cannot meet this requirement due to physical constraints will be evaluated for alternatives on a case by case basis. Managing stormwater per current Regulations for the current proposed disturbance area may be an option.

4. The stormwater design for projects within designated levee districts such as Monarch-Chesterfield, Earth City, Howard Bend, and Riverport will be based on the Stormwater Master Plan for these districts. If the Stormwater Master Plan does not address water quality, the requirements of this manual shall apply.

5. Stormwater quality BMPs may include a combination of structural and non-structural BMPs. Before MSD can approve the development plans, MSD must be able to determine from the information provided by the engineer:

a. Whether the proposed work is new development or redevelopment. Sites with 20 percent or less existing impervious area are generally considered new development. Any subsequent or additional development or expansion projects on those sites will also be considered new development. Subdividing does not affect this determination. In some instances as determined by the District, the area of development proposed will be evaluated versus existing conditions for that area, to determine whether new development or redevelopment stormwater management criteria will be required.

b. Whether there are sensitive areas on the development site that should be protected by BMPs. For all new development projects, the engineer shall prepare an Existing Site Conditions Map to identify sensitive areas and natural resources. This Map may be based on the current version of the Site Design Guidance found on the MSD website.

c. Whether the development plan adequately protects sensitive areas and minimizes the creation of stormwater pollution. The engineer shall prepare a Site Development Plan that adequately protects sensitive areas and natural resources and that does not generate unwarranted amounts of stormwater pollution. This Plan may be based on the current version of the Site Design Guidance found on the MSD website.

d. Whether the development plan utilizes BMPs that effectively remove stormwater pollution. See Section 4.060.05 for a list of acceptable BMPs. BMPs shall be sized to capture the 90th percentile daily rainfall depth or 90 percent of annual rainfall (using continuous simulation modeling). For all new development sites, BMPs shall reasonably mimic pre-development run-off conditions by reducing runoff volume to calculated pre-development levels, to the maximum extent practicable.

1. **Rainfall Frequency**

A twenty (20) year rainfall frequency is to be used in the City of St. Louis and areas of St. Louis County where combined sewers are used. A fifteen (15) year rainfall frequency is to be used in areas of St. Louis County where storm sewers are separated from sanitary sewers. In the design of local storm sewer systems, a twenty (20) minute time of concentration shall be used, unless drainage area and time of concentration dictates a different duration as indicated in item 3 below. **Figure 4-1** gives rainfall curves for 2, 5, 10, 15, 20 and 100 year frequencies.

2. **Impervious Percentages and Land Use**

Minimum impervious percentages to be used are as follows:

a. For manufacturing and industrial areas, 100%*

b. For business and commercial areas, 100%*

c. For residential areas, including all areas for roofs of dwellings and garages; for driveways, streets, and paved areas; for public and private sidewalks; with adequate allowance in area for expected or contingent increases in imperviousness:

In apartment, condominium and multiple dwelling areas: 75%*

In single family areas:

1/4 Acre or less	50%
1/4 Acre to 1/2 Acre	40%
1/2 Acre to 1 Acre	35%
One acre or larger	Calculate impervious percentage*
Playgrounds (Non-Paved)	20-35%*

d. For small, non-perpetual charter cemeteries, allow 30%

For parks and large perpetual charter cemeteries 5%

***NOTE:** Drainage areas may be broken into component areas, with the appropriate run-off factor applied to each component, i.e. a proposed development may show one hundred percent (100%) impervious for paved areas and five percent (5%) impervious for grassed areas. Use of actual component areas may be required, however, where minimum impervious percentages are deemed misleading, or too approximate.

The design engineer shall provide adequate detailed computations for any proposed, expected or contingent increases in imperviousness and shall make adequate allowances for changes in zoning use. If consideration is to be given to any other value than the above for such development, the request must be made at the beginning of the project, must be reasonable, fully supported, and adequately presented, and must be approved in writing before its use is permitted.

Although areas generally will be developed in accordance with current zoning requirements, recognition must be given to the fact that zoning ordinances can be amended to change the currently proposed types of development, and any existing use. Under these circumstances the possibility and the probability of

residential areas having lot sizes changed or re-zoned to business, commercial, or light manufacturing uses should be given careful consideration.

e. Average 20-minute values of P.I. (cfs per acre) to be used are as follows:

Percent Imperviousness	20 Minute Duration 15 Year	20 Year
5	1.70	1.78
10	1.79	1.87
20	2.00	2.09
30	2.19	2.28
40	2.39	2.50
50	2.58	2.69
90	3.36	3.50
100	3.54	3.70

*Roofs (Combined Sewer Areas)
20-year 20 minute PI 6.00, 100-year 20 minute PI 7.75

*Roofs (Separate Sewer Areas)
15-year 20 minute PI 4.20, 100-year 20 minute PI 5.62

*When connected directly to sewer

3. **Reduction in P.I. with Time and Area**

Reduction in P.I. values for the total time of concentration exceeding twenty (20) minutes, and for tributary areas exceeding three hundred (300) acres will be allowed only in trunk sewers and main channels. The reduced average P.I. value for the tributary area shall not be less than the value determined as follows on the basis of:

a. Time. As the time of concentration increases beyond twenty (20) minutes, select the appropriate P.I. value from Table 4-2. The travel time through a drainage channel should be based on an improved concrete section. These reduced values shall be used unless a further reduction is allowed for area.

b. Area. As the total tributary area at any given location in a channel increases in excess of three hundred (300) acres, the P.I. value may be further reduced by multiplying it by an area coefficient "Ka". (The area coefficient is obtained from data in a special study of a major storm in the St. Louis area by the U.S. Corps of Engineers.) The average rainfall rate, for a given storm, for a given period for the tributary area, is less than the corresponding point value as determined from recording rainfall gauges. The curve data is as follows:

P.I. Coefficients Ka

Area (Abscissas)	"Ka" (Ordinates)
300 to 449 Acres	1.00
450 to 549 Acres	.99
550 to 749 Acres	.98
750 to 999 Acres	.97
1000 to 1280 Acres	.96
1281 to 1600 Acres	.95
1601 to 1920 Acres	.92
1921 to 2240 Acres	.91

ATTACHMENT 2

Chapter 400. Zoning Code
ARTICLE V. Supplementary Regulations

CURRENT UNIVERSITY CITY CODE

Current City code ends at Division 15 Marijuana Regulations.

PROPOSED CHANGES TO CITY CODE

A new Division 16 is proposed to be added as follows.

Division 16 Flatwork permit, Section 400. 1500

A. It shall be unlawful for any person to pave or otherwise create more than 100 square feet of impervious surface without first securing a Flatwork Permit to do so from the Public Works Department. It would include any paving, pavers, or any other impervious material outside of the right-of-way and not attached to another permit. To secure a Flatwork Permit an applicant must satisfy the requirements as set forth in Section 405.510.
B. Permits expire 180 days from the date of issuance.
C. The fee for such permit shall be in an amount established by the City Council.

ATTACHMENT 3

City of University City
Department of Public Works
6801 Delmar Blvd. University City, Missouri 63130 314-505-8560

FLATWORK PERMIT APPLICATION

Project site address: _____

Property Owner's Name: _____

Address: _____

Phone:_____Cell Phone: _____ Email: _____

Contractor's Name: _____

Address: _____Phone: _____

Contact Name: _____ Phone: _____ Email: _____

Project Scope: _____

_____

Increasing impervious cover by _____square footage.

Stormwater Management Applicable: YES_____NO _____

If yes, see requirements in Section 405.510 (A)(4)(c)

Applicant Signature: _____Date: _____

****

OFFICE USE ONLY

Project # _____Issue Date _____

Permit Fee _____Date Paid _____Payment Type _____

Permit Approved by _____Title _____Date Approved _____

****

FINAL INSPECTION NEEDED: YES _____NO _____

IF YES, Date _____Signature _____Title _____

Sec o-o Revised oo/oo/2024

ATTACHMENT 3

Typical submittal requirements for Flatwork permits include, but are not limited to, the following:

- Description of the proposed work, type of flatwork, total dimensions, and total square feet.
- Demonstrate that the proposed flatwork project ensures compliance with zoning ordinances.
- (3) copies of a site plan showing:
    - the location of all existing structures, paved areas, and the new impervious addition, with dimensions shown.
    - the direction that rainwater runoff will take to leave the paved areas indicated with arrows. Surface water shall not be directed to adjacent properties.
    - the location of new green infrastructure designed in accordance with zoning ordinances.
- During and after construction of the stormwater management facilities City requires that two inspections (Initial and final) of the facilities take place.
- No flatwork shall be placed over a utility easement.
- Additional documents may be requested by City staff to establish that the ordinances are being met.

ATTACHMENT 4

Chapter 405. Zoning Code
ARTICLE IV. Land Development Standards
Section 405. 510 Site Grading, Erosion Control, And Stormwater Consideration In Site Design

CURRENT UNIVERSITY CITY CODE

Section 405.510 Site Grading, Erosion Control, And Stormwater Consideration In Site Design.

[R.O. 2011 §16.16.100; Prior Code §29-51.8; Ord. No. 6143 §1(part), 1997]

A.4 Stormwater Consideration In Site Design.

[Ord. No. 7060, 11-13-2017[1]]

a. Applicability. The standards referenced and adopted in this Section shall apply to site design for any project which includes alteration of site drainage or floodplain areas, connection to storm sewer systems or open storm water channels, and all land disturbance projects encompassing more than one (1) acre.

b. MSD Approval Required. All private and public projects to which this Article is applicable must be reviewed and approved for storm water issues by the Metropolitan St. Louis Sewer District in accord with rules, regulations, standards, and procedures of that body prior to the issuance of any permits for land disturbance or construction.

c. Submittal Requirements. Applicants for any development, redevelopment, land disturbance, construction or other undertaking to which this Article is applicable shall be required to provide any and all information necessary to enable the Metropolitan St. Louis Sewer District ("MSD"), the City and City plan review personnel to assess and apply the principles promulgated by MSD known as "Site Design Guidance — Tools for Incorporating Post-Construction Stormwater Quality Protection Into Concept Plans and Land Disturbance Permitting," and "Landscape Guide for Best Management Practice Design," as revised from time to time.

[1] Editor's Note: Ord. No. 7060 also changed the title of this Section from "Site Grading and Erosion Control" to "Site Grading, Erosion Control, And Stormwater Consideration In Site Design."

PROPOSED CHANGES TO CITY CODE

Item 405.51 A.4.c is proposed to become Item 405.51 A.4.e

Item 405.51 A.4.c is proposed to be added as follows:

405.51.A.4.c. No improvements shall increase storm water runoff onto adjacent properties.

Item 405.51 A.4.d is proposed to be added as follows:

405.51.A.4.d. Green Infrastructure to offset New Impervious Development

To reduce the impacts of any development on stormwater, the City requires that stormwater management measures be utilized when proposed increases in impermeable development exceed 100 square feet (sf or SF) unless MSD evaluates the development for stormwater. MSD permit requirements take precedence. Impervious development includes new buildings, new garages, new sheds, new gazebo, new patio, new walks, new driveway or other new pavement (asphalt or concrete or pavers in which most of the individual pavers are in contact with each other), or similar new structure or pavement. Surfaces such as decks, permeable pavement, permeable pavers, where the rainwater is allowed to soak into the ground, are not considered impervious. Green infrastructure such as shown in the following table are encouraged, but alternate green infrastructure may be proposed and approved for review by City permitting officials. The use of matrix items is site-specific. The developer is invited to discuss with the City which matrix items may be the most successful and easiest to maintain. Variances due to pre-existing matrix items that are in place prior to the new impervious development may be considered on a case-by-case basis by the Public Works Director. Offsets are not required for replacement of existing impervious site features when area of proposed and existing impervious features are equal. This guideline is complementary to the use of the Metropolitan St. Louis Sewer District (MSD) Rules and Regulations and Engineering Design Requirements for Sanitary Sewer and Stormwater Drainage Facilities, as set forth in item 405.51.A.4.e.

ATTACHMENT 4

#	Green Infrastructure	Offset Guidelines Ratio of New Impervious surface area: to green infrastructure improvement
1	Plant Native Plants such as grassy and herbaceous vegetation.	1 : 3.25 Example: 100 SF of new concrete patio must be offset by establishment of 325 SF of native garden plants replacing turf grass.
2	Amended Soil Good soil for growing vegetation Porous soil to soak up sheet flow. Suitable for narrow areas of pavements	1 :1 for amended soils installed 1 ft deep. The area of amended soils must generally be installed along the downhill side of the new impervious area and at a width equal to the longest flow path of the new impervious area it is treating. Example: A new 20 foot x 40 foot patio drains to the long side requires a 20 foot x 40 foot amended soil area.
3	Install tree cover	100 SF : One tree Tree planting plan approval by City Arborist. Example: 100 SF of new concrete patio can be offset by planting and maintaining one large tree (canopy trees such as oaks and maples). For practicality, one understory tree per 100 SF of impervious area addition will be accepable
4	Install permeable pavement including sand base at least 3 inches thick	No offset required as this is not considered an impermeable development.
5	Build green roofs	5:1 Example: 100 SF of new concrete patio can be offset by converting 20 SF of a flat roof to a green roof
6	Install rain barrels to capture and slow runoff	100 SF : 55 gallons of barrel
7	Install infiltration basins such as rain gardens and bioswales	5:1 Example: 100 SF of new concrete patio can be offset by installing a rain garden 20 SF with an average depth of 6-inches[1].
8	French drains (shallow small detention basins constructed as shallow rectangular trenches filled with gravel and covered with 6 to 12 inches of topsoil and turf grass)	4 :1 for 6-inch deep French Drain[2] 7 : 1 for 12-inch deep French Drain[2]

1 - Differential runoff and detention are based on a 1.14 inch, 60-minute rectangular rainfall hyetograph (1.67 annual probability of occurring). Rain garden basin areas are based on an average depth of 6 inches and consider the volume in sloping slide walls.

2 -French Drain and related Dry Wells are based on gravel with a void volume of 50 percent.

Thresholds that trigger GISW (Green Infrastructure Stormwater Management) requirements

Communities Reviewed
by
Ad Hoc Subcommittee for Pervious Surfaces Ordinances 2023-2024

Crestwood	MO	**200**	GISW
Brentwood	MO	**200**	GISW
Kirkwood	MO	**1,000**	GISW
Ladue	MO	**400**	GISW
Olivette	MO	**400**	GISW
Town& Country	MO	**2,500**	GISW
University City (proposed)	MO	**100**	GISW
Webster Groves	MO	**100**	GISW

Urban Flood Control Projects

Springfield	MO	Flood Project
Dubuque	IA	Flood Project
Tulsa	OK	Flood Project
Kansas City	MO	Green Roof Project