Storm Water Commission
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**Draft: MINUTES OF THE STORMWATER COMMISSION**
**February 4, 2025**

**Call to Order.** The forty-eighth meeting of the Stormwater Commission (Commission) was called to order at 3:30 PM on Tuesday, February 4, 2025, by Chair Todd Thompson. The January meeting was canceled because of a snow storm.

1. **ttendance-Roll Call**. The following Commission members were present at the Community Center: Susan Armstrong, Garry Aronberg, Robert Criss, Phillip Eastin, Mark Holly, Eric Karch, Todd Thompson. Also, in attendance were Dennis Fuller, Councilman; Darin Girdler Director of Parks and Recreation; John Mulligan, City Attorney.

   Visitor: David Sandel, resident and iNeighborhood

2. **Agenda.** By voice vote, discussion of proposed FEMA flood insurance rate map was added to the published agenda. The amended agenda was approved by voice vote (motion by Armstong, second by Holly):
   *Attendance-Roll Call; Approval of Agenda; Approval of Minutes; Citizen Comments; Announcements by Commissioners; Committee Reports; New Business to included discussion of FEMA proposed FIRM; Old Business; Council Liaison Comments; Adjournment.*

3. **Minutes**. The minutes of the December, 2024, meeting was approved (Eastin, Holly).

4. **Citizen Comments.** None.

**Announcement By Commissioners and Staff**. None

5. **Committee Reports**
   - River Des Peres (RdP) Monitoring Subcommittee
     - Commissioners Eastin and Karch and Criss with assistance from David Sandel reported the following information.
       - Geolux radar elevation sensors and cameras have been installed at two locations: (1) the upstream end of MSD's RdP Tubes southwest of the intersection of Kingsland and Vernon; (2) the Hafner Court Apartments northeast of the intersection of Olive and 82nd Street.
       - The installation was completed by PayneCrest Electrical Contractors under contract to University City.
       - Calibration is on-going.
       - Web page development for public access and communication and integration of the water surface elevation and camera data is on-going, including selection of integration method, internet, cellular, radio, iNeighborhood.
       - Dave Sandel's iNeighborhood company has been instrumental in equipment installation webpage development.
       - A sight gauge will be installed at the Tube.
       - We need to resolve the inconsistencies between our very focused flood

warning system and the National Weather Service's broader waring system. Discussions continue with the Fire Chief about warning notifications. Fire Chief has authority to issue warnings and that is appropriately his responsibility.

- Batteries have been replaced at the three rain gueges that are key to our early warning system. (1.5 inches of rainfall in one hour is the threshold for imminent flash flood.)

- **Ad Hoc Committee to develop an ordinance**.
  - Code and Planning and Zoning is reviewing the impervious ordinance.
  - SW Commission renewed our preference for using a 100 square foot threshold for permitting new flat work and requiring runoff control of the differential runoff.

**6. New Business**

- Commissioner Criss discussed his evaluation of FEMA's proposed Flood Insurance Rate Map and pointed out the following key facts. Commissioner Criss's detailed analysis is attached to the minutes.
  - Proposed water surface elevation of the base flood (100-year elevation) is too low. The proposed WSE is not consistent with flooding history over many decades, recent flood history, and flows in the RdP.
  - **Commission moved that Commissioner Criss's report by sent to City Manager Rose for discussion by Council and transmission to FEMA.**
  - Commissioner Criss may also send his comments as an individual without City's participation.

**7. Old Business**. None.

**8. Council Liaison Comments**.

**a. Councilman Fuller reported:**

1) Wilson Avenue buyouts are now funded, and the purchases will begin soon.
2) Mixed used development project has begun construction on Delmar at site of Commerce Bank and Craft Alliance buildings in the Loop.
3) Dr. Lisa Brenner has been selected to replace Jeff Hales on the City Council representing Ward 1. Jeff Hales had resigned to take position as State Representative. Dr. Brenner has been an active community member for many years and has served on the School Board in the past.

**9. Adjournment. Motion to adjourn passed at 4:58 PM (Armstrong, Holly).**

**Minutes Preparation**. The minutes were prepared by Garry Aronberg.

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# Evaluation of the Preliminary, 2024 FEMA FIS on the upper River des Peres, University City, Missouri

draft 2/3/25

Robert E. Criss, Professor Emeritus, Washington University in St. Louis

**Abstract.** Comparison of the FEMA FIS models on the upper River des Peres with the historical record and with flood mark data from several recent floods shows that the 2024 update is much less realistic than the standing 2015 FEMA model.

**Introduction.** The upper River des Peres (uRdP) is an extensively studied and heavily monitored watershed that drains a 9.7 sq. mi. area in St. Louis County, Missouri. Most of the uRdP basin is included in University City, but its headwaters extend into the municipalities of Overland, Olivette, and Pagedale. The watershed has a very high impervious character of 43.5% (Southard, 2010), and the main thalweg is highly channelized, with large reaches having concrete, rock or riprap walls. At its lower end the open channel of the uRdP enters a 21' dia. concrete drainage tunnel that was completed in 1940. Further downstream this tunnel gathers contributions from additional tributaries and storm sewers while progressively increasing in size, until ultimately debouching into the trapezoidal, open channel of the lower River des Peres about 3.5 air miles to the southeast (ASCE, 1988).

The uRdP has experienced repeated, damaging flooding, and a combination of factors renders it, for its size, the flashiest stream in Missouri (Criss, 2022). The most damaging floods occurred in 1957, 2008, and 2022, but even since 2008, the finished floors of several homes were damaged in 2011, 2013, 2014, 2019, 2020, and 2022, with basement flooding being far more common. The 2008 flood resulted in two fatalities and a federal buyout of ~24 damaged homes, mostly along Wilson Ave (e.g., University City, 2010). The 2022 flood was even higher, causing severe damages and the condemnation of ~300 homes in University City alone, and caused yet another fatality about 0.8 miles downgradient of the tunnel entrance. The vast majority of homes along the uRdP floodplain that were damaged by these floods were built in the 1940s and 1950s, apparently in the mistaken belief that the massive channelization and tunnel projects had eliminated flooding problems in the area.

**Methods.** This report will compare the preliminary 2024 FEMA FIS model with 1) the standing FEMA FIS of 2015; 2) the post 1997 record of peak annual water levels at the uRdP gauge in University City (USGS, 2025); 3) the stage-discharge calibration at the uRdP stream gauge (USGS, 2025); and most importantly 4) the detailed records of uRdP flood marks that are available for the damaging floods of 1957 (Hauth and Spencer, 1971), 2008 (Criss and Nelson (2022), and 2022 (Criss et al, 2022). All measurements and calculations are referred to thalweg distances as established by FEMA (2015), in feet upstream of Kingsland Ave. in University City.

**Results.**

*Flood Profiles.* Figure 1 compares the "100 year" flood profile along the lower ~3 miles of the uRdP calculated by FEMA (2024) with that estimated by FEMA (2015). Those theoretical profiles are compared with measured flood levels for the three highest floods, which occurred in

June 1957 (Hauth and Spencer, 1971), September 14, 2008 (Criss and Nelson, 2022), and July 26, 2022 (Criss et al., 2022). The latter flood was the most severe, and its profile is based on data collected by 9 in-channel level sensors, an extensive, post event survey of flood marks, and the USGS gauge. The flood of August 1915 may have been even higher, but it is poorly documented and much less relevant as it occurred before the major channelization and drainage tunnel were constructed, and long before the impervious character of the uRdP basin became so high.

Figure 1 shows that most of the measured water levels of the 1957, 2008 and 2022 floods were well above the FEMA (2024) estimated profile. Were this profile to be adopted, 10s to 100s of homes that were damaged during each of these events would NOT be included in revised Zone AE. The owners and future buyers of these homes would be misled as to the great flood risk that is clearly associated with these properties.

Note that the severity of the 2022 flood increased downstream (Fig. 1), exceeding all prior estimates of "500 year" levels near and downstream of the tunnel entrance, located 1250 ft. upstream of Kingsland Ave. This extraordinary condition arose because the uRdP drainage tunnel became overcharged and overwhelmed during this flood, partly due to constriction by large concrete blocks that moved into the tunnel (Criss et al., 2024). The tunnel capacity and its rating curve are key issues and are essential for modeling efforts; a radar stream gauge has been recently installed by UCFWS (2025) to secure the accurate data needed to quantify this.

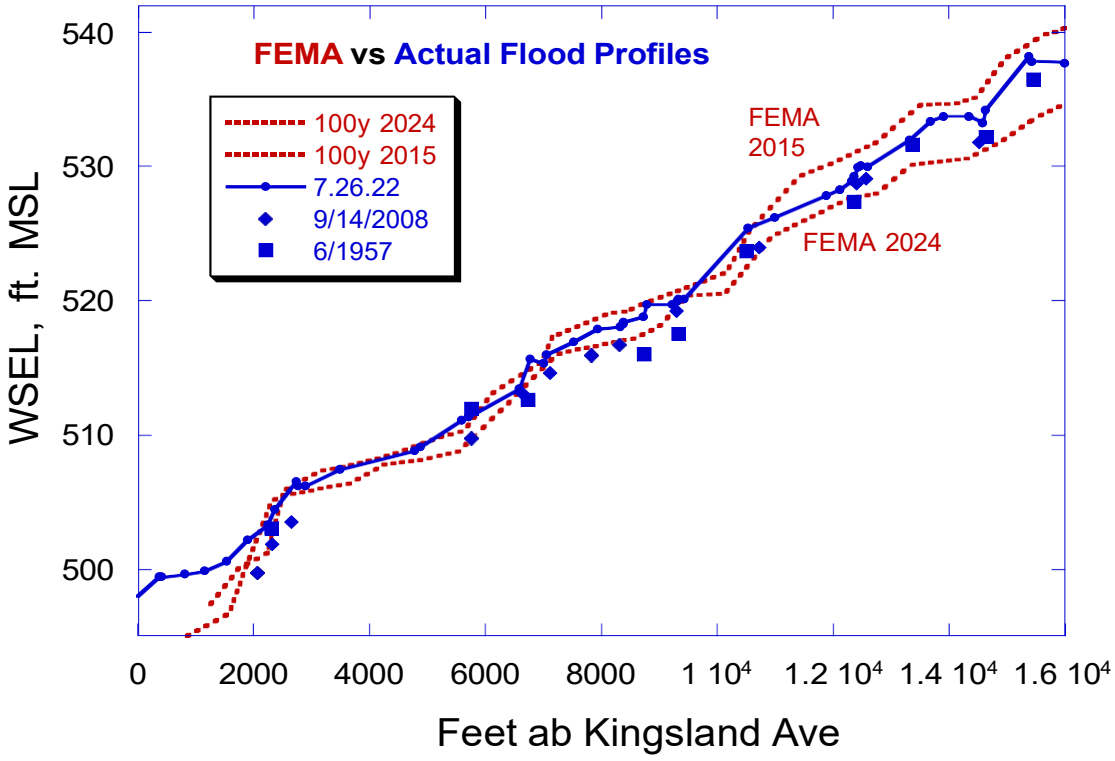


**Figure 1.** FEMA's 2015 and 2024 estimated profiles of the base, "100 year" floods along the uRdP (red dotted lines) compared to the detailed measured profile of the record flood of July 26, 2022 (data-point dots and interpolated solid blue line; Criss et al., 2022), and with flood marks (blue diamonds and squares) for the 2008 and 1957 events as reported by Criss and Nelson (2022) an d Hauth and Spencer (1971). The FEMA 2024 profile is too low to be realistic.

*Statistical Flood Levels.* Data for peak annual water levels are available for USGS gauge 07010022 on the uRdP for full years starting with 1998, based on a nearly complete record of stage readings every 5 minutes for 27 years (USGS, 2025). The mean annual peak stage and its standard deviation is 14.60 ± 2.00 ft, corresponding to a WSEL of 506.36' rel MSL. As calibrated by USGS (2025), the mean annual peak flow is 3570 ±975 cfs.

Simple statistical processing of these annual peak stages provide the results in the "Gaussian" column of Table 1, where the left column shows the familiar recurrence interval in years, instead of the more accurate annual percentage of exceedance. (e.g., "100 year" instead of 1.0%). For each statistical water level, the companion number in each column indicates the number of observed events in the 27 year-long USGS record that exceeds that level. The next column, the Criss estimate, shows the expected statistical flood peaks for the year 2025, based on the trend analysis method of Criss (2016), which both quantifies and incorporates the progressive worsening of floods at this specific site that is documented by the gauge data. For this case only, the tabulated number of floods compares each event to the statistical water levels at the time of occurrence, which has steadily risen by about one foot over the 27 year period of record. The next column is the estimate from the recent USACE (2021) evaluation report, based on a detailed study that used PCSWMM to simulate flows that were then incorporated in their HEC-RAS model. The last two columns show the statistical water levels estimated by FEMA, as read from the graphical stream profiles in the 2015 and 2024 FIS reports for this particular site.

Simple statistical analysis shows that the observed record of annual floods is consistent with the Criss (2025) and FEMA (2015) estimates, unsupportive of the simple Gaussian and USACE estimates, and incompatible with the FEMA (2024) estimate, which can be rejected with >99.9% confidence. In short, the FEMA (2024) FIS unreasonably suggests that flooding along the uRdP will be less severe than was estimated by FEMA (2015) and HUD (1978). To the contrary, abundant evidence shows that flooding along Midwestern rivers has been increasing in severity for >100 years (Criss and Luo, 2017), and that precipitation and flooding extremes and associated damages have grown for decades in the USA (NOAA, 2023).

**Table 1**: Statistical Flood Levels at Gauge 07010022

| Return Interval, y | Gaussian | Criss estimate; 2025 stages | USACE 2021 | FEMA 2015 | FEMA 2024 |
|---|---|---|---|---|---|
| <2 y | <506.4 ; 14 | <506.8; 14 | <507.5; 17 | | |
| <10y | | | | <509.2; 26 | <507.0; 15 |
| 2 y | 506.4 ; 11 | 506.8 ; 11 | 507.5 ; 9 | | |
| 10 y | 509.0 ; 1 | 510.1 ; 2 | 509.4 : 1 | 509.2 ; 0 | 507.0 ; 5 |
| 50y | 510.5 ; 0 | 512.1 ; 0 | 511.5 ; 0 | 510.3 ; 1 | 507.9 ; 5 |
| 100y | 511.0 ; 1 | 512.8 ; 0 | 512.2 ; 0 | 511.4 ; 0 | 508.4 ; 1 |
| 500y | 512.2 ; 0 | 514.2 ; 0 | 513.8 ; 0 | 512.9 ; 0 | 509.6 : 1 |
| Total | 27 | 27 | 27 | 27 | 27 |

*Rating Curve Comparison.* Figure 2 shows that the stage-discharge pairs for the 27 annual peak floods (crosses) are compatible with the rating curve for this gauged site (blue line). This

agreement is expected because the channel in this vicinity is concrete and rock-lined, so its geometry has been affected only by thin gravel deposits on its concrete bottom, and because the discharge estimates for the 27 actual floods are based on the USGS's own field measurements and their own extrapolated rating curve based on those data (USGS, 2025).

In contrast, the stage-discharge pairs estimated by FEMA (2024) for the 10, 50, 100, and 500-year floods are incompatible with those estimated by FEMA (2015), and both are incompatible with the real USGS field measurements and the resultant USGS rating curve, which has changed little since the gauge was installed.

Accurate simulations of many flood pulses at the USGS gauge solely from the observed rainfall (UCFWS, 2025), using the theoretical diffusion model of Criss and Winston (2008), lend support to the accuracy of the USGS rating curve. This predictive method has no free or fitting parameters at any gauged site because the time constant can be fully constrained (Criss, 2022).

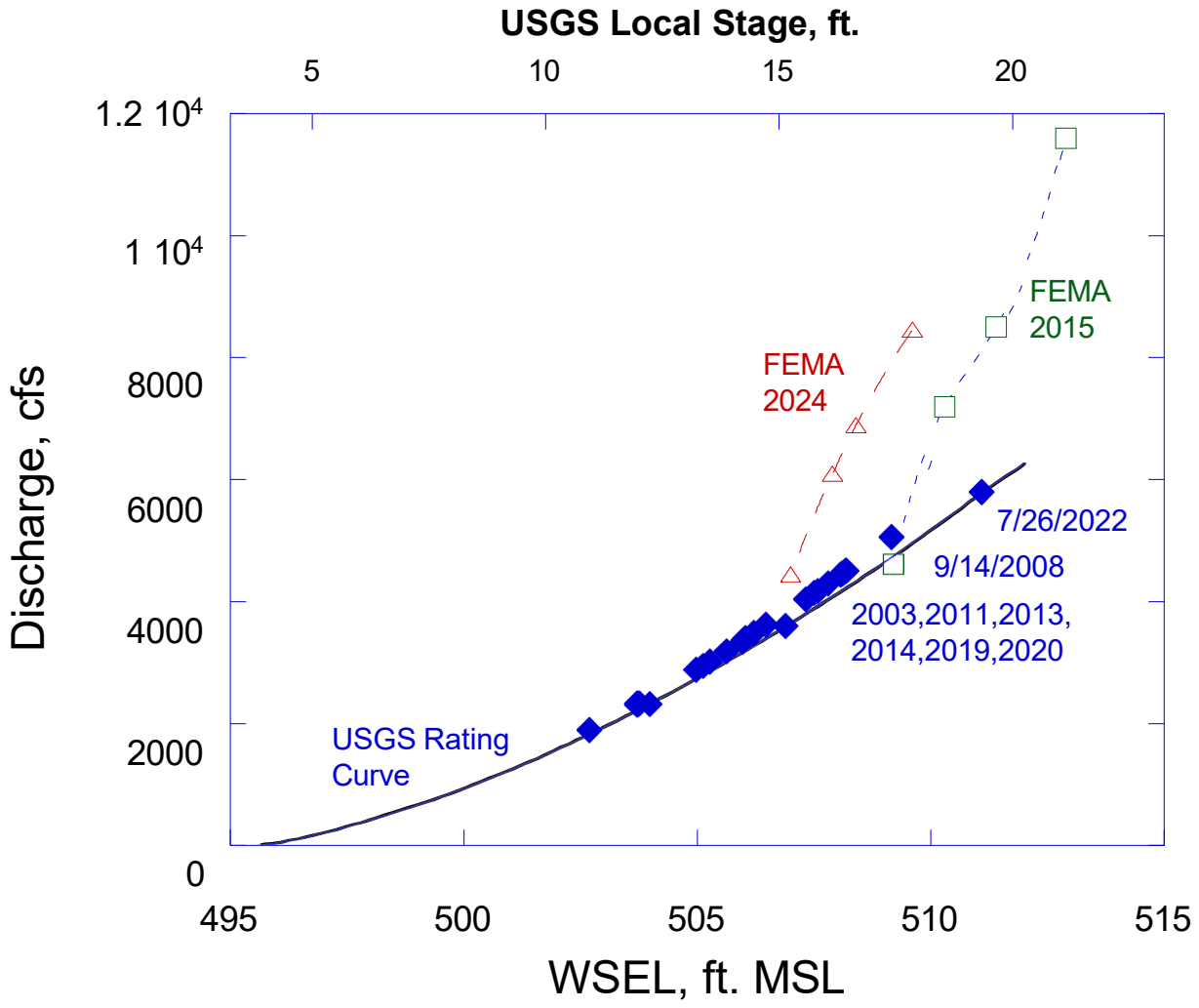


**Figure 2.** FEMA (2015) and FEMA (2024) estimates of stage-discharge pairs for the 10, 50, 100 and 500 year floods near USGS gauge 07010022, compared to the current USGS rating curve for this gauge (solid blue line), and the 27 peak annual floods (blue diamonds) documented by this

gauge (USGS, 2025). Dates of the largest actual floods are indicated.

**Conclusions.** The preliminary FEMA (2024) FIS model on the upper River des Peres is less realistic than the standing FEMA (2015) FIS, and is inconsistent with the following data in this well-studied basin:

1) The 27-year record of peak annual floods at the USGS stream gauge 07010022.
2) The published flood profiles of the three largest floods, that occurred in 1957, 2008 and 2022.
3) The stage-discharge rating curve at the USGS stream gauge.
4) Many detailed simulations of flows predicted by the diffusion hydrograph method, which is based on a theoretical equation that utilizes no fitting parameters, and is driven solely by observed rainfall.
5) The corpus of meteorological and statistical evidence showing that extreme rainfall events are becoming more frequent, and that Midwestern flooding is becoming more severe over time.

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