



**COMMISSION ON STORM WATER ISSUES
VIA VIDEOCONFERENCE
Tuesday, June 1, 2021
6:30 p.m.**

**IMPORTANT NOTICE REGARDING
PUBLIC ACCESS & PARTICIPATION**

On March 20, 2020, City Manager Gregory Rose declared a State of Emergency for the City of University City due to the COVID-19 Pandemic. Due to the ongoing efforts to limit the spread of the COVID-19 virus, the June 1, 2021 meeting will be conducted via videoconference.

Observe and/or Listen to the Meeting (your options to join the meeting are below):

Webinar via the link below:

<https://us02web.zoom.us/j/87941258159?pwd=MGVrdkptRE9Ua0d6dW5JekFMUFF4UT09>

Password: 989598

Audio Only Call

iPhone one-tap :

US: +13126266799,,87941258159# or +19292056099,,87941258159#

Or Telephone:

US: +1 312 626 6799 or +1 929 205 6099 or +1 301 715 8592 or +1 346 248 7799 or +1 669 900 6833 or +1 253 215 8782 or 888 788 0099 (Toll Free) or 877 853 5247 (Toll Free)

Webinar ID: 879 4125 8159

Citizen Participation and Public Hearing Comments:

Those who wish to provide a comment during the "Citizen Participation" portion as indicated on the agenda; may provide written comments to Sinan Alpaslan ahead of the meeting.

ALL written comments must be received **no later than 12:00 p.m. the day of the meeting**. Comments may be sent via email to: salpaslan@ucitymo.org, or mailed to the City Hall – 6801 Delmar Blvd. – Attention: Sinan Alpaslan. Such comments will be provided to Board/Commission member prior to the meeting. Comments will be made a part of the official record and made accessible to the public online following the meeting.

Please note, when submitting your comments, a **name and address must be provided**. Please also note if your comment is on an agenda or non-agenda item. If a name and address are not provided, the provided comment will not be recorded in the official record.

The City apologizes for any inconvenience the meeting format change may pose to individuals, but it is extremely important that extra measures be taken to protect employees, residents, and elected officials during these challenging times.



AGENDA

COMMISSION ON STORM WATER ISSUES MEETING

June 1, 2021 at 6:30 p.m.

Via Zoom

1. MEETING CALLED TO ORDER
2. ROLL CALL
3. APPROVAL OF AGENDA
4. APPROVAL OF MINUTES
5. CITIZEN PARTICIPATION

Procedures for submitting comments for Citizen Participation and Public Hearings:

ALL written comments must be received **no later than 12:00 p.m. the day of the meeting.** Comments may be sent via email to: salpaslan@ucitymo.org, or mailed to the City Hall – 6801 Delmar Blvd. – Attention: Sinan Alpaslan. Such comments will be provided to the Commission on Storm Water Issues members prior to the meeting. Comments will be made a part of the official record and made accessible to the public online following the meeting *Please note, when submitting your comments, a **name and address must be provided.** Please also not if your comment is on an agenda or non-agenda item. If a name and address are not provided, the provided comment will not be recorded in the official record.*

6. NEW BUSINESS

- a. Coordination with the US Army Corps of Engineers team and data sharing

7. OLD BUSINESS

- a. Relief Map Project – Update (Commissioner Holly) – (please see Attachment #1)
- b. US Army Corps of Engineers Upper River Des Peres Flood Risk Management Study – Update to Commission from Army Corps Vertical Team Meeting of May 26, 2021 – (please see Attachment #2)
- c. Flooding Early Warning System – Update

8. SUBCOMMITTEE REPORTS

- a. Flood Early Warning System
- b. Communications

9. MISCELLANEOUS BUSINESS

- a. Sherwood Lake Update
- b. Deer Creek Tunnel Virtual Walkthrough (approximately 4 min. video)

10. COUNCIL LIAISON COMMENTS

11. ADJOURNMENT

Please call (314) 505-8572 or email salpaslan@ucitymo.org to confirm your attendance.

A relief map of University City, California, showing topographic contours and elevation. The map is color-coded by elevation, with higher elevations in shades of orange and red, and lower elevations in shades of green and blue. A thick black outline defines the city's irregular boundary. A network of red lines is overlaid on the map, representing a stormwater relief project. The text "University City Commission on Storm Water Relief Map Project" is centered over the map in a black serif font.

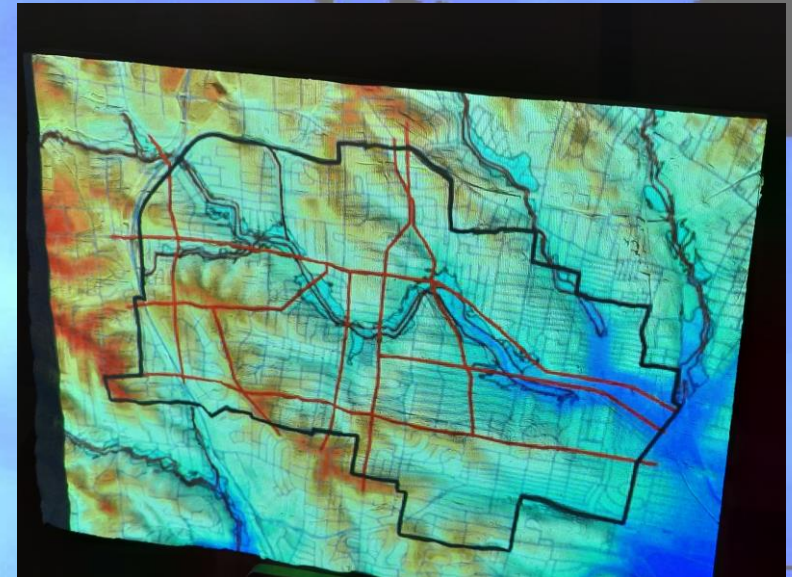
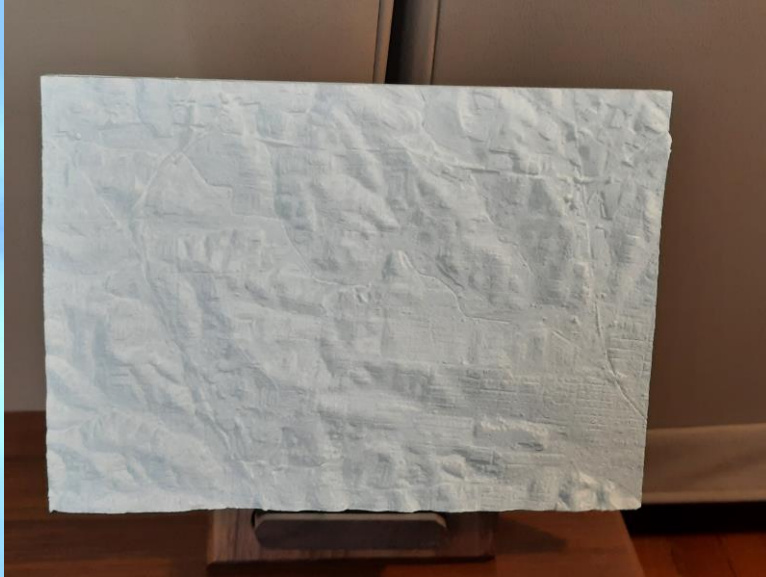
University City Commission on
Storm Water
Relief Map Project



Progress Since Last Commission Meeting

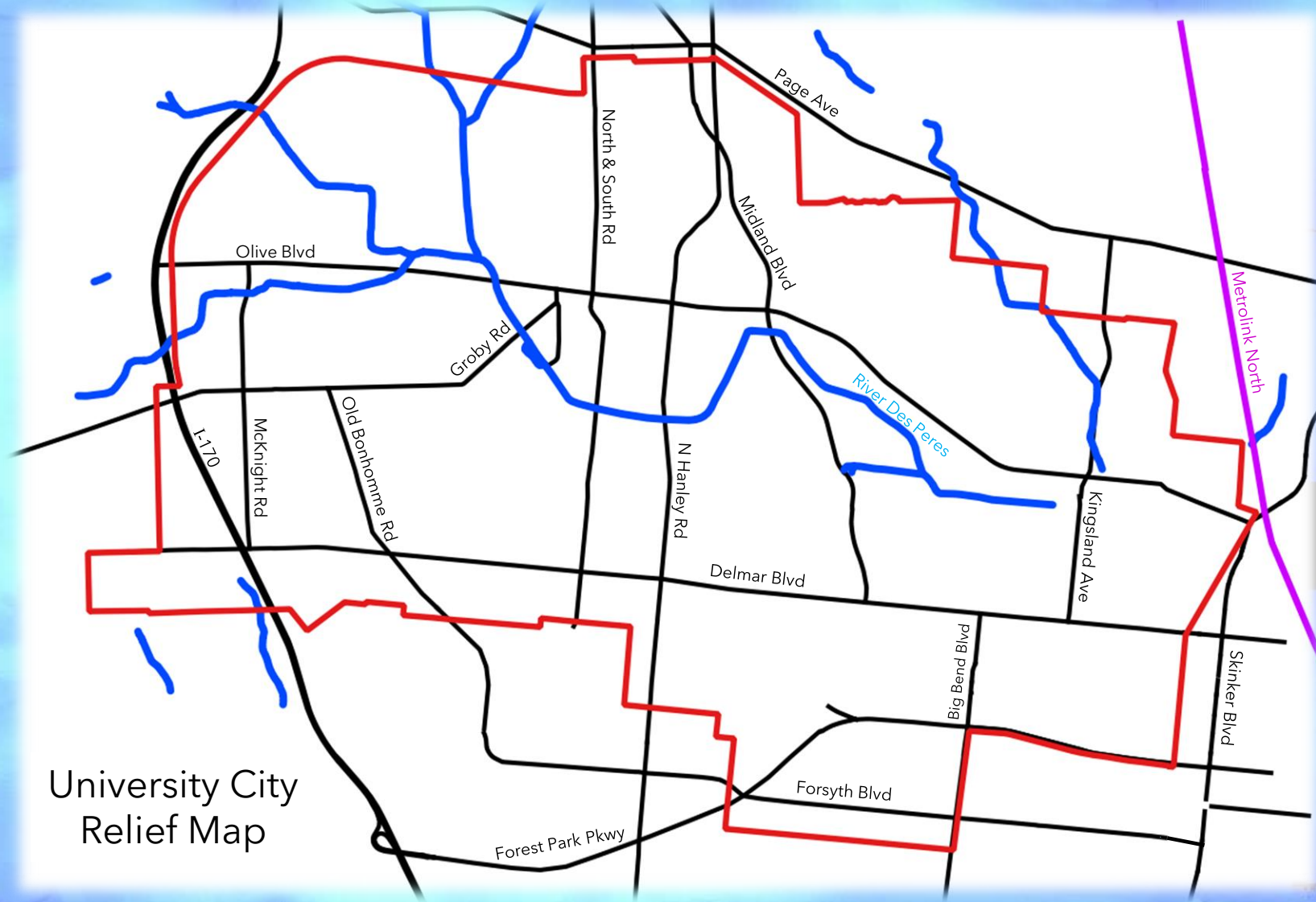
- Commission Delayed Go-Ahead on 3D Printed Relief Map Pending Commission Members Having Opportunity to View the Prototype Model Personally
- All Commission Members Plus Councilperson Cusick Have Now Seen Model
- Based Upon What I Believe Was a Consensus, I Conducted Projection Experiments on the Prototype Model
 - 3 D Model, Basic Reference Markings on Model & Supplemental Fly-Thru's

Projection Experiment





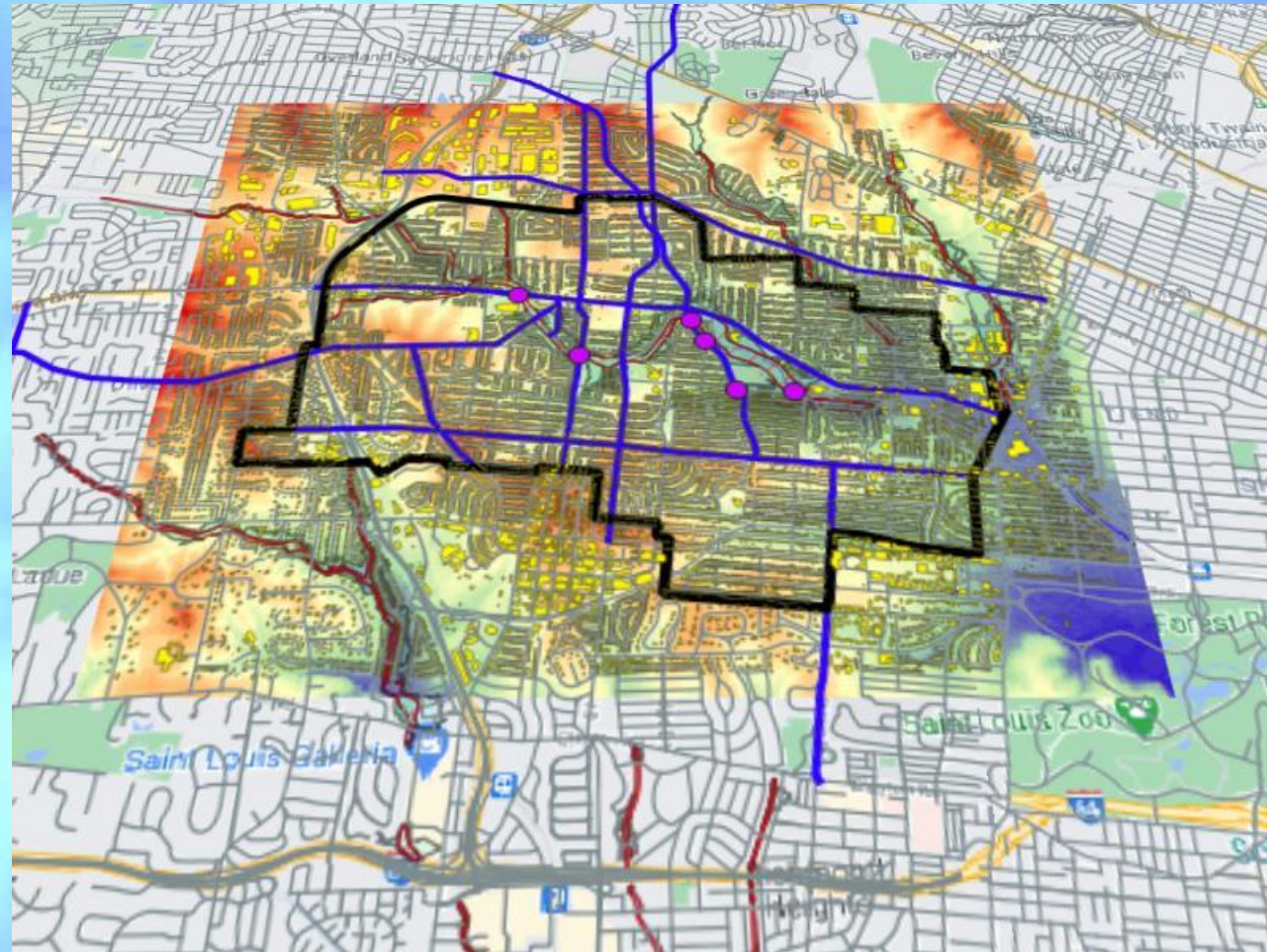
Basic Reference Markings



University City
Relief Map



Fly-Thru Example





Estimated Grand Total Relief Map Project

- Three-dimensional printing
- Stand Materials
- Artist Labor and Materials
- Incidentals (@ 10% of subtotal)
- 8 -12 Week Execution Time

\$1739.59

\$234.92

\$625.00

\$260.00

\$2859.51



Work Ahead

- Seek endorsement of Commission; if "GO" work on more detailed description of work, drawings, schedule, deliverables & responsibilities
- Explore next steps for city approval based on full estimate
- Explore possible educational collaboration with UCHS arts and STEM
- Continue to geocode and add survey responses and US Corps of Engineers buyout recommendations
- Investigate slope gradients vs purely elevations and survey trends
- Import US Corps of Engineers 2021 inundation shapefiles into model

Questions and input from the Commission on Stormwater Issues and University City Council

13 May 2021

Questions and input that the Commission and/or City Council has for the USACE, and *USACE preliminary responses in blue:*

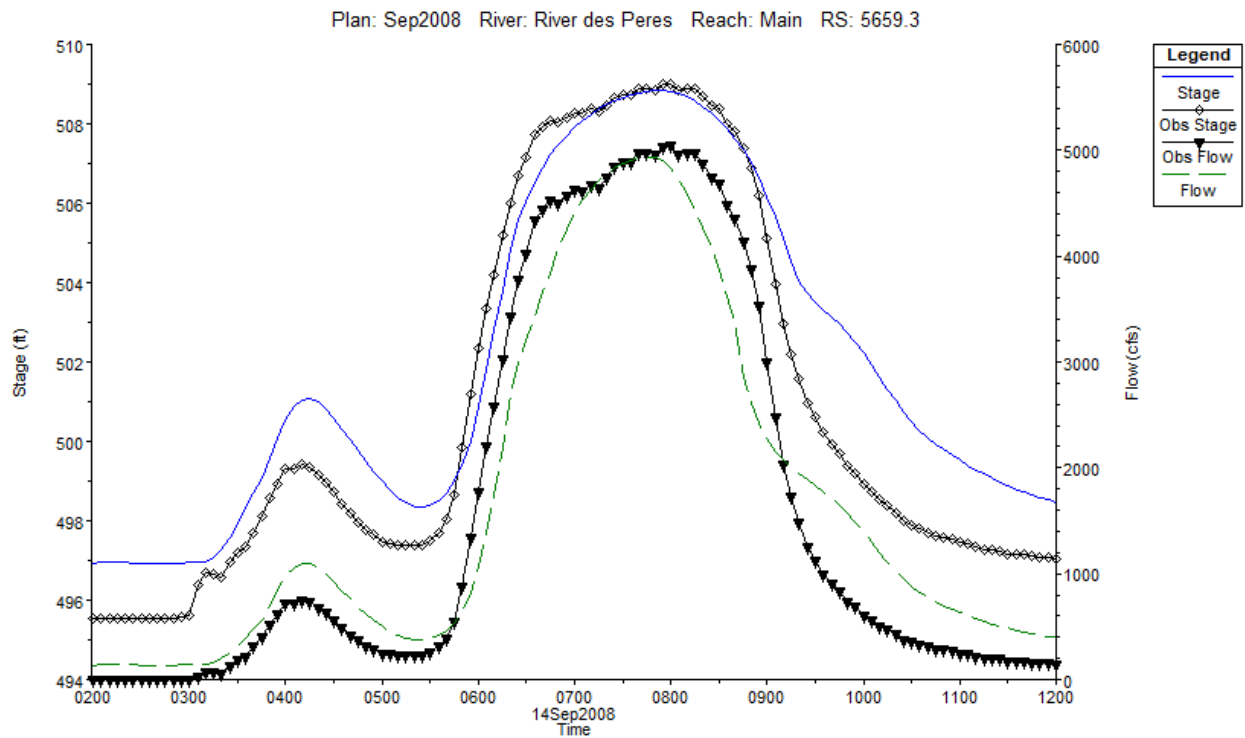
H&H Modeling

1. How does the modeling coincide with the extent of actual flooded area experienced during prior flood events? (Councilman Cusick)

At the time of model calibration, the only data available for calibration was the University City stream gage. The figure below demonstrates model calibration at the University City gage for the 2008 event. This demonstrates excellent calibration at that location, which was used as an indicator of overall model calibration. The blue line is the simulation of river stage with the circle marked line as the observed. The simulated discharge is denoted by the green dashed line and the observed flow marked with triangles.

Within the past week, additional data on damaged parcels has been identified by the Commission on Storm Water Issues. This data has not yet been provided to USACE. We will gladly incorporate it into the analysis after it is received, although at this time we do not fully understand its usefulness for model verification.

Also within the past week, USACE found high water marks that were surveyed by MSD along Wilson Ave after the 2008 flood. These marks indicate the model is underpredicting water surfaces in that area by approximately 0.8 feet.



- Your inundation modeling does not show where flooding has actually taken place? (Councilman Cusick)

Actual flooding events have some data associated with them that we can use (rainfall at rain gages, stream levels at stream gages, etc.). For this study area, there is little data available on where and how much flooding has actually taken place. To create a model which is as close to actual flooding as possible, we create hypothetical flood events which take average rainfall, average gage data, etc., as a reference. For this model, we used the 2008 flood as a reference for calibration. There are infinite possibilities with real world flooding events, as timing, uneven rainfall, and geographic features impact how floods occur. We cannot model every possibility, so we model representative floods at various frequencies with averaged information.

The frequency storm model runs are not intended to represent actual events. They are hypothetical events that represent levels of flooding that have a certain percent chance of not being exceeded in any given year. These events are used in the USACE economic analysis to determine benefits on an average annual basis for alternatives. HEC-RAS will show inundation for each scenario simulated. If the Commission would like to see inundation in more detail for a specific area, this can be included in the report. There will be some inundation figures in the report.

- Incorporate additional data (highwater marks, rainfall data, and dates). Revise 25-year flood boundary, and the homes being considered as beneficiaries and for improvements. Recognize at a minimum that the 2008 flood produced the highest stage since 1997 (24-years data on modern gage, with additional data in 70's) and has a 6-hour rainfall total that meets Atlas-40 25-year rainfall frequency. This flood did not overtop tube entrance or flood homes on

Braddock/Coolidge/Archer. Is it reasonable to say 2008 was not a 25-year storm? (Eric Karch, provided 5/13/21)

This question has multiple parts that touch on many facets of the modeling and other analyses completed as part of this project. With respect to incorporating additional data, please refer to the response to questions 1 and 2. There appears to be a belief that the 2008 flood and the 25-yr storm inundation area developed with the model represent the same event. This is not the case. To address the distinction, the 2008 flood and its likely return period and the reasoning behind the method chosen for the frequency floods analyzed are discussed below.

The question appears to take the largest flood in a gage record and assume the return period for that flood matches the record length. Determining the return period of the flood involves following a process to complete a statistical analysis of the gage data to develop a flow frequency curve for the gage. The return period for a specific event can then be approximated from the resulting curve. The 24-year record of the University City gage is probably long enough to make an estimate of the 25 and possibly 50- year flows, but it is not long enough to provide a reasonable estimate of events larger than the 50-year. 30 years of record is considered the minimum to estimate a 100-year discharge. Another way to determine the return period is to look at the frequency of the rainfall that occurred that resulted in that flooding. Using rainfall data collected by MSD at the Pennsylvania Ave rain gage (located just east of Pennsylvania between Olive and Vernon), the total storm over 8 hours was 3.93 inches. If we look at Atlas 14, which is the most recent rainfall frequency data for the US, we can extract the following from the table for University City. Based on these values, the rainfall was roughly a 15-year event.

Duration	Average recurrence interval (years)					
	1	2	5	10	25	50
6-hr	2.02 (1.77-2.33)	2.34 (2.05-2.70)	2.91 (2.53-3.36)	3.41 (2.95-3.97)	4.16 (3.47-5.11)	4.78 (3.86-5.97)
12-hr	2.38 (2.10-2.72)	2.75 (2.42-3.15)	3.41 (2.99-3.92)	4.02 (3.50-4.65)	4.94 (4.16-6.05)	5.72 (4.65-7.12)

The statement that the 2008 flood did not overtop the tubes is appreciated. If there is any additional documentation of this, please provide. Results of modeling of the 2008 event agree with the statement that there was no flooding of homes on Braddock/Coolidge/Archer.

The second topic for this response is the frequency floods modeled for the project. As discussed above, there are two generally accepted methods of determining these flows: computing a flow frequency curve from gage data, or assuming that a specific rainfall frequency will result in the same flood frequency. The USACE planning process requires us to analyze the full range of flooding from the 2-year flood to the 500-year flood. Since the gage record is not long enough to compute a 100-year or rarer discharges, the second assumption had to be used for the analysis. Regardless of which method is chosen, this results in hypothetical flooded areas that may not match flooding that has been observed in the recent past.

4. Why can't the downstream tubes receive additional flow if channel modifications/bridge adjustments are made to increase conveyance? (Councilman Cusick)

The downstream tubes can receive additional flow by modifications. However, the additional cost to mitigate the downstream impacts is not economically justified for Federal investment (0.7 BCR). The question of whether a USACE recommended project should allow increased flow to the tubes is more a planning question than an H&H question. The original authorized plan from the 1988 study (measure U-12) consisted of channel and bridge modifications that would have increased conveyance into the tubes, but this would have increased the flood risk to the area downstream of the tubes. USACE is required to mitigate any induced flooding caused by its projects, which is why when measure U-12 was re-evaluated, the detention basins were added to the alternative. Additionally, MSD has also expressed concern about the management and infrastructure impacts of increasing the downstream flow from current conditions.

5. If additional [H&H] data is provided by the sponsor, can the model be updated? (general)

Yes. Any additional data to be included in the model calibration process needs to have enough information with it to be accurately included in the model. For instance, photographs need location, date, and time. High water marks need to be surveyed. It should be noted that additional information may not change the calibration of the model or model outputs significantly. At this level of design in the planning process, we are comfortable with moving forward with the current modeling, but we recognize that the Commission would like more actual flood data to be included in the analysis.

Channel and Bridge Modifications

1. Road bridges in the project reach show that openings are too small and is contributing to the flooding. Could increasing size of bridges increase conveyance and solve the problem? (Councilman Cusick)

Increasing the size of bridge openings would likely relieve flooding in some areas. As indicated in the answer to Q4 above, this would increase conveyance into the Tubes which would need to be mitigated elsewhere in the project. The inclusion of bridge modification in the TSP can be further assessed and optimized in the post-TSP phase of the study.

Nonstructural – Floodproofing

1. The 500 identified at-risk structures are based on what data? (Councilman Cusick)

These are all the structures in the 25-year floodplain according to USACE H&H modeling.

2. How many at-risk structures are identified upstream of 82nd Avenue? There are no reports of flooding in these areas, yet the inundation model shows flooding. (Councilman Cusick)

There are about 20 structures identified that may receive damages upstream from I-170 in the 25-year floodplain. See H&H question #3 response for discussion of the frequency of flooding.

In addition, FEMA and our modeling have identified a greater extent of flood inundation upstream of I-170 in the 100-year floodplain.

3. The NED plan would result in residents losing their basements. Is there any compensatory space added to their home as a result of the solution? (or financial compensation for loss of basement?) (Councilman Clay)

Unfortunately, there is no compensatory space added to the home to make up for the loss of a basement. There are situations where elevating utilities would require adding a platform/pad or something similar to a home if doing so would move it out of the floodwater (Example: if the floodwaters do not reach the first floor but do inundate the basement, the utilities could be moved to a newly constructed pad or “room” on the outside of the first floor of the home). Also, the team will confirm how the cost to acquire the easement placed on a structure that would lose its basement is included in the analysis.

4. The elimination of basements resides in the plan (as an element of floodproofing/elevation). Do you proceed on the premise that 100 percent participation can be achieved? (Councilman McMahon)

The USACE used a 100% participation rate in calculating the benefits in the first analysis. This number will be refined as economic optimization occurs (meaning we tweak the flood event level and structure count to yield the most net benefits). There will also be a participation rate analysis after the TSP Milestone to get closer to a realistic participation rate.

5. Survey resident’s participation rates in floodproofing and incorporation into planning. (Eric Karch, provided 5/13/21) (Jordan confirm)

See previous answer.

6. Revise floodproofing costs. Include summary of the floodproofing being considered. Does dry floodproofing consider only filling basements, or does flash flooding scenario include alternate dry floodproofing? (Eric Karch, provided 5/13/21)

Our current understanding is that dry floodproofing will only be appropriate for non-residential structures. The most common measures included in dry floodproofing must be actively installed, such as gates across doorways, to keep water out of the building. We are currently confirming the flood arrival time, but it looks to be too short to allow people enough warning time to install active dry floodproofing measures. As a result, we will likely rule out all active dry floodproofing measures. We will look into passive dry floodproofing for commercial structures in the optimization process in the next phase of the study.

7. Revise building elevation costs to consider loss of home value when eliminating basement and accommodating utilities in main floor. Appropriate to consider adding out-building and/or shed to offset lost basement? Would not make a property owner whole, but would be a more

realistic compromise than putting the furnace into the den. (Eric Karch, provided 5/13/21)

We do not have an answer on this at this time; we will investigate USACE policy on what types of interior and exterior utility elevation would be supported. The lost home value, optimum utility placement, and cost to replace lost space will be analyzed further during feasibility level design if the non-structural plan is determined to be not only the NED plan, but the tentatively selected plan endorsed by the City.

Nonstructural – Acquisition

1. Question the BCR of acquisition at \$500K per structure. City has acquired 26 structures at total cost of \$4M which equates to \$160-180K per structure? (Councilman Cusick)

Actual buyout costs will be reviewed, however, the buyout costs used in the study at this level of design are very high level and include relocation, administrative, structure value, demolition, etc. The \$500K is also the average, and we recognize that includes both residential and commercial structures. During feasibility level design, this number will be refined to be structure-by-structure.

2. Repetitive loss structures will be forced by FEMA and local Floodplain Ordinance to be acquired? (Councilman Cusick)

Per FEMA, a Repetitive Loss Structure is an NFIP-insured structure that has had at least 2 paid flood losses of more than \$1,000 each in any 10-year period since 1978. A severe repetitive loss (SRL) property is a repetitive loss property with four claims greater than \$5,000 or two or more claims that are greater than the building's value. SRL properties are required to be acquired by FEMA under certain specific conditions; we are in communication with SEMA. FEMA's handling of SRL properties is not a constraint on the USACE planning process, but we will include it as a consideration and plan to be able to communicate on the topic to the City and the public.

3. Revise buyout costs by using actual U City data, including Council Resolution 2010-16 establishing Voluntary Flood Buyout Policy.

The buyout costs used in the study so far at this level of design have been very high level and include relocation, administrative, structure value, demolition, etc. Actual buyout costs from the Wilson Ave acquisitions will be reviewed and may be incorporated in the analysis as we move forward to structure-by-structure analysis in the next phase of the study.

4. Report to the Commission on what revised costs (buyouts, floodproofing, building elevation) are used for revised TSP (Eric Karch, provided 5/13/21)

Revised costs and benefits will be provided to the Commission as soon as they are available and have been internally reviewed. The numbers may or may not change ahead of the TSP Milestone meeting, but they are certain to change as the NED plan is further refined and further optimized in the next phase of the study.

FEMA Flood Insurance

1. I am located in the Third Ward. Why is flood insurance only identified in one alternative and not mentioned across all alternatives? The impact that each measure would have on Flood insurance premiums is critical to consider in your analysis of alternatives. (Councilman Smotherson)

Flood insurance is a consideration across all alternatives; it was highlighted in the slides for alternative #6 as a specific talking point because it is the only alternative for which flood risk would be reduced but flood insurance premiums would not necessarily be reduced. The slides were tailored to the USACE Mississippi Valley Division, and while flood insurance is very important to the City and community, it is not as significant as other criteria to the decisionmakers at the Division level evaluating the Federal interest. Per USACE guidance, National Flood Insurance Program (NFIP) regulations alone are not sufficient criteria for screening nonstructural measures (PB 2016-01), but we will include flood insurance as a consideration and plan to be able to communicate on the topic to the City and the public.

Detention Basins

1. A combination of detention basin and floodproofing is being considered. Will approval be needed in other jurisdiction (Overland)? (City Manager Rose)

There will absolutely need to be buy-in from the City of Overland for any measures located in their jurisdiction. To implement detention basin 4, the City of Overland would need to be willing to sell the real estate interest. The USACE's understanding is that Sinan is speaking with City leadership to identify the best path forward for introducing the project to the City of Overland, with USACE coordination.

2. What if City of Overland determines they don't want this detention facility in their community what do we do? (Mayor Crow)

If the City of Overland chooses not to support involvement in the project, the USACE would screen the alternatives that include measures constructed in that municipality (detention basins, floodproofing/elevation of structures, etc.). Current analysis shows a great deal of benefit for measures located solely within University City, so while lack of participation from the City of Overland would reduce project net benefits, there is still plenty of federal interest (overall net benefits) in the study continuing.

Questions that the USACE has for the City Council/Commission:

1. Does the Commission or Council have a feel for public preference on structure elevation versus floodproofing?
2. How would the City like to proceed with outreach to City of Overland?
3. Does the City have or have access to repetitive loss data, damage information, or claims information that they could provide to the USACE?

4. The Commission has previously mentioned surveyed high-water marks from the 2008 flooding; can this information be provided?
5. Who from the City will be participating in the TSP Milestone meeting on May 26th? And speaking on the City's behalf? (We are anticipating Sinan Alpaslan)
6. What do you suggest in terms of presenting to the City Council once more (perhaps on the 24th of May) in anticipation of the TSP?
7. Can you provide actual (not modeled) flood elevation data referenced during the Commission Q&A (e.g. flood elevations from high water marks), and the East-West Gateway Council of Governments map and list of properties impacted by the 2008 flood?

RIVER DES PERES, UNIVERSITY CITY, MO

General Reevaluation Report

Tentatively Selected Plan (TSP) Milestone Meeting

26 May 2021



US Army Corps
of Engineers®



Photo: University City, 2019. Inset: KSDK, 2019



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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PDT

Project Manager – Matt Jones

Plan Formulation – Janet Buchanan

H&H Engineer and Technical Lead – Joel Asunskis

Economist – Jordan Lucas

Civil Engineer – Matt Hartman

Geotechnical Engineer – Jose Lopez / Amanda Goltz

Environmental Planning – Evan Hill

Cultural Resources – Lara Anderson

Environmental Specialist (HTRW) – Ben Greeling

Regulatory – Samantha Hollenberg

Cost Engineer – Michelle Puzach

Real Estate – Terrence Ollis

Scheduler – Kate Leese



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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AGENDA

- Overview:
 - TSP Meeting Purpose
 - Authority
 - Sponsor
 - Study Overview and Schedule
- Existing & Future Without Project Conditions
- Plan Formulation:
 - Measures and Alternatives
 - Design, Costs, and Economics
 - Evaluation Criteria and Final Array
- TSP Selection
- Remaining Risks
- Discussion



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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PURPOSE OF THE TSP MILESTONE MEETING

- Achieve vertical team alignment and approval of TSP selection
- Affirm Project Delivery Team (PDT) readiness to move forward with a clear path to the ADM milestone
- Acknowledge and accept identified study risks and the strategies to manage those risks



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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STUDY AUTHORITY

Congress provided project authorization in the Water Resources Development Act of 1990. Section 101(a)(17) identified projects with a Report of the Chief of Engineers for water resources development and conservation and other purposes. The authorizations were to be carried out by the Secretary substantially in accordance with the plans, and subject to the conditions, recommended in the respective reports designated in the subsection:

River Des Peres, Missouri. The project for flood control, River Des Peres, Missouri: Report of the Chief of Engineers, dated May 23, 1989, at a total cost of \$21,318,000, with an estimated first Federal cost of \$15,846,000 and an estimated first non-Federal cost of \$5,472,000.

FEDERAL INTEREST

WRDA 1990, and the 2013 Economic Update, identify a federal interest in flood risk management for River Des Peres in University City. The problems identified in the 1988 Feasibility Report (approved in the 1989 Chief's Report) have not been fully addressed; recurrent flooding in the study area continues to threaten life safety and cause economic damage to buildings and infrastructure in the area.



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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NON-FEDERAL SPONSOR

University City, Missouri

No FCSA; Amendment to the Design Agreement signed January 31, 2020.

Sponsor contributed funds



Stakeholders:



Metropolitan St. Louis Sewer District



FEMA



MISSOURI DEPARTMENT OF NATURAL RESOURCES



SEMA



Great Rivers Greenway



Serving nature and you



River Des Peres Watershed Coalition



EAST-WEST GATEWAY Council of Governments

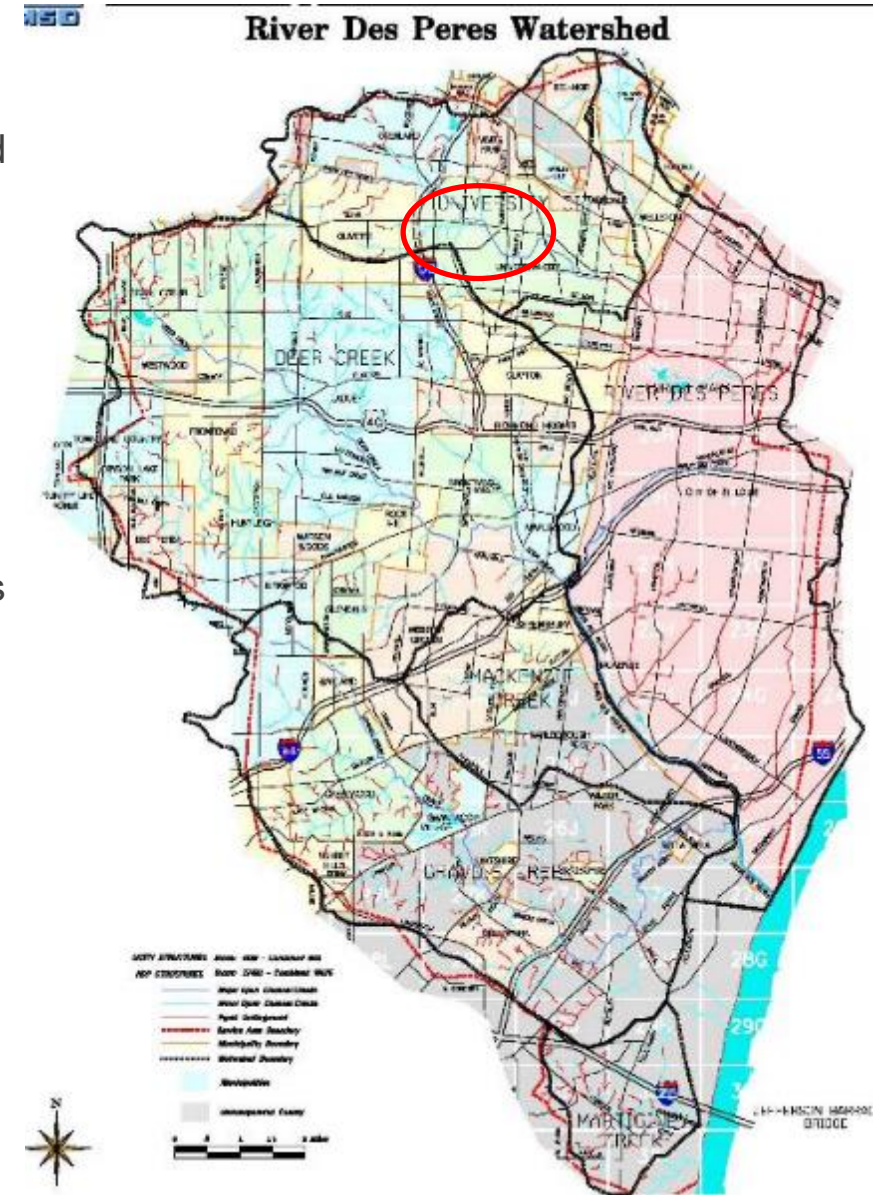


Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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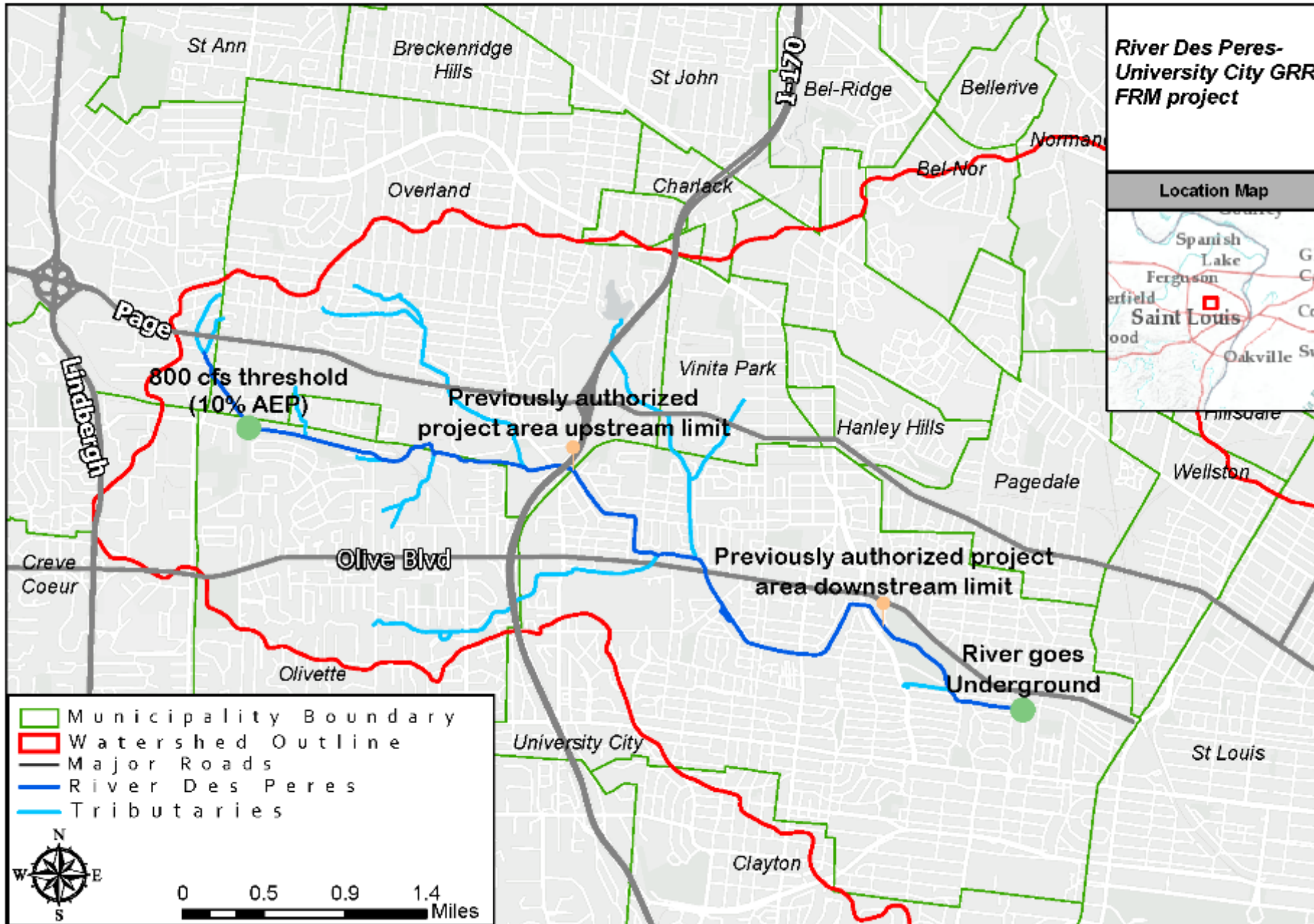
STUDY OVERVIEW

- Purpose: Reevaluate the flooding problems and potential plans to reduce flood risk and confirm the authorized project or identify a revised recommendation.
- Budget: \$650,000 (contributed funds)
- Schedule: Funds became available on 29 April 2020; 3 years to completion
- Study Authority Limits
 - Limited to University City Branch watershed of upper River Des Peres
 - Flood Risk Management is the only authorized purpose
- Partial list of required analysis and modeling
 - Must reevaluate the authorized plan
 - Must evaluate life safety in addition to economics
 - Preparing an Environmental Assessment
 - Must complete a qualitative climate change analysis
- Period of Analysis for economic analysis
 - 50 years (roughly 2025 to 2075)





River Des Peres-University City Study Area



IMAGES FROM THE GROUND

River Des Peres at the entrance to the Tubes
(downstream end of study area)



Images (above and left): Paul Sableman (Flickr)

Flooding



2008 flooding. Image: YouTube



2014 flooding. Image: University City



Image (right): St Louis Post Dispatch



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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PROBLEMS

- **Risks to life safety associated with riverine flood inundation.**
 - This includes direct life loss, flooding of critical infrastructure, flooding of evacuation routes, health concerns with flooded structures (mold, etc.)
- **Economic damage resulting from riverine flood inundation.**
 - This primarily focuses on direct structure inundation (structure, content and vehicles) but can also consider traffic disruption, emergency costs, etc.

OPPORTUNITIES

- Increased outdoor recreation;
- Improved risk communication;
- Reduced sewer backups;
- Improved water quality, including reduced sedimentation/turbidity;
- Re-established natural wildlife habitat such as wetlands;
- Increased community resiliency to flood events, such as reduced response/recovery time; and
- Improved mental & physical health.



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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OBJECTIVES

Objectives:

- Reduce life safety risk due to flooding, including inundation of structures & public infrastructure, in the Upper River Des Peres watershed over the period of analysis.
- Reduce economic damage due to flooding in Upper River Des Peres over the period of analysis.
- Increase recreational opportunities associated with FRM features over the period of analysis.

CONSTRAINTS

- Previous buyouts in the study area acquired through FEMA's Hazard Mitigation Grant Program: USACE is prohibited from constructing project features on lands previously acquired through this program. Parks and natural areas are allowed.
- Project area contains cultural and historic resources such as two areas of concern identified in the SHPO database.



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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STUDY SCHEDULE

Start date (funding received)	29 April 2020
Alternatives Milestone Meeting (AMM)	25 August 2020
Public Scoping Meeting	30 September 2020
Tentatively Selected Plan (TSP) Meeting	26 May 2021
Draft Report Released to the Public	July 2021
Public Meeting	July 2021
Agency Decision Milestone (ADM)	October 2021
Final Report Submitted for Approval	September 2022
Report Approval (Chief's Report)	April 2023



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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EXISTING & FUTURE WITHOUT PROJECT CONDITIONS – UPDATES

- Data and analysis performed since AMM
 - H&H: updated HEC-RAS & PCSWMM models; climate change analysis; flood history
 - Economics: updated structure inventory (1,098 structures in study area)
 - Economics: \$5.8M expected annual economic damages in the existing condition (1% AEP)
 - Environmental & cultural: further analysis of FWOP conditions

- DQC comments addressed
 - 800 cfs cutoff, section length vs page limits

- Targeted ATR comments addressed
 - H&H: clarity on modeling and calibration, concern about flood warning system
 - Economics: clarity on depth-damage functions used



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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EXISTING & FUTURE WITHOUT PROJECT CONDITIONS – RISKS

Existing Condition*	Future Without Project Condition	Risk Addressed – Y/N? If N, Remaining Risk/Uncertainty & Path Forward?
Climate (temperature and precipitation)	Upward trends in temperature, precipitation, and runoff	Y - Climate assessment addressed risk to appropriate level of detail (qualitative; budget constraints)
Future development and sewer infrastructure	Sewer authority (MSD) identified 55 proposed projects in study area	Y - MSD & USACE anticipate all these projects combined would not impact flow enough to affect H&H modeling
Water quality, incl. current <i>E. coli</i> concerns	Improvement in water quality due to MSD sewer improvements	Y - FWOP condition likely to improve. Also, water quality considered an opportunity rather than a goal for GRR
Cultural resources – two areas of concern	Potential minor adverse effects to areas of concern; potential new areas of concern added within 50-yr period of analysis	Y - Analysis of inundation of cultural resources conducted; continued flooding would result in further damages
Flood damage to structures	No substantial change expected	Y - No new major construction, large-scale acquisition, or substantial change to the structure inventory is expected
Population and socio-economics, incl. minority & low-income populations	Projected downward population trend; in 20% AEP, dilapidated structures, vacant lots, minor adverse socioeconomic impacts	Y - Structure flood depth and flooded roads/parking lot locations identified, referenced against appraisal value map
PAR (3,000 at 2 a.m.) & critical infrastructure (4)	PAR and existing critical infrastructure would continue to be threatened	Y - PAR analysis conducted; more detailed evacuation analysis will be conducted post-TSP

*Conditions not shown are either no change or low concern re impacts to measures in the FWOP condition

Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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MEASURES EXPLORED

Structural

- Detention basins
- Levee/floodwall
- Channel & bridge modifications
- Modifying the Tubes
- Diversion

Non-Structural

- Floodproofing (wet & dry)
- Elevation of structures
- Relocation of structures
- Acquisition (buyouts)
- Flood warning system
- Risk communication/education
- Ordinances/regulations
- Other: Outdoor recreation

Nature-Based

- Floodplain storage
- Removal of invasive species
- Constructed wetlands





Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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MEASURES SCREENED

Type	Measure	Retained for further evaluation	Screening Criteria	Additional Explanation
S	Modifying the Tubes	No	Inefficient	Allowing more volume into the Tubes would cause downstream impacts outside the study area; cost to construct and address downstream impacts would be extremely high vs other measures; MSD and Sponsor do not support
S	Diversion	No	Inefficient	Highly urbanized environment would require significant acquisition and relocation costs in addition to construction costs. Would displace homes/structures and potentially transfer water and flood risk to another watershed.
NS	Dry floodproofing (ACTIVE)	No	Ineffective	Flood warning time of ~30 minutes not long enough to implement active floodproofing measures; only passive systems would be effective to reduce flood risk.
NS	Relocation of structures	No	Inefficient	Buyouts would be more efficient since no need to relocate the structure; also, there is no space for relocated structures within same parcels or neighborhoods.
NB	Floodplain storage	No	Inefficient	Similar to detention basins but less effective due to lower elevation (less storage); also high value RE in floodplain locations; native floodplain vegetation may be added to DBs later
NB	Removal of invasive species	No	Ineffective	Does not address the planning objectives; invasive species not a major concern for bank stability/flooding problems in the study area
NB	Constructed wetlands	No	Ineffective	Limited open space to restore wetlands; not enough locations to attenuate peak flows.

*Types: S: Structural, NS: Non-Structural, NB: Natural/Nature-Based

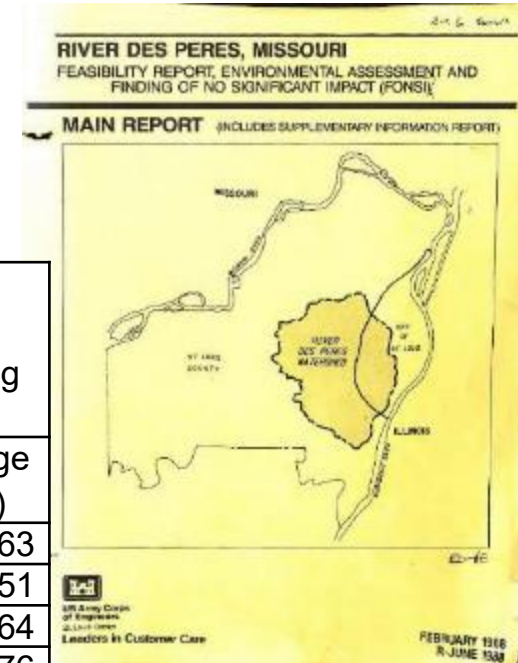


Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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RE-EVALUATING RECOMMENDATIONS IN THE 1988 FEASIBILITY REPORT

- 1988 Feasibility Report for River Des Peres watershed
- WRDA 1990 authorized project
- University City recommended features:
 - Approx. 2.5 miles of channel modification, including bridge replacement, bank stabilization and grade control – **x**
Confirmed measure U-12 causes downstream impacts that would need to be addressed →
 - Flood forecasting and warning plan – ✓ **Rainfall gages in upper watershed; new technology can improve plan**
 - Recreation features – ✓ **1.85 miles of trail alongside channel modification, incl. one small park with amenities**
 - Environmental features (not much detail for U City branch) – **x**
Environmental features were compatible with channel modifications; do not mitigate downstream impacts; not complete as standalone measures

AEP (%)	U-12 difference from existing condition	
	Flow (cfs)	Stage (ft)
0.2	+770	+0.63
0.5	+589	+0.51
1	+655	+0.64
2	+680	+0.76
4	+566	+0.71
10	+593	+0.86
20	+217	+1.59
50	+124	+0.78



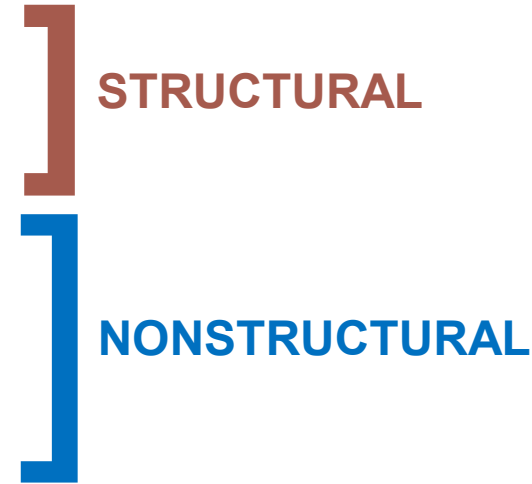


Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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MEASURES DEVELOPED INTO ALTERNATIVES

Measures:

1. Detention basins
2. Levees/floodwalls
3. Channel and bridge modification
4. Elevation of structures
5. Floodproofing
6. Acquisition (buyouts)
7. Flood warning system
8. Risk communication/education
9. Other: Outdoor recreation





Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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FINAL ARRAY OF ALTERNATIVES

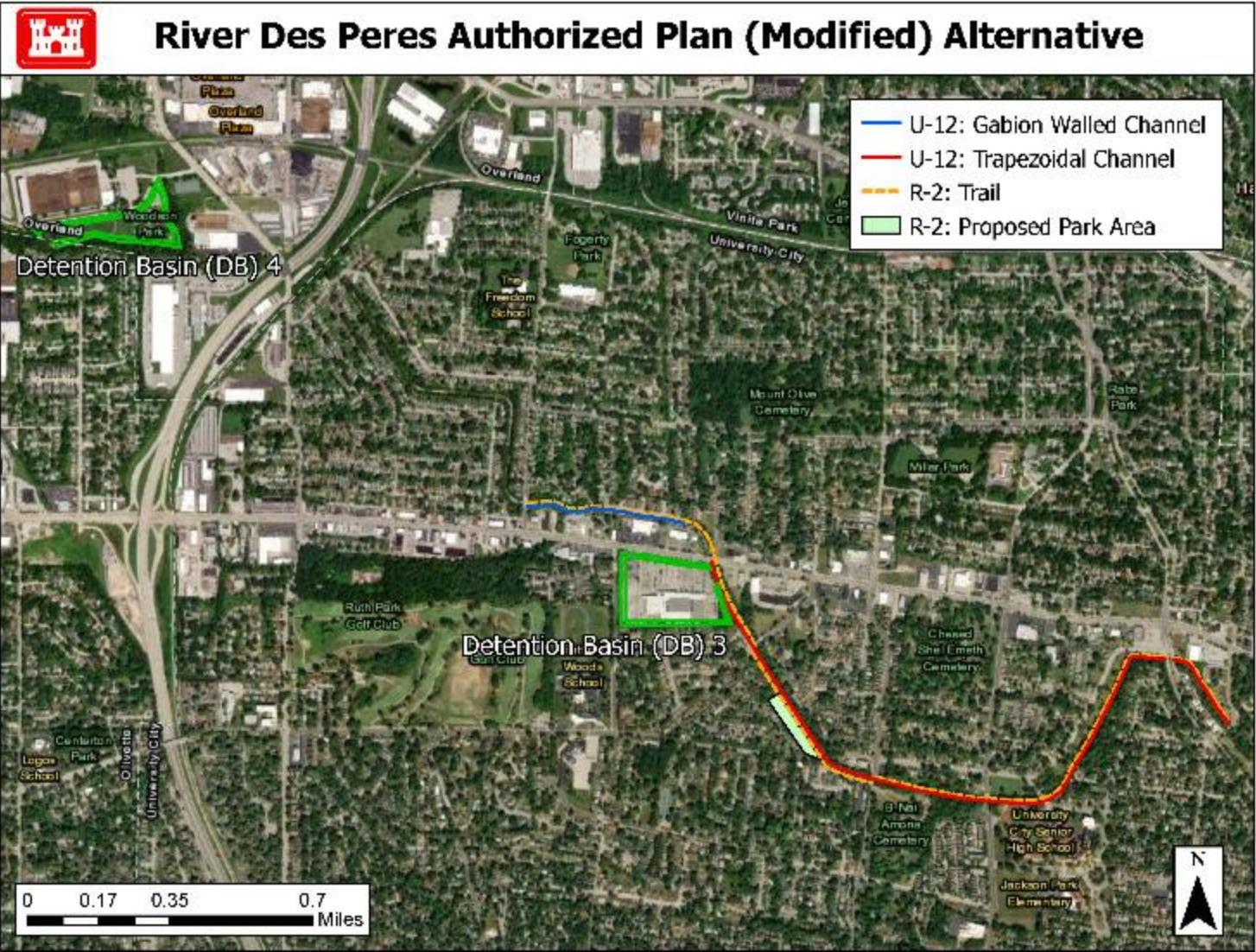
		Alternatives						
Type*	Measures	1. No Action	2. Authorized plan with modifications (DB3 & 4)	3. a. Detention basins 3 & 4	3. b. Detention basin 4	4. Levees/floodwalls (with DB3 & 4)	5. Nonstructural - Acquisition	6. Nonstructural – Floodproofing & elevation
S	Detention basins		X	X	X	X		
S	Levee/floodwall					X		
S	Channel modifications		X					
S	Bridge modifications		X					
NS	Floodproofing (wet/dry)							X
NS	Elevation of structures							X
NS	Acquisition						X	
NS	Flood forecasting/warning system		X	X	X	X	X	X
NS	Risk communication/education			X	X	X	X	X
O	Outdoor recreation		X	X	X	X	X	

*S = structural, NS = nonstructural, O = other



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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2. AUTHORIZED PLAN WITH MODIFICATIONS



- Features:
- Channel and bridge modifications from measure U-12 in authorized plan
 - Detention basins added to mitigate downstream impacts/address induced flooding

Level of risk reduction: TBD (range)
 Total Cost: \$59M
 Net Annual Benefits: \$20,000
 BCR: 1.01

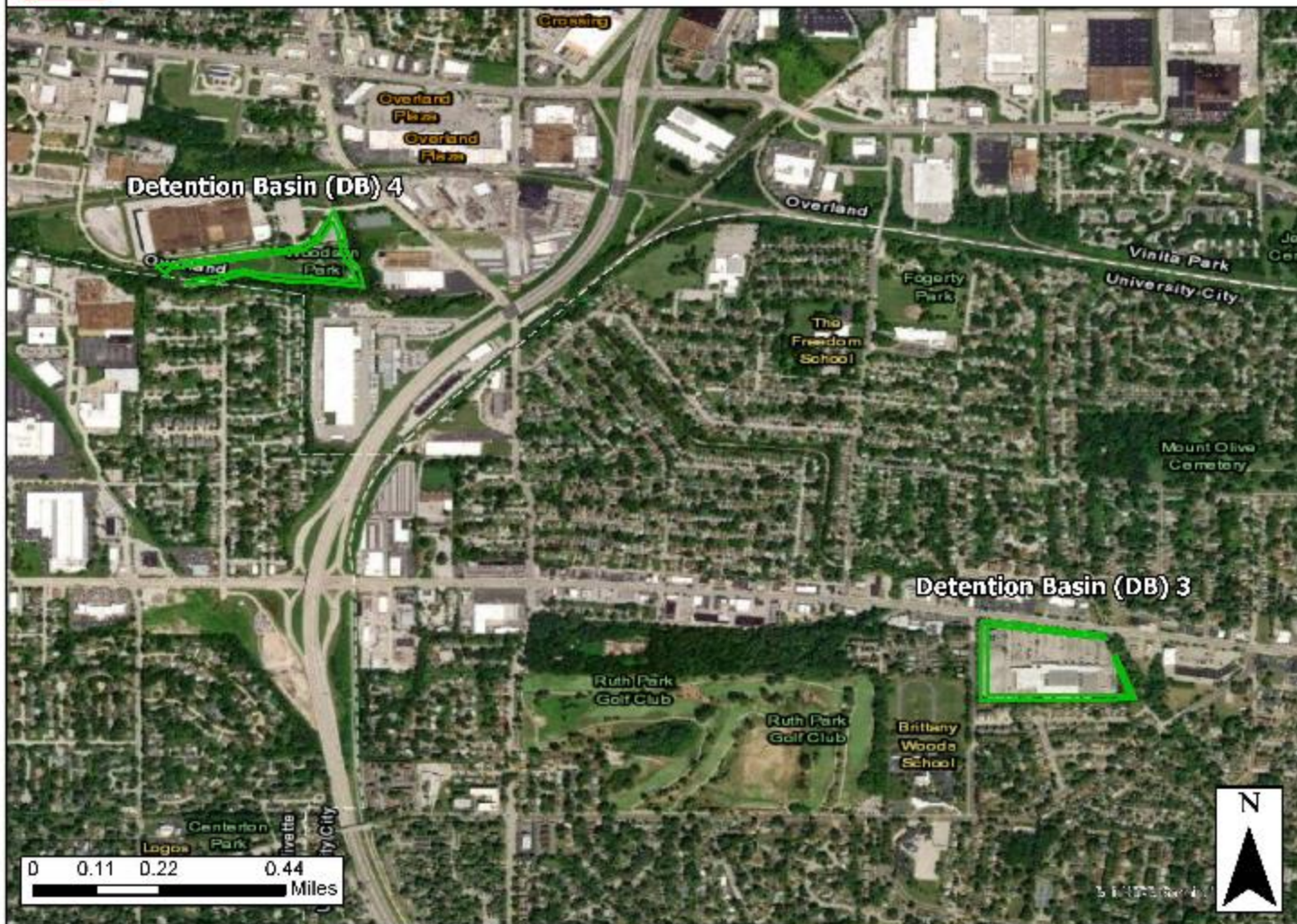
- Study risks/uncertainty:
- Other possible methods to address induced flooding
 - Channel modifications may impact FEMA HMGP parcels; coordination needed
 - Costs were indexed to 2020 dollars from 1987 dollars rather than estimated from contemporary structural examples

Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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3. DETENTION BASINS



River Des Peres Detention Basin Alternative



Features:

- 5 examined, 2 determined hydraulically feasible
 - Greater effect higher upstream in the watershed
- Dry detention for maximum storage during storms
- Recreation & naturalized features TBD

Level of risk reduction: 50% (2-yr) to 10% AEP (10-yr)

3.a. DB3 and DB4

Total Cost: \$43M

Net Annual Benefits: \$724,000 (3rd highest)

BCR: 1.33

3.b. DB4 only

Total Cost: \$9M

Net Annual Benefits: \$1.2M (2nd highest)

BCR: 2.98

Study risks/uncertainty:

- DB4 location in City of Overland; coordination needed
- DB3 location – Asian businesses, amenity
- Life safety risk – further analysis needed



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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4. LEVEE/FLOODWALL



Features:

- 6 reaches identified; 1 in final alternative
- Floodwall is major component
- Avoids floodway, ties into high ground, minimizes road crossings
- Impacts FEMA HMGP lands
- Recreation TBD, eg trail on levee crown

Level of risk reduction: 1% AEP (100-yr)
 Total Cost: \$85M
 Net Annual Benefits: -\$1M
 BCR: 0.73

Study risks/uncertainty:

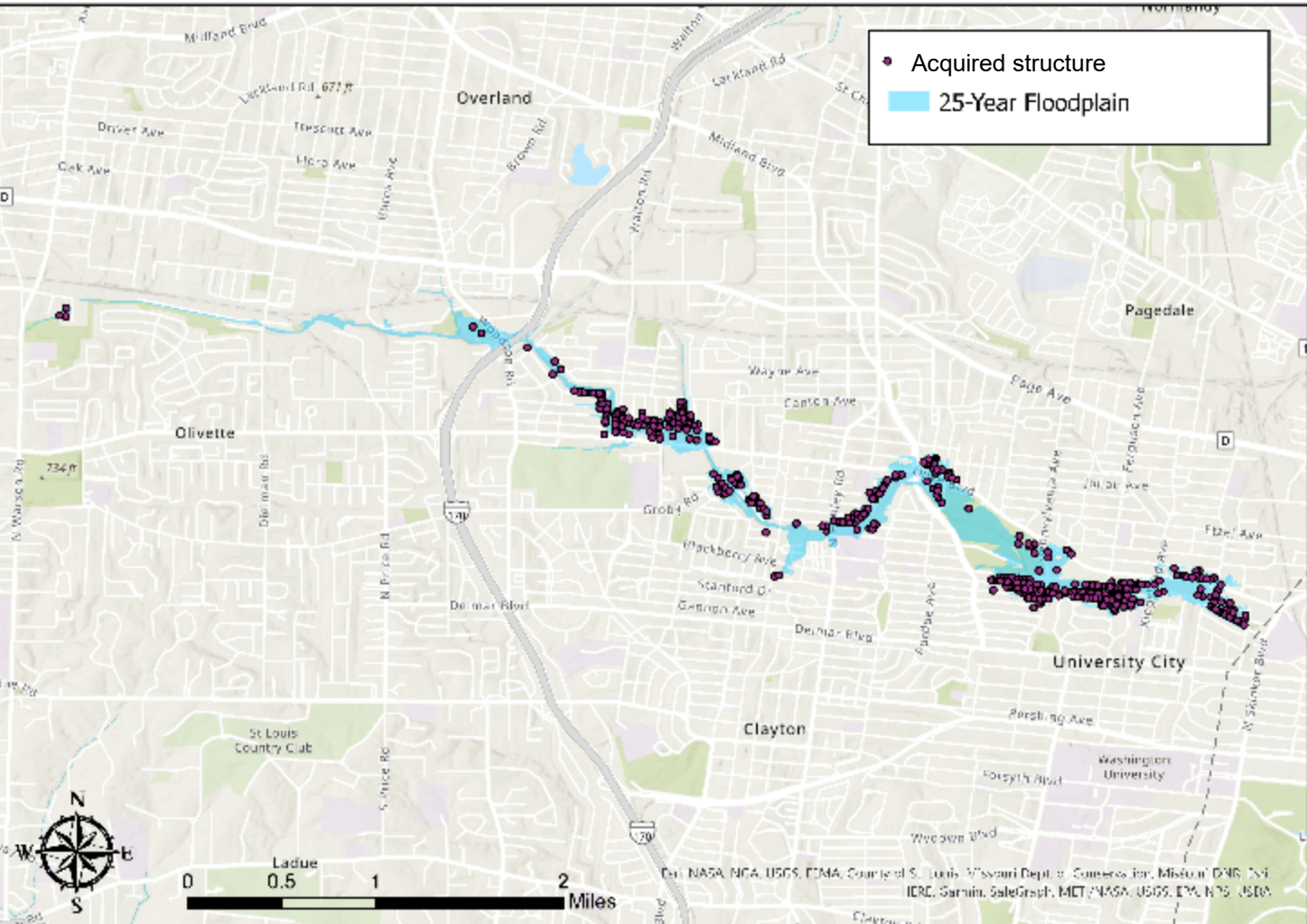
- Channel modifications may impact FEMA HMGP parcels; coordination needed
- Impacts to cultural resources
- Life safety risk – further analysis needed



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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5. NONSTRUCTURAL - ACQUISITION/BUYOUT

River Des Peres Nonstructural Alternative Map - Acquisition



Features:

- ~500 structures acquired in 4% AEP (25-year) floodplain; people relocated
- Recreation & natural features (eg parks, green space) TBD

Level of risk reduction: 4% AEP (25-yr)
 Total Cost: \$223M
 Net Annual Benefits: -\$2.8M
 BCR: 0.66

Study risks/uncertainty:

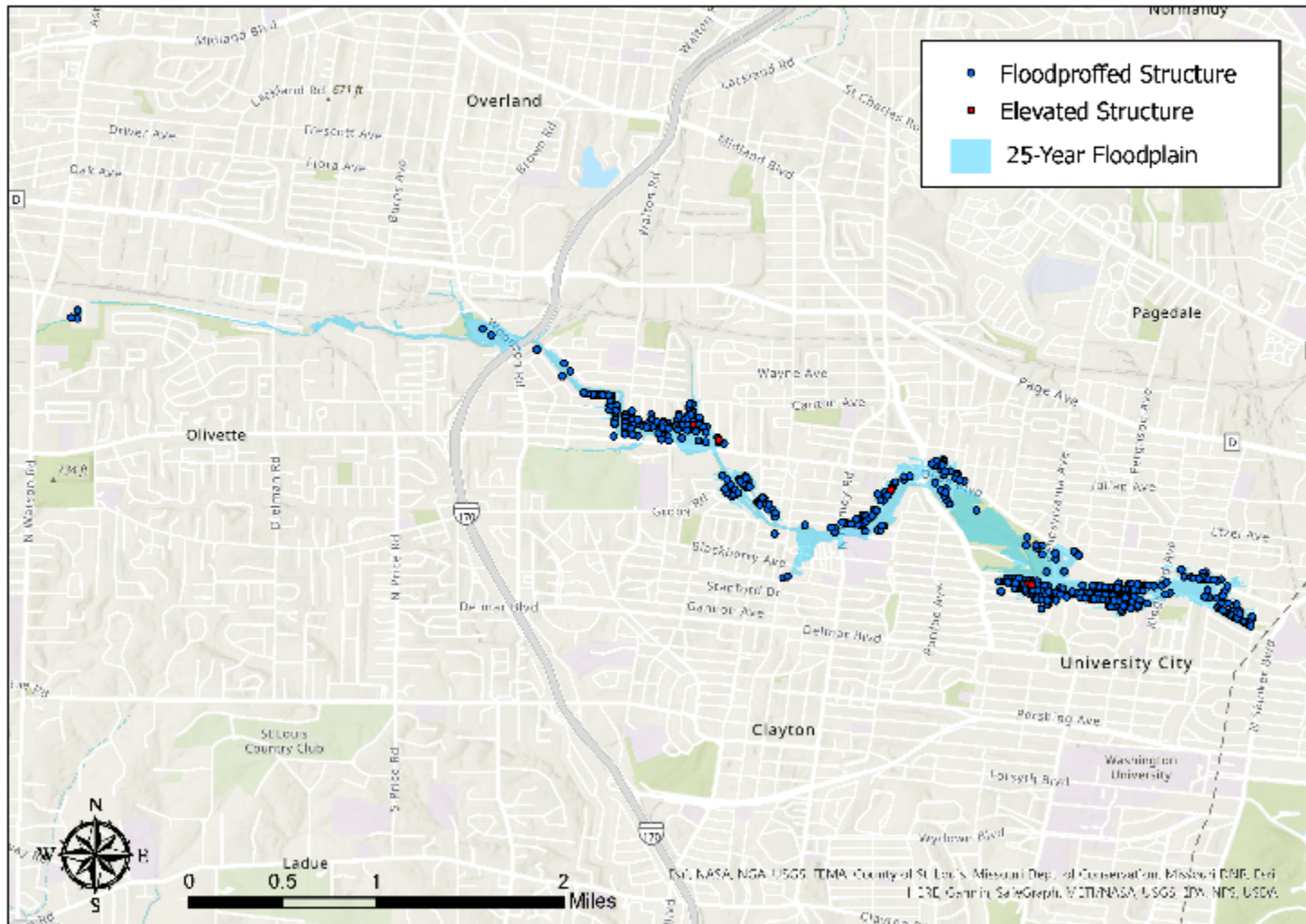
- Buyouts are mandatory; likely not acceptable to Sponsor (except some repeatedly flooded homes)



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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6. FLOODPROOFING AND ELEVATION OF STRUCTURES

River Des Peres Nonstructural Alternative Map - Combination



Features:

- ~500 residential structures in 4% AEP (25-year) floodplain; most floodproofed, ~7 elevated
- Height of elevation/floodproofing: 1% AEP (100-yr)
- No acquisition (not cost-effective in comparison)

Level of risk reduction: 4% AEP (25-yr)
 Total Cost: \$69M
 Net Annual Benefits: \$1.7M (1st – highest)
 BCR: 1.67

Study risks/uncertainty:

- Optimized risk level, eg smaller than 25-year
- Participation rate – 100% used in analysis; likely less; need sensitivity analysis to refine
- Cultural resources impacts – historic structures
- Floodproofing type – must be passive, given low warning times
- Acceptability to Sponsor – FEMA does not reduce flood insurance premiums for floodproofing



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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FLOOD WARNING SYSTEM: INCLUDED IN ALL ALTERNATIVES

- Sponsor developing its own municipal system
- Expertise from Commission on Storm Water Issues
- Data available:
 - >20 years of 5-minute-interval data from USGS stream gage at Purdue Ave
 - >10 years of mostly 5-minute-interval data from 6 MSD rain gages in or proximal to the watershed
- Commission member Dr. Criss built an extensive data base and developed statistical protocols for flood prediction based on the actual measurements
- Warning system components:
 - 3 NexSens G2-RAIN Alert Systems with solar power packs (2 already installed) in watershed
 - Gages are configured to report at 5 minute intervals at the onset of rainfall
 - Data is transmitted to the city's account at the NexSens WQDataLIVE cloud-based data center
 - Alarms will be issued when rainfall exceeds a predetermined threshold that is predictive of flooding
 - Public portal: <https://www.wqdatalive.com/public/1473>



Photo: Radio NB



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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EVALUATION METRICS FOR THE FOUR ACCOUNTS

NED	RED
<ul style="list-style-type: none"> - Economic consequences of alternatives, including flood damage to the community - Costs of construction, RE, nonstructural measures, and OMRR&R - Estimated implementation schedule 	<ul style="list-style-type: none"> - Economic impacts of project implementation – reductions in employment and labor income - RECONS-generated regional benefits - ECAM-generated regional growth & development
EQ	OSE
<ul style="list-style-type: none"> - Qualitative impacts to threatened and endangered species - Qualitative impacts to wetlands - HTRW impacts/risks - Cultural resources impacted 	<ul style="list-style-type: none"> - Life safety risk - Critical infrastructure protected - Socioeconomic consequences including to tax base, low-income neighborhoods - Recreation opportunities

*Table format from 'Incorporating the Four Accounts into Planning Studies', USACE, 2020 (Table 6.1)



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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ALTERNATIVES COMPARISON – COST BENEFIT SUMMARY

Alternatives	Level of Risk Reduction (% AEP)	Residual Risk (annual damage remaining)	Total Cost (incl. RE)	Net <u>Annual</u> Benefits (Benefits - costs)	BCR (annual benefits/costs)
1 - No Action	n/a	\$ 5,800,000	\$ -	\$ -	0
2 - Authorized Plan with Modifications (DB3 & DB4)*	TBD - range	\$ 2,823,000	\$ 58,547,000	\$ 20,000	1.01
3a - Detention Basins (DB3 and DB4)	50% (2-year) (filled by 10-yr, underwater by 100-yr)	\$ 2,976,000	\$ 43,330,000	\$ 724,000	1.33
3b - Detention Basin 4 (DB4)	50% (2-year) (filled by 10-yr, underwater by 100-yr)	\$ 4,079,000	\$ 8,476,000	\$ 1,201,000	2.98
4 - Levee/Floodwall (with DB3 & DB4)	1% (100-year)	\$ 2,947,000	\$ 84,589,000	\$ (1,096,000)	0.73
5 - Nonstructural – Acquisition	4% (25-year)	\$ 595,000	\$ 222,591,000	\$ (2,754,000)	0.66
6 - Nonstructural – FP & elevation	4% (25-year)	\$ 1,723,000	\$ 68,836,000	\$ 1,675,000	1.67

NED Plan



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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TSP SELECTION, REFINEMENT SINCE THE IPR

The TSP selected is the NED Plan: Nonstructural – Combination alternative

- Highest net benefits; 2nd highest BCR

Since the IPR, two refined analyses were conducted:

- 1) Nonstructural (25-year), elevation only
- 2) Combination – DB4 + nonstructural (25-year), elevation only

‘Hot off the press’ numbers:

Alternatives	Level of Risk Reduction (% AEP)	Residual Risk (annual damage remaining)	Total Cost (incl. RE)	Net Annual Benefits (Benefits - costs)	BCR (annual benefits/costs)
6 - Nonstructural – FP & elevation	4% (25-year)	\$ 1,723,000	\$ 68,836,000	\$ 1,675,000	1.67
7 - Nonstructural (elevation only)	4% (25-year)	\$ 5,133,000	\$ 26,498,000	\$ (204,000)	0.79
8 - DB4 + Nonstructural (elevation only) (25yr)	4% (25-year)	\$ 3,630,000	\$ 25,650,000	\$ 1,030,000	1.84



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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7. NONSTRUCTURAL - ELEVATION ONLY

25-Year Residential Elevations



Features:

- ~90 residential structures in 4% AEP (25-year) floodplain with flood depth above first floor; all elevated
- Developed as a 'no floodproofing possible' scenario
- Height of elevation/floodproofing: 1% AEP (100-yr)

Level of risk reduction: 4% AEP (25-yr)
 Total Cost: \$26M
 Net Annual Benefits: -\$204k
 BCR: 0.79

Study risks/uncertainty:

- Optimized risk level, eg smaller than 25-year
- Participation rate – 100% used in analysis; likely less; need sensitivity analysis to refine
- Cultural resources impacts – historic structures



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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POSSIBILITY OF A LOCALLY PREFERRED PLAN

If an LPP needed, waiver request and ASA approval needed (per ER 1105-2-100):

1. MSC Commander submits waiver request to the appropriate HQ RIT
2. HQ RIT prepares a letter responding to the MSC request, coordinated through Headquarters and OASA(CW) staff

Timeframe: before decision document; likely submitted before Public Review & Public Meeting in July 2021

We will plan to get back to you in a month if an LPP is likely to be requested.

Questions for vertical team:

OK to move forward while LPP waiver request is under consideration?

Waiver request: examples/template? Sponsor letter needed?

Expected ease of approval? (lower cost than NED Plan)



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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PATH FORWARD AND SPONSOR VIEWPOINT

Path forward:

1. Refine TSP in feasibility-level design:
 - Optimize % AEP in the next phase (may be <4% / 25-year)
 - Look into combining with DBs; combination structural-nonstructural may be NED Plan
 - Refine nonstructural measures in feasibility level design
 - Discuss key information and concerns about nonstructural measures with Sponsor and the public
2. Confirm whether LPP waiver needed
3. Confirm funding received from Sponsor for second half of study
4. Coordinate with City of Overland as needed
5. DQC draft report
6. Legal and technical editor review
7. Public meeting and public review period
8. Perform resource agency coordination; environmental effects analysis; ensure environmental compliance

Sponsor viewpoint



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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RISK SUMMARY – STUDY RISKS

Risk Rating	Risk	Consequence	Response
H	Cultural Resources - Multiple National Historic Register Districts affected by TSP.	If historic properties affected, MOA and potential mitigation would be required. Study may be delayed.	Perform early consultation with the SHPO. Assume impacts are unavoidable and add time/cost to schedule.
H	Study Cost – Extremely limited funds to complete study	Study halts; Sponsor may choose to provide more funding or end study	Conduct full PDT budget reassessment; investigate funding contingencies
M	H&H – Degree of backwater from the Tubes may be over or under estimated	If backwater is less than the conservative estimate used in the modeling, fewer structures are inundated	Conduct sensitivity analysis for range of backwater impacts
M	Economics - Structures may be over or under valued.	Damage calculations may be over or under estimated -> false justifications/non-justifications of alternatives.	Accept the risk; Appraise the structures.
M	Economics - First floor elevations for structures may be over or under estimated	Damage calculations may be over or under estimated -> false justifications/non-justifications of alternatives.	Accept the risk; Survey first floor elevations.
M	Other - Existing Phase I report is dated and may not cover the entire project area if a different plan is recommended.	Alternatives could be located on sites that should be avoided -> re-design or mitigation by sponsor.	Accept the risk. Perform Phase I for TSP only.



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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RISK SUMMARY – IMPLEMENTATION RISKS

Risk Rating	Risk	Consequence	Response
H	Low number of homeowners signing up for voluntary nonstructural measures like floodproofing and elevation. Reluctance for floodproofing may stem from people not wanting to lose basements, and/or no FEMA flood insurance reduction	The flood risk to these structures remains the same or worsens. The expected benefits are much lower, changing the NED plan	Participation survey, public outreach, and public review will reduce uncertainty and help determine expected level of participation
M	Limited or no participation from City of Overland (public park for DB4 if included; 2 structures for nonstructural)	DB4 not able to be constructed. The flood risk to the structures remains the same or worsens. The expected benefits are somewhat lower, potentially changing the NED plan	Coordination with the City of Overland and University City to determine level of participation



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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RISK SUMMARY – OUTCOME RISKS

Risk Rating	Risk	Consequence	Response
M	Residual risk – the nonstructural alternative benefits structures impacted at the 4% AEP/25-year event, providing benefit to the 1% AEP elevation; damage from larger flood events will not be mitigated	In flood events larger than the 1% AEP, such as the 0.2% AEP/500-year event, structures that are floodproofed will not receive any benefit over the FWOP; elevated structures would still benefit from elevation	Consider residual risk and additional benefits of elevation over floodproofing in larger flood events in economic analysis



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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TSP REQUIREMENTS MET

This Vertical Team Tentatively Selected Plan (TSP) Milestone is being conducted in accordance with guidance contained in Planning Bulletin 2018-01(S) and in full compliance with SMART Planning guidance.

The following requirements have been completed prior to the TSP: (orange: expected by 28 May; green: completed)

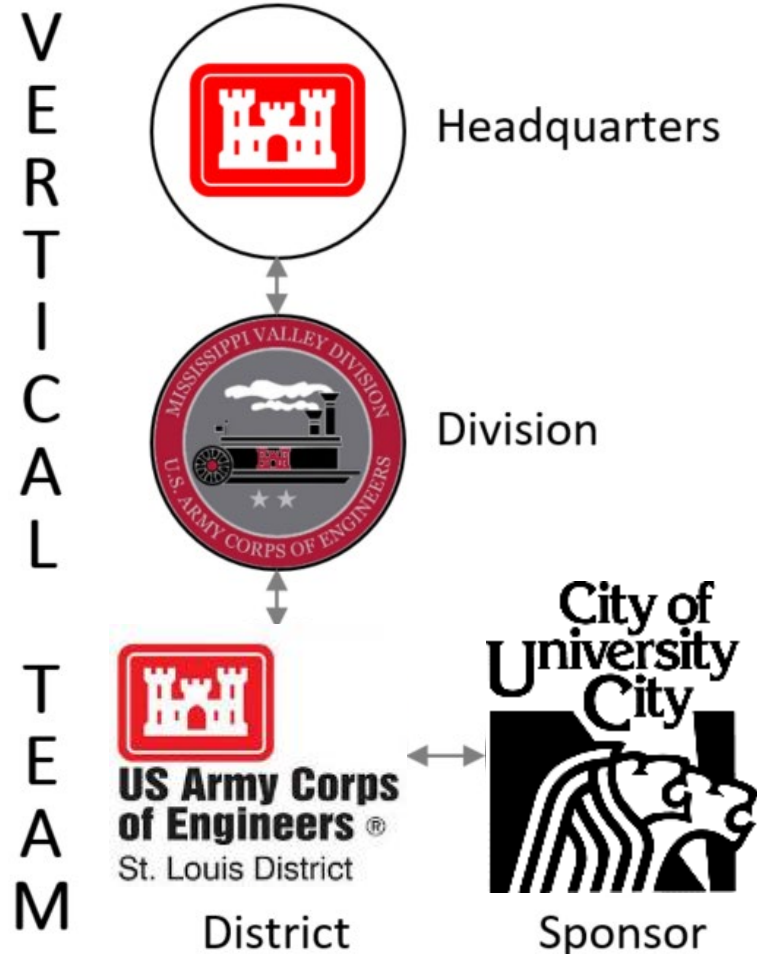
- Publish NOI to develop an Environmental Impact Statement (if applicable) – Not applicable
- Initiate IEPR contract process or prepare an IEPR Exclusion Request (if applicable) – Not applicable
- Environmental Compliance Activities (this list not inclusive of all environmental requirements):
 - Initiate consultation under Section 106 (NHPA) with State Tribal Historic Preservation Officer (SHPO/THPO)
 - Define Section 106 APE; identify and evaluate historic properties within the APE.)
 - Coordination with State / Tribal Historic Preservation Office (SHPO/THPO) on Area of Potential Effects (Cultural Resources)
 - Draft Conceptual Mitigation Proposal – Not applicable; no mitigation proposed because no habitat impacted by NS TSP (also, negligible impacts of DBs)
 - Prepare Draft Biological Assessment (if applicable)
 - Prepare Essential Fish Habitat (EFH) Assessment (if applicable) – Not applicable, for marine habitat only
 - Draft Fish and Wildlife Coordination Act (FWCA) Report – Not applicable; USFWS declined to participate
- Develop draft 404(b)(1) report
- Obtain habitat and other Planning Model Approvals or Certification (if applicable) – PCSWMM model CoP “approved for use”
- As many additional iterations of risk-informed planning process (six steps) as necessary to distinguish among alternatives and communicate level of uncertainty with the TSP; plan formulation activities resulting in identification of the TSP (and potential Locally Preferred Plan (LPP))
- Identify potential policy waivers required by ASA(CW), including 3x3 exemption, LPP Waiver, etc. (if applicable; The District Commander will submit a policy exemption package as needed after the TSP milestone but in all cases no less than 60 days before the end of the 36 month time frame. See PB 2018-01(S) for more.)
- PMP and Review Plan updated; document scope and schedule to Final Report Transmittal

The decisions coming out of the TSP Milestone will be documented in the Memorandum for Record (MFR).



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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TSP MILESTONE DECISIONS



Vertical Team Concurrence

1. Concurrence on Final Array and TSP
2. Concurrence on proposed path to ADM



Overview	EC/FWOP	Formulation	TSP Selection	Risks	Discussion
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QUESTIONS



Photo: St. Louis Post Dispatch

Contact:

Mr. Matthew Jones, Project Manager
Matthew.a.jones@usace.army.mil
1222 Spruce Street
St. Louis, MO 63103

Public comments may be directed to:
ucityfloodrisk@usace.army.mil

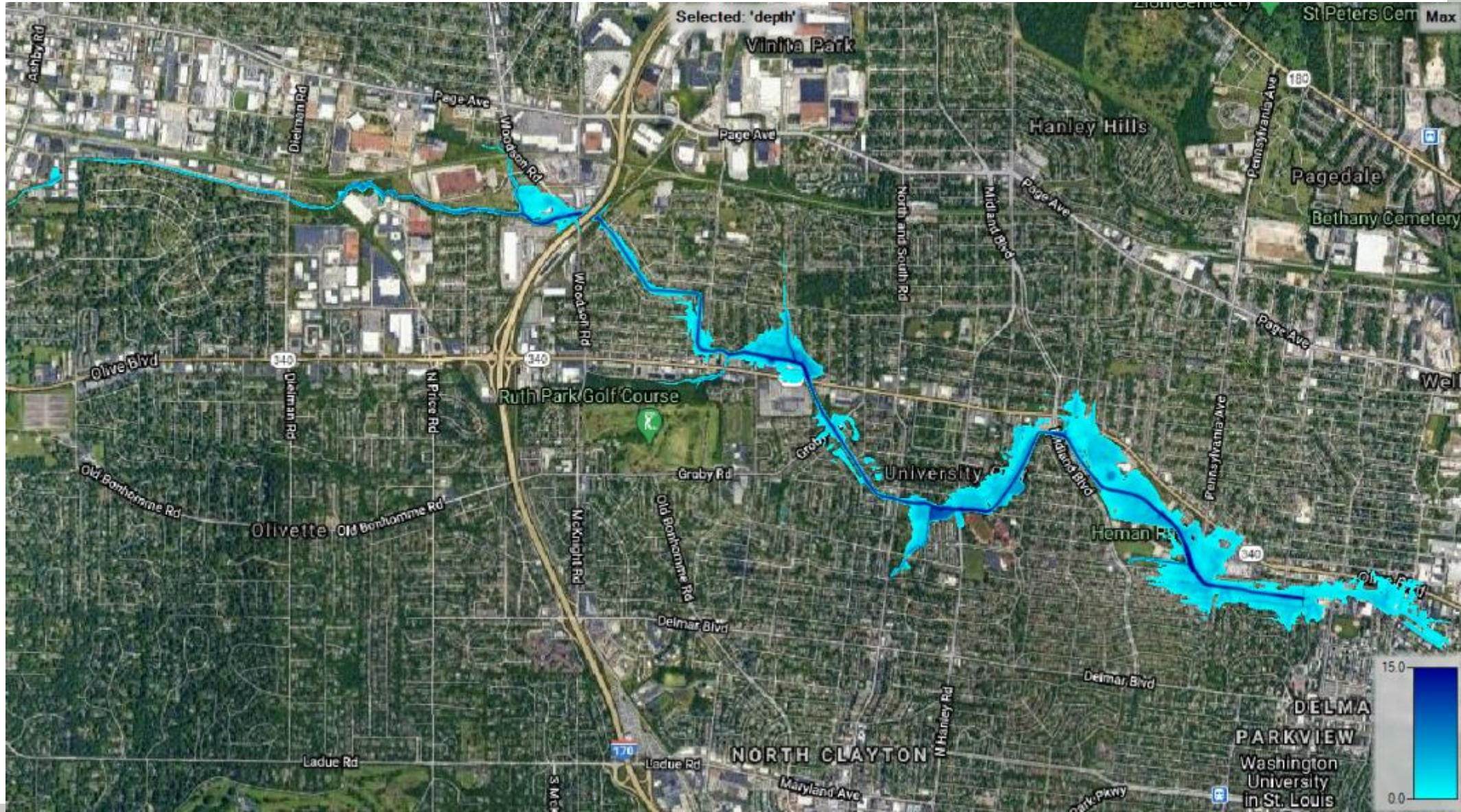
Project website:
<https://www.mvs.usace.army.mil/Missions/Programs-Project-Management/River-Des-Peres-University-City-General-Reevaluation-Report/>



REFERENCE SLIDES

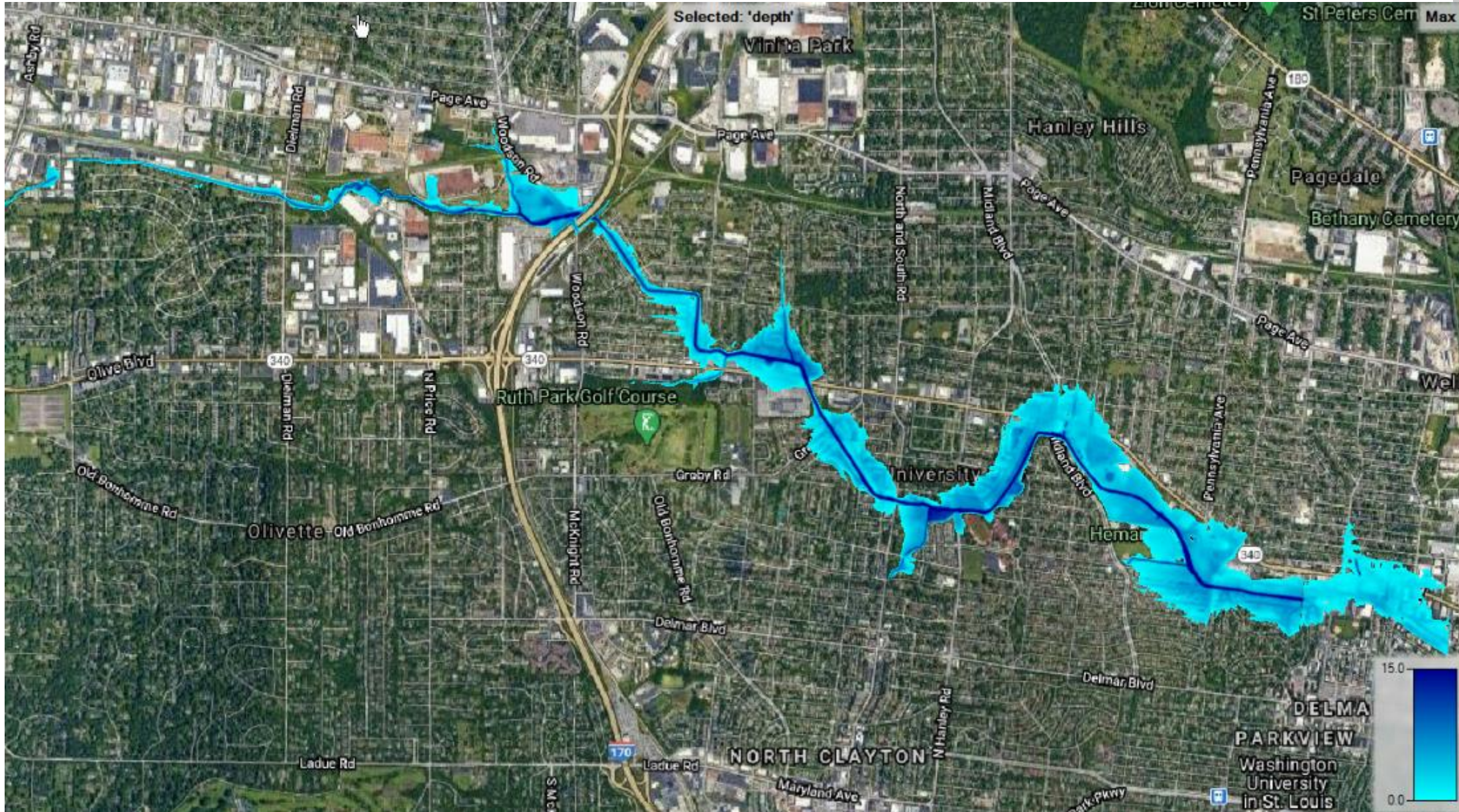


INUNDATION – 10% AEP (10 YEAR)





INUNDATION – 1% AEP (100-YEAR)





DETAILED TABLE WITH CRITERIA ON THE FOUR ACCOUNTS

	RED			EQ					
Alternatives	RECONS	ECAM	Notes	Wetland impacts	Env. mitigation cost	T&E sp. Impacts	HTRW impacts/risk; 401	Cultural - #, type properties affected	Notes
1 - No Action	TBD	TBD		None	\$ -	n/a	None	None	Every historic property within floodplain impacted.
2 - Authorized Plan with Modifications (DB3 & DB4)*	704.3 full-time equivalent jobs \$56,526,679 in labor income \$56,907,175 in gross regional product \$96,219,914 in economic output in the local impact area	TBD		None	Yes, TBD, not likely to affect decision	NLAA (not likely to adversely affect)	Low risk	Low risk	Env. Mitigation & T&E - NLAA; trees cut down for DBs; field work needed re roosting habitat. Cultural: 0 structures impacted; arch. survey needed
3a - Detention Basins (DB3 and DB4)	521.3 full-time equivalent jobs \$41,834,783 in labor income \$42,116,383 in gross regional product \$71,211,315 in economic output in the local impact area	TBD		None	Yes, TBD, not likely to affect decision	NLAA	Low risk	Low risk	Env. Mitigation & T&E - NLAA; trees cut down for DBs; field work needed re roosting habitat. Cultural: 0 structures impacted; arch. survey needed
3b - Detention Basin 4 (DB4)	102.0 full-time equivalent jobs \$8,183,513 in labor income \$8,238,598 in gross regional product \$13,930,005 in economic output in the local impact area	TBD		None	Yes, TBD, not likely to affect decision	NLAA	Low risk	Low risk	Env. Mitigation & T&E - NLAA; trees cut down for DBs; field work needed re roosting habitat. Cultural: 0 structures impacted; arch. survey needed
4 - Levee/Floodwall (with DB3 & DB4)	1,017.6 full-time equivalent jobs \$81,670,031 in labor income \$82,219,772 in gross regional product \$139,019,015 in economic output in the local impact area	TBD		None	Yes, TBD, not likely to affect decision	NLAA	Low risk	Low risk	Env. Mitigation & T&E - NLAA; trees cut down for DBs; field work needed re roosting habitat. Cultural: 0 structures impacted; arch. survey needed
5 - Nonstructural - Acquisition	TBD	TBD		None	\$ -	n/a	Low risk	TBD	~507 structures acquired; land converted to open space
6 - Nonstructural - Combination	644.4 full-time equivalent jobs \$51,590,442 in labor income \$64,973,069 in gross regional product \$101,016,420 in economic output in the local impact area	TBD		None	\$ -	n/a	Low risk	TBD	7 structures elevated, ~500 structures for floodproofing; some in SHPO areas. Consultation with SHP needed if floodproofing/elevation affects facades. Would affect cost and time for consultation. Could be mitigation costs.



DETAILED TABLE WITH CRITERIA ON THE FOUR ACCOUNTS (2)

	Other Social Effects				Constraints, Opportunities, Risks, Uncertainty		
Alternatives	Life safety, incl. evacuation, breach	Critical infrastructure protected?	Impacts to low income neighborhoods	Notes	Constraints - HMGP...	Opportunities - WQ, habitat, recreation...	Risks & Uncertainty re TSP Selection
1 - No Action				Warning time, evacuation routes, duration, evacuate up, velocities	n/a	n/a	
2 - Authorized Plan with Modifications (DB3 & DB4)*	TBD. Should benefit: DBs delay the peak; lower WSE & velocities	Fire station (currently impacted at 1% AEP) - total mitigation	Some impacts and some benefits	Expected similar life safety across structural alternatives. (Depth & velocity accounted for in benefits)	Risk: Channel mod. adjacent to HMGP lands	Recreation; potential WQ	Designs taken from 1988 Feasibility Study; need updated
3a - Detention Basins (DB3 and DB4)	TBD. Should benefit: DBs delay the peak; lower WSE & velocities	Fire station - total mitigation	No/low impact	Life safety - DB berm height >3 ft.; document risk in event of a breach. Other: DB3 location at Asian food businesses; community amenity	n/a	Recreation; potential WQ	2:1 slopes and foundation type -> foundation exploration and load case info at weir structure needed
3b - Detention Basin 4 (DB4)	TBD. Should benefit: DBs delay the peak; lower WSE & velocities	Fire station - some reduction in stage	No impact	Life safety - DB berm height >3 ft. - document risk in event of a breach	n/a	Recreation; potential WQ	2:1 slopes and foundation type -> foundation exploration and load case info at weir structure needed
4 - Levee/Floodwall (with DB3 & DB4)	TBD. Should benefit: DBs delay the peak; lower WSE & velocities	Fire station - total mitigation	Some impacts and some benefits	Life safety - document risk in event of levee breach	Risk: HMGP lands in levee footprint	Recreation; potential WQ	PAR and further life safety assessment needed
5 - Nonstructural - Acquisition	Improved life safety	No change	TBD		n/a	Recreation	NSI likely to be more accurate for large aggregations than for small/structure level analysis
6 - Nonstructural - Combination	Improved life safety	No change	Some impacts; does not appear disproportionate		n/a	None	NSI likely to be more accurate for large aggregations than for small/structure level analysis