

Equitable Engineering – How MSD is Addressing Vulnerabilities through Planning

September 26, 2023



Equitable Engineering



1

Application of equity lens at front end of the capital planning process

2

Spectrum of applications at the project, program, and enterprise levels

3

Connection to Justice40 platform – how this process has positioned us for alternate funding pursuits

MSD Protects Public Health and Safety through Three Core Services

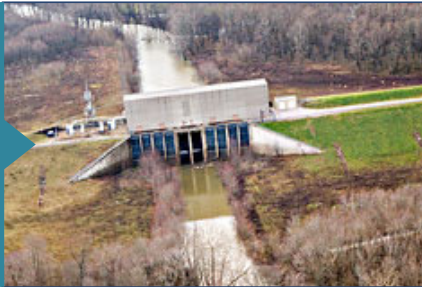
Wastewater Collection and Treatment



3,200 miles of sewer lines collect **153 million gallons** of wastewater each day for treatment at five regional water quality treatment centers (Morris Forman, Derek R. Guthrie, Cedar Creek, Floyds Fork, and Hite Creek) in Jefferson County.

Regional expansion is allowing water quality improvements in Oldham and Bullitt Counties.

Reliable Flood Protection



The Ohio River Flood Protection System includes **26.1 miles of floodwall** and earthen levee, **16 flood pump stations**, 150 floodgates, and 80 floodwall closures

This system **protects more than 200,000 people, 87,000 homes, and \$24 billion in property** throughout Louisville Metro.

Stormwater Drainage Management



MSD manages inland drainage systems and improvements

The municipal separate storm sewer system (MS4) program protects **11 watersheds** and **760 miles of streams** in Jefferson County.

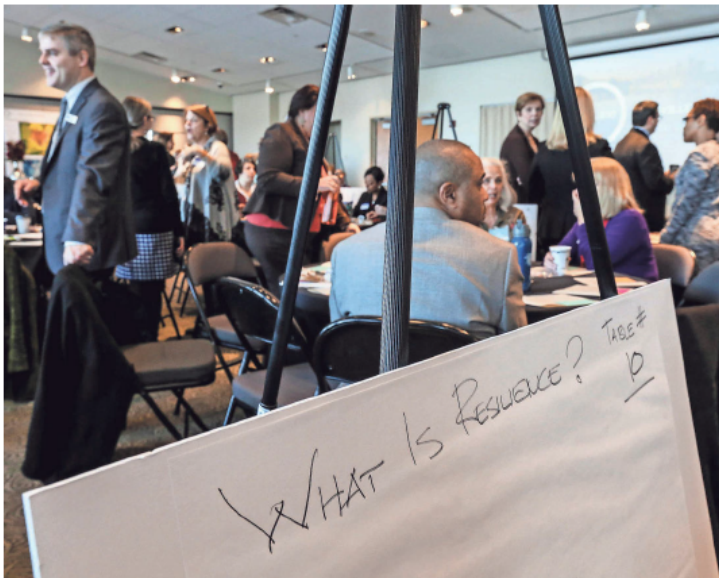
Equity Lens



Louisville is Committed to Becoming a Resilient City



100 RESILIENT CITIES



MICHAEL CLEVINGER/COURIER-JOURNAL
Attendees for a conference on resilience mingle ahead of the start of the conference Tuesday morning at the Muhammad Ali Center.

February 1, 2017
100 Resilient Cities Workshop
article (Courier-Journal)

CITY GETTING HELP TO FACE THREATS

Effort aims to protect Louisville from shocks, stresses

JAMES BRUGGERS
@JBRUGGERS

Louisville may be able to tap into millions of dollars of free services from some of the world's leading companies or organizations as part of its participation in a network of 100 global cities trying to become more adaptable in the face of serious threats.

But first the city will have to narrow its focus on the problems it will seek to solve.

Among the priorities that made the first cut in a Tuesday workshop:

Top six shocks identified by workgroups

- » Economic crisis
- » Severe or catastrophic weather
- » Infrastructure vulnerability or failure
- » Riot or civil unrest
- » Hazardous materials accident
- » Cyber attack

Top seven stresses identified by workgroups

- » Poverty and inequality
- » Lack of wellbeing and poor health
- » Low-performing education systems
- » Aging infrastructure
- » Racial and lack of social cohesion
- » Degradation of built and natural environment
- » Climate change

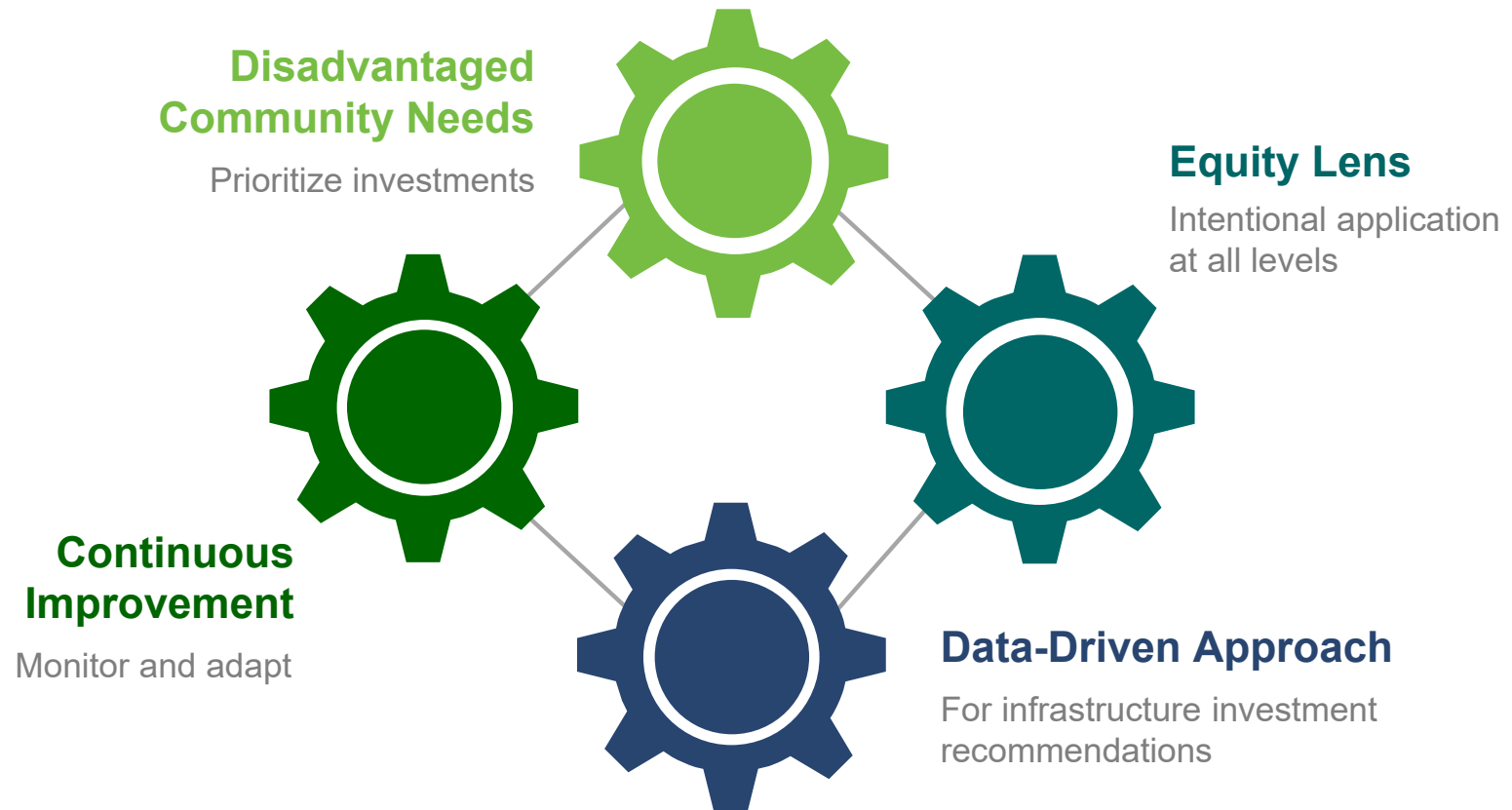
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Top seven stresses identified by workgroups

- Poverty and inequality
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- *Aging infrastructure*
- Racial and lack of social cohesion
- Degradation of built and natural environment
- *Climate Change*

Equitable Planning – Begin with the End in Mind



Project, Program, and Enterprise Application Examples



Planning Program Examples

Enterprise Level

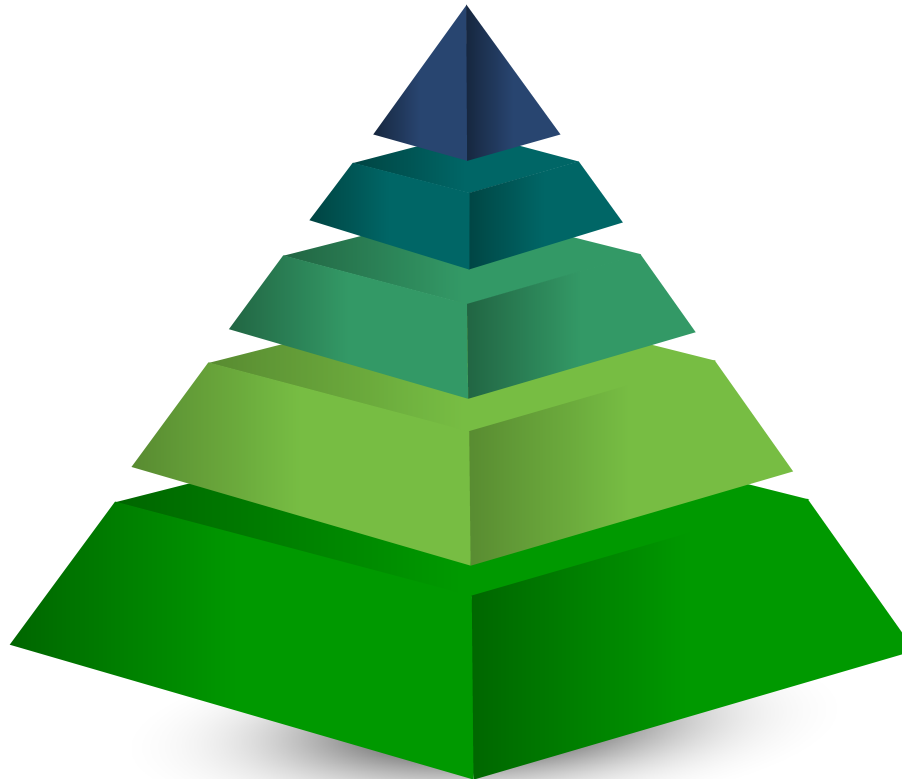
CIP Prioritization

Program Level

Stormwater Master Planning

Project Level

Business Case Evaluations



Planning Program Examples

Project Level
Business Case Evaluations

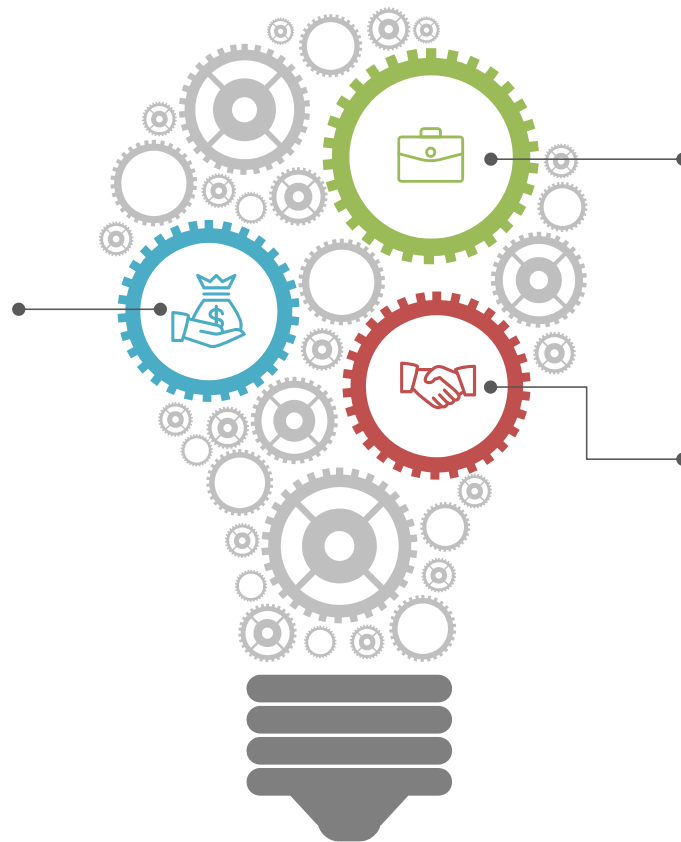


Intent of the BCE

Robust planning analysis that assesses project alternatives

Path Forward

Documents approval and concurrence prior to project initiation



Project Details

Answers the “How,” “Who,” “What,” “When,” “Where,” and “Why”

Coordination

Provides coordination with Operations during scope development

Intent of the BCE

Robust planning analysis that assesses project alternatives

Path Forward

Documents approval and concurrence prior to project initiation

Disadvantaged community metrics are evaluated as part of this process



Project Details

Answers the “How,” “Who,” “What,” “When,” “Where,” and “Why”

Coordination

Provides coordination with Operations during scope development

Planning Program Examples

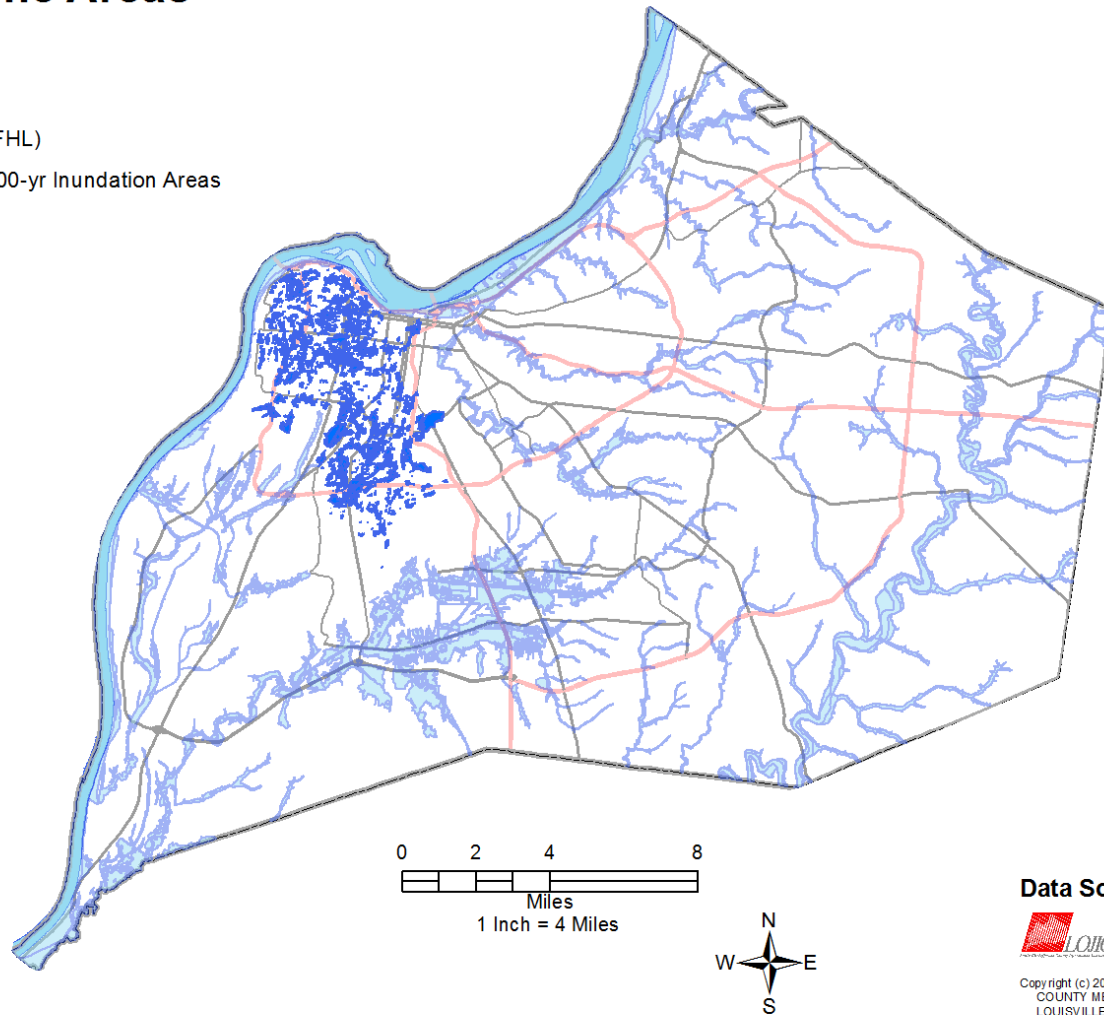
Program Level
Stormwater Master Planning



Louisville and Jefferson County Floodprone Areas

Legend

- SFHA (NFHL)
- CSSA - 100-yr Inundation Areas



Created: June 9, 2014
Path: \\eng9\Projects\LMSW\00030\GIS\Task04_Inventory\FloodProneAreas.mxd

Data Sources:



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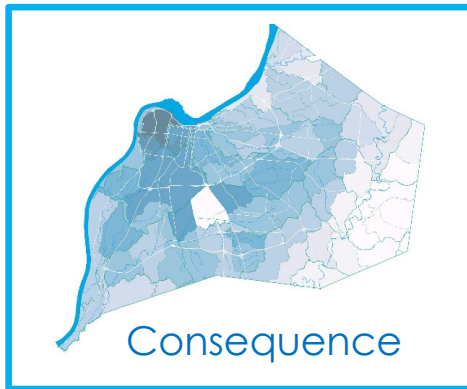


Stormwater Master Planning Strategy

- Budget limitations
 - Watershed-by-watershed approach for analysis and solution development
- Risk-based prioritization

Consequence Variables:

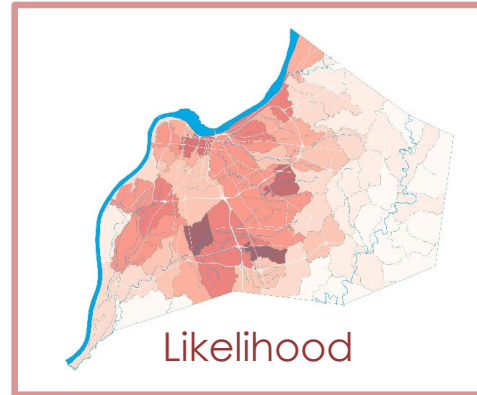
- Population Density
- Building Density
- **Social Vulnerability Index Scores**
- Critical Facilities
- Infrastructure
- Government Facilities



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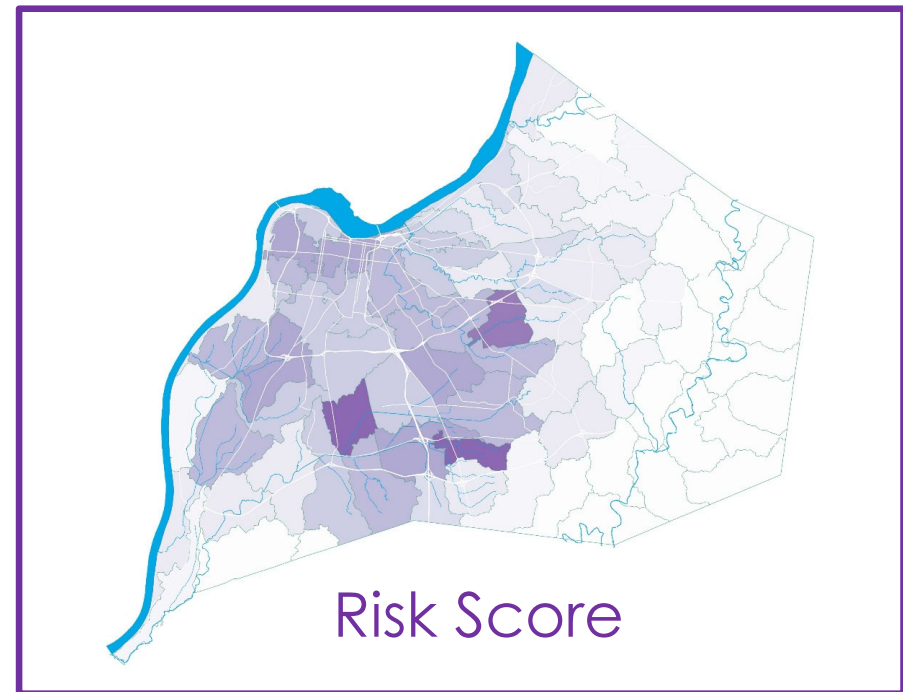
Likelihood Variables:

- Building Density Within Floodplain
- Road Density Within Floodplain
- Customer Calls (IPS)
- Pre-Rain Event Inspections
- Repetitive & Severe Repetitive Loss
- Flood Insurance Policies
- Water Quality

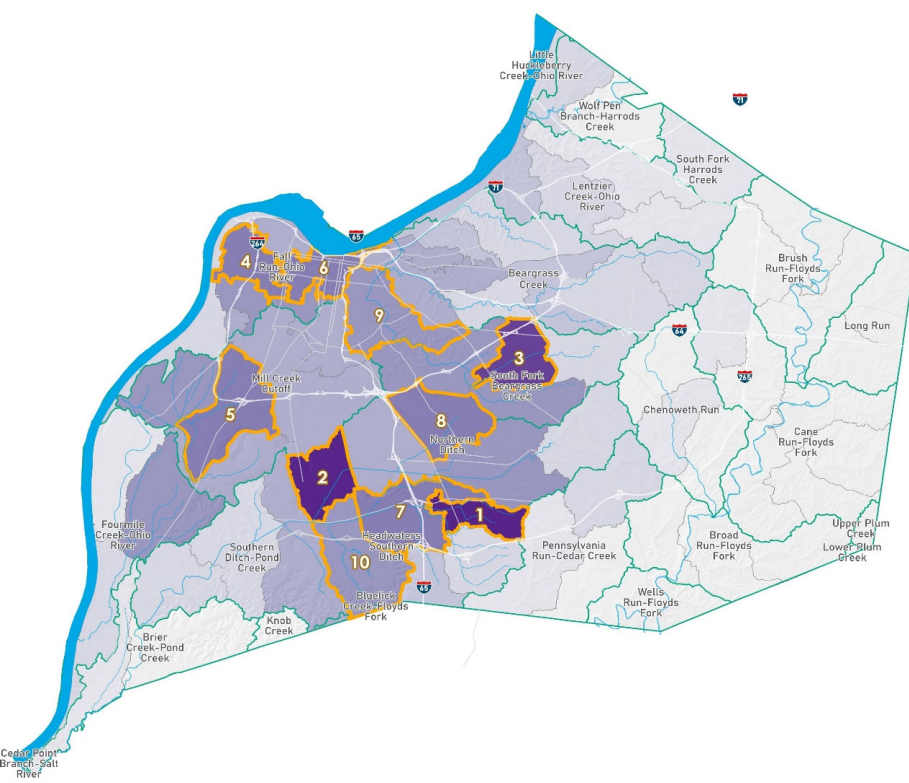
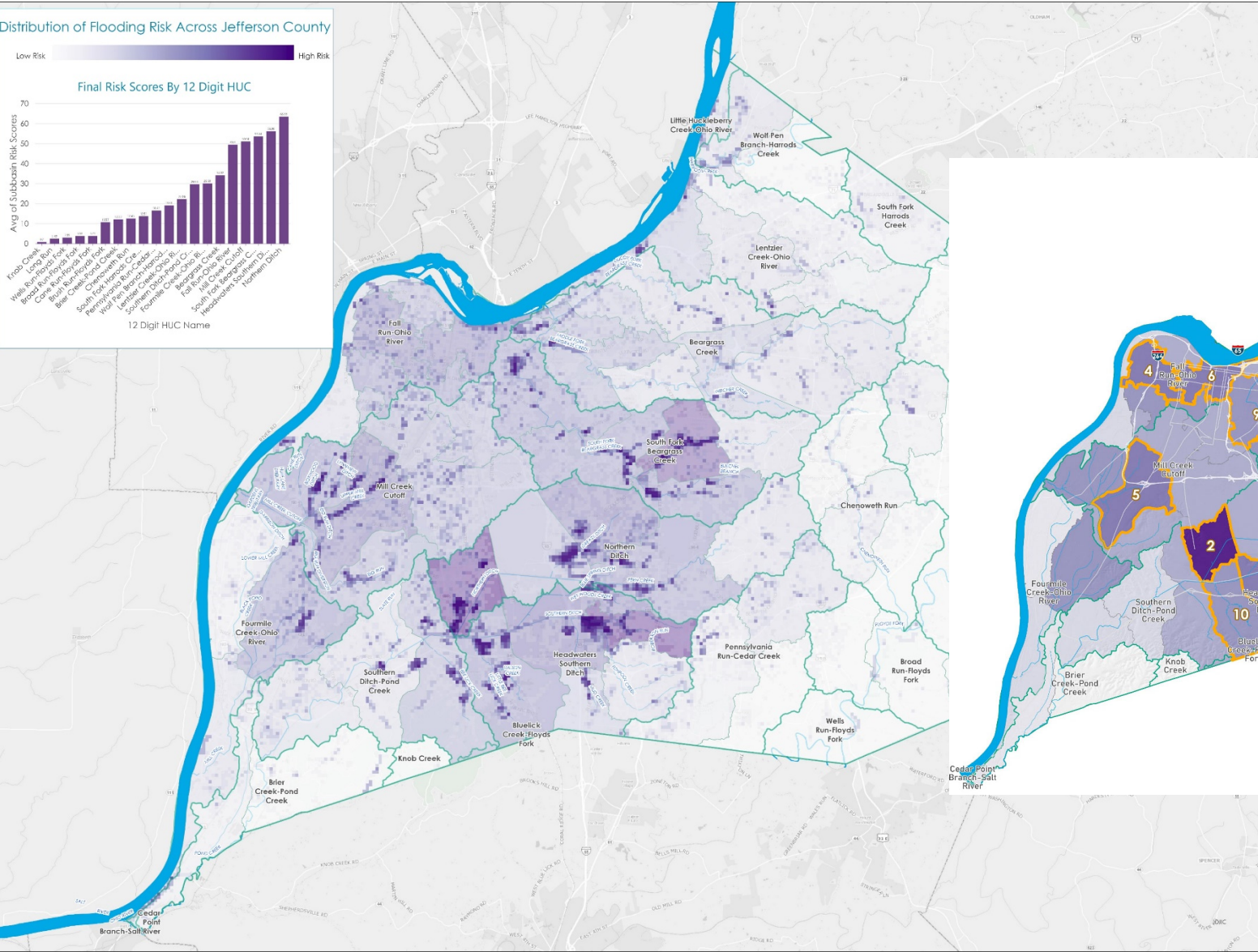
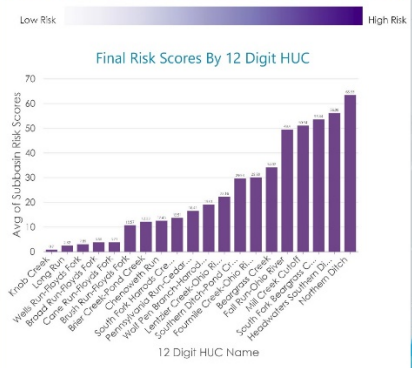


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Output:



Distribution of Flooding Risk Across Jefferson County



Planning Program Examples

Enterprise Level

CIP Prioritization



Prioritize Any Type of Project



Community



Repairs



Partnership



Flood Control



Facilities



Growth

Inputs



List of
Projects



Drivers &
Scoring



Financials:
Costs & Budgets

Project Drivers Included in the Optimization



Cost

Annual Budget
Funding Source
Equitable Spend



Risk (Score)

Asset Condition
Natural Disaster Mitigation
Regulatory Compliance
Safety

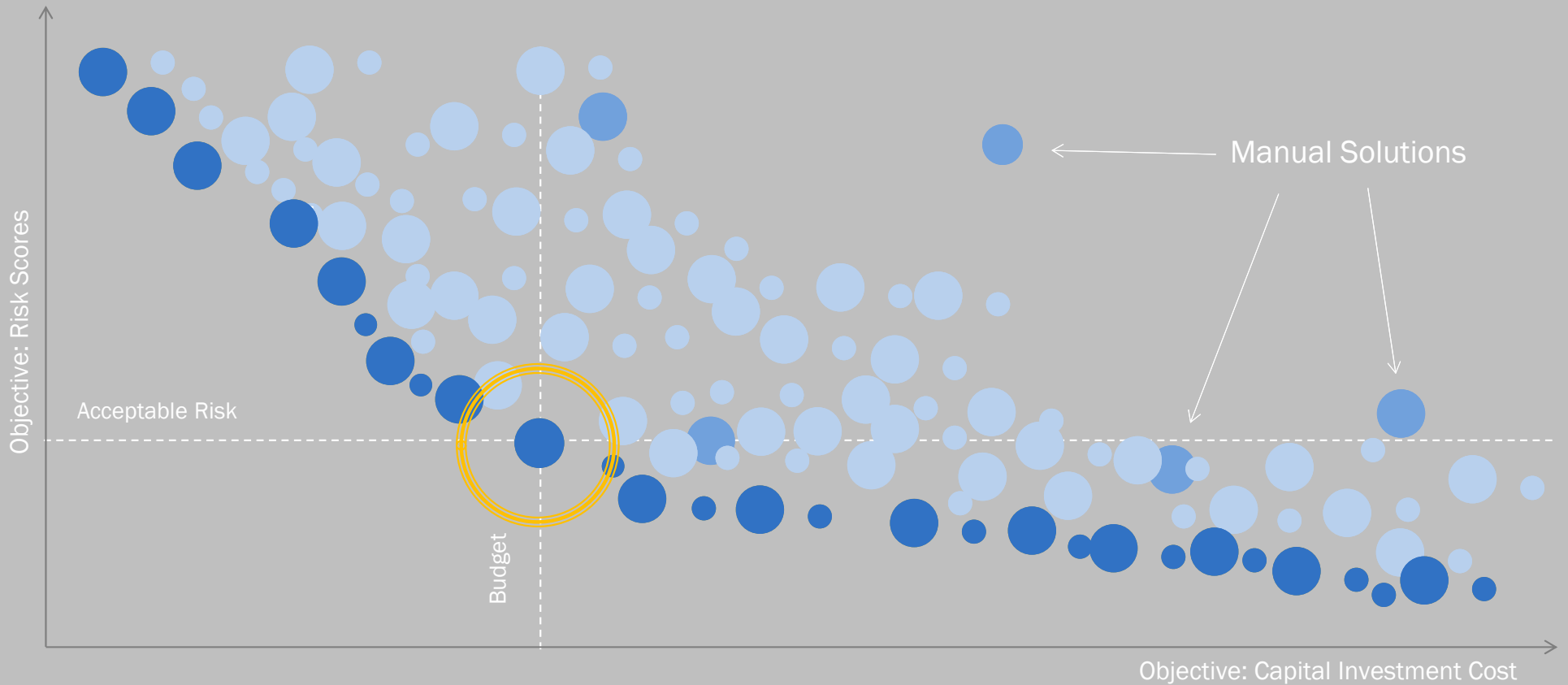


Benefit (Score)

Community Impact
Customer Service
Sustainability
Public Health
Economic Development

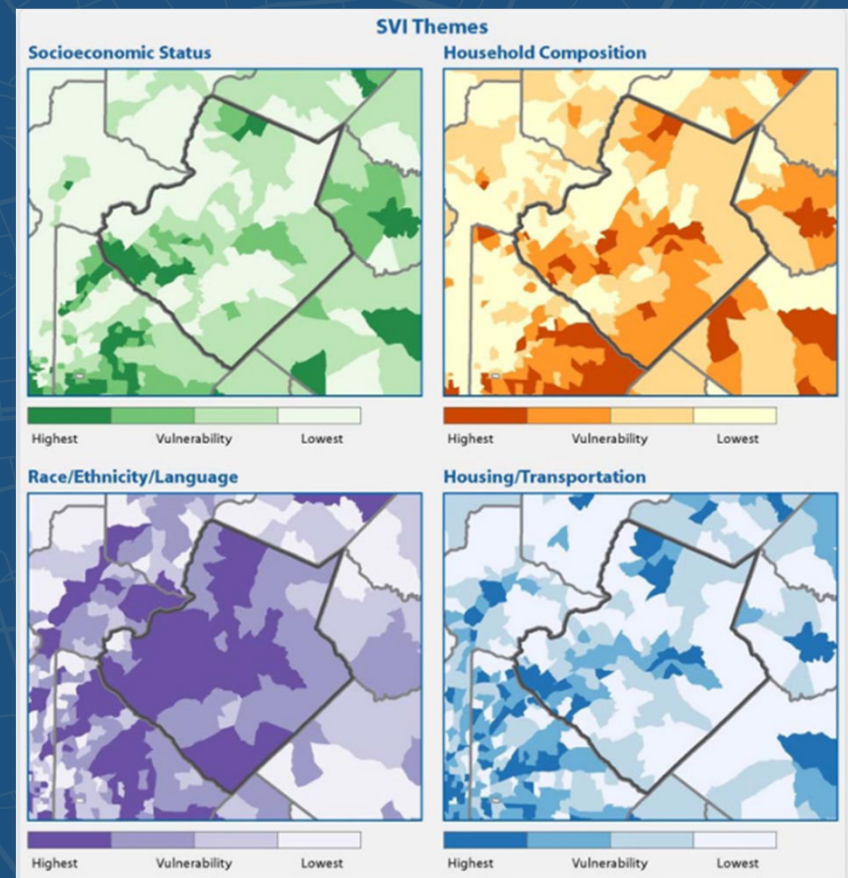
Consider Thousands of Alternatives & Select the Optimal Strategy

Every dot represents a different selection and schedule of projects.



Social Vulnerability Index [CDC/ATSDR SVI Database]

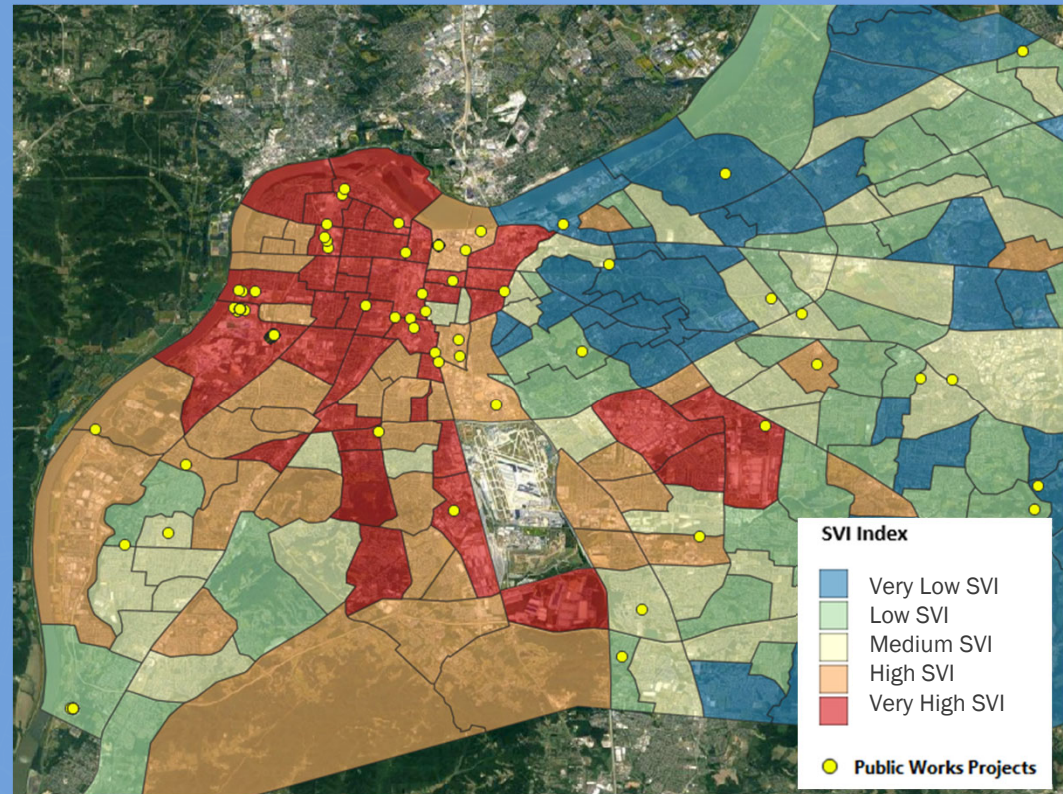
- **Social vulnerability index:** A quantitative metric characterizing the factors that allow a community to prevent human suffering and financial loss in the event of a disaster
- Originally developed for emergency response planners and public health officials, the CDC's SVI database utilizes U.S. Census Data to determine a holistic metric of social vulnerability for every census tract
- SVI database can also provide clean water utilities with an initial dataset from which to determine a multi-objective decision making approach to project planning



Example of Equity Focused Multi-Objective Prioritization

Metropolitan Area SVI Characterization

- When scheduling large public works projects over extended intervals of time, utility managers need to prioritize projects which:
 - Maximize Engineered Benefits
 - Minimize Asset Risk
 - Meet Budgetary Constraints
- Each project in need of scheduling can exhibit high variability in terms of these objectives, making prioritization an exercise in balancing tradeoffs on a massive scale

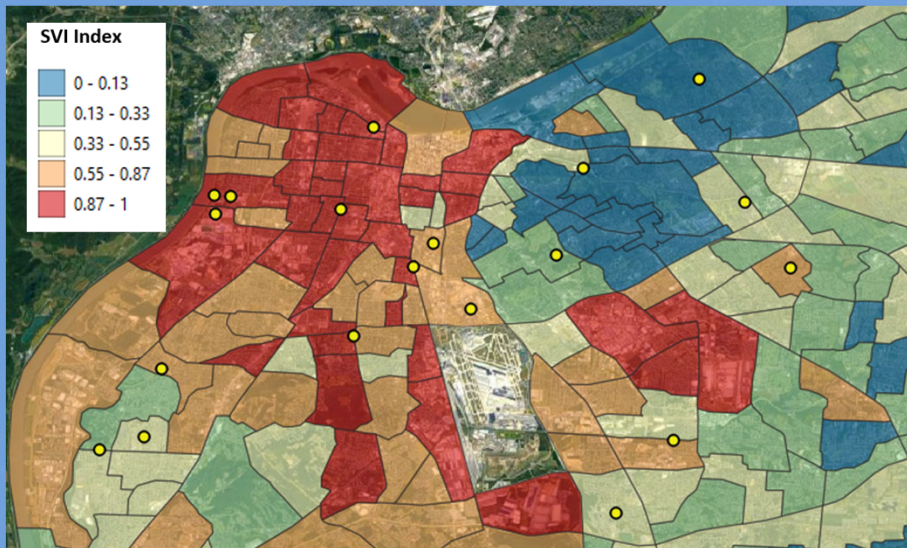


Example of Equity Focused Multi-Objective Investment

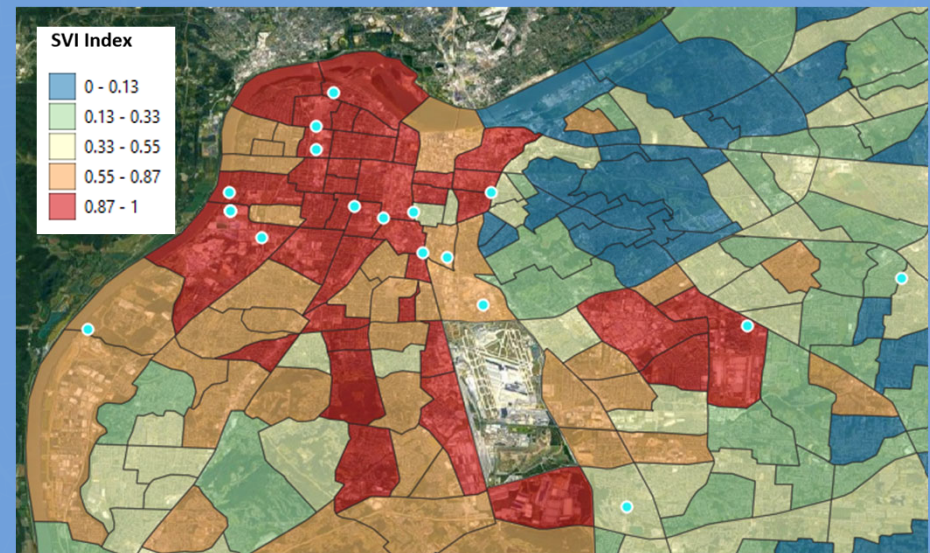
Grouping of Projects Chosen for Implementation in 2025

	Standard	Equity Focused
Very High SVI	6	15
High SVI	6	3
Medium SVI	4	2
Low SVI	3	0
Very Low SVI	1	0

Standard Optimization



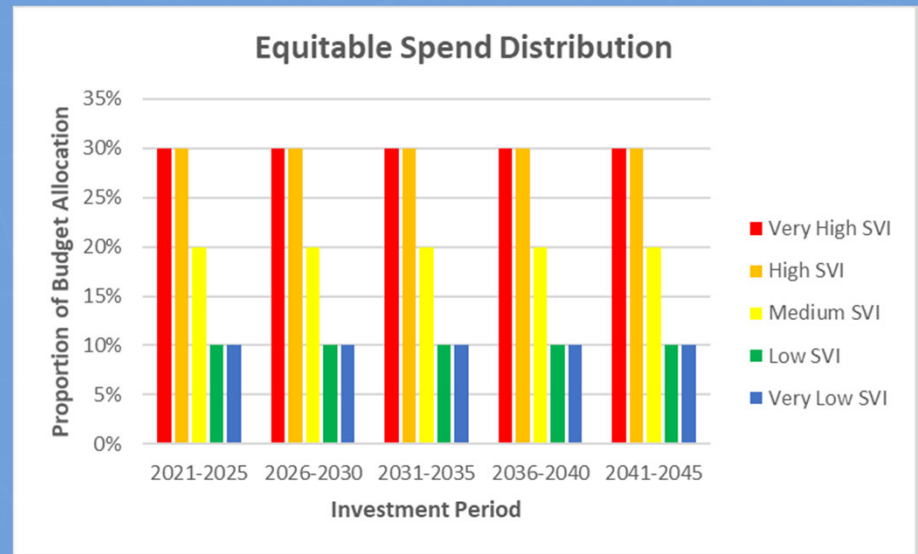
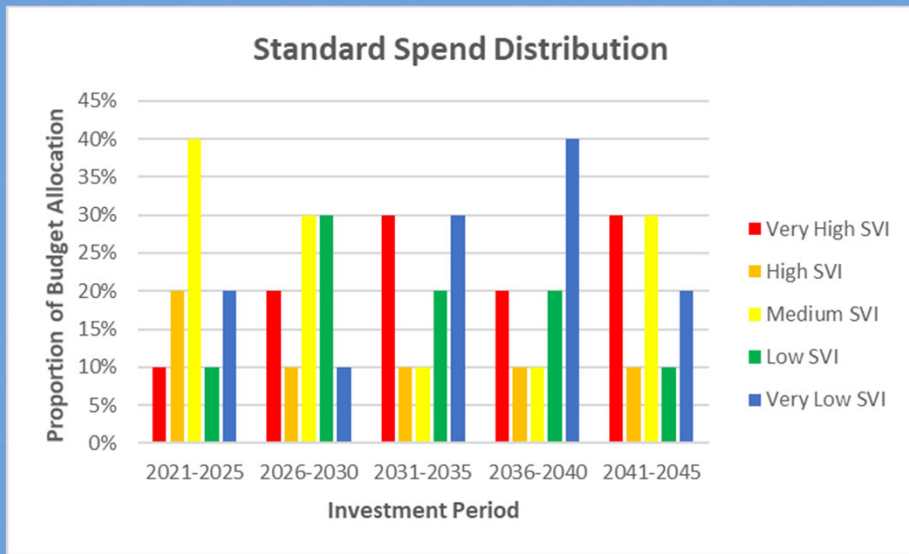
Equity Focused Optimization



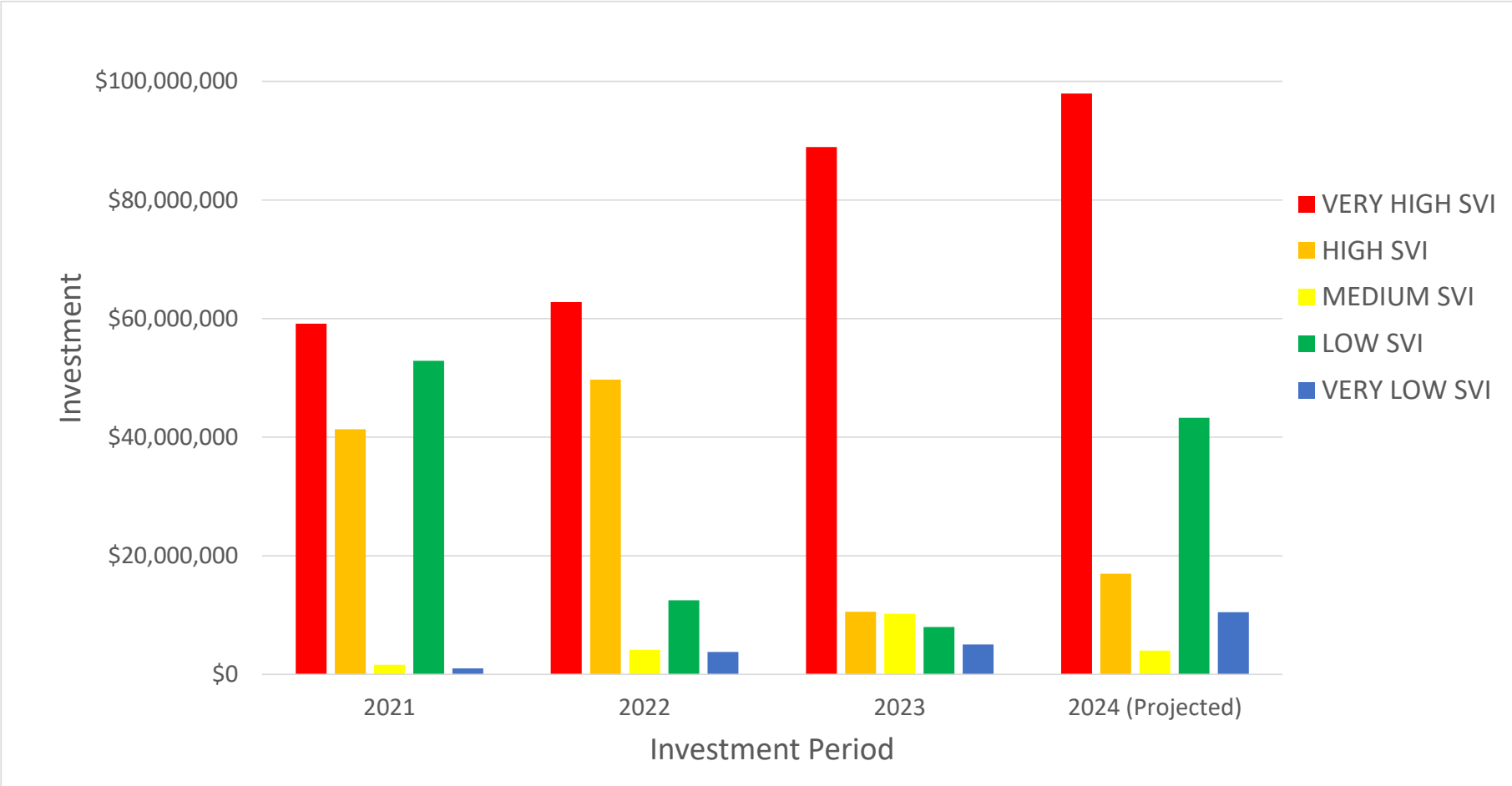
Example of Equity Focused Multi-Objective Investment

Scheduling Projects Based on Equitable Budgetary Distributions

Equity focused optimization also has the capability to create project prioritization plans that encourage equitable distributions of budgetary spend, while simultaneously optimizing other objectives of interest (i.e.: Cost, Risk, Benefits)



CIP Spending Distribution by SVI

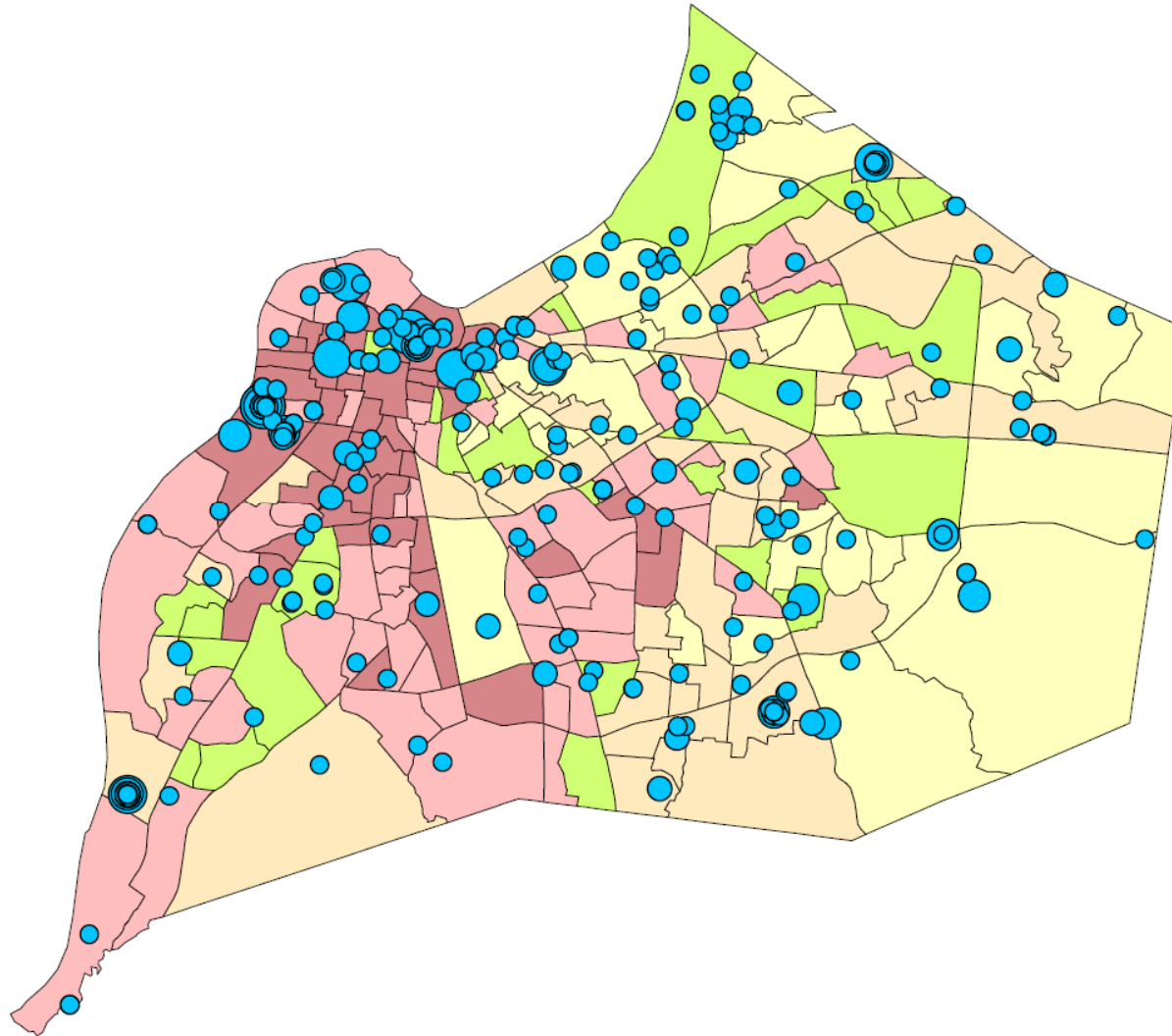


CAPITAL IMPROVEMENT PROJECT COST

- \$0 - \$1,000,000
- \$1,000,000 - \$5,000,000
- \$5,000,000 - \$10,000,000
- \$10,000,000 - \$50,000,000
- \$50,000,000 - \$100,000,000

VULNERABLE SERVICE AREAS

- 0 - 0.13
- 0.13 - 0.33
- 0.33 - 0.55
- 0.55 - 0.87
- 0.87 - 1.0






Justice40 Platform Opportunities

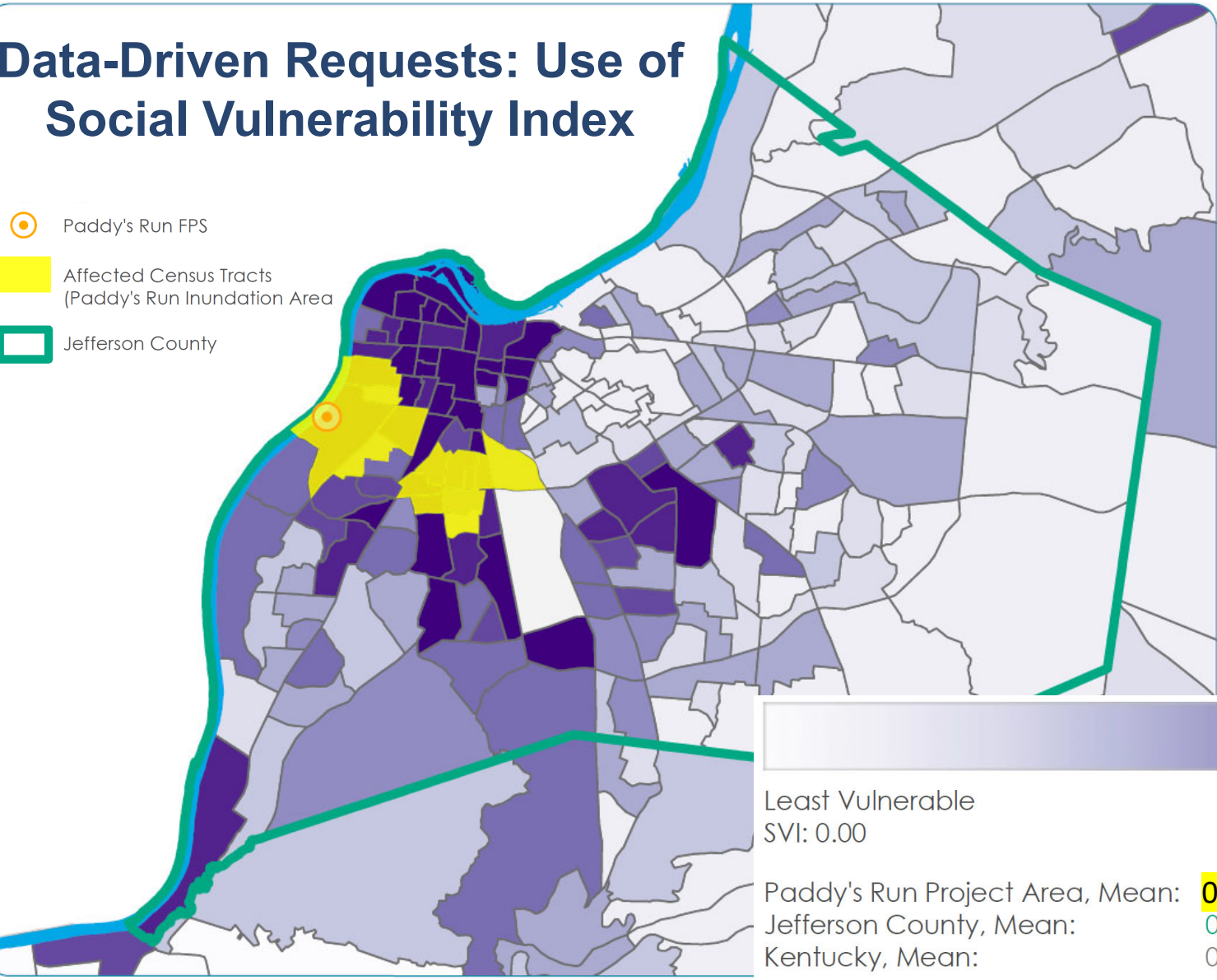


Justice40 Platform

- Released by White House in 2022
- Calls for at least 40% of federal investments in clean water infrastructure to be directed to disadvantaged communities that are marginalized, underserved, and overburdened by pollution.
- The Bipartisan Infrastructure Law intent to “***tackle the climate crisis and advance environmental justice, while investing in communities—both urban and rural—that have too often been left behind***”
- EPA provides guidance. States establish definitions.
 - MHI
 - Watershed/system approach vs project area

Data-Driven Requests: Use of Social Vulnerability Index

-  Paddy's Run FPS
-  Affected Census Tracts (Paddy's Run Inundation Area)
-  Jefferson County



The Center for Disease Control Social Vulnerability Index (SVI) provides insight into the compounding intersection of adversities beyond just income level:

- socioeconomic status
- household composition
- race/ethnicity/language
- housing/transportation

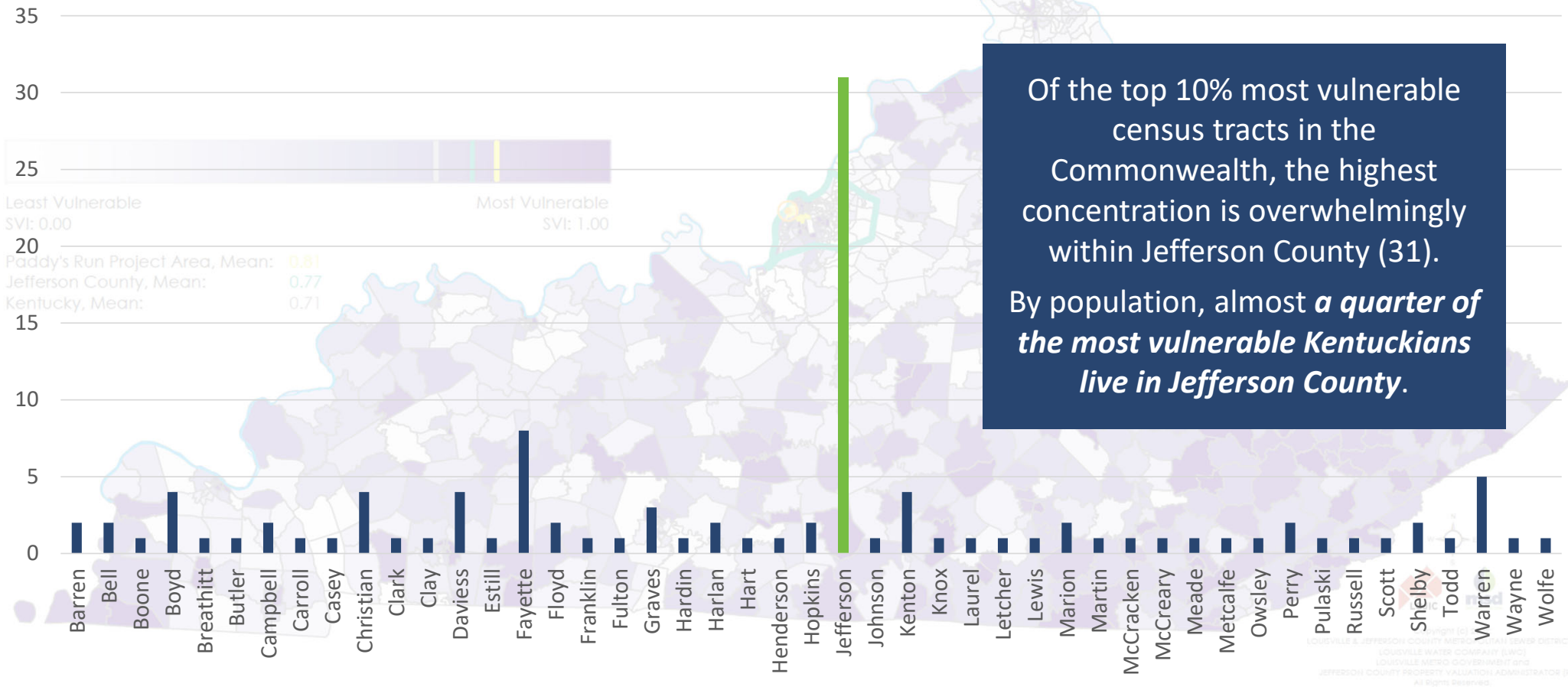


Least Vulnerable SVI: 0.00 Most Vulnerable SVI: 1.00

Paddy's Run Project Area, Mean: **0.81**
 Jefferson County, Mean: 0.77
 Kentucky, Mean: 0.71

Measure of the Most Socially Vulnerable Counties in Kentucky

Count of Kentucky Census Tracts with SVIs Over 0.90 (by County)



Of the top 10% most vulnerable census tracts in the Commonwealth, the highest concentration is overwhelmingly within Jefferson County (31).
 By population, almost *a quarter of the most vulnerable Kentuckians live in Jefferson County.*

Leveraging Alternate Funding Sources to Advance Investments in Justice40 Communities

- MSD has received more than **\$170 million** in funding for vulnerable communities
- Nearly **\$50 million** of awards have been in the form of grants / principal forgiveness

