

KENNEDY INTERCHANGE RECLAMATION

FINDINGS & RECOMMENDATIONS REPORT 2006



TABLE OF CONTENTS

ACKNOWLEDGEMENTS

INTRODUCTION

Location	6
Design Principles	7
Project Context	8

SITE ANALYSIS

Scale Comparisons	10
Roadways & Access	16
Railroad Relocation Alternatives	18
Flood Protection	20

RECOMMENDATIONS

Conceptual Plan	24
Street Sections & Design Guidelines	26

APPENDIX

ACKNOWLEDGEMENTS

CLIENT

Downtown Development Corporation
Barry Alberts
Patti Clare

CONSULTANTS

Chan Krieger & Associates
Alex Krieger
Alan Mountjoy
Andrea Gaffney
Radhika Bagai

FMSM

Vincent Bowlin
Justin Gray

STEERING COMMITTEE

Metropolitan Sewer District
Randy Stambaugh
Bud Schardein

Waterfront Development Corporation
Mike Kimmel
David Karem

Butchertown Neighborhood Association
Jim Segrest

Citizens

Norman Tasman
Norman Berry
David Tandy, Louisville Metro Council

Community Transportation Systems
John Sackstetter

INTRODUCTION

As part of the larger \$5 billion dollar **Ohio River Bridges Project**, KYDOT in conjunction with the Federal Highway Administration and USDOT will be relocating a mile-long section of Interstate 64/71 to the south of its current position, in order to improve traffic flow at the Kennedy interchange. The intersection, which is a confluence of three interstates, is popularly referred to as “Spaghetti Junction.” The project envisions more through-lanes than currently exist, and will acquire industrial lands south of the current alignment to construct a new highway while maintaining traffic in the existing alignment. In twenty years, if the project proceeds on schedule, approximately sixty acres of prime waterfront land will be reclaimed when the old interstate alignment is demolished.

Plans for this Herculean shift of the interstate have instigated much discussion in Louisville at large and particularly in Butchertown. Today, residents of Butchertown are seeking to mitigate the potential traffic impacts of the new, larger highway, preserve the quality of their historic neighborhood, and connect to newly developing public amenities along the Ohio Riverfront. Even neighborhoods further south, such as Phoenix Hill, have a vested interest in improving connections to the Ohio River through Butchertown and under the interstate.

With the belief that this acreage will someday be a natural extension to the developments that have occurred around the downtown over the past 20 years, the Downtown Development Corporation on behalf of itself, the Waterfront Development Corporation and the Butchertown Neighborhood Association contracted Chan Krieger & Associates to study the area. The study’s purpose was twofold:

Identify an ideal street network plan that would enhance connections to the Louisville Waterfront Park and provide optimal access for the reclaimed land.

Review existing highway plans and make recommendations for locations of underpasses (cut-throughs), design guidelines for the underpasses, and other aesthetic treatments to highway design.

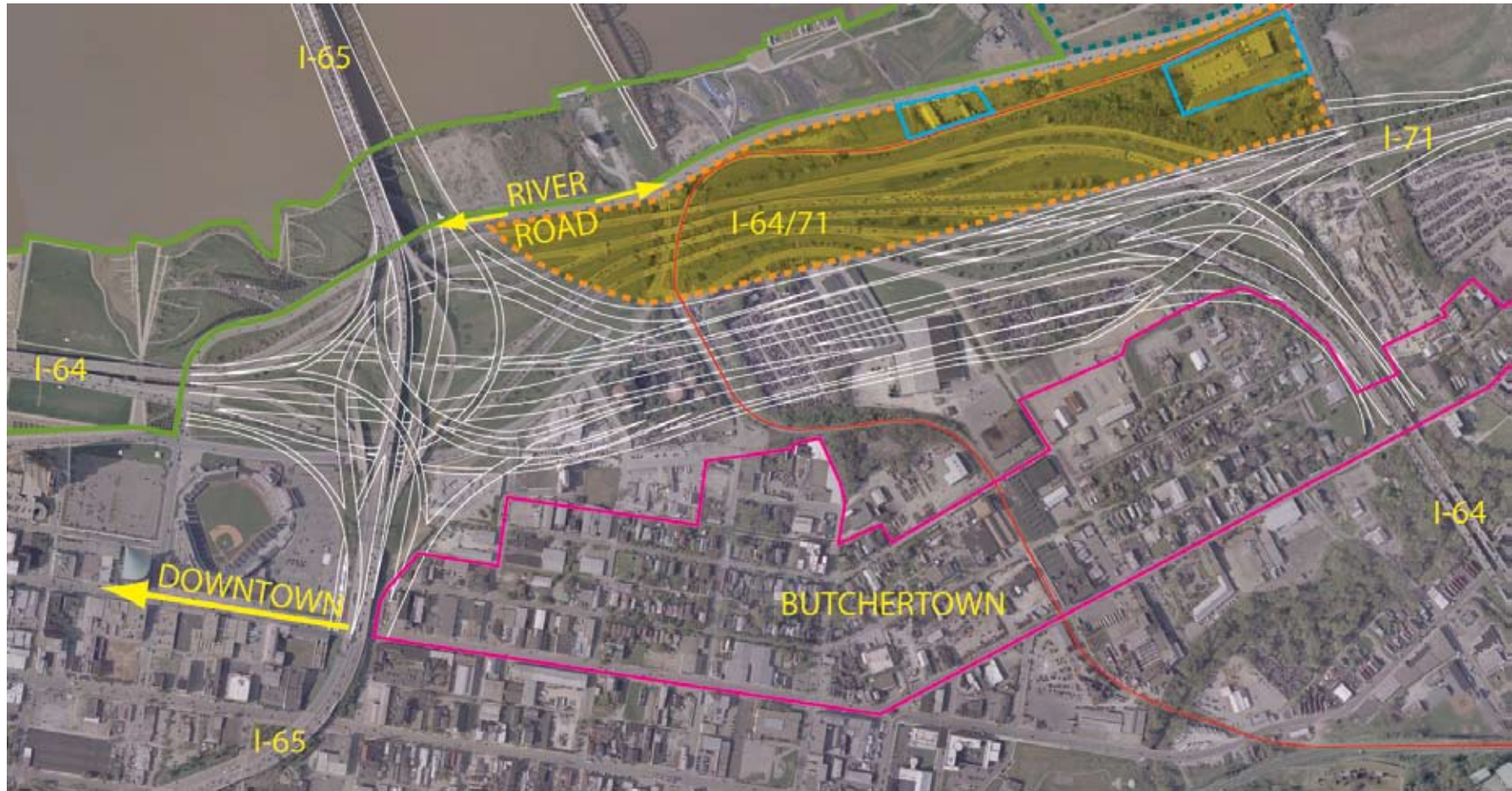


*Rendering of new interstate alignment
Source: Immediate Needs Report*



*Image of existing site
Source: Immediate Needs Report*

LOCATION



- | | |
|--|--|
| ----- STUDY AREA | — BOUNDARY OF BUTCHERTOWN NEIGHBORHOOD |
| — EXISTING COMMERCIAL USES WITHIN STUDY AREA | — BOUNDARY OF LOUISVILLE WATERFRONT PARK |
| — EXISTING RAILROAD ALIGNMENT | — PROPOSED INTERSTATE REALIGNMENT |
| ----- PROPOSED ICON DEVELOPMENT | |

DESIGN PRINCIPLES

At the onset of the process, the steering committee assembled a set of design principles to guide the decision making and design processes:

1. Plan must benefit Riverfront, Butchertown and Downtown neighborhoods.
2. Optimize the potential access to and from the waterfront acreage.
3. Arrange the area in a manner conducive to reasonable development phasing.
4. Improve the public realm along River Road - make Louisville's waterfront one of nation's finest.
5. Create a series of comfortable, convenient & well-designed vehicular and pedestrian connections between Butchertown and the Riverfront.
6. Minimize the new highway's impact on the Butchertown neighborhood.
7. Align Witherspoon Avenue with the existing street grid and design it to be an important neighborhood spine.
8. Accommodate adequate flood protection for the reclaimed acreage.
9. Provide adequate flood protection for the Butchertown neighborhood.
10. Incorporate the values of urban ecology and environmental sustainability throughout the plan.

PROJECT CONTEXT

In addition to the Bridges project, other ongoing planning and construction improvements will establish a future context for the study area.

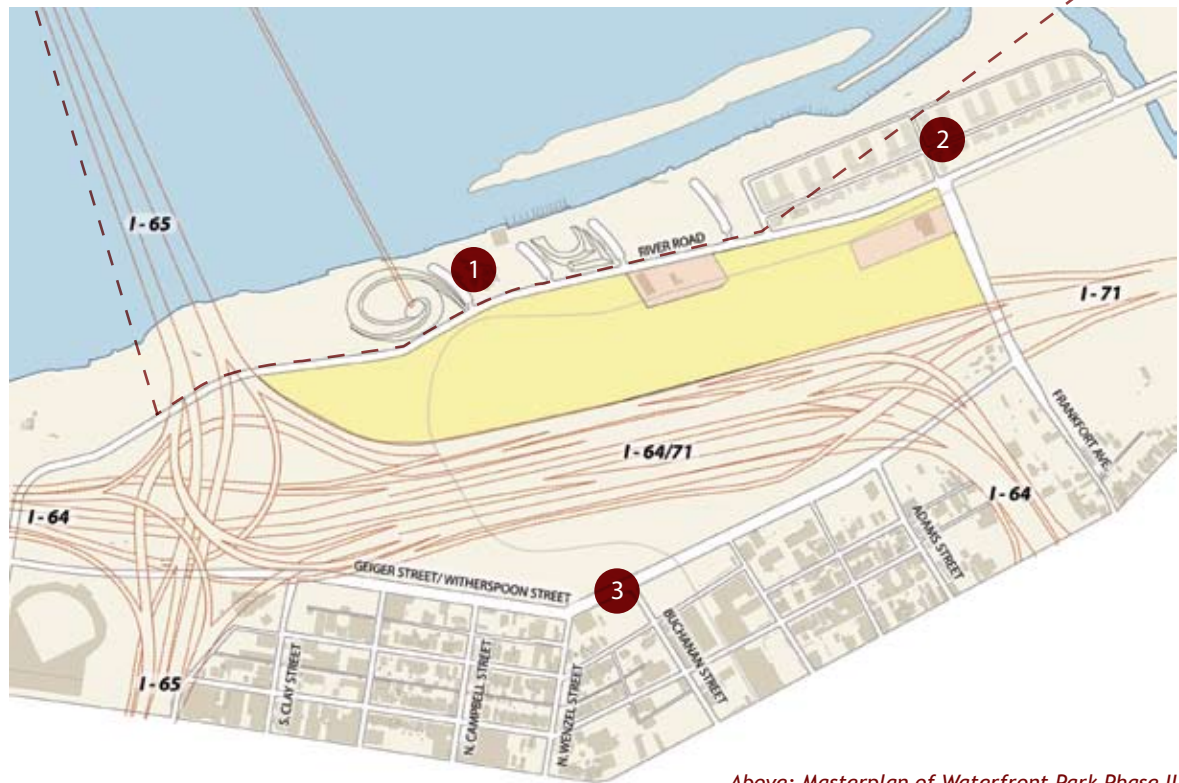
To the north of the project area, the land between River Road and the Ohio River has been improved from its former industrial uses into the **Louisville Waterfront Park (1)** an area covering 85 acres for both active and passive recreation. The Louisville Waterfront Development Corporation is in the process of completing its fifteen year master plan and has a vested interest in adjacent land uses. The study area will ultimately form the southern edge of River Road and play an important role in activating the park by adding new program elements to complement the park. The park already is an attraction for the community which will continue to draw residents from nearby neighborhoods to the shores of the Ohio River.



Diagram of surrounding areas. Source: KTA



Image from Waterfront Park.



Above: Masterplan of Waterfront Park Phase II
Below: Keyplan of future developments in study area and surrounding areas

To the northeast of the study area at the termination of Frankfort Avenue is a residential development underway called **River Park Place** (2). This project, once built, will be the first new riverfront residential development east of I-65 in the vicinity of Downtown. The plan calls for dense mid-rise residential development lifted above the flood plain on parking decks; the first phase will open with 600 units.

The **Historic Butchertown Neighborhood**, south of the interstate, will be impacted by the realignment of I-64. New highway lanes will be closer to the neighborhood and the ramps and elevated sections of highway will be considerably higher than they are today, increasing the visual and sonic disturbances. KYDOT is currently studying the impacts of the highway on the neighborhood with an **Historical Preservation Plan(3)** that is in a draft stage at the time of this study. Initial recommendations address the quality of the highway and potential benefits of access and enhancement; these are contained in a report entitled Immediate Needs Report. These recommendations are as follows:

Place new highway lanes and ramps on solid earth, to the extent possible, rather than elevated bridges to reduce sound impacts to the neighborhood.

Create cut-throughs from the neighborhood to the river at various, strategic locations; ensure that the locations chosen will not increase traffic on historic residential streets.

Locate the planned southern “frontage road” so that it forms a new neighborhood street paralleling the existing street grid in Butchertown. Ensure that this boulevard is not another highway-like off ramp but a city street.



*River Park Place development masterplan
Source: ICON Development*



Delineation of historic districts and cut-through recommendations of Immediate Needs Report



Rendering of new interstate alignment with southside development. Source: Immediate Needs Report

SITE ANALYSIS

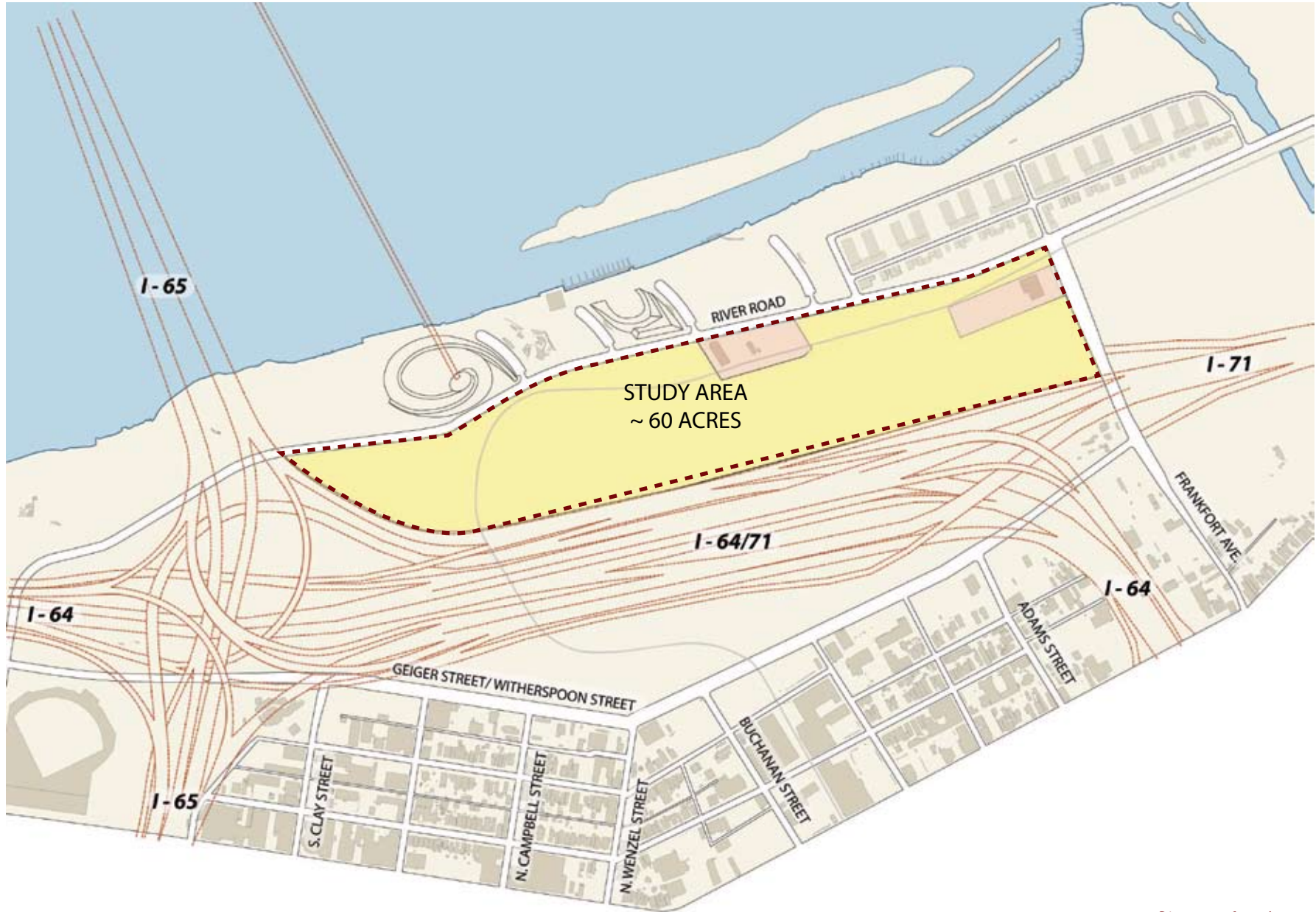


Diagram of study area

Louisville has come a long way in redeveloping its waterfront; the industrial uses of an antiquated river-based economy have been transformed into a nationally-acclaimed riverfront park. A useful tool initially used to generate ideas for the vision of Waterfront Park is the scale comparison. This tool can also be used to help us compare the the interstate land reclamation area to familiar places and suggest ways in which other places of a similar size have been organized.

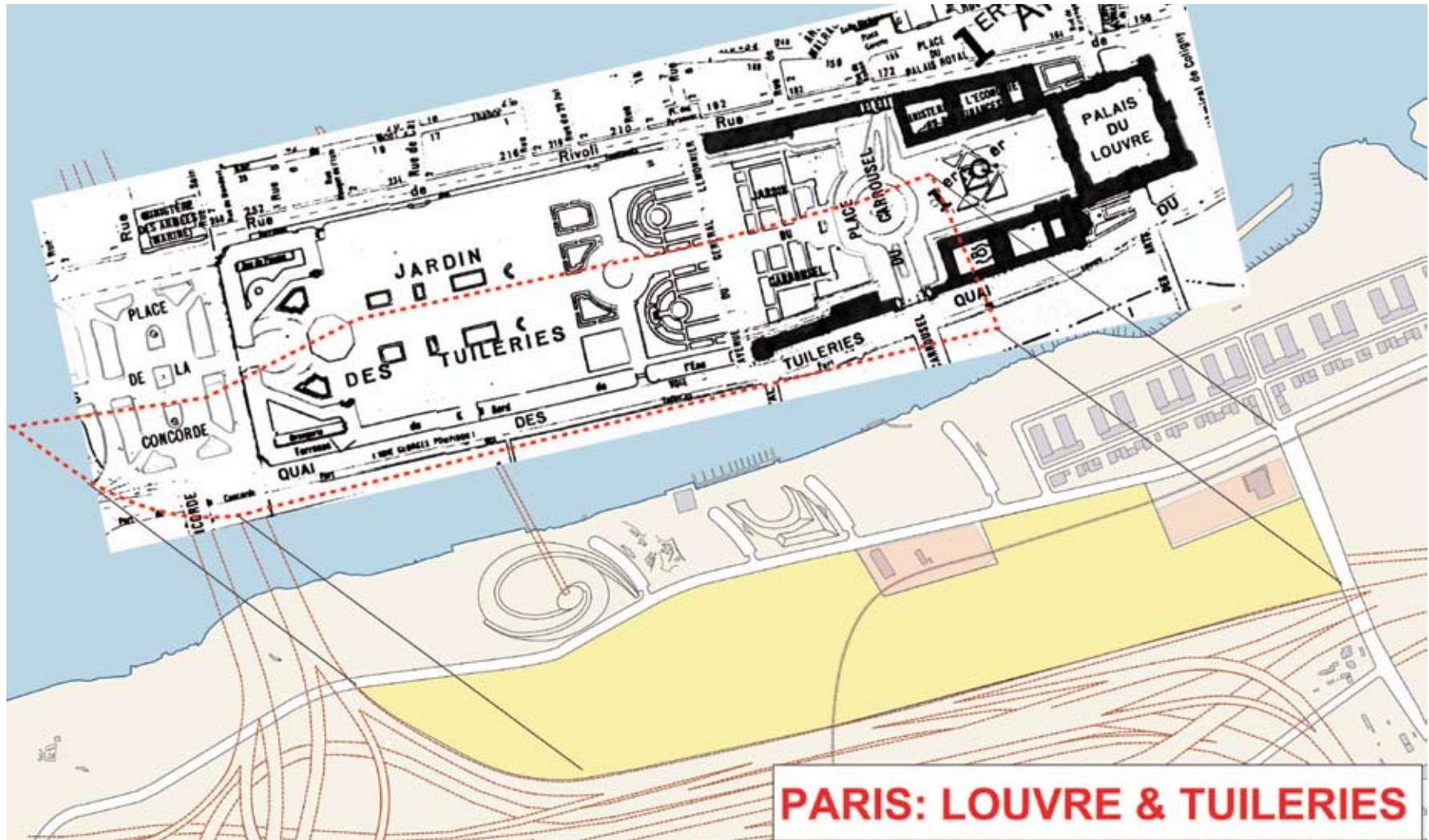
Butchertown Extended: Simply extending the grid pattern of Butchertown to River Road would create a new street grid on the 60 acres that would be nearly the size of the historic district as it exists today.

Below: Aerial of Butchertown and Riverfront in 1949

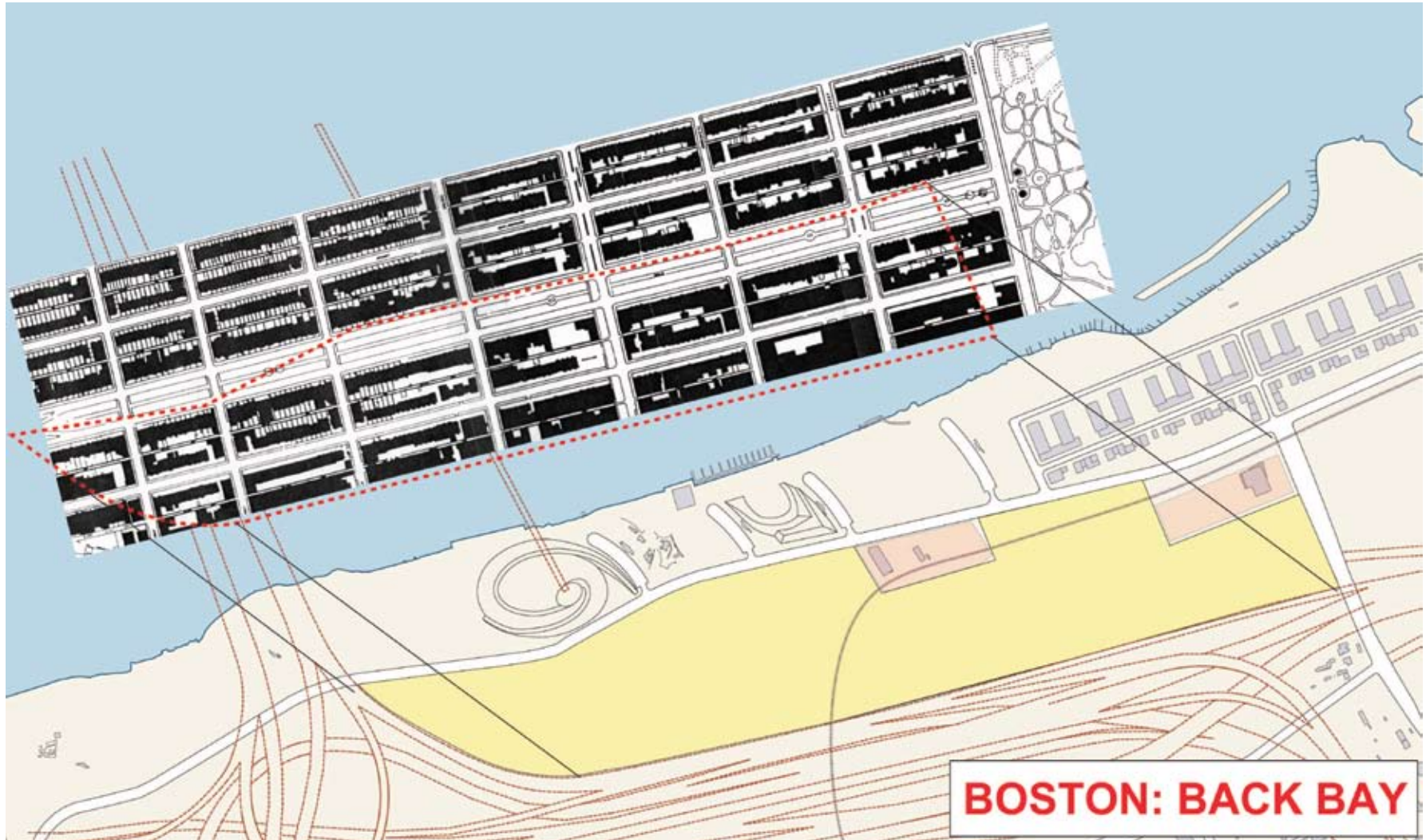


Above: Collage of Butchertown Neighborhood superimposed North of the proposed interstate realignment.

SITE ANALYSIS



Louvre & Tuileries, Paris: The 60 acres together with the extension of Louisville Riverfront Park, equals the size of the Tuileries. The monumental size of such a space would rival the Great Lawn to the west of this site. A large public facility (such as the Louvre) would fit within the site with room remaining for gardens.

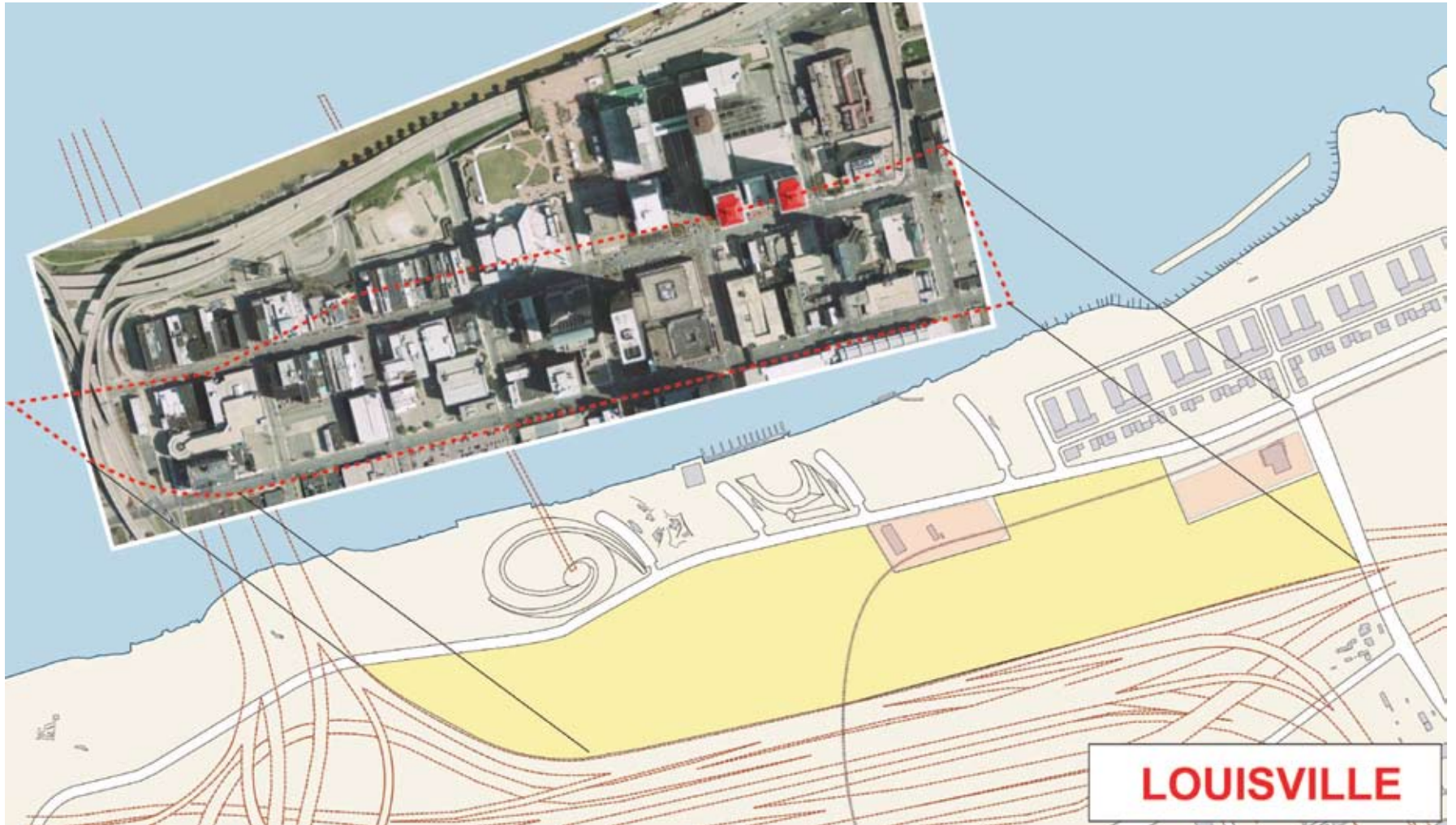


Boston Back Bay Neighborhood: The study area could accommodate eight linear blocks of Boston's most famous neighborhood. This comparison suggests that the scale of the site is quite large without intervening streets to lend scale.

SITE ANALYSIS



Savannah, Georgia: Savannah's small scale grid represents an even finer-grain pattern that could be deployed on the site. Nearly five of Savannah's famous wards would fit on the site.



Downtown Louisville: The site from end to end is the same length as Downtown from the Clark Memorial Bridge to 9th Street.

ROADWAYS AND ACCESS

Today, two north-south roads, East Witherspoon Street and Frankfort Avenue pass under I-64/71 connecting either end of Butchertown to the Ohio River. East Witherspoon will be removed as a result of the reconstruction of I-64/71. In its place, Campbell Street will be paired with the CSX railway spur connecting to River Road and the industrial uses east of Frankfort Avenue.

Frequent access points will help to overcome the barrier that the older highway has created and the new highway has the potential to perpetuate. The Butchertown neighborhood has requested better--or at least equal--access to that which they enjoy today. By providing frequent access to the riverfront from Butchertown, there is also an opportunity to extend these connections further south to Beargrass Creek and Phoenix Hill neighborhood for expanded regional pedestrian and recreational access. The abandoned railway span over the Ohio River to Indiana, the "Big Four Bridge" is planned to be reopened for pedestrian travel in the coming years.

Frequent access must, however, be balanced with the recommendation to keep the highway ramps on solid earth rather than bridges to control sound. In addition, neighborhood concerns dictated that certain residential and historic streets should not be burdened with additional traffic.

In relation to the 60 acre study area north of I-64, a sufficient number of connections between Butchertown and the river had to be balanced with creating parcels of land large enough to address a variety of future land uses. Frequent street crossings would facilitate smaller scale development but could preclude larger land uses.

The confluence of these considerations, resulted in a recommendation for the addition of five north-south crossings under the new I-64/71 highway. These crossings will create direct vehicular and pedestrian connections from Butchertown through the study area to River Road, which will enable convenient access and connectivity for multiple users, create sizable parcels of land for development on both sides of the interstate, and minimize the amount of bridge construction.

In addition to the north-south streets, a new east-west arterial is being proposed on the south side of I-64 in conjunction with the interstate realignment. This new street will run along the approximate alignment of Geiger and Witherspoon Streets and will act as a local road that can provide access to the interstate and occasional bypass relief. Residents of Butchertown and Phoenix Hill are concerned about the capacity and character of Witherspoon as it has the potential to add significant traffic to their neighborhoods. Together, River Road and Witherspoon Street will improve the network of east-west streets and will have the ability to reduce traffic on smaller residential streets in Butchertown.



Existing cut-through at East Witherspoon looking north.



Existing cut-through at East Witherspoon and River Road.



EXISTING ROADS EXISTING ROADS IN NEW ALIGNMENT PROPOSED ROADS

Aerial image of site with infrastructure connections.

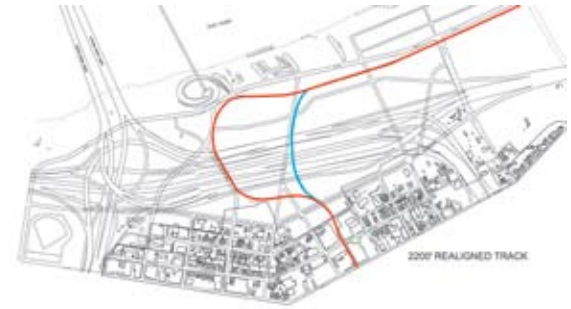
RAILROAD RELOCATION ALTERNATIVES

A legacy of the industrial uses in the area is a CSX railroad spur that serves users to the east of the Frankfort Avenue. The railway spur crosses under the interstate parallel to Campbell Street and then curves to the east adjacent to River Road. In order to optimize the use of land available after the interstate is relocated, several new alignments were analyzed.

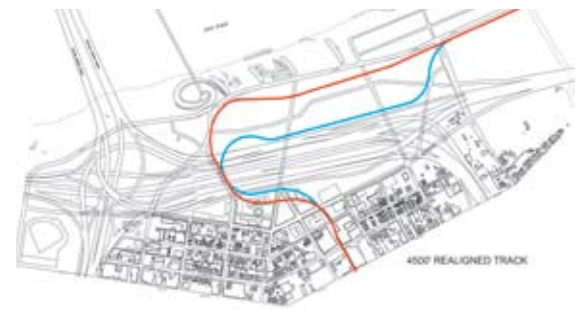
Each of the alternatives attempts to reduce the impact of the railway line on Riverfront Park and River Road by moving it to the east and south. The alternatives also aim to reduce the number of at-grade roadway crossings. The alternatives were also analyzed for feasibility with the current I-64/71 alignment and bridge designs to determine engineering and cost impacts to the current design.

Option A

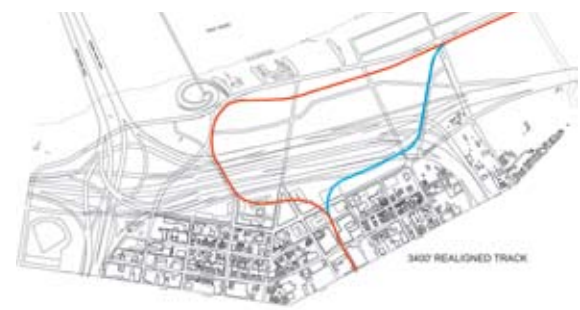
Option A explores relocating the railroad underpass from Campbell Street to Wenzel/Buchanan Street. The motivation for moving the railroad from Campbell to Wenzel is to remove the railroad from one of the parcels on the 60 acre site. However, the railroad would still run along River Road at the northern edge of two other parcels, making connections between Riverfront Park and the 60 acre site less convenient. This requires relocating approximately 2,200 feet of track at a cost of \$3.2 million. In addition to the cost of relocating the railroad, there is the increased cost for bridge construction to widen the Wenzel Street underpass and raise bridge levels equaling \$22.1 million.



Option A



Option B



Option C



Image of railroad as it exists today.

Option B

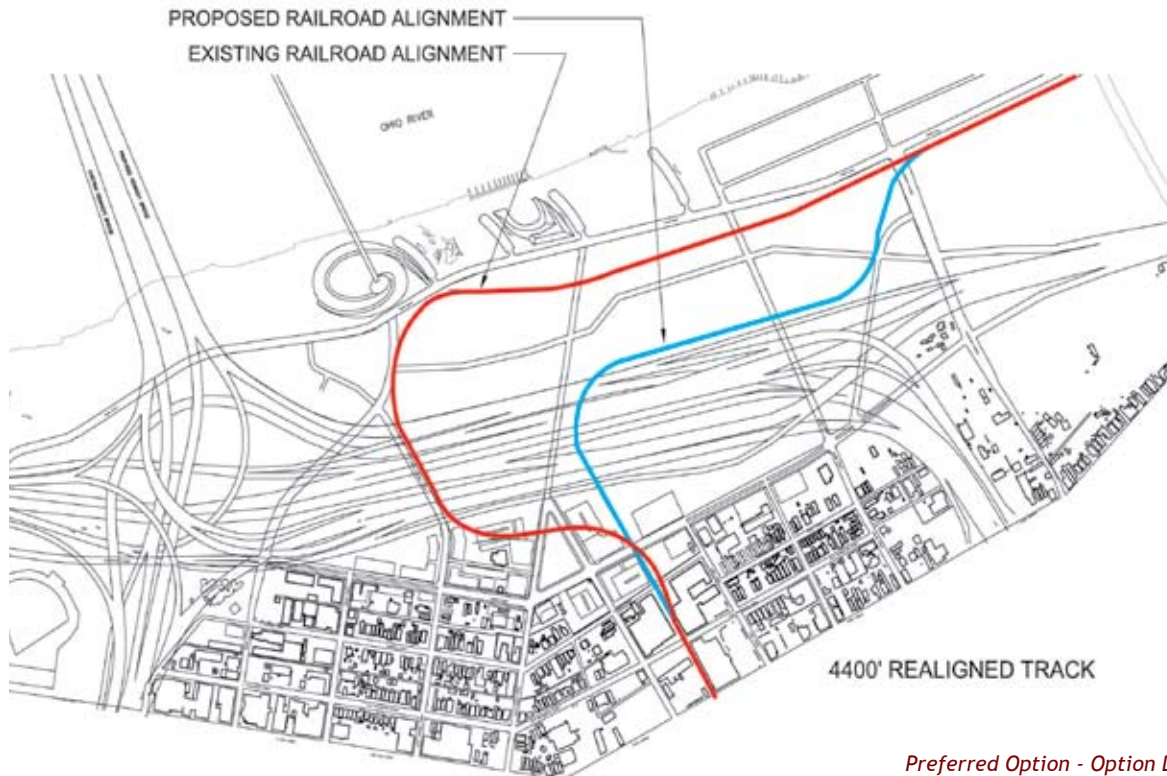
Option B maintains the crossing at Campbell Street and proposes realigning the track southward from its current east west alignment to the north edge of the interstate. This option would allow all parcels within the 60 acres to have unimpeded access to River Road and Riverfront Park. Option two would require relocating approximately 4,500 feet of track at a cost of \$6.7 million. Additional costs for structures equal \$7.1 million bringing the total cost for this option to \$13.8 million. Of the four options, this one is the least expensive, however it fails to reduce the number of anticipated at-grade crossings compared to other options.

Option C

Option C considers relocating a majority of the railroad spur to the south side of the interstate. This option reduces the length of track significantly but poses potential impacts to the Butchertown historic district. This option also creates unsolvable engineering problems for the I-71, I-64 interchange because of the increased clearances required for the railroad. The costs associated with option four were not studied once the engineering was shown to be significantly problematic.

Option D - Preferred

This is the preferred option and is an amalgam of options one and two. This option relocates the the railroad underpass to the Wenzel/Buchanan Street cut-through and relocates the track along the edge of the interstate on the north side. This option calls for a relocation of approximately 4,400 feet of track at a cost of \$5.5 million. Similar to option one, the additional cost for construction of the bridges is estimated at \$25.4 million dollars. The benefit of this alignment is the wider underpass at the Wenzel/Buchanan Street cut-through visually reinforces the connections between Butchertown and the river, and potentially serves as a new gateway between the two neighborhoods.



Preferred Option - Option D

OPTION	TRACK LENGTH	TRACK COST (\$MILLIONS)	BRIDGE COST (\$MILLIONS)	TOTAL COST (\$MILLIONS)
A	2200'	3.2M	22.1M	25.3M
B	4500'	6.7M	6.3M	13.0M
C	3400'	N/A	N/A	N/A
D	4400'	5.5M	20.0M	25.5M

*Comparison of different railroad realignment options
 Note: In reference to the QK4 analysis,
 Option A = Option 1; Option B = Option 2;
 Option C = Option 4; Option D = Option 3.*

FLOOD PROTECTION

Most of Butchertown is protected from Ohio River flooding by a concrete flood wall constructed in the 1950's that roughly traces the northern edge of the historic district. The wall protects residential neighborhoods to the height of a theoretical five-hundred year flood level with eight feet of additional freeboard. The wall is breached by thirteen separate streets that, in the event of a flood, need to be closed with removable wood cribbing stored in vaults adjacent to the openings. The condition of the aging wall and the cost and effort needed to install the cribbing suggest that a replacement for this system would be cost effective and timely. MSD has indicated that newer swinging gates would be preferable to the existing system due to ease of installation and storage.

All of the industrial and park land between the flood wall and the river is subject to flooding, which has resulted in less than ideal land uses in this area. Any new buildings proposed for this area (such as Tumbleweeds Restaurant) must provide a method for project flood protection or be lifted above the 100 year flood level. The proposed residential development, River Park Place, will be lifted above the 100 year flood level with parking structures in the flood zone. The proposed new I-64/71 alignment will be elevated above the five hundred year flood elevation in order to remain in operation during the most severe flood event.

Several options for flood protection were analyzed both relative to the 60 acre site and the larger Butchertown area. *The three variables evaluated were: area of protection; level of protection; and method of protection.*

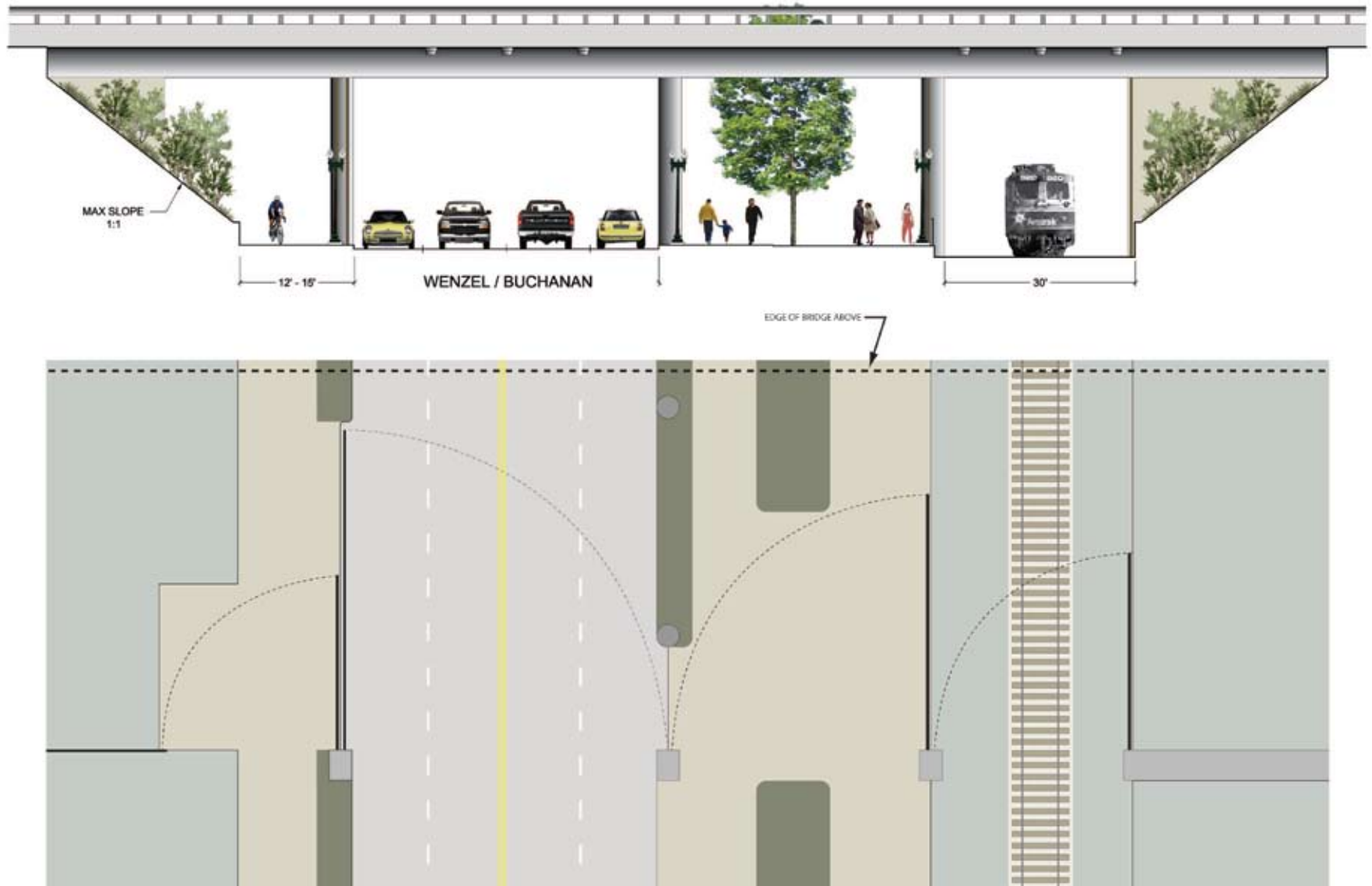
Area of Protection: If "blanket" five-hundred year flood protection were to be provided for

the study area, and tied back to the existing flood wall, all of the flood-prone acreage south of the interstate would benefit from this protection. Providing this type of protection within the study area would require a significant initial investment of approximately \$40 million. Providing such "blanket" protection would also have a large aesthetic impact on the Riverfront Park by creating a wall or levee of approximately 25 feet in height along the southern edge of River Road. Such a tall visual barrier, even with openings, would severely inhibit the reuse of the 60 acres of reclaimed land and present an unsightly edge to River Road.

While blanket flood protection was determined inappropriate for the 60 acre study area, there remained an interest to protect the flood-prone 40 acres south of the interstate. This discussion was fortified with the knowledge that the floodwall in Butchertown will be more than fifty years old when the interstate realignment project is complete, and MSD is already discussing replacement plans for the wall. Given that the new interstate structures will be protected against the five hundred year flood, replacement protection could be incorporated into the interstate construction.



Existing flood walls in Butchertown are approaching 50 years of age and require cribbing at all openings.



Area-wide flood protection could be integral to the new interstate earthen berms with swinging barrier gates.

FLOOD PROTECTION

Level of Protection: Current requirements for project flood protection require habitable structures to be protected or lifted to three feet above the 100 year flood level. This approach would allow for flood protection to be built incremental to new development in the same manner as the adjacent River Park Place. One hundred year protection is also lower than the existing flood wall and would have less of a visual impact on the Waterfront Park as the level is only 10-12 feet above River Road.



— preliminary floodplain — preliminary 500 year floodplain — preliminary floodway

Diagram of flood levels. Source: FMSM See Appendix

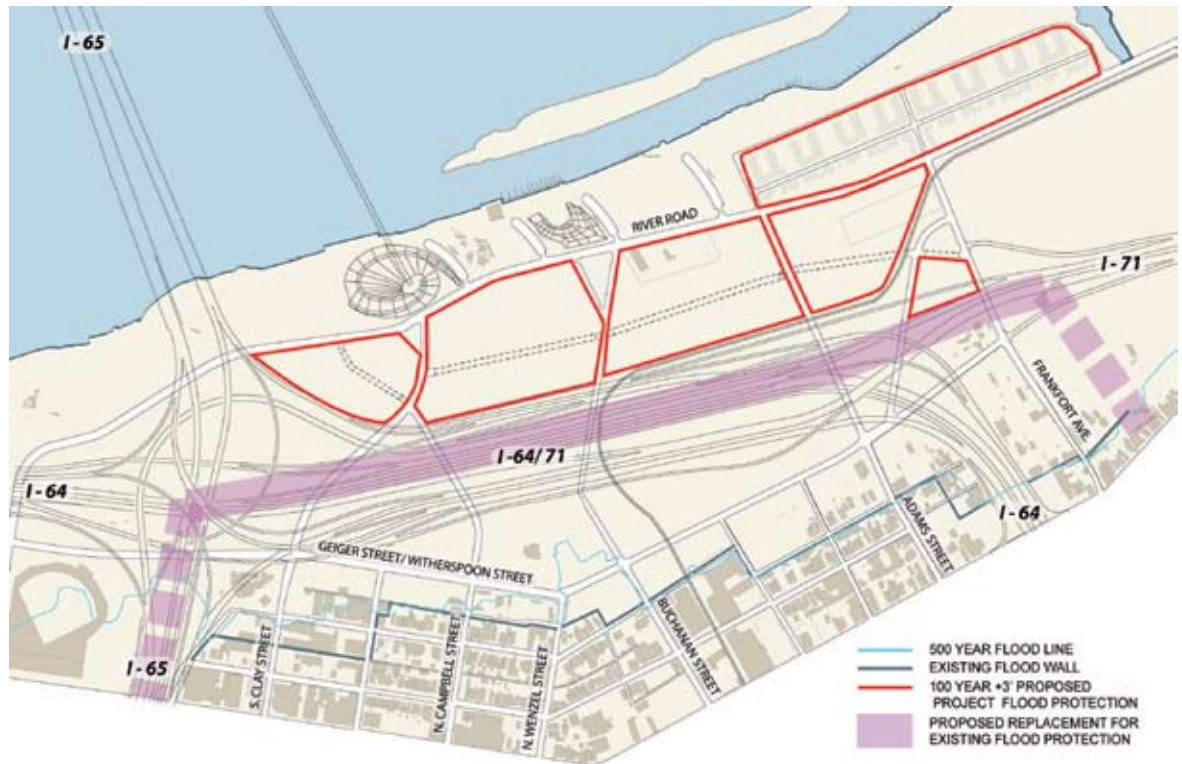
Method of Protection: Two primary methods of flood protection were reviewed for feasibility for both 100 year and 500 year protection and for both area-wide and project specific protection. Earthen berms and flood walls would be effective for the 500 year flood protection. However given the necessary height of 25 feet, earthen berm protection would be considerably more affordable than constructed concrete flood walls. The most cost effective solution would be to incorporate flood wall features into the proposed earthen berms of the interstate highway. Flood gates would then be built under bridges at openings.

For project-specific flood protection up to the 100 year level, three methods of flood protection are possible: flood walls, berms and elevating habitable structures on top of floodable structures. The most cost effective strategy would be to lift any habitable development above the 100 year flood level. Parking could be provided within the flood zone. Parks or open spaces would not require flood protection and individual buildings could be constructed similar to Tumbleweeds Restaurant with a ground level that can tolerate flood conditions. The 60 acres would thus fall into five separate parcels for the purpose of flood protection, with each parcel providing individual project flood protection.

The intervening north to south streets could be elevated up to five feet above the level of River Road to provide marginal protection and access to the parcels during lesser flood events.



100 year protection for the 60 acres should be achieved by lifting any habitable spaces above the flood level. Parking can be placed below in a floodable zone. A landscaped earthen berm would be the preferred method of screening.



A combination of project-specific and area-wide flood protection methods is proposed.

CONCEPTUAL PLAN

The total gross acreage of the study area bounded by the new alignment of the interstate, River Road and Frankfort Avenue is approximately 60 acres. However, due to allowances for infrastructure and public space, the acreage available for reuse in this study is limited to approximately 50 acres.

Several future land use scenarios were studied and are more fully described in the appendix. Given the long timeline of the project, predicting future land use was a hypothetical exercise. Scenarios ranged from public uses such as parks and open space to publicly occupied development. Because the site is located within the flood plain, larger parcels between ten and fifteen acres would be ideal to allow for open space or large-scale public that could be lifted above the flood plain, in a manner similar to that of the proposed River Park Place. The size of resulting parcels, given the proposed roadways, varies from 7 to 16 acres with one smaller parcel of about one acre. A variety of land uses are all possible with the larger site parcelizations.

The preferred site plan establishes five streets that will connect Butchertown to River Road beneath the new interstate alignment. The five streets would be designed to facilitate safe and convenient pedestrian and vehicular traffic between the Ohio River and Louisville neighborhoods with ample sidewalks and street lighting. In addition to Frankfort Avenue, the following streets would be connected:

Clay Street:
2 lanes of traffic, 2 lanes of parking, sidewalks

Campbell Street:
2 lanes of traffic, sidewalks

Wenzel/Buchanan Street:
2 lanes of traffic, 2 lanes of parking, sidewalks, bicycle path, railroad right-of-way

Adams/Spring Street:
2 lanes of traffic

Connector Street:
2 lanes of traffic connecting Witherspoon to the I-71 westbound offramp at Frankfort Avenue.

The preferred plan re-routes the CSX railway to a more southeasterly alignment to maximize parcel size and eliminate the railway along River Road for the length of the study area. The railway alignment has fewer at-grade crossings with this alignment than any other and no more than it has currently.

The preferred plan proposes that the I-64 interstate embankments be designed to provide flood protection capacity to allow for removal of the floodwalls in Butchertown. Any land-use north of the highway would provide project specific flood protection as necessary for the use proposed.



Diagram illustrating parcels and proposed infrastructure.



STREET SECTIONS & DESIGN GUIDELINES

Two types of street sections are identified for streets passing below the interstate. Both allow for two lanes of traffic while one allows additional width for on-street parking.

The wider street section allows for eleven-foot-wide vehicular lanes in each direction and on-street parking. The Clay street extension will replace Witherspoon Street and will maintain the current width. Twelve to fifteen foot sidewalks and sloping planted berm walls create a generous pedestrian buffer on either side of the roadway. Due to the number of lanes and width of the interstate above, there are areas along the underpass that could support the planting of street trees. Street trees and street lighting will help to “normalize” the connection between the north and south sides of the interstate.

The smaller street sections for North Campbell, Adams/Spring Street and the connector street underpasses will be of a similar scale, but will not accommodate on-street parking. Thirty feet of roadway can accommodate

one lane of vehicular traffic in each direction while allowing enough room for ample bicycle lanes. The existing CSX railway alignment at Campbell Street could also be converted to pedestrian-only use after the railway spur is relocated in the future. This would connect directly to the railway pedestrian bridge to Indiana.

As the largest of the underpasses, the Buchanan/Wenzel Street underpass will serve as a primary gateway between Butchertown and the riverfront. Wenzel street will not be connected for vehicular traffic to mitigate concerns of cut-through traffic through historic residential neighborhoods. The Wenzel Buchanan cut-through adds a dedicated bicycle path and the relocated CSX railroad right-of-way to the components of the Clay Street section making it the widest of underpasses.

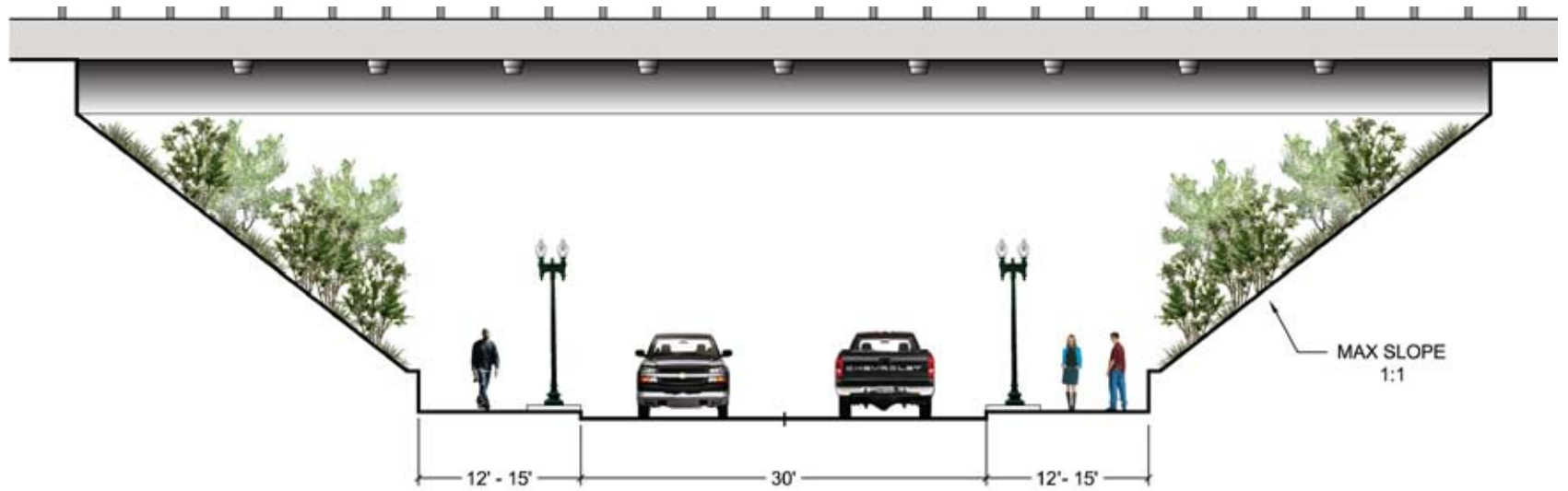
Flood protection gates can be accommodated into the street plan with the use of swinging gates located below overpasses. Swinging gates can be up to 50' wide and require minimal effort to operate. Vertical enclosure walls will be required at these locations to seal the sloped landscaped areas.



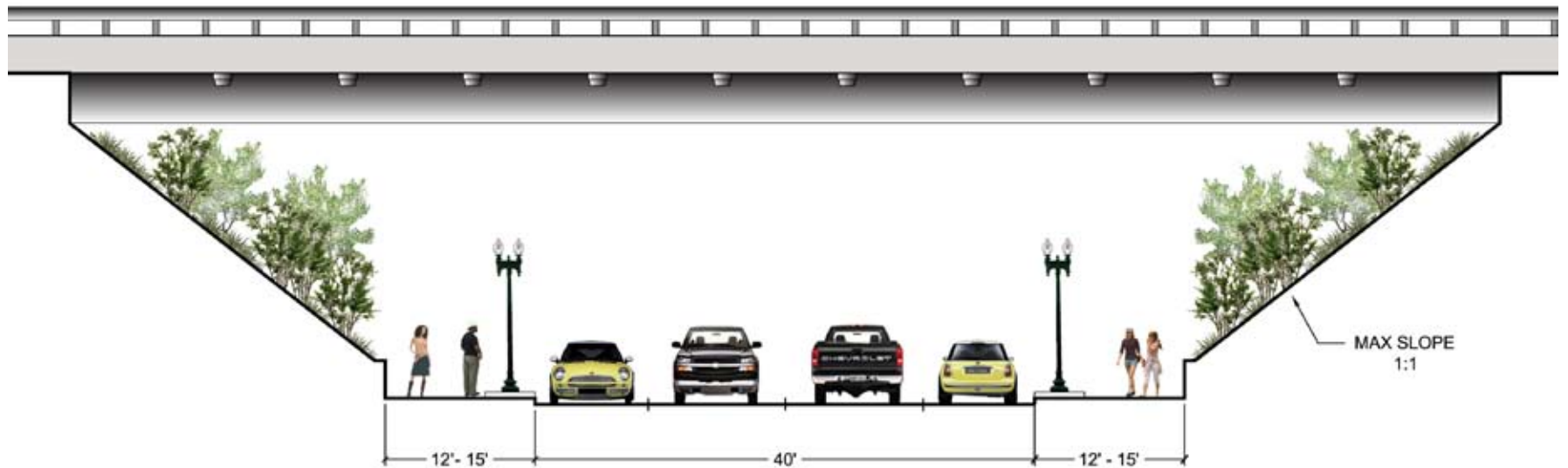
View of E. Washington Street looking past flood wall towards I-64.



Schematic street section at Wenzel/Buchanan Street underpass. Swinging flood gates can be installed below the interstate bridges to provide flood protection for Butchertown.



Schematic street section at North Campbell, Spring Street, and Connector Street underpasses



Schematic street section at Clay Street underpass

APPENDIX

SOUTH OF THE INTERSTATE

Street Section ii

Land Use Study iii

FLOOD PROTECTION

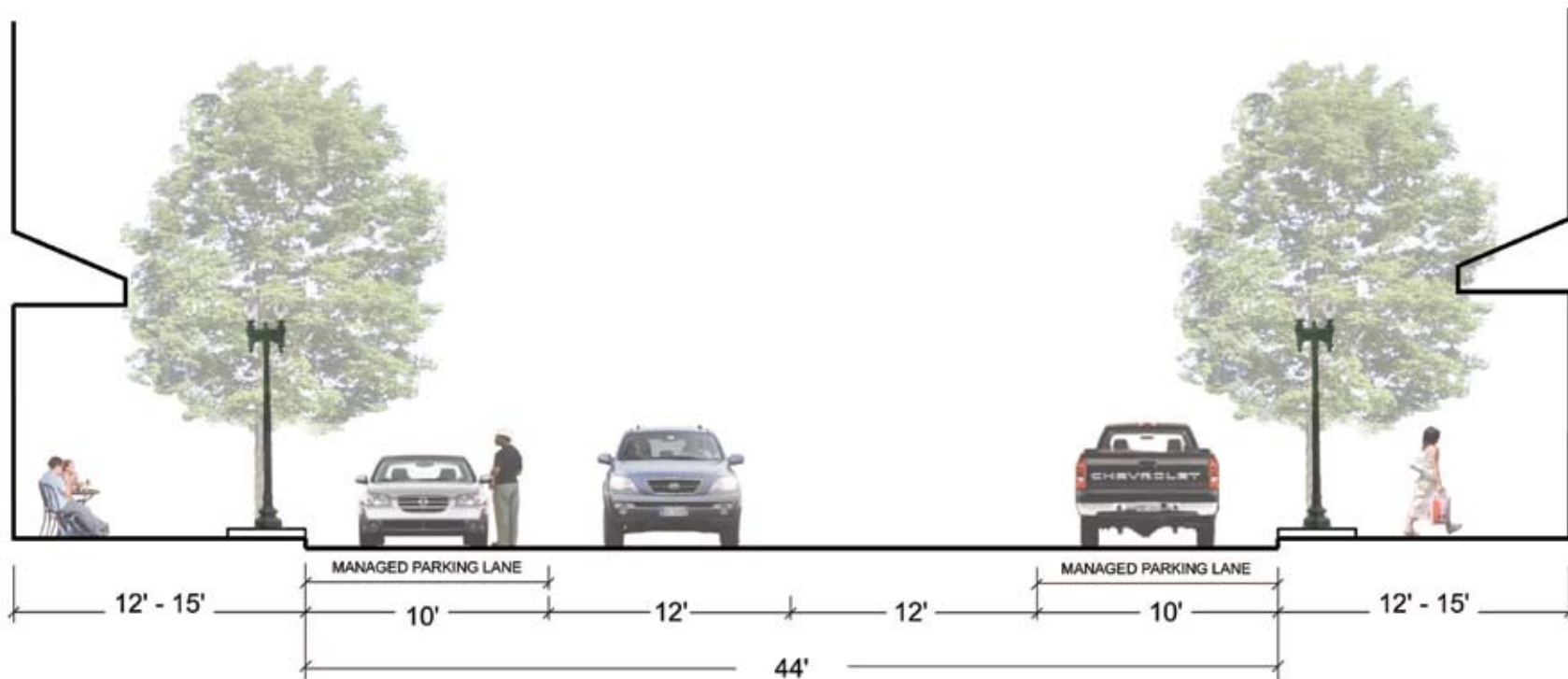
Flood Protection Alternatives iv

CONSULTANT REPORTS

FMSM Report vi

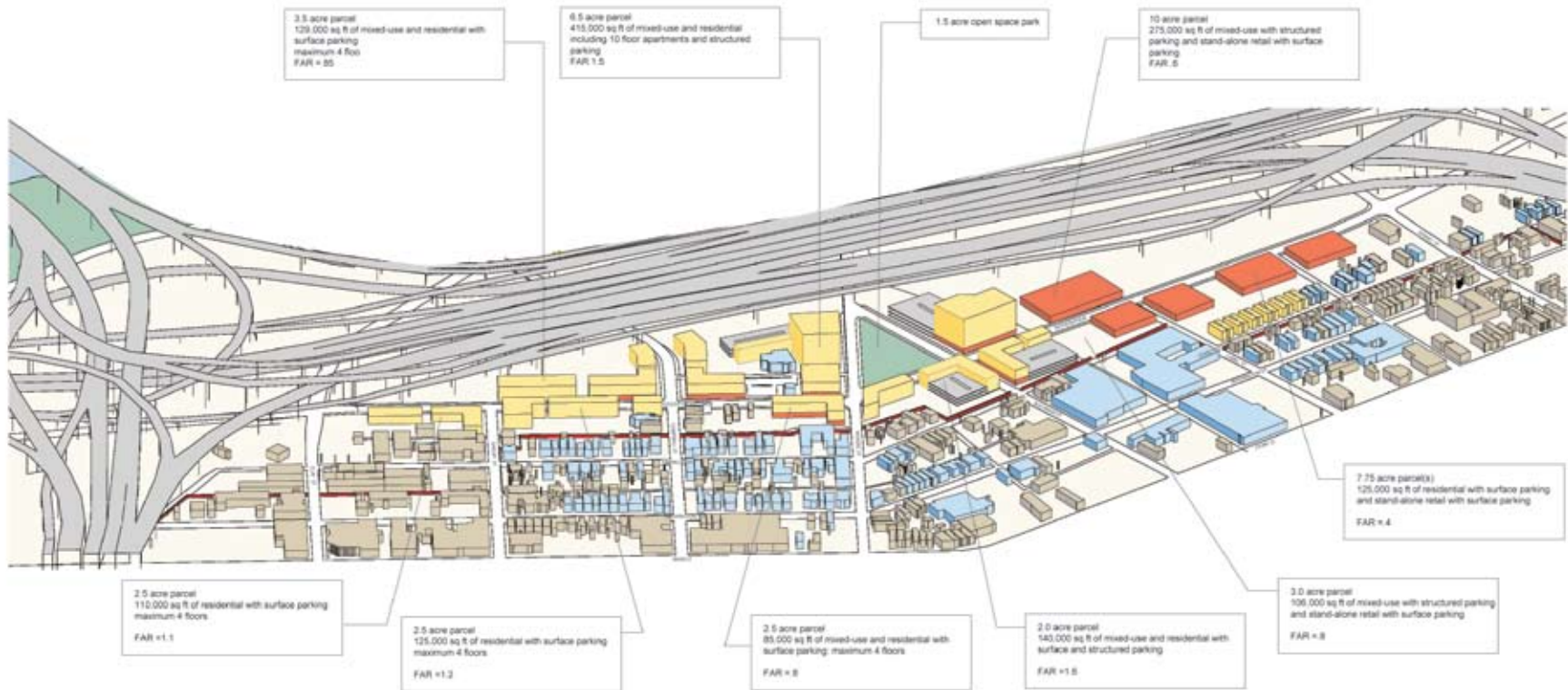
SOUTH OF THE INTERSTATE

STREET SECTION



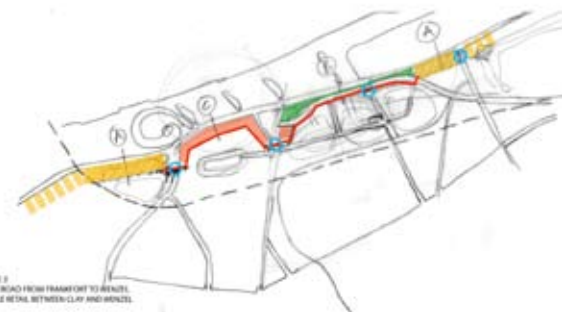
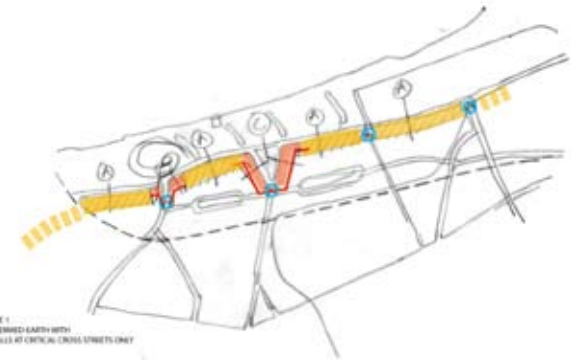
Proposed cross section of Witherspoon/Geiger Street. This is a typical section, however there are portions of the right-of-way that do not accommodate this width due to the location of historic structures.

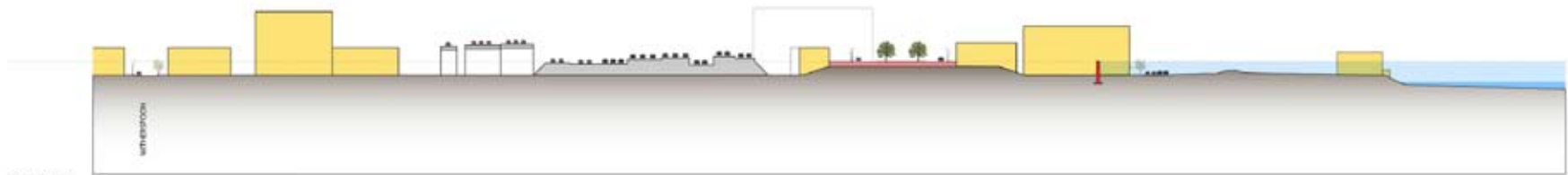
WITHERSPOON DEVELOPMENT CONCEPT
 ~40 acres of development area
 1.5 million sq. ft. of development including residential, mixed-use and retail between 4 and 10 stories
 Protects all contributing buildings
 Preserves 1.5 acres for new open space
 aggregate FAR = 9



Mixed-use development study for area between existing floodwall and southside of interstate. The study assumes replacement flood protection is located within the interstate realignment.

FLOOD PROTECTION ALTERNATIVES





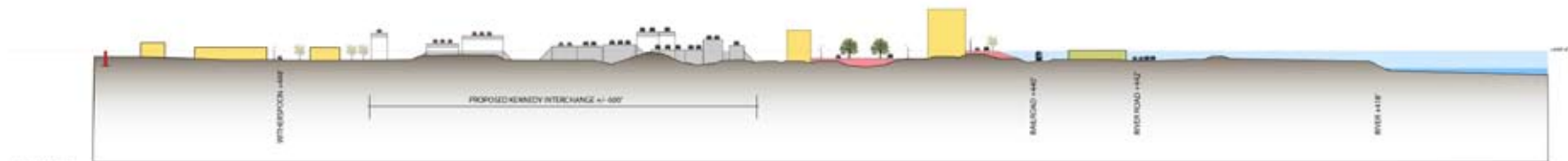
SECTION A-A
 FLOOD PROTECTION: BERMED EARTH
 ADDITIONAL PROJECT PROTECTION: FLOOD WALL & GATES

Section A-A illustrates a combination of comprehensive flood protection using a berm, and project flood protection using a wall integrated into the buildings north of the comprehensive protection. While this creates frontage along River Road across from the park, it would mean that the spaces north of the flood wall would be subject to flooding and therefore have a limited use.



SECTION B-B
 FLOOD PROTECTION: FLOOD WALL & GATES

A similar situation is described at section B-B, except that it includes the existing railroad line. A flood wall south of the existing railroad is used as comprehensive flood protection. Any buildings between River Road and railroad would flood.



SECTION B-B
 FLOOD PROTECTION: BERMED EARTH

Section C-C proposes using a berm along the south side of the railroad for comprehensive protection in lieu of a flood wall. The berm could provide an opportunity for a cornice road.

FMSM REPORT

Overview

The Kentucky Transportation Cabinet (KTC) is proceeding with a project that will realign a portion of Interstate 64 in downtown Louisville Metro, east of Interstate 65 as part of their Bridges project. When construction is completed, some 40 acres of land may be available for redevelopment on the site of the existing Interstate 64. An additional 30 to 40 acres of land may be available for redevelopment on the south side of the relocated interstate highway, between the interstate and the current flood protection system, which consists of a concrete floodwall in the vicinity of this project

Both areas lie within the floodplain of the Ohio River, and The Downtown Development Corporation has retained Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) to evaluate and recommend options for providing flood protection for any development that takes place.

The options that were considered included the following:

- **Filling** - Bringing in material to raise the elevation of the property above the 100 year flood elevation;
- **Floodwalls** - Construction of a concrete structure that would protect buildings and other structures against the 100 year (also known as the 1% annual chance) flooding event;
- **Levees** - Construction of an earthen berm that would protect buildings and structures against the 100 year flooding event;
- **Floodwalls/Levees** - Construction of a combination of concrete walls and earthen berms that would protect buildings and other structures against the 100 year flooding event; and

- **Floodproofing** - Constructing buildings and other structures in a manner in which lower levels (below the 100 year flood level) and parking areas could be inundated during flood events;

For areas north of the relocated Interstate highway, floodproofing is the preferred option. It will allow the most feasible use of the property with the least amount of cost.

For areas south of the relocated interstate highway, the preferred option calls for using the interstate itself as the line of protection against flooding. The highway embankments can act essentially as a berm, and the incremental costs for providing flood protection over and above the costs to construct the interstate should be relatively small.

Flood Protection - North of Interstate 64/71

Most of Louisville Metro is currently protected from flooding by a combination of concrete floodwalls, earthen levees and flood pumping stations. The current level of protection is set at three feet above the elevation of the January, 1937 flood, when the Ohio River reached its maximum elevation of record. In the vicinity of this project, the elevation of the current flood protection system is approximately 464 feet, based on the datum used by the National Weather Service in Louisville, Kentucky. Any modifications to the system that call for replacing portions of the existing system will have to be constructed to at least the same elevation as what exists today.

On the north side of the relocated interstate, FMSM evaluated several options for providing flood protection against the 100 year event rather than protecting the area to the same level as what is provided by the existing system (which would require a structure 20 - 25 feet in height). It is simply not practical to construct any kind of system that is more than 20 feet high, where

the flood protection cost could approach \$30 million, depending on the alignment and areas protected.

Additional detail on the options for protecting the north side against the 100 year event is found in the following sections.

Filling

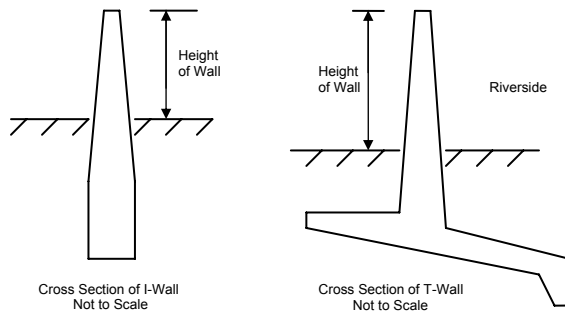
The area north of the relocated interstate can be protected from flooding by bringing in significant amounts of fill material in order to raise the ground elevation of the property above the 100 year flood elevation. The primary advantage of this option is that the development could proceed in phases, with each section being filled as development takes place.

Filling the entire 40 acres would require approximately 645,000 cubic yards of material. Finding enough suitable material could be a challenge, and the costs will be excessive - approximately \$10 million to haul and place the fill.

Another disadvantage to filling the area is that new roadways within the development would require steep slopes in order to tie into existing streets (like River Road) and new underpasses beneath Interstate 64. The slopes would probably exceed design standards. When coupled with the cost of filling the area, this option is not feasible.

Floodwalls

For the purposes of this study, floodwalls were assumed to be constructed of reinforced concrete, designed in a manner acceptable to the local US Army Corps of Engineers (USACE) District office. Generally this allows construction of an “I-Wall” for heights up to 15 feet. For heights greater than 15 feet, a “T-Wall” would be needed.



On the north side of the relocated interstate, the elevation of River Road is approximately 440 feet. In order to protect the area against the 100 year event, a twelve to thirteen foot high wall would need to be constructed along the south side of River Road. This option is not feasible for several reasons.

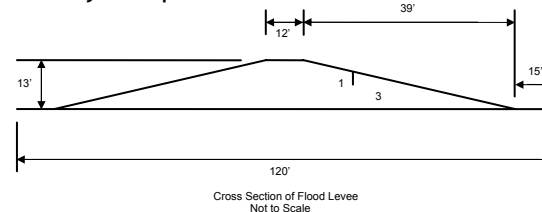
- Cost - At an average of \$1,200 per linear foot, the cost to install a floodwall on the northern portion of the project would exceed \$8.5 million, and could approach \$11 million depending upon the final alignment and how much property is protected.
- Aesthetics - The Waterfront Development Corporation has expended significant energy and several millions of dollars redeveloping the riverfront, making it more accessible to the public. A twelve to thirteen foot high

wall along River Road would act as an impediment to the Ohio River.

- Construction Sequencing - In order to protect the area, the entire floodwall would need to be constructed prior to any development taking place. Trying to phase the work to coincide with sections of new development would result in additional costs to construct portions of the floodwall that would later be abandoned.

Levees

Levees, consisting of earthen berms, are also used for flood control, but they can get quite wide as the height of the berm increases. 3:1 side slopes are needed in order to properly maintain the berms, and if the height exceeds approximately 14', the USACE will require 4:1 side slopes. The top of the levee should be at least 12' wide and a 15' access easement is needed at the base of the berm. The only vegetation allowed is grass, but some enhancements, like walking trails or bike paths, are usually acceptable.



On the north side of the relocated interstate, the elevation of River Road is approximately 440 feet. In order to protect the area against the 100 year event, a twelve to thirteen foot high levee would need to be constructed along the south side of River Road. At approximately \$350 per linear foot, this option is less expensive than installing a floodwall, but it is not feasible for the following reasons.

- Footprint - At an average width of 120' for a thirteen foot high levee, the land requirements would be excessive, subtracting from the area available for development.
- Aesthetics - The Waterfront Development Corporation has expended significant energy and several millions of dollars promoting the riverfront, making it more accessible to the public. A twelve to thirteen foot high berm along River Road, while not as objectionable as a wall, would still act as an impediment to the Ohio River. The restriction on plantings (other than grass) on the levee also detracts from the aesthetic value.
- Construction Sequencing - In order to protect the area, the entire levee would need to be constructed prior to any development taking place. Trying to phase the work to coincide with sections of new development would result in additional costs to construct temporary portions of the system that would later be abandoned.

Floodwalls and Levees

It would be possible to install a combination of floodwalls and levees to protect the north side of the relocated interstate, but all of the same issues associated with either a floodwall or levee system are still a concern. The height of the wall/levee will detract from the access to the river and in areas where the levee would be constructed, a significant amount of land would be required, with restrictions on plantings.

Floodproofing

The preferred method for providing flood protection on the north side of the relocated interstate calls for the floodproofing of buildings for the 100 year flood event. This involves several factors, but basically allows for the lower levels of the buildings to be inundated with water during flooding events. Most developers choose to locate their parking garages on the lower levels when this method of flood protection is selected.

Floodproofing is the least expensive option, but there are issues to be considered when selecting this method, including:

- Access during flood events. Since all finished floors must be at least one foot above the 100 year flood elevation, residential and commercial spaces will remain dry during flood events, unless the event exceeds the 100 year level. It may be impossible to access buildings by vehicles, so residents and businesses should be prepared for lengthy periods where access is limited. Of particular concern are fire and medical emergencies. For residents and business owners who choose to stay in buildings during flood events, this can be especially trying. Fire protection may be minimal, and if emergency medical attention is required, it may be necessary to use boats or helicopters to gain access to residents.
- Emergency operating plans. Each building owner should have a plan in place to deal with the issues associated with flooding events. For example:
 - o Vehicles in lower level garages must be moved out of the floodplain, even if the owners are not present.
 - o Utilities in lower levels must be disconnected or protected from flood waters.

- o Elevators must be prevented from accessing flooded levels.
- o Evacuation plans should be developed in case they are necessary.
- Floods in excess of the 100 year event. While rare, the possibility exists for a flood event that will exceed the design parameters of the buildings and their floodproofing methods. Emergency operating plans should address this possibility and the actions that will be taken if necessary.

Nearby developments (the Tumbleweed Restaurant across River Road and the ICON property at River Road and Frankfort Avenue) have chosen to use this method of flood protection for their projects.

Flood Protection - South of Interstate 64

Another sizeable area was considered on the south side of the relocated interstate highway. A portion of this area is already developed, but it will be impacted by the interstate relocation and the extension of Witherspoon Street as part of the Bridges project. All of the previously identified options are available, along with another opportunity using the relocated interstate embankments as part of the flood protection system, and abandoning the existing floodwall in the area.

It is not practical to bring in fill material for new development because of the existing structures in the area. Costs are still significant, and having new buildings sitting at elevations higher than their neighbors in existing structures would look out of place.

Constructing new floodwalls or levees in this area makes little sense. Asking the Louisville and Jefferson County Metropolitan Sewer District (MSD), which is responsible for maintaining the flood protection system, to take on the added responsibility of maintaining a second system in

close proximity to their existing floodwall is unlikely to be accepted.

Floodproofing of buildings may be acceptable, but the option of using the interstate embankment has enough potential that it should be pursued with the Kentucky Transportation Cabinet (KTC).

Use of Interstate 64 Embankment

MSD is responsible for maintaining the flood protection system, which is more than 50 years old in this area, and they have already initiated plans to upgrade portions of the system. MSD has indicated that they would support the option of using Interstate 64 as part of the flood protection system under the right set of circumstances. Their primary concern is that closures would need to be easily erected, allowing relatively quick installations.

KTC officials have indicated that the interstate embankment design can be modified to levee standards with little concern or additional costs. However, there are two issues that will need to be addressed - the height of the flood protection system and the closures beneath the interstate overpasses.

The interstate roadways are planned to be at least as high as the 500 year flood elevation. This will be approximately 8' lower than the current level of protection. In order to abandon the existing flood protection facilities, the new system must provide the same level of protection, meaning it must be built at least to the same height. Many of the interstate roadways already meet this requirement, but a sizable portion of the project does not. Additional study will be needed to determine how much will be affected and how much additional height is needed, but options to accomplish this include either a permanent wall or a temporary wall that could be installed when

needed. In either case, some form of Memorandum of Understanding between MSD and KTC to address maintenance responsibilities would be needed.

The closures under the interstate overpasses may be the biggest challenge for this option. At least one of the street openings will be approximately 200' wide. Several devices can be considered, but before selecting a final product, KTC, MSD and the Louisville District of the USACE will have to reach agreement. If it is decided to pursue this option, the interstate design will need to be modified to accommodate constructing closures in the future.

Other Issues

Compensation for filling in the floodplain must be addressed. MSD manages a "flood storage bank." The developer must contribute money into the "bank" as compensation for loss of floodplain. MSD currently plans to use the money as matching funds for grants that are secured in order to buy flood prone properties along the Ohio River and for similar Hazard Mitigation Grant Program projects.

If new levees or floodwalls will be constructed, a Riverine Structures Form (see Attachment A) must be submitted to the Federal Emergency Management Agency (FEMA). The form must be accompanied by plans and calculations for the new facilities that address (but are not limited to) the following:

- Certification by a Federal agency that the structure provides protection from the base flood
- Adequate freeboard above the base flood
- Closure devices and locations
- Embankment protection

- Foundation Stability
- Seepage Analysis
- Settlement
- Interior Drainage
- Sediment Transport
- Operation and Maintenance

Recommendations for Proceeding

The preferred option for providing flood protection on the north side of the relocated interstate calls for floodproofing of all new buildings. At this time, no additional steps need to be taken for this portion of the project area. However, planners should revisit this option from time to time over the next 10 to 15 years during construction of the highway realignment to keep abreast of changing federal, state and local regulations that could affect this option.

For the portion of the project on the south side of the interstate, the preferred option is to use the interstate embankment to replace the existing flood protection system. In order to accomplish this, the following actions will need to be incorporated into the design of the interstate highway:

- Modify the embankment design to meet USACE standards for levee design.
- Incorporate the ability to add floodwall closures to the underpasses of the interstate design. The actual closures do not have to be installed as part of the interstate construction, but the highway design must include the option to add the closures at a later date.
- Develop a method for ensuring the level of protection along the interstate is at least as high as the existing flood protection system. This can be accomplished by either installing a permanent wall along the edge of the highway or by making accommodations for the installation of a temporary wall.

Agreements will need to be developed between KTC, MSD and the USACE, and this should take place in the near future, before design proceeds too far.