CHAPTER 2

Development of Alternatives

Chapter 2 discusses the formulation of flood protection measures and alternatives considered for the Pike County (Levisa Fork Basin) Section 202 Flood Control Project, as presented in the 1991 and 1997 Draft Supplements to the Section 202 General Plan.

The initial and intermediate screening of alternative measures was conducted in prior studies. Alternatives evaluated in detail in this DEIS consist of a combination of these alternative measures and would meet the Congressional direction to provide flood damage reduction in Pike County.

2.0 Development of Alternatives

2.1 Planning Objective

The primary planning objective is to formulate the most cost effective, socially acceptable, and environmentally sound project alternatives to reduce financial and personal losses, and social and economic disruptions within the study area due to flooding such as occurred in April 1977.

2.2 Formulation Criteria

Multiple criteria were used to formulate a protection plan. These planning criteria, as discussed below, are based on legislation as described in Chapter 1, good engineering judgment and sound water resource planning. Additional detail is provided in both the 1991 and 1997 GPS.

2.2.1 Program Eligibility

Section 202 of the 1982 Water and Energy Development Appropriations Act, as discussed previously in Chapter 1, Section 1.2, is to provide flood damage reduction "to a level of protection against flooding at least sufficient to prevent any future losses from the likelihood of flooding as occurred in April 1977." Structures eligible to participate in the Section 202 program are those either:

- incurring damages by the 1977 flood event, or
- that would be damaged by a future flood equal in magnitude to the 1977 event.

2.2.2 Level of Protection

The basin-wide target level of protection is the higher of either the April 1977 flood levels or the 1% chance flood (100-year frequency). This ensures consistency with National Flood Insurance Program (NFIP), which requires flood insurance for structures not protected for at least the 1% chance flood (100-year frequency). Within Pike County, the 1977 flood event was of a higher magnitude than the 1% chance flood (100-year frequency), and the 1977-level flood event was set as the minimum level of protection.

The Fiscal Year 1982 Supplemental Appropriations Act (PL 97-257), directed that high levees and floodwalls in urban areas provide for Standard Project Flood (SPF) level of protection "where the consequences from overtopping caused by large floods would be catastrophic".

2.3 Initial Screening of Alternative Measures

This section discusses alternatives initially considered in the planning process (See Section 1.5, Relationship to Previous Studies). Measures retained for consideration in the current Proposed Action are identified. Justification for measures discontinued from further consideration is also discussed.

A wide variety of measures that could provide flood protection were evaluated in both the 1991 and1997 GPS. Measures directly related to the development and management of land and water resources are summarized in this section. Additional detail on the screening evaluation is provided in the GPS documents.

2.3.1 Nonstructural Measures

- ***Zoning.*** Zoning is a legal measure that local jurisdictions can implement to regulate land use and which could provide some measure of protection by designating permitted uses of developable land. Zoning was considered to be an applicable management tool but outside the jurisdiction of the USACE to implement.

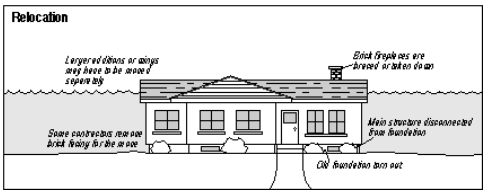
- ***Flood Insurance.*** Federally-subsidized flood insurance coverage for individual properties is available in communities that meet requirements of the National Flood Insurance Program (NFIP). Purchase of flood insurance coverage is voluntary and will not protect against flooding, but will reimburse property owners for a portion of losses that might be incurred due to flooding. Flood insurance was also considered to be an applicable management tool but outside the jurisdiction of the USACE to implement.

- ***Building Code Regulations.*** Adoption of building codes to reduce future flood damage is typically considered to be an integral part of a flood insurance program (such as NFIP). Consequently, this measure would be considered redundant, and was not retained for further consideration and evaluation as an overall plan component.

- ***Flood Warning and Temporary Floodplain Evacuation.*** Flood warning and emergency evacuation was considered to have a beneficial effect in reducing loss of life yet has a limited effect on reducing flood damage, as warning times for area flood events are typically short and most susceptible property within the study area is stationary. The National Weather Service's Integrated Flood Observing and Warning System (IFLOWS) has been operational in the Levisa Fork Basin since 1981. Because the system did not achieve full coverage or effectiveness due to a lack of funding, the 1997 GPS included an IFLOWS upgrade plan. A memorandum of agreement to implement the IFLOWS upgrade was later prepared between the USACE, other state and Federal agencies, Pike County, and communities within Pike County, and is being implemented. Therefore, no further consideration is given to this measure within this DEIS.

- ***Permanent Floodplain Evacuation.*** Permanent evacuation is a voluntary program that would offer eligible residents assistance with relocating out of the

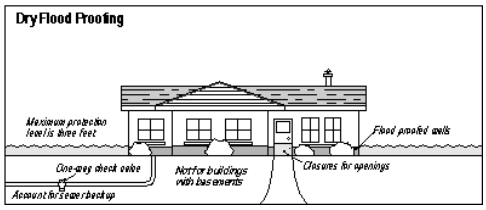
floodplain. This measure includes purchase of the floodplain structure and lot at fair market value, demolition of the existing structure, payment of relocation assistance funds (moving expenses), and relocation of floodplain residents to available flood-safe housing in accordance with the Uniform Relocation and Assistance and Real Property Acquisition Polities Act of 1970. Land acquired through a floodplain evacuation program would subsequently become available for purposes not subject to substantial flood damages, such as preserves, parks, or open land.

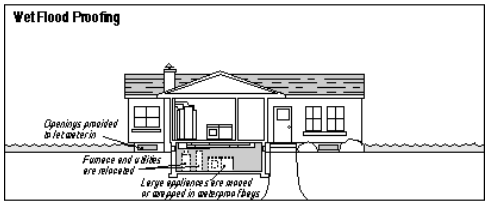


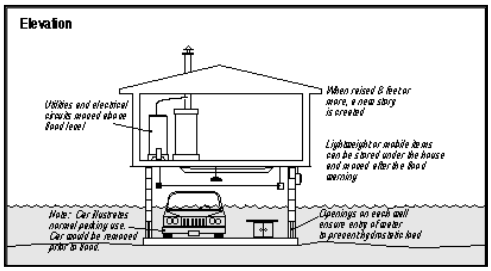
Permanent evacuation of all man-made development would be the optimum solution to flood damages from a corridor perspective. Total floodplain evacuation would result in a lowering of the base flood elevation by removal of restrictions to flow and would completely reduce flood damages thereby eliminating stress to floodplain residents resulting from frequent flooding. However, adequate developable land is not available in Pike County to accommodate relocation of all residents and their homes, institutions, roadways, infrastructure and businesses. Removal of all structures would also impact historic cultural resources, such as historic districts. In addition, the cost and community impacts would be prohibitive.

Using permanent floodplain evacuation on a selective basis with concern for the individual affected residents and their needs could be successful for both flood damage reduction and community re-development. This measure was retained for further consideration and evaluation as an overall plan component.

- ***Floodproofing.*** Floodproofing, also offered as a voluntary measure, consists of altering individual floodplain structures or their sites so that flood waters either do not enter a structure (dry floodproofing) or flood waters that are allowed to enter the structure (wet floodproofing) do not produce significant damages. Techniques evaluated include raising-in-place, sealing exterior surfaces, and installing bulkheads in doorways or gate valves in drains. Single-facility ringwalls are also considered a nonstructural floodproofing measure.







Floodproofing does not eliminate some residual nuisance damages to property, outbuildings utilities, and access. It also does not prevent business losses during flooding as the structure would not be accessible during flood events. Floodproofing produces spatially limited, short-duration environmental impacts in the floodplain area, and requires relatively high per-unit investment costs. However, these techniques have been successful in other areas authorized by Section 202 legislation measured in both technical and social acceptability terms. Floodproofing was retained for further consideration and evaluation as an overall plan component. Additional detail on floodproofing is found in **Appendix B**.

2.3.2 Structural Measures

- ***Channel Modification.*** Channel modification usually involves widening, deepening and/or straightening a stream to improve its hydraulic carrying capacity. In the study area, most available level lands are found along the river and are currently occupied by rail, highway, residential and community facilities. Therefore, most of the existing development targeted for protection would need to be removed in order to accommodate an adequately sized channel. Channel modification was not retained for further consideration because of the extensive land acquisition and infrastructure relocation that would be needed

- ***Reservoirs.*** Reservoirs reduce flood levels by retaining peak runoff until downstream channels can handle the increased flows without flooding. Existing reservoirs operating in the Levisa Fork basin control approximately 42.5 percent of the basin's drainage. In the 1991 and 1997 GPS documents, a dam at Haysi, Virginia was formulated as an alternative (see Section 1.5, Relationship to Previous Studies). However, the Haysi Dam watershed-based alternative is not in consideration at this time because required project sponsorship was withdrawn by the Commonwealth of Virginia.

- ***Stream Cleanout and Rehabilitation.*** As part of the recovery from the 1977 flood, the USACE removed obstructions, trash, and major sediment deposits along the Levisa Fork in 1979-80 on behalf of the Appalachian Regional Commission. While overall appearance, and conveyance of flows improved to a minor degree, the effect was temporary. Debris and sediments returned during subsequent flood events. These cleanout operations can also have short-term environmental impacts from disturbance within the river ecosystems. No further consideration was given to this measure because of its limited effectiveness and environmental impacts.

- ***Floodwalls and Levees.*** Floodwalls and levees are referred to as Local Protection Projects (LPPs) because they provide structural protection to a group of homes and businesses. These LPPs can be effective in preventing floodwaters from entering floodplain areas susceptible to flood damages. Because they require relatively narrow rights-of-way for construction, they can be used where channel modification is not practical and can be significantly

more effective. LPPs would be particularly effective in reducing flood damages to major community centers where maintain the social and economic function of the community is vital to the study area. However, floodwalls and levees can cause significant environmental impacts to land and water resources depending on their design and alignment. They can also be expensive to operate and maintain. Floodwalls and levees were retained for further consideration due to their potential effectiveness for major community centers along Levisa Fork.

2.4 Intermediate Screening of Alternative Measures

This section summarizes the evaluation of those alternatives retained from the initial screening above. Formulation of alternatives at this level required additional technical information including more detailed design and cost estimates, safety, economic analysis, and assessment of social and environmental impacts. This additional information has been used to evaluate which alternatives are feasible and should be further evaluated as final alternative plans. Additional detail, including methodology and assumptions made, can be found in the 1991 and 1997 GPS documents. The Haysi Dam alternative, although retained for consideration in previous documents, is not further evaluated in this document (see Section 2.3).

2.4.1 Nonstructural Measures

Permanent floodplain evacuation and floodproofing, as described previously were considered to be an effective component of an overall plan for flood damage reduction. However, none as a single feature would be totally effective or practical. Several limitations to a completely nonstructural program were noted in the 1997 GPS. First, these measures do not address flood damages to infrastructure such as roads, railroads, utilities, municipal and county sewage and water treatment facilities. Secondly, because these programs are voluntary, participation rates can influence overall effectiveness. Finally, these measures, through acquisition and relocation of structures, have the potential to impact geographically contiguous economic and social communities. In the 1997 GPS, a combination of the Haysi Dam, unspecified LPPs, and nonstructural techniques was recommended. Since the Haysi Dam is not under consideration in this DEIS, a completely nonstructural Pike County-specific alternative is included in this DEIS for evaluation.

2.4.2 Structural Measures

Of the ten communities within the greater Levisa Fork basin considered for floodwalls or levees (LPPs) in the 1991 and 1997 GPS documents, two are in Pike County. Both the North Pikeville and Coal Run Village communities in Pike County were included in preliminary and detailed design and costing activities conducted as part of the 1991 and 1997 GPS documents.

The 1997 study found that North Pikeville and Coal Run Village contained structures of sufficient numbers and densities to make LPPs an effective alternative measure. Screening-level costs appeared to make LPPs competitive with nonstructural measures for these two areas. Consideration of LPPs in the few densely populated areas within the Pike County project area was retained as a potential plan component in the 1997 FEIS.

2.5 Final Screening of Alternative Measures

Reevaluation of the GPS began in 2000, and does not include the Haysi Dam as a potential plan component (see Section 2.3). As a result, LPP measures have been reevaluated on a county-by-county basis as part of smaller, stand-alone flood damage reduction projects within the Levisa Fork Basin. The flood warning system and temporary floodplain evacuation which is currently being implemented is still considered to be part of a comprehensive flood management plan and would be continued.

Final Screening of the alternative measures within Pike County included updates of costs, number of structures eligible for protection under the Section 202 program, condition of eligible structures, and LPP structure design. The results of the Pike County reevaluation indicated that the most economically feasible and socially acceptable alternative for reducing flood damages in Pike County include a combination of structural and non-structural measures.

2.5.1 Nonstructural Measures

There are an estimated 2,000 structures in the Levisa Fork Basin of Pike County eligible for participation (see section 2.2 for eligibility) in the Section 202 Program. Of these structures, approximately 1,500 are residential and 500 are nonresidential.

Participation in the nonstructural flood protection program would be voluntary. Nonstructural measures as described in Section 2.3 are still considered to be an effective component of an overall plan for flood damage reduction. A combination of techniques was recommended in the 1998 FEIS and are retained in this DEIS.

Eligibility criteria for the various nonstructural measures were developed by the USACE in the 1998 FEIS and are retained in this DEIS. Generally, the least cost alternative, either floodproofing (see Section 2.3) or permanent floodplain evacuation, would be offered to eligible structures within the area affected by a 1977-level flood event. However, structures which meet the following criteria are considered eligible for permanent floodplain evacuation only.

- The structure would require greater than a 12-foot raise (measured from the low ground elevation to the raised 1st floor height) to provide 1 foot of freeboard above the target level of protection;
- The structure is in dilapidated condition; or
- The structure is located in the regulatory 100-year floodway.

One ringwall is anticipated at this time. The ringwall construction would protect the Millard School Complex south of Pikeville.

2.5.2 Structural Measures

Increased structure values and additional development within the North Pikeville and Coal Run Village areas demonstrated that floodwall/levee structures may be more cost-effective when compared to nonstructural measures. A floodwall alternative was developed for North Pikeville, and two combination levee/floodwall alternatives were developed for Coal Run Village.

Each LPP reevaluation also included analysis of the probability of overtopping during flood events. As previously discussed in Section 2.2, the Fiscal Year 1982 Supplemental Appropriations Act (PL 97-257) of September 10, 1982 directed that high levees and floodwalls in urban areas provide for SPF level of protection where the consequences from overtopping would be catastrophic.

Overtopping analysis indicates that catastrophic consequences are possible at both locations if a wall designed to protect for the 1977 flood event is overtopped during an SPF flood event. The rate of rise of the Levisa Fork for a major flood event would be up to 3 feet per hour. The only evacuation route out of the area is US 23, which would be inundated both upstream and downstream prior to the 1977-level wall height being overtopped. As a result, remaining residents could be trapped inside the floodwall areas without an escape route The SPF flood event has been determined to be the level of protection required (USACE 2003).

Borrow areas are required to provide a source of suitable soil (impervious material) for levee construction. The USACE policy is to identify at least two suitable borrow areas each capable of providing sufficient quantities of suitable soil to construct the project. Three potential borrow areas have been identified for evaluation, and are described later in this section, following descriptions of the North Pikeville and Coal Run Village LPPs.

- **North Pikeville LPP.** The North Pikeville LPP would consist of a floodwall designed to protect approximately 45 structures in an area north of downtown Pikeville along Mayo Trail, the access road along US 23/80/460. Structures between the river and the west side of the highway would be protected if the North Pikeville floodwall and levee system is constructed. The floodwall would have a gate closure at Mayo Trail to the north of Pikeville High School, thus providing protection to the school and associated athletic fields as well as several commercial structures and a residential area of approximately 30 structures. The North Pikeville LPP is shown in **Figure 2-1.**

  The proposed floodwall would be approximately 4,475 feet in length, with 3,585 feet directly facing the Levisa Fork. The wall height would be on average approximately 18 feet. An approximately 850-foot long sheet-pile retaining wall would be constructed as part of the floodwall behind Pikeville High School, because the school annex is located close to the river bank. This would require stone slope protection (rip rap) placed as a wedge of stone to support the toe of the sheetpile retaining wall. This wedge would be constructed on the lower terrace. There would be no rip rap placed on the streambank or below the ordinary high water level of the Levisa Fork.

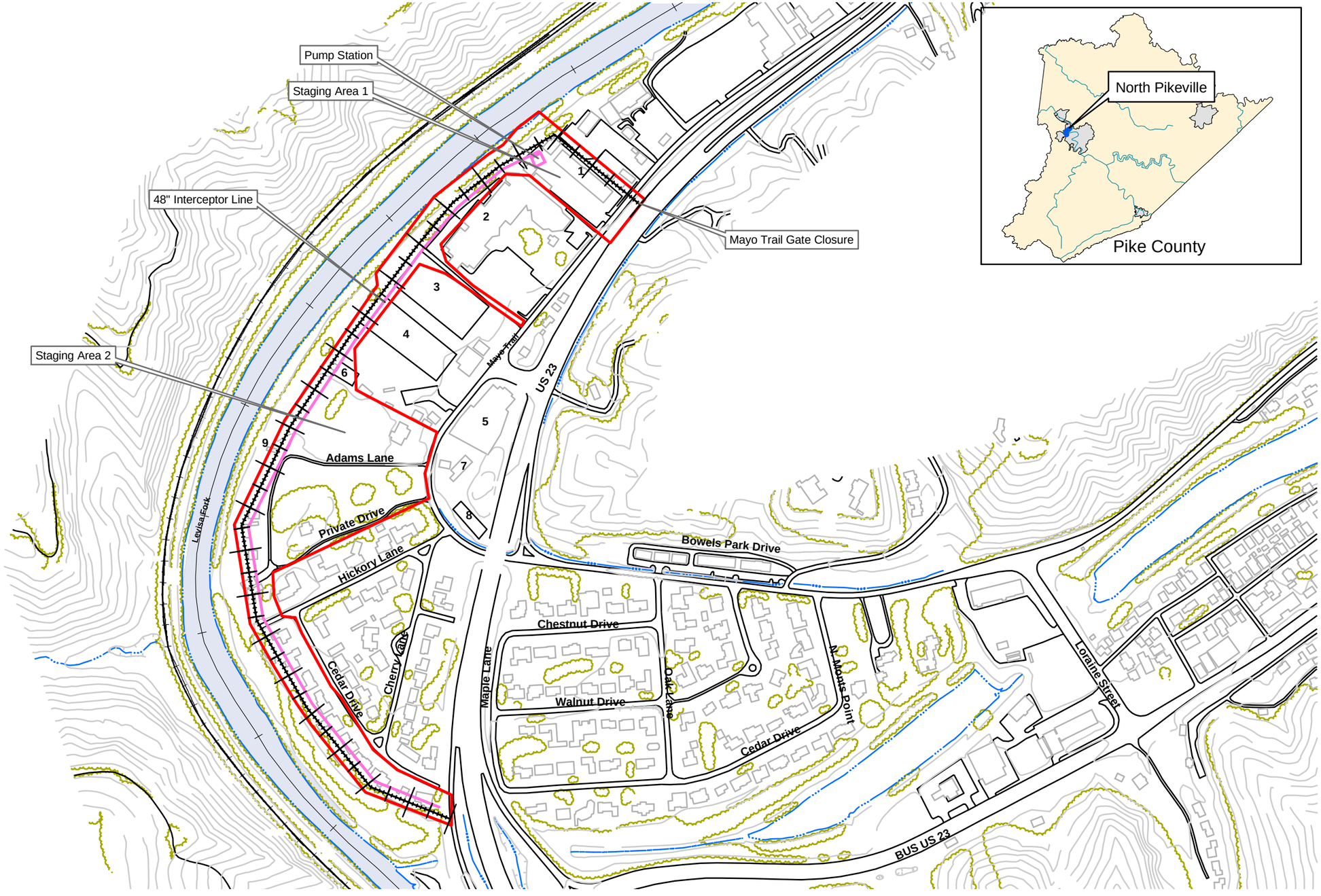
  An existing 5.5-foot high gate closure is located at the southern terminus under US 23. An additional 16-foot high gate closure would be constructed at the northern terminus to close Mayo Trail during flood events.

A 48-inch diameter interceptor line would be installed to collect interior drainage and a 93,000 gallon per minute (GPM) pump station would be located at the existing Kentucky Transportation Cabinet (KTC) maintenance facility on Mayo Trail to pump the interior stormwater over the floodwall during flood events. The KTC facility would be demolished and a ponding area created to store interior drainage during heavy storm events until it reached a level to start the pump.

A floodwall gate is proposed behind the athletic fields to preserve existing access to the Levisa Fork corridor during non-flood periods. Existing stairways, ramps, and walkways would be preserved or restored to at least their existing condition. No access to the river itself is planned.

During construction, staging areas would be located at the KTC maintenance center area and in the area immediately south of the athletic fields near Pikeville High School. Preliminary cost for the floodwall is $103 million (M). Damages that would be prevented by this floodwall during a 1977-level flood event are estimated at $10M.

1. KTC Maintenance Center
2. Pikeville High School
3. Athletic Field
4. Football Field
5. Community Trust Bank
6. Playground and Shelter
7. Marathon
8. Cedar Tree Plaza
9. Cell Tower



Legend

Surface Features

- Contours
- Roads
- Streams
- Structures
- Vegetation
- Buildings
- Floodwall Center Line
- Construction Work Limits
- Intercepter
- Rail Line

N

0 500 1,000 1,500 Feet

0 100 200 300 400 Meters

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Huntington District

Figure 2-1
North Pikeville Local Protection Project (LPP)

- **Coal Run Village LPP "A".** The Coal Run Village LPP "A" consists of a floodwall and levee combination. The Coal Run Village LPP "A" is shown in Figure 2-2. The LPP would protect approximately 100 structures in Coal Run on the west side of US 23/80/460. Structures between the highway and the Levisa Fork River and between the Rax Restaurant and American Electric Power (AEP) would be protected if the optimized short floodwall and levee system is constructed.

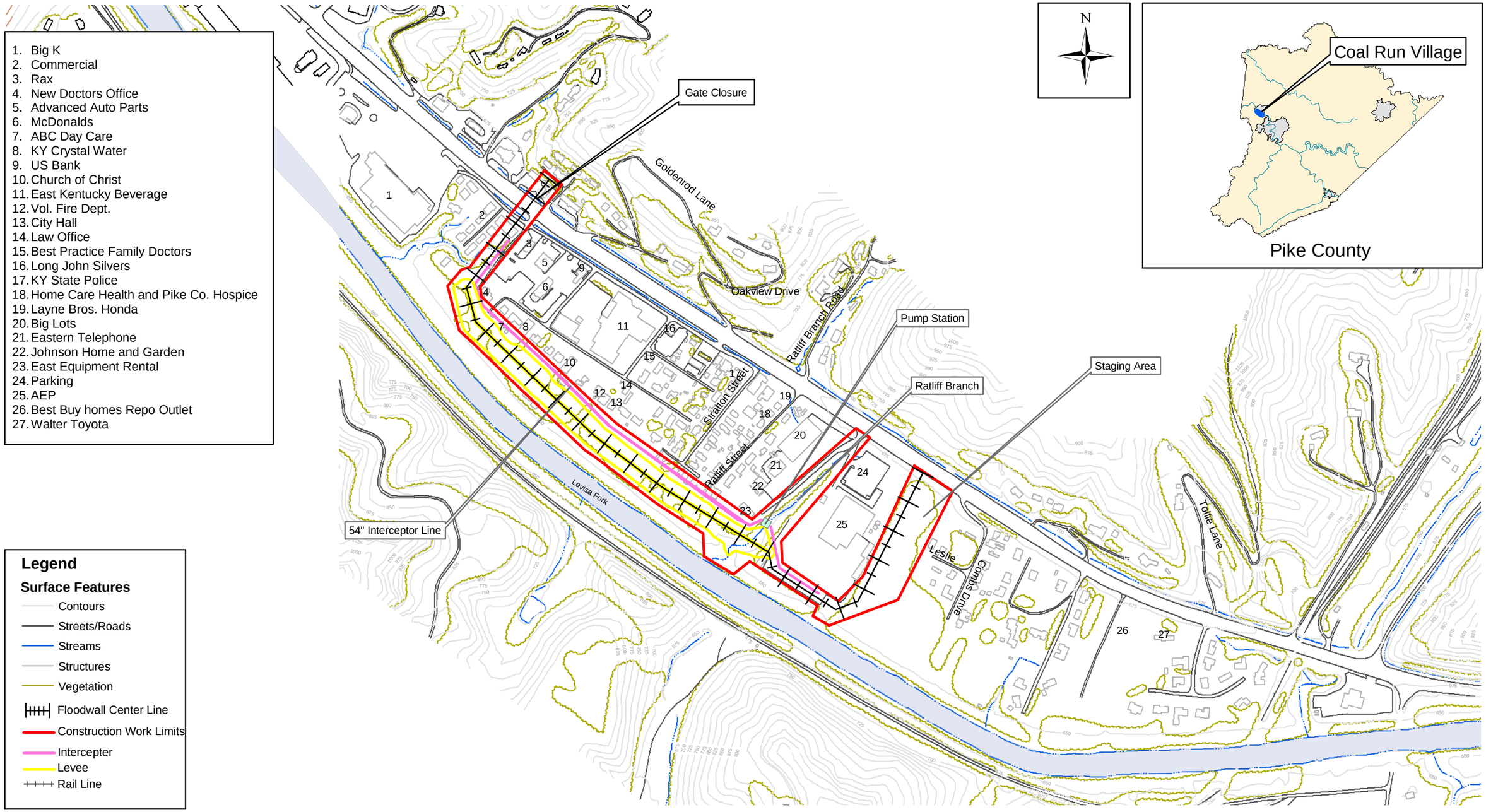
The proposed floodwall is approximately 4,877 feet in length, with approximately 2,871 feet directly facing the Levisa Fork. Approximately 2,275 feet of the LPP would consist of a levee with a small floodwall on top, with the remainder of the total length being entirely floodwall. The average height is 27 feet.

Two gate closures would close Mayo Trail and US 23 during flood events. Both would be located at the downstream terminus of the project. The gates would be 12.5 and 17.5 feet tall, respectively. The upstream terminus of the floodwall would tie into the bank of US 23.

A 54-inch diameter interceptor line would be installed to collect interior drainage, and a 105,000 GPM pump station would be located at Ratliff Branch to pump the interior stormwater over the floodwall during flood events In order to stabilize the existing streambanks and provide adequate storage for temporary ponding upstream of the pump station, the most of the Ratliff Branch riparian area would be cleared of vegetation and lined with stone slope protection.

During construction, a staging area would be located adjacent to the AEP facility on the east side. Preliminary cost for the floodwall is $103M. Damages prevented by this floodwall during a 1977-level flood event are estimated at $14M.

1. Big K
2. Commercial
3. Rax
4. New Doctors Office
5. Advanced Auto Parts
6. McDonalds
7. ABC Day Care
8. KY Crystal Water
9. US Bank
10. Church of Christ
11. East Kentucky Beverage
12. Vol. Fire Dept.
13. City Hall
14. Law Office
15. Best Practice Family Doctors
16. Long John Silvers
17. KY State Police
18. Home Care Health and Pike Co. Hospice
19. Layne Bros. Honda
20. Big Lots
21. Eastern Telephone
22. Johnson Home and Garden
23. East Equipment Rental
24. Parking
25. AEP
26. Best Buy homes Repo Outlet
27. Walter Toyota



Legend

Surface Features

- Contours
- Streets/Roads
- Streams
- Structures
- Vegetation
- Floodwall Center Line
- Construction Work Limits
- Intercepter
- Levee
- Rail Line

0 500 1,000 1,500 2,000 Feet

0 100 200 300 400 500 Meters

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Figure 2-2
Coal Run Village Local Protection Project (LPP) A

Coal Run Village LPP "B". The Coal Run Village LPP "B" also consists of a floodwall and levee combination. This alternative was developed due to significant comment received during public scoping requesting the extension of proposed protection to the Scott Addition area. The extension would also allow for the protection of currently undeveloped, flood susceptible acreage, allowing for additional flood-free developable land.

The Coal Run Village LPP "B" is shown in Figure 2-3.The LPP would protect approximately 137 structures in Coal Run Village on the west side of US 23/80/460. The "B" LPP has the same alignment as the "A" LPP except that the "B" extends further south to protect additional structures upstream of AEP, including the residential area known as Scott Addition.

The LPP "B" would be approximately 7,400 feet in length, with 5,800 feet directly facing the Levisa Fork. Approximately 3,950 feet of the LPP would consist of a levee with a short floodwall on top, with the remainder of the total length being entirely floodwall. The average height would be 27 feet.

Two upstream gate closures would close Mayo Trail and US 23 during flood events. Both are located at the downstream terminus of the project. The gates would be 12.5 and 17.5 feet tall. Downstream, an additional gate will close US 23 just west of the rail line overpass.

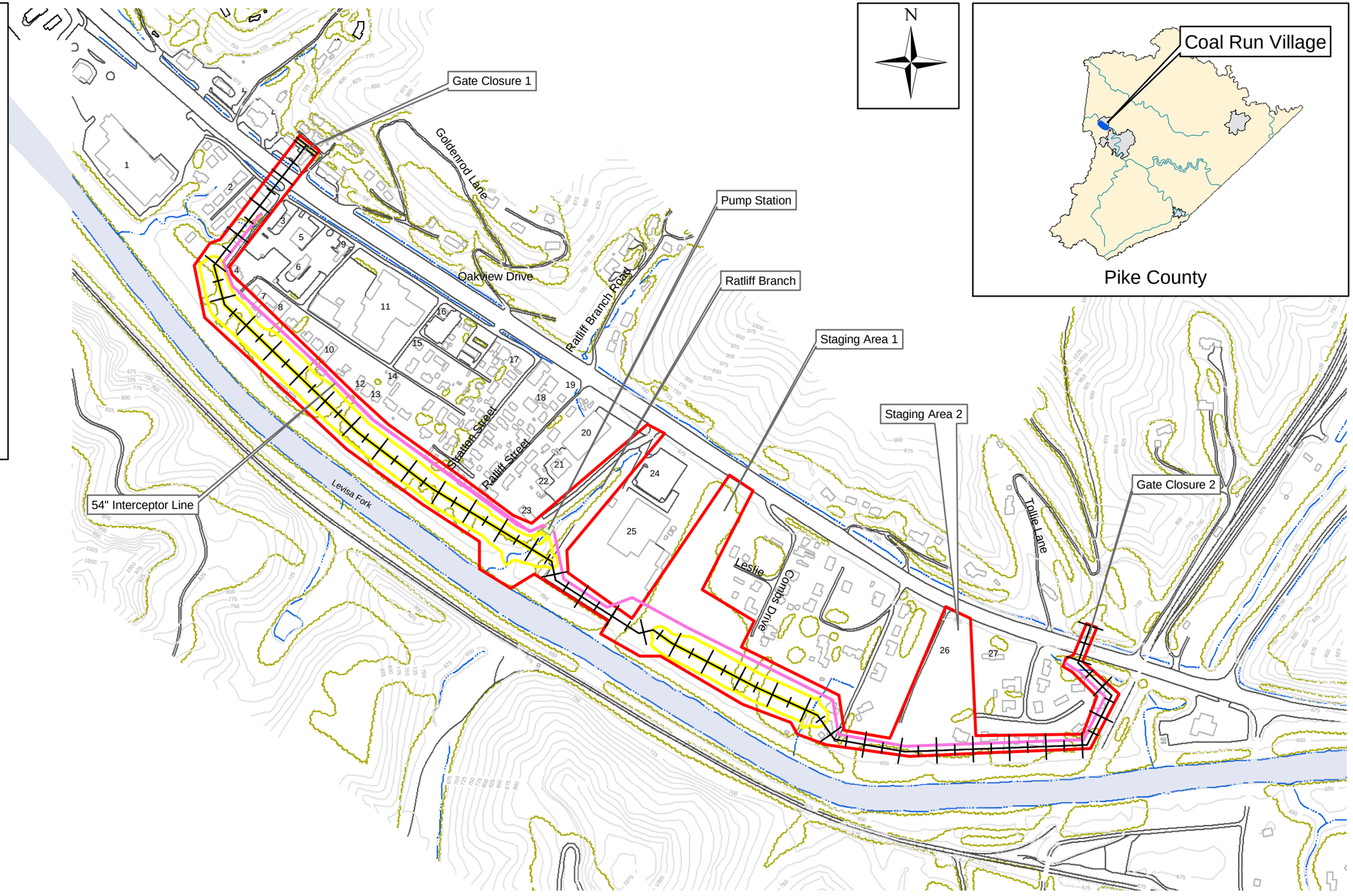
A 54-inch diameter interceptor line would be installed to collect interior stormwater which would occur within the protected area. Two 105,000 GPM pump stations would be installed to pump this stormwater over the floodwall during flood events. One pump would be located at Ratliff Branch and the second nearer to the railroad line at the eastern end of the project. In order to stabilize the existing streambanks and provide adequate storage for temporary ponding upstream of the pump station, the most of the Ratliff Branch riparian area would be cleared of vegetation and lined with stone slope protection.

During construction, two staging areas would be used. The first is located adjacent to the AEP facility on the east side, and the second would be behind the Best Buy Homes Repo Outlet adjacent to Walters Toyota.

Preliminary cost for the floodwall is $150 M. Damages prevented by this floodwall during a 1977-level flood event are estimated at $17M.

- **Borrow Areas.** The two identified potential borrow areas are located within a few miles of the North Pikeville and Coal Run Village LPPs on the Mossy Bottom USGS Topographic Quadrangle, as shown on **Figure 2-4.** Up to four feet of surface soil would be removed from the selected borrow area. In addition, the USACE will be coordinating with the KTC and local companies to identify alternate sources for borrow material that could satisfy suitability and timing requirements for this project. These materials could include excavated soil and rock from roadway construction or mine overburden.

1. Big K
2. Commercial
3. Rax
4. New Doctors Office
5. Advanced Auto Parts
6. McDonalds
7. ABC Day Care
8. KY Crystal Water
9. US Bank
10. Church of Christ
11. East Kentucky Beverage
12. Vol. Fire Dept.
13. City Hall
14. Law Office
15. Best Practice Family Doctors
16. Long John Silvers
17. KY State Police
18. Home Care Health and Pike Co. Hospice
19. Layne Bros. Honda
20. Big Lots
21. Eastern Telephone
22. Johnson Home and Garden
23. East Equipment Rental
24. Parking
25. AEP
26. Best Buy homes Repo Outlet
27. Walter Toyota



Legend

Surface Features

- Contours
- Streets/Roads
- Streams
- Structures
- Vegetation
- Floodwall Center Line
- Construction Work Limits
- Intercepter
- Levee
- Rail Line

0 500 1,000 1,500 2,000 Feet

0 100 200 300 400 500 Meters

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Figure 2-3
Coal Run Village Local Protection Project (LPP) B

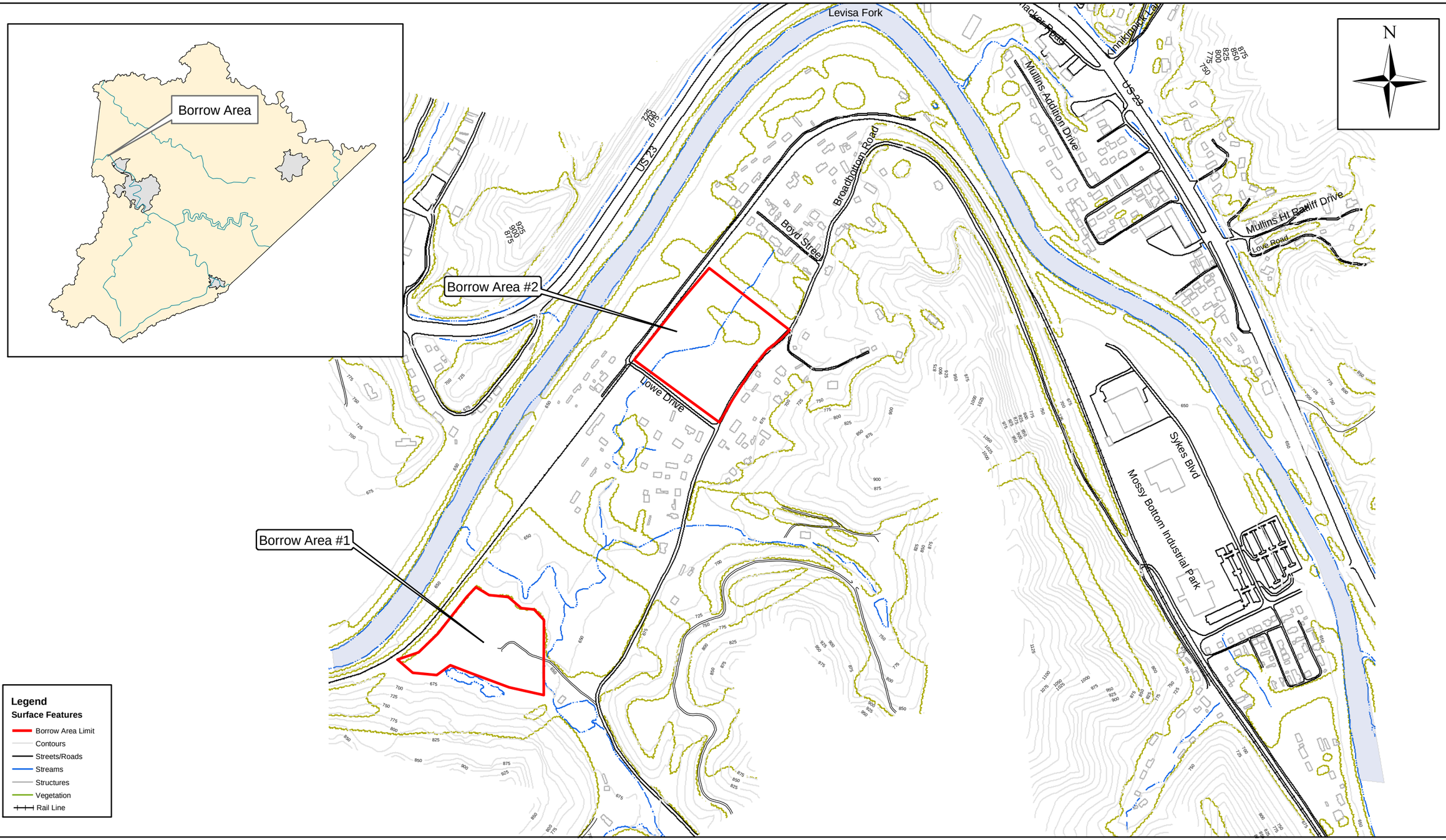

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Figure 2-4
Proposed Borrow Areas

0 500 1,000 1,500 2,000 Feet

0 100 200 300 400 500 Meters

Table 2-2 Alternatives Evaluated in this DEIS

Item	ALTERNATIVE			
	No Federal Action	**Alternative 1**	**Alternative 2**	**Alternative 3**
Physical Resources				
Land Use/Land Cover	If development in the floodplain continues, damages associated with future flooding will increase.	Temporary loss of approximately 55 acres, permanent loss of 20 acres Land use patterns may change due to number of voluntary relocations.	Temporary loss of approximately 72 acres, permanent loss of 25 acres Land use patterns may change due to number of voluntary relocations.	Land use patterns may change due to number of voluntary relocations.
Topography and Drainage	No impact.	Change in drainage patterns due to interceptor at North Pikeville and Coal Run Village. Upland area development possible, depending on voluntary participation rate.	Change in drainage patterns due to interceptor at North Pikeville and Coal Run Village. Upland area development possible, depending on voluntary participation rate.	Upland area development possible, depending on voluntary participation rate.
Geology and Soils	Continued bank erosion due to periodic flooding, and continued beneficial deposition of sediments in floodplain.			
Air Quality	Continued periodic minor fugitive air quality impacts from post-flood cleanup activities.	Temporary impacts due to construction (diesel emissions and fugitive dust).	Temporary impacts due to construction (diesel emissions and fugitive dust).	Localized temporary impacts due to construction (diesel emissions and fugitive dust).
Noise	Continued periodic equipment noises from post-flood cleanup.	Temporary impacts due to floodwall/levee construction. Adverse impact to residences near floodwall/levee footprint as well as residents along Mossy Bottom and Wagner Station Roads (fill haul route).	Temporary impacts due to floodwall/levee construction. Adverse impact to residences near floodwall/levee footprint as well as residents along Mossy Bottom and Wagner Station Roads (fill haul route).	Localized temporary impacts due to individual structure demolitions.
Ecological Resources				
Terrestrial Habitat	No impact.	Overall beneficial impact in county by returning floodplain areas to passive use open to wildlife. Minor adverse impact from loss of vegetated land in footprint of floodwall/levees and borrow area.	Overall beneficial impact in county by returning floodplain areas to passive use open to wildlife. Minor adverse impact from loss of vegetated land in footprint of floodwall/levees and borrow area.	Beneficial impact to wildlife by returning floodplain areas to passive use open to wildlife.
Wetlands	No impact	Potential impact to adjacent wetlands in borrow areas.	Potential impact to adjacent wetlands in borrow areas.	No impact

Item	ALTERNATIVE			
	No Federal Action	**Alternative 1**	**Alternative 2**	**Alternative 3**
Aquatic Resources	No impact	Temporary impacts to Levisa Fork habitat during construction. Increases in stream velocity would have minor effect on existing stream characteristics. Permanent loss of aquatic habitat in portion of Ratliff Branch.	Temporary impacts to Levisa Fork habitat during construction. Increases in stream velocity would have minor effect on existing stream characteristics. Permanent loss of aquatic habitat in portion of Ratliff Branch.	No impact
Riparian Resources	Continued degradation of Levisa Fork banks due to highly variable flow	Continued degradation of Levisa Fork banks due to highly variable flow. Permanent loss of portion of Ratliff Branch due to pump station.	Continued degradation of Levisa Fork banks due to highly variable flow. Permanent loss of portion of Ratliff Branch due to pump station.	Continued degradation of Levisa Fork banks due to highly variable flow.
Wildlife	No impact	Temporary minor impact due to noise and activity during construction,. Minor impact due to loss of habitat used for construction of floodwall/levees. Impacts offset by addition of open land through revegetation of floodplain on the riverward side of levee and nonstructural program in balance of study area.	Temporary minor impact due to noise and activity during construction. Minor impact due to loss of habitat used for construction of floodwall/levees. Impacts offset by addition of open land through revegetation of floodplain on the riverward side of levee and nonstructural program in balance of study area.	Temporary minor impact due to noise and activity during demolitions or floodproofing activities. Overall beneficial impact from addition of open land through nonstructural program.
Threatened and Endangered Species	No impact	Loss of roosting habitat for Indiana bat due to clearing trees within construction work limits.	Loss of roosting habitat for Indiana bat due to clearing trees within construction work limits.	Potential loss of roosting habitat for Indiana bat due to clearing trees adjacent to residences.
Cultural Resources				
Architecture/Historic Resources	No impact	Some potentially eligible structures may be removed as part of the structural and non-structural components.	Some potentially eligible structures may be removed as part of the structural and non-structural components.	Some potentially eligible structures may be removed as part of the non-structural component.
Archaeological Resources	No impact	Some potentially significant resources could be impacted as part of the floodwall/levee construction and excavation for interceptor.	Some potentially significant resources could be impacted as part of the floodwall/levee construction and excavation for interceptor.	No impact.

Item	ALTERNATIVE			
	No Federal Action	**Alternative 1**	**Alternative 2**	**Alternative 3**
Socioeconomic Resources				
Demographics	Existing trends in population decline likely to continue.	Additional population decline could result from lack of available relocation locations.	Additional population decline could result from lack of available relocation locations.	Additional population decline could result from lack of available relocation locations.
Community Cohesion	Minor adverse impact do to continued periodic flooding and effects on human population.	Potential lack of available, affordable, safe and sanitary housing due to number of relocations county-wide. Outmigration and/or fragmented development resulting from relocations could weaken community cohesion.	Potential lack of available, affordable, safe and sanitary housing due to number of relocations county-wide. Outmigration and/or fragmented development resulting from relocations could weaken community cohesion.	Potential lack of available, affordable, safe and sanitary housing due to number of relocations county-wide. Outmigration and/or fragmented development resulting from relocations could weaken community cohesion.
Economics and Employment	Continued periodic flooding may discourage investment and business growth.	Protected areas within floodwall areas could encourage business investment.	Protected areas within floodwall areas could encourage business investment.	If suitable business relocation sites not available, could result in business relocation outside study area.
Housing	Continued flooding may discourage investment and maintenance and contribute to decline of housing stock countywide.	Number of relocations could result in temporary housing shortage. This could either spur construction or encourage outmigration.	Number of relocations could result in temporary housing shortage. This could either spur construction or encourage outmigration.	Number of relocations could result in temporary housing shortage. This could either spur construction or encourage outmigration.
Education	No impact.	Number of relocations could affect student distribution, bus routes, and school funding.	Number of relocations could affect student distribution, bus routes, and school funding.	Number of relocations could affect student distribution, bus routes, and school funding.
Environmental Justice	No impact.	No impact. Project impacts are not disproportionately borne by low income or minority populations.	No impact. Project impacts are not disproportionately borne by low income or minority populations.	No impact. Project impacts are not disproportionately borne by low income or minority populations.
Recreation	No Impact.	Adverse impact to church recreational area (loss of picnic shelter). Beneficial impacts countywide by returning more of floodplain to passive use that could be used for recreation.	Adverse impact to church recreational area (loss of picnic shelter). Beneficial impacts countywide by returning more of floodplain to passive use that could be used for recreation.	Beneficial impacts by returning more of floodplain to passive use that could be used for recreation.
Aesthetic and Scenic Resources	Minor adverse impact of deterioration of existing housing stock	View of Levisa Fork will be blocked in floodwall areas.	View of Levisa Fork will be blocked in floodwall areas.	Visual impact from elevated structures.
Hazardous, Toxic, and Radioactive	No impact.	Beneficial impact due to excavation/cleanup	Beneficial impact due to excavation/cleanup	Beneficial impact due to excavation/cleanup

Item	ALTERNATIVE			
	No Federal Action	**Alternative 1**	**Alternative 2**	**Alternative 3**
Wastes		of contaminated soils and structures for all acquired sites.	of contaminated soils and structures for all acquired sites.	of contaminated soils and structures for all acquired sites.
Health and Safety	Continued periodic flooding with associated adverse effects on community health and safety	Beneficial because fewer people living in areas prone to flooding. Adverse impact of flood gate closures impeding emergency vehicles. Temporary potential for safety issues during construction.	Beneficial because fewer people living in areas prone to flooding. Adverse impact of flood gate closures impeding emergency vehicles. Temporary potential for safety issues during construction.	Beneficial because fewer people living in areas prone to flooding.
Infrastructure	Utilities and public services will continue to be damaged and destroyed by floods.	Potential utility relocations in North Pikeville and Coal Run Village areas will need coordination with local providers.	Potential utility relocations in North Pikeville and Coal Run Village areas will need coordination with local providers.	Limited potential utility impacts as structures are removed. Coordination with local providers required.
Traffic and Transportation	Continued periodic flooding with corresponding impacts to roadway conditions and imperiled access.	Adverse impact of flood gate closures impeding emergency vehicles.	Adverse impact of flood gate closures impeding emergency vehicles.	Continued periodic flooding with corresponding impacts to roadway conditions and imperiled access.