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4.0 ENVIRONMENTAL IMPACT ANALYSIS

The following sections discuss the environmental impacts associated with implementing the proposed Interstate-71 (I-71) Corridor Light Rail Transit (LRT) alignment. The effects of the alternatives regarding soils, contaminated materials, noise and vibration, and air quality are discussed in this section. Natural resource impacts such as wetlands, wildlife, protected species, and aquatic resources are also addressed.

Graphics for Chapter 4 are included together at the end of this chapter.

4.1 SOILS, GEOLOGY AND TOPOGRAPHY

This section describes the existing soil characteristics, geology, and topography in the vicinity of the proposed I-71 Corridor LRT alignment.

4.1.1 SOILS

The proposed I-71 Corridor LRT alignment area lies within six general soil associations as mapped by the U.S. Soil Conservation Service, now the Natural Resources Conservation Service. General soil units are indicative of stream bottoms, terraces, outwash plains and uplands in Kenton County, Kentucky and Hamilton County, Ohio. All of the soil units have in some form or other been disturbed by the use of the land for urban practices. Urban practices generally include some form of disturbance or removal due to excavation or construction of buildings and pavement. Soil associations are briefly described below:

Wheeling-Huntington-Alluvial land steep association – This soil association is dominantly nearly level and gently sloping, and has a loamy subsoil. The soils are located on stream terraces, first bottoms and moderately steep to steep areas of variable textured alluvium. Most of this soil association has been modified for urban use. This soil covers the city of Covington area of the proposed LRT alignment.

Urban land-Huntington-Elkinsville association – This soil association is urban land and deep, nearly level to strongly sloping, well-drained medium textured soil. The soils are on flood plains and terraces. Most of this soil is in urban and industrial use. This soil covers the southern portion of the city of Cincinnati along the Ohio River.

Urban land-Martinsville-Fox association – This soil association is urban land and deep, nearly level to strongly sloping, well-drained medium textured soil. The soils are on stream terraces and outwash plains that border larger streams in Hamilton County. Most of these soils are in urban land use and most areas are long and narrow. This soil association covers the southern portion of the city of Cincinnati.

Eden-Pate association - This soil association is moderately deep and deep, strongly sloping to very steep, well drained and moderately well drained. The soil is moderately fine textured soil on uplands, ridges and hillsides. The Eden soils are on ridges and the steeper parts of hillsides near the top of the slope. The Pate soils are on colluvial areas at the base of the slope. The soils are on the slope out of the Ohio River valley toward the Over-the-Rhine area.

Rossmoyne-Urban land-Switzerland association – This soil association is deep, nearly level to moderately steep, moderately well drained and well drained, medium textured soil. The soil is on uplands of the broad Illinoian till plains. Rossmoyne soils are mainly on higher less sloping parts of the landscape. Switzerland soils are on the more sloping parts along waterways. This soil association generally covers the remainder of the proposed LRT alignment with the exception of the north end.

Russell-Urban land-Xenia association – This soil association is deep, nearly level and gently sloping, well drained and moderately well drained, medium textured soil. The soil is urban land and on upland plains. Most of this soil is Urban and Xenia soil. The Xenia soil is moderately well drained with moderately slow permeability. The Xenia soils have a seasonal high water table between depths of 24 to 72 inches. These soils cover the area around a water body in the area of Blue Ash at the northern end of the proposed LRT alignment.

Detailed Soil Descriptions – Within each of the major soil associations, smaller areas are described and classified. Delineation on a general soil map represents the area dominated by one type of soil or several co-dominant soils. These soils are described by unit in the soil surveys but would be too lengthy to describe within this document. The individual map units are briefly described along with their limitations on the Soil Units and Limitations for Site Development, Table 4.1.1. The soil units are illustrated on Figures 4.1-1a-c.

Table 4.1.1: Soil Unit Classifications and Limitations for Site Development

Symbol	Detailed Soil Map Unit	Limitations for Site Development							Hydric Soil	Estimated Predevelopment Ecosystem
		Shallow Excavations	Small Buildings	Roads & Streets	Lawns and Landscaping	Potential Frost Action	Risk of Corrosion			
							Uncoated Steel	Concrete		
AvA	Avonburg silt loam, 0-2% slopes	Severe: wetness	Severe: wetness	Severe: low strength, frost action	Moderate: wetness	High	High	High	No	Till plains under hardwood trees
AwA	Avonburg-Urban land complex, 0-2% slopes	Severe: wetness	Severe: wetness	Severe: low strength, frost action	Moderate: wetness	High	High	High	No	Till plains under hardwood trees
BoE	Bonnell silt loam, 25-35% slopes	Severe: slope	Severe: shrink-swell, slope	Severe: low strength, slope, shrink-swell	Severe: slope	Moderate	High	Moderate	No	Till plains under hardwood trees
EcC2	Eden silty clay loam, 8-15% slopes, eroded	Severe: slope	Severe: slope	Severe: slope, low strength	Severe: slope	High	Moderate	Low	No	Till plains under hardwood trees
EcD	Eden silty clay loam, 15-25% slopes	Severe: slope, slippage	Severe: slope, slippage	Severe: slope, low strength, slippage	Severe: slope	High	Moderate	Low	No	Till plains under hardwood trees
EcE	Eden silty clay loam, 25-40% slopes	Severe: slope, slippage	Severe: slope, slippage	Severe: slope, low strength, slippage	Severe: slope	High	Moderate	Low	No	Till plains under hardwood trees
EdF	Eden flaggy silty clay loam, 40-60% slopes	Severe: slope, slippage	Severe: slope, slippage	Severe: slope, low strength, slippage	Severe: slope	High	Moderate	Low	No	Till plains under hardwood trees
EeD	Eden-Urban land complex, 15-25% slopes	Severe: slope, slippage	Severe: slope, slippage	Severe: slope, low strength, slippage	Severe: slope	High	Moderate	Low	No	Till plains under hardwood trees
Go	Genesee-Urban Land, occasionally flooded	Moderate: flooding	Severe: flooding	Severe: flooding	Moderate: flooding	Moderate	Low	Low	No	Till plains under hardwood trees
PfE	Pate silty clay loam, 25 to 35% slopes	Severe: slope, slippage	Severe: shrink-swell, slope, slippage	Severe: low strength, slope, shrink-swell	Severe: slope	Moderate	High	Moderate	No	Till plains under hardwood trees
PhD	Pate-Urban land complex, 15-25% slopes	Severe: slope, slippage	Severe: shrink-swell, slope, slippage	Severe: low strength, slope, shrink-swell	Severe: slope	Moderate	High	Moderate	No	Till plains under hardwood trees
RpA	Rossmoyne silt loam, 0-3 % slopes	Severe: wetness	Moderate: wetness, shrink-swell	Severe: low strength, frost action	Moderate: wetness	High	High	High	No	Till plains under hardwood trees
RpB2	Rossmoyne silt loam, 3-8 % slopes	Severe: wetness	Moderate: wetness, shrink-swell, slope	Severe: low strength, frost action	Moderate: wetness	High	High	High	No	Till plains under hardwood trees
RpC2	Rossmoyne silt loam, 8-15 % slopes	Severe: wetness	Severe: slope	Severe: low strength, frost action	Moderate: wetness, slope	High	High	High	No	Till plains under hardwood trees
RtA	Rossmoyne-Urban land complex, 0-3 % slopes	Severe: wetness	Moderate: wetness, shrink-swell	Severe: low strength, frost action	Moderate: wetness	High	High	High	No	Till plains under hardwood trees
RtB	Rossmoyne-Urban land complex, 3-8 % slopes	Severe: wetness	Moderate: wetness, shrink-swell, slope	Severe: low strength, frost action	Moderate: wetness	High	High	High	No	Till plains under hardwood trees
RtC	Rossmoyne-Urban land complex, 8-15 % slopes	Severe: wetness	Severe: slope	Severe: low strength, frost action	Moderate: wetness, slope	High	High	High	No	Till plains under hardwood trees
RwB2	Russell silt loam, 3-8% slopes, eroded	Slight	Moderate: shrink-swell, slope	Severe: low strength, frost action	Slight	High	Moderate	Moderate	No	Till plains under hardwood trees
SxC	Switzerland-Urban land complex, 8-15 % slopes	Moderate: too clayey, slope	Severe: slope	Severe: low strength, frost action	Moderate: slope	High	Moderate	High	No	Upland ridgetops and hillsides under hardwood trees
UgC	Urban land-Elkinsville complex, 8-15 % slopes	Moderate: slope	Severe: slope	Severe: low strength, frost action	Moderate: slope	High	Moderate	High	No	Low outwash terraces
Uh	Urban land-Huntington complex, frequently flooded	Moderate: wetness, flooding	Severe: flooding	Severe: flooding, frost action	Severe: flooding	High	Low	Moderate	No	Floodplains, frequently flooded
UmB	Urban land-Martinsville complex, 3-8 % slopes	Severe: cutbacks cave	Moderate: shrink-swell, slope	Moderate: low strength, frost action	Slight	Moderate	Moderate	Moderate	No	Stream terraces and outwash plains
UmC	Urban land-Martinsville complex, 8-15 % slopes	Severe: cutbacks cave	Moderate: shrink-swell, slope	Moderate: low strength, frost action	Slight	Moderate	Moderate	Moderate	No	Stream terraces and outwash plains
Ur	Urban land	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
UrB	Urban land-Rossmoyne complex, 0-8 % slopes	Severe: wetness	Moderate: wetness, shrink-swell, slope	Severe: low strength, frost action	Moderate: wetness	High	High	High	No	Till plains under hardwood trees
XfA	Xenia silt loam, 0-2 % slopes	Severe: wetness	Moderate: wetness, shrink-swell	Severe: low strength, frost action	Slight	High	High	Moderate	No	Till plains under hardwood trees

Notes: This table indicates the degree and kind of limitations that affect shallow excavations, small buildings, roads and streets, and lawns and landscaping. This information was obtained from the U.S. Department of Agriculture Soil Surveys for Hamilton County, Ohio; and Boone, Campbell, and Kenton Counties, Kentucky. Slight: Soil properties and features are favorable for the indicated use and limitations are minor and easily overcome. Moderate: Soil properties and features are not favorable for the indicated use and special planning, design or maintenance is required to minimize or overcome the limitations. Severe: Soil properties and features are so unfavorable or difficult to overcome that special design, significant increases in construction costs and possibly increased maintenance are required.

Soil Limitations - Limitations of soils for intended uses are based on evaluation of the surface soil in its unmodified state. Most of the soils within the project area have been modified for urban development and are not expected to support viable natural habitat. An inventory of the project area soils reveals that none of the soils are hydric soils that could support wetlands.

All of the soils have moderate to severe limitations for most site development. Several of the soils are limited by high water tables. Most of the soils are prone to severe wetness in shallow excavations for small buildings and landscaping. Most of the soils have severe limitations for road and street development based on low strength and frost action. The risk of corrosion to untreated steel and concrete is moderate to high in most of the soils.

4.1.2 SURFICIAL GEOLOGY

Surficial sediments beneath the soil along the proposed I-71 Corridor LRT alignment were deposited primarily by glacial lakes, glacial ice and meltwater from the last glaciation (Wisconsinan Glaciation). Glacial lakes were formed during the Pre-Illinoian Glaciation and the Illinoian Glaciation as glaciers formed dams in Teays River tributaries (Pre-Illinoian) and the Ohio River (Illinoian). Thick sequences of lake clay were deposited during this time.

Sediments along the major portion of the proposed LRT alignment can be attributed to the deposition of a terminal moraine in the northern parts of the Cincinnati area. As the glacial ice receded, valleys to the south were filled with outwash deposits of sand and gravel. Stream erosion has since eroded these outwash deposits leaving terraces along many of the river valleys.

Surface Geology of Kenton County, Kentucky - alluvium and outwash deposits.

- Alluvium consists of clay, silt, sand, and gravel. Older low-terrace alluvium along the Ohio River is predominantly deeply weathered pale-grayish-orange, yellowish-brown, and pale-grayish-red silty clay and clayey silt; limestone slabs and cobbles are common in the lower part of the alluvium.
- Outwash deposits consist of clay, silt, sand, and some gravel; predominantly greenish-gray silty clay, interbedded with sandy and clayey silt. Clay in the lower part contains organic matter.

Surface Geology of Hamilton County, Ohio - alluvium, sand, glacial till, clay, and bedrock.

- Alluvium along the Ohio River consists of clay, silt, sand, and gravel deposited by the river.
- Sand, deposited from the Wisconsinan glacial period, located north of the alluvial deposits, north of the Ohio River.
- Glacial till from the Illinoian glacial period.
- A small area of clay deposits from the Illinoian glacial period, located near the proposed Over-the-Rhine station site.
- Bedrock from the Ordovician Period, consisting of undifferentiated limestone and shale.

4.1.3 BEDROCK GEOLOGY

The uppermost bedrock along the proposed I-71 Corridor LRT alignment consists of (from oldest to youngest) the Point Pleasant Member, the Kope Formation, the Fairview Formation, the Miamitown Shale, and the Grant Lake Formation.

- The Point Pleasant Member consists of nearly equal amounts of interbedded limestone and shale. The limestone is characterized as a gray to bluish-gray bed occurring as both planar and lenticular beds up to 1 foot in thickness. The shale is also gray to bluish-gray occurring as platy beds up to 1.5 feet in thickness.
- The Kope Formation is predominantly a calcareous, compaction (uncemented) shale, interbedded with one to three inches thick (occasionally up to 8.5 inches thick) hard, crystalline, fossiliferous limestone layers. The formation consists of 80 to 90 percent shale, typically with two to three foot intervals of shale between limestone layers. The shale is characterized as a light to medium gray calcareous bed, and the limestone is a gray, fine to coarse grained unit containing ripple marks and graded bedding.
- The Fairview Formation is a shale rich bedrock with more abundant and more closely spaced limestone beds than Kope. Hard, coarsely crystalline limestone layers constitute up to 50% of the formation, and occur in .5 to 15inch thick layers. As with the Kope, the shale is a relatively weak compacted shale.
- Miamitown Shale consists of thin shale and mudstone with thin, discontinuous and, in places, nodular limestone interbeds. Shale comprises 75% or more of the unit.
- The Grant Lake Formation consists of a relatively thinly bedded, discontinuous, wavy-bedded, rubbly limestone interbedded with shale.

4.1.4 TOPOGRAPHY

Land surface in the proposed I-71 Corridor LRT alignment area ranges in elevation from approximately 460 feet to greater than 850 feet based on National Geodetic Vertical Datum of 1929. Figure 4.1-2a through Figure 4.1-2c depicts the general topography of the proposed LRT alignment. Elevation generally increases with distance away from the Ohio River, with the high points at the Cornell Park and Mount Auburn Station sites, and the low points near the Ohio River.

The south end of the proposed LRT alignment, near the proposed 12th Street Station site in Covington, Kentucky is approximately 540 feet. As the proposed LRT alignment proceeds north, elevation decreases continuously to approximately 460 feet at the south side of the Ohio River. The elevation at the north side of the river is approximately 470 feet, and rises steadily to approximately 550 feet at the proposed Over-the-Rhine Station site. Elevation increases sharply to approximately 850 feet between the proposed Over-the-Rhine and Mt. Auburn Station sites, then gradually decreases to 600 feet between the proposed Mt. Auburn and Ridge Avenue Station sites. The elevation increases rapidly to about 850 feet between the proposed Ridge Avenue and Silverton Station sites. As the proposed LRT alignment proceeds north between the Silverton and Cornell Park Station sites, topography is relatively flat between 800 and 850 feet. The Cornell Park Station site near the north end of the proposed LRT alignment near is approximately 850 feet.

4.1.5 ENVIRONMENTAL IMPACTS

The following paragraphs describe the environmental impacts by alternative.

4.1.5.1 No-Build Alternative

No significant impacts to the proposed project relating to the project area soils or geology are anticipated in association with the No-Build Alternative.

4.1.5.2 TSM Alternatives

No significant impacts to the proposed project relating to the project area soils or geology are anticipated in association with the TSM Alternative.

4.1.5.3 Build (LRT) Alternatives

Anticipated modifications related to soils under the build alternatives would include cut and fill associated with new rail bed construction and development of station areas. Exposed bedrock may impact the proposed project in areas along the Corridor.

Urban Land-Huntington soils are frequently flooded any may impact the proposed LRT alignment. Rossmoyne soils are subject to wetness in winter, spring, and other extended wet periods.

Several of the soil types pose severe limitations to site development due to slope, shrink-swell potential, frost action, and corrosivity to steel and or/concrete.

4.1.6 MITIGATION MEASURES

Special care concerning bank stabilization should be exercised in the vicinity of the Ohio River, stream banks and drainageways. Soil erosion and the pollution of surface water during construction caused by stormwater runoff would be addressed in the facility design and permitting phase. Erosion control measures including ground coverage and tree conservation should also be utilized throughout the project corridor.

Project construction would not be expected to effect existing structural foundations in and around the project corridor. All project related construction activity should adhere to appropriate standards and applicable permitting requirements of the Ohio Environmental Protection Agency (Ohio EPA), the Kentucky Department for Environmental Protection, Hamilton and Kenton County and Ohio and Kentucky Departments of Transportation.

4.2 HAZARDOUS MATERIALS CONTAMINATION

The purpose of this section is to evaluate the likelihood of soil and/or groundwater contamination present on or in the immediate vicinity of the proposed I-71 Corridor LRT alignment.

4.2.1 METHODOLOGY

4.2.1.1 Site Identification

No single comprehensive source of information is available that identifies known or potential sources of environmental contamination along the proposed I-71 Corridor LRT alignment. Therefore, to identify and evaluate sites containing hazardous materials, petroleum products, or other sources of potential contamination in these areas, a government database computer search was conducted by VISTA Information Solutions, Inc. (VISTA). This screening tool maps the location of sites with known or potential environmental liabilities based on information contained in various federal and state government databases. The following databases and their respective search radii were included in the VISTA search:

- National Priority List – 1-mile
- Resource Conservation and Recovery Act (RCRA) Corrective Actions (CORRACTS) – 1-mile
- Treatment, Storage, and Disposal (TSD) CORRACTS – 1-mile
- RCRA permitted TSD facilities – ½-mile
- Comprehensive Environmental Response, Compensation and Liability Information System – No Further Remedial Action Planned (CERCLIS-NFRAP) – ½-mile
- State equivalent CERCLIS List (SCL) – ½-mile
- Leaking Underground Storage Tanks (LUST) – ½-mile
- Solid waste landfills, incinerators, or transfer stations (SWLF) – ½-mile
- Registered underground storage tanks (UST) – ¼-mile
- RCRA registered large quantity generators of hazardous waste (LQG) – ⅛-mile
- RCRA registered small quantity generators of hazardous waste (SQG) – ⅛-mile
- Emergency Response Notification System of spills (ERNS) – ⅛-mile
- State spills list – ⅛-mile
- RCRA Notifiers list – ⅛-mile

The VISTA database also listed 449 unmapped sites in the search. Unmapped sites are sites that may or may not be located within the search area, which there is insufficient address information for VISTA to accurately map them. A more detailed search of the 449 unmapped sites found in the VISTA search eliminated 29 of the unmapped sites, as the information provided by VISTA or their proximity relative to the proposed LRT alignment suggests that they did not pose a material risk. The remaining unmapped sites did not provide suffcient address information to accurately locate them.

A summary of the VISTA search is included in Appendix 4-I. The USTs and ASTs identified in Appendix 4-I can provide pertinent information to aid in fulfilling requirements of the NFPA 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems. The NFPA 130 Standard requires review of USTs and ASTs from the perspective of the life safety requirements of public transit. NFPA provides standards for fire protection, emergency ventilation systems, emergency lighting systems and means of egress. The NFPA standard requires review of the location of LRT subsurface facilities relative to USTs, service stations and storage tanks in or under buildings. Although the NFPA requirements were not addressed during this study, they will be specifically addressed in the preliminary engineering phase of the I-71 Corridor LRT project.

4.2.1.2 Impact Assessment Methodology

Each of the sites identified in the search was assigned a degree of priority for potential soil and/or groundwater contamination impact: NO, LOW, MEDIUM, or HIGH. These ratings are generally based on criteria listed below. Only sites identified as topographically upgradient of the proposed LRT Alignment were considered a potential impact and subsequently rated. Due to the lack of shallow groundwater flow direction was suspected to mirror topography for the purpose of this evaluation. Precise groundwater flow direction cannot be determined without installing a network of groundwater monitoring wells.

- NO – After a review of all available information, there is no indication that environmental issues would be a concern to the proposed LRT alignment. It is possible potential contaminants could have been generated or handled on the proposed alignment; however, all information indicates a priority should be minimal.
- LOW – The former or current operation is identified as a large quantity hazardous waste generator, or a release and remediation of hazardous materials or petroleum products has been reported. However, currently based on reported information, there are little indications of contamination on the property.
- MEDIUM – After a review of available information, indications identifying known soil and/or groundwater contamination. Information may indicate that the problem does not require remediation, is being remediated, or that continued monitoring is required. The ranking is established for each site within this category with regard to its acceptability for use within the proposed LRT Alignment, what action might be required if the site is acquired, and the possible alternative if there is need to avoid this parcel.
- HIGH – After a review of available information indications were found that identify a high probability of contamination associated with the site. Further assessment will be required after alignment selection to determine the presence and/or levels of contamination, the source of contamination, and the need for mitigation. Actual physical assessment is not expected to begin until the final alignment is defined. Sites that are identified as known High priority active sites or LUST sites, and have not been evaluated or assessed would receive a High priority ranking.

4.2.2 IMPACTS

A total of 258 sites are reported as having the potential for hazardous material contamination that could impact the proposed LRT alignment. These sites primarily include hazardous materials, petroleum products, or a combination of the two. Of these sites, 19 have been ranked as having a “HIGH” potential for contamination, 6 ranked “MEDIUM” and 161 ranked “LOW”. A summary of the environmental sites and their rankings is presented in Appendix 4-1. The total number of sites that have a potential to impact the proposed I-71 Corridor LRT alignment are summarized in Table 4.2.1. Each of the High and Medium ranked sites are discussed in the following paragraphs and illustrated on Figures 4.2-1.

Table 4.2.1: Hazardous Material Contamination Sites

	Ranking Totals		
Alternative and Design Options	**High**	**Med**	**Low**
Covington Segment	0	0	11
Ohio River Crossing Segment	0	0	3
Cincinnati Riverfront Segment	1	0	7
Downtown Cincinnati Segment	0	0	18
Over-the-Rhine Segment	0	1	10
Mount Auburn Tunnel Segment	0	1	7
University of Cincinnati Segment			
• Option A Alternative	5	2	20
• Option B Alternative	4	2	14
Avondale to Norwood Segment	5	2	42
Norwood to Blue Ash Segment	5	0	24
Blue Ash Segment	1	0	17
Total[1]	**19**	**6**	**161**

Source: URS, 2001

[1]Several of the sites within the University of Cincinnati Segment may be considered hydraulically upgradient from one or both of the alignment options but the totals represent the individual number of ranked sites.

4.2.2.1 Summary of Impacts by Segment

Covington Segment

Twenty-one sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Covington Segment. The hazardous sites identified were listed in one or more of the following databases: UST, ERNS, RCRA Notifiers, and RCRA SQG. Ten sites were ranked as No priority, and eleven sites were ranked as Low priority. No sites were ranked Medium or High priority

Ohio River Crossing Segment

Four sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Ohio River Crossing Segment. The hazardous sites identified were listed in one or more of the following databases: ERNS, LUST, RCRA Notifiers, UST, and Ohio spills. One site was ranked as No priority, and three sites were ranked as Low priority. No sites were ranked Medium or High priority.

Cincinnati Riverfront Segment

Nine sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Cincinnati Riverfront Segment. The hazardous sites identified were listed in one or more of the following databases: LUST, RCRA Notifiers, UST, ERNS, and Ohio spills. One site was ranked as No priority, seven sites were ranked as Low priority, and one site was ranked as High priority. No sites were ranked as Medium priority. A summary of environmental activity and status of the High priority sites is provided in the following paragraphs.

Former Crosset Co., Inc. (currently Third and Central parking lot), 205 Central Avenue is located adjacent to the proposed I-71 Corridor LRT alignment. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, the release and the source of the release have been identified, but the extent of contamination has not been determined. According to Bonnie Phillips, City of Cincinnati, the City of Cincinnati removed the LUST and submitted the closure report to Bureau of Underground Storage Tank Regulations (BUSTER). Groundwater samples were not collected and soil contamination was not above state limits. Based on the lack of information and the proximity of this site to the proposed alignment, it was ranked High priority.

Downtown Cincinnati Segment

Twenty-seven sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Downtown Cincinnati Segment. The hazardous sites identified were listed in one or more of the following databases: RCRA SQG, LUST, RCRA Notifiers, ERNS, CERCLIS-NFRAP, SCL, and Ohio spills. Nine sites were ranked as No priority and eighteen sites were ranked as Low priority. No sites were ranked Medium or High priority.

Over-the-Rhine Segment

Fourteen sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Over-the-Rhine segment. The hazardous sites identified were listed in one or more of the following databases: SCL, CERCLIS-NFRAP, LUST, RCRA Notifiers, RCRA SQG, and Ohio spills. Three sites were ranked as No priority, ten sites were ranked as Low priority, and one site was ranked as Medium priority. No sites were ranked as High priority. A summary of environmental activity and status of the Medium priority site is provided in the following paragraph.

Greyhound Lines, 1005 Gilbert Street, is located 0.35-mile southeast of the proposed I-71 Corridor LRT alignment. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the active status of this LUST site, and the proximity of the site to the proposed alignment it was ranked Medium priority.

Mount Auburn Tunnel Segment

Ten sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Mount Auburn Tunnel Segment. The hazardous sites identified were listed in one or more of the following databases: LUST, RCRA SQG, UST, ERNS, CERCLIS-NFRAP, SCL, and Ohio spills. Two sites were ranked as No priority, seven sites were ranked as Low priority, and one site was ranked as Medium priority. No sites were ranked as High priority. A summary of environmental activity and status of the High priority site is provided in the following paragraph.

Vacant Lot, 721 Reading Road, is located 0.40-mile southeast of the proposed corridor. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the status and proximity of the site to the proposed alignment it was ranked Medium priority.

University of Cincinnati Segment

Forty-six sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the University of Cincinnati Segment. The hazardous sites identified were listed in the LUST, UST, RCRA-CORRACTS, RCRA SQG and LQG, CERCLIS-NFRAP, ERNS, RCRA Notifiers, and Ohio spills. Fifteen sites were ranked as No priority, twenty-two sites were ranked as Low priority, two sites were ranked as Medium priority, and seven sites were ranked as High priority. Three of the High priority sites are topographically upgradient from Alternatives three and four which include the Cincinnati Zoo, but are topographically downgradient from Alternatives 1 and 2 which do not include the Cincinnati Zoo. These sites are considered High priority for Alternatives 3 and 4 and No priority for Alternatives 1 and 2. A summary of environmental activity and status of the Medium and High priority sites is provided in the following paragraphs.

Apartment Building, 2610 Jefferson Avenue, is located adjacent to the proposed corridor. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, suspected soil and groundwater contamination are present at the site. Subsurface investigations have not been conducted. Based on the proximity of the site to the proposed LRT alignment and active status of this LUST, the site was ranked High priority.

Former Bethesda Hospital, Reading Road and June Road, is located 0.5-mile southeast of the proposed I-71 Corridor LRT alignment. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, suspected soil and groundwater contamination are present at the site. Subsurface investigations have not been conducted. Based on the active status and distance from the proposed LRT alignment, the site was ranked Medium priority.

Department of Veterans Affairs, 3200 Vine Street, is located adjacent to the proposed Alternatives 3 and 4, and topographically downgradient of the proposed Alternatives 1 and 2. This site was identified as an active LUST site, and was identified on the UST database. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed LRT alignment, active status, and topographic gradient of this LUST, the site was ranked High priority for Alternatives 3 and 4, and No priority for Alternatives 1 and 2.

US EPA Research Center, 26 W. Martin Luther King, Jr. (MLK) Drive, is located adjacent to the proposed I-71 Corridor LRT alignment. This site was listed on the ERNS, UST, CERCLIS-NFRAP, RCRA SQG, and RCRA CORRACTS databases. According to Ms. Pam Allen of the Ohio EPA, no information is available regarding this site. Based on the proximity to the proposed LRT alignment and lack of information regarding this facility, the site was ranked Medium priority.

Hamilton County Coroner's Office, 3159 Eden Drive, is located 0.15-mile southeast of the proposed Alternatives 3 and 4, and topographically downgradient of the proposed Alternatives 1 and 2. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed LRT alignment, active status, and topographic gradient of this LUST, the site was ranked High priority for Alternatives 3 and 4, and No priority for Alternatives 1 and 2.

University of Cincinnati Hospital, 234 Goodman Street, is located 0.09-mile southeast of the proposed Alternatives 3 and 4, and topographically downgradient of the proposed Alternatives 1 and 2. This site was identified as an active LUST site, and was also identified on the UST and RCRA SQG databases. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination are suspected at the site. Subsurface investigations have not been conducted. Based on the proximity to the proposed LRT alignment, active status, and topographic gradient of this LUST, the site was ranked High priority for Alternatives 3 and 4, and No priority for Alternatives 1 and 2.

Formerly Ashland Oil (currently Marathan Station), 3041 Reading Road, is located 0.02-mile south of the proposed I-71 Corridor LRT alignment. This site was identified twice as a LUST site, and was also identified on the UST database. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed LRT alignment and active status of this LUST, the site was ranked High priority.

University of Cincinnati Parking Lot, 3010 Stanton Avenue, is located 0.25-mile southeast of the proposed LRT alignment. The October 5, 2001 field investigation, conducted by URS, determined the University of Cincinnati does not currently own a parking lot at this address. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity and active status of the LUST, the site was ranked High priority.

Shell Oil Company, 2936 Gilbert Avenue, is located 0.5-mile southeast of the proposed I-71 Corridor LRT alignment. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed alignment and the active status of this LUST, the site was ranked High priority.

Avondale to Norwood Segment

Fifty-eight sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Avondale to Norwood Segment. The hazardous sites identified were listed in one or more of the following databases: SCL, CERCLIS-NFRAP, LUST, UST, ERNS, RCRA CORRACTS RCRA Notifiers, RCRA SQG and LQG, and Ohio spills. Nine sites were ranked as No priority, forty-two sites were ranked as Low priority, two sites were ranked as Medium priority, and five sites were ranked as High priority. A summary of environmental activity and status of the Medium and High priority sites is provided in the following paragraphs.

Cincinnati Neighborhood Housing, 3350 Montgomery Road, is located 0.5-mile southeast of the proposed I-71 Corridor LRT alignment. URS conducted a field investigation on October 5, 2001 and concluded United Jewish Cemetery of Cincinnati is the current occupant of 3350 Montgomery Road. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination are suspected at the site. Subsurface investigations have not been conducted. Based on the proximity to the proposed alignment and active status of this LUST, the site was ranked Medium priority.

Ferguson Car Wash, 3858 Montgomery Road, is located 0.1-mile southeast of the proposed I-71 Corridor LRT alignment. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed alignment and active status of this LUST, the site was ranked High priority.

Former BASF Facility, 1720-1754 Dana Avenue, is located adjacent to the proposed I-71 Corridor LRT alignment. This facility was listed on the ERNS, RCRA-CORRACTS, RCRA SQG, CERCLIS-NFRAP, SCL, and LUST databases. It is reported that operations at the former BASF facility ceased following a major explosion and fire in July of 1990. The remaining buildings were dismantled and demolished. Elevated concentrations of organic constituents were detected in the upper few feet of soil across the site. In addition, groundwater samples collected from several of the monitoring wells revealed organic constituents above established drinking water criteria. Contamination was detected in a perched and discontinuous groundwater system beneath the site. Soils at the site were remediated. Groundwater remediation did not occur as the affected groundwater across the site is discontinuous and does not represent a viable water source and potable water is supplied by the municipality. However, groundwater contamination has migrated off site to the north, toward the Norwood Trough. The Ohio EPA recommended that no further remedial action be taken at the former BASF facility, and BASF has received a NFRAP status. Based on the residual contaminants in the groundwater on site and off the site, the site was ranked High priority. It is anticipated the Xavier/Evansten station (near Dana Avenue) will be located on portions of this site.

Salvation Army, 2250 Park Avenue, is located adjacent to the proposed I-71 Corridor LRT alignment. This site was identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed alignment and active status of this LUST, the site was ranked High priority.

Kleiman Auto Body, 2506 Norwood Avenue, is located adjacent to the proposed I-71 Corridor LRT alignment. This site was identified as an active LUST site, and also as RCRA SQG. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination are suspected at the site. Subsurface investigations have not been conducted. Based on the proximity to the proposed alignment and active status of this LUST, the site was ranked High priority.

General Polymers Corporation, 3925 Huston Avenue, is located 0.10-mile northwest of the proposed I-71 Corridor LRT alignment. This site was not identified during the October 5, 2001 field investigation conducted by URS. It is suspected it was replaced by Norwood Plaza. This site is identified in the RCRA CORRACTS and RCRA Notifiers databases. According to Ms. Pam Allen of the Ohio EPA, no information was available or on file for the site. The current status and degree of environmental impact of the facility are unknown. Due to proximity to the proposed LRT alignment and lack of information regarding this site, the site was ranked Medium priority.

SuperAmerica #9576, 4425 Montgomery Road, is located 0.35-mile northwest of the proposed corridor. This site is identified as an active LUST site, and is also listed in the UST database. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed alignment and active and status of this LUST, the site was ranked High priority.

Norwood to Blue Ash Segment

Thirty-three sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Norwood to Blue Ash segment. The hazardous sites identified were listed in one or more of the following databases: LUST, UST, ERNS, CERCLIS-NFRAP, RCRA CORRACTS, RCRA Notifiers, RCRA SQG and LQG, and Ohio spills. Four sites were ranked as No priority, twenty-four sites were ranked Low priority, and five sites were ranked as High priority. No sites were ranked as Medium priority. A summary of environmental activity and status of the High priority sites is provided in the following paragraphs.

Former Gulf Oil (currently Meiers Wine Cellars), 7001 Plainfield Road, is located adjacent to the proposed I-71 Corridor LRT alignment. This site is identified as an active LUST site, and is also listed on the UST database. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed alignment and active and status of this LUST, the site was ranked High priority.

FormerBP #09321(currently a convenience store), 7123-7125 Montgomery Road, is located adjacent to the proposed I-71 Corridor LRT alignment. This site is identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA Agency, soil and groundwater contamination remain at the site. Based on the proximity to the proposed alignment and active and status of this LUST, the site was ranked High priority.

Zigler's Auto Service, 8590 Blue Ash Road, is located 0.05-mile east of the proposed I-71 Corridor LRT alignment. This site is identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination are suspected at the site. Subsurface investigations have not been conducted. Based on the proximity to the proposed alignment and active and status of this LUST, the site was ranked High priority.

Former Marathon Station (currently Jay's Instant Recovery), 6805 Montgomery Road, is located 0.25-mile northwest of the proposed I-71 Corridor LRT alignment. This site is identified as an active LUST site, and is also listed on the UST database. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed alignment and active and status of this LUST, the site was ranked High priority.

Car-X Muffler Break Shop, 6725 Montgomery Road, is located 0.35-mile northwest of the proposed I-71 Corridor LRT alignment. This site is identified as an active LUST site. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination are suspected at the site. Subsurface investigations have not yet been conducted. Based on the proximity to the proposed alignment and active and status of this LUST, the site was ranked High priority.

Blue Ash Segment

Thirty-six sites were identified topographically upgradient of the proposed I-71 Corridor LRT alignment in the Blue Ash Segment. The hazardous sites identified were listed in one or more of the following databases: LUST, UST, ERNS, SCL, RCRA-CORRACTS, CERCLIS-NFRAP, RCRA Notifiers, RCRA SQG and LQG, and Ohio spills. Eighteen sites were ranked as No priority, seventeen sites were ranked as Low priority, and one site was ranked as High priority. No sites were identified as Medium priority. A summary of environmental activity and status of the High priority site is provided in the following paragraph.

Former Blue Ash Shell, 10415 Kenwood Road, is located 0.15-mile east of the proposed I-71 Corridor LRT alignment. During the October 2, 2001 field investigation it was discovered that the former Blue Ash Shell has been replaced with a now Shell station and the address redesignated to 47685 Glendale-Milford Road (which is the cross street to Kenwood Road site). This site is identified as an active LUST site, and is also listed on the UST database. According to Mr. Jason Anthony of the Ohio EPA, soil and groundwater contamination remain at the site. Based on the proximity to the proposed alignment and active status of this LUST, the site was ranked High priority.

4.2.2 ENVIRONMENTAL IMPACTS

The following paragraphs describe the environmental impacts by alternative.

4.2.2.1 No-Build Alternative

Under the No-Build Alternative four proposed roadway projects would be constructed. They include the addition of two lanes on I-71 between Interstate-275 (I-275) and State Route 48 (one lane in each direction); the reconstruction/realignment of Fort Washington Way, the addition of one southbound lane on I-71/75 between Dixie Highway and Kyles Lane; and the addition of one eastbound lane on Montgomery Road between Kenwood Road and I-71 and one travel lane in each direction from I-71 to Hosbrook Road.

Three of the four proposed roadway projects are outside the search radii of the VISTA database search. Therefore, without expanding the database search radius, it is unknown if any environmentally contaminated sites have the potential to be impacted by these three proposed projects. The reconstruction/realignment of Fort Washington Way falls within the search radii of the VISTA databases search and former Crosset Co., Inc., located within the Cincinnati Riverfront Segment (see Section 4.2.2.1), may potentially be impacted.

4.2.2.2 TSM Alternative

Under the Transportation System Management (TSM) Alternative four proposed transit centers would be constructed. They include the Peebles Corner Transit Center, on the corner of Gilbert Avenue and McMillian Street; the Kenwood Transit Center, in the vicinity of Kenwood Road and I-71; the Fields Ertel Transit Center, on Fields Ertel Road and I-71; and the Reading Transit Center, located at the intersection of US 42 and Galbraith Road.

Each of the four proposed roadway projects are outside the search radii of the VISTA database search. Therefore, without expanding the database search radius, it is unknown if any environmentally contaminated sites have the potential to be impacted by these proposed projects.

4.2.2.3 Build (LRT) Alternatives

Alternatives one through four have the potential to impact the High and Medium ranked sources of potential environmental contamination mentioned in Section 4.2.1

Several of these High and Medium ranked sites may only have the potential to be impacted by alternatives three and four. They are located in the University of Cincinnati Segment and include the Department of Veterans Affairs, Hamilton County Coroner's Office, and the University of Cincinnati Hospital.

4.2.3 MITIGATION MEASURES

Following the selection of a preferred alternative, sampling and testing can be conducted on the proposed alignment in the areas of the Medium and High priority sites to determine the potential for contamination and the mitigation costs associated with it. Additional potential sources of environmental contamination may be located along the corridor that were not identified in the VISTA database search and therefore not included in this analysis. If encountered during subsequent engineering and construction phases they will be addressed at that time.

Any industrial facility that needs to be closed following the selection of a preferred alternative may fall under the Cessation of Regulated Operations Program. This program is regulated by the Ohio EPA and is designed to prevent environmental contamination that may result from closing industrial facilities (see www.epa.state.oh.us/dhwm/cepps.html).

4.3 AIR QUALITY

This chapter documents the potential air quality impacts associated with the No-Build, TSM, and Build Alternatives for this I-71 Corridor LRT project. The purpose of the analysis is to estimate the future air quality conditions in the study area with and without the alternatives, to identify potential air quality impacts and mitigations, and to address conformity with state and regional air quality implementation plans.

4.3.1 EXISTING ENVIRONMENT

The description of the existing environment for the air quality analysis includes an overview of the airborne pollutants of interest, the regulatory setting, and the regional air quality trends.

4.3.1.1 Airborne Pollutants

Ambient air quality is a function of many factors, including climate, topography, meteorological conditions and the production of airborne pollutants by natural or artificial sources. Major airborne pollutants of interest in the study area include carbon monoxide, particulate matter, and ozone.

- *Carbon Monoxide* – Carbon monoxide (CO) is an odorless, colorless gas formed by the burning of fuels containing carbon. Motor vehicles are the principal source of CO emissions in urban areas. Maximum concentrations usually occur near intersections and other areas of traffic congestion, and they decrease rapidly with distance from the source.

- *Particulate Matter* – Particulate matter enters the air from industrial operations, vehicular traffic and other sources, including fireplaces. Most of the particulate matter generated by motor vehicles consists of resuspended road dust. Measurements of particulate matter concentrations include TSP (total suspended particulates), PM_{10} (particles with a diameter less than or equal to 10 micrometers), and $PM_{2.5}$ (particles with a diameter less than or equal to 2.5 micrometers).

- *Ozone* – Ozone (O_3) in the lower atmosphere is a harmful air pollutant and contributes to the formation of smog. It is a secondary pollutant formed by the reaction of volatile organic compounds and oxides of nitrogen in the presence of strong sunlight. Thus, ozone levels are reduced by minimizing emissions of those precursor pollutants.

- *Volatile Organic Compounds* – Volatile organic compounds (VOC) are a key component in the formation of ozone. These hydrocarbons are emitted or evaporate into the atmosphere from a variety of sources, particularly the storage and combustion of fuels in motor vehicles.

- *Oxides of Nitrogen* – Oxides of nitrogen (NO_X) are another precursor to the formation of ozone. They are produced as the result of high-temperature fuel combustion and subsequent atmospheric reactions. Major sources of NO_X include diesel engines, power plants, refineries and other industrial operations.

4.3.1.2 Regulatory Setting

National and state ambient air quality standards identify pollutant concentrations that are not to be exceeded over specified time periods. Table 4.3-1 shows the National Ambient Air Quality Standards (NAAQS) for the major airborne pollutants of interest. Primary ambient air quality standards are defined for the protection and preservation of public health. In some cases, more stringent secondary standards have been established to protect the public welfare from the adverse effects of air pollutants. Compliance is required for both primary and secondary standards.

Table 4.3.1: National Ambient Air Quality Standards

Pollutant	Primary Standard		Secondary Standard	
	$\mu g/m^3$ [f]	Ppm [f]	$\mu g/m^3$	Ppm
Carbon Monoxide			same as primary	
8-hour concentration	10,000 [a]	9 [a]		
1-hour concentration	40,000 [a]	35 [a]		
Sulfur Dioxide				
annual arithmetic mean	80	0.03		
24-hour concentration	365 [a]	0.14 [a]		
3-hour concentration			1,300 [a]	0.50 [a]
Nitrogen Dioxide			same as primary	
annual arithmetic mean	100	0.053		
Ozone			same as primary	
8-hour concentration	157	0.08 [b]		
1-hour concentration	235 [c]	0.12 [c]		
Lead			same as primary	
quarterly arithmetic mean	1.5			
Particulate Matter			same as primary	
PM_{10}				
annual arithmetic mean	50 [d]			
24-hour concentration	150 [e]			
$PM_{2.5}$				
annual arithmetic mean	15 [d]			
24-hour concentration	65 [e]			

Source: 2000 Air Quality Report, Hamilton County Department of Environmental Services, 2000 Ambient Air Quality Report, Natural Resources & Environmental Protection Cabinet, Kentucky Department for Environmental Protection

Notes:

[a] Not to be exceeded more than once per year.

[b] Three-year average of the fourth highest 8-hour concentration may not exceed 0.08 ppm.

[c] Areas not attaining the 1-hour standard by the end of 1997 must attain that standard before demonstrating attainment with the 8-hour standard.

[d] Based on a 3-year average of annual averages.

[e] Based on a 3-year average of annual 98th percentile values.

[f] $\mu g/m^3$ refers to micro-grams per cubic meter; Ppm is parts per million.

The Hamilton County Department of Environmental Services and the Kentucky Department for Environmental Protection enforce ambient air quality standards that are identical to the NAAQS.

Under federal regulations, areas that violate primary ambient air quality standards are designated as nonattainment areas. A State Implementation Plan (SIP) must be developed to bring these areas into attainment. The Federal Clean Air Act Amendments of 1990 require that regionally significant transportation plans, programs and projects in nonattainment areas conform with the appropriate SIP. SIP conformity involves eliminating or reducing the severity and number of violations of the NAAQS and achieving attainment of those standards.

4.3.1.3 Air Quality Trends

The I-71 Corridor runs between Kenton County, Kentucky and Hamilton County, Ohio. According to the *2000 Air Quality Data Report*, Hamilton County Department of Environmental Services, and the *2000 Kentucky Ambient Air Quality Annual Report,* Kentucky Department for Environmental Protection, the study area is in compliance with the National Ambient Air Quality Standards for all pollutants.

4.3.2 ENVIRONMENTAL IMPACTS

The purpose of this section is to identify and compare the potential air quality impacts of the alternatives considered for the I-71 Corridor LRT project. Automobiles and other motor vehicles represent a major source of air pollution in the region. Minimizing the growth in travel by single-occupant automobiles will be an important factor in achieving the regional air quality goals. The proposed project would provide a critical link in the regional network of high capacity transit services, increasing the opportunities for non-automotive travel. As a result, the Build Alternative is expected to have positive regional air quality impacts.

4.3.2.1 Regional Air Quality

Methodology

For the purposes of this analysis, air quality impacts are defined as the incremental change in Year 2020 regional emissions of CO, VOC, and NO_X under the Build Alternatives relative to the No-Build Alternative. Further, the relative differences in regional pollutant levels among the alternatives are attributed entirely to changes in daily vehicular emissions. Differences in vehicular emissions are a direct function of the change in daily vehicle-miles traveled (VMT) and pollutant emission rates.

Specific steps in the air quality analysis include the following:

- Identify the impact of the project alternatives on the Year 2020 regional VMT.
- Estimate Year 2020 average pollutant emission rates for CO, VOC and NO_X.
- Determine the relative regional pollutant emissions for each alternative by applying the emission rates to the corresponding changes in regional VMT.
- Compare the relative pollutant emissions to identify potential regional air quality impacts.

Analysis

The net reductions in regional VMT for the TSM and Build Alternatives were derived from ridership forecasts based on the Ohio-Kentucky-Indiana Regional Council of Governments (OKI) Travel Demand Model. Model runs were based on Year 2020 socioeconomic forecasts that reflect the most recent projections, disaggregated to the model traffic analysis zone level.

Comparing the highway network assignments of the project alternatives provided an estimate of the reduction in regional VMT due to mode shift. The initial VMT reduction estimates then were adjusted to account for the portion of vehicular travel that would be redirected to park-and-ride locations. The resulting net VMT reductions were used as the basis of the regional air quality analysis.

Year 2020 emission rates for CO, VOC and NO_X were estimated using the U.S. Environmental Protection Agency (U.S. EPA) MOBILE5a_H model with selected parameters adjusted to reflect assumed conditions in the corridor.

Table 4.3.2 summarizes the results of the Year 2020 regional air quality analysis for the No-Build, TSM and Build Alternatives. It shows the net reduction in regional VMT for the TSM and Build Alternatives relative to the No-Build Alternative, along with the estimated pollutant emission factors and the corresponding differences in regional emissions.

Table 4.3.2: Year 2020 Regional Air Quality Impact Analysis and Results Relative to the No-Build Alternative

Project Alternative	*Annual VMT Reduction (veh-mi)*	*Carbon Monoxide (CO)*		*Hydrocarbons (NOx)*		*Volatile Organic Compounds (VOC)*	
		Emission Factor (g/veh-mi)	*Emission Reduction (tons/year)*	*Emission Factor (g/veh-mi)*	*Emission Reduction (tons/year)*	*Emission Factor (g/veh-mi)*	*Emission Reduction (tons/year)*
No-Build	***0.00***	***2.24***	***0.00***	***0.49***	***0.00***	***0.76***	***0.00***
TSM	***-1,717,025***	***2.24***	***-4.231***	***0.49***	***-0.925***	***0.76***	***-1.435***
LRT Build	***12,620,322***	***2.24***	***31.099***	***0.49***	***6.803***	***0.76***	***10.552***

Source: URS. November 2001

As the results in Table 4.3.2 indicate, the Build Alternatives are expected to reduce the amount of regional vehicular travel relative to the No-Build Alternative. A net reduction in VMT would result in lower emissions of CO and the ozone precursors (VOC and NO_X). The TSM Alternative, however, is expected to increase regional travel relative to the No-Build Alternative. Based upon this analysis, the TSM Alternative would result in an adverse effect, relative to the No Build Alternative and the Build Alternatives would result in a positive effect on the regional air quality. Furthermore, by providing an alternative to single-occupant vehicle travel, implementation of the Build Alternatives would support the maintenance of air quality standards in the region.

4.3.2.2 Microscale Air Quality

Vehicular traffic is the most significant source of CO emissions in the region. Because CO emissions dissipate rapidly with increasing distance from the source, the highest concentrations are likely to occur in the vicinity of congested roadway intersections or other locations where motor vehicles tend to idle for a period of time. The local intersection air quality analysis consists of a microscale “hot spot” investigation for potential violations of the ambient air quality standards for CO.

Methodology

The methodology for identifying potential local air quality impacts follows the USEPA-recommended procedure for CO microscale impact analysis. The general evaluation procedure, outlined in the *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (EPA, 1992), includes a multiple intersection screening process, followed by microscale CO analysis with the CAL3QHC line-source dispersion model. The multiple intersection screening analysis is used to identify the locations requiring further analysis for CO hot spots. The intersection screening process includes the following steps:

Identify and rank the top 11 signalized intersections in the study area by peak hour traffic volumes. Determine the average delay and level-of-service for those 12 intersections.

From those 11 intersections, select the three highest volume locations and the three highest delay locations for further analysis. The total may be less than six if one or more study area intersections meet both selection criteria. The selected intersections then are evaluated for each alternative using a microscale analysis procedure. The procedure is used to estimate maximum 1-hour and 8-hour CO concentrations in the vicinity of each intersection for comparison with the NAAQS. It is assumed that if microscale analysis does not identify significant local air quality impacts at the selected intersections, then impacts would be unlikely at any other study area location.

The microscale air quality analysis procedure includes the following steps:

1. Assemble the required data for the analysis, including meteorological conditions, site characteristics, traffic parameters and emission variables.
2. Estimate the future background CO concentration based on monitoring data and the expected change in regional emissions.
3. Identify receptor locations near the intersection for simulation of future ambient CO concentrations.
4. Compute the worst-case 1-hour CO concentration using CAL3QHC.
5. Estimate the worst case 8-hour CO concentration by applying a suitable persistence factor to the computed 1-hour concentration. The use of a persistence factor is intended to reflect the relationship between 1-hour and 8-hour traffic and meteorological conditions.
6. Compare the results with the ambient air quality standards to identify adverse impacts, including new or aggravated violations.

Analysis

Using peak hour traffic analysis results for the I-71 Transportation study area, the top 11 intersections were identified, ranked and screened. These intersections are listed in Table 4.3-3.

Table 4.3.3: Intersection Screening Results

Project Study Area Top 11 Intersections by Volume	Year 2020 PM Peak Hour Traffic	
	Volume [a]	Delay [b]
Reed Hartman Hwy. / Cornell Road	7,838	1,270
Reed Hartman Hwy. / Pfeiffer Road	7,800	1,101
Kenwood Road / Cooper Road	6,586	2,372
Pfeiffer Road / Kenwood Road	5,662	559
Ridge Avenue /Highland Avenue	5,304	873
Reed Hartman Hwy. / Creek Road	5,043	119
Reed Hartman Hwy. / West Lake Forest Drive.	4,864	870
MLK Drive / Reading Road	4,794	28
Reed Hartman Hwy. / Cornell Park Road	4,485	109
MLK Drive / Harvey Avenue	3,914	Less the 20
Walnut Street / Third Street	3,700	Less the 20

Source: URS, November 2001

Notes:

[a] Combined intersection approach volume, in vehicles per hour.

[b] Average delay in seconds per vehicle.

The screening resulted in a total of three intersections being selected for further analysis based on traffic volume and delay. Those intersections included the following:

- Reed Hartman Highway/Cornell Road
- Reed Hartman Highway/Pfeiffer Road
- Kenwood Road/Cooper Road

The microscale modeling process requires a number of parameters and assumptions. The model inputs listed below are consistent with current EPA recommendations, and are intended to represent reasonable worst case scenarios at the three selected intersections.

- Meteorological Characteristics
  - Averaging Time: 60 minutes
  - Surface Roughness: 108 cm
  - Settling Velocity: 0 cm/sec
  - Deposition Velocity: 0 cm/sec
  - Wind Speed: 1.0 m/sec
  - Stability Class: D
  - Mixing Height: 1,000 meters
- Traffic Characteristics
  - Lane configuration, link volume, signal cycle length, red time and lost time were taken from the traffic impact assessment for the I-71 Transportation Study corridor.
- Site Characteristics
  - Intersection layouts and roadway link coordinates were determined from maps and aerial photographs of the study area.
- Emission Characteristics
  - Running emission rates were generated with MOBILE5a_H using default parameters. The average free flow speed was assumed to be 35 mph on all roadway links, and the minimum and maximum temperatures were assumed to be 65° F and 95° F.
  - Idle emission rates were calculated by converting the 3.0 mph MOBILE5a_H running rate from grams per mile to grams per hour.
  - The EPA-recommended default persistence factor for urban areas of 0.7 was used to estimate 8-hour CO concentrations.

According to the 2000 Air Quality Data Report, produced by Hamilton County Department of Environmental Services, two sites in downtown Cincinnati were monitored in the year 2000 to determine a 1-hour average for carbon monoxide. The two sites resulted in 1-hour averages of 4.6 ppm and 5.7 ppm. For the purpose of the analysis, the more conservative estimate of 5.7 ppm was used. The Year 2000 background CO level then was modified to approximate conditions in Year 2020 using the following adjustment factors:

- **Change in Average CO Emission Rates** – Average CO emission rates in the region are expected to decrease because of emission controls and turnover in the vehicle fleet. The change in average CO emission rates will tend to decrease background CO concentrations. Average CO emission rates for Year 2000 and Year 2020 were generated using MOBILE5a_H, with an average speed of 35 mph. The ratio of the Year 2020 rate to the Year 2000 rate was used to adjust the background CO level.

- **Change in Regional VMT** – As travel in the region increases, it will tend to increase background CO levels. Based upon input from OKI, an annual VMT growth rate of 2.0 % was assumed. This value is a conservatively high estimate of VMT growth in the region. To approximate the change in regional VMT between Year 2000 and Year 2020, the annual growth rate was compounded for a 20-year period. The resulting value was used to adjust the background CO level.

The computation of the Year 2020 background CO level is summarized in Table 4.3.4. As shown in the table, the adjustment factors described above were applied only to the mobile source component of the background CO concentrations (estimated to be 80% of the total). The non-mobile source component of the background CO concentration was assumed to remain constant. Based upon this analysis, the estimated Year 2020 background CO level is 2.5 ppm (1-hour average). The 8-hour average, defined as 0.7 (1-hour average) is 2.0 ppm.

Receptors at each intersection were defined where the public is likely to have access and potential long-term exposure to the ambient CO concentrations.

Table 4.3.4: Year 2020 Background CO Level Computations

Background CO Level for 2000 (1-Hour Average) Monitored in downtown Cincinnati	5.7 ppm
MOBILE5a Emission Factor for 2000	6.72 g/veh-mi
MOBILE5a Emission Factor for 2020 (35 mph)	2.24 g/veh-mi
Adjustment for Emission Reduction (2000 to 2020)	0.33
Adjustment for VMT Growth at 2.0% per year (2000 to 2020)	1.48
Estimated CO Level for 2020 (1-Hour Average)	
Total Estimated Background CO Level (1-Hour Average)	2.8 ppm
Total Estimated Background CO Level (8-Hour Average)	2.0 ppm

Source: URS, November 2001

After all the necessary parameters and assumptions had been defined for the selected intersections, the CAL3QHC model was run for each project alternative. The results of the CO microscale modeling are summarized in Table 4.3.5. For each location, the table shows the highest predicted 1-hour and 8-hour CO concentrations under the existing year 2000 condition and for each of the project alternatives. The No-Build and Build Alternatives are identical due to minimal changes in traffic volume and operation.

Table 4.3.5: Year 2020 Maximum Predicted CO Computations

Intersection	Averaging Period	Maximum Concentration (ppm) [a, b]		
		Existing (2000)	No-Build (2020)	LRT Build (2020)
Reed Hartman Hwy./ Cornell Road	1-hour	5.0	4.5	4.5
	8-hour	3.5	3.2	3.2
Reed Hartman Hwy./ Pfeiffer Road	1-hour	6.3	4.7	4.7
	8-hour	4.5	3.3	3.3
Kenwood Road / Cooper Road	1-hour	5.6	3.9	3.9
	8-hour	4.0	2.8	2.8

Source: URS, November 2001

Notes:

[a] Results include estimated background CO levels of 2.8 parts per million (ppm) (1-hour) and 2.0 ppm (8-hour).

[b] The applicable ambient CO standards for the 1-hour and 8-hour averaging periods are 35 ppm and 9 ppm, respectively. The No-Build and Build Alternatives are identical due to minimal changes in traffic volume and operation.

As the results in Table 4.3.5 indicate, no violations of the current CO standards are projected under the No-Build or Build Alternatives. In addition, CO concentrations in the horizon year (2020) are expected to be lower than the current year 2000 concentrations. As a result, the implementation of one of the Build Alternatives would have no significant air quality impacts at these locations. Because the selected intersections represent the worst locations in the corridor in terms of traffic volume and vehicular delay, it is reasonable to conclude that other locations in the study area would not experience significant air quality impacts as a result of one of the Build Alternatives.

4.4 NOISE AND VIBRATION

This section provides background for the general assessment of noise and vibration impacts. The background includes a screening for sensitive noise and vibration sites and an investigation of the ambient noise conditions. The Federal Transit Administration's (FTA) *Transit Noise and Vibration Impact Assessment, April 1995,* guidelines were followed to conduct the noise and vibration screening and collection of ambient noise within the study area.

4.4.1 NOISE

"Noise" is defined as "unwanted sound." Sounds are described as noise if they interfere with an activity or disturb the person hearing them. Sound is measured in a logarithmic unit called a decibel (dB). Since the human ear is more sensitive to middle and high frequency sounds than it is to low frequency sounds, sound levels are weighted to reflect human perceptions more closely. These "A-weighted" sounds are measured using the decibel unit dBA.

Sound levels fluctuate with time depending on the sources of the sound audible at a specific location. In addition, the degree of annoyance associated with certain sounds can vary by time of day, depending on other ambient sounds affecting the listener and the activities of the listener. Because the time-varying fluctuations in sound levels at a fixed location can be quite complex, they typically are reported using statistical or mathematical descriptors that are a function of sound intensity and time. Measures of noise account for sound magnitude, frequency and duration. A commonly used descriptor of noise is the L_{eq}, which represents the equivalent of a steady, unvarying level over a defined period of time containing the same level of sound energy as the time varying noise environment. In areas where sleep activity takes place, the L_{dn}, which measures an average "day-night" sound, is the most commonly used measure. The L_{dn} is a 24-hour L_{eq} average calculated from hourly L_{eq} measurements, with a 10 dBA added to nighttime levels to account for heightened noise-sensitivity at night.

4.4.1.1 Noise Screening Procedure

A noise screening procedure was conducted to identify noise sensitive areas within 500 feet from the centerline of the proposed alignment, and within 1000 feet of the proposed yard and shop location and from the center of each proposed station. If intervening buildings existed between the source and the noise sensitive receiver, then a screening distance of 250 feet was used for the proposed alignment or 500 feet for the yard and shop locations and station location, as required. Maps, Geographic Information Systems, aerial photographs, and field studies were used to identify noise sensitive land uses within the appropriate screening distance. Sensitive noise receivers include residences, schools, churches, libraries, auditoriums, hotels, and parks. Figures 4.4-1a through 4.4-1l show the location of each of the noise sensitive receivers within the appropriate screening distance. Table 4.4.1 identifies each noise sensitive receiver for each I-71 Corridor LRT segment, provides a land use description and the corresponding FTA noise category corresponding to the land use. Residential areas will be clustered and the closest structure to the noise source will be used in the analysis to determine potential impact.

Table 4.4.1: Sensitive Noise Receivers

Covington Segment

Site No.	Receiver Site	Land Use	FTA Noise Category
1	Cathedral Basilica	Church	3
2	Covington Latin High School	School	3
3a	John G. Carlisle Elementary School	School	3
3b	Annie Hargreaves Park	Park	3
3	John G. Carlisle Elementary School	School	3
4	Mother of God Church	Church	3
5	13th District Elementary School	School	3
C1	Residential Contour 50-100 ft from track	Residential	2
C2	Residential Contour 100-250 ft from track	Residential	2
C3	Residential Contour 250-500 ft from track	Residential	2
C4	Residential Contour 500-1000 ft from station	Residential	2

Ohio River Crossing Segment

No Sensitive Receiver Sites

Cincinnati Riverfront Segment

No Sensitive Receiver Sites

Downtown Cincinnati Segment

No Sensitive Receiver Sites

Over-the-Rhine Segment

Site No.	Receiver Site	Land Use	Category
7	Peaslee Elementary School	School	3
78	School for the Creative and Performing Arts	School	3

Mount Auburn Tunnel Segment

Site No.	Receiver Site	Land Use	Category
R0	North of Liberty, surrounding Rothenberg School	Residential	2
6	Rothenberg Elementary School	School	3
8	Filsons Park	Park	3
	No Additional Sensitive Receiver Sites due to tunnel.		

University of Cincinnati

Site No.	Receiver Site	Land Use	FTA Noise Category
9	University of Cincinnati	School	3
R1	Between Daniels St. and Corry St.	Residential	2
R2	Between University Ave and Corry St.	Residential	2
R3	Between MLK Drive and University Ave	Residential	2
R4	Between Vine Ave and Eden Ave (500 ft. contour)	Residential	2
R5	Between Vine Ave and Eden Ave (250 ft. contour)	Residential	2
R6	Between Eden Ave and Highland Ave (500 ft.)	Residential	2
R7	Between Eden Ave and Highland Ave (250 ft.)	Residential	2
10	Correyville Playground	Park	3

University of Cincinnati, cont.

Site No.	Receiver Site	Land Use	FTA Noise Category
11	University Hospital	Hospital	2
ZR1	Vine Street	Residential	3
ZR2	Intersection of Vine Street and Erkenbrecher Ave	Residential	3
ZR3	Dury Ave	Residential	3
ZR4	Burnet Ave	Residential	3
ZR5	Vernon Ave	Residential	3
R8	Van Buren Ave	Residential	2
R9	South of Whittier Street (500 ft. contour)	Residential	2
R10	South of Whittier Street (250 ft. contour)	Residential	2

Avondale to Norwood Segment

Site No.	Receiver Site	Land Use	FTA Noise Category
R11	Milton Ct (500 ft. contour)	Residential	2
R12	Milton Ct (250 ft. contour)	Residential	2
R13	Between Cleveland Ave and Blair Ave	Residential	2
R13B	Blair Ave, South of I-71	Residential	2
R14	Cleveland Ave	Residential	2
R15	Idelwild Ave (station)	Residential	2
R16	Idelwild Ave (500 ft. contour)	Residential	2
R17	Idelwild Ave (250 ft. contour)	Residential	2
12	Xavier University	School	3
13	Christ the Savior Holy Spirit Orthodox Church	Church	3
14	Ashland Avenue Baptist Church	Church	3
R18	Intersection of Dana Ave and Woodburn Ave	Residential	2
R19	Intersection of Mentor and Ivanhoe Ave (500 ft.)	Residential	2
R20	Intersection of Mentor and Ivanhoe Ave (250 ft.)	Residential	2
R21	Between Delaware Ave and Mentor Ave	Residential	2
R22	Between Hopkins Ave and Williams Ave	Residential	2
R23	Intersection of Washington and Ashland Ave	Residential	2
R24	Between Washington Ave and Cameron Ave	Residential	2
R25	Between Flofal Ave and Slane Ave	Residential	2
R26	Between Norwood Ave and Harper Ave	Residential	2
R27	Between Norwood Ave and Highland Ave	Residential	2
R28	Moundview Dr	Residential	2

Norwood to Blue Ash Segment

Site No.	Receiver Site	Land Use	FTA Noise Category
15A	Kennedy Heights Park	Park	3
15B	Lang Playfield	Park	3
15C	Woodford Elementary School	School	3
16	The fellowship of Jesus Christ Church	Church	3
17	St. John’s The Evangelist Church	Church	3
18	St. John’s Eagles School	School	3
19	Multi-Housing	Residential	2
20	Multi-Housing	Residential	2
21	Calvary Baptist Church	Church	3
22	Chamberlain Park	Park	2
23	Multi-Housing	Residential	2
24	Multi-Housing	Residential	2
25	Deer Park Elementary Schools	School	3
26	Memorial Baptist Church	Church	3
27	Happy Hearts Day Care	Day Care	3
R29	Cypress Way	Residential	2

Norwood to Blue Ash Segment, cont.

Site No.	Receiver Site	Land Use	FTA Noise Category
R30	Tanner Ave (500 ft. contour)	Residential	2
R31	Tanner Ave (250 ft. contour)	Residential	2
R32	Lester Rd (250 contour)	Residential	2
R33	Lester Rd (550 ft. contour)	Residential	2
R34	Intersection of Leaf Ave and Ridge Rd	Residential	2
R35	Intersection of Auten Ave and Ridge Rd	Residential	2
R36	Intersection of Beaver Ave and Ridge Rd	Residential	2
R37	Pandora Ave (250 ft. contour)	Residential	2
R38	Pandora Ave (500 ft. contour)	Residential	2
R39	Pandora Ave (station)	Residential	2
R40	Edgeview Drive	Residential	2
R41	Between Woodford Rd and S. Woodmont Ave (250)	Residential	2
R42	Between Woodford Rd and S. Woodmont Ave (500)	Residential	2
R43	Intersection of Woodford Rd and Alignment	Residential	2
R44	North Dale Place (south)	Residential	2
R45	North Dale Place (north)	Residential	2
R46	Between Oak Ave and Dunloe Ave	Residential	2
R47	Between Queen Crest Ave and Dunloe Ave	Residential	2
R48	Between Hampton Ave and Standish Ave	Residential	2
R49	Between Hampton Ave and Iona Ave	Residential	2
R50	Elm Street (between 250-1000 ft.)	Residential	2
R51	Elm Street (adjacent to alignment)	Residential	2
R52	Orchard Street	Residential	2
R53	Intersection of Montgomery Rd and Ohio Ave	Residential	2
R54	Intersection of Section Road and Ohio Ave	Residential	2
R55	Carnation Ave	Residential	2
R56	Carnation Ave and Webster Ave	Residential	2
R57	Between Oakwood Ave and Hegner Ave	Residential	2
R58	Between O'Leary Ave and Hornton Drive	Residential	2
R59	Between O'Leary Ave and Superior Ave	Residential	2
R61	Two blocks north and south or Clifford Rd	Residential	2
R62	Between E. Galbraith Rd and Matson Ave	Residential	2
R63	Between Kugler Mill Rd and Matson Ave (250')	Residential	2
R64	Between Kugler Mill Rd and Matson Ave (500')	Residential	2
R65	Intersection of Beech St. and E. Galbraith Rd	Residential	2
R66	Between Elizabeth Pl and E. Galbraith Rd	Residential	2
R67	Between Elizabeth Pl and Kugler Mill Rd	Residential	2
R68	Surrounding Bethlehem United Baptist Church	Residential	2
R69	Adjacent to Bechtold Park	Residential	2
28	Bechtold Park	Park	2
29	Bethlehem United Baptist Church	Church	3

Blue Ash Segment

Site No.	Receiver Site	Land Use	FTA Noise Category
30	Blue Ash Church of the Nazarene	Church	3
31	Town Square Apts.	Residential	2
32	Blue Ash Educational Day Care	Day Care	3
R70	Between Alpine Ave and Belleview Ave	Residential	2
R71	Tillsam Ct (West)	Residential	2
R72	Tillsam Ct (East)	Residential	2
R73	Floral Ave	Residential	2
R74	Alma Ave	Residential	2
R75	Intersection of Perry Ave/Highland Rd (south)	Residential	2
R76	Intersection of Perry Ave/Highland Rd (north)	Residential	2
R77	Intersection of Perry Ave/Conklin Rd	Residential	2

Blue Ash Segment, cont.

Site No.	Receiver Site	Land Use	FTA Noise Category
R78	Intersection of Miller Rd/Conklin Rd	Residential	2
R79	Intersection of Miller Rd/Conklin Rd (station)	Residential	2
R80	Intersection of Northfield Rd/Conklin Rd	Residential	2
R81	Kenwood Ave (between Aldine and Prospect Dr)	Residential	2
R82	Kenwood Ave (between Hagewa and Creek Dr)	Residential	2
R83	Kenwood Ave (between Meyerdale and Hagewa Dr)	Residential	2
R84	Kenwood Ave (south of Zig Zag Rd)	Residential	2
R85	Kenwood Ave (north of Zig Zag Rd)	Residential	2
R86	North of Milford RD	Residential	2
33	Christ Hospital	Hospital	2
34	Marriott Court Yard	Hotel	2
35	Embassy Suites	Hotel	2
36	Rainbow Rascal Learning	School	3
37	Hampton Inn, Holiday Inn	Hotels	2
38	The Children's House Preschool	School	3
39	Comfort Suites	Hotel	2
40	Marriott Residential Inn	Hotel	2
41	AmeriSuites	Hotel	2

Source: URS, 2000

4.4.1.2 Existing (Ambient) Noise Conditions

Noise monitoring was conducted using a Metrosonics dB-308 Statistical Sound Level Analyzer. Existing ambient noise levels were measured at representative locations near eighteen sensitive receiver areas. In order to identify the best measurement locations, the study area was reviewed relative to the location of each of the sensitive receiver areas identified in Table 4.4.1 and located on Figure 4.4-1a through 4.4-1l. The sensitive receiver areas were then analyzed to determine where the monitoring equipment could be located to measure representative characteristics for the noise sensitive receiver areas.

Monitoring was conducted for a one-hour period at each site during weekdays during either the morning peak hours (6:00 AM to 9:00 AM), midday (9:00 AM to 4:00 PM), or evening peak hours (4:00 PM to 7:00 PM) during the week to determine the noise level at these highest hour (L_{eq}). The L_{eq} was extrapolated to 24-hours to determine the L_{dn} equivalents. The monitored existing noise levels are shown in Table 4.4.2 and shown on Figure 4.4-2a through Figure 4.4-2j.

4.4.1.3 Noise Level

Table 4.4.2: Monitored Existing Noise Levels (dBA)

Monitoring Site #	L_{eq}	L_{dn}	Primary Noise Sources
N1	62	60	Freight Train/Airplanes/Cars
N2	60	58	Freight Train/Airplanes/Cars
N3	69	67	Freight Train/Airplanes/Cars
N4	62	60	Airplanes/Cars
N5	54	52	Cars
N6	59	57	Airplanes/Cars
N7	63	61	Airplanes/Cars
N8	54	52	Cars
N9	65	63	Cars
N10	56	54	Freight Trains/Airplanes/Cars
N11	51	49	Cars
N12	52	50	Cars
N13	51	49	Cars
N14	73	71	Playground/Airplane/Cars
N15	64	62	Airplane/Cars
N16	61	59	Cars
N17	58	57	Cars
N18	74	73	Lawn Mower/Airplane/Cars

Source: URS, 2000
Note: L_{dn} calculated from L_{eq} actual measurements

Covington Segment

The Covington Segment is primarily single, multi-family residential, and a historic downtown consisting of a mix of small businesses with second story residences. Due to the character of the area instead of clustering residential areas, noise contours were drawn to group together residences by distance from the proposed centerline. The number of residential structures is approximately 565. I-75, the CSX railroad and Madson Avenue are significant sources of ambient noise.

Ohio River Crossing Segment

No sensitive noise receptor sites are located in this segment.

Cincinnati Riverfront Segment

No sensitive noise receptor sites are located in this segment.

Downtown Cincinnati Segment

The proposed I-71 Corridor alignment runs through the fully developed central business district (CBD). Automobile traffic is the primary contributor to ambient noise. Land use is primarily mixed commercial and high-rise office buildings. Although there are residences, hotels, libraries and performing arts centers along the alignment, the existing environment generates noise at a level that these sites would not be impacted by the proposed project.

Over-the-Rhine Segment

A historic neighborhood and located north of the Cincinnati CBD, new townhouses along Walnut Street, the Peaslee Elementary School School, School for the Creative & Performing Arts and residential units along Main and Walnut Street are sensitive noise receptors located in this segment of the proposed I-71 Corridor alignment. This area is fully developed and generates high ambient noise levels due to dense population, urban nightlife and heavy traffic along Liberty Avenue as well as other adjacent streets.

Mount Auburn Tunnel Segment

The proposed I-71 Corridor alignment at this location will primarily be in a tunnel beneath Mount Auburn and will not impact sensitive noise receptors found in the vicinity of the tunnel. The Rothenberg Elementary School is surrounded by residential units and is located in this segment. Sensitive noise receptors that exist above this tunnel segment include approximately 27 single-family residential units, the William H. Taft Historical Home, Christ Hospital and Mount Auburn Baptist Church

University of Cincinnati Segment

The proposed I-71 Corridor alignment surfaces with the north portal of the Mount Auburn tunnel located near the intersection of Jefferson Avenue and Cory Street. There are approximately 200 residential units consisting of primarily multi-family use located within the University of Cincinnati segment. In addition, approximately 114 multi-family residential units are located within 1000 ft. of the University of Cincinnati and the Medical Center Stations. Traffic along Jefferson Avenue and MLK Drive are significantly contributing to the ambient noise. The University of Cincinnati, University Hospital, Veteran's Administration Medical Center, U.S. EPA – Cincinnati Center, Corryville Community Center and local offices are the primary trip producers and attractions for this area and are also a significant source of ambient noise.

Avondale to Norwood Segment

Norwood Plaza and Xavier University are the Avondale/Evanston area's primary trip producers and attractions. The University and I-71 are significant contributors to the ambient noise. Surrey Square is the primary trip producer and attractor in the Norwood area and is a significant source of ambient noise. There are approximately 550 single and multi-family residential units adjacent to the proposed I-71 Corridor alignment through this segment. Within 1,000 feet of the Xavier and Norwood Stations, there are an additional 60 single-family and multi-family residential units. There is a large residential section near the intersection of Ivanhoe Avenue and the alignment as well as on the east side of the alignment north of Monroe Avenue up to Washington Avenue. The Silverton Station is also located at the north end of this residential section. North of Norwood Avenue and south of Highland Avenue on the west side of the alignment, a third cluster of primarily single-family residences. No additional units were located within the 1,000-foot screening radius at the proposed Silverton Station location.

Norwood to Blue Ash Segment

The land use through the proposed I-71 Corridor alignment through the Norwood to Blue Ash segment is primarily single-family residential. There are approximately 1,069 single-family units within the 200-foot screening distance. There are 260 additional residences within the 1,000-foot screening distance from Galbraith Station.

Another small cluster of homes is located at the intersection of Lester Road and the alignment. North of the Ridge Avenue Station, site a substantial residential area begins and continues to Woodford Road. Just south of Woodford Road to the east of the alignment is another single-family residential area. The alignment continues to traverse through residential clusters until the Silverton Station near the intersection of Montgomery Road and the alignment. North of Silverton Station, land use becomes a little more mixed with churches, schools and multi-family residences as will as small businesses serving the neighborhoods. Sensitive sites include the Olivet Baptist Church, the Fellowship of Jesus Christ Church, St. John the Evangelist Church, St. John Eagles School, Calvary Baptist Church, Chamberlain Park, Memorial Baptist Church and Happy Hearts Day Care.

Blue Ash

There are approximately 227 single-family residential units within 500 feet of the proposed I-71 Corridor alignment in the Blue Ash segment. Residences are located primarily along Kenwood Road. Primary land use is mixed, including hotel, commercial and office buildings. The Reed Hartman Highway, Highway 126 and the Blue Ash Airport are significant sources of ambient noise. In addition, 45 single-family residences are included due to the 1,000 foot screening distance from Cooper Station, Pfeiffer Station, and Reed Hartman Station.

4.4.1.4 Noise Impacts

General Noise Assessment

Based on the potential for the Light Rail Alternatives to impact nearby noise sensitive areas, a general noise assessment was conducted using FTA methodology.

An impact is assessed based on the comparison of the existing (ambient) noise levels and the predicted noise level at a given noise sensitive area in terms of either the L_{dn} or L_{eq} descriptors assigned for the appropriate land use category. This comparison was completed by using the FTA guidelines provided in Table 4.4.3, which defines noise level impacts for transit projects.

The steps in conducting a general noise assessment include the following:

- Identify noise sensitive receiver sites in the vicinity of the proposed alignment.
- Determine the distance from the receiver to the centerline of the light rail tracks or the center point of the transit stations.
- Identify the appropriate land use category (1, 2, or 3) for each sensitive area.
- Estimate the ambient noise for each sensitive area based upon the monitoring data. (Use the most conservative measured ambient noise level figures for the land use's hours of activity).
- Determine the project-related noise level based on the light rail operating data using the formula provided for each noise source (light rail operations, transit stations, or yard and shop) in the guidance manual for each sensitive area.
- Determine the project-induced noise levels from the change in operation of freight activity to nighttime hours.
- Compare the estimated light rail noise level to the noise criteria level to determine the potential for noise impacts.

Table 4.4.3: Noise Levels Defining Impact for Transit Projects

Existing Ambient Noise Level L_{eq} or L_{dn} (dBA)	PROJECT NOISE IMPACT LEVELS L_{eq} Or L_{dn} (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Impact	Severe Impact	No Impact	Impact	Severe Impact
<43	<(Amb.+10)	Ambient + 10 to 15	>(Amb.+15)	<(Amb.+15)	Ambient + 15 to 20	>(Amb.+20)
43	<52	52-58	>58	<57	57-63	>63
44	<52	52-58	>58	<57	57-63	>63
45	<52	52-58	>58	<57	57-63	>63
46	<53	53-59	>59	<58	58-64	>64
47	<53	53-59	>59	<58	58-64	>64
48	<53	53-59	>59	<58	58-64	>64
49	<54	54-59	>59	<59	59-64	>64
50	<54	54-59	>59	<59	59-64	>64
51	<54	54-60	>60	<59	59-65	>65
52	<55	55-60	>60	<60	60-65	>65
53	<55	55-60	>60	<60	60-65	>65
54	<55	55-61	>61	<60	60-66	>66
55	<56	56-61	>61	<61	61-66	>66
56	<56	56-62	>62	<61	61-67	>67
57	<57	57-62	>62	<62	62-67	>67
58	<57	57-62	>62	<62	62-67	>67
59	<58	58-63	>63	<63	63-68	>68
60	<58	58-63	>63	<63	63-68	>68
61	<59	59-64	>64	<64	64-69	>69
62	<59	59-64	>64	<64	64-69	>69
63	<60	60-65	>65	<65	65-70	>70
64	<61	61-65	>65	<66	66-70	>70
65	<61	61-66	>66	<66	66-71	>71
66	<62	62-67	>67	<67	67-72	>72
67	<63	63-67	>67	<68	68-72	>72
68	<63	63-68	>68	<68	68-73	>73
69	<64	64-69	>69	<69	69-74	>74
70	<65	65-69	>69	<70	70-74	>74
71	<66	66-70	>70	<71	71-75	>75
72	<66	66-71	>71	<71	71-76	>76
73	<66	66-71	>71	<71	71-76	>76
74	<66	66-72	>72	<71	71-77	>77
75	<66	66-73	>73	<71	71-78	>78
76	<66	66-74	>74	<71	71-79	>79
77	<66	66-74	>74	<71	71-79	>79
>77	<66	66-75	>75	<71	71-80	>80

Source: Transit Noise & Vibration Impact Assessment, U.S. DOT, April 1995
Note: L_{dn} is used for land uses where nighttime sensitivity is a factor, and L_{eq} during the noisiest transit-related hour is used for land use involving only daytime activities.

Project-Related Noise Levels

Future project-related noise levels were computed by using base reference source exposure level (SEL) values and assumptions for light rail operations provided in Table 4.4.4. Peak hour volumes, off-peak hour volumes, speed of the Light Rail Vehicles, the number of cars per train, and the absence of noise barriers were conservatively estimated in the analysis. The SEL values and the correction per doubling distance are defined in the Guidance Manual.

Park-and-ride lots and additional bus service around station areas were included in the model for projecting noise associated with the project.

Table 4.4.4: Assumptions for Light Rail Operations

Type of Source	Line
Source Exposure Level (SEL) at 50 ft.	82 dBA
L_{max} at 50 ft. (15 meters)	74 dBA
Alignment	At-grade
Track	Continuous welded rail on ballast
Daytime Light Rail Volumes	17 Trains (both directions)
Nighttime Light Rail Volumes	1.5 Trains (both directions)
No. of Cars per Train	2
Length of Train	180 feet
Hours of Operation	5:30 AM - midnight
Nominal Speed	15- 25 mph depending on location
Maximum Speed	55 mph
Noise Barriers	None
L_{eq} at 50 Feet (15 meters)	61 dBA
Embedded Track	+3 dBA
Correction/Double Distance	-4.5 dBA
Aerial Structures	+10 dBA

Source: Transit Noise and Vibration Impact Assessment, US DOT, April 1995

Noise Impact Criteria

FTA's noise impact criteria, shown in Table 4.4.3, is based on comparing the existing noise levels to future project-related noise levels. The criteria are defined by two curves, which designate different levels of project noise which result in "no impact", "impact", and "severe impact" conditions. According to the guidance manual, mitigation should be considered if the project falls within an "impact" range and should be implemented if the project would result in a severe impact. The basis of noise impact criteria is the percentage of people that would be highly annoyed by measured noise levels in their living environment. As a result, criteria reflect a range of annoyance associated with different human activities that occur in such areas as homes, businesses, and parks. Noise impacts are assumed to vary between differing land uses/existing noise levels and predicted project noise levels.

Criteria are applied to three categories of land use with varying degrees of sensitivity to noise. Generally, in evaluating the potential for a noise impact from a proposed project, the L_{eq} is established for the peak traffic hour when noise levels are expected to be the highest. Where there is nighttime occupancy of noise sensitive buildings such as residences, hotels and hospitals, the "Day-Night" sound level (L_{dn}) is more appropriate for assessing noise impacts than the peak hour L_{eq}.

The noise criteria and descriptors used in impact analysis depend on whether the land use is designated within Category 1, 2 or 3. The following is a description of the categories of noise-sensitive land uses for which those noise criteria apply and the descriptor used to determine impact.

Description of Land Use Categories	Noise Metric (dBA)
Category 1 - Buildings and parks where quiet is an important element of their intended purpose. This category includes tracts of land set aside for serenity and quiet, and special uses such as outdoor concert pavilions.	Outdoor Leq(h)
Category 2 - Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where nighttime sensitivity to noise is assumed to be of utmost importance.	Outdoor Ldn
Category 3 - Institutional land uses with primarily daytime use. This category includes schools, libraries, churches, and active parks	Outdoor Leq(h)

Noise Assessment Results

No-Build Alternative
The No-Build Alternative would have no affect on noise levels in the area. Changes in traffic volumes, bus operations, and rail freight operations would not significantly change existing noise or vibration levels.

TSM Alternative
The TSM Alternative would have no affect on noise levels in the area. Changes in traffic volumes, bus operations, and rail freight operations would not significantly change existing noise or vibration levels.

Build (LRT) Alternatives
The general noise assessment included noise from all possible sources, including: light rail, freight service, bus service at transit stations and automobile activity associated with park-and-ride lots. The assessment includes comparing the project-related noise levels to the existing noise levels in order to determine human reaction to the amount of change. There are three possible outcomes to the general noise assessment: no impact, impact and severe impact.

The results of the General Assessment for the Light Rail Alternatives are identified in Table 4.4.5. Table 4.4.5 identifies the ambient noise levels, the future project-related noise levels, and whether using the noise impact criteria described above identified any potential or severe impacts. Table 4.4.6 summarizes the results of the General Assessment. As indicated in the tables, 12 of the 114 noise sensitive areas have the potential to experience an impact as a result of the proposed project. These 12 potentially impacted noise sensitive areas are primarily residential land uses and represent a cluster of homes, rather than single residences. Four new sensitive receiver sites were added due to the zoo alignment for Alternatives 3 and 4. There are no differences between alternatives with respect to number of impacted sensitive receivers.

Table 4.4.5: General Assessment Results

Site No.	Receiver Site	FTA Noise Category	Metric	Measured Existing Noise (dBA)	Estimated Project Noise (dBA)	Range of Impact (dBA)	Potential Noise Impact
Covington Segment							
1	Cathedral Basilica	3	Leq	62	41	64-69	None
2	Covington Latin High School	3	Leq	62	36	64-69	None
3A	John G. Carlisle Elementary School	3	Leq	62	39	64-69	None
3B	Annie Hargreaves Park	3	Leq	62	39	64-69	None
4	Mother of God Church	3	Leq	60	38	63-68	None
5	13th District Elementary School	3	Leq	60	35	63-68	None
C1	Residential Contour 50-100 ft from track	2	Ldn	60	57	58-63	None
C2	Residential Contour 100-250 ft from track	2	Ldn	60	52	58-63	None
C3	Residential Contour 250-500 ft from track	2	Ldn	60	46	58-63	None
C4	Residential Contour 500-1000 ft from station	2	Ldn	60	42	58-63	None
Ohio River Crossing Segment							
	No Sensitive Receiver Sites						
Cincinnati Riverfront Segment							
	No Sensitive Receiver Sites						
Downtown Cincinnati Segment							
	No Sensitive Receiver Sites						
Over-The-Rhine Segment							
7A	Peaslee Elementary School	3	Leq	62	38	64-69	None
7B	School for the Creative & Performing Arts	3	Leq				
Mount Auburn Tunnel Segment							
R0	North of Liberty, surrounding Rothenberg School	2	Ldn	60	58	58-63	Impact
6	Rothenberg Elementary School	3	Leq	62	64	64-69	Impact
8	Filsons Park	3	Leq	54	45	60-66	None
	No additional Sensitive Receiver Sites due to tunnel.						
University of Cincinnati Segment							
9	University of Cincinnati	3	Leq	59	54	63-68	None
R1	Between Daniels St. and Corry St.	2	Ldn	57	43	57-62	None
R2	Between University Ave and Corry St.	2	Ldn	57	53	57-62	None
R3	Between MLK Drive and University Ave	2	Ldn	57	53	57-62	None
R4	Between Vine Ave and Eden Ave (500 ft. contour)	2	Ldn	57	39	57-62	None
R5	Between Vine Ave and Eden Ave (250 ft. contour)	2	Ldn	61	54	59-64	None
R6	Between Eden Ave and Highland Ave (500 ft.)	2	Ldn	61	37	59-64	None
R7	Between Eden Ave and Highland Ave (250 ft.)	2	Ldn	61	43	59-64	None

Site No.	Receiver Site	FTA Noise Category	Metric	Measured Existing Noise (dBA)	Estimated Project Noise (dBA)	Range of Impact (dBA)	Potential Noise Impact
University of Cincinnati Segment, cont.							
10	Correyville Playground	3	Leq	63	52	65-70	None
11	University Hospital	3	Leq	63	46	65-70	None
R8	Van Buren Ave	2	Ldn	57	53	57-62	None
R9	South of Whittier Street (500 ft. contour)	2	Ldn	57	52	57-62	None
R10	South of Whittier Street (250 ft. contour)	2	Ldn	57	40	57-62	None
Zoo Alignment – Alternatives 3 & 4							
ZR1	Vine Street	2	Ldn	57	49	57-62	None
ZR2	Intersection of Vine Street and Erkenbrecher Ave	2	Ldn	57	47	57-62	None
ZR3	Dury Ave	2	Ldn	57	47	57-62	None
ZR4	Burnet Ave	2	Ldn	57	46	57-62	None
Avondale to Norwood Segment							
R11	Milton Ct (500 ft. contour)	2	Ldn	57	61	57-62	Impact
R12	Milton Ct (250 ft. contour)	2	Ldn	57	66	57-62	Impact
R13	Between Cleveland Ave and Blair Ave	2	Ldn	57	59	57-62	Impact
R14	Cleveland Ave	2	Ldn	57	46	57-62	None
R15	Idelwild Ave (station)	2	Ldn	52	40	55-60	None
R16	Idelwild Ave (500 ft. contour)	2	Ldn	52	45	55-60	None
R17	Idelwild Ave (250 ft. contour)	2	Ldn	52	47	55-60	None
12	Xavier University	3	Leq	54	56	60-66	None
13	Christ the Savior Holy Spirit Orthodox Church	3	Leq	65	40	66-71	None
14	Ashland Avenue Baptist Church	3	Leq	65	51	66-71	None
R18	Intersection of Dana Ave and Woodburn Ave	2	Ldn	52	42	55-60	None
R19	Intersection of Mentor and Ivanhoe Ave (500 ft.)	2	Ldn	52	39	55-60	None
R20	Intersection of Mentor and Ivanhoe Ave (250 ft.)	2	Ldn	52	50	55-60	None
R21	Between Delaware Ave and Mentor Ave	2	Ldn	52	50	55-60	None
R22	Between Hopkins Ave and Williams Ave	2	Ldn	52	44	55-60	None
R23	Intersectionof Washington and Ashland Ave	2	Ldn	63	33	60-65	None
R24	Between Washington Ave and Cameron Ave	2	Ldn	63	43	60-65	None
R25	Between Flofal Ave and Slane Ave	2	Ldn	63	52	60-65	None
R26	Between Norwood Ave and Harper Ave	2	Ldn	54	55	55-61	Impact
R27	Between Norwood Ave and Highland Ave	2	Ldn	54	46	55-61	None
Norwood to Blue Ash Segment							
15	Olivet Baptist Church	3	Leq	51	44	59-65	None
16	The fellowship of Jesus Christ Church	3	Leq	51	45	59-65	None
17	St. John's The Evangelist Church	3	Leq	73	51	71-76	None
18	St. John's Eagles School	3	Leq	73	47	71-76	None
19	Multi-Housing	2	Leq	73	53	71-76	None
20	Multi-Housing	2	Leq	73	55	71-76	None
21	Calvary Baptist Church	3	Leq	73	53	71-76	None

Site No.	Receiver Site	FTA Noise Category	Metric	Measured Existing Noise (dBA)	Estimated Project Noise (dBA)	Range of Impact (dBA)	Potential Noise Impact
Norwood to Blue Ash Segment, cont.							
22	Chamberlain Park	2	Leq	73	61	71-76	None
23	Multi-Housing	2	Leq	73	52	71-76	None
24	Multi-Housing	2	Leq	73	61	71-76	None
25	Deer Park Elementary Schools	3	Leq	73	42	71-76	None
26	Memorial Baptist Church	3	Leq	73	52	71-76	None
27	Happy Hearts Day Care	3	Leq	73	53	71-76	None
R29	Cypress Way	2	Ldn	54	44	55-61	None
R30	Tanner Ave (500 ft. contour)	2	Ldn	49	41	54-59	None
R31	Tanner Ave (250 ft. contour)	2	Ldn	49	51	54-59	None
R32	Lester Rd (250 contour)	2	Ldn	49	54	54-59	Impact
R33	Lester Rd (550 ft. contour)	2	Ldn	49	46	54-59	None
R34	Intersection of Leaf Ave and Ridge Rd	2	Ldn	49	47	54-59	None
R35	Intersection of Auten Ave and Ridge Rd	2	Ldn	49	45	54-59	None
R36	Intersection of Beaver Ave and Ridge Rd	2	Ldn	49	39	54-59	None
R37	Pandora Ave (250 ft. contour)	2	Ldn	49	50	54-59	None
R38	Pandora Ave (500 ft. contour)	2	Ldn	49	43	54-59	None
R40	Edgeview Drive	2	Ldn	50	42	54-59	None
R41	Between Woodford Rd and S. Woodmont Ave (250)	2	Ldn	50	50	54-59	None
R42	Between Woodford Rd and S. Woodmont Ave (500)	2	Ldn	50	44	54-59	None
R43	Intersection of Woodford Rd and Alignment	2	Ldn	50	48	54-59	None
R44	North Dale Place (south)	2	Ldn	50	55	54-59	Impact
R45	North Dale Place (north)	2	Ldn	50	45	54-59	None
R46	Between Oak Ave and Dunloe Ave	2	Ldn	49	46	54-59	None
R47	Between Queen Crest Ave and Dunloe Ave	2	Ldn	49	54	54-59	Impact
R48	Between Hampton Ave and Standish Ave	2	Ldn	49	55	54-59	Impact
R49	Between Hampton Ave and Iona Ave	2	Ldn	49	45	54-59	None
R50	Elm Street (between 250-1000 ft.)	2	Ldn	49	46	54-59	None
R51	Elm Street (adjacent to alignment)	2	Ldn	49	54	54-59	Impact
R52	Orchard Street	2	Ldn	71	60	66-70	None
R53	Intersection of Montgomery Rd and Ohio Ave	2	Ldn	71	47	66-70	None
R54	Intersection of Section Road and Ohio Ave	2	Ldn	71	42	66-70	None
R55	Carnation Ave	2	Ldn	71	56	66-70	None
R56	Carnation Ave and Webster Ave	2	Ldn	71	48	66-70	None
R57	Between Oakwood Ave and Hegner Ave	2	Ldn	71	48	66-70	None
R58	Between O'Leary Ave and Hornton Drive	2	Ldn	71	62	66-70	None
R59	Between O'Leary Ave and Superior Ave	2	Ldn	71	47	66-70	None
R61	Two blocks north and south or Clifford Rd	2	Ldn	71	53	66-70	None
R62	Between E. Galbraith Rd and Matson Ave	2	Ldn	71	42	66-70	None

Site No.	Receiver Site	FTA Noise Category	Metric	Measured Existing Noise (dBA)	Estimated Project Noise (dBA)	Range of Impact (dBA)	Potential Noise Impact
Norwood to Blue Ash Segment, cont.							
R63	Between Kugler Mill Rd and Matson Ave (250’)	2	Ldn	71	61	66-70	None
R64	Between Kugler Mill Rd and Matson Ave (500’)	2	Ldn	71	46	66-70	None
R65	Intersection of Beech St. and E. Galbraith Rd	2	Ldn	71	41	66-70	None
R66	Between Elizabeth Pl and E. Galbraith Rd	2	Ldn	62	48	59-64	None
R67	Between Elizabeth Pl and Kugler Mill Rd	2	Ldn	62	54	59-64	None
R68	Surrounding Bethlehem United Baptist Church	2	Ldn	62	55	59-64	None
R69	Adjacent to Bechtold Park	2	Ldn	62	47	59-64	None
28	Bechtold Park	3	Leq	64	43	66-70	None
29	Bethlehem United Baptist Church	3	Leq	64	55	66-70	None
Blue Ash Segment							
30	Blue Ash Church of the Nazarene	3	Leq	61	55	64-69	None
31	Town Square Apts.	2	Leq	61	44	59-64	None
32	Blue Ash Educational Day Care	3	Leq	58	58	62-67	None
R70	Between Alpine Ave and Belleview Ave	2	Ldn	59	55	58-63	None
R71	Tillsam Ct (West)	2	Ldn	59	49	58-63	None
R72	Tillsam Ct (East)	2	Ldn	59	54	58-63	None
R73	Floral Ave	2	Ldn	59	53	58-63	None
R74	Alma Ave	2	Ldn	59	54	58-63	None
R75	Intersection of Perry Ave/Highland Rd (south)	2	Ldn	59	55	58-63	None
R76	Intersection of Perry Ave/Highland Rd (north)	2	Ldn	59	43	58-63	None
R77	Intersection of Perry Ave/Conklin Rd	2	Ldn	59	43	58-63	None
R78	Intersection of Miller Rd/Conklin Rd	2	Ldn	59	58	58-63	Impact
R79	Intersection of Miller Rd/Conklin Rd (station)	2	Ldn	59	43	58-63	None
R80	Intersection of Northfield Rd/Conklin Rd	2	Ldn	59	54	58-63	None
R81	Kenwood Ave (between Aldine and Prospect Dr)	2	Ldn	57	46	57-62	None
R82	Kenwood Ave (between Hgewa Hagewa? and Creek Dr)	2	Ldn	57	58	57-62	Impact
R83	Kenwood Ave (between Meyerdale and Hagewa Dr)	2	Ldn	57	60	57-62	Impact
R84	Kenwood Ave (south of Zig Zag Rd)	2	Ldn	57	45	57-62	None
R85	Kenwood Ave (north of Zig Zag Rd)	2	Ldn	57	47	57-62	None
R86	North of Milford Rd	2	Ldn	57	55	57-62	None
33	The Christ Hospital	2	Ldn	72	33	66-71	None
34	Marriott Court Yard	2	Ldn	72	33	66-71	None
35	Embassy Suites	2	Ldn	72	38	66-71	None
36	Rainbow Rascal Learning	3	Leq	74	48	71-77	None
37	Hampton Inn, Holiday Inn	2	Ldn	72	50	66-71	None
39	Comfort Suites	2	Ldn	72	39	66-71	None
40	Marriot Residential Inn	2	Ldn	72	42	66-71	None
41	AmeriSuites	2	Ldn	72	35	66-71	None

Source: URS, 2000

Table 4.4.6: Noise Impact Summary

Impact Type	Noise Sensitive Receivers
No Impact	98
No Impact w/ Mitigation	4
Impact (one w/ Mitigation)	12
Severe Impact	0
Total	114

4.4.1.5 Noise Mitigation

No-Build Alternative

Mitigation would not be warranted, as a noise impact would not occur as a result of the implementation of the No-Build Alternative.

TSM Alternative

Mitigation would not be warranted, as a noise impact would not occur as a result of the implementation of the TSM Alternative.

Build (LRT) Alternatives

Light Rail Alternatives 1,2,3 and 4
The FTA guidance manual states that mitigation must be considered for any site that falls within the impact range and mitigation measures should be employed if they are feasible and prudent. During Preliminary Engineering, a Detailed Noise Analysis will be conducted for each receiver determined to have an impact in Table 4.4.6-. This Detailed Noise Analysis will evaluate effective mitigation methods that would eliminate or reduce potential noise impact. In addition, the detailed assessment will evaluate the impacts of specific operational characteristics such as horn warnings, emergency ventilation shafts or wheel squeal on nearby receivers.

Mitigation techniques can be applied to the noise source (the light rail vehicle), the sound path, or the receiver. Light rail vehicle specifications prior to purchase can include treatments to ensure lower sound levels and can include options such as vehicle skirts (6-10 dB reduction), undercar absorption (5 dB), wheel treatments such as resilient and dampened wheels (2dB reduction). The sound path can be altered by the erection of noise barriers that can achieve a reduction between 6 and 10 dB or the use of ballast along the tracks can reduce noise up to 3 decibels. Sound insulation can also be provided at the receiver and has a varied sound reduction dependent upon the type of building construction and methods employed.

4.4.2 VIBRATION IMPACT ASSESSMENT

4.4.2.1 Ground-Borne Noise and Vibration

Transit systems can sometimes create ground-borne noise and vibration impacts. In contrast to airborne noise, ground-borne vibration is not a common environmental issue. Ground-borne vibration is the transmission of energy through the earth. Similar to airborne noise, ground borne noise is also quantified using a decibel unit of measure. However, noise and vibration decibels are unrelated. Ground-borne vibration, if strong enough to be perceptible, is sensed as motion of the floors or walls inside a building. The low-pitched, rumbling noise that can result from ground-borne vibration is called "ground-borne noise" and can only occur inside a building. Ground-borne noise impacts usually only occur for subway (underground) transit operations or in situations where the affected building is specially designed and constructed to be isolated from the exterior ambient noise environment such as a concert hall or recording studio.

Like airborne noise, ground-borne vibration is expressed in decibels and identified with the abbreviation of VdB. The vertical motion due to ground-borne vibration is described in terms of vibration velocity levels, measured in vibration decibels (VdB), dB re (relative to) 10^{-6} in/sec (2.6 x 10^{-8} m/sec). The threshold of human perception for vibration is on the order of 60 to 70 VdB. Ground-borne noise, the noise within a building produced by external vibration, is measured in dBA.

The potential impacts with ground-borne noise and vibration from Light Rail Transit operations are highly dependent on local geology and structural details of associated buildings. When Light Rail Vehicle (LRV) speeds are moderate (less than 30 mph (49 kph), vibration impacts are usually limited to buildings within 50 feet (15 meters) of the guideway. When LRV speeds are higher, the zone of ground-borne noise and vibration impacts may extend further. A significant percentage of complaints about both ground-borne vibration and noise can be attributed to the proximity of switches, rough or corrugated track or LRV wheel flats.

The effects of various levels of ground-borne vibration differ among vibration sensitive activities. The land uses that are most sensitive to vibration include those that conduct precision research and manufacturing, hospitals with highly sensitive equipment and university research operations.

4.4.2.2 Ground-borne Noise and Vibration Screening

A vibration screening procedure was conducted to identify whether the proposed project would have a potential to cause an impact to nearby vibration sensitive areas within proximity to the Light Rail Transit guideway track. The screening distances assume normal vibration propagation and are based on the FTA's recommended screening distances for assessing potential vibration impact due to LRT operations. For a Light Rail project, vibration impact could occur within 450 feet for Category 1 land uses, 150 feet for Category 2 land uses, and 100 feet for Category 3 land uses. Table 4.4.7 identifies each vibration sensitive receiver for each I-71 Corridor LRT segment, provides a land use description and the corresponding FTA vibration category corresponding to the land use.

Vibration sensitive receivers were identified within the study area. In general, the same types of land uses that are sensitive to airborne noise are also sensitive to ground-borne vibration with the exception of parks. Since vibration and ground-borne noise are perceived in the form of rattling windows, and other items contained within a building, ground-borne noise and vibration in outdoor areas would not be perceived. Ground-borne noise and vibration sensitive areas have been screened using the screening distances provided in the FTA guidance manual for the following land use categories:

Vibration Category 1: High Sensitivity - Included in Category 1 are buildings where low ambient vibration is essential for the operations within the building, but which may be well below levels associated with human annoyance. Concert halls and other special use facilities are covered separately. Typical land uses covered by Category 1 are vibration sensitive research and manufacturing, hospitals with vibration sensitive equipment, and university research operations.

Vibration Category 2: Residential - This category covers all residential land uses and any buildings where people sleep, such as hotels and hospitals. No differentiation is made between different types of residential areas.

Vibration Category 3: Institutional - Vibration category 3 includes schools and other institutions that do not have vibration sensitive equipment, but still have the potential for activity-interference.

Table 4.4.7: Sensitive Vibration Receivers

Covington Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
C1	Residential Contour 50-100 ft from track	Residential	2

Ohio River Crossing Segment

	No Sensitive Receiver Sites		

Cincinnati Riverfront Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
	No Sensitive Receiver Sites		

Downtown Cincinnati Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
V1	Aronoff Performing Arts Center	Entertainment	1

Over-the-Rhine Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
	No Sensitive Receiver Sites		

Mount Auburn Tunnel Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
R0	North of Liberty, surrounding Rothenberg School	Residential	2
2	Rothenberg Elementary School	School	3
V2	Residential area 50 ft. from tunnel.	Residential	2
V3	Mount Auburn Baptist Church	Church	3
V4	William H. Taft Historical Home	Historic	3
V5	Christ Church	Church	3

University of Cincinnati Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
7	University of Cincinnati	School	3
R2	Between University Ave and Corry St.	Residential	2
R3	Between MLK Drive and University Ave	Residential	2
R5	Between Vine Ave and Eden Ave (250 ft. contour)	Residential	2
11	University Hospital	Hospital	1
R8	Van Buren Ave	Residential	2
R9	South of Whittier Street (500 ft. contour)	Residential	2

Avondale to Norwood Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
R13	Between Cleveland Ave and Blair Ave	Residential	2
12	Xavier University	School	3
14	Ashland Avenue Baptist Church	Church	3
R20	Intersection of Mentor and Ivanhoe Ave (250 ft.)	Residential	2
R21	Between Delaware Ave and Mentor Ave	Residential	2
R25	Between Flofal Ave and Slane Ave	Residential	2
R26	Between Norwood Ave and Harper Ave	Residential	2

Norwood to Blue Ash Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
19	Multi-Housing	Residential	2
20	Multi-Housing	Residential	2
21	Calvary Baptist Church	Church	3
22	Chamberlain Park	Park	2
23	Multi-Housing	Residential	2
24	Multi-Housing	Residential	2
R31	Tanner Ave (250 ft. contour)	Residential	2
R32	Lester Rd (250 contour)	Residential	2
R37	Pandora Ave (250 ft. contour)	Residential	2
R41	Between Woodford Rd and S. Woodmont Ave (250)	Residential	2
R43	Intersection of Woodford Rd and Alignment	Residential	2
R44	North Dale Place (south)	Residential	2
R47	Between Queen Crest Ave and Dunloe Ave	Residential	2
R48	Between Hampton Ave and Standish Ave	Residential	2
R51	Elm Street (adjacent to alignment)	Residential	2
R52	Orchard Street	Residential	2
R55	Carnation Ave	Residential	2
R58	Between O'Leary Ave and Hornton Drive	Residential	2
R61	Two blocks north and south or Clifford Rd	Residential	2
R63	Between Kugler Mill Rd and Matson Ave (250')	Residential	2
R67	Between Elizabeth Pl and Kugler Mill Rd	Residential	2
R68	Surrounding Bethlehem United Baptist Church	Residential	2

Blue Ash Segment

Site No.	Receiver Site	Land Use	FTA Vibration Category
29	Bethlehem United Baptist Church	Church	3
30	Blue Ash Church of the Nazarene	Church	3
32	Blue Ash Educational Day Care	Day Care	3
R72	Tillsam Ct (East)	Residential	2
R73	Floral Ave	Residential	2
R74	Alma Ave	Residential	2
R75	Intersection of Perry Ave/Highland Rd (south)	Residential	2
R78	Intersection of Miller Rd/Conklin Rd	Residential	2
R80	Intersection of Northfield Rd/Conklin Rd	Residential	2
R82	Kenwood Ave (between Hagewa and Creek Dr)	Residential	2
R83	Kenwood Ave (between Meyerdale and Hagewa Dr)	Residential	2
37	Hampton Inn, Holiday Inn	Hotels	2

Source: URS, 2000

4.4.2.3 Vibration Impacts

General Vibration Assessment

The general assessment procedure is intended to provide more specific estimates of potential vibration impacts at sensitive locations by incorporating project-specific information. The basic approach for the general assessment is to define a base curve that relates overall ground-borne vibration to distance from the source, then apply adjustments to the curve to account for other factors such as vehicle speed and track conditions. Using the base curve, the ground-borne vibration and noise due to the project are then estimated for sensitive land use locations in the corridor. After the forecasts are developed for each location, they are compared to the existing vibration levels and the applicable criteria to evaluate the level of impact. For this analysis, the base curve provided in the guidance manual was used.

No-Build Alternative
The No-Build Alternative would have no affect on vibration levels in the area. Changes in traffic volumes and bus operations would not change existing vibration levels.

TSM Alternative
The TSM Alternative would have no affect on vibration levels in the area. Changes in traffic volumes and bus operations would not change existing vibration levels.

Build (LRT) Alternatives
Alternatives 1,2,3 and 4 - The base curve provided in the FTA guidance manual was used to determine if nearby sensitive areas have the potential to be impacted by the LRT Alternatives. No adjustments were made to the base curve during the general assessment. The base curve defines that a potential for vibration impact for a Light Rail project could occur within 450 feet for Category 1 land uses, 150 feet for Category 2 land uses, and 100 feet for Category 3 land uses.

There are four additional potential sensitive vibration receivers located in the zoo alignment for alternatives 3 and 4. There are no differences in identified impacted sensitive vibration receivers between the four alternatives.

Vibration Mitigation Plan

No-Build Alternative
No vibration producing activities would occur under the No-Build Alternative, therefore, no vibration mitigation would be required.

TSM Alternative
The TSM Alternative would have no affect on vibration levels in the area. Changes in traffic volumes and bus operations would not change existing vibration levels.

Build (LRT) Alternatives
Light Rail Alternatives 1,2,3 and 4 - During Preliminary Engineering, a Detailed Vibration Analysis will be conducted for each receiver determined to have a potential impact as identified in Table 4.4.8. This Detailed Vibration Analysis will evaluate effective mitigation methods to eliminate or reduce potential noise impact and would be conducted during the final design phase of this project.

Vibration can be kept to a minimum through the use of good maintenance measures which should be implemented all along the track to ensure that vibration due to future LRT operations would remain at acceptable levels. The most significant opportunity for controlling ground-borne vibration and noise from rail transit projects is ongoing maintenance of wheels and rails. Problems with rough wheels and/or rails can increase vibration levels by as much as 10 dB. Specific maintenance measures to control vibration include rail grinding, wheel truing, wheel flat detector systems, and vehicle reconditioning programs.

Table 4.4.8: General Vibration Assessment Results

Site No.	Receiver Site	Screening Distance (feet)	Vibration Impact Level (VdB)	Estimated Project Vibration (VdB)	Potential Vibration Impact
Covington Segment					
C1	Residential Contour 50-100 ft from track	150	72	64	None
Ohio River Crossing Segment					
	No Sensitive Receiver Sites				
Cincinnati Riverfront Segment					
	No Sensitive Receiver Sites				
Downtown Cincinnati Segment					
	No Sensitive Receiver Sites				
Over-The-Rhine Segment					
	No Sensitive Receiver Sites				
Mount Auburn Tunnel					
R0	North of Liberty, surrounding Rothenberg School		72	65	None
6	Rothenberg Elementary School		75	66	None
University of Cincinnati Segment					
9	University of Cincinnati		75	59	None
R2	Between University Ave and Corry St.		72	63	None
R3	Between MLK Drive and University Ave		72	63	None
R5	Between Vine Ave and Eden Ave (250 ft. contour)		72	64	None
11	University Hospital		75	48	None
R8	Van Buren Ave		72	63	None
R9	South of Whittier Street (500 ft. contour)		72	62	None
Zoo Alignment – Alternative 3 & 4					
ZR1	Vine Street		72	57	None
ZR2	Intersection of Vine Street and Erkenbrecher Ave		72	58	None
ZR3	Dury Ave		72	59	None
ZR4	Burnet Ave		72	53	None
Avondale to Norwood Segment					
R13	Between Cleveland Ave and Blair Ave		72	68	None
14	Ashland Avenue Baptist Church		75	55	None
R20	Intersection of Mentor and Ivanhoe Ave (250 ft.)		72	65	None
R21	Between Delaware Ave and Mentor Ave		72	65	None
R25	Between Flofal Ave and Slane Ave		72	61	None
R26	Between Norwood Ave and Harper Ave		72	62	None

Site No.	Receiver Site	Screening Distance (feet)	Vibration Impact Level (VdB)	Estimated Project Vibration (VdB)	Potential Vibration Impact
Norwood to Blue Ash Segment					
19	Multi-Housing		72	56	None
20	Multi-Housing		72	59	None
21	Calvary Baptist Church		75	56	None
23	Multi-Housing		72	55	None
24	Multi-Housing		72	65	None
R32	Lester Rd (250 contour)		72	63	None
R37	Pandora Ave (250 ft. contour)		72	54	None
R41	Between Woodford Rd and S. Woodmont Ave (250)		72	64	None
R43	Intersection of Woodford Rd and Alignment		72	54	None
R44	North Dale Place (south)		72	65	None
R47	Between Queen Crest Ave and Dunloe Ave		72	63	None
R48	Between Hampton Ave and Standish Ave		72	69	None
R51	Elm Street (adjacent to alignment)		72	63	None
R52	Orchard Street		72	69	None
R55	Carnation Ave		72	65	None
R58	Between O'Leary Ave and Hornton Drive		72	71	None
R61	Two blocks north and south or Clifford Rd		72	61	None
R63	Between Kugler Mill Rd and Matson Ave (250')		72	70	None
R67	Between Elizabeth Pl and Kugler Mill Rd		72	63	None
R68	Surrounding Bethlehem United Baptist Church		72	64	None
29	Bethlehem United Baptist Church		75	58	None
Blue Ash Segment					
30	Blue Ash Church of the Nazarene		75	59	None
32	Blue Ash Educational Day Care		75	68	None
R70	Between Alpine Ave and Belleview Ave		72	65	None
R72	Tillsam Ct (East)		72	64	None
R73	Floral Ave		72	61	None
R74	Alma Ave		72	62	None
R75	Intersection of Perry Ave/Highland Rd (south)		72	64	None
R80	Intersection of Northfield Rd/Conklin Rd		72	63	None
R82	Kenwood Ave (between Hagewa and Creek Dr)		72	72	Impact
R83	Kenwood Ave (between Meyerdale and Hagewa Dr)		72	70	None
R86	North of Milford RD		72	64	None
37	Hampton Inn, Holiday Inn		72	56	None

Source: URS, 2000

4.5 ECOLOGY AND HABITAT

For purposes of this Ecology and Habitat section, the I-71 Corridor LRT study area was determined to include 500 feet either side of the proposed alignment, unless otherwise noted. The proposed alignment was defined as the Minimum Operable Segment (MOS) extending from Covington, Kentucky to Blue Ash, Ohio, including approximately 20 stations, a maintenance facility, tunnel portals and tunnel portal construction area. This chapter discusses existing ecological resources in the study area, including upland habitats, wetland and aquatic habitats, plant and animal inventories, and reported occurrences of threatened and endangered species or critical habitats. Regulations are disclosed, followed by existing conditions for each segment of the proposed alignment beginning at the south end of the proposed alignment (Covington) and proceeding north to the proposed Phase 1 terminus (Blue Ash). Following the existing conditions are details regarding the potential impacts and respective mitigation measures to offset the impacts related to the I-71 Corridor LRT Project.

Unlike new development in suburban, rural, or agriculture areas, the proposed project encompasses relatively few natural areas. Former native ecosystems that supported substantial wildlife habitat have been replaced with mostly asphalt and buildings. Wetlands were modified or eliminated; streams have been culverted and channelized. The resultant loss of wetlands and natural areas has allowed untreated stormwater to discharge directly into the Ohio River. While the ability of the corridor to support rare, threatened, or endangered species is minimal, urban environments can support systems that can provide a balanced environment for people, plants, and wildlife.

4.5.1 UPLAND HABITATS

Upland habitats, or cover types, were identified by reviewing aerial photography and follow up field investigation. Vegetative cover type was used as an indicator of habitat potential for plant and animal species. Cover types generally correspond to plant associations and structural habitat components that provide essential life requisites such as food, shelter, and nesting sites. Cover types are identified as landscaped, parkland, forested, riparian, disturbed, rivers and streams, open water, and fields. Descriptions of these cover types are as follows:

Developed – Areas primarily occupied by man-made impervious surfaces, such as downtown urban areas, high-density residential areas, industrialized areas, streets, highways, and parking lots. Areas in this category exhibit little or no vegetation and what vegetated areas exist are typically landscaped or otherwise maintained. Areas in this category offer little or no habitat potential and were not inventoried for the presence of plant or animal species.

Landscaped – Primarily residential areas that encompass significant areas of maintained vegetation. May also include large commercial, institutional, or industrial buildings or complexes with similar characteristics. Areas in this category offer limited habitat potential.

Parkland – Includes parks, golf courses, cemeteries, large institutional campuses, and other areas characterized by open areas of maintained vegetation interspersed with naturalized areas.

Forested – Wooded areas, generally steep slopes or ravines, dominated by deciduous tree cover.

Riparian – Forested or shrub-dominated areas associated with stream channels or the Ohio River shoreline.

Disturbed – Areas undergoing construction activities where all or most of the original vegetation has been removed. Areas in this category offer little or no habitat potential.

Rivers and Streams – This category includes intermittent and perennial stream channels and the Ohio River.

Open Water – Includes ponds and lakes.

Fields – Includes areas occupied primarily by grasses and forbs.

4.5.1.1 Regulations

The majority of the study area is urbanized; however, there are still a number of areas offering habitat for wildlife. Aside from wetlands, there are no regulations for protecting or preserving specific habitats unless there is record of a rare, threatened, or endangered (RTE) species within the habitat or the area is associated with parkland. Regulations concerning RTE species are discussed in Section 4.5.4. Regulations concerning parklands are discussed in Section 3.7.1

4.5.1.2 Historical Resources

Flora

Before European settlement, Ohio was largely occupied by hardwood forests of various types. In the Cincinnati area, the principal historical forest types were mixed hardwood forest. Composition of the historical Mixed Mesophytic Forest was variable throughout its range, depending upon climate and physiography. Southwestern Ohio areas occupied by the Mixed Mespophytic Forest type would most likely have been dominated by various oaks (*Quercus* spp.), white ash (*Fraxinus americana)*, hickories *(Carya* spp.), sugar maple *(Acer saccharum*), and Kentucky coffee-tree *(Gymnocladus dioicus)* (Gordon 1969). The Mixed Mesophytic Forest alternated predominantly with "wet beech" and mesophytic segregates of the Beech Forest. The "wet beech" segregate was composed chiefly of beech (*Fagus grandifolia)* and red maple (*Acer rubrum*) on wetter flats. The mesophytic Beech Forest segregate was dominated almost exclusively by beech, with sugar maple and white ash occasionally represented in the canopy, and sugar maple, white ash, hickories, and black cherry *(Prunus serotina)* as associates in the understory. Herbaceous vegetation would have been sparse, consisting of shade tolerant forest floor species such as spring beauty (*Claytonia virginica)*, toothwort *(Dentaria laciniata)*, May apple *(Podophyllum peltatum)*, and white snakeroot *(Eupatorium urticaefolium*) (Braun 1916).

Fauna

These historical forests provided habitat for many species of mammals, birds, reptiles and amphibians. Early traders and settlers reported an abundance of wild game in Ohio, including deer, bison, bear, and turkey (Gordon 1969). Today, over 50 species of mammals, 400 species of birds and 80 species of reptiles and amphibians may be found in Ohio. Urbanized areas such as the greater Cincinnati metropolitan area generally provide limited habitat opportunities for wildlife. However, many familiar animal species such as white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), gray squirrel (*Sciurus carolinensis*), house sparrow (*Passer domesticus*), common crow (*Corvus brachyrhynchos*), turkey vulture (*Cathartes aura*), American robin (*Turdus migratorius*), European starling (*Sturnus vulgaris*), cardinal (*Cardinalis cardinalis*) red-tailed hawk (*Buteo jamaicensis*); and mourning dove (*Zenaida macroura*) have adapted well to urbanized conditions and these species may commonly be found in all but the most densely built zones of urban and suburban areas, particularly where natural areas are linked by small streams, parks, highway right-of-ways, residential green space and other "corridors" which allow movement between natural areas.

4.5.1.3 Existing Conditions

Although the corridor traverses an urban/suburban environment, there are still a number of areas that may offer upland habitat; however, the type of species inhabiting these areas would be ones that have adapted to such an environment. Existing vegetation communities may be associated with parkland, residential and commercial lawns, or undeveloped areas. They can provide habitat for birds, mammals, reptiles, and amphibians in the Study Area. In addition to these communities, vegetation may exist within the railroad right-of-way; however, this vegetation is expected to be sparse and/or dominated by disturb-tolerant species due to the proximity of the existing tracks, providing minimal wildlife habitat.

Field Investigation and Inventory

Areas having the greatest potential to provide habitat were sampled during the course of a detailed field investigation between September 21 and October 5, 2000. These areas are illustrated on Figure 4.5-1a – Figure 4.5-1c. Sampling in each habitat area consisted of successively inventorying all plant species present in a series of circular sample plots until additional plots yielded no new species for the area. Herbaceous species were recorded in approximately 5-foot radius plots and trees and shrubs were recorded in approximately 30-foot radius plots.

No recent detailed field surveys of animal species in the study area were available. Detailed field investigations include an inventory of animal species observed in the study area. Inventory techniques included direct observation where possible, but also other available indicators, including, but not limited to, vocalizations, tracks, scat, skeletal remains, nests and burrows. Tables 1 and 2 in Appendix 4-2 present the detailed results of the plant and animal inventory for the study area.

Four additional potential upland habitat areas within the Study Area were evaluated in September 2001 – Jackson Hill Park, a small portion of the Cincinnati Zoo, wooded area surrounding Corinthian Baptist Church, and the northwest quadrant of the Williams Avenue/Ivanhoe Avenue Intersection. A species list for each of these areas is located Tables 3-6 in Appendix 4-2.

A brief description of all areas sampled is described below.

Covington Segment

This segment of the proposed alignment is densely urbanized and was classified developed. This cover type offers little or no habitat potential for plant or animal species.

Ohio River Crossing Segment

The Ohio riverfront at the site of the proposed crossing is urbanized and largely developed. However, a narrow shoreline riparian zone exists on both banks illustrated on Figure 4.5-1a.

Access to the Ohio side of the Ohio River shoreline was restricted by the presence of an active sand and gravel operation. This area consists of relatively steep wooded banks, leading down to a sparsely vegetated sandy shoreline with a wide variety of herbaceous plant species. Dominant herbaceous species at the top of slope were characteristic of open fields and waste places; and the wooded slopes were dominated by species characteristic of moist woods and floodplains. Shoreline areas were generally devoid of vegetation, but were sparsely colonized by typical shoreline species.

The corridor also crosses Central Riverfront Park which consists of acres of public space. The park includes walkways, fountains, terraces, and a Great Lawn for staging concerts and events. Land use of this park would not provide substantial upland habitat.

Cincinnati Riverfront Segment

This segment is densely urbanized and was classified as developed. This cover type offers little or no habitat potential for plant or animal species.

Downtown Cincinnati Segment

This segment is densely urbanized and classified as developed. This cover type offers little or no habitat potential for plant or animal species.

Over-the-Rhine Segment

This segment of the proposed alignment is primarily urban residential and was classified developed or landscaped. This type of cover offers little or no habitat potential for plant or animal species.

Mount Auburn Tunnel Segment

Areas offering upland habitat potential in the study area surrounding this segment of the proposed alignment include Jackson Hill Park, Inwood Park and several small wooded areas interspersed with urban residential areas. The locations of these areas are shown on Figure 4.5-1a.

The Jackson Hill Park location is located at Eleanor Place and Dorchester Avenue in Mount Auburn. The park consists of an 8-acre park that has an open picnic area including a fenced children's area and other athletic facilities. Portions of the site have steep relief, consisting of a vertical difference of approximately 160 feet in elevation across the site. The south and southwest facing slopes exhibit exposed bedrock in places. The vegetation of the upslope areas is characterized by shrubs and sparse understory vegetation while the lower slopes exhibit more mature woody vegetation. Open portions of the site were sparsely vegetated owing to the rock outcrop and lack of surficial soils. Table 3 in Appendix 4-2 lists the plants observed and their relative abundance.

Inwood Park is primarily open and mowed, with scattered mature trees and shrub areas around the perimeter. Inwood Park also has a man made pond. Herbaceous vegetation in the park was dominated by typical lawn species including cultivated grasses and common weeds.

The small wooded areas (identified on Figure 4.5-1a with the letter "A") surrounding this segment were either slopes or ravines too steep to support developed uses and were found interspersed, primarily, with urban residential uses. These wooded areas were generally dominated by common trees within an understory of shrubs and herbaceous plants.

University of Cincinnati Segment

The university area is densely urbanized and was classified developed or landscaped. Potential habitat areas east of the university include the Cincinnati Zoo, Levine Park, several wooded areas in the vicinity of Whittier Street and I-71, a portion of Woodward Park, a large wooded tract bordering on the Southwest Ohio Regional Transit Authority (SORTA) right-of-way and Victory Parkway. The locations of these areas are shown on Figure 4.5-1a.

The University of Cincinnati Segment includes the path past the Cincinnati Zoo and Botanical Gardens site along Erkenbrecker Avenue. This segment passes along the southern edge of the zoo property and would include some of the vegetation potentially along both sides of the avenue. Since 1875 the Cincinnati Zoo and Botanical Gardens have occupied this location. Over the years extensive landscaping of the zoo property has included installation of a wide variety of native and exotic vegetation. The site is characterized by both tree and shrub plantings and a manicured lawn as the dominant groundcover. The tree and shrub species have only occasional abundance since there is a wide variety of species present. Table 4 provides a list of the tree and shrub species observed in this location in Appendix 4-2. All of the species present are more or less ornamental vegetation species and are the result of intensive landscaping developments.

Levine park is a landscaped area entirely within the University of Cincinnati east campus on the south side of Sabin Way. The park consists of a concrete plaza and amphitheater with several formal plantings, lighting and benches. It was developed in the early 1980's and serves as a passive outdoor space between the University's medical educational and research buildings to the south and Children's Hospital Medical Center to the north across Sabin Way.

The small wooded areas (identified on Figure 4.5-1a with the letter “B”) in the vicinity of Whittier Street and I-71 also consist of steep wooded slopes along the I-71 right-of-way and a steep wooded ravine, consisting of trees, shrubs, and vines between Whittier Street and Ridgefield Avenue. Herbaceous vegetation was sparse under the tree canopy, but many common old field and weed species were observed on the edges of these areas.

The Corinthian Baptist Church (associated with Area B) portion of the University of Cincinnati Segment is located along Whittier Avenue. Native vegetation consists of land that is located to the north and the east of the existing church property boundary. There are two dominant cover types - woodland and open field, which has been allowed to regrow and is in oldfield succession. The groundcover vegetation in this segment was highly varied and included a number of woodland and oldfield vegetation elements. Table 5 in Appendix 4-2 provides a listing of the overstory, understory shrub and groundcover species observed at the site.

The portion of Woodward Park that falls within the study area is also steep and dominated by trees and shrubs.

The large wooded tract (identified on Figure 4.5-1a with the letter “C”) along the SORTA right-of-way consists of a steep, dry slope dominated by mixed hardwood tree species with an understory of shrubs, vines and herbs. Herbaceous vegetation was sparse in the wooded interior, but a variety of species common to old fields and waste places was observed along the railroad.

Avondale to Norwood Segment

Habitat areas surrounding this segment of the proposed alignment include a portion of Waterworks Park and a large forested tract along the SORTA right-of-way in the vicinity of the railroad yards at Highland Avenue. The locations of these areas are shown on Figure 4.5-1a and Figure 4.5-1b.

Waterworks Park is a small community park located at the intersection of Forest and Harris Avenues, just south of the Norwood Lateral. The portion of the park that falls within the proposed alignment contains ball fields and is primarily mowed fields, with scattered shade trees and a wooded border. Mowed areas were dominated by typical lawn grasses and weeds.

The large wooded tract (identified on Figure 4.5-1b with the letter “D”) along the SORTA right-of-way consists of a steep wooded slope with sparse herbaceous vegetation. Various herbaceous species characteristic of old fields and waste places were observed at the edges of this area.

The northwest quadrant of the Williams Avenue/Ivanhoe Avenue intersection is an irregularly shaped parcel of land that surrounds a residence. The land is essentially flat and is covered by mature tree species. The lands immediately surrounding the residence have been landscaped and the ground cover in this location consists of a mowed lawn. Table 6 in Appendix 4-2 provides a listing of the overstory tree, understory shrub and groundcover species observed at the site.

Norwood to Blue Ash Segment

The study area surrounding this segment of the proposed alignment contains several substantial potential habitat areas, including Kennedy Heights Park, Chamberlain Park, Woodford Park, two large wooded tracts, several smaller wooded areas. The locations of these areas are shown on Figure 4.5-1b and Figure 4.5-1c. Each area is described below proceeding south to north.

The small wooded tract (identified on Figure 4.5-1b with the letter “E”) at Lester and Delmar Avenues is a steep wooded slope with an understory of shrubs, vines and herbs.

The southernmost large wooded tract (identified on Figure 4.5-1b with the letter “F”) along the SORTA right-of-way begins at Acomb Avenue near its intersection with Ridge Avenue and extends north to Woodford Park at the intersection of Robison and Woodford Roads. This area is a steep ravine with an intermittent stream at the bottom. Slopes are wooded with an herbaceous understory.

Kennedy Heights Park and nearby Woodford Park consist of mowed fields and wooded areas.

The second large wooded tract (identified on Figure 4.5-1b with the letter “G”) along the SORTA right-of-way begins just north of Kennedy Heights Park and extends northward to Coleridge and Dunloe Avenues. This area consists of steep wooded slopes.

Several small wooded areas (identified on Figure 4.5-1b and Figure 4.5-1c with the letter “H”) are located along the SORTA right-of-way in the vicinity of Red Bank Road and Odin Avenue. These areas are interspersed with surrounding residential development. The overstory was dominated by a mixture mature of hardwoods.

Chamberlain Park is a small community park located at Blue Ash Avenue and Duneden Avenue in Deer Park. The park contains ball fields and isolated shade trees. Mowed areas contained typical lawn grasses and weeds.

Blue Ash Segment

The study area surrounding this segment of the proposed alignment contains several small wooded areas. The locations of these areas are shown on Figure 4.5-1c. The areas are described below proceeding south to north.

The first area (identified on Figure 4.5-1c with the letter "I") is located along the SORTA right-of-way behind Crown Services Inc. off Alliance Road in the vicinity of the Blue Ash Airport. A small intermittent stream runs parallel to the railroad tracks through this area. A variety of plant species characteristic of old fields and waste places were observed at the edges of this area.

The second area (identified on Figure 4.5-1c with the letter "J") in this segment is a wooded stream corridor located approximately ¼-mile to the north along Alliance Road where an unnamed tributary to the North Branch of Sycamore Creek crosses under the existing SORTA right-of-way via a small bridge. The stream runs through a concrete channel on the west side of the existing tracks, but the corridor is natural and wooded to the east.

A steep wooded stream corridor (identified on Figure 4.5-1c with the letter "K") is located in the vicinity of the Reed Corporate Center along Reed Hartman Highway between Creek and Cornell Roads. The stream crosses under Reed Hartman Highway and the proposed alignment at two locations, via underground culverts. The wooded corridor in this area is dominated by a mixture of hardwoods with a shrubby and herbaceous understory.

A small wooded corridor (identified on Figure 4.5-1c with the letter "L"), not associated with a stream, is located off Grooms Road at the current location of the Brown-Campbell Company warehouse. This corridor is dominated by mixed hardwoods.

4.5.1.4 Impacts and Mitigation

No Build

All road projects listed below have been completed; thus, there would be no impacts to upland habitat under the No-Build Alternative.

- Adding two lanes on I-71 between I-275 and State Route 48
- Reconstructing /alignment of Fort Washington Way (I-71)
- Adding one southbound lane on I-71/75 between Dixie Highway and Kyles Lane
- Adding one eastbound lane on U.S. 62 (Montgomery Road) between Kenwood Road and I-71 and adding one travel lane on U.S. 22 in each direction eastwardly from I-71 to Hosbrook Road

TSM

The locations of the proposed transit centers have not been identified; therefore, no impacts can be measured.

Build (LRT) Alternatives

In general, for all four build alternatives, station construction and track installation and/or realignment will have little to no impact to wildlife habitat within the construction limits since the plants are generally sparse and/or dominated by disturb-tolerant species. Typical clearing, grading, and excavation activities within each segment is required in order to install the track. Any vegetation within 20 feet of the corridor's centerline would need to be removed for staging and/or construction purposes. Removal of vegetation of this nature would not have substantial impact to wildlife habitat because it is generally of low quality and offers minimal habitat value.

For Alternatives 1 and 2 that follow the south option in the University of Cincinnati segment, there would be clearing of vegetation on the I-71 embankment in order to install track. There is little to no upland habitat associated with the embankment, therefore no adverse impacts are anticipated. Post construction activities, landscape design would include planting native trees and shrubs to improve potential urban wildlife habitat.

For Alternatives 3 and 4 that follow the north option in the University of Cincinnati segment, Levine Park would be completely reconstructed to accommodate the development of the Medical Center station. Additionally, Area B would have some woody vegetation cleared in order to install track. There is little to no upland habitat within these areas; therefore, no adverse impacts are anticipated. The proposed landscape design would include planting native trees and shrubs to improve potential habitat for urban wildlife.

Ground photos of the proposed station locations were reviewed do determine potential impacts to upland habitat. The majority of the sites are located in areas where the cover type is 100 percent impervious. Construction of stations within these areas would not result in loss of upland habitat. In areas where there is open and/or undeveloped land, station construction would require clearing of vegetation. Most of this vegetation consists of mowed bluegrass. There are a few sites, such as at 12th Street, where there is some surrounding woodland vegetation. A portion or all of the woodland may be removed. This would not cause a substantial loss of upland habitat only be a small percent of this habitat available in the Study Area would be removed. Additionally, where appropriate, landscape design would include planting native trees and shrubs to accommodate any loss of vegetation, and potentially improve wildlife habitat for urban species.

4.5.2 OHIO RIVER AND STREAM HABITAT

The proposed alignment crosses or runs parallel to six streams/drainageways and the Ohio River (see Figure 4.5-2a though Figure 4.5-2c). Habitat within the Ohio River and the streams or drainageways is degraded due to the surrounding urban setting. Results of sampling conducted in the Ohio River and in Catulpa Creek are included in Table 7- Table 12 in Appendix 4-2.

4.5.2.1 Regulations

There are no regulations that pertain specifically to river and stream habitat. However there are regulations pertaining to water quality (discussed in Section 4.6.2.1).

4.5.2.2 Historic Resources

Before the 1750s, Ohio’s rivers and streams were dominated by fish, molluskan, and invertebrate communities that preferred clean silt-free water and coarse substrates (Trautman 1981). The abundance of forests, wetlands, and natural vegetation that maintained these conditions slowly gave way to agriculture as farming practices became more widespread and mechanized. Farming interests cleared forests, drained fields and wetlands; and dredged, cleared, and channelized streams in order to increase the arable acreage of the land. These practices had a significant impact on hydrologic conditions; resulting in a lower water table, lower stream flows, and increased sedimentation. As a result, fish and molluscan communities have generally evolved from communities requiring clean water and silt-free substrates to communities tolerant of turbid waters and fine substrates (Trautman 1981).

Industrialization and accompanying human population increases beginning in the early 1900s also increased pollutant loads to streams and rivers. Untreated sanitary wastes, fertilizers, detergents, pesticides, and other toxic chemical discharges contributed to water quality degradation along with aquatic habitat alterations and sedimentation. Construction and upgrade of domestic and industrial wastewater treatment plants to meet in the early 1970s have resulted in significant water quality improvements in the past two decades. However, urbanization, nonpoint source discharges, and point sources continue to impact water quality and aquatic communities in the proposed project area.

4.5.2.3 Existing Conditions

Six streams and/or drainageways parallel or cross the corridor within the Norwood to Blue Ash and Blue Ash segments (see Figure 4.5-2b and Figure 4.5-2c). The Ohio River, illustrated on Figure 4.5-2a, is the only river the proposed I-71 Corridor LRT alignment would cross. There are no rivers, streams, or drainageways that cross the proposed I-71 Corridor LRT alignment within the Covington, Cincinnati Riverfront, Downtown Cincinnati, Over-the-Rhine, Mount Auburn Tunnel, University of Cincinnati, Avondale to Norwood Segments.

Ohio River Crossing Segment

The proposed Ohio River crossing is located at river mile (RM) 471. A data request was submitted to the Ohio River Valley Water Sanitation Commission (ORSANCO) in Cincinnati, Ohio for information on both fish and macroinvertebrate species collected in the vicinity of the proposed Ohio River crossing. Table 7 - Table 11 in Appendix 4-2 present surveys conducted on the Ohio River from 1957 to 1997. The location of the survey is indicated by the river miles (RM). The closest available data for fish species collected by ORSANCO is upstream of the proposed crossing for RM 463 and 463.3. Table 3 in Appendix 4-2 contains a species list of fish collected by ORSANCO from this area during the period from 1993 to 1997. Generally the species reported inhabiting the area are indicative of a highly degraded river habitat.

Norwood to Blue Ash Segment

Drainageway #1
The existing drainageway flows parallel along the eastern side of the track. The native vegetation in this area is common of the Kennedy Heights Park area, which is described in Section 4.5.1.3. This drainageway, which is in the vicinity of Robinson and Woodford Road near Kennedy Heights Park, has been rerouted and is currently placed into underground culverts in the vicinity of the rail crossing location.

Blue Ash Segment

There are five intermittent streams and/or drainageways that flow through or parallel this portion of the corridor as illustrated in Figure 4.5-2c. Stream and drainageway crossings #2, #5, and #6 occur via underground culverts. Drainage flows under a bridge at crossing #3. Drainageway #4 parallels the existing tracks.

Drainageway #2
This unnamed stream passes under the railroad right-of-way through a culvert. Woody shrubby vegetation is located along and within the existing rail right-of-way. To the west of the proposed alignment at this crossing, the land consists of residential lawns. The channel consists of a grassy shallow “u” shaped area.

Drainageway #3
This stream, known as Catulpa Creek, flows east to the North Branch of Sycamore Creek, which in turn flows southeast to join Sycamore Creek and the Little Miami River in Remington, Ohio. The stream flows through a concrete lined channel to the west of the SORTA right-of-way, but through a natural wooded corridor to the east of the right-of-way. No flow was observed during the September 2001 site evaluation. Both the north and south banks of the concrete lined channel are mowed and lack any significant riparian vegetation. The existing railroad crosses the stream via a bridge. The eastern channel remains in a fairly natural condition with a series of pool-riffle complexes. The channel is roughly 10 feet wide and characterized by a riparian corridor approximately 15 feet wide consisting of both mature trees and shrubs, with little herbaceous vegetation. Land use beyond the riparian corridor includes both industrial and residential property. Dominant substrates within the natural portion of the stream include primarily gravel and sand, with smaller amounts of cobble, silt, and detritus. Instream cover in this stream is limited primarily to logs and various woody debris. An aquatic survey of this stream was completed on September 21, 2000. The results of the biological and water quality survey are presented in Tables 12 and 13 in Appendix 4-2.

Drainageway #4
The majority of the area was identified as upland habitat; however, an organized drainageway in this area parallels the rail road embankment on the west. At the time of the September 2001 site evaluation, no hydrology was observed. This area is an old field successional area, that has been subject to past disturbance in the form of possible earthwork (i.e., grading, soil removal) and occasional deposition of construction debris. Commercial/industrial sites are adjacent to the rail road right-of-way in this area. To the east of the existing track is a very narrow strip of fencerow type upland vegetation. At the northern end of this area on the east side of the track, the land abuts residential lawn. In the area to the west of the existing track, the land is oldfield and wooded. Portions of the land have been used for soil storage and dumping of various debris.

Drainageway #5
At the time of the 2001 site evaluation, this area was dry. The drainageway is intermittent and is only anticipated flow during storm events. West of the proposed corridor and east of the adjacent Reed Hartman Highway, the land has been graded and a sediment basin has been installed. The area has been seed with turf grass to cut down the erosion and possible siltation to the sediment basin. Land cover to the east of the proposed corridor consists pasture grasses. Aquatic habitat would be minimal here due to the lack of hydrology and altered landscape

Drainageway #6
At the time of the site evaluation no flow was observed. Presumably during rainy periods water does flow through this drainageway. The slopes surrounding the drainageway are not mowed like the surrounding land; vegetation consists of a mixture of riparian and upland plants including herbaceous, shrub and small tree species. The watershed that drains into this area consists of impervious surfaces of Perspectivas Park, Crossland Economy Studios, Blue Ash Corporate Center and the northwestern portion of the Blue Ash Distribution Center parking lots. Aquatic habitat would be minimal here due to the polluted drainage.

4.5.2.4 Impacts and Mitigation

No Build

All road projects, listed below, have been completed; thus, there would be no impacts to river or stream habitat under the No-Build Alternative.

- Adding two lanes on I-71 between I-275 and State Route 48
- Reconstructing /alignment of Fort Washington Way (I-71)
- Adding one southbound lane on I-71/75 between Dixie Highway and Kyles Lane
- Adding one eastbound lane on U.S. 62 (Montgomery Road) between Kenwood Road and I-71 and adding one travel lane on U.S. 22 in each direction eastwardly from I-71 to Hosbrook Road

TSM

The locations of the proposed transit centers have not been identified; therefore, no impacts can be measured

Build (LRT) Alternative

Proposed construction of a new bridge over the Ohio River, reconstruction of the bridge over Catulpa Creek (Crossing #3), and culvert extension at Crossings #2, #5 and #6 are included in all four alternatives.

Habitat within the Ohio River would have temporary impacts due to construction activities. Specifically, grading and installation of bridge abutments and pilings may increase sediment loads to the river. Best management practices will be used to minimize impacts, such as, installation of silt fences, installation of coffer dams for piling construction, and prompt revegetation of slopes once construction is complete.

Impacts such as sedimentation would also occur with the reconstruction of the bridge at Crossing #3 and extension of the culverts at Crossings #2, #5 and #6. Best management practices will be used to minimize impacts, including installation of silt fences and prompt revegetation once construction is complete.

4.5.3 WETLANDS

National Wetland Inventory (NWI) maps produced by the U.S. Fish & Wildlife Service (USFWS) were reviewed to identify potential wetland areas present within 200 feet on either side of the proposed alignment. NWI maps are produced using stereoscopic analysis of satellite photography and are generally not field verified. While they are useful as a screening tool, they cannot be relied upon exclusively to determine the presence or absence of wetlands at a particular site. On-site field review was conducted in September 2001 to verify this recorded information and to identify any other existing wetland resources.

4.5.3.1 Regulations

Wetlands are regulated as waters of the U.S. under the Clean Water Act (CWA). Section 404 of the CWA requires a permit to be issued by the U.S. Army Corps of Engineer (USACOE) (or a delegated state) prior to the placement of any dredged or fill material into any waters of the United States, including wetlands. Section 401 of the CWA requires the affected state to issue a water quality certification, or a waiver, for each Section 404 permit.

In general, for wetland impacts that cannot be avoided a USACOE Permit (Nationwide or otherwise) and mitigation of at least a 2:1 ratio is required. For small impacts, mitigation may not be necessary unless the project is impacting a particularly ecologically or politically sensitive wetland area. Permitting would then consist of a Letter of Notification or a Pre Construction Notification to the USACOE that a proposed action is intended for a particular site. A written confirmation of concurrence from the USACOE that wetland impacts do not require any mitigation should be obtained prior to construction activities.

4.5.3.2 Existing Conditions

National Wetland Inventory

Much of the study area is urbanized, providing limited potential for the existence of wetlands. The NWI map covering the study area showed one small palustrine emergent wetland (PEMFx) area located within the Blue Ash segment. This area is located off Alliance Road in the vicinity of the Blue Ash Airport. This wetland area is identified on the map as having been excavated, with a semi-permanently flooded water regime. Additionally, the NWI map shows several small ponds (PUBGx) within or close to the proposed alignment, also in the vicinity of the Blue Ash Airport.

Field Investigation

On-site investigation was conducted September 2001. The locations of the PEMFx and PUBGx wetlands illustrated on the NWI were determined to be outside the Study Area. No further assessment was necessary for these areas. Six areas were investigated for wetland characteristics. Table 14 in Appendix 4-2 presents a list of plant species identified . Drainageway #6 was the only area that satisfied all three wetland parameters.

4.5.3.3 Impacts and Mitigation

No Build

All road projects, listed below, have been completed; thus, there would be no impacts to wetlands under the No-Build Alternative.

- Adding two lanes on I-71 between I-275 and State Route 48
- Reconstructing /alignment of Fort Washington Way (I-71)
- Adding one southbound lane on I-71/75 between Dixie Highway and Kyles Lane
- Adding one eastbound lane on U.S. 62 (Montgomery Road) between Kenwood Road and I-71 and adding one travel lane on U.S. 22 in each direction eastwardly from I-71 to Hosbrook Road

TSM

The locations of the proposed transit centers have not been identified; therefore, no impact analysis can be discussed.

Build (LRT) Alternative

The existing wetland at Drainageway #6 is within the construction limits of all four build alternatives. In order to install new track, the rail bed would need to be widened; this would require extending the existing culvert that Drainageway #6 flows through. There would be temporary wetland impacts as a result of this activity. The existing railway currently crosses the drainageway; therefore, avoiding the wetland is not feasible since proposed activities intend to follow the rail right-of-way. Impacts would be minimized by increasing the side slopes. During the final design, coordination with USACOE will determine if replacing any wetland losses is necessary. Nationwide permits are being re-evaluated at this time, so potential wetland replacement will depend on what has been approved at the time of application submittal.

4.5.4 RARE, THREATENED, AND ENDANGERED SPECIES

4.5.4.1 Regulations

Section 7 of the Endangered Species act (ESA) requires all federal agencies to consider and avoid, if possible, adverse impacts to federally listed threatened or endangered flora or fauna or their critical habitats resulting from their direct, regulatory, or funding actions. The U.S. Fish and Wildlife Service is responsible for compiling and maintaining the federal list of threatened and endangered species. Section 9 of the ESA also prohibits the "taking" of any federally listed species by any person without prior authorization. The term "taking" is broadly defined at the federal level and explicitly extends to any habitat modifications that may significantly impair the ability of that species to feed, reproduce, or otherwise survive.

Ohio and Kentucky also have state laws directing their respective natural resource agencies to compile and maintain lists of species that are rare, threatened or endangered at the state level, and prohibits their "taking". However, the term "taking" is defined more narrowly at the state level by both states. In the case of animals, the term is limited to physical harm or possession of the animal itself, and neither state restricts the right of private property owners to remove rare, threatened, or endangered plants from their own property.

There are no specific state regulations in either Ohio or Kentucky on elements with no federal or state status (i.e., potentially threatened, special concern); however, these elements are viewed as rare or unique and should be avoided if possible.

4.5.4.2 Existing Conditions

Available information regarding reported or potential occurrences of rare, threatened and endangered (T&E) species or critical habitats in the study area was obtained in August of 2000 from the following state and federal resource agencies.

- U.S. Fish & Wildlife Service (USFWS) Reynoldsburg, Ohio and Cookeville, Tennessee Field Offices
- U.S. Army Corps of Engineers (USACOE), Louisville District
- Ohio Department of Natural Resources (ODNR), Division of Natural Areas and Preserves
- Ohio Department of Natural Resources (ODNR), Division of Wildlife
- Kentucky State Natural Preserves Commission (KSNPC)

A ½-mile radius search area was selected for reported occurrences of T&E species. Reported information also includes occurrences of potentially threatened species and species designated of special interest or concern to state resource agencies. Copies of interagency correspondence are included as Appendix 4-3.

Federal List

The USACOE did not report any occurrences of threatened or endangered species in the vicinity of the proposed Ohio River crossing or elsewhere in the study area.

The USFWS reports that the study area falls within the range of the following federally listed T&E species. Preferred habitat characteristics for each of these species are described below.

- Indiana Bat (*Myotis sodalis*), federally endangered
- Bald Eagle (*Haliaeetus leucocephalus*), federally threatened
- Running buffalo clover (*Trifolium stoloniferum*) federally endangered.

Indiana bats hibernate during the winter months in caves and abandoned mines, often in large colonies. Summer habitat requirements are not well defined, but this species is thought to prefer habitats offering large diameter dead or live trees with exfoliating bark that provide roosting sites. They are also thought to prefer habitats located along streams or otherwise near water. Indiana bats feed on a variety of aquatic and terrestrial flying insects. Their habit of hibernating together in large numbers in only a few caves makes them vulnerable to human disturbance and catastrophic events. The are no caves located in the proposed construction limits of the LRT alignment; therefore, these bats are not expected to be inhabiting the area..

The Bald Eagle prefers mature conifer forests located near water. They feed largely on fish and require tall trees, preferably conifers, for nesting sites. Bioaccumulative effects of the pesticide DDT reduced the species to near extinction in the 1960s. The bald eagle has recovered remarkably since DDT was banned in the early 1970s. The eagle was recently upgraded from federally endangered to threatened status in 1994. Habitat alteration, illegal shootings, lead poisoning, and power line collisions still pose threats to the species. It is unlikely that the eagle would be inhabiting the area since habitat for this species not located within the construction limits.

Running buffalo clover historically thrived in forest and prairie clearings with rich, mesic soils. Today it may be found in forest clearings, pastures, regularly mowed areas and other disturbed areas with mesic soils and which receive filtered light. The species historically relied on grazing bison herds to disperse seed and maintain the particular habitat conditions it prefers, and its decline is believed to be linked to the disappearance of bison from the Midwest. It is distinguished from the more common white clover primarily by habitat and leaf shape. Although "mowed areas" are within the proposed construction limits, theses areas are most likely maintained for turf and are controlled for broadleaf species; therefore, the running buffalo clover is not expected to be found within the construction limits.

State List

ODNR and KSNPC provided information from their respective Natural Heritage Program databases. Unpublished aquatic survey data provided by the Ohio EPA and the ORSANCO were also reviewed. Table 15 in Appendix 4-2 summarizes the current state status of the thirty-seven RTE species that have been observed within or near the Study Area. Twenty-seven of these species are not expected to be inhabiting the site; the DNR has described their record as "historical" (meaning greater than 25 years old) or the KSNPC has considered the species as "extirpated from the site". The remaining ten species have current records – four fish species, four plant species, Kirtlands's snake, and the six banded longhorn beetle.

<u>*Terrestrial Species*</u>
Kirtland's snake (state threatened) and three plant species - few flowered tick trefoil (state potentially threatened), Carolina ruellia (state potentially threatened), and southern blackhaw (state potentially

threatened) were reported more than a mile from the proposed corridor. Kirtland's snake prefers open damp habitats, such as marsh edges, wet fields and pastures, and along creeks, canals, sluggish ponds and ditches. This type of habitat is limited within the construction limits of the LRT corridor. Although the corridor crosses or parallels a number of creeks, they are intermittent and most likely would not support habitat for the snake. The plant species habitat may exist within the Study Area - rich, moist, dry, and rocky woods or river banks, however most likely not within the construction limits. Most of the cover type within the construction limits is either 100 percent impervious or sparsely vegetated and therefore these plant species are not expected to occur in the Study Area. The remaining plant – smooth buttonweed (state potentaill threatened) – prefers habitat of swamps and wet ground, which is not found within the Study Area. The beetle's reported location was in a climax hardwood forest habitat in the Covington vicinity. The Covington segment does not encompass this type of habitat.

Aquatic Species
ORSANCO supplied lists of both fish and macroinvertebrate species that have been collected from the Ohio River in the Markland Pool, which encompasses the proposed Ohio River LRT crossing location. This list includes state reported occurrences of various fish and mussel species in the Ohio River, most notably in the vicinity of its confluence with the Licking River, approximately ¾-mile upstream of the proposed crossing location. The species include mooneye (special concern), river redhorse (special concern), channel darter (state endangered), and river darter (state threatened). All four records are within two miles from the proposed Ohio River crossing. ORSANCO also reported occurrences of these species during their sampling activities in the vicinity of the proposed crossing in the 1990s. These species are likely to be inhabiting the area today.

4.5.4.3 Impacts and Mitigation

No Build

All road projects, listed below, have been completed; thus, there would be no impacts to upland habitat under the No-Build Alternative.

- Adding two lanes on I-71 between I-275 and State Route 48
- Reconstructing /alignment of Fort Washington Way (I-71)
- Adding one southbound lane on I-71/75 between Dixie Highway and Kyles Lane
- Adding one eastbound lane on U.S. 62 (Montgomery Road) between Kenwood Road and I-71 and adding one travel lane on U.S. 22 in each direction eastwardly from I-71 to Hosbrook Road

TSM

The locations of the proposed transit centers have not been identified; therefore, no impact analysis can be discussed.

Build (LRT) Alternative

For all four build alternatives, no impacts to terrestrial species are anticipated. The existing habitat within the construction limits is would not support any of the terrestrial species as described under Existing Conditions.

For the aquatic species, potential impacts would be related to bridge construction on the Ohio River. Specifically impacts may occur due to erosion and sedimentation within the river channel. Minimization of potential impacts will be implemented through best management practices such as construction timing restrictions (no construction during spawning) and erosion/sedimentation control.

Prior to construction activities, coordination with Kentucky DNR would be necessary for further information regarding protection of the state listed fish species or any critical areas that may be impacted under new bridge construction[1].

4.6 WATER QUALITY AND FLOODPLAINS

For purposes of the Water Quality and Floodplains review, the I-71 Corridor LRT study area was determined to include 500 feet either side of the proposed alignment. The proposed alignment was defined as the MOS extending from Covington, Kentucky to Blue Ash, Ohio, including approximately 20 station locations, a maintenance facility, tunnel portals and tunnel portal construction area. This section discusses water resources within the study area, including navigable waterways and water quality.

4.6.1 GENERAL DESCRIPTION OF OHIO RIVER BASIN

Principal lakes, rivers, and streams influencing drainage in the proposed alignment and vicinity were identified primarily from U.S. Geological Survey (USGS) quadrangles and the *Gazetteer of Ohio Streams*, published by the ODNR.

The entire study area falls within the Ohio River Basin. The proposed crossing of the river is located approximately half way between the beginning and end of the river. Most of the Ohio River Valley is relatively narrow and geologically young, having been formed when glaciers diverted pre-existing rivers during the Pleistocene Epoch, which ended about 10,000 years ago. The Ohio River is navigable throughout its length. A navigation channel 9 feet deep is maintained throughout the river's entire course through a series of locks and dams. Instream and riparian habitats along the river have been modified substantially by navigation works, flood-control walls and levees, agriculture, and industrial and urban development.

The typical navigable vessels utilizing the Ohio River include commercial barges, other small commercial vessels, excursion boats, and private recreational boats. Based on the 1999 lock usage data, collected by the USACOE, a total of 5,327 and 4,752 vessels passed the main portion of the Captain Anthony Meldahl and Markland locks, respectively. These vessels were likely commercial barges based on their use of the main locks. According to the same data, 6,967 and 5,243 vessels passed the auxiliary portion of these locks, likely indicating small commercial vessels, excursion boats or private recreational boats. The proposed LRT bridge over the Ohio River is situated between these two locks and thus will likely experience similar volumes. Based on the 1997 freight traffic, a total of 12,879,000 short tons were transported between mile 465 and 491, the segment on which the proposed LRT bridge will be located.

4.6.2 SURFACE WATER QUALITY IN STUDY AREA

The primary receiving waters in the study area are presented in Figure 4.6-1 and are discussed within this section.

[1] Personal communication: with Wayne Davis, Kentucky Department of Fish and Wildlife, November 2001.

4.6.2.1 Regulations

Federal Regulations

Navigable waters of the U.S. have historically been regulated by the USACOE under the Rivers and Harbors Act of 1899 (RHA). Section 9 and Section 10 of the RHA establish the Corps' basic authority to regulate construction, filling, dumping, channelization and other activities in the waters, laying seaward of mean high tide elevation and subject or potentially subject to commercial navigation. The USACOE will review the Draft Environmental Impact Statement (DEIS) and provide comments. Permits will be obtained from the USACOE prior to the start of construction.

The General Bridge Act of 1946 requires the location and plans for bridges over navigable waters of the United States be approved by the U.S. Coast Guard (USCG) prior to commencing construction. The USCG is a cooperating agency and has authority to make decisions related to bridge construction, such as determination of navigational clearances and the location of river piers. The USCG will review the DEIS and provide comments. Permits will be obtained from the USCG prior to the start of construction.

The Wild and Scenic Rivers Act of 1968 creates a process for designating rivers or river segments with "outstandingly remarkable" scenic, recreation, geologic, fish & wildlife, historic, cultural or other values and affording them protection from dams and other water development projects undertaken directly, regulated, or funded by federal agencies. Ohio and Kentucky also have parallel programs for designating and protecting wild and scenic rivers at the state level. These programs generally require review of development projects proposed within the protected river corridor for conformance with an overall river management plan.

In 1972, the CWA was passed to address the growing problem of water pollution. The CWA equated the terms "navigable waters" and "water of the U.S.", ultimately expanding federal jurisdiction in matters regulated by the CWA to virtually all water bodies regardless of geographic position or actual navigability. Any potential impacts to streams would be reviewed by the appropriate agencies, and permits would be obtained prior to the start of construction.

State and Local Regulations

Water quality regulations within Kentucky are administered by the Kentucky Natural Resources and Environmental Protection Cabinet (NREPC), www.nr.state.ky.us. The NREPC, Division of Water regulates water quality. As part of the National Pollutant Discharge Elimination System (NPDES), completion of and compliance with the Kentucky Pollution Discharge Elimination System permit is required for storm water runoff associated with industrial activities (including construction activities). Local (County and municipal) regulations cover erosion control and storm water retention practices. These permits would be obtained prior to the start of construction.

Water quality in the Ohio River and direct discharge to the Ohio River is monitored, documented and regulated by ORSANCO, www.orsanco.org, an interstate compact composed of the states within the Ohio River drainage basin and the U.S. EPA. Water quality standards are implemented primarily through National NPDES permits issued to dischargers by the member states. All facilities discharging to the Ohio River which are subject to regulation under the NPDES are subject to the ORSANCO Pollution Control Standards. These permits would be obtained prior to the start of construction.

Water quality regulations within Ohio are administered by the Ohio EPA, www.epa.state.oh.us. The Ohio EPA Division of Surface Water regulates water quality. As part of the NPDES, completion of and compliance with the Ohio NPDES permit is required for storm water discharges associated with construction activity. For the proposed yard and shop facilities, located within the Avondale to Norwood Segment, an additional NPDES permit will likely be required for storm water and/or wastewater discharges associated with industrial activity. Local regulations (County and municipal) cover erosion control and storm water retention practices. These permits would be obtained prior to the start of construction.

4.6.2.2 Existing Conditions

The Ohio River is the primary receiving water in the study area. Principal Ohio River tributaries influencing drainage include Mill Creek to the west, the Little Miami River to the east, and the Licking River near the south terminus in the Kentucky portion of the study area. These streams and their principal named tributaries draining the study area are listed below and presented in Figure 4.6-1.

Ohio River

- Mill Creek (Ross Run and Sharon Creek)
- Licking River
- Little Miami River (Duck Creek and Sycamore Creek)

Surface water patterns are well established within the project corridor. The proposed LRT alignment will traverse these three separate drainage basins. Figure 4.5-2a – Figure 4.5-2c show that the corridor crosses or is adjacent to the Ohio River and various intermittent streams and drainage ways.

Ohio River

The proposed Ohio River crossing would occur just east of the Clay Wade Bailey Bridge, at approximately Ohio River Mile 471, which is located in the Markland Pool formed by the Markland Locks & Dam downstream in Markland, Indiana. The average depth of the Ohio River in the area of the proposed crossing is about 26 feet with a flood stage of 52 feet. Normal pool elevation is 454.3 feet above mean sea level (amsl). Ordinary high water is at 467.4 feet amsl. At the location of the crossing, the Ohio River is not classified as a Wild and Scenic River.

The 1998-1999 *Biennial Assessment of Ohio River Water Quality Conditions* (July 2000) published by ORSANCO concluded that water quality standards for aquatic life were being fully attained throughout approximately 881 miles (90 percent) of the river main stem, which includes the proposed Ohio River crossing. Standards associated with public water supply use were fully met in 977 miles (99.6 percent) of the river main stem. “Restricted consumption” fish advisories are in effect for the river in all member states, resulting in only partial attainment of fish consumption standards throughout the entire 981 miles (100 percent) of the main stem. Contaminants of concern include PCBs, mercury, and dioxins.

Mill Creek

Mill Creek joins the Ohio River approximately 1.5 miles downstream of the study area at RM 472.5. It is 28 miles long with a drainage area of approximately 106 square miles. Average gradient is 11.9 feet per mile. Mill Creek and its tributaries flow largely through the urbanized greater Cincinnati area. Ross Run begins in Norwood and flows northwest, joining Mill Creek in the small community of Winton Place. Sharon Creek begins near Pisgah in Butler County, Ohio and flows southwest through Sharon Woods Park and Sharonville to join Mill Creek near the intersection of Glendale Milford and Reading Roads.

Generally, the overall picture of Mill Creek's water quality is one of conditions unfavorable to the maintenance of desirable stream ecology. Dissolved oxygen (DO) values are low, and anaerobic conditions are common. In addition, there are proliferations of green and blue-green algae in static pool situations. These conditions infer that the stream is heavily impacted by nutrient loadings and contains an excessive amount of decomposable organic material (USACOE District 1974).

Little Miami River

The Little Miami River joins the Ohio River at RM 463.5 approximately 7.5 miles upstream of the proposed crossing location. The Little Miami River is approximately 105 miles long and is a designated National and State Wild and Scenic River for most of its length. It is also the longest stream segment designated as Exceptional Warmwater Habitat (EWH) in Ohio and is well known for supporting an ecologically diverse aquatic community, including several threatened and endangered species of fish and mollusks. The Little Miami River watershed also contains several significant archaeological sites including Fort Ancient, a well-known Moundbuilders site, located near Lebanon, Ohio. The Little Miami River main stem is not located in the study area, but several unnamed tributaries to Duck Creek and Sycamore Creek, both principal Little Miami tributaries are located in the study area. Duck Creek joins the Little Miami approximately 3 miles upstream of its confluence with the Ohio River just north of the Lunken Field Airport. Sycamore Creek joins the Little Miami east of Blue Ash at Loveland, Ohio.

In 1993, Ohio EPA sampled water quality in the Little Miami River and several of its tributaries including Sycamore Creek. (Ohio EPA 1995). The Ohio EPA study covered the first 30 miles of the river's length, roughly from the Ohio River north to Muddy Creek and the City of Kings Mills. For the river miles addressed in this study, the Little Miami has an EWH aquatic life use designation. The EWH use designation is assigned to waters that support "unusual and exceptional assemblages of aquatic organisms, which are characterized by a high diversity of species, particularly those that are highly intolerant and/or rare, threatened, endangered, or special status."

Licking River

The Licking River joins the Ohio River approximately 1 mile upstream of the study area at RM 470.2. It is approximately 320 miles long with a drainage area of approximately 3,600 square miles or about 10 percent of the entire state of Kentucky. It begins in the Allegheny highlands of Magoffin County and drains a diverse watershed encompassing forests, farmland, and the urbanized areas of Newport and Covington, Kentucky. No major tributaries to the Licking River are located within the study area or vicinity.

The Licking River and the smaller streams in the region drain a diverse watershed, with forested hills in the upper reaches, rolling farmland along the middle regions and urban/industrial development near the confluence with the Ohio River in Northern Kentucky. The Licking River begins in the highlands of the Allegheny Plateau in Magoffin County. The river flows northwest through the Eastern Bluegrass for about 300 miles before emptying in to the Ohio River between Newport and Covington. The two principal tributaries are the North Fork, which joins the main stem of the river near Milford, and the South Fork, which joins at Falmouth.

Drainageways

There are five intermittent drainageways that flow through or parallel this portion of the corridor as illustrated in Figure 5.5-2c. Drainageway crossings #2, #5, and #6 occur via underground culverts. Drainage flows under a bridge at crossing #3. Drainageway #1 and #4 parallel the existing tracks but do not cross.

Drainageway #1
This drainageway flows parallel along the eastern side of the track. The native vegetation in this area is common of the Kennedy Heights Park area, which is described in Section 4.5.1.3. This drainageway, which is in the vicinity of Robinson and Woodford Road near Kennedy Heights Park, has been rerouted and is currently placed into underground culverts in the vicinity of the rail crossing location.

Drainageway #2
This unnamed stream passes under the railroad right-of-way through a culvert. Woody shrubby vegetation is located along and within the existing rail right-of-way. To the west of the proposed alignment at this crossing, the land consists of residential lawns. The channel consists of a grassy shallow "u" shaped area.

Drainageway #3
This stream, known as Catulpa Creek, flows east to the North Branch of Sycamore Creek (gradient of 45.2 feet per mile and drainage area of 9.50 square miles for the North Branch Sycamore Creek, Gazetteer of Ohio Streams), which in turn flows southeast to join Sycamore Creek and the Little Miami River in Remington, Ohio. This drainageway, located off Alliance Road at the Blue Ash Airport , flows through a concrete lined channel to the west of the SORTA right-of-way, but through a natural wooded corridor to the east of the right-of-way. No flow was observed during the September 2001 field evaluation. Both the north and south banks of the concrete lined channel are mowed and lack any significant riparian vegetation. The existing railroad crosses the stream via a bridge. The eastern channel remains in a fairly natural condition with a series of pool-riffle complexes. The channel is roughly 10 feet wide and characterized by a riparian corridor approximately 15 feet wide consisting of both mature trees and shrubs, with little herbaceous vegetation. Land use beyond the riparian corridor includes both industrial and residential property. Dominant substrates within the natural portion of the stream include primarily gravel and sand, with smaller amounts of cobble, silt, and detritus. Instream cover in this stream is limited primarily to logs and various woody debris. An aquatic survey of this stream was completed on September 21, 2000. The results of the biological and water quality survey are presented in Tables 12 and 13 in Appendix 4-2.

Drainageway #4
The majority of the area was identified as upland habitat; however, an organized drainageway in this area parallels the rail road embankment on the west. At the time of the September 2001 site evaluation, no hydrology was observed. This area is an old field successional area, that has been subject to past disturbance in the form of possible earthwork (i.e., grading, soil removal) and occasional deposition of construction debris. Commercial/industrial sites are adjacent to the rail road right-of-way in this area. To the east of the existing track is a very narrow strip of fencerow type upland vegetation. At the northern end of this area on the east side of the track, the land abuts residential lawn. In the area to the west of the existing track, the land is oldfield and wooded. Portions of the land have been used for soil storage and dumping of various debris.

Drainageway #5
At the time of the 2001 field survey, this area was dry. The drainageway is intermittent and is only anticipated flow during storm events. West of the proposed corridor and east of the adjacent Reed

Hartman Highway, the land has been graded and a sediment basin has been installed. The area has been seed with turf grass to cut down the erosion and possible siltation to the sediment basin. Land cover to the east of the proposed corridor consists pasture grasses. Aquatic habitat would be minimal here due to the lack of hydrology and altered landscape

Drainageway #6
At the time of the field survey no flow was observed. Presumably during rainy periods water does flow through this drainageway. The slopes surrounding the drainageway are not mowed like the surrounding land; vegetation consists of a mixture of riparian and upland plants including herbaceous, shrub and small tree species. The watershed that drains into this area consists of impervious surfaces of Perspectivas Park, Crossland Economy Studios, Blue Ash Corporate Center and the northwestern portion of the Blue Ash Distribution Center parking lots. Aquatic habitat would be minimal here due to the polluted drainage.

Lakes

There are no named lakes located within the study area. Named lakes just outside the study area include Carter Lake (Sharonville, Ohio), Sharon Lake (Sharon Woods, Ohio), Kenridge Lake (Blue Ash, Ohio), and Prisoner's Lake (Park Hills, Kentucky). No water quality data was gathered for these lakes.

4.6.2.3 Impacts and Mitigation

No-Build Alternative

All road projects, listed below, have been completed; thus, there would be no impacts to surface water quality under the No-Build Alternative.

- Adding two lanes on I-71 between I-275 and State Route 48
- Reconstructing /alignment of Fort Washington Way (I-71)
- Adding one southbound lane on I-71/75 between Dixie Highway and Kyles Lane
- Adding one eastbound lane on U.S. 62 (Montgomery Road) between Kenwood Road and I-71 and adding one travel lane on U.S. 22 in each direction eastwardly from I-71 to Hosbrook Road

TSM Alternative

The locations of the proposed transit centers have not been identified; therefore, no analysis can be discussed for potential impacts to surface water quality.

Build (LRT) Alternatives

The impact to the existing stormwater management system and associated water quality would be insignificant. Existing drainage connections would be maintained to avoid changes to the existing surface water management system. Best Management Practices (BMPs) for stormwater management would be implemented via the NPDES permits and local requirements for each region. BMPs typically consist of silt fence, haybales, gravel construction entrances, slope grading methods, turf restoration, etc. Stormwater associated with new infrastructure would be directed to existing stormwater management facilities or new facilities would be constructed as necessary based on site specifics. In areas where filling or dredging of a watercourse is anticipated, a Section 401 Water Quality Certification is required to obtain a federal Clean Water Act Section 404 permit from the USACOE. The USCG also requires completion of a Section 10 permit regarding dredging or filling of navigable waters.

<u>*Alternative 1*</u>

Covington Segment - No surface water exists within this segment of the corridor; therefore, construction within this segment is not anticipated to impact surface water quality. The required NPDES permits from the (NREPC), Division of Water would be acquired prior to commencement of construction activities.

Ohio River Crossing Segment - Stormwater runoff to the Ohio River is anticipated to be insignificant, with only a minor addition of impervious surface area draining directly into the Ohio River. Impacts to the Ohio River water quality are also anticipated be insignificant, however, runoff from the proposed LRT bridge could introduce small amounts of sediment, petrochemicals or other chemical pollutants to the Ohio River. If the bridge is constructed of steel, potential contamination with paint, paint chips, sand and steel exists during sandblasting and painting activities. This risk could be minimized based on construction techniques. The greatest potential impacts to the water quality of the Ohio River would occur during construction and would involve increased turbidity associated with excavation and construction of the cofferdams and foundations for the two river piers as well as the temporary falsework needed for steel erection.

Modification to the soils along the river banks is anticipated to be minimal with no significant changes in compaction or permeability. Vegetation would be removed and erosion control measures, likely consisting of riprap, would be implemented on both of the river banks and along the Covington floodwall.

No impacts to the municipal water sources for the area are anticipated as the Ohio River water source intakes for the Cincinnati and Northern Kentucky Water District waterworks are located approximately eight miles upstream of the Study area.

The required permits from the USACOE, USCG and ORSANCO would be acquired prior to the commencement of bridge construction activities.

Cincinnati Riverfront Segment - *Avondale to Norwood Segment* - No surface water exists within these segments of the corridor; therefore, construction within these segments is not anticipated to impact surface water quality. The required NPDES permits from Ohio EPA Division of Surface Water would be acquired prior to commencement of construction activities.

Norwood to Blue Ash Segment - The intermittent stream, which flows parallel on the eastern side of the existing tracks and proposed LRT alignment, is the only surface water within this segment of the corridor. The stream is not navigable or a drinking water source. Due to the small size of the contributing drainage area associated with the proposed project, the associated runoff would have very minor impacts on the aquatic environment. BMPs for stormwater management would be implemented via the NPDES permits for this area to minimize impacts during construction. The required permits from Ohio EPA Division of Surface Water and USACOE would be acquired prior to commencement of construction activities.

Blue Ash Segment – The culverts at #2, #3, #5 and #6 drainageway crossings will be replaced and/or extended as necessary to maintain flow conditions, per Ohio Department of Transportation standards and/or local jurisdictions. None of these streams are navigable or drinking water sources. Modifications to these crossings will be coordinated with existing stormwater facilities and proposed developments.

Due to the small size of the contributing drainage areas associated with the proposed project, the associated runoff would have very minor impacts on the aquatic environment. BMPs for stormwater management would be implemented via the NPDES permits for this area to minimize impacts during construction. The required permits from Ohio EPA Division of Surface Water and USACOE would be acquired prior to commencement of construction activities.

<u>*Alternative 2*</u>
Covington Segment - Same as Alternative 1.

Ohio River Crossing Segment **-** Same as Alternative 11.

Cincinnati Riverfront Segment – Blue Ash Segment - Same as Alternative 11.

<u>*Alternative 3*</u>
Covington Segment - Same as Alternative 1.

Ohio River Crossing Segment - *Same as* Alternative 1.

Cincinnati Riverfront Segment – Blue Ash Segment -

<u>*Alternative 4*</u>
Covington Segment - Same as Alternative 1.

Ohio River Crossing Segment - Same as Alternative 1.

Cincinnati Riverfront Segment – Blue Ash Segment - Same as Alternative 1.

4.6.3 FLOODWAYS AND FLOODPLAINS

The addition of impervious surface within floodplain increases the runoff and potentially alters the drainage pattern of stormwater. The altered drainage-ways have potential to increase sediment load thereby affecting water quality. This section discusses existing floodplains and floodways located within the proposed alignment.

4.6.3.1 Floodways

Rivers and streams where Federal Emergency Management Agency (FEMA) has prepared detailed engineering studies may have designated floodways. For most waterways, the floodway is defined as the area where floodwaters are likely to run deepest and fastest. It is the area of the floodplain that should be reserved (kept free of obstructions) to allow floodwaters to move downstream. Placing fill or buildings in a floodway may block the flow of water and increase flood heights. Such activities in the floodway are generally restricted and require mitigation in the form of compensatory volume to offset lost floodway storage.

4.6.3.2 Floodplains

To prepare Flood Insurance Rate Maps (FIRMs) that illustrate the extent of flood hazard in a participating flood prone community, FEMA conducts Flood Insurance Studies. Using information gathered in these studies, FEMA engineers and cartographers delineate Special Flood Hazard Areas (SFHAs) on FIRMs. SFHAs are those areas subject to inundation by flood that have a 1 percent or greater chance of being equaled or exceeded during any given year. This type of flood is referred to as a base flood or a 100-year flood and defines the 100-year flood plain. The term "100-year flood" is misleading; it is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1 percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the regulatory standard used by most federal and state agencies in natural resource and development planning, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance.

4.6.3.3 Regulations

Executive Order (E.O.) 11988, signed on May 24, 1977 by President Jimmy Carter, requires all federal agencies to evaluate and, to the extent possible, avoid adverse impacts to floodplain areas which may result from actions they administer, regulate, or fund. E.O. 11988 specifically requires floodplain impacts to be considered in the preparation of Environmental Impact Statements for "major" federal actions.

4.6.3.4 Existing Conditions

The most widely available source of information on the location and characteristics of floodplains and regulated floodways in the United States is the FEMA's FIRM system. FIRM maps are produced for participating communities in the NFIP. Flood risk information presented on FIRMs is based on historic, meteorologic, hydrologic, and hydraulic data, as well as open-space conditions, flood control works, and development. A variety of information can be found depicted on FIRMs, including:

- Common physical features, such as major highways, secondary roads, lakes, railroads, streams, and other waterways
- Special Flood Hazard Areas
- Base (1 percent annual chance) flood elevations or depths
- Flood insurance risk zones
- Areas subject to inundation by the 0.2 percent annual chance flood
- Areas designated as regulatory floodways
- Undeveloped coastal barriers

Floodway and 100-year floodplain boundaries for the study area are shown on the map provided in Figure 4.6-2a through Figure 4.6-2c. Only the proposed Ohio River Crossing location is affected by a designated floodway and 100-year floodplain. An existing floodwall exists on the Covington, KY side of the Ohio River at the proposed bridge crossing location. The 100-year floodplain of the Ohio River at Cincinnati is approximately 497.9 feet.

Floodplains within the I-71 corridor are associated with the Ohio River, which intersects the proposed alignment within the Ohio River Crossing Segment. Proposed construction involves construction of a new bridge, east of the Clay Wade Bailey bridge. Details of the bridge's design have not been completed.

4.6.3.5 Impacts and Mitigation

No-Build Alternative

All road projects, listed below, have been completed; thus, there would be no impacts to floodplains under the No-Build Alternative.

- Adding two lanes on I-71 between I-275 and State Route 48
- Reconstructing /alignment of Fort Washington Way (I-71)
- Adding one southbound lane on I-71/75 between Dixie Highway and Kyles Lane
- Adding one eastbound lane on U.S. 62 (Montgomery Road) between Kenwood Road and I-71 and adding one travel lane on U.S. 22 in each direction eastwardly from I-71 to Hosbrook Road

TSM Alternative

The locations of the proposed transit centers have not been identified; therefore, no impact analysis can be discussed for floodplains.

Build (LRT) Alternative

Design of the proposed LRT bridge will accommodate the 100-year flood. The Kentucky approach to the proposed LRT bridge over the Ohio River will be protected by the floodwall and will not be located in the 100-year floodplain. The Ohio approach to the proposed LRT bridge will be elevated above the 100-year flood plain on several new and existing bridge structures. The piers of the proposed bridge will be located within the 100-year floodplain, however, minimal impact to the 100-year flood elevation is anticipated. The floodway opening provided by the proposed LRT bridge will be equal to, or larger than, that provided by the adjacent Clay Wade Bailey and CSX Railroad Bridges. It is not anticipated that the LRT bridge would have any impact to the 100-year flood elevation.

<u>*Alternative 1*</u>
Covington Segment - No floodplains exist within this segment of the corridor; therefore, there would be no impact to floodplains within this segment.

Ohio River Crossing Segment – The only displacement of the 100-year flood elevation would be associated with the piers of the proposed LRT bridge. No significant impacts to the Ohio River floodplain are expected during or following construction.

Cincinnati Riverfront Segment – Blue Ash Segment - No floodplains exist within these segments of the corridor; therefore, there would be no impact to floodplains within these segments.

<u>*Alternative 2*</u>
Covington Segment - Same as Alternative 1.

Ohio River Crossing Segment - Same as Alternative 1.

Cincinnati Riverfront Segment – Blue Ash Segment - Same as Alternative 1.

Alternative 3
Covington Segment - Same as Alternative 1.

Ohio River Crossing Segment - Same as Alternative 1.

Cincinnati Riverfront Segment – Blue Ash Segment - Same as Alternative 1.

Alternative 4
Covington Segment - Same as Same as Alternative 1.

Ohio River Crossing Segment - Same as Same as Alternative 1.

Cincinnati Riverfront Segment – Blue Ash Segment - Same as Alternative 1.

4.6.4 GROUNDWATER RESOURCES

4.6.4.1 Drainage Basins

The study area extends across four different drainage basins. All of the LRT segments in Ohio are located within the Mill Creek Basin except for the Norwood to Blue Ash segment, which lies in the Little Miami River Basin. The Covington segment in Kentucky is located within the Licking River Basin (EPA, 2001). All of these drainage basins drain to the Ohio River. The Mill Creek and Licking River basins combine at the Ohio river to create the Central Basin, which extends through the majority of the downtown area and into Newport (Potter, 1996).

4.6.4.2 Hydrogeology

Two general types of unconsolidated deposits are found in the study area: weathered Illinoian-age glacial tills mantling upland bedrock, and Wisconsinan-age glacial valley fill deposits at lower elevations (Lloyd and Lyke 1995). These types are distributed according to topographic elevation in the study area. Upland elevations commonly range from about 825 to 900 feet above msl, and valley elevations commonly range from about 500 to 600 feet above msl.

Upland tills consist of dense, hard, unstratified mixtures of clay, silt, sand, and gravel with discontinuous, thin interbedded units of sand and/or gravel. These deposits are thin, on the order of 20 feet, and they contain isolated occurrences of perched groundwater. The interface between the clayey till and the weathered bedrock surface typically contains groundwater capable of yielding less than 3 gpm to shallow wells (Potter 1996). The underlying Ordovician-age shale and limestone bedrock is a poor source of groundwater, typically yielding less than 3 gpm. Valley fill in the study area consists of stratified deposits of sand and gravel outwash with interbedded layers of lacustrine silt and clay. Valley fill deposits are typically between 120 and 200 feet thick. Thicker, deeper outwash deposits are capable of yielding 1,000 gpm or more. Interbedded units of finer-grained sediments are lower yielding, and the lacustrine deposits yield the least groundwater, on the order of 3 gpm (Potter 1996). Based on topography in the valleys, shallow groundwater can generally be found within 30 feet of the ground surface.

Moving from south to north, the Covington through Over-the-Rhine segments are located on valley fill deposits of the Central Basin. From the beginning of the Mount Auburn segment to the approximately the Norwood Station of the Norwood segment, the surfical deposits are upland tills. Between the Norwood Station and the Ridge Station in the Norwood to Blue Ash segment, the line crosses valley fill deposits found in the Norwood Trough, an abandoned preglacial valley linking the Little Miami River and Mill Creek valleys. The remainder of the line north of the Ridge Station is located on upland tills.

Shallow ground water flow direction is dependent on surface topography (in the absence of groundwater pumping influences) and is different in each segment of the line. The following discussion is based on a review of topographic maps of the study area. Groundwater in the western part of the area surrounding the Blue Ash segment generally flows west to southwest. The eastern part generally flows east to southeast towards tributaries of the Little Miami River (USGS, 1961a). Groundwater in the northern portion of the Norwood to Blue Ash segment generally flow to the west to southwest, while the southern portion along with the northern portion of the Avondale to Norwood segment generally flows to the west and to the southeast along the Norwood Trough (USGS, 1961b). The southern portion of the Avondale to Norwood segment along with the University of Cincinnati, Mount Auburn Tunnel, Over-the-Rhine, Downtown Cincinnati, and the Cincinnati Riverfront segment, all generally flow to the south to southwest through the alluvium deposits of the Ohio River (USGS, 1961c). In the Covington segment in Kentucky, groundwater on the eastern side of the Licking River generally flows to the north to northwest. Groundwater on the western side of the Licking river generally flows to the north to northeast to the Ohio River (USGS, 1981 and 1983).

4.6.4.3 Potable Water Supply

Although many residential and industrial groundwater wells are located within the study area, potable water is supplied to the entire study area by municipal water suppliers. These suppliers are the City of Cincinnati Water Works and the Northern Kentucky Water District (CWW 2001).

4.6.4.4 Impacts and Mitigation

As for the Build Alternatives, project construction can affect the groundwater by

- contamination from accidental spills of petroleum products or hazardous substances which migrate from the ground surface or other point of release to the water table,
- any dewatering needed for foundation or tunnel construction

Although groundwater is not anticipated to serve as a resource for potable water supply (based on availability of municipal water supply, not on any wellhead research) in the study area, the potential for groundwater impacts will need to be mitigated during project construction. The greatest potential for existing groundwater usage in the vicinity of the study area exists in the Covington, Downtown Cincinnati, and Norwood segments where the corridor crosses more permeable valley fill deposits. Because of the nature of the underlying deposits, these areas are also the most vulnerable to contamination by releases of petroleum products or hazardous substances during construction.

4.7 ENERGY

The change in regional energy consumption in the forecast year (2020), measured in British Thermal Units (BTU) per mile, is used as a means of comparing the No-Build, TSM and build alternatives. For this analysis, the project area consists of the regional transportation network modeled for travel demand and air quality forecasting purposes.

4.7.1 OPERATING ENERGY CONSUMPTION

Energy consumption factors used for this analysis are based on the most recently available estimates of average energy consumption, as listed in the *Oak Ridge National Laboratory, Transportation Energy Book: Edition 16, 1996*.

Rail transit operating energy consumption is defined as the energy used for vehicle propulsion, operation of stations and ancillary facilities and the maintenance of transit vehicles and track systems. The energy impacts of the proposed rail transit system are determined by comparing total energy consumption of the build alternative with the No-Build and TSM Alternatives.

4.7.2 METHODOLOGY

Automobile and commercial vehicle miles of travel (VMT) were developed for each alternative from data reports generated by the OKI regional travel demand model. Annual VMT for bus and rail transit modes were calculated using the bus and rail system operating plans. Total annual VMT for each alternative is shown in Table 4.7.1. Energy consumption factors derived for each technology were applied to the estimated VMT and are summarized in Table 4.7.2 The benefits associated with the Build Alternatives were determined by comparing energy consumption by mode with the No-Build and TSM Alternatives. The energy benefits demonstrated by this comparison are also shown in Table 4.7.2.

4.7.3 IMPACTS IN RELATION TO ENERGY

The following paragraphs describe energy impacts estimated for each alternative.

4.7.3.1 No-Build Alternative

The No-Build Alternative is estimated to generate 15,916 million annual VMT and would consume 116,078,703 million BTUs of energy annually.

4.7.3.2 TSM Alternative

The TSM Alternative includes enhanced bus transit service that would generate an estimated 15,918 million annual VMT and would result in the consumption of 116,159,024 million annual BTUs. The enhanced bus transit service would be responsible for approximately 614,099 million BTUs of the total amount.

Table 4.7.1: Vehicle Miles of Travel by Alternative (Millions)

Modal Technology	BTU/ VMT	VMT/Year (millions)		
		No-Build	**TSM**	**Build Alternatives**
Passenger Vehicles *Auto, van, truck*	6,233	15,903.4	15,903.2	15,888.4
Bus Improvements *all vehicle types*	41,655	12.8	14.7	15.2
Light Rail Transit Electric	77,739	0	0	0.7
Totals		**15,916.2**	**15,917.9**	**15,904.3**

Source URS and Burgess & Niple, Ltd.

Table 4.7.2: Energy Consumption by Alternative (Millions of BTU/Year)

Modal Technology	BTU/Year (millions)		
	No-Build	**TSM**	**Build Alternatives**
Passenger Vehicles *Auto, van, truck*	115,546,473	115,544,925	115,452,750
Bus Improvements *all vehicle types*	532,229	614,099	632,879
Light Rail Transit Electric	0	0	54,193
Totals	116,078,702	116,159,024	116,139,822

Source: URS and Burgess & Niple, Ltd.

4.7.3.3 Build (LRT) Alternatives

The results of the change in energy consumption for the build alternative compared to the No-Build and TSM Alternatives are summarized in Table 4.7.3.

The Build Alternative would result in the total consumption of 116,139,822 BTUs of energy annually. Operation and maintenance activities of the LRT transit system would be responsible for consuming 54,193 BTUs of the total amount. The energy consumption associated with this alternative would increase by 61,120 BTU when compared to the No-Build Alternative. The savings in energy consumption associated with this alternative would amount to 19,202 BTU when compared to the TSM Alternative.

Table 4.7.3: Change in Regional Energy Consumption (Millions of BTU/Year)

Modal Technology	Build Alternatives vs. No-Build	Build Alternative vs. TSM
Passenger Vehicles *auto, van, truck*	-93,723	-92,175
Bus Improvements *all vehicle types*	100,650	18,780
Light Rail Transit Electric	54,193	54,193
Total Change	**61,120**	**-19,202**

Source: URS and Burgess & Niple, Ltd.

4.7.4 ENERGY SUPPLY

Electrical use for the year 1999 in the states of Ohio and Kentucky was 560,500,000 million BTU, and 269,900,000 million BTU, respectively. The increase in electric use by the LRT system will be 54,193 million BTU. This would represent an overall increase in energy use of 0.006 percent between the two states, or for each state alone, the increase would be .01 or .02 percent for Ohio or Kentucky, respectively.