D. PROBABLE IMPACTS OF THE PROJECT ALTERNATIVES

CONSTRUCTION PERIOD (2006)

FUTURE COMMON TO ALL ALTERNATIVES

Pedestrian trips in the study area are expected to increase as commercial and residential projects are opened and as currently vacated buildings are reoccupied in the vicinity of the WTC site. Table 8D-4 summarizes pedestrian levels of service for the 2006 baseline conditions. (It should be noted that the baseline conditions include the trips to and from the temporary WTC PATH station, since it would be maintained in 2006.)

The east crosswalk at Church and Fulton Streets would operate at LOS E in the PM peak hour; this pedestrian movement experienced LOS E conditions following September 11, 2001, as discussed above. The west crosswalk at Church and Vesey Streets would operate at LOS F in the AM and PM peak hours, primarily due to the large volume of temporary WTC PATH station pedestrians accessing the Vesey Street bridge over Route 9A. The intersection of Church Street at Liberty Street would experience LOS E in the north crosswalk in the AM and PM peak hours, and LOS F and E in the west crosswalk in the AM and PM peak hours, respectively. These poor levels of service would result from temporary WTC PATH station pedestrians, who would originate from and be destined for points south and east of the WTC. They would primarily use the north crosswalk to go to or come from the east, and would use the west crosswalk to go to or come from the south. All other crosswalks would operate at acceptable levels of service.

The Route 9A pedestrian overpasses at Vesey and Liberty Streets, reconstructed after September 11, 2001, would be maintained throughout the construction period. The pedestrian overpasses would process additional pedestrian volumes due to temporary WTC PATH station trips and growth since the 2003 pedestrian counts.

NO ACTION ALTERNATIVE

The No Action Alternative would not result in construction of a Permanent WTC PATH Terminal. Thus, pedestrian operations in the study area would be unchanged from the baseline conditions presented in Table 8D-4.

PREFERRED ALTERNATIVE

During the construction period, pedestrian conditions would be nearly identical to those previously described for the No Action Alternative. Because construction of the Preferred Alternative would maintain pedestrian patterns from conditions following September 11, 2001, major shifts in pedestrian patterns would not be expected. Also, the construction activities would maintain access to NYCT subways and the temporary WTC PATH station.

The east side of the Route 9A (West Street) sidewalk would stay closed between Liberty and Vesey Streets during Route 9A reconstruction. Meanwhile, free-flow pedestrian walkways would be maintained on Liberty and Vesey Streets between the Route 9A pedestrian overpasses and Church Street during PATH/WTC construction. The width of the sidewalk on the west side of Church Street would be maintained to at least ten feet, while the area between Liberty and Vesey Streets would be for equipment storage and staging.

Table 8D-4
2006 Construction Period Baseline Pedestrian Level of Service

Location	AM Peak Hour	Midday Peak Hour	PM Peak Hour
Route 9A (West Street) at Vesey Street (1)			
North Crosswalk	Out of service for other construction; pedestrians diverted to overpass		
East Crosswalk			
South Crosswalk			
Route 9A (West Street) at Liberty Street (2)			
North Crosswalk	Out of service for other construction; pedestrians diverted to overpass		
East Crosswalk			
South Crosswalk			
West Broadway at Vesey Street (3)			
North Crosswalk	Out of service for other construction; pedestrians diverted to walkway		
East Crosswalk			
West Crosswalk			
Greenwich Street at Liberty Street (4)			
East Crosswalk	Out of service for other construction; pedestrians diverted to walkway		
South Crosswalk			
West Crosswalk			
Church Street at Vesey Street (5)			
North Crosswalk	B	B	B
East Crosswalk	C	C	C
South Crosswalk	C	B	D
West Crosswalk	F	D	F
Church Street at Fulton Street (6)			
North Crosswalk	B	B	B
East Crosswalk	D	D	E
South Crosswalk	D	D	C
Church Street at Dey Street (7)			
North Crosswalk	B	A	B
East Crosswalk	C	D	D
South Crosswalk	D	C	D
Church Street at Cortlandt Street (8)			
North Crosswalk	B	B	B
East Crosswalk	B	C	C
South Crosswalk	B	C	B
Church Street at Liberty Street (9)			
North Crosswalk	E	C	E
East Crosswalk	C	B	D
South Crosswalk	C	B	B
West Crosswalk	F	C	E
Northwest Corner	N/A	N/A	N/A

Note: Refer to Figure 8D-1 for location numbers.

Currently, because of construction-related street closures at the WTC site, the West Broadway/Vesey Street and Greenwich Street/Liberty Street intersections do not have any conflict points with pedestrians. These pedestrians, similar to current conditions, would be diverted onto walkways to or from the Vesey and Liberty Street overpasses at Route 9A, separating them from construction activities and, therefore, conflicting vehicles or pedestrian traffic signals.

It has been assumed that during construction there would be limited at-grade pedestrian crossings of Route 9A at Vesey or Liberty Street (most likely construction workers), and the majority of pedestrian crossings would be made using the two pedestrian overpasses crossing Route 9A. These overpasses at Vesey and Liberty Streets, reconstructed after September 11, 2001, would be maintained throughout the construction period. They would process nearly identical pedestrian volumes when compared to conditions without the Preferred Alternative, and would operate at improved levels of service when compared to pre-September 11, 2001 conditions.

As described in Chapter 17, "Safety and Security," PANYNJ would implement measures to protect pedestrians, including temporary WTC PATH riders, during the construction period.

OPENING YEAR (2009)

FUTURE COMMON TO ALL ALTERNATIVES

As private development occurs on and near the WTC site, pedestrian activity in the study area will increase. Furthermore, the opening of a memorial and cultural facilities at the WTC site will attract visitors to the area during all periods of the day. These pedestrians will increase the demand for on-street facilities on and near the proposed Project Site.

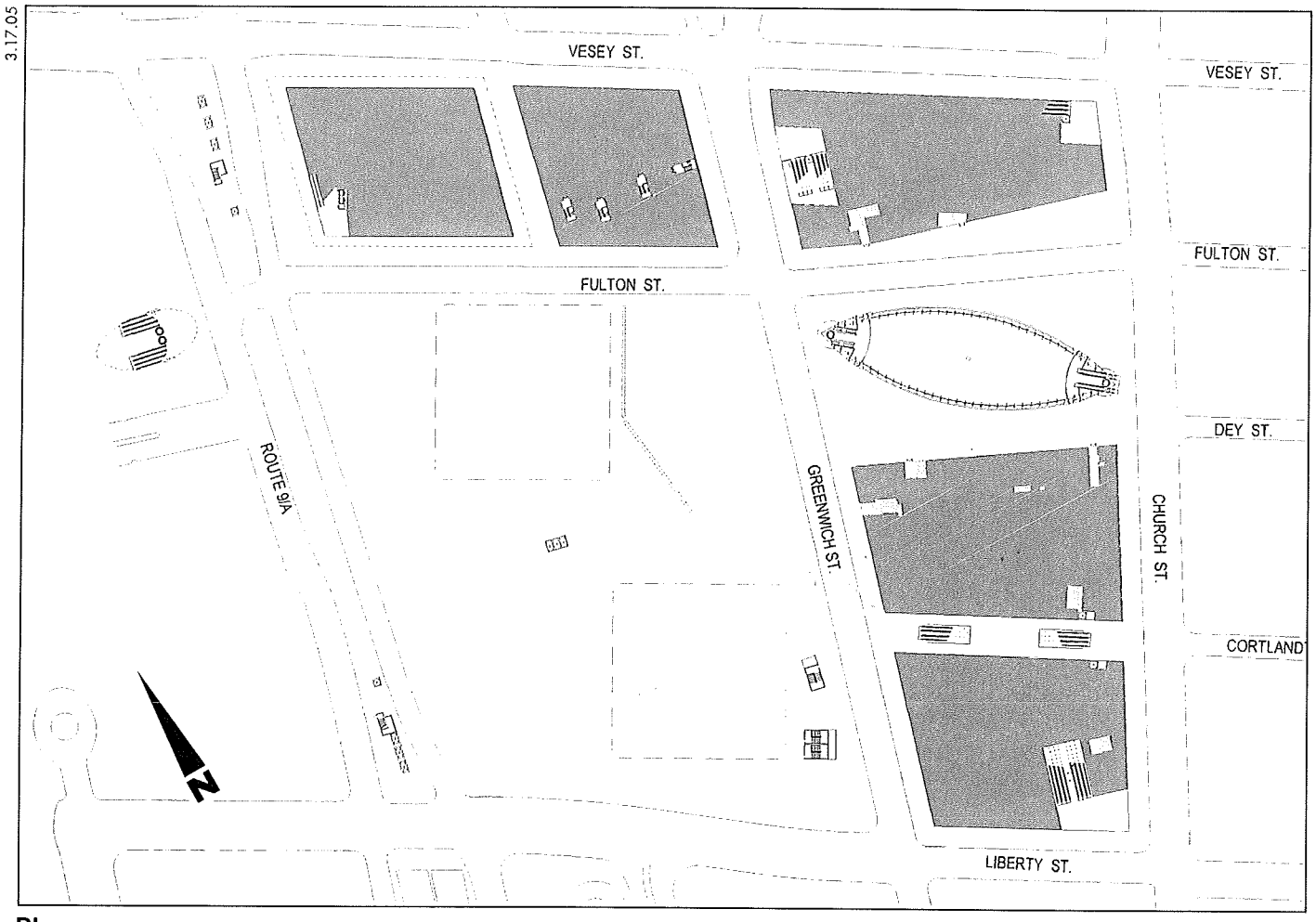
NO ACTION ALTERNATIVE

Absent the Preferred Alternative, it is expected that the temporary WTC PATH station would continue to maintain service to the extent possible. However, as stated in Chapter 8, "PATH", Section A, increasing passenger volumes anticipated over time would place severe operating constraints on the temporary WTC PATH and projected WTC-bound PATH, passengers would be diverted to other modes of travel. Furthermore, on-street pedestrian circulation in the area would increase in the opening year with the completion of elements of LMDC's World Trade Center Memorial and Redevelopment Plan (Freedom Tower, retail and restaurants, Performing Arts Center, Memorial, and cultural land uses), and would likely exceed levels measured before September 11, 2001

PREFERRED ALTERNATIVE

The Preferred Alternative would have nine access points to the street and WTC concourse. Eight access points would be available within the WTC site and there would be an access point through a concourse connecting the WTC site with the World Financial Center via a pedestrian tunnel below Route 9A (see Figure 8D-2).

Hourly pedestrian volumes under the Preferred Alternative are illustrated in Appendix C. Complete pedestrian volume maps are included in the Technical Appendix. Table 8D-5 summarizes the projected future conditions in the opening year if the events of September 11, 2001 had not taken place and compares them to conditions under the Preferred Alternative.



Plan

Figure 8D-2
Street-Level Access

Table 8D-5
2009 Opening Year Preferred Alternative: Pedestrian Level of Service

Location	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
	Pre-9/11 Baseline	Preferred Alternative	Pre-9/11 Baseline	Preferred Alternative	Pre-9/11 Baseline	Preferred Alternative
Route 9A at Vesey Street (1)						
North Crosswalk	A	C	A	C	A	C
East Crosswalk	N/A	B	N/A	E	N/A	B
South Crosswalk	A	A	A	B	A	A
Route 9A at Liberty Street (2)						
North Crosswalk	C	A	B	A	C	A
East Crosswalk	N/A	A	N/A	B	N/A	A
South Crosswalk	B	C	A	C	B	D
West Broadway at Vesey Street (3)						
North Crosswalk	N/A	E	N/A	E	N/A	E
East Crosswalk	C	D	C	D	C	D
South Crosswalk	N/A	D	N/A	E	N/A	D
West Crosswalk	B	D	B	E	B	E
Greenwich Street at Fulton Street (10)						
North Crosswalk	N/A	C	N/A	E	N/A	D
East Crosswalk	N/A	D	N/A	D	N/A	C
South Crosswalk	N/A	C	N/A	C	N/A	D
West Crosswalk	N/A	E	N/A	E	N/A	E
Greenwich Street Midblock (11)						
North Crosswalk	N/A	B	N/A	B	N/A	B
Greenwich Street at Liberty Street (4)						
North Crosswalk	N/A	A	N/A	B	N/A	A
East Crosswalk	B	B	A	C	A	B
South Crosswalk	N/A	D	N/A	D	N/A	D
West Crosswalk	A	D	A	E	A	C
Church Street at Vesey Street (5)						
North Crosswalk	B	D	C	C	B	D
East Crosswalk	D	E	E	E	D	E
South Crosswalk	C	D	C	D	D	D
West Crosswalk	E	D	E	D	E	E
Church Street at Fulton Street (6)						
North Crosswalk	C	B	C	C	C	B
East Crosswalk	E	D	E	D	E	E
South Crosswalk	E	B	E	C	E	C
West Crosswalk	N/A	C	N/A	D	N/A	B

Table 8D-5 (cont'd)
2009 Opening Year Preferred Alternative:
Pedestrian Level of Service

Location	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
	Pre-9/11 Baseline	Preferred Alternative	Pre-9/11 Baseline	Preferred Alternative	Pre-9/11 Baseline	Preferred Alternative
Church Street at Dey Street (7)						
North Crosswalk	E	B	D	B	E	B
East Crosswalk	D	C	E	C	E	C
South Crosswalk	E	B	E	C	E	C
Church Street at Cortlandt Street (8)						
North Crosswalk	B	C	C	D	B	D
East Crosswalk	B	B	E	D	D	D
South Crosswalk	C	B	E	B	C	B
Church Street at Liberty Street (9)						
North Crosswalk	E	E	E	C	F	E
East Crosswalk	B	C	B	B	C	C
South Crosswalk	E	D	B	B	D	C
West Crosswalk	F	E	D	C	E	E
Northwest Corner	F	E	E	B	F	C

Note: Refer to Figure 8D-1 for location numbers.

The proposed site plan for the WTC complex would extend Fulton Street westward from Church Street to Route 9A and extend Greenwich Street between Vesey and Liberty Streets, which would create additional pedestrian crossing areas at the Fulton Street intersections at Route 9A, Greenwich Street, and Church Street; the Greenwich Street intersections at Vesey Street/West Broadway; and at Cortlandt Street's extension from Church Street. These new crossings have been analyzed, with the exception of the Fulton Street at Route 9A intersection because of the proximity of the World Financial Center pedestrian concourse crossing under Route 9A, which is estimated to carry nearly all of Route 9A-crossing PATH riders.

The redevelopment of the WTC and the future memorial are expected to generate increased pedestrian circulation within the WTC and in crosswalks on Vesey, Church, and Liberty Streets. The redevelopment adds land uses such as a memorial, cultural facilities, retail, and a performing arts center, that were not included in the pre-September 11, 2001 program, which results in higher trip generation and pedestrian volumes.

The Preferred Alternative includes the WTC Memorial and Redevelopment Program in its background pedestrian volumes. The Preferred Alternative conditions were compared to the pre-September 11, 2001 projected future conditions, which included the WTC complex. Because the pre-September 11, 2001 WTC complex included fewer pedestrian volumes and less on-street circulation between land uses than the proposed WTC Memorial and Redevelopment Plan, the cumulative pedestrian volumes calculated for the build condition would be higher in many places than pre-September 11, 2001 projected future conditions. However, the on-street pedestrian trips to and from the Preferred Alternative would be lower than the pre-September 11, 2001 projected future conditions crossing Route 9A because of an improved connection to the World Financial Center. Pedestrian trips would also be higher at Vesey Street and West Broadway because of the destruction of the 7 WTC pedestrian overpass. Because of the unequal number of background trips generated by the pre-September 11, 2001 WTC complex and the proposed WTC Memorial and Redevelopment, it

was difficult to determine the impacts of the Preferred Alternative. Therefore, a different methodology for determining adverse impacts was employed.

The analyses below summarize pedestrian conditions by intersection, and identify crosswalks operating at unacceptable LOS E or F. The summaries identify whether these levels of service result from WTC Memorial and Redevelopment Plan background volumes or from the Preferred Alternative by assigning a percentage share of trips to the latter. Calculating this share of trips is achieved by dividing the number of trips to and from the Terminal by the total number of pedestrians crossing. In the summaries below, an adverse impact is defined as a location operating at LOS E or F, at which 50 percent or more of the total volume is associated with the Preferred Alternative.

Route 9A and Vesey Street

The Route 9A/Vesey Street east crosswalk would operate at LOS E during the midday peak hour. AM and PM peak hour levels of service would be acceptable. During the midday peak hour, PATH ridership is low while WTC shopping, tourism, and employee trip generation and circulation is high, so midday LOS E conditions are most likely not a result of PATH trips.

Route 9A and Liberty Street

The Route 9A/Liberty Street intersection would experience improved levels of service, most likely a benefit of the World Financial Center connection, which would improve access to Battery Park City for residents and the World Financial Center for commuters and shoppers.

West Broadway and Vesey Street

Before September 11, 2001, this intersection operated at acceptable levels of service because of the pedestrian overpass spanning Vesey Street west of West Broadway, which connected 6 and 7 WTC. In the opening year, the West Broadway/Vesey Street intersection would operate at LOS D and E during all peak hours because street crossings must be made at grade. Approximately 10 to 15 percent of these AM peak hour trips are project-generated. Thus, based on the impact criteria described above, this project would not require mitigation at this location.

Greenwich Street and Fulton Street

Several of the new Greenwich Street/Fulton Street crosswalks would operate at LOS E during specific peak hours, as described in Table 8D-5. Entrances to the WTC Memorial and cultural land uses, Performing Arts Center, Tower 2, and Wedge of Light Plaza are located adjacent to this intersection. There would be heavy on-street pedestrian flows between these uses and public transportation access on the south side of Fulton Street, such as subways and the Preferred Alternative. It is estimated that the share of the Preferred Alternative trips to 7 WTC and points north of Vesey Street would be approximately 20 to 30 percent. Thus, based on the impact criteria described above, this project would not require mitigation at this location.

Greenwich Street Midblock and Cortlandt Street

The new Greenwich Street midblock pedestrian crossing at Cortlandt Street would operate at acceptable levels of service during all peak hours. Project-generated trips using this crosswalk destined for the WTC Memorial, Tower 5, and points south of Liberty Street would be able to cross Greenwich Street using the pedestrian-only phase.

Greenwich Street and Liberty Street

The Greenwich Street/Liberty Street west crosswalk would operate at LOS E during the midday peak hour. During the midday peak hour, PATH ridership is low while WTC shopping, tourism, and employee trip generation and circulation is high, so midday LOS E conditions are most likely not a result of PATH trips.

Church Street and Vesey Street

The Church Street/Vesey Street east crosswalk would operate at LOS E during all peak hours, and the west crosswalk would operate at LOS E during the PM peak hour. These levels of service are generally similar to pre-September 11, 2001 projected future conditions, or worsened from LOS D to E. It is estimated that the share of project-generated trips to points north of Vesey and east of Church Streets would be approximately 15 to 25 percent. Thus, based on the impact criteria described above, this project would not require mitigation at this location.

Church Street and Fulton Street

The Dey Street connection between the WTC site and the Fulton Street Transit Center would be operational in the 2009 Opening Year. As a result, pedestrians would be diverted from the east-west crossings at the intersection of Fulton and Church Streets, and the intersection would experience an improved level-of-service as compared to pre-September 11, 2001 conditions.

Church Street and Dey Street

As noted above, the Dey Street connection between the WTC site and the Fulton Street Transit Center would be operational in the 2009 Opening Year. The new concourse would divert pedestrians from the east-west crossings at the intersection of Dey and Church Streets, and the intersection would experience an improved level-of-service as compared to pre-September 11, 2001 conditions.

Church Street and Cortlandt Street

The Dey Street connection would also divert pedestrians from the east-west crossings at the intersection of Cortlandt and Church Streets, and the intersection would experience an improved level-of-service as compared to pre-September 11, 2001 conditions.

Church Street and Liberty Street

For access to the Financial District, pedestrians would use Permanent WTC PATH Terminal exits in the vicinity of WTC Towers 3 and 4, and cross Church and Liberty Streets at street level. Based on surveys conducted before September 11, 2001, it is anticipated that 40 percent of alighting AM peak hour PATH trips are destined for the Financial District.

In the AM, midday and PM peak hours, approximately 4,070, 70, and 1,890 new trips would be added to the totals of 5,840, 3,170 and 5,110 trips, respectively, resulting in increases of up to 70 percent.

The loss in area per person would range from 1 to 17 SFP in the crosswalks, and from 2.8 to 17.7 in the northwest corner reservoir. The northwest corner reservoir LOS F in the AM peak hour would congest pedestrian flows when pedestrians are queued to cross away from the WTC/PATH site in the west and north crosswalks, and block pedestrians crossing inbound from the northeast and southwest corners of the intersection. Pedestrians normally crossing at Church and Liberty Street may divert to the Cortlandt or Cedar Street intersections, or illegally cross

Church Street between Liberty and Cortlandt Streets. Pedestrians circulating through the northwest corner reservoir during surge conditions require more physical space than could be afforded in that area, which could force pedestrians to wait on the street in Liberty or Church Street vehicular travel lanes.

Mitigation to restore LOS E conditions would include widening the north and west crosswalks by 10 feet each, making them 25 feet wide. To restore the northwest corner reservoir LOS F conditions to LOS E conditions would include widening the north and west sidewalks by five feet each.

Given that the Preferred Alternative would generate more than 50 percent of the volume at this location, mitigation measures would be necessary as part of this project.

DESIGN YEAR (2025)

FUTURE COMMON TO ALL ALTERNATIVES

Independent of the Preferred Alternative, the on-street pedestrian circulation in the design year would increase beyond opening year levels with the completion of the WTC office and hotel land uses and the development of Battery Park City Site 26. These levels would also exceed conditions measured before September 11, 2001.

NO ACTION ALTERNATIVE

For analysis purposes, it was assumed that absent the Preferred Alternative, projected WTC-bound PATH passengers would be diverted to other modes of travel. Because on-street connections to mass transit located away from the WTC site would have to be made, on-street pedestrian conditions under the No Action Alternative would likely be worse than prior to September 11, 2001. The Permanent WTC PATH Terminal's purpose of serving as a central transit hub for Lower Manhattan would be negated, since PATH passengers would be diverted to overloaded NJ Transit commuter trains and NYCT subways; additional NY Waterway ferries would be needed; and additional passenger vehicle, taxi, express bus, and van trips would increase traffic on NYCDOT and NYSDOT roadways. These cumulative diversions would all increase on-street pedestrian circulation in Lower Manhattan.

Conditions described for the No Action Alternative in the opening year would worsen substantially by the design year. AM peak hour WTC Memorial and Redevelopment trips would increase over 100 percent from approximately 15,000 to 35,000 people per hour. The increased volumes in the design year may result in deteriorated levels of service at many analysis locations.

Without the sub-grade Route 9A connection, which is proposed as part of the Preferred Alternative, at-grade pedestrian activity will increase along Route 9A and its cross streets. Because ferry connections are made west of Route 9A, deteriorated levels of service on Route 9A could occur. Levels of service could deteriorate on Church Street between Liberty and Vesey Streets due to the locations of express bus routes and subway stations east of the WTC site. Auto and commuter van activity will increase and will worsen pedestrian levels of service because passenger drop-offs will occur adjacent to Liberty, Vesey, and Church Streets. As compared to the Preferred Alternative, the No Action Alternative would increase on-street pedestrian flows and worsen crosswalk congestion, necessitating additional mitigation to ensure proper circulation.

PREFERRED ALTERNATIVE

The hourly volumes representing pedestrians using the Permanent WTC PATH Terminal and the on-street pedestrian network in the design year are illustrated in Appendix C. Table 8D-6 summarizes projected future conditions in the design year if the events of September 11, 2001 had not taken place and compares them to conditions under the Preferred Alternative. Similar to the opening year conditions, at the Church and Liberty Street intersection, the northwest corner reservoir and all crosswalk levels of service in all peak hours deteriorate substantially.

Route 9A and Vesey Street

The Route 9A/Vesey Street east crosswalk would operate at LOS E during the midday peak hour. AM and PM peak hour levels of service would be acceptable. During the midday peak hour, PATH ridership is low while WTC shopping, tourism, and employee trip generation and circulation is high, so midday LOS E conditions are most likely not a result of PATH trips.

Route 9A and Liberty Street

The Route 9A/Liberty Street intersection would operate at acceptable levels of service during the AM, midday, and PM peak hours.

West Broadway and Vesey Street

Before September 11, 2001, this intersection operated at acceptable levels of service because of the pedestrian overpass spanning Vesey Street west of West Broadway, which connected 6 WTC to 7 WTC. In the opening year, the West Broadway/Vesey Street intersection would operate at LOS D, E, and F during all peak hours because street crossings must be made at grade. Approximately 10 to 15 percent of the AM peak hour trips using these crosswalks are project-generated trips destined to points north of Vesey Street including 7 WTC. Thus, based on the impact criteria described above, this project would not require mitigation at this location.

Greenwich Street and Fulton Street

All crosswalks at the new Greenwich and Fulton Street intersection would operate at LOS D, E, or F during all peak hours. Entrances to the WTC Memorial and cultural land uses, Performing Arts Center, Tower 2, and Wedge of Light Plaza are located adjacent to this intersection. There would be heavy on-street pedestrian flows between these uses and public transportation access on the south side of Fulton Street, such as subways and PATH. It is estimated that the share of project-generated trips to 7 WTC and points north of Vesey Street would be approximately 20 to 30 percent. Thus, based on the impact criteria described above, this project would not require mitigation at this location.

Table 8D-6
2025 Design Year Preferred Alternative:
Pedestrian Level of Service

Location	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
	Pre-9/11 Baseline	Preferred Alternative	Pre-9/11 Baseline	Preferred Alternative	Pre-9/11 Baseline	Preferred Alternative
Route 9A at Vesey Street (1)						
North Crosswalk	A	C	A	C	A	C
East Crosswalk	N/A	C	N/A	E	N/A	C
South Crosswalk	A	A	A	C	A	A
Route 9A at Liberty Street (2)						
North Crosswalk	C	A	B	B	C	A
East Crosswalk	N/A	A	N/A	A	N/A	A
South Crosswalk	B	D	A	D	B	D
West Broadway at Vesey Street (3)						
North Crosswalk	N/A	F	N/A	F	N/A	E
East Crosswalk	C	D	C	E	C	D
South Crosswalk	N/A	D	N/A	E	N/A	D
West Crosswalk	B	E	D	E	C	E
Greenwich Street at Fulton Street (10)						
North Crosswalk	N/A	D	N/A	E	N/A	D
East Crosswalk	N/A	E	N/A	F	N/A	E
South Crosswalk	N/A	D	N/A	E	N/A	E
West Crosswalk	N/A	E	N/A	F	N/A	E
Greenwich Street Midblock (11)						
North Crosswalk	N/A	B	N/A	B	N/A	B
Greenwich Street at Liberty Street (4)						
North Crosswalk	N/A	D	N/A	E	N/A	D
East Crosswalk	B	D	A	E	A	D
South Crosswalk	N/A	E	N/A	E	N/A	E
West Crosswalk	A	E	A	F	A	E
Church Street at Vesey Street (5)						
North Crosswalk	C	D	C	D	B	D
East Crosswalk	D	E	E	E	D	E
South Crosswalk	C	D	C	D	D	E
West Crosswalk	E	E	E	E	E	E
Church Street at Fulton Street (6)						
North Crosswalk	C	C	C	E	C	C
East Crosswalk	E	E	E	D	E	E
South Crosswalk	E	B	D	C	E	C
West Crosswalk	N/A	D	N/A	E	N/A	D

Table 8D-6 (cont'd)
2025 Design Year Preferred Alternative:
Pedestrian Level of Service

Location	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
	Pre-9/11 Baseline	Preferred Alternative	Pre-9/11 Baseline	Preferred Alternative	Pre-9/11 Baseline	Project Alternative
Church Street at Dey Street (7)						
North Crosswalk	E	C	D	C	E	C
East Crosswalk	D	C	E	C	E	D
South Crosswalk	E	B	E	C	E	C
Church Street at Cortlandt Street (8)						
North Crosswalk	B	C	C	D	C	D
East Crosswalk	C	B	E	D	E	D
South Crosswalk	C	B	E	C	C	B
Church Street at Liberty Street (9)						
North Crosswalk	E	E	C	E	C	E
East Crosswalk	B	C	E	B	D	D
South Crosswalk	E	D	B	C	D	C
West Crosswalk	F	E	D	C	E	E
Northwest Corner	F	E	F	C	F	D

Note: Refer to Figure 8D-1 for location numbers.

Greenwich Street Midblock and Cortlandt Street

The new Greenwich Street midblock pedestrian crossing at Cortlandt Street would operate at acceptable levels of service during all peak hours. Project-generated trips using this crosswalk destined for the WTC Memorial, Tower 5, and points south of Liberty Street would be able to cross Greenwich Street using the pedestrian-only phase.

Greenwich Street and Liberty Street

All crosswalks at the Greenwich Street/Liberty Street intersection would operate at LOS D, E, or F during all peak hours. Approximately 5 to 10 percent of peak hour trips using these crosswalks are project-generated trips destined to points south of Liberty Street including Tower 5. Thus, based on the impact criteria described above, this project would not require mitigation at this location.

Church Street and Vesey Street

The Church Street/Vesey Street east and west crosswalks would operate at LOS E during all peak hours, and the south crosswalk would operate at LOS E during the PM peak hour. These levels of service are generally similar to pre-September 11, 2001 projected future conditions, or worsened from LOS D to E. The Preferred Alternative would generate 20 to 25 percent of trips to points north of Vesey and east of Church Streets. Thus, based on the impact criteria described above, this project would not require mitigation at this location.

Church Street and Fulton Street

The Church Street/Fulton Street north and west crosswalks would operate at LOS E during the midday peak hour, the east crosswalk at LOS E during the AM and PM peak hours, and the

south crosswalk at acceptable levels of service during all peak hours. It is estimated that the share of project-generated trips to points east of Church Street would be less than 5 percent. Thus, based on the impact criteria described above, this project would not require mitigation at this location.

Church Street and Dey Street

The Dey Street concourse between the WTC site and the Fulton Street Transit Center would divert pedestrians from the east-west crossings at the intersection of Dey and Church Streets, and the intersection would experience an improved level-of-service as compared to pre-September 11, 2001 conditions.

Church Street and Cortlandt Street

The Dey Street connection would also divert pedestrians from the east-west crossings at the intersection of Cortlandt and Church Streets, and the intersection would experience an improved level-of-service as compared to pre-September 11, 2001 conditions.

Church Street and Liberty Street

Pedestrians would use Terminal exits in the vicinity of WTC Towers 3 and 4, and cross Church Street and Liberty Streets at street level, as noted under opening year conditions. Based on surveys conducted before September 11, 2001, it is anticipated that 40 percent of alighting AM peak hour PATH trips are destined for the Financial District.

In the AM, midday, and PM peak hours, approximately 4,490, 90 and 2,010 new trips would be added to the totals of 8,420, 4,980 and 7,050 trips, respectively, resulting in increases of up to 50 percent.

At crosswalk conditions in all peak hours at this location, LOS F conditions at the north and west crosswalks could cause pedestrians to spill into the opposing traffic travel lanes during the pedestrian signal. The loss in area per person would range from 1 to 10 SFP in the crosswalks, and from 1.3 to 12.4 in the northwest corner reservoir. The northwest corner reservoir LOS F in the AM peak hour would congest pedestrian flows when pedestrians are queued to cross away from the WTC/PATH site in the west and north crosswalks, and block pedestrians crossing inbound from the northeast and southwest corners of the intersection. Pedestrians normally crossing at Church and Liberty Street may divert to the Cortlandt or Cedar Street intersections, or illegally cross Church Street between Liberty and Cortlandt Streets. Pedestrians circulating through the northwest corner reservoir during surge conditions require more physical space than could be afforded in that area, which could force pedestrians to wait on the street in Liberty or Church Street vehicular travel lanes.

Mitigation to restore LOS E conditions would include widening the north and west crosswalks by 11 feet each, making them 26 feet wide. To restore the northwest corner reservoir LOS F conditions would include widening the north and west sidewalks by six feet each.

Given that the Preferred Alternative would generate more than 50 percent of the volume at this location, mitigation measures would be necessary as part of this project.

E. MITIGATION

The overall effect of the Preferred Alternative on the on-street pedestrian network would be an improvement over conditions that existed with the pre-September 11, 2001 WTC PATH

Terminal. The off-street connections to the Fulton Street Transit Center and many of the redeveloped WTC land uses would reduce pedestrian trips made by PATH riders that would be made on the street.

CONSTRUCTION PERIOD (2006)

During the construction period, pedestrian conditions would be nearly identical to the No Action conditions, and no specific mitigation is necessary. Because the construction of the Preferred Alternative would maintain pedestrian patterns from conditions following September 11, 2001, major shifts in pedestrian patterns are not expected. When considering the cumulative construction impacts on the pedestrian network discussed in Chapter 15, "Cumulative Effects," coordination between lead agencies would help ensure that pedestrian crossing patterns are maintained and pedestrian safety needs are accommodated.

However, to ensure the safe and convenient movement of pedestrians during the construction period, PANYNJ would implement Environmental Performance Commitments (EPCs) as part of the Preferred Alternative. As described in Chapter 8, Section B, "Vehicular Traffic and Parking," these EPCs would include a Maintenance and Protection of Traffic (MPT) Plan as well as communication tools to inform and protect the public.

OPENING YEAR (2009)

The opening year levels of service were compared to projected future conditions based on pre-September 11, 2001 volumes. Based on the criteria described above, the Preferred Alternative would result in an adverse impact at the intersection of Church and Liberty Streets.

The location of the Terminal's access points combined with the large volumes generated by the World Trade Center Memorial and Redevelopment Plan would adversely impact some crosswalks. To assess the proportion of impacts from this project, a percent share of trips attributed to the Preferred Alternative was calculated for crosswalks operating at unacceptable LOS E or F. This calculation divides the number of trips destined to and from the Permanent WTC PATH Terminal by the total number of pedestrians. Table 8D-7 summarizes adversely impacted crosswalks and lists mitigation measures, followed by the percentage share of trips attributed to the Preferred Alternative in relation to total pedestrian volumes.

Mitigation is necessary to restore some crosswalks in the Preferred Alternative's conditions to the levels of service calculated in projected future conditions based on pre-September 11, 2001 volumes. The measures suggested to mitigate adverse impacts include increases in crosswalk widths to improve levels of service at selected crosswalks on West Broadway, and on Greenwich, Church, Vesey, Fulton, and Liberty Streets, which would primarily be the result of background volumes generated by the WTC Memorial and Redevelopment Plan. The measures suggested to mitigate adverse impacts primarily due to the Preferred Alternative at the intersection of Church and Liberty Streets would consist of widening crosswalks by ten feet and sidewalks by five feet. To avoid subsequent impacts to vehicular traffic operations, it is recommended that sidewalks be widened within the limits of the WTC site. Table 8D-7 provides summaries of impacted intersections and mitigation.

It should be noted that additional or more aggressive measures may be required to mitigate the project's effects in the design year, as described below. FTA and PANYNJ would ensure that all of the required mitigation for both the opening and design year impacts is implemented in a single phase in or about the opening year.

Table 8D-7
Pedestrian Impacts and Mitigation Measures

Location	Mitigation Measure	Percent share of volumes attributed to the Preferred Alternative
Route 9A at Vesey Street		
North Crosswalk	No impact; no action needed	
East Crosswalk	No impact; no action needed	
South Crosswalk	No impact; no action needed	
Route 9A at Liberty Street		
North Crosswalk	No impact; no action needed	
East Crosswalk	No impact; no action needed	
South Crosswalk	No impact; no action needed	
West Broadway at Vesey Street		
North Crosswalk	Widen crosswalk	10-15 percent PATH effects
East Crosswalk	Widen crosswalk	10-15 percent PATH effects
South Crosswalk	Widen crosswalk	10-15 percent PATH effects
West Crosswalk	Widen crosswalk	10-15 percent PATH effects
Greenwich Street at Fulton Street		
North Crosswalk	Widen crosswalk	20-30 percent PATH effects
East Crosswalk	Widen crosswalk	20-30 percent PATH effects
South Crosswalk	Widen crosswalk	20-30 percent PATH effects
West Crosswalk	Widen crosswalk	20-30 percent PATH effects
Greenwich Street Midblock		
North Crosswalk	No impact; no action needed	
Greenwich Street at Liberty Street		
North Crosswalk	Widen crosswalk	5-10 percent PATH effects
East Crosswalk	Widen crosswalk	5-10 percent PATH effects
South Crosswalk	Widen crosswalk	5-10 percent PATH effects
West Crosswalk	Widen crosswalk	5-10 percent PATH effects
Church Street at Vesey Street		
North Crosswalk	No impact; no action needed	
East Crosswalk	Widen crosswalk	5-10 percent PATH effects
South Crosswalk	No impact; no action needed	
West Crosswalk	Widen crosswalk	25-35 percent PATH effects
Church Street at Fulton Street		
North Crosswalk	Widen crosswalk	0-5 percent PATH effects
East Crosswalk	Widen crosswalk	0-5 percent PATH effects
South Crosswalk	Widen crosswalk	0-5 percent PATH effects
West Crosswalk	Widen crosswalk	0-5 percent PATH effects
Church Street at Dey Street		
North Crosswalk	No impact; no action needed	
East Crosswalk	No impact; no action needed	
South Crosswalk	No impact; no action needed	

Table 8D-7 (cont'd)
Pedestrian Impacts and Mitigation Measures

Location	Mitigation Measure	Percent share of volumes attributed to the Preferred Alternative
Church Street at Cortlandt Street		
North Crosswalk	No impact; no action needed	
East Crosswalk	No impact; no action needed	
South Crosswalk	No impact; no action needed	
Church Street at Liberty Street		
North Crosswalk	Widen crosswalk by 10 feet	55 percent PATH effects
East Crosswalk	No impact; no action needed	
South Crosswalk	No impact; no action needed	
West Crosswalk	Widen crosswalk by 10 feet	75 percent PATH effects
Northwest Corner	Widen sidewalks by 5 feet each	75 percent PATH effects

DESIGN YEAR (2025)

The design year levels of service were compared to projected future conditions based on pre-September 11, 2001 volumes. Mitigation would be necessary at adversely impacted crosswalks at the West Broadway and Vesey Street intersection, Greenwich Street intersections at Fulton and Liberty Streets, and Church Street intersections at Vesey and Fulton Streets. The mitigation measures include widening crosswalks. At the intersection of Liberty and Church Streets, LOS F conditions would result on the northwest corner reservoir, and in the north and west crosswalks in the AM peak hour. More aggressive mitigation would be required at this location, consisting of widening crosswalks by 11 feet and sidewalks by six feet. Thus, crosswalks and sidewalks would need to be one foot wider than was presented for the opening year. The mitigation measures presented for other impacts in the opening year section would also mitigate all design year impacts. PANYNJ will coordinate with LMDC and NYCDOT to implement the recommended pedestrian improvements in the vicinity of the WTC site. ✶

A. INTRODUCTION

By fostering the use of mass transit to Lower Manhattan, the Preferred Alternative would have a beneficial effect on regional air quality in the New York Metropolitan Area (NYMA). Without the Terminal, it is expected that vehicles–miles–traveled in the metropolitan area would increase as some portion of the transit riders shift to automobiles for their daily commute (see Chapter 8B, "Vehicular Traffic and Parking"); this, in turn, would result in an increase in vehicle–related emissions such as carbon monoxide, nitrogen oxides, particulate matter, and volatile organic compounds, as discussed later in this chapter.

While the Preferred Alternative would result in a net air quality benefit to the NYMA, the pre–September 11, 2001 conditions also included that same benefit. Furthermore, since the Preferred Alternative would not, in itself, result in an increased ridership when compared to the forecasts prepared before September 11, 2001 condition, there would be no change in local air quality in the vicinity of the Project Site or stations in New Jersey. The Preferred Alternative would essentially provide better service to demand that was forecasted to have occurred under any condition. Moreover, as discussed in Chapter 8B, Chapter 8, Section B, "Vehicular Traffic and Parking," a very small percentage of PATH riders generated vehicle trips at the WTC site. Therefore, the Preferred Alternative would result in a very small number of vehicle trips in the vicinity of the WTC, which is consistent with pre–September 11, 2001 conditions. The Preferred Alternative would also use electricity, steam, and/or river water cooling to provide for energy needs and would not require any on–site combustion of pollution–generating fossil fuels.

The greatest potential for adverse impacts on ambient air quality from the Preferred Alternative is during the construction phase. A detailed assessment of the potential construction–related impacts to air quality is included in this chapter. The cumulative effects of the Preferred Alternative's construction along with other projects planned in Lower Manhattan are discussed in Chapter 15, "Cumulative Effects." Furthermore, as described in Chapter 2, "Project Alternatives," the Port Authority of New York and New Jersey (PANYNJ) has committed to a series of environmentally friendly ("green") design measures, including energy conservation measures, which would result in an overall reduction in pollutant emissions.

B. METHODOLOGY

POLLUTANTS FOR ANALYSIS

In the NYMA, ambient concentrations of carbon monoxide are predominantly influenced by mobile source emissions. Emissions of particulate matter and nitrogen oxides come from both mobile and stationary sources; emissions of sulfur dioxide are associated mainly with stationary sources. Ozone, one of the region's most problematic air pollutants, is not emitted directly in any substantial quantity, but is formed in the atmosphere by a series of complex chemical reactions involving mainly volatile organic compounds and nitrogen oxides.

CARBON MONOXIDE

Carbon monoxide (CO), a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In an urban area, approximately 80 to 90 percent of CO emissions are from motor vehicles. CO concentrations can vary greatly over relatively short distances. Elevated concentrations are usually limited to crowded intersections, heavily traveled and congested roadways, or parking lots or garages. Consequently, CO concentrations must be predicted on a local scale (microscale).

While operation of the Preferred Alternative would not result in any long–term increase in vehicular traffic at local intersections, a microscale analysis of the impact of construction on CO concentrations at affected intersections has been performed.

NITROGEN OXIDES AND OZONE

Nitrogen oxides (nitrogen oxide, NO, and nitrogen dioxide, NO_2—together NO_x) are of principal concern because of their role, together with volatile organic compounds (VOCs), as precursors in the formation of ozone. While there is a standard for average annual NO_2 concentrations, it is normally examined only for large fossil fuel energy sources. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow and occur as the pollutants are diffusing downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from mobile sources are therefore generally examined on a regional basis, together with the emission of these pollutants from stationary sources. The change in regional mobile source emissions of these pollutants is related to the total number of vehicle trips and vehicle miles of travel throughout the NYMA, which is designated as a severe non–attainment area for ozone by the United States Environmental Protection Agency (EPA) (i.e., counties in Northern New Jersey, New York City, Long Island, Southern Hudson Valley, and western Connecticut).

Operation of the Preferred Alternative would result in a long–term reduction in vehicular traffic at local intersections; however, its construction would result in temporary emission of ozone precursors from on–road and on–site engines. A regional (mesoscale) analysis has been performed for both sources.

LEAD

Lead emissions in air are principally associated with industrial sources and motor vehicles that use gasoline containing lead additives. Most U.S. vehicles produced since 1975, and all produced after 1980, are designed to use unleaded fuel. As these newer vehicles have replaced the older ones, motor–vehicle–related lead emissions have decreased. As a result, ambient concentrations of lead have declined substantially. Nationally, the average measured atmospheric lead level in 1985 was only about one–quarter the level of 1975.

In 1985, EPA announced new rules drastically reducing the amount of lead permitted in leaded gasoline. Monitoring results indicate that this action has been effective in substantially reducing atmospheric lead levels. Even at locations in the New York City area where traffic volumes are very high, atmospheric lead concentrations are far below the national standard of 1.5 micrograms per cubic meter (3–month average).

No substantial sources of lead are associated with the Preferred Alternative, and, therefore, analysis was not warranted.

RESPIRABLE PARTICULATE MATTER—PM_{10} AND $PM_{2.5}$

Particulate matter (PM) is a broad class of air pollutants that includes discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets (aerosols) or solids suspended in the atmosphere. The constituents of PM are both numerous and varied, and they are emitted by a wide variety of sources (both natural and anthropogenic). Natural sources include the condensed and reacted forms of natural organic vapors; salt particles resulting from the evaporation of sea spray; wind–borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and debris from live and decaying plant and animal life; particles eroded from beaches, soil and rock; particles emitted from volcanic and geothermal eruptions and from forest fires. Major anthropogenic sources include the combustion of fossil fuels (e.g., vehicular exhaust, power generation, home heating), chemical and manufacturing processes, all types of construction, agricultural activities, as well as wood–burning stoves and fireplaces. Particulate matter also acts as a substrate for the adsorption of other pollutants, often toxic and some likely carcinogenic compounds.

Fine particulate matter, or $PM_{2.5}$, are fine particles with an aerodynamic diameter of less than or equal to 2.5 micrometers. This smaller fraction of the particle size range has the ability to reach the lower regions of the respiratory tract, delivering with it other compounds that adsorbed to the surfaces of the particles, and is also extremely persistent in the atmosphere. $PM_{2.5}$ is mainly derived from combustion material that has volatilized and then condensed to form primary particulate matter (often soon after the release from an exhaust pipe or stack) or from precursor gases reacting in the atmosphere to form secondary particulate matter. Diesel–powered vehicles, especially heavy trucks and buses, are a substantial source of respirable PM; PM concentrations may, consequently, be locally elevated near roadways with high volumes of heavy diesel–powered vehicles.

A microscale analysis of $PM_{2.5}$ and PM_{10} (particles with an aerodynamic diameter of less than or equal to 10 micrometers) has been conducted for the construction phase of the Preferred Alternative, which would include potential sources such as diesel engine and fugitive dust emissions.

SULFUR DIOXIDE

Sulfur dioxide (SO_2) emissions are primarily associated with the combustion of sulfur–containing fuels: oil and coal.

Due to the federal restrictions on the sulfur content in diesel fuel for on–road vehicles, no substantial quantities are emitted from vehicular sources. Additionally, during the construction phase, all on–site nonroad engines would be employing ultra low sulfur diesel (ULSD), which would emit very small amounts of SO_2. Therefore, analysis of SO_2 was not warranted.

AIR QUALITY STANDARDS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the Clean Air Act, primary and secondary NAAQS have been established for six major air pollutants: CO, NO_2, ozone, respirable PM, SO_2, and lead. The primary standards protect public health and represent levels at which there are no known substantial effects on human health. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the

environment. For NO_2, ozone, lead and PM, the primary and secondary standards are the same; there is no secondary standard for CO. EPA recently promulgated additional NAAQS which became effective September 16, 1997: a new 8–hour standard for ozone, which will replace the existing 1–hour standard, and in addition to retaining the PM_{10} standards, EPA adopted 24–hour and annual standards for $PM_{2.5}$. The standards for these pollutants are presented in Table 9–1. These standards have also been adopted as the ambient air quality standards for New York State.

INTERIM GUIDANCE CRITERIA REGARDING $PM_{2.5}$ IMPACTS

New York State Department of Environmental Conservation (NYSDEC) has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts. This draft policy would apply only to facilities applying for permits or major permit modification under the State Environmental Quality Review Act (SEQRA) that emit 15 tons of PM_{10} or more annually. The interim draft policy states that such a project will be deemed to have a potential adverse impact if the project's maximum predicted impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 $\mu g/m^3$ averaged annually or more than 5 $\mu g/m^3$ on a 24–hour basis. Projects that exceed either the annual or 24–hour threshold will be required to prepare a written assessment of the severity of the impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts to the maximum extent practicable. The Preferred Alternative as a whole was not predicted to have emissions of more than 15 tons per year at any stage, and is not a "source" requiring a permit from NYSDEC.

New York City Department of Environmental Protection (NYCDEP) is currently recommending interim guidance criteria for evaluating the potential $PM_{2.5}$ impacts from projects in New York City. The interim guidance criteria currently employed by NYCDEP[1] for determination of adverse impacts from $PM_{2.5}$ are as follows:

- Predicted 24–hour (daily) average increase in $PM_{2.5}$ concentrations greater than 5 $\mu g/m^3$ at a discrete location of public access, either at ground or elevated levels (microscale analysis); and
- Predicted annual average increase in ground–level $PM_{2.5}$ concentrations greater than 0.1 $\mu g/m^3$ on a neighborhood scale (i.e., the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating background monitoring stations).

In order to put these levels in context, the average bias (difference) between 24–hour average $PM_{2.5}$ concentrations measured at collocated monitors (two identical monitors at the same location) in four monitoring stations in New York City from January to December 2000 ranged from 0.41 to 0.83 $\mu g/m^3$. Monitored changes in concentration that would be lower than these levels could not conclusively indicate any change in concentration.

The above NYCDEP draft interim guidance criteria have been used for the purpose of evaluating the impacts of the Preferred Alternative on $PM_{2.5}$ concentrations from mobile sources, and determine the need to mitigate particulate matter emissions from the Preferred Alternative.

[1] NYCDEP, Croton Water Filtration Plant EIS, January 2004.

Table 9–1
Ambient Air Quality Standards

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
Maximum 8–Hour Concentration[1]	9	10,000	None	
Maximum 1–Hour Concentration[1]	35	40,000		
Lead				
Maximum Arithmetic Mean Averaged Over 3 Consecutive Months	NA	1.5	NA	1.5
Nitrogen Dioxide (NO_2)				
Annual Arithmetic Average	0.053	100	0.053	100
Ozone (O_3)				
1–Hour Average[2]	0.12	235	0.12	235
8–Hour Average[3]	0.08	157	0.08	157
Total Suspended Particles (TSP)				
Annual Mean Rural Open Space Rural Residential Urban Residential Urban Industrial	NA	 45 55 65 75	None	
Maximum 24–Hour Concentration	NA	250		
Respirable Particulate Matter (PM_{10})				
Average of 3 Annual Arithmetic Means	NA	50	NA	50
24–Hour Concentration[1]	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Average of 3 Annual Arithmetic Means	NA	15	NA	15
24–Hour Concentration[4]	NA	65	NA	65
Sulfur Dioxide (SO_2)				
Annual Arithmetic Mean	0.03	80	NA	NA
Maximum 24–Hour Concentration[1]	0.14	365	NA	NA
Maximum 3–Hour Concentration[1]	NA	NA	0.50	1,300

Notes:

ppm – parts per million
µg/m^3 – micrograms per cubic meter
NA – not applicable

Particulate matter concentrations are in µg/m^3. Concentrations of all gaseous pollutants are defined in ppm — approximately equivalent concentrations in µg/m^3 are presented.

TSP levels are regulated by a New York State Standard only. All other standards are National Ambient Air Quality Standards (NAAQS).

[1] Not to be exceeded more than once a year.
[2] Applies only to previously designated non attainment areas—until formal revocation by EPA.
[3] Three–year average of the annual fourth highest daily maximum 8–hr average concentration.
[4] Not to be exceeded by the 98th percentile averaged over 3 years.

Sources: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards;
6 NYCRR Part 257: Air Quality Standards.

STATE IMPLEMENTATION PLAN (SIP)

The Clean Air Act, as amended in 1990 (CAA) defines non–attainment areas (NAA) as geographic regions that have been designated as not meeting one or more of the NAAQS. When an area is designated as non–attainment by EPA, the state is required to develop and implement a State Implementation Plan (SIP) for each applicable NAAQS, which is a state's plan on how it will meet the NAAQS under the deadlines established by the CAA.

EPA has re–designated New York City as in attainment for CO. The CAA requires that a maintenance plan ensure continued compliance with the CO NAAQS for former non–attainment areas. New York City is also committed to implementing site–specific control measures throughout the city to reduce CO levels, should unanticipated localized growth result in elevated CO levels during the maintenance period.

Manhattan has been designated as a moderate NAA for PM_{10}. On December 17, 2004, EPA took final action designating the five boroughs of New York City as well as Nassau, Suffolk, Rockland, Westchester and Orange counties as $PM_{2.5}$ non-attainment areas under the CAA. State and local governments are required to develop implementation plans (by early 2008) that include measures designed to attain the standards in or after 2010.

Nassau, Rockland, Suffolk, Westchester and the five counties of New York City have been designated as severe non–attainment for ozone 1–hour standard. In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which was finalized and approved by EPA effective March 6, 2002, addressing attainment of the one–hour ozone NAAQS by 2007. New York State has recently submitted revisions to the SIP; these SIP revisions included additional emission reductions that EPA requested to demonstrate attainment of the standard, and an update of the SIP estimates using two new EPA models—the mobile source emissions model MOBILE6, and the non–road emissions model NONROAD—which have been updated to reflect current knowledge of engine emissions, and the latest mobile and non–road engine emissions regulations. On April 15, 2004, EPA designated these same counties as moderate non–attainment for the new 8–hour ozone standard which became effective as of June 15, 2004 (the entire Orange county was moved to the Poughkeepsie moderate non–attainment area for 8–hour ozone). EPA will revoke the 1–hour standard in June, 2005; however, the specific control measures for the 1–hour standard included in the SIP will be required to stay in place until the 8–hour standard is attained. The discretionary emissions reductions in the SIP would also remain but could be revised or dropped based on modeling. A new SIP for ozone will be adopted by the state no later than June 15, 2007, with a target attainment deadline of June 15, 2010.

TRANSPORTATION CONFORMITY

The conformity requirements of the Clean Air Act and regulations promulgated thereunder (conformity requirements) limit the ability of Federal agencies to assist, fund, permit, and approve transportation projects that do not conform to the applicable SIP. An area's metropolitan planning organization, which is the entity responsible for transportation planning, together with the State, are responsible for demonstrating conformity of metropolitan long–range transportation plans and transportation improvement programs. The U.S. Department of Transportation (USDOT) has final approval authority over the conformity of plans and transportation improvement programs. Conformity determinations for FTA projects must be made according to the requirements of 40 CFR Part 93.

At this time, as a result of the terrorist attacks of September 11, 2001, and the loss of New York Metropolitan Transportation Council (NYMTC's) files containing regional transportation and air quality data, combined with the damage incurred to the downtown mass transit system, the conformity requirements for the NYMA have been temporarily waived until September 30, 2005, pursuant to Public Law 107–230; Stat. 1469, enacted October 1, 2002. As part of the waiver process, project sponsors are to consult with the Interagency Consultation Group (ICG) to determine if the Preferred Alternative would be considered regionally significant and if additional air quality analysis is required during the waiver period. PANYNJ consulted with the ICG in February 2004, and the ICG has determined that in the absence of the waiver, this project would be exempt from conformity analysis requirements in accordance with 40 CFR 93.127. The ICG also agreed that a mesoscale analysis is not required.

MICROSCALE AIR QUALITY ANALYSIS METHODOLOGY

OVERVIEW

The air quality analysis in this EIS focuses on the potential adverse impacts during construction of the proposed WTC Permanent PATH Terminal. The cumulative air quality analysis in Chapter 15, "Cumulative Effects," applies the same procedures discussed below to a number of major projects assumed to be under construction simultaneously. In addition, regional (mesoscale) emissions inventories were prepared to determine the predicted direct and indirect emissions during construction, and predicted direct and indirect emissions savings attributable to the operation of the Terminal.

During construction, the potential effects on ambient air quality in the study area are the sum of three distinct sources of air pollutant emissions. The three sources are:

- On Road mobile sources (CO and PM)
- Construction equipment (CO, NO_2 and PM)
- Fugitive dust (PM only)

Mobile sources are the on–road construction vehicles (transporting materials or removing debris) traveling to and from the site, as well as their effects (i.e., increased congestion) on the base vehicular traffic traveling on the same roads. The construction equipment includes all of the fossil–fueled machinery that would be necessary to complete each element of the Preferred Alternative in the 2006 analysis year. Fugitive dust emissions are a result of activities that disturb material likely to result in the release of particulate matter. Examples of this type of emission include excavation, demolition, and vehicular traffic on paved or unpaved surfaces.

It is important to include each of these sources since they may act in concert to yield elevated levels of air pollutants. For example, while the particulate matter in diesel exhaust mostly consists of $PM_{2.5}$ and the fugitive dust from earth–moving activities are generally greater in size that PM_{10}, there is some contribution of $PM_{2.5}$ from the latter.

The following sections describe the methodologies used for each of the analyses described above.

ANALYSIS OF ON-ROAD MOBILE SOURCES

To compare estimated CO concentrations from the Preferred Alternative with the national ambient air quality standards for CO (which are based on 1– and 8–hour averages of CO

concentrations), estimates of maximum construction-related concentrations for these same periods must be prepared. Since experience in the study area has been that violations of the 1–hour CO standard are extremely rare, the CO analysis for this study focuses on determining the maximum predicted 8–hour CO concentrations.

Similarly, analyses of PM_{10} and $PM_{2.5}$ were conducted for the 24–hour and annual average conditions.

The on–road analyses for the Preferred Alternative are based on a modeling approach approved by EPA that has been widely employed for evaluating air quality impacts of projects in New York City, New York State, and throughout the country. Some additional, newer procedures for modeling $PM_{2.5}$ that have been developed in coordination with NYCDEP are also used. A series of worst–case assumptions relating to meteorology, traffic, and background concentration levels, were used as inputs. This approach results in a conservative estimate of expected air quality impacts caused by the Preferred Alternative and the resulting total pollutant concentrations.

Dispersion Models for Microscale Analyses

At all sites selected for CO analysis, maximum predicted 8–hour average CO concentrations were determined using EPA's CAL3QHC model[1], Version 2.0. The CAL3QHC model is a Gaussian dispersion model, which assumes that the dispersion of pollutants downwind of a pollution source follows a Gaussian (or normal) distribution, and is designed specifically for predicting CO concentrations along roadway segments.

Ambient concentrations of PM were computed at the selected receptor sites using the more refined version, CAL3QHCR. This version of the model can utilize hourly traffic and meteorology data, and is therefore more appropriate for calculating 24–hour and annual average concentrations. Tier II analysis, which includes the modeling of hour–by–hour concentrations based on hourly traffic data and 5–years of monitored hourly meteorological data, was performed to predict maximum 24–hour and annual average PM levels.

Worst–Case Meteorological Conditions

In general, the transport and concentration of pollutants from vehicular sources are influenced by three principal meteorological factors: wind direction, wind speed, and atmospheric stability, which accounts for the effects of dispersion or mixing in the atmosphere.

The CAL3QHC CO computations were performed using a wind speed of one meter per second, and stability class D, representative of neutral conditions in New York City. At each receptor location, the wind angle that maximized the pollutant concentrations was used in the analysis regardless of frequency of occurrence.

The CAL3QHCR Tier II PM analyses utilized monitored hourly meteorological data from LaGuardia Airport station in the years 1998–2002. All hours are modeled, and the highest resulting concentration for any averaging time is presented.

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[1] EPA, *A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections,* User's Guide to CAL3QHC. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, September 1995.

Vehicle Emissions Data

Vehicular exhaust emission factors were computed using the EPA Mobile Source Emissions Model, MOBILE6.2[1]. This is the latest, recently released emissions model, capable of calculating engine emission factors for various vehicle types, based on the fuel type (gas, diesel, or alternative technologies), meteorological conditions, vehicle speeds, roadway types, number of starts per day and engine soak time, and various other factors that influence emissions, such as inspection maintenance programs.

Vehicle classification data were based on field studies and data obtained from other traffic studies as discussed in Chapter 8, "Transportation." Emission estimates were based on guidance from NYCDEP and NYSDEC on the appropriate credits to be used in the MOBILE6.2 model to accurately reflect the inspection and maintenance program. The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from the vehicles' exhaust systems are below acceptable emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered.

Based on the latest guidance from NYSDEC and NYCDEP, taxis are assumed to all be in hot stabilized mode which excludes any start-up emissions. The general categories of vehicle types for specific roadways were further categorized into subcategories based on their relative fleet–wide breakdown[2].

An ambient temperature of 52.5° Fahrenheit was used for the sites in New York City. This temperature, calculated based on the latest guidance from EPA, NYSDEC, and NYCDEP, represents the average temperature measured at the Central Park meteorological station during the 10 highest 8–hour CO events measured at the East 34th Street NYSDEC air quality monitoring station during the years 2000 through 2002.

Re–entrained road dust is not expected to have a substantial impact on $PM_{2.5}$ concentrations since these particles are typically larger than 2.5 micrometers. However, the contribution of re–entrained road dust to PM_{10} concentrations, as presented in the PM_{10} SIP, is considered to be substantial, so the PM_{10} estimates include both exhaust and road dust. Road dust emission factors were calculated according to the latest procedure delineated by EPA[3].

Site Selection

The selection of air quality receptor sites followed the guidance suggested by EPA in the Revisions to the Guideline on Air Quality Models (40 CFR Part 51) and in Guideline on Air Quality Models, the EPA's Guideline for Modeling Carbon Monoxide from Roadway Intersections (EPA–454/R–92–005, 1992).

Based on the results of this screening analysis, the sites that were analyzed were the intersections of Route 9A and Vesey Street, and Route 9A and Liberty Street. These intersections include the

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[1] EPA, *User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model*, EPA420-R-02-028, October 2002.

[2] The MOBILE6 emissions model utilizes 29 vehicle categories by size and fuel. Traffic counts and predictions are based on broader size categories, and then broken down according to the fleet–wide distribution of subcategories and fuel types (diesel, gasoline, or alternative).

[3] EPA, *Compilation of Air Pollutant Emission Factors AP–42, Fifth Edition, Volume I: Stationary Point and Area Sources*, Ch. 13.2.1, NC, http://www.epa.gov/ttn/chief/ap42/, December 2003.

locations that would experience a combination of the highest background traffic volumes and levels of service, and the highest volumes of project-induced traffic from all access routes converging near the Project Site and leaving the Project Site.

In addition, for PM modeling only, the roadways surrounding the entire site, Vesey, Church, Liberty and West Streets were modeled, adding both project contributions and additional background contributions from local roadways that would not be included in the measured background levels.

ANALYSIS OF ON-SITE CONSTRUCTION ACTIVITY

Scenarios

The analyses were performed for two scenarios, based on the alternatives being considered for the Route 9A Project. Since air pollutant emissions for the construction of the pedestrian concourse which would run under Route 9A would vary significantly depending on the choice of an at-grade or short bypass tunnel scenario for Route 9A, both scenarios were analyzed.

Emission Factors

Stationary source analysis was conducted for all construction engines predicted to be on-site, including trucks entering, exiting and idling when necessary. Diesel construction engines—excluding trucks—would be using ultra low-sulfur diesel (ULSD) fuel; where practicable, engines larger that 60 horsepower (HP) would include emissions reduction measures to reduce emissions of PM and volatile organic compounds (VOCs). These emission reductions are premised on the application of the Environmental Performance Commitments (EPCs) discussed in Chapter 3, "Construction Methods and Materials," which the PANYNJ has committed to as part of the Lower Manhattan Recovery Project's Environmental Analysis framework. These commitments have been made to lessen the severity of the potential adverse effects of construction on ambient air in lower Manhattan. For the purpose of this study, it was assumed that PM emissions from all such engines would be reduced by 40 percent—the average reduction achieved by using diesel oxidation catalysts (DOC)[1,2]. PM emissions may be further reduced in cases where diesel particle filters (DPF) would be used—85 percent reductions or higher can be achieved with this technology, and in cases where diesel engines can be replaced with electric engines connected to grid power thus eliminating those local emissions altogether. Since it is uncertain at this time what emission reduction technologies would be most efficient with each equipment type, and since DOCs reduce more VOCs, which are ozone precursors and are of regional concern, the EPCs provide the flexibility to utilize either DOC or DPF control technologies. Therefore, the minimum PM emissions reduction of DOCs was assumed for the local impact analyses.

Emission factors for all analyzed pollutants emitted from the combustion of fuel by on-site construction equipment (excluding delivery trucks/heavy vehicles) were developed using the Draft EPA NONROAD2004 Emissions Model (NONROAD)[3,1]. The model is based on source

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[1] NESCAUM, Memorandum - Diesel Emissions Resulting from Ground Zero Activity, April 8, 2002.

[2] Environment Canada, NESCAUM, Manufacturer of Emission Controls Association, The Impact Of Retrofit Exhaust Control Technologies on Emissions From Heavy-Duty Diesel Construction Equipment, SAE 199-01-0110.

[3] EPA, *EPA's Newest Draft Nonroad Emission Inventory Model*; www.epa.gov/otaq/nonrdmdl.htm, May 2004

inventory data accumulated for specific categories of nonroad equipment. Data provided in the output files from NONROAD were used to derive (i.e., back-calculate from regional emission estimates) the emission factors for each type of equipment that is expected to be present on-site during construction activities. Rates of emission from on-site trucks delivering or removing material were developed using the EPA MOBILE6.2 emissions model as described above. Emission rates associated with fugitive dust emissions from mobile equipment were developed using the procedures defined in EPA's AP–42[2]. Engine emissions are generally predicted to diminish over the years, as newer technologies are introduced. However, for the multi-year regional emissions inventory, VOC and PM emissions were conservatively assumed throughout construction. NO_x emissions were predicted to gradually decrease over the years as newer technologies become available.

In order to predict average concentrations for the time periods corresponding to the appropriate standards and regulations, emissions were modeled for two time periods: 24–hour and annual. These emissions were based on the construction activity predicted for each of those time scales. As described previously in Chapter 3, "Construction Methods and Materials," typical daily activity emissions were calculated on a monthly basis and averaged over the year to produce annual emission rates for each work zone; peak–day activity emissions were calculated on a monthly basis, and the values calculated for the month with the highest total emissions from all work zones were used for the 24–hour emission rates. For predictions of annual average concentrations annual average emissions were used throughout the year.

The analysis has been updated since the DEIS. The Liberty Plaza Connection is no longer assessed, and more refined information and data regarding the construction of the pedestrian concourse under Route 9A have been incorporated into the analysis based on updated construction plans from NYSDOT. This includes the elimination of the bus–way to site 26 in Battery Park City, now included as part of the WTC subgrade parking facilities (within the cumulative model). In addition to the construction under the Route 9A Short Bypass Alternative, the effect of the Route 9A At Grade Alternative on the construction of the pedestrian concourse was examined. This impacts not only the cumulative analysis, but the project-specific analysis as well since it would change the construction of the pedestrian concourse which is associated with the Preferred Alternative.

NO_x emissions include both NO and NO_2. For the microscale analyses, NO_2 is the pollutant of interest, to be compared to the NAAQS of 100 $\mu g/m^3$. Approximately 10 percent of NO_x emissions from diesel engines, such as construction equipment or trucks, are in the form of NO_2. However, NO transforms into NO_2 after it is emitted as part of the photochemical process that occurs as the pollutants travel downwind. Since the focus in the microscale analyses is on receptors immediately adjacent to the site, it is assumed that a full conversion of NO to NO_2 would not occur. The time scale for maximal conversion under urban conditions is on the order of 30 to 45 minutes (Seinfeld and Pandis, 1997).[3] After that time, maximal conversion would

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[1] EPA, *User's Guide for the EPA Nonroad Emissions Model Draft NONROAD 2002*, EPA420-P-02-013, December 2002

[2] USEPA, *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*, various sections, www.epa.gov/ttn/chief/ap42, NC, January 1995—updates and draft sections through 2003.

[3] Seinfeld, John H., Pandis, Spyros N. 1998, Atmospheric Chemistry and Physics – From Air Pollution to Climate Change, John Wiley & Sons, New York, NY, 1997.

reach peak at approximately 58 percent, which is the regional NO_2/NO_x ratio monitored at NYSDEC stations. Since mean wind speed is 5.4 meters per second, the average detention time for the chemical reactions would be on the order of a few seconds for the nearest location, and a few minutes at most for the furthest locations downwind. At five minutes the expected conversion level is 36 percent (this would be the level at a minimum of approximately 100 meters from the source). Although much less conversion would occur by the time the pollutants reach the nearest receptors (where the highest concentrations are expected), a more conservative estimate was used for this study, assuming the average conversion rate to be 40 percent for all modeled locations.

Dispersion Modeling

Air quality impacts from construction emissions were evaluated using the Industrial Source Complex Short Term (ISC3) dispersion model developed by EPA[1]. The ISC3 model calculates pollutant concentrations from one or more sources based on hourly meteorological data, and has the capability to take into account the effect of downwash (exhaust plume affected by wakes and eddies from nearby structures). The meteorological data set consisted of the five latest years of concurrent meteorological data appropriate for the study site at LaGuardia Airport (1998–2002).

Background Concentrations

The modeling analysis directly accounts for only those pollutants emitted by local sources included in the model. Background concentrations, representing all other source contributions, must be added to the model predictions to obtain total or ambient levels at a prediction site. The highest recent monitoring data from NYCDEP monitoring stations (discussed in the next section) was used to represent background contributions from distant sources. Only the CO concentrations have been adjusted for future years to account for reduced vehicular emissions in the analysis years. Background traffic contributions from local roadways (that is traffic which is not related to the Preferred Alternative) were modeled explicitly in the same model for mobile source models, or separately for the construction site model.

RECEPTOR LOCATIONS

The emission estimates and dispersion modeling are used to determine the increase in pollutant concentration from construction activities at discrete locations in the analysis which are called receptors. Receptors were placed at locations that would have continuous public access such as residences, offices, open spaces, and in some cases sidewalks—representative locations in the vicinity of the construction activities, as well as elevated locations on all residential buildings and hotels. As shown in Figure 9–1, receptors were concentrated at locations surrounding the Project Site and in close proximity to the construction activities. As the distance increases from the construction site, the effects of construction of the Preferred Alternative on ambient air quality decreases and therefore, the greatest potential for project–related impacts would occur in the nearest group of receptors.

[1] USEPA, *User's Guide for the Industrial Source Complex (Isc3) Dispersion Models*, EPA-454/B-95-003a, NC, 1995 and update 2002.

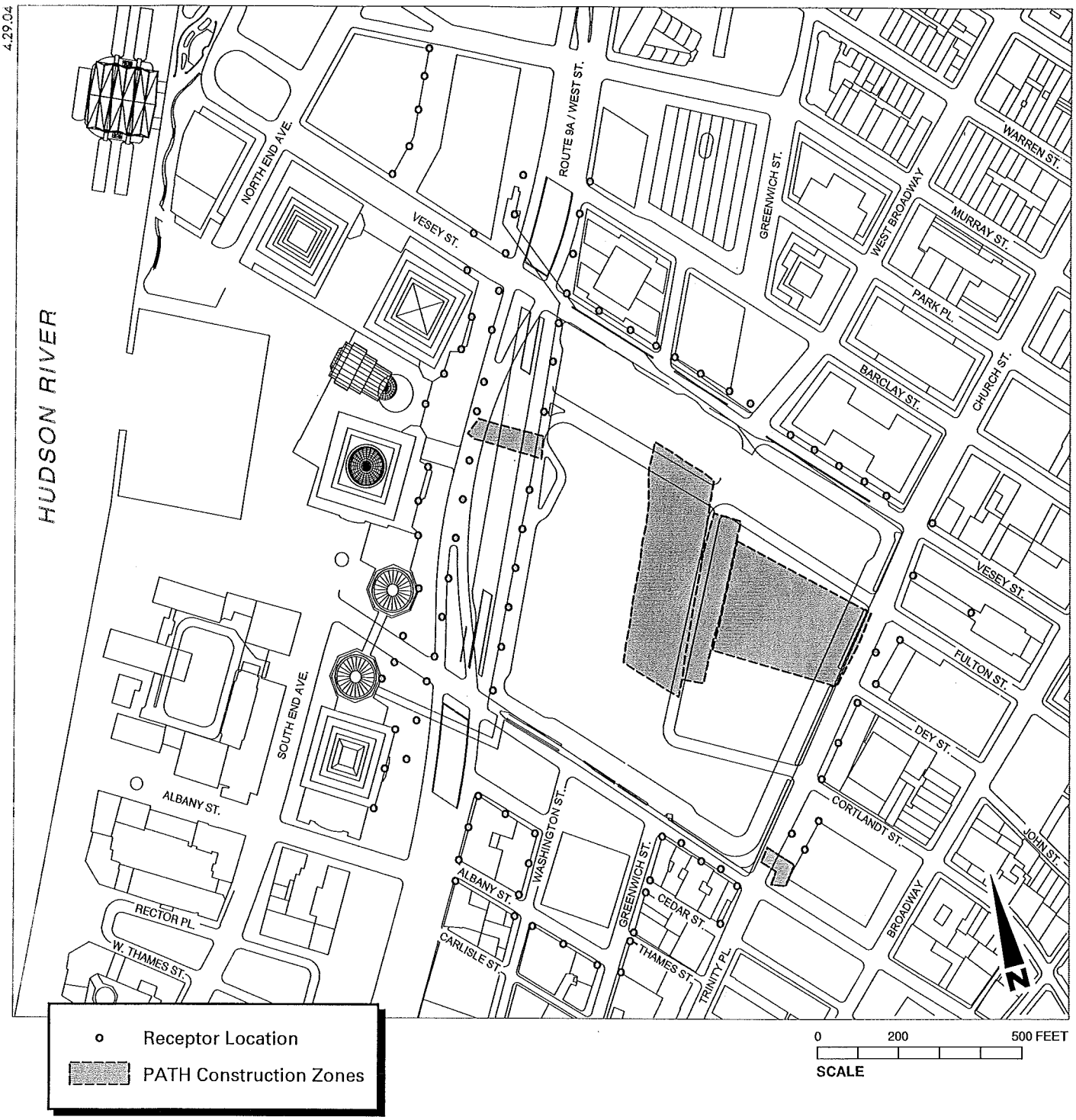


Figure 9-1

On-Site Model Source and Receptor Locations

MESOSCALE ANALYSIS OF EMISSIONS FROM CONSTRUCTION AND OPERATION OF THE PROJECT

A mesoscale (i.e., regional) analysis of air pollutants is typically performed by computing total pollutant levels ("burdens") within a project's overall study area. Pollutant burdens represent total expected quantities of pollutant emissions for a region throughout a defined time period.

CONSTRUCTION PERIOD EMISSIONS

An inventory of emissions from construction engines which would be operating on-site and from vehicles serving the construction operations of the Project Site, on an annual basis, was prepared based on the same assumptions presented above for the microscale analyses.

The inventory includes all emissions related to the construction of the Preferred Alternative. Emission factors were modeled using EPA's MOBILE6.2, AP-42 and NONROAD emissions models, as described above for the microscale analysis.

All worker, supervisor, service, utilities and fuel trips were assumed to be a round-trip distance of 18.4 miles, which is the average distance traveled for work related trips as reported by the New York Metropolitan Transportation Council (NYMTC). Concrete trucks were assumed to travel a distance of 26.2 miles—the average distances to four major concrete plants that were identified as potential suppliers. All other materials and excavated material removed from the site were assumed to travel across the George Washington Bridge, a round trip distance of 20.6 miles within the New York Metropolitan area.

A detailed description of the construction process, the engines predicted to be operating on-site and emission factors for all engines and vehicles throughout the construction years can be found in Appendix D.

Total annual emissions from construction engines were obtained by multiplying the emission factor by the hours of operation per day and the duration in days for each engine. On-road emissions were calculated by multiplying the average region-wide emission factors for each vehicle type by the distance traveled for each trip.

OPERATIONAL PERIOD EMISSIONS REDUCTION

The increment in pollutant emissions was computed for annual quantities of CO, VOCs, NO_x, and PM_{10} emitted by project-related changes in vehicular activity within the study area. Traffic reduction and the associated vehicle miles were estimated for conditions both with and without the Terminal, with the difference representing the reduction in VMT attributable to the Preferred Alternative.

Vehicular pollutant burdens were computed based on the EPA emission estimating procedures, using MOBILE6.2 (for CO, PM_{10}, VOCs, and NO_x) and the procedures described in AP-42 (for resuspended road dust). The choice and use of MOBILE6.2 is described in more detail above.

The estimate of reduced emissions due to the operation of the Terminal as compared to the No Action scenario, in which temporary service would be entirely disrupted, was computed based on annual trip reduction estimates. The annual number of vehicle trips was estimated based on travel demand factors presented in Chapter 8, "Transportation," and translated into vehicle miles based on an average travel distance of 9.2 miles for work related trips as reported by NYMTC. Assignment of the destinations and origins of the trips associated with the Preferred Alternative

was based on origin–destination information reported in the U.S. Census for the New York region.

NYSDEC has submitted detailed draft MOBILE6 regional emissions modeling results to EPA for 2007 as an update to the ozone SIP, including a breakdown of miles traveled on all roadway types and speeds by all vehicle classes. This model was used to generate NO_x and VOC emissions for all model years. The same model was revised in order to produce worst case winter CO emissions, as described in above. Meteorological conditions for the VOCs and NO_x were taken from the SIP determination, reflecting the summer ozone season.

C. DESCRIPTION OF THE AFFECTED ENVIRONMENT

PRE–SEPTEMBER 11, 2001 BASELINE CONDITIONS

The modeling analyses directly account for pollutants emitted by sources that are included in the models. However, background concentrations must be added to the concentrations predicted from these sources to obtain the total predicted ambient concentrations at any given location.

Worst–case background concentrations are represented by the highest concentrations monitored during past years at the nearest NYSDEC background monitoring stations. Stations used for background would generally be stations that are designed to monitor general population exposure and are located so as not to monitor specific local sources (i.e., stations that are not source–oriented, such as mobile source stations) but rather the impact of distant background sources. The concentrations monitored at such stations do nonetheless include a component of impacts from local sources, such as traffic, and therefore this approach results in a conservatively high estimate of total predicted concentrations.

The case of Lower Manhattan is somewhat unique in this respect. Prior to September 11, 2001, there were few, if any, monitoring stations in the immediate vicinity of the WTC site; however. in response to the terrorist attacks and the ensuing impact on air quality, New York State and Federal agencies initiated numerous air monitoring activities to better understand the ongoing impact of the disaster on air quality.

Table 9–2 provides monitoring data for both before and after the terrorist attacks. Because the post–September 11, 2001 data were collected long after the attacks, they are not influenced by the attacks themselves. These data represent existing conditions with reduced activity in Lower Manhattan, but possibly include components of ongoing reconstruction activity. Concentrations measured during both of these periods can be used as background for current conditions and future conditions in the absence of the major Lower Manhattan Recovery Projects. Modeled impacts of future activity can be added to these background concentrations as described above, to obtain the total predicted outdoor air quality. This procedure results in conservatively high concentrations because background concentrations of pollutants are decreasing over the years. The maximum concentrations presented for each pollutant and averaging period are the levels that were used as background in this study.

CHANGES IN THE AFFECTED ENVIRONMENT SINCE SEPTEMBER 11, 2001

The impact of September 11, 2001 on air quality in Lower Manhattan is related in this section. This is not intended as a comprehensive analysis, but is restricted to an overview of issues

Table 9–2
Measured Concentrations from the Nearest Air Quality Monitoring Stations

Pollutant	Station	Period	Units	2000	2001	2002	Max
CO	PS 59, 288 E. 57th Street, Manhattan	1–hour	ppm	4.1	3.7	3.2	4.1
		8–hour	ppm	2.8	2.3	2.2	2.8
NO_2	Mabel Dean, 240 2nd Ave.	Annual	ppm	0.036	0.038	NA	0.038
	PS 59, 288 E. 57th Street, Manhattan	Annual	ppm	0.038	0.038	0.038	
SO_2	Mabel Dean, 240 2nd Ave.	3–hour	ppm	0.081	0.064	NA	0.081
	PS 59, 288 E. 57th Street, Manhattan	3–hour	ppm	0.073	0.065	0.057	
	Mabel Dean, 240 2nd Ave.	24–hour	ppm	0.045	0.045	NA	0.046
	PS 59, 288 E. 57th Street, Manhattan	24–hour	ppm	0.046	0.038	0.036	
	Mabel Dean, 240 2nd Ave.	Annual	ppm	0.013	0.014	NA	0.014
	PS 59, 288 E. 57th Street, Manhattan	Annual	ppm	0.013	0.012	0.012	
PM_{10}	Mabel Dean, 240 2nd Ave.	24–hour	$\mu g/m^3$	49	30	NA	50
	JHS 126 424 Leonard St, Brooklyn	24–hour	$\mu g/m^3$	NA	50	42	
	Mabel Dean, 240 2nd Ave.	Annual	$\mu g/m^3$	22	19	NA	22
	JHS 126 424 Leonard St, Brooklyn	Annual	$\mu g/m^3$	NA	20	21	
$PM_{2.5}$	Mabel Dean, 240 2nd Ave.	24–hour	$\mu g/m^3$	43	44	NA	44
	JHS 126 424 Leonard St, Brooklyn	24–hour	$\mu g/m^3$	NA	35	34	
	Mabel Dean, 240 2nd Ave.	Annual	$\mu g/m^3$	16.8	17.1	NA	17.1
	JHS 126 424 Leonard St, Brooklyn	Annual	$\mu g/m^3$	NA	15.3	14.0	

Notes: NA = Full data not available.
All averages other than annual are second–highest of the year, except $PM_{2.5}$ 24–hour averages, which are the 98th percentile value.
Sources: NYSDEC, EPA.

pertinent to understanding what occurred, what may be relevant to future conditions, and to an evaluation of air quality impacts of the Preferred Alternative on the Lower Manhattan population. Data and information presented here are based on analysis of NYSDEC monitored data; the EPA study of WTC exposure[1] and oral comments on the EPA report made by the external technical peer review committee and by the public on July 14–15, 2003 and the summary report of that meeting[2], the Evaluation Report by the Office of Inspector General of the EPA on the EPA response[3]; the Natural Resources Defense Council's (NRDC) assessment[4]; and

[1] EPA, *External Review Draft*—Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster, NCEA, October 2002.

[2] EPA, *Summary Report of the U.S.EPA Technical Peer Review Meeting on the Draft Document Entitled: Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster*, NCEA, Washington, DC; EPA/600/R-03/142; NTIS, Springfield, VA, and www.epa.gov/ncea December, 2003 (publicly available as of March, 2004)];

[3] EPA, *EPA's Response to the World Trade Center Collapse: Challenges, Successes, and Areas for Improvement*, Report No. 2003-P-00012, Office of Inspector General, August 21 2003.

[4] NRDC, The Environmental Impacts of World Trade Center Attacks—A Preliminary Assessment, February 2002.

the results of a health survey in Lower Manhattan from December 2001, performed by New York City Department of Health (NYCDOH) in collaboration with the Centers for Disease Control and Prevention (CDC)[1], as well as anecdotal information, and questions and concerns raised by members of the general public in various forums and media and can be summarized as follows:

- The massive plume of pulverized material consisted mainly of cement, glass fibers, and cellulose, but also included high concentrations of silica, calcium, sulfate, metals such as lead and zinc, and numerous other compounds. Roughly 1.5 percent of the material was respirable, i.e., smaller than 10 micrometers (μm), including approximately 0.5 percent in the $PM_{2.5}$ size range.
- During the weeks that followed September 11, 2001, concentrations of monitored air pollutants exceeded screening benchmarks, and elevated levels of contaminants were recorded within and near the WTC Site. Population exposure to these exceedances was reduced by the fact that after the event, most of the affected areas were within restricted access zones.
- By mid– to late–October, particulate matter, chromium, PCBs, and lead concentrations across Lower Manhattan had largely returned to levels typical of New York City and other U.S. urban areas.
- The large majority of outdoor air measurements of asbestos were below established benchmarks and within the range of typical background levels. A few exceedances occurred near September 11, 2001 in time and in close proximity to the WTC site. A few very high levels of asbestos were found in settled dust indoors and, of course, in the debris on the WTC site itself.
- Of the 11 VOCs evaluated, short–term exceedances of screening benchmarks were seen for acetone, benzene, 1,3–butadiene, chloromethane, ethylbenzene, and toluene. Except for benzene, exceedances for these chemicals occurred in restricted zones.

With the above in mind, and in order to minimize impacts from the simultaneous reconstruction efforts in Lower Manhattan, PANYNJ, in coordination with the other agencies involved in the reconstruction efforts, have committed to a higher standard for environmental performance in an effort to minimize or eliminate environmental impacts during the construction and the operational phases, with special attention given to air quality. The policy for substantially reducing diesel emissions during construction, for instance, will result in a large fleet of clean–technology construction equipment in service long after the Preferred Alternative is constructed; the associated long-term benefit to air pollution will be on both local and regional scales.

Regarding pollutants that are discussed in this study, particulate matter monitoring around the WTC site began on September 26, 2001. Nearly all particulate matter associated with the September 11, 2001 dust cloud was debris larger than 30 micrometers in diameter. As shown in Table 9–3, $PM_{2.5}$ measurements from newly established ground–based sampling sites around the WTC perimeter varied widely, depending on wind direction. During some days in late September and early October, 24–hr average $PM_{2.5}$ concentrations exceeded 200 $\mu g/m^3$ at locations along the WTC site perimeter. However, $PM_{2.5}$ concentrations decreased rapidly with distance from the WTC, with few $PM_{2.5}$

[5] NYCDOH, A Community Needs Assessment of Lower Manhattan Following the World Trade Center Attack, Community HealthWorks, December 2001.

Table 9–3
Particulate Matter Concentrations for WTC Specific Monitors, 2001–2003

	Albany Street	Battery Park	Chambers Street	Pace Plaza	Wall Street	Max
PM_{10}						
Sept. 24 to Dec. 31, 2001, 24–hour average (range)	11.9 – 79.5	NA	NA	NA	11.0 – 49.1	79.5
2002 annual average	26.8	NA	NA	20.5	27.4	27.4
July 2002 to July 2003 annual average	19.1	NA	NA	20.4	NA	20.4
2002 2nd high 24-hour average	65.4	NA	NA	45.0	54.0	65.4
July 2002 to July 2003 2nd high 24-hour average	52.9	NA	NA	73.1	NA	73.1
$PM_{2.5}$						
Sept. 24 to Dec. 31, 2001, 24–hour average (range)	5.9 – 37.6	4.8 – 32.9	4.8 – 39.3	5.2 – 42.4	5.6 – 25.1	42.4
2002 annual average	15.1	NA	14.7	14.8	15.0	15.1
July 2002–July 2003 annual average	16.9	NA	NA	13.2	NA	16.6
2002 98th percentile 24-hour average	41.7	NA	32.0	42.3	31.9	42.3
July 2002–July 2003 98th percentile 24-hour average	30.4	NA	NA	33.9	NA	33.3

Note: Data that was impacted by the Quebec forest fire in July 2002 were eliminated from this summary.
Source: AKRF analysis of hourly data provided by NYSDEC.

values exceeding EPA's Air Quality Index (AQI) level of concern at monitoring locations ranging from three to ten blocks away from the WTC. During the entire period following September 11, 2001, $PM_{2.5}$ values recorded at Lower Manhattan monitoring sites away from the WTC perimeter were not markedly different than during periods before or since the attacks.

The particulate matter concentrations monitored at the source–oriented stations, starting in 2002 (see Table 9–3), are comparable to normal concentrations in Manhattan (see Table 9–2). The PM_{10} concentrations are somewhat higher in 2002, possibly due to recovery and cleanup operations. The highest $PM_{2.5}$ concentrations in Lower Manhattan at these monitors in 2002 were actually slightly lower than the highest concentrations monitored elsewhere in Manhattan.

D. PROBABLE IMPACTS OF THE PROJECT ALTERNATIVES

CONSTRUCTION PERIOD (2006)

FUTURE COMMON TO ALL ALTERNATIVES

In 2006, absent this project, it is likely that construction will be occurring on several major projects that could substantially affect air quality in the study area. A detailed analysis of the potential effects of these projects on ambient air quality is included in Chapter 15 "Cumulative Effects." Without the federal transportation recovery projects and the redevelopment of the WTC Memorial and Redevelopment Plan, the level of construction activity would be much less, similar to the current condition. Therefore, in the absence of the major projects, air quality in the vicinity of the Project Site would not be substantially different than current conditions.

NO ACTION ALTERNATIVE

Under the No Action Alternative, a Permanent WTC PATH Terminal would not be constructed. Therefore, air quality emissions would be the same as those described for the Future Common to All Alternatives. Predicted conditions with other major Lower Manhattan Recovery projects can be found in Chapter 15, "Cumulative Effects."

PREFERRED ALTERNATIVE

As discussed in Chapter 3, "Construction Methods and Materials," 2006 was selected as the analysis year for the microscale (local) construction impact assessment. Maximum predicted pollutant concentrations with construction of the Preferred Alternative would be lower in 2005, 2007 and 2008 than predicted for 2006 since the activity level would be much less in those years. Therefore, the predicted pollutant concentrations for 2006 have been used for impact assessment and the determination whether any additional mitigation is necessary beyond the EPCs discussed in Chapter 3. The regional (mesoscale) emissions inventory was prepared for all construction years.

Microscale (Local) On-Road Carbon Monoxide Analysis

An analysis was conducted to determine the effects of project–generated construction vehicles on ambient CO concentrations at critical intersections. The sites selected for analysis include the intersections of West Street (Route 9A) with Liberty and Vesey Streets.

Table 9–4 shows the maximum predicted 8–hour average CO concentrations with and without construction of the Preferred Alternative. As shown in the table, construction vehicles would have a negligible effect on ambient CO concentrations even at the most heavily traveled intersections in the study area. The cumulative effect from other planned construction projects along with the Preferred Alternative on CO concentrations is discussed in Chapter 15, "Cumulative Effects."

Microscale (Local) Particulate Matter and Nitrogen Dioxide Analysis

The highest predicted increase in pollutant concentrations at various locations due to construction activity of the Preferred Alternative are presented in Table 9–5. The concentrations at locations adjacent to the construction sites include contributions from both on–road sources and on–site construction activity emissions.

Table 9–4
2006 Construction Period:
Maximum Predicted 8–Hour Average CO Concentrations

Site	No Action	Preferred Alternative
Route 9A and Liberty Street	5.1	5.1
Route 9A and Vesey Street	5.5	5.5
Note: NAAQS is 9 ppm.		

Table 9–5
2006 Highest Predicted Increase in Pollutant Concentrations from Construction of the Preferred Alternative

Pollutant	Average Period	Receptor Type	Maximum Increase [$\mu g/m^3$] With Route 9A Short Bypass	Maximum Increase [$\mu g/m^3$] With Route 9A At Grade
NO_2	Annual	Highest of All Receptors	6.0	7.8
		Residential Buildings / Hotel	5.3	5.3
$PM_{2.5}$	24–hour	Highest of All Receptors	47.8*	21.7*
		Residential Buildings / Hotel	6.0*	6.8*
		Other Locations on Access Routes	0.1	0.1
	Annual	Local Highest of All Receptors	0.7*	1.0*
		Local Highest Residential / Hotel	0.5*	0.5*
		Local on Access Routes	0.01	0.01
		Neighborhood Scale	0.08	0.08
PM_{10}	24–hour	Highest of All Receptors	53.4	30.7
		Residential Buildings / Hotel	7.8	14.0
		Other Locations on Access Routes	1.0	1.0
	Annual	Highest of All Receptors	1.0	1.4
		Residential Buildings / Hotel	0.9	0.9
		Other Locations on Access Routes	0.3	0.3

Notes: Interim guidance threshold levels for $PM_{2.5}$ are 5 $\mu g/m^3$ and 0.3 $\mu g/m^3$ for 24–hour and annual increases respectively, and 0.1 $\mu g/m^3$ for neighborhood scale annual average. For determination of adverse impacts, these values are applied in the absence of specific criteria.
The NAAQS are as follows: NO_2—Annual = 100 $\mu g/m^3$; $PM_{2.5}$—24–hour = 65 $\mu g/m^3$ and Annual = 15 $\mu g/m^3$; PM_{10}—24–hour = 150 $\mu g/m^3$ and Annual = 50 $\mu g/m^3$.
* Indicates substantial adverse impact–exceeding the interim guidance thresholds.

Annual average NO_2 concentrations were predicted to increase by a maximum of 7.8 $\mu g/m^3$. This maximum was predicted near the pedestrian concourse construction zone.

In the immediate vicinity of the Project Site, the increase in PM_{10} concentrations is predicted to range up to a maximum of 53.4 $\mu g/m^3$ on a 24–hour basis, and 1.4 $\mu g/m^3$ on an annual basis due to construction of the Preferred Alternative. The predicted increase in maximum $PM_{2.5}$ concentrations in the immediate vicinity of the site would be up to a maximum of 47.8 $\mu g/m^3$ and 1.0 $\mu g/m^3$ on 24–hour average and annual average basis, respectively, and an annual average of 0.08 $\mu g/m^3$ on a neighborhood scale. The local predicted increases in $PM_{2.5}$ concentration would exceed the interim guidance threshold values. The highest annual average particulate matter concentrations, in both cases, would be near West Street by the pedestrian concourse

construction. All maximum concentrations are predicted at locations immediately adjacent to the construction site boundary. Increments would be 10 to 90 percent lower at residential locations, depending upon the pollutants and the averaging period.

To illustrate the effects of the emissions from construction on ambient air quality in the vicinity of the WTC site, isopleths (i.e. lines of equal concentration) were developed based on the predicted concentration increments. Figures 9–2 through 9–11 show the increase in annual average PM_{10}, 24–hour average PM_{10}, annual average $PM_{2.5}$, 24–hour average $PM_{2.5}$ and annual average NO_2 concentrations due to construction of the Preferred Alternative for the year 2006, under both Route 9A alternatives. These figures also indicate the location of the highest predicted increase in emissions that are detailed in Tables 9-5 and 9-6. As shown in the figures, increases in these pollutant concentrations are centered on specific construction activities, and do not vary significantly by the Route 9A alternative. Most notable are the increases centered on the West Street area (related to the construction of the pedestrian concourse). Construction activities within the bathtub or the WTC itself would have a much smaller effect on off–site concentrations due to the distance from the sources to affected areas. As shown in Figures 9–8 and 9–9, at the north–eastern edge of the site, the intersection of Church Street and Vesey Street, the 5–$\mu g/m^3$ isopleth does not extend past the northern edge of the site. This is the extent of the impacts from the elements of the Preferred Alternative's construction within the bathtub in the northern–eastern direction. The impact is somewhat more pronounced when combined with the contribution from the pedestrian concourse construction, in the north–western direction to approximately one to two blocks north of the site. The annual impact on $PM_{2.5}$, which is of higher importance due to the exceedance of the NAAQS in the existing condition, is much smaller, barely extending past the site boundary in the north and at one spot near the pedestrian concourse construction.

The above concentrations were predicted assuming only a 40 percent reduction in particulate matter based on the use of ULSD fuel in conjunction with diesel oxidation catalysts. Without these EPCs, predicted concentrations would be much higher. Additional pollution reduction estimates are discussed in Section F, "Mitigation."

The maximum total annual average NO_2 concentrations presented in Table 9–6, including background levels, predicted near the pedestrian concourse construction zone, would not exceed the NAAQS. As presented in Figures 9–10 and 9–11, slight increases in NO_2 levels may be detected in the immediate vicinity of the pedestrian concourse construction.

The total predicted PM_{10} concentrations are not predicted to exceed the NAAQS at any location during construction; therefore, construction of the Preferred Alternative alone would not result in a significant adverse impact on PM_{10} concentrations. This is largely due to strict control of both engine emissions and fugitive dust emissions.

The $PM_{2.5}$ concentrations presented are based on the highest measured 24-hour background concentration of 44 $\mu g/m^2$. It is possible that without further mitigation measures, the predicted 24-hour average $PM_{2.5}$ concentrations could exceed the NAAQS level—65 $\mu g/m^3$ at locations immediately adjacent to the site, but not at residential locations. Current annual measured background levels of $PM_{2.5}$ in New York City exceed the NAAQS of 15 $\mu g/m^3$; predicted increments are therefore compared with the threshold levels to determine the significance of impacts, as presented above.

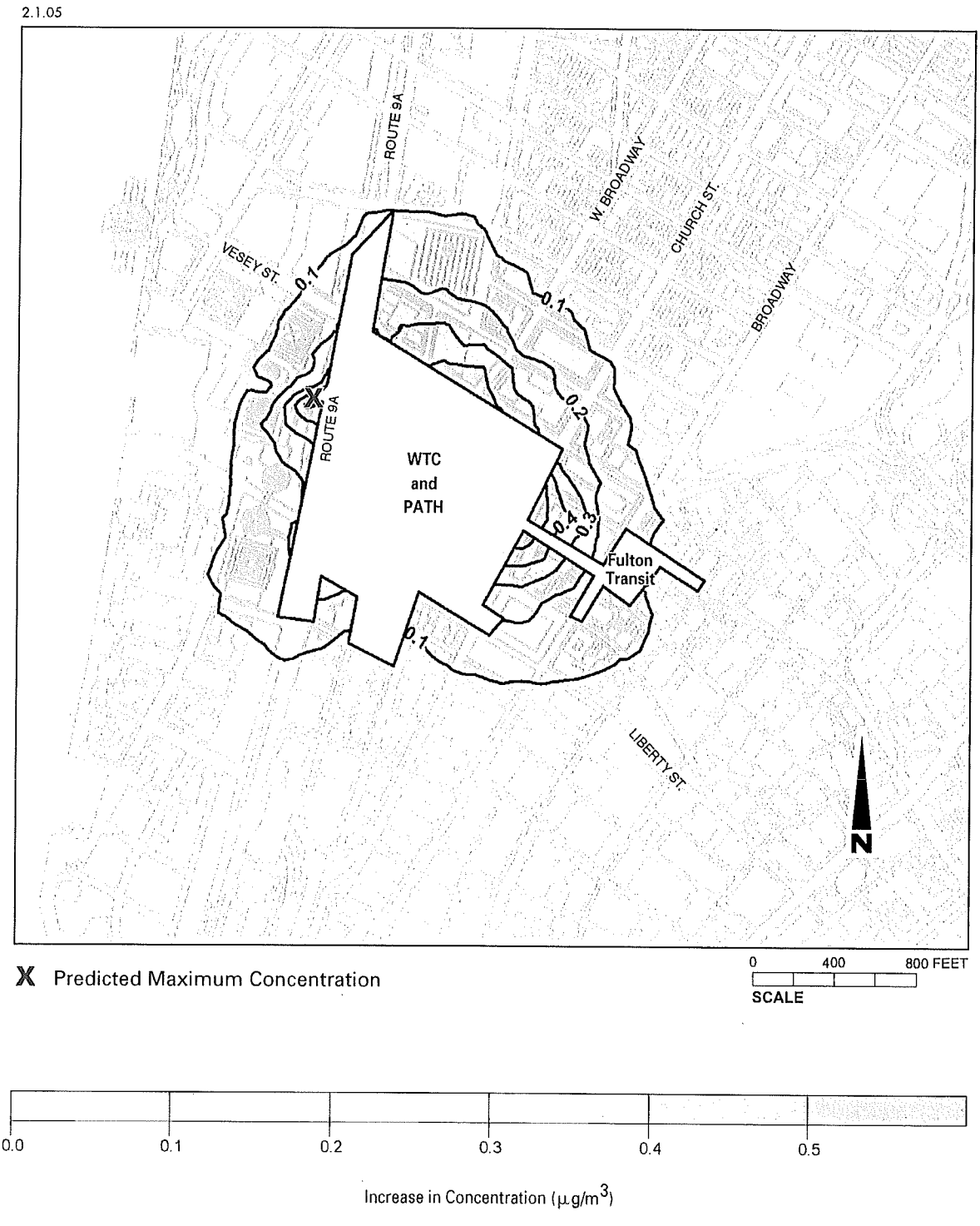


Figure 9-2

Maximum Predicted Annual Average PM_{10} PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative

2.1.05

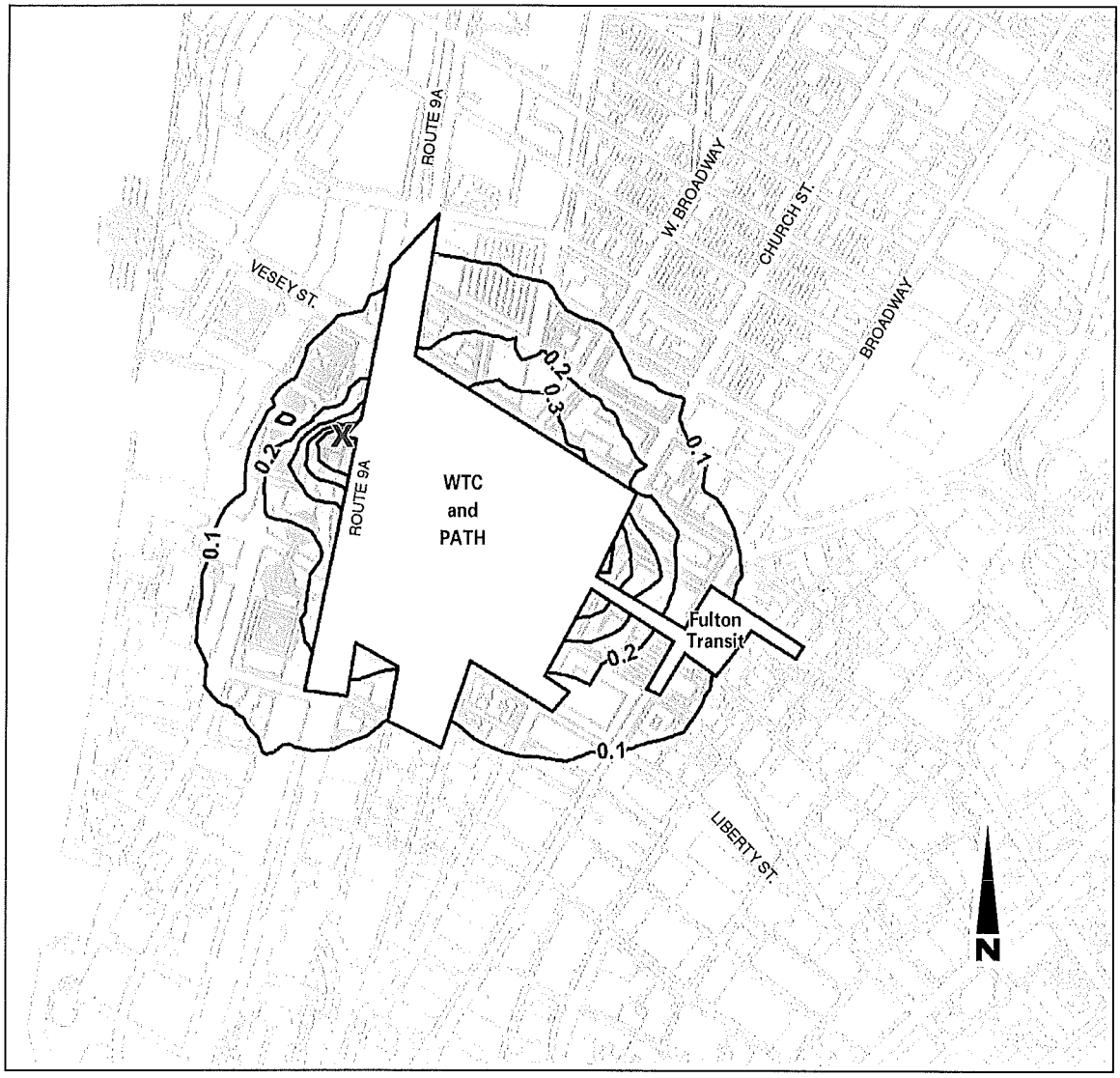


Figure 9-3

Maximum Predicted Annual Average PM_{10} PATH Construction Increment with Route 9A At-Grade Alternative

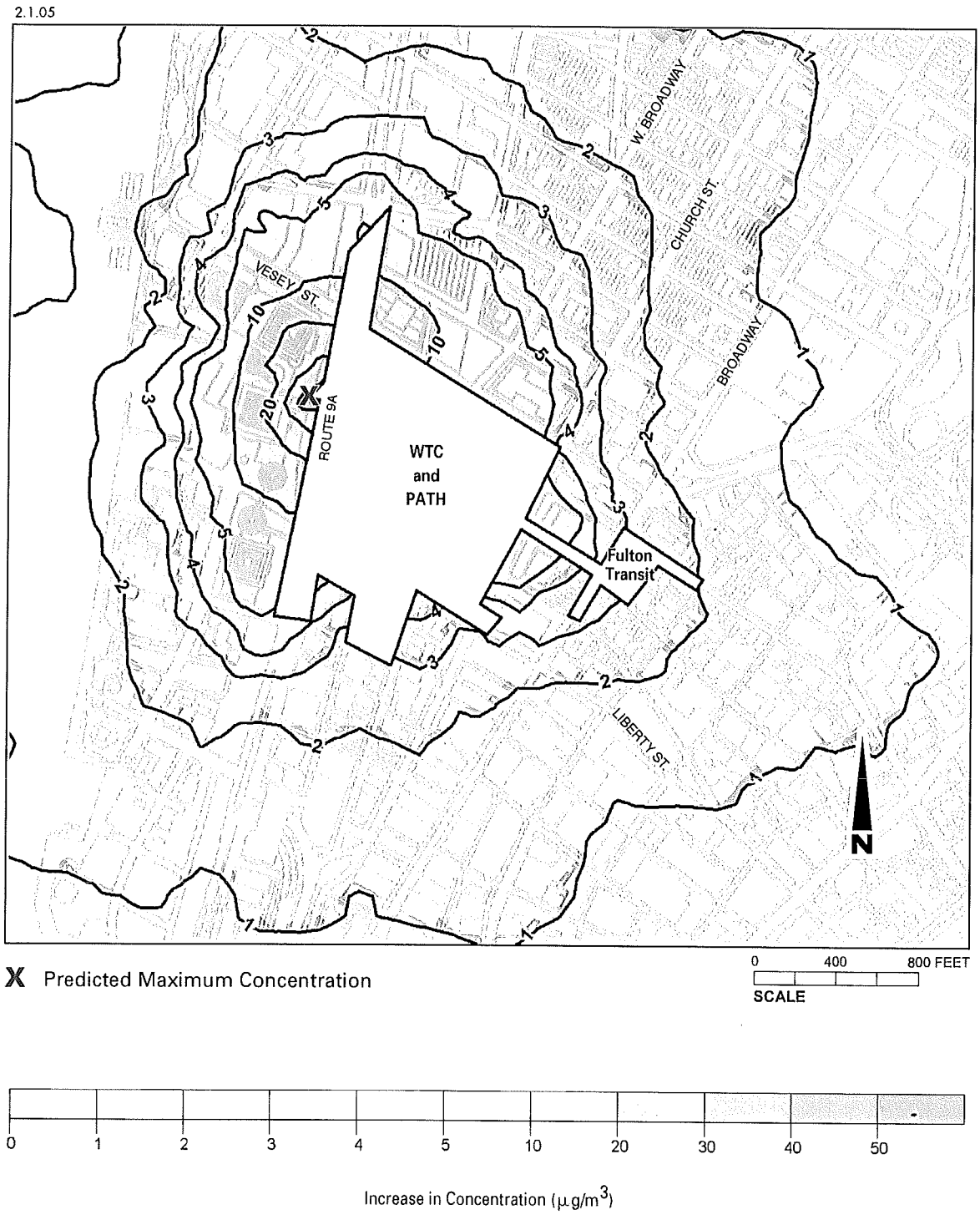


Figure 9-4

Maximum Predicted 24-Hour Average PM_{10} PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative

2.1.05

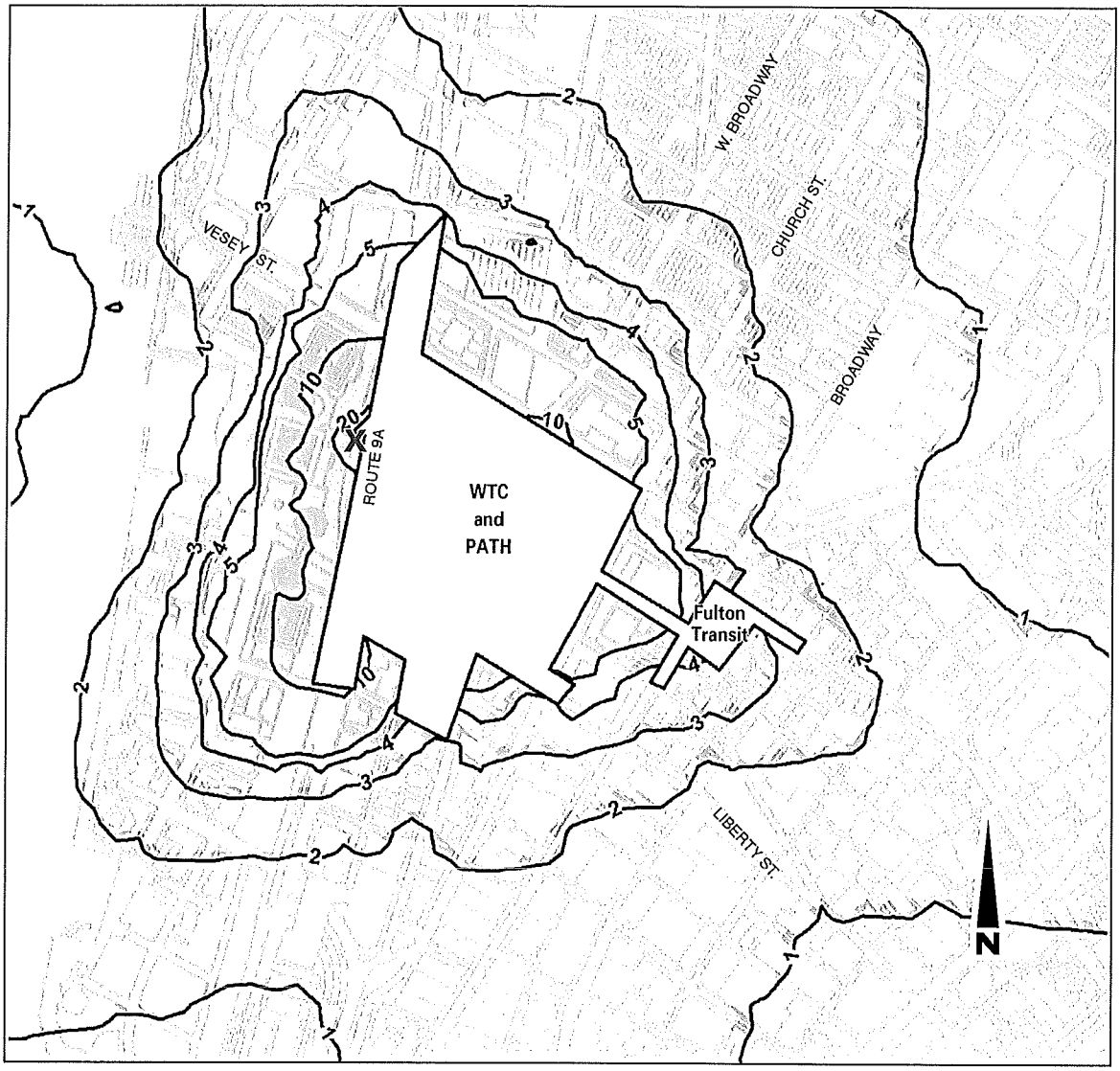


Figure 9-5

Maximum Predicted 24-Hour Average PM_{10} PATH Construction Increment with Route 9A At-Grade Alternative

2.1.05

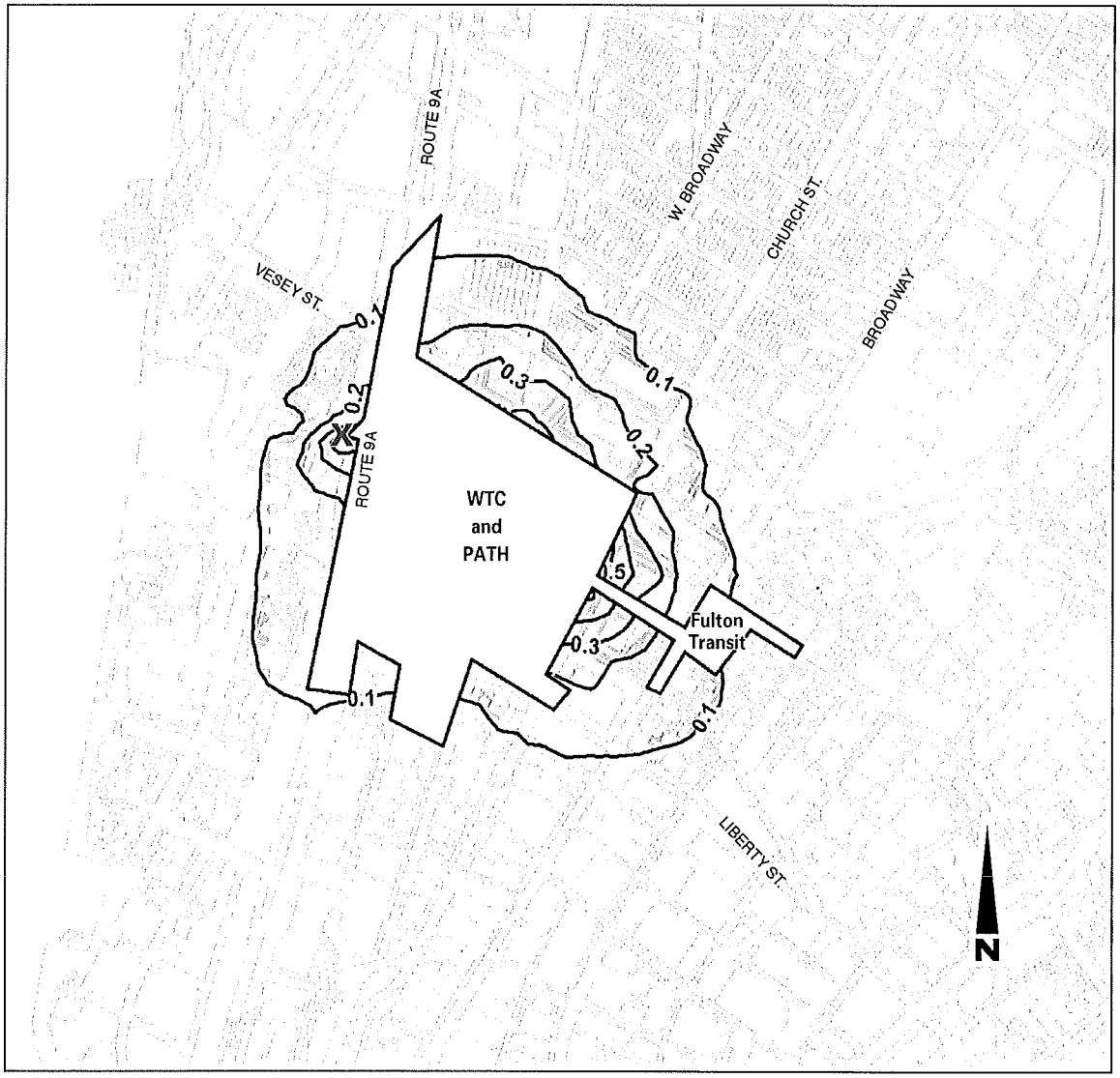


Figure 9-6

Maximum Predicted Annual Average $PM_{2.5}$ PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative

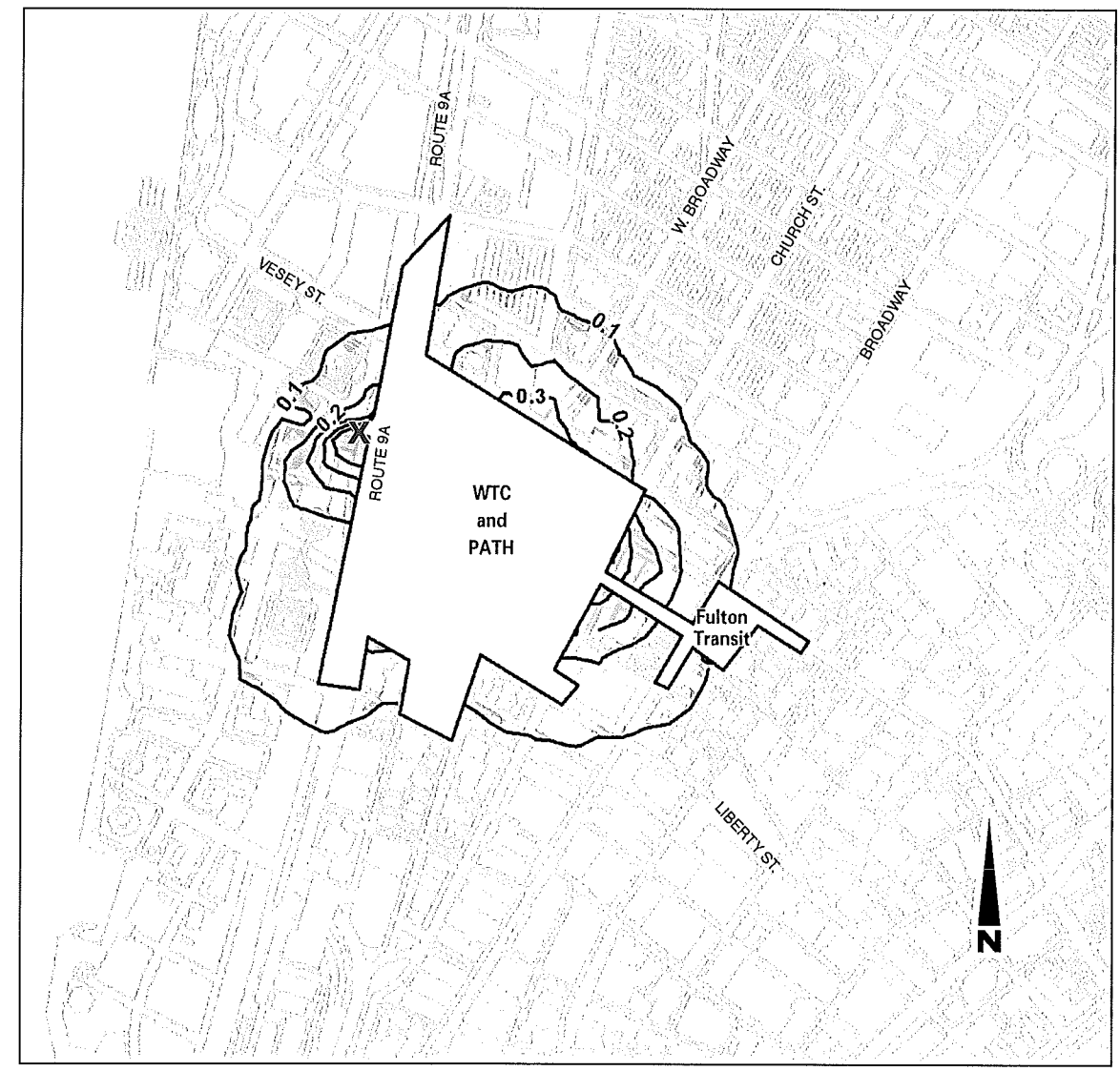


Figure 9-7

Maximum Predicted Annual Average $PM_{2.5}$ PATH Construction Increment with Route 9A At-Grade Alternative

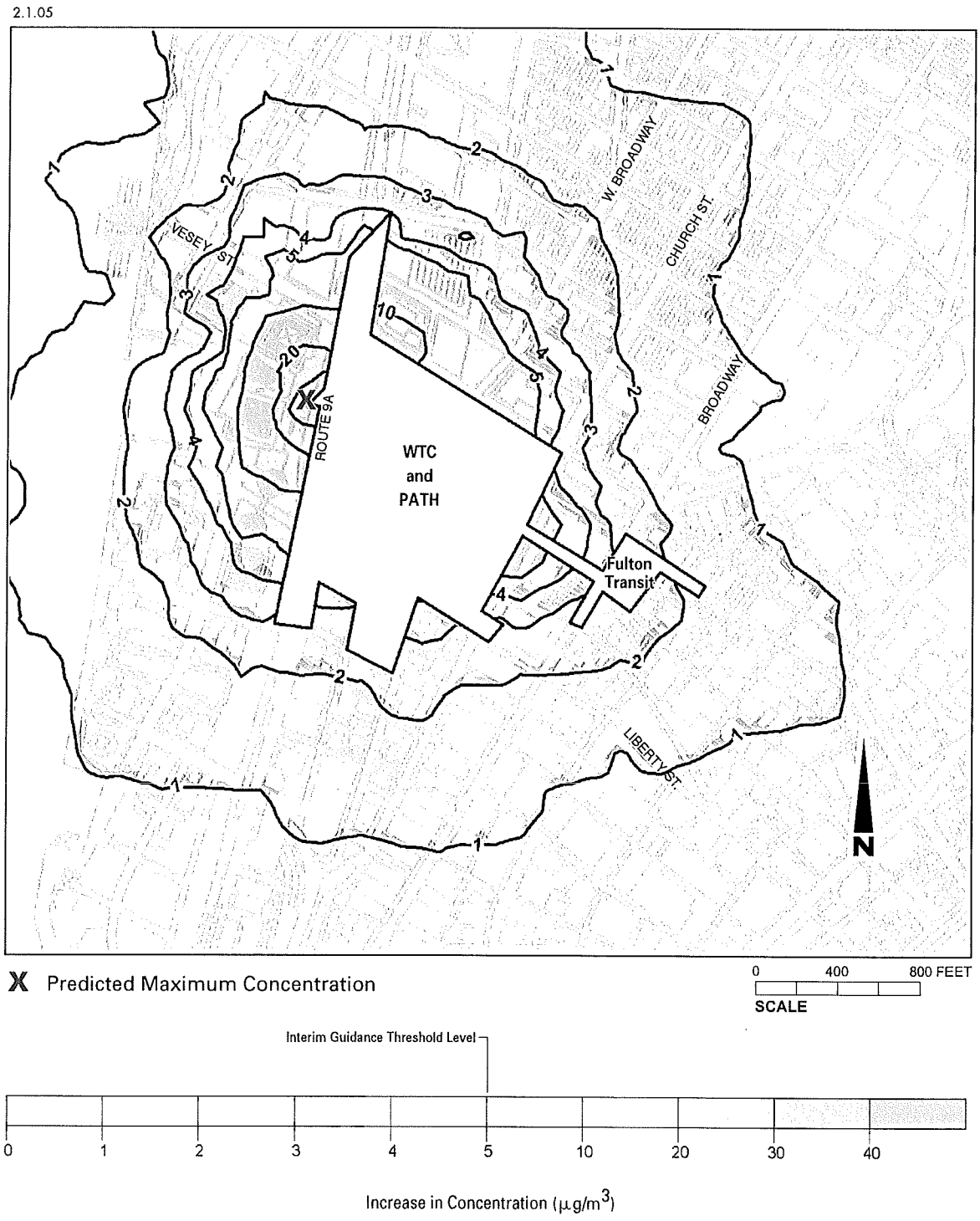
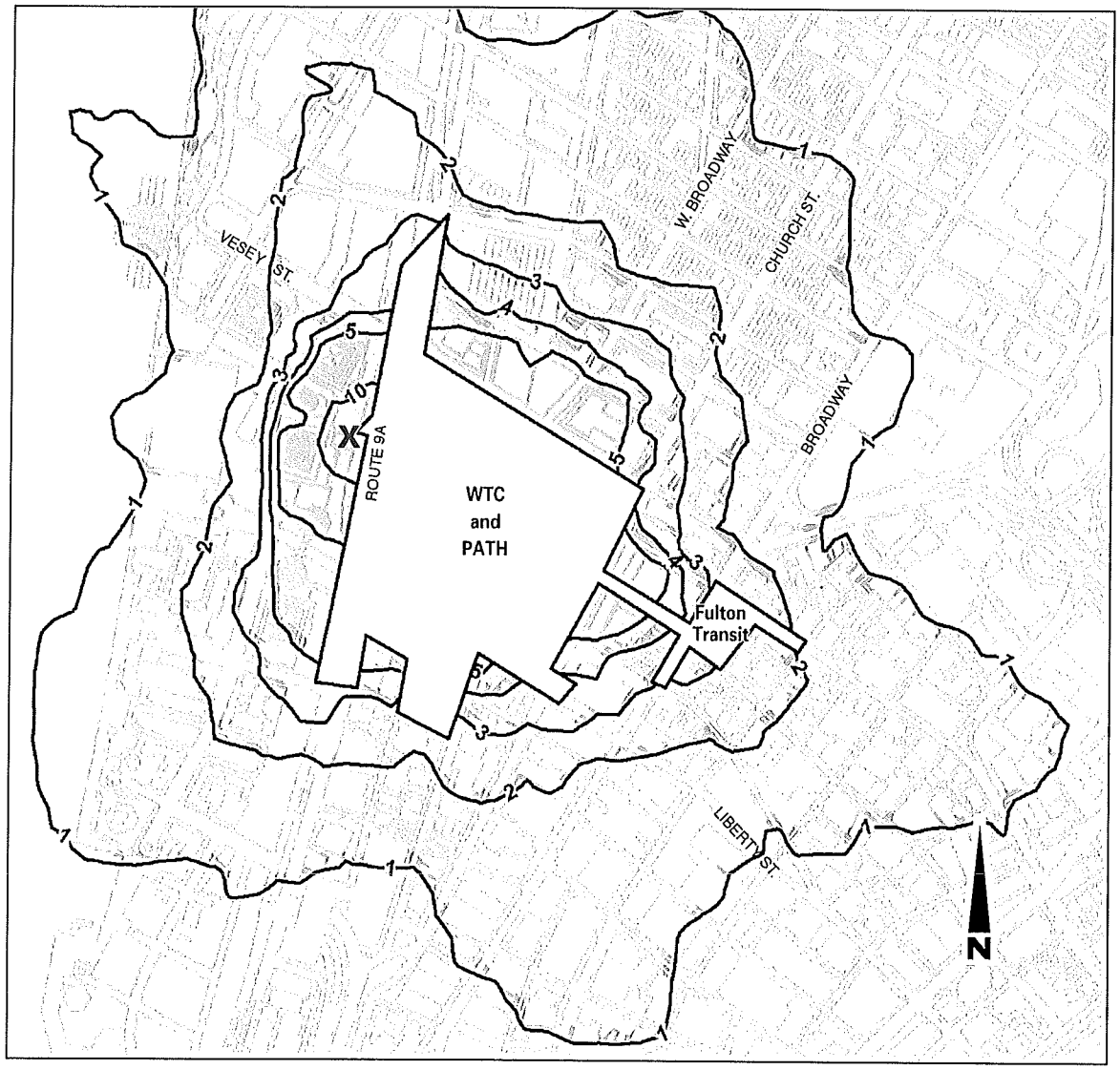


Figure 9-8

Maximum Predicted 24-Hour Average $PM_{2.5}$ PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative

2.1.05



X Predicted Maximum Concentration

0 400 800 FEET
SCALE

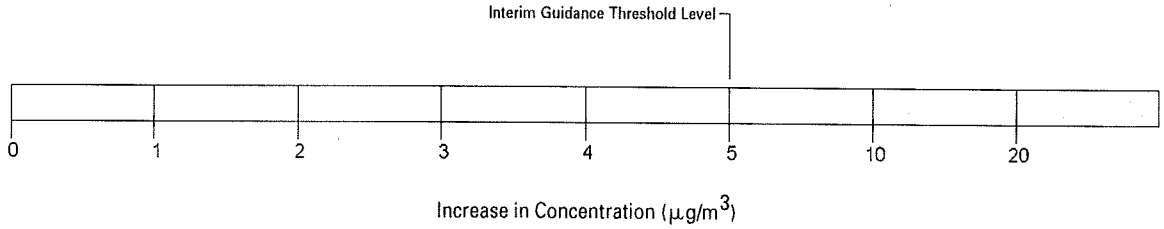


Figure 9-9

Maximum Predicted 24-Hour Average $PM_{2.5}$ PATH Construction Increment with Route 9A At-Grade Alternative

2.1.05

Figure 9-10

Maximum Predicted Annual Average NO_2 PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative

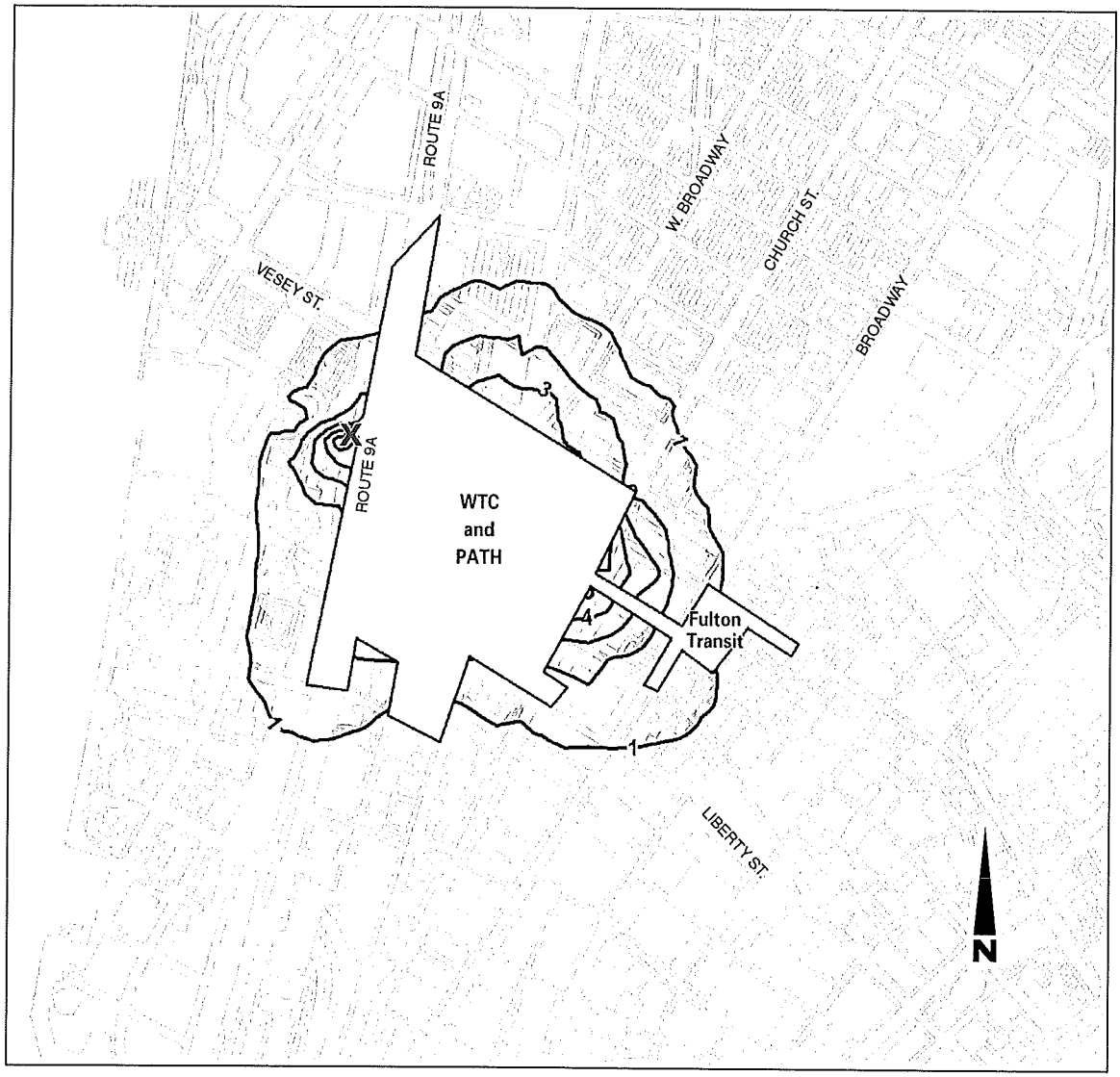


Figure 9-11

Maximum Predicted Annual Average NO_2 PATH Construction Increment with Route 9A At-Grade Alternative

Table 9–6
2006 Highest Predicted Total Pollutant Concentrations During Construction of the Preferred Alternative

Pollutant	Average Period	Receptor Type	Maximum Increase [µg/m³]	
			With Route 9A Short Bypass	With Route 9A At Grade
NO_2	Annual	Highest of All Receptors	78.0	79.8
		Residential Buildings / Hotel	77.3	77.3
$PM_{2.5}$	24–hour	Highest of All Receptors	94.9*	68.9*
		Residential Buildings / Hotel	52.0	52.8
		Other Locations on Access Routes	48.2	48.2
	Annual	Highest of All Receptors	19.1**	19.2**
		Highest Residential / Hotel	18.4**	18.4**
PM_{10}	24–hour	Highest of All Receptors	115.4	92.6
		Residential Buildings / Hotel	62.8	63.7
		Other Locations on Access Routes	63.0	63.0
	Annual	Highest of All Receptors	29.6	29.9
		Residential Buildings / Hotel	26.9	26.9
		Other Locations on Access Routes	28.9	28.9

Notes: All total concentrations include calculated background contributions from local mobile sources, as well as measured regional background values as follows: NO_2—Annual average 72 µg/m³; $PM_{2.5}$—Annual average 17.1 µg/m³ (highest of 2000-2002 annual values); 24-hour average 44.0 µg/m³ (highest of the three 2nd highest 24-hour averages in 2000-2002); PM_{10}—Annual average 24 µg/m³; 24-hour average 50 µg/m³.

The NAAQS are as follows: NO_2—Annual = 100 µg/m³; $PM_{2.5}$—24–hour = 65 µg/m³ and Annual = 15 µg/m³; PM_{10}—24–hour = 150 µg/m³ and Annual = 50 µg/m³.

Cumulative and project–generated maximum concentrations may occur at a different time and/or location.

* Indicates predicted exceedance of new NAAQS without mitigation.

** $PM_{2.5}$ annual average concentrations exceed the NAAQS in the existing background condition. See Table 9-10 for comparison with incremental thresholds.

As described above, conformity requirements limit the ability of Federal agencies to assist, fund, permit, and approve transportation projects that do not conform with the applicable SIP. The New York metropolitan area has been designated by USEPA as non-attainment for $PM_{2.5}$ in December 2004, and the State of New York has until April 2008 to complete a SIP delineating how the standard will be met by 2010 (with a possible extension as late as 2015.) The SIP would include emission inventories of existing and predicted sources, including construction emission, and the planned reductions for each source. Substantial increases in $PM_{2.5}$ concentrations were predicted during construction of the Preferred Alternative, which would constitute an adverse $PM_{2.5}$ impact. However, PANYNJ's current mitigation plan (see Section E, "Mitigation") incorporates measures aimed at reducing $PM_{2.5}$ emissions to the extent practicable. In the absence of any specific guidance regarding construction emissions as it relates to transportation conformity, project-level criteria have been used to assess these potential impacts and to develop appropriate mitigation measures.

Mesoscale Emissions Analysis

The total predicted emission of PM_{10}, NO_x and VOCs by year due to the proposed construction activity, including both on-site activity and related on-road emissions, are presented in Table 9-7. Of the total predicted project-generated emissions, 50 to 61 percent of VOC, 77 to 91 percent of NOx, 40 to 61 percent of PM_{10} and 78 to 88 percent of $PM_{2.5}$ would be from on–site sources.

Table 9–7
Total Regional (Mesoscale) Direct and Indirect Emissions from Construction of the Preferred Alternative (tons per year)

Pollutant	2005	2006	2007	2008
PM_{10}	1.8	2.4	0.6	0.7
$PM_{2.5}$	1.5	1.8	0.4	0.5
NO_x	39.1	44.4	10.1	11.1
VOC	2.1	2.9	0.7	0.8
Note: PM_{10} emissions include both engine emissions and resuspended road dust.				

As compared to the projected regional emissions inventory in the New York ozone SIP for the same years—the on–road portion of the emissions would be less than 0.007 percent and 0.002 percent of the SIP mobile source NO_x and VOC emissions, respectively; the on-site portion of the emissions would be 0.06 percent and 0.004 percent of the non-road SIP NO_x and VOC emissions or less (depending on the year), respectively.

The proposed mitigation for construction emissions, aimed at reducing impacts in the immediate vicinity of the construction sites (see above) would also reduce the total region-wide emissions related to the Preferred Alternative. See Section E, "Mitigation" for details.

Air Toxins

As discussed previously, the terrorist attacks resulted in the emission of a number of hazardous air pollutants (i.e. air toxics) that raised concern regarding the public health of residents and workers in Lower Manhattan. In response to the release of these potentially hazardous materials, numerous federal, state, and local agencies initiated air quality monitoring programs in Lower Manhattan to assess the potential short- and long-term effects of these air pollutant emissions.

It should be noted that the Preferred Alternative would not introduce sources of most of the non-criteria pollutants that affected Lower Manhattan following September 11, 2001, nor would the Preferred Alternative introduce new sources of high–alkalinity PM or glass fibers. Any excavation and tunneling would not include WTC debris, which has already been removed from the site during recovery and cleanup operations. The most substantive new emission of pollutants other than criteria pollutants would be from diesel emissions from construction equipment and later from buses and trucks. Diesel exhaust includes gaseous components, such as aldehydes, benzene, 1,3–butadiene, and formaldehyde, as well as some toxics adsorbed to the surfaces of particles, such as PAHs and their derivatives—comprising less than 1 percent of the particulate diesel exhaust mass. The EPCs (see Section E, "Mitigation") of the Preferred Alternative would require strict control of diesel emissions, including emissions reduction technologies such as diesel oxidation catalysts and diesel particulate filters as well as other

measures aimed at minimizing diesel exhaust emissions during construction to the extent practicable.

OPENING YEAR (2009)

FUTURE COMMON TO ALL ALTERNATIVES

Without this project, air quality in the opening year would be similar to the no action condition in 2006. It would be a function of whether the other federal transportation recovery projects and redevelopment of the WTC are under construction. At the present time, based on current schedules, it is expected that pollutant concentrations from construction activities would peak in 2006. Therefore, contributions of air pollutant emissions from construction activities would be less in 2009 than 2006.

NO ACTION ALTERNATIVE

Under the No Action Alternative, temporary WTC PATH service would continue to operate in the opening year. Therefore, any changes in local or regional air quality emission would be attributed to other independent projects or actions.

PREFERRED ALTERNATIVE

In the opening year, major construction activity would have been completed for the Preferred Alternative. Therefore, the only potential air quality impacts from this alternative in the opening year would be beneficial, since the Preferred Alternative would generate few, if any, vehicle trips as compared to the No Action condition.

The ventilation structures would emit tunnel air during normal operations, and smoke exhaust in case of fire in the tunnels. Under normal circumstances, ventilation air would be emitted at the new locations, similar to that which was emitted in the pre-September 11, 2001 condition at ground level from the Route 9A median. The new locations would be 40 feet above grade, 28 feet higher than the previous elevation. There would be no combustion of fossil fuels, since the trains are electrically operated.

DESIGN YEAR (2025)

FUTURE COMMON TO ALL ALTERNATIVES

By the design year for the Permanent WTC PATH Terminal, construction associated with the Route 9A Project, WTC Memorial and Redevelopment Plan, Fulton Street Transit Center, and South Ferry Terminal will have been concluded for several years. Thus, certain air quality emissions anticipated during the construction period and in the opening year will be much lower in the design year. There may be some increases in vehicular traffic from residential and commercial development in Lower Manhattan. However, federal regulation will have reduced vehicle emissions, resulting in improved air quality, as compared to the pre–September 11, 2001 conditions.

NO ACTION ALTERNATIVE

Because temporary WTC PATH service would be fully disrupted by 2025 an increase in motor vehicle–related air pollutant emissions is predicted with this alternative. While motor vehicle emissions are predicted to be much lower in the design year than the opening year due to engine improvements,

the number of projected PATH riders to Lower Manhattan would be much greater. Reflecting each of these issues, Table 9–8 shows the additional air pollutants emitted in the absence of the Permanent WTC PATH Terminal.

Table 9–8
2025 Design Year No Action Alternative: Incremental Increase in Regional Pollutant Emissions without the Permanent WTC PATH Terminal (Tons/Year)

Pollutant	New Jersey	New York	Total
VOC	45.8	8.1	53.9
NO_x	39.9	7.0	46.9
PM_{10}	33.1	5.8	38.9
CO	527	93	620

Notes: Estimate for CO is high because model produces winter emissions. NO_x and VOC emissions are summer emissions, as per the ozone SIP standard procedure.

By 2025, approximately 15.7 tons of VOCs, 18.0 tons of NO_x, 1.5 tons of PM_{10}, and 236.0 tons of CO would be emitted by motor vehicles destined from New Jersey to Lower Manhattan if a Permanent Terminal is not built and if temporary PATH service is not available.

PREFERRED ALTERNATIVE

The Preferred Alternative would reduce motor vehicular traffic congestion and emissions as compared to the No Action Alternative. Therefore, the Preferred Alternative for a Permanent WTC PATH Terminal would have a far greater beneficial impact on air quality in the NYMA than the No Action Alternative.

E. MITIGATION

As described in Chapter 2, "Project Alternatives," and Chapter 3, "Construction Methods and Materials," PANYNJ has committed to EPCs to reduce the potential construction period impacts of the Preferred Alternative (see Table 9-9).

The EPCs shown in Table 9-9, were assumed as part of the construction period analysis presented above. However, the DEIS for the Permanent WTC PATH Terminal determined that addition mitigation would be needed to reduce potential construction period impacts. Following the publication of the DEIS, PANYNJ developed an enhanced mitigation plan that would substantially reduce the project's construction-period emissions.

PROJECT-SPECIFIC COMMITMENTS

In addition to measures identified in the original EPCs, PANYNJ would implement the following mitigation to further reduce project-generated emissions during the construction period.

ULTRA LOW SULFUR DIESEL FUEL (ULSD)

As described in the EPCs, PANYNJ would require that contractors use ULSD for all non-road vehicles that operate with diesel engines.

Table 9–9
Environmental Performance Commitments

Commitment	Implementation Plan
Use ultra low sulfur diesel fuel in non–road construction equipment with engine horsepower (HP) rating of 60 HP and above.	PANYNJ's construction specifications would require ULSD for all non-road, diesel-powered engines. The Authority would collect monthly samples of the ULSD fuel to verify compliance for all diesel powered engines.
Where practicable, use diesel engine retrofit technology in non–road equipment to further reduce emissions. Such technology may include Diesel Oxidation Catalyst / Diesel Particulate Filters, engine upgrades, engine replacements, or combinations of these strategies.	As part of the contract specifications, the contractor would be required to retrofit all diesel-powered equipment greater than 50 HP.
Limit unnecessary idling times on diesel powered engines to 3 minutes	As part of the contract specifications, the contractor would provide a Diesel Emission Mitigation (DEM) Plan for review and prior approval by the Resident Engineer (RE). The DEM Plan shall address the control of emissions from all engines and vehicles including those that are not equipped with emission control devices.
Locate diesel powered exhausts away from fresh air intakes.	As part of the DEM, the contractor, as determined by the RE will be required to ensure diesel powered engines vehicles are located away from fresh air intakes.
Control dust related to construction site through a Soil Erosion Sediment Control Plan that includes, among other things: a) spraying of a suppressing agent on dust pile (non–hazardous, biodegradable); b) containment of fugitive dust; c) adjustment for meteorological conditions as appropriate.	PANYNJ has developed specifications for dust suspension, materials handing, and wheel washing. The specifications require the contractor to submit a Dust Control Plan which would be implemented 24 hours per day 7 days per week.

ELECTRIFICATION

Certain construction engines which operate in a fixed position or temporarily fixed position, such as welding machines and compressors, could operate on electric power source, thus eliminating the on–site diesel exhaust source. However, there may be instances where some local generation would be needed when access to connection points is not feasible.

PANYNJ or its contractor would develop a plan, in consultation with Con Ed, as appropriate, to disperse grid power throughout the contraction zone for the Preferred Alternative. In its contract documents, PANYNJ would require all contractors and subcontractors to use electrically powered equipment for air compressors, pumps, mixing, desanding and grout plants, welding machines, and any other diesel powered equipment that can be replaced with an electrically powered version. However, this does not apply to the east-west pedestrian concourse beneath Route 9A if the concourse is built by NYSDOT, since NYSDOT has not yet finalized what level of electrification would be possible for its projects.

Given current conditions, it is expected that at lest 50 percent of the air compressors, pumps, mixing, desanding and grout plants, welding machines, and other diesel powered equipment that can be replaced with an electrically powered version would operate on electric power sources.

ADVANCED REDUCTION TECHNOLOGIES

In addition to the DOCs, which were considered as part of the original EPCs, other tailpipe emission technologies are available which can achieve reductions in PM emissions of 85 percent and as high as 98 percent, such as diesel particle filters (DPF). However, DPFs are not effective for every type of engine operation, and there may be technical difficulties in applying DPFs to some engines. The existing DPFs which have been verified by EPA or by the California Air Resources Board (CARB) as effective at substantially reducing PM emissions are mostly dependent on a high operational exhaust temperature for part of the operational cycle in order to

regenerate the filter and enable the continued operation of the engine. In some cases of construction engines that requirement is not met. DPFs with other means of regeneration exist, but would need to be tested for the specific desired applications. Also, it is possible that first application costs of cutting edge diesel reduction technology may prove to be prohibitive.

In its contract documents, PANYNJ would require the use of DPFs or other measures with equivalent PM removal efficiency for all nonroad diesel engines of 50 horsepower or greater wherever the implementation of such a device is feasible. However, there may be cases where DPFs would not be feasible for safety considerations, mechanical reasons, or where the technology would not function properly. In such cases, the constructor would submit a request for an exception for review and approval by PANYNJ prior to implementation, and in these cases, DOCs may be used. Only in cases where, for technical reasons, neither DPFs or DOCs can be used effectively, and where the operation cannot be performed by another engine or other means, would the use of diesel engines greater than 50 horsepower be allowed without tailpipe reduction measures, subject to the above described approval process.

NEWER ENGINES

The use of new construction engines would ensure that older, higher emitters are not operating on–site, and would make the operation of added control technologies easier and more efficient. For example, DPFs do not generally function with engines manufactured prior to 1994/5, since those engines did not include fuel injection. Since newer engines tend to have lower emissions to begin with, tailpipe reduction technologies would function more efficiently.

In its contract documents, PANYNJ would require the use of post-1995 fuel injection engines, which meet the Tier II engine emissions standards, as defined in Title 40, Part 89.112. Exceptions will be made only for specific engines that are not yet commercially available as Tier II, and where the task cannot be reasonably accomplished using alternative engines or means which do comply with these demands. In such cases, the contractor would submit a request for an exception for review and approval by PANYNJ prior to implementation.

DIESEL EMISSION MITIGATION (DEM) PLAN

PANYNJ would require contractors to prepare a DEM Plan that shall address the control of emissions from all engines and vehicles including those that are not equipped with emission control devices. As described in the EPCs, the DEM Plan would limit idling times on diesel powered engines to 3 minutes and would require that contractors locate diesel powered engines away from fresh air intakes.

DUST CONTROL PLAN

As described in the EPCs, PANYNJ would require contractors to submit a Dust Control Plan. Among other things, the plan would contain protocols and procedures for the spraying of dust piles, containment of fugitive dust, and appropriate adjustment measures to accommodate changes in meteorological conditions.

VERIFICATION

The effectiveness of measures to reduce construction period emissions depends on compliance. To that end, verification procedures would be implemented through construction specifications and contract documents. PANYNJ would verify mitigation and would identify opportunities to

expand its implementation as part of its ongoing oversight and auditing of the Project's construction. Furthermore, verification procedures would be implemented in accordance with decisions of the Lower Manhattan Construction Command Center, including procedures for reporting updates to the public.

OTHER EMISSIONS REDUCTION TECHNOLOGIES

PANYNJ is and will continue to investigate additional means (e.g., fuel emulsions) to reduce NO_x (NO and NO_2) emissions, but it is not yet known whether these measures would reduce the effectiveness of the above described mitigation. Therefore, specific means to further reduce NO_x have not been identified in the mitigation plan for the Preferred Alternative at this time. If this investigation results in additional means to reduce NO_x without jeopardizing the PM reduction measures and if other constraints such as technological availability are resolved, then PANYNJ would implement these additional mitigation techniques, as appropriate.

MITIGATION ANALYSIS

The above described mitigation measures would substantially reduce project-generated, construction period emissions. To quantify the effect of these measures on local pollutant concentrations, a mitigation scenario was developed and modeled using the general methodology described in Section B above.

The precise emissions reduction for each engine type is not yet known. Therefore, a conservative scenario was developed to demonstrate the effectiveness of the mitigation measures. The following assumptions were used for this analysis:

- ULSD was assumed for all non-road equipment. The use of ULSD alone was assumed to reduce PM emissions by 14 percent as compared to normal non-road diesel fuel.
- Research indicated that most diesel equipment over 150 HP can successfully employ DPFs; however, fewer pieces of equipment in the 50-150 HP range are able to do so. Because the majority of the Preferred Alternative's construction emissions would be from equipment having engines of 150 HP or greater, it was assumed that 75 percent of all engines of 50 HP or greater would employ DPFs or equivalent technology and that the remaining 25 percent would employ DOCs. On average, engines using DPFs were assumed to achieve a 90 percent reduction in PM. Those employing DOCs were assumed to achieve a 40 percent reduction in PM.
- It was assumed that all engines would be Tier II compliant; and
- It was assumed that half of all air compressors, pumps, mixing, desanding and grout plants, and welding machines used on site would operate with electric power.

Tables 9-10 and 9-11 present the results of the mitigation analysis. Table 9-10 shows the highest predicted microscale (local) increase in pollutant concentrations at various types of locations, which are depicted graphically in Figures 9-12 through 9-17. The concentrations presented in the Tables include contributions from both on–road sources and on–site construction activity emissions. The concentrations marked "Other Locations along Access Routes" represent the highest predicted impacts from on–road sources at more distant locations that would not be impacted by the construction activity on–site. The total concentrations, including background levels, are presented in Table 9-11.

Table 9–10
2006 Highest Predicted Increase in Pollutant Concentrations from Construction of the Preferred Alternative with Mitigation

Pollutant	Average Period	Receptor Type	Maximum Increase [µg/m3]	
			Route 9A Short Bypass	Route 9A At Grade
NO_2	Annual	Highest of All Receptors	5.7	7.7
		Residential Buildings / Hotel	4.4	4.4
$PM_{2.5}$	24–hour	Highest of All Receptors	16.4*	7.9*
		Residential Buildings / Hotel	2.2	2.4
		Other Locations on Access Routes	0.1	0.1
	Annual	Local Highest of All Receptors	0.2	0.3
		Local Highest Residential / Hotel	0.2	0.2
		Local on Access Routes	0.01	0.01
		Neighborhood Scale	0.04	0.04
PM_{10}	24–hour	Highest of All Receptors	21.1	16.4
		Residential Buildings / Hotel	4.1	13.3
		Other Locations on Access Routes	1.0	1.0
	Annual	Highest of All Receptors	0.6	0.7
		Residential Buildings / Hotel	0.5	0.5
		Other Locations on Access Routes	0.3	0.3

Notes:
Interim guidance threshold levels for $PM_{2.5}$ are 5 µg/m^3 and 0.3 µg/m^3 for 24–hour and annual increases, respectively, and 0.1 µg/m^3 for neighborhood scale annual average. For determination of adverse impacts, these values are applied in the absence of specific criteria.
The NAAQS are as follows: NO_2—Annual = 100 µg/m^3; $PM_{2.5}$—24–hour = 65 µg/m^3 and Annual = 15 µg/m^3; PM_{10}—24–hour = 150 µg/m^3 and Annual = 50 µg/m^3.
* Indicates substantial adverse impact–exceeding the interim guidance thresholds.

With mitigation, the maximum predicted increments are substantially lower than were shown in the construction period assessment (see Figures 9-12 through 9-21 and Table 9-10). With mitigation, maximum $PM_{2.5}$ increments would be reduced by approximately 66 percent. More importantly, neighborhood scale increments would be reduced by half to below the threshold level of 0.1 µg/m^3. As can be seen in Figures 9-16 through 9–19 (compare to base case Figures 9–6 through 9–9), the extent of increments above the interim threshold guidance levels would be reduced to a small area immediately adjacent to the site boundary, along the West Street bikeway, for 24–hour averages only. The occurrence of such high levels would depend on the coincidence of peak background levels above the 98th percentile together with peak construction activity and the extreme metrological conditions that led to the concentration predicted in the model. At a very conservative maximum, this could occur on up to six days of the peak construction year. Such an occurrence, although possible, is not likely and in any event would be rare. This would be a temporary situation, limited to a small area immediately adjacent to the Route 9A construction site and would not be expected to occur in subsequent years during which construction activity would be reduced. Construction activity will be managed by PANYNJ in this area to ensure that emissions from construction equipment and extreme meteorological conditions are prevented from occurring concurrently.

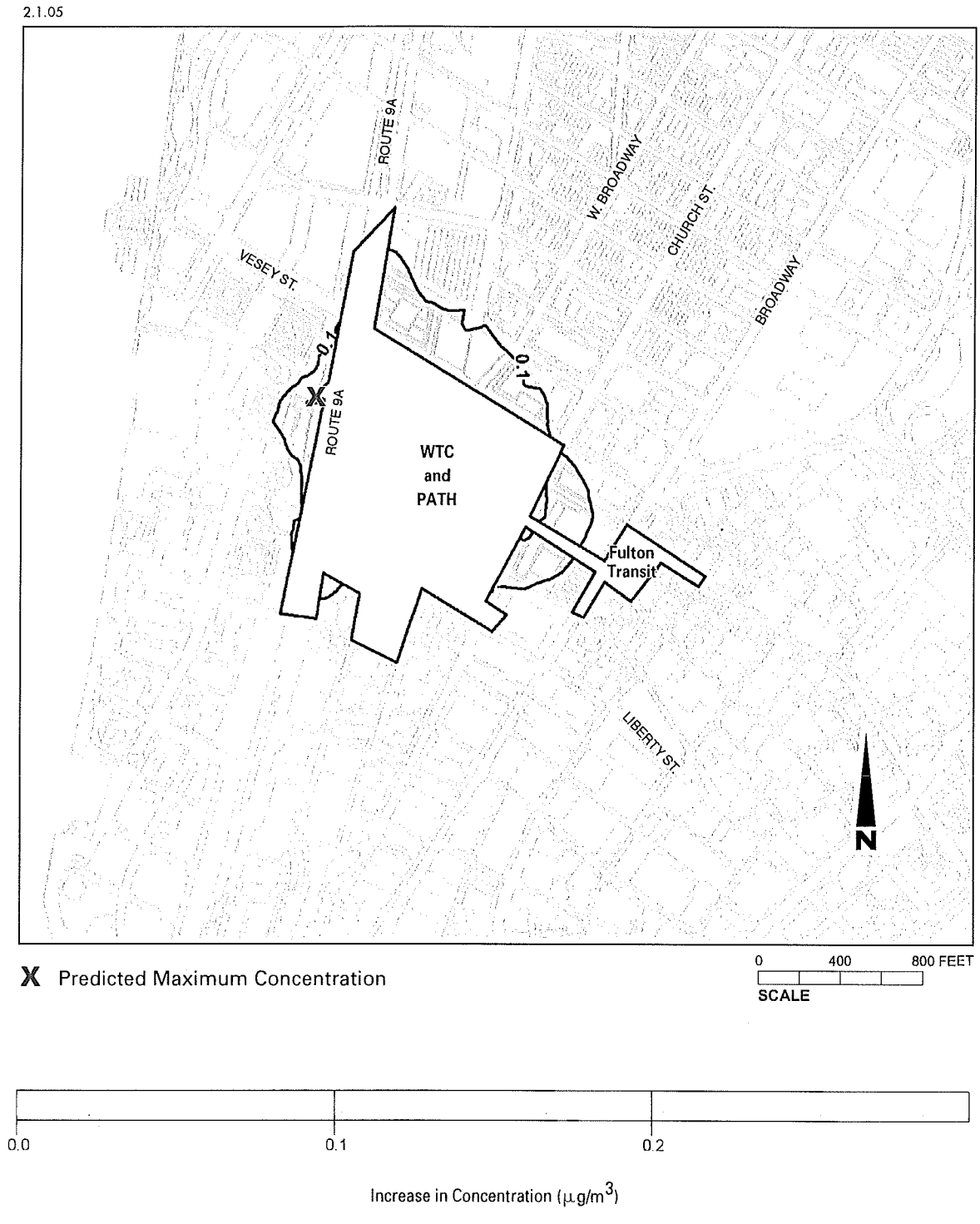


Figure 9-12

Maximum Predicted Annual Average PM_{10}
PATH Construction Increment with
Route 9A Short Bypass Tunnel Alternative and Mitigation

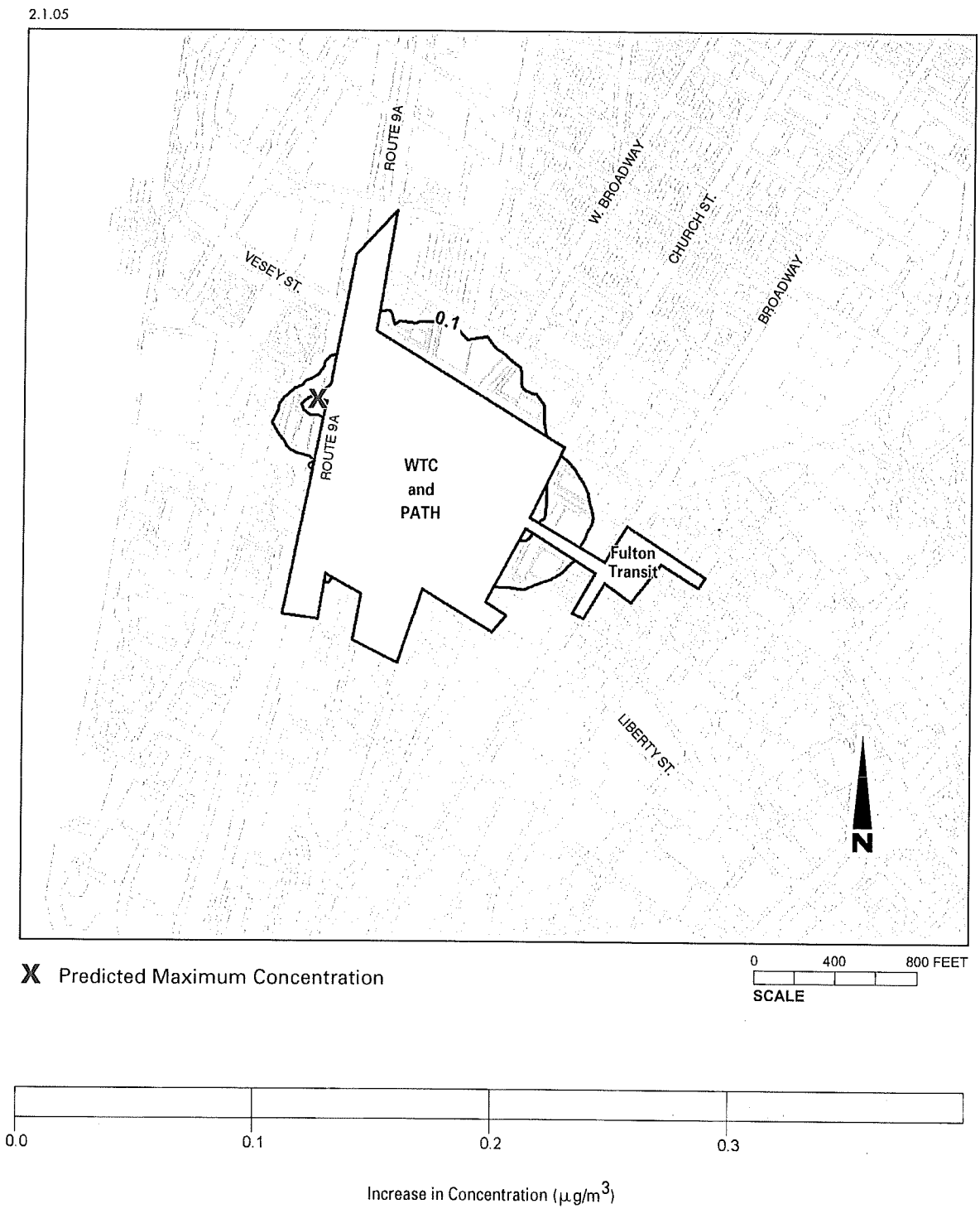


Figure 9-13

Maximum Predicted Annual Average PM_{10} PATH Construction Increment with Route 9A At-Grade Alternative and Mitigation

2.1.05

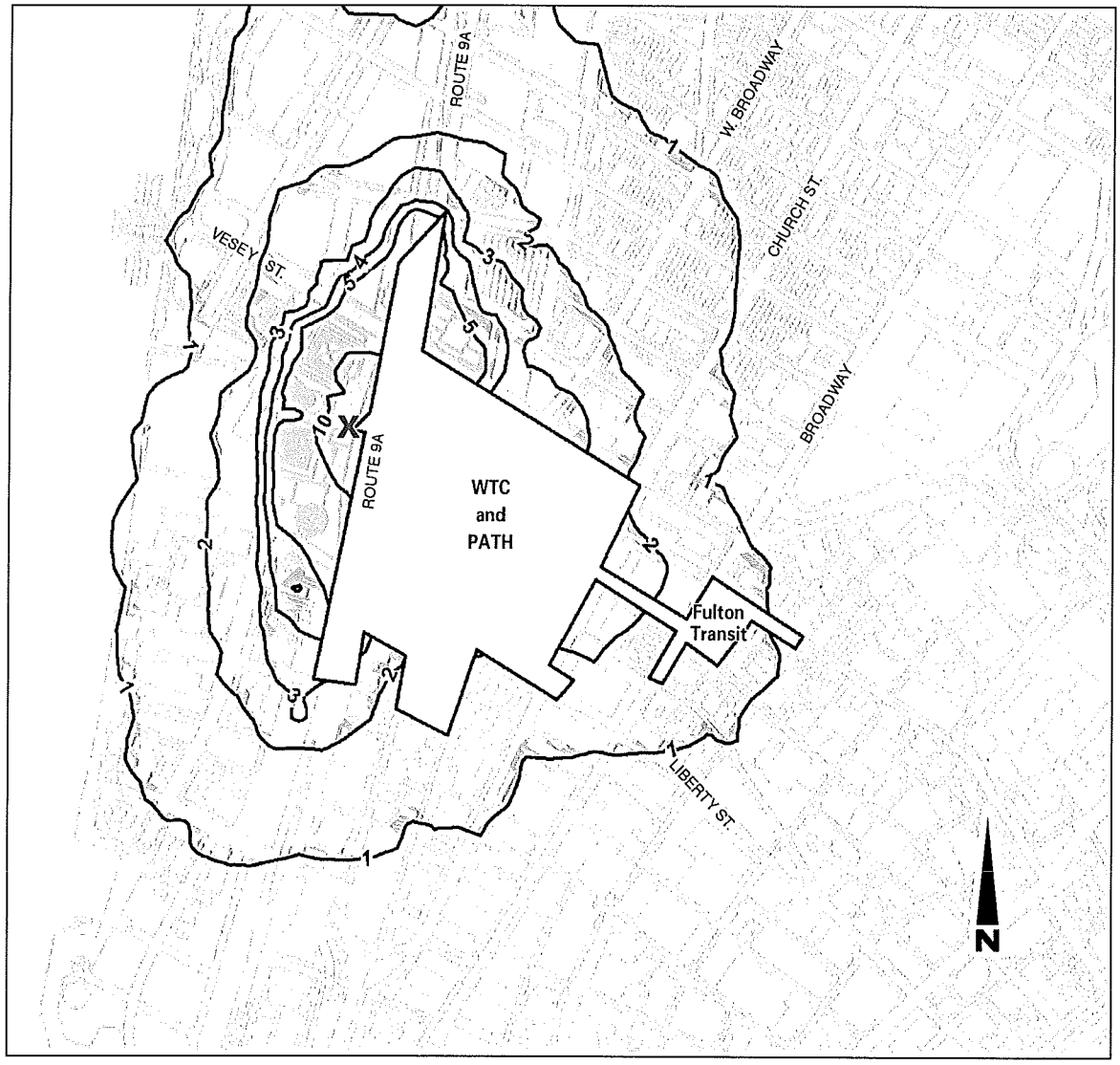


Figure 9-14

Maximum Predicted 24-Hour Average PM_{10} PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative and Mitigation

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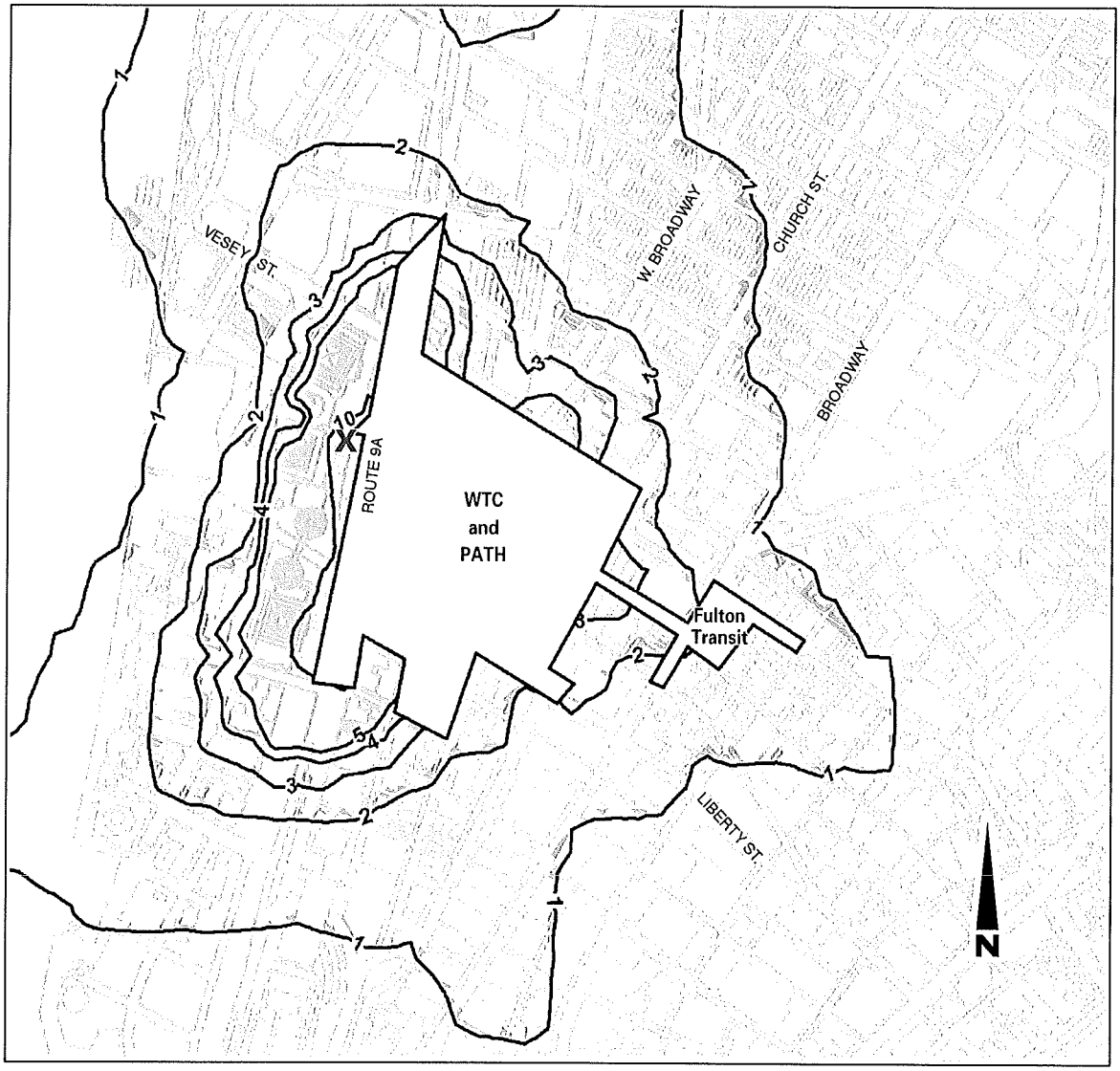


Figure 9-15

Maximum Predicted 24-Hour Average PM_{10} PATH Construction Increment with Route 9A At-Grade Alternative and Mitigation

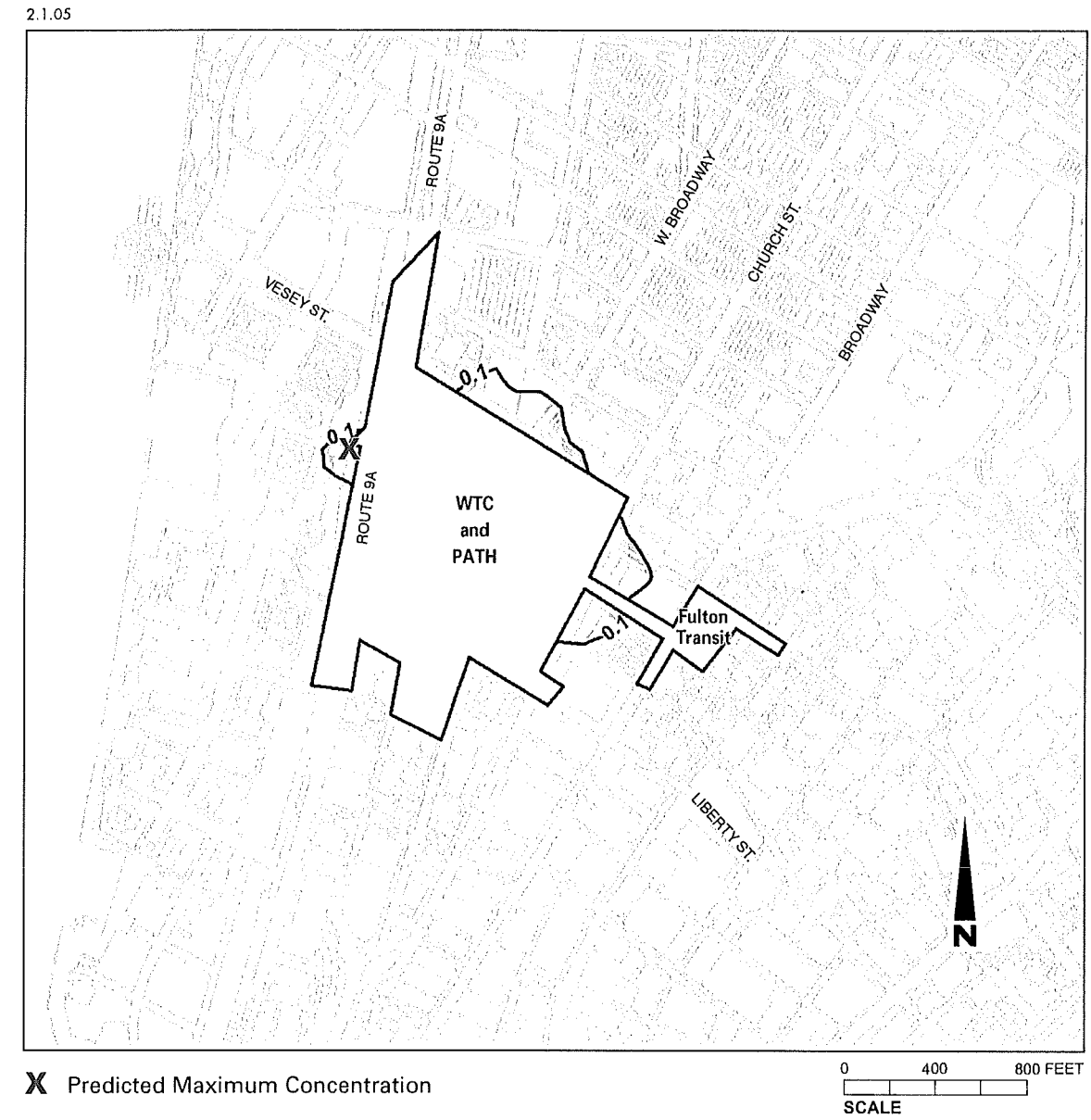


Figure 9-16

Maximum Predicted Annual Average $PM_{2.5}$ PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative and Mitigation

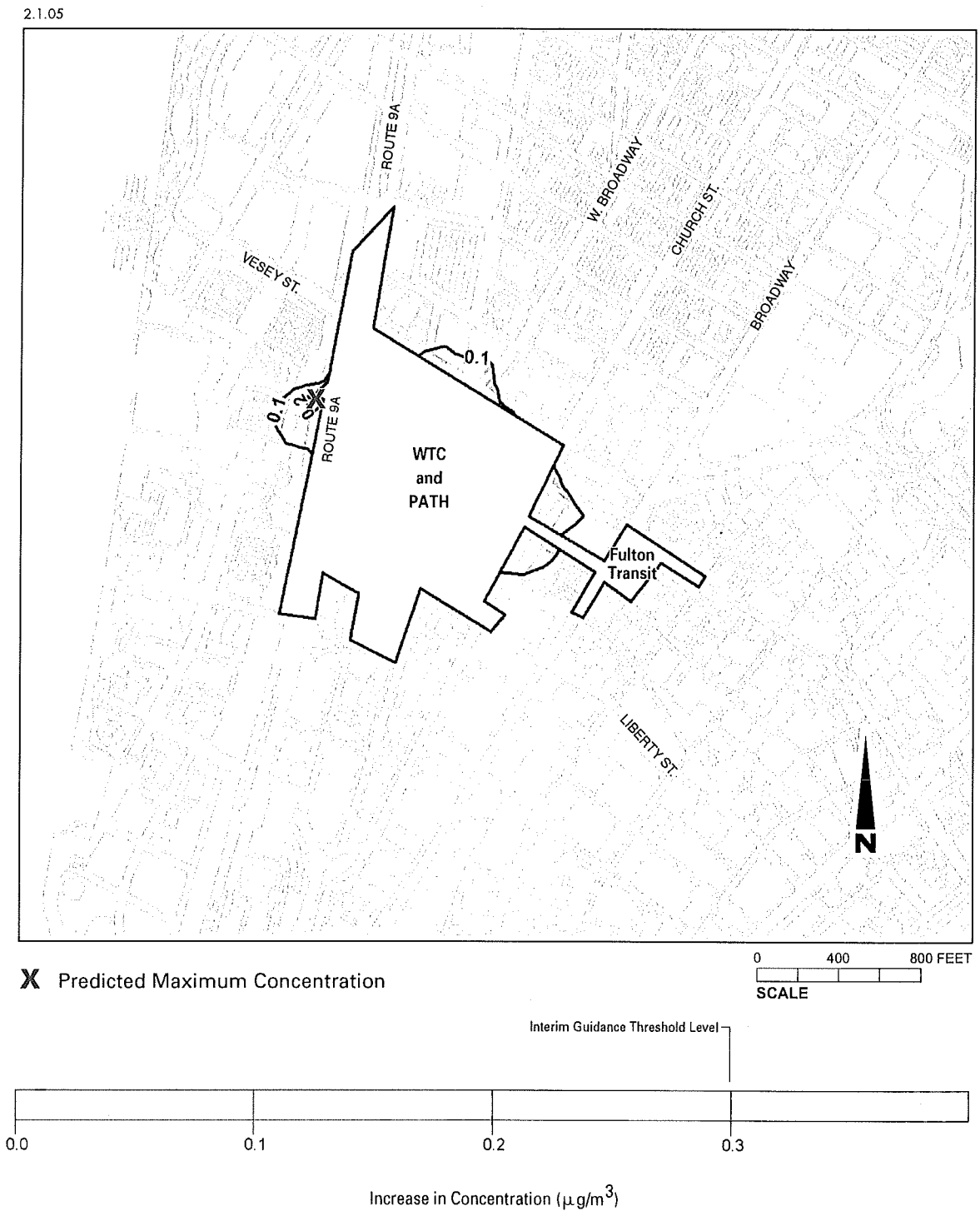


Figure 9-17

Maximum Predicted Annual Average $PM_{2.5}$ PATH Construction Increment with Route 9A At-Grade Alternative and Mitigation

2.1.05

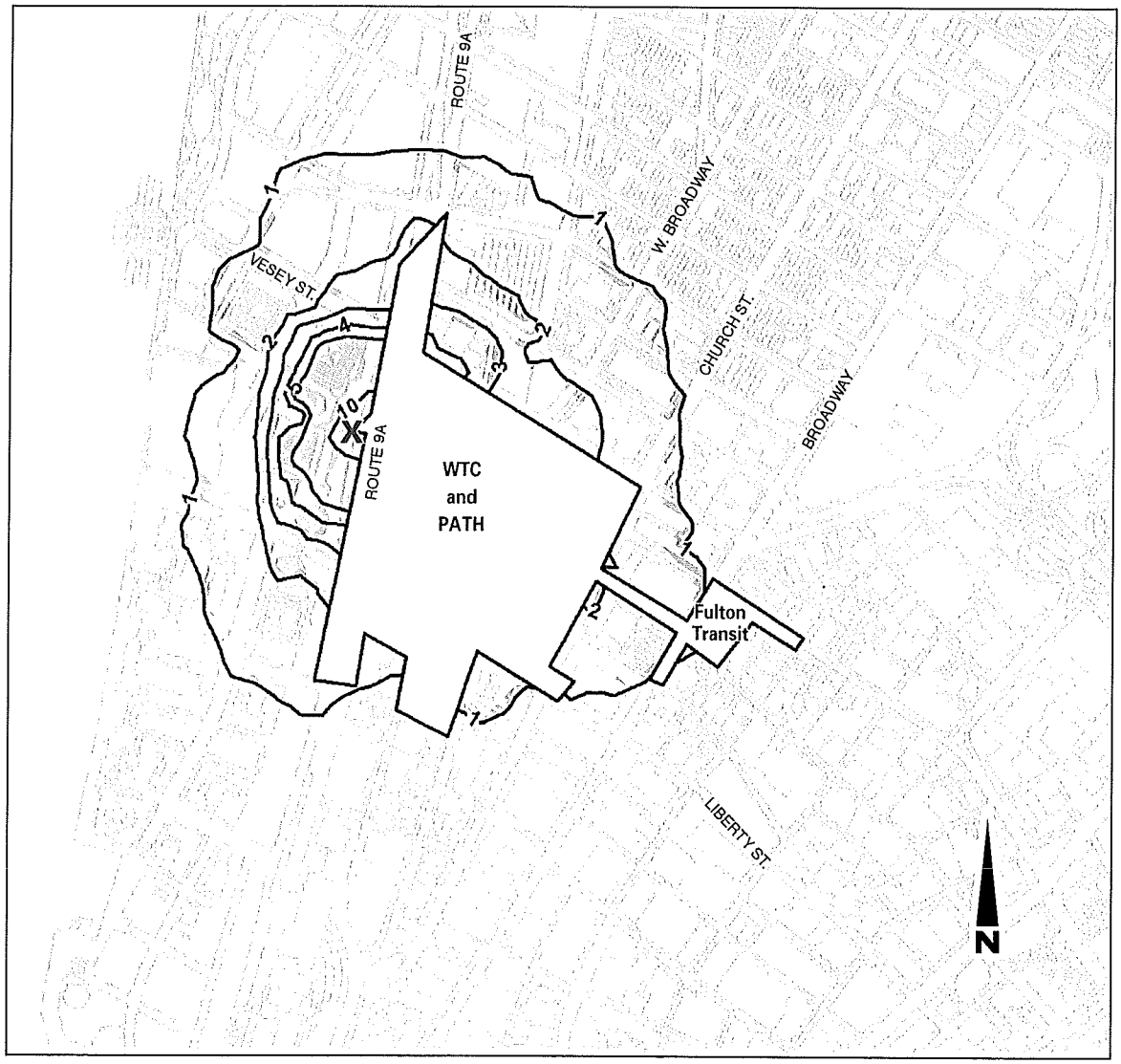
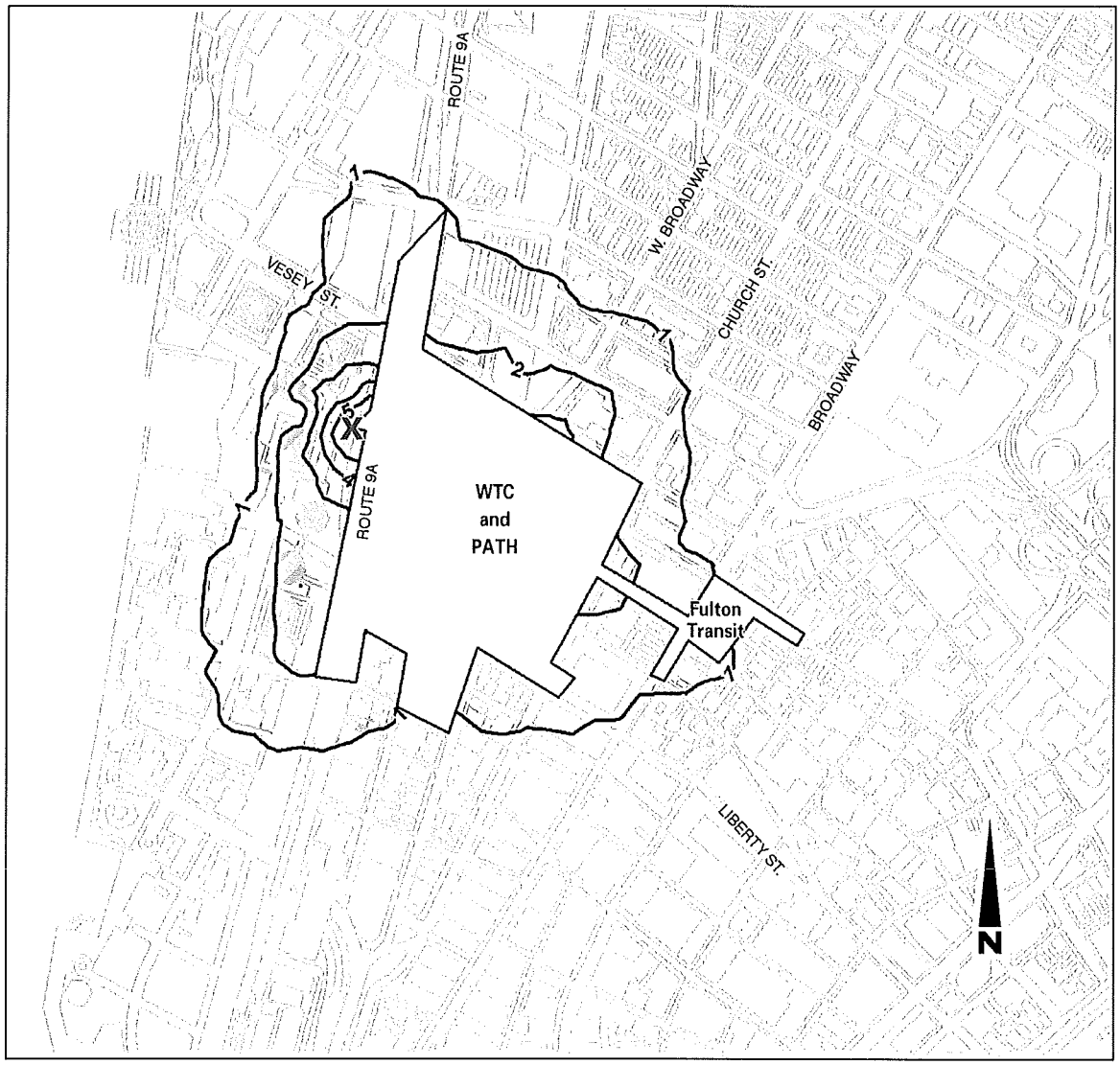


Figure 9-18

Maximum Predicted 24-Hour Average $PM_{2.5}$ PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative and Mitigation

2.1.05



X Predicted Maximum Concentration

0 400 800 FEET
SCALE

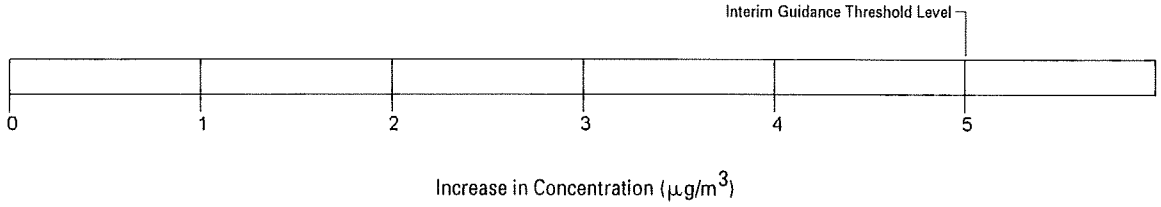


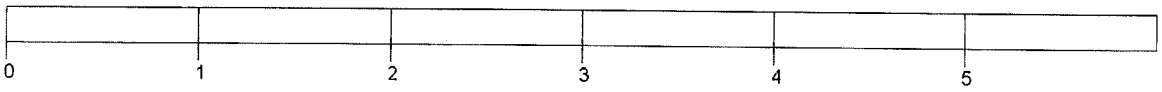
Figure 9-19

Maximum Predicted 24-Hour Average $PM_{2.5}$ PATH Construction Increment with Route 9A At-Grade Alternative and Mitigation

2.1.05

X Predicted Maximum Concentration

0 400 800 FEET
SCALE



Increase in Concentration ($\mu g/m^3$)

Figure 9-20

Maximum Predicted Annual Average NO_2 PATH Construction Increment with Route 9A Short Bypass Tunnel Alternative and Mitigation

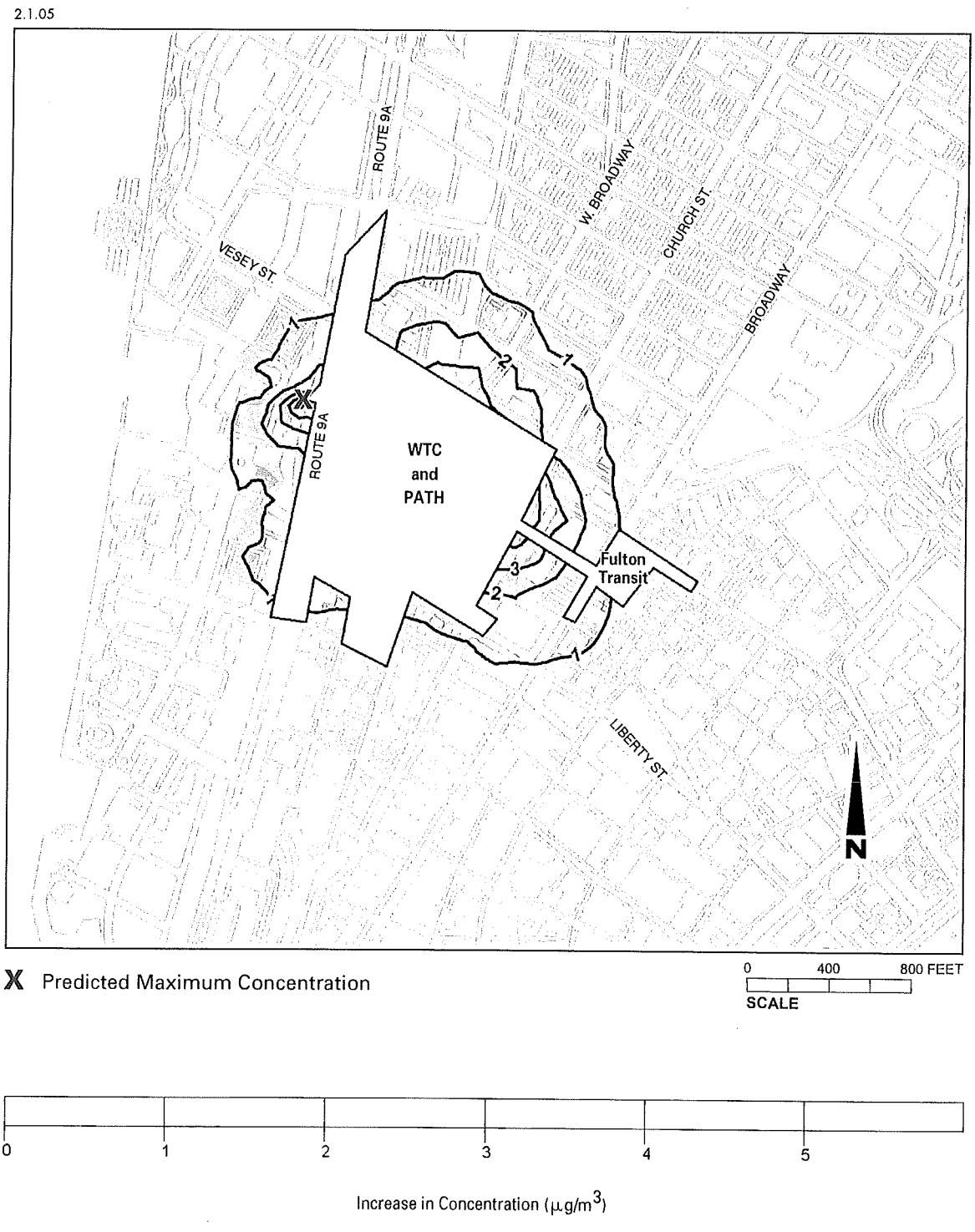


Figure 9-21

Maximum Predicted Annual Average NO_2 PATH Construction Increment with Route 9A At-Grade Alternative and Mitigation

Table 9–11
2006 Highest Predicted Total Pollutant Concentrations During Construction of the Preferred Alternative with Mitigation

Pollutant	Average Period	Receptor Type	Maximum Increase [µg/m^3]	
			Route 9A Short Bypass	Route 9A At Grade
NO_2	Annual	Highest of All Receptors	77.7	79.7
		Residential Buildings / Hotel	76.4	76.4
$PM_{2.5}$	24–hour	Highest of All Receptors	63.6	55.1
		Residential Buildings / Hotel	48.2	48.5
		Other Locations on Access Routes	48.2	48.2
	Annual	Highest of All Receptors	18.4**	18.7**
		Highest Residential / Hotel	18.1**	18.1**
PM_{10}	24–hour	Highest of All Receptors	83.0	78.4
		Residential Buildings / Hotel	60.1	69.3
		Other Locations on Access Routes	63.0	63.0
	Annual	Highest of All Receptors	29.2	29.2
		Residential Buildings / Hotel	26.8	26.8
		Other Locations on Access Routes	28.9	28.9

Notes:

All total concentrations include calculated background contributions from local mobile sources, as well as measured regional background values as follows: NO_2—Annual average 72 µg/m^3; $PM_{2.5}$—Annual average 17.1 µg/m^3 (highest of 2000-2002 annual values); 24-hour average 44.0 µg/m^3 (highest of the three 2nd highest 24-hour averages in 2000-2002); PM_{10}—Annual average 24 µg/m^3; 24-hour average 50 µg/m^3.

The NAAQS are as follows: NO_2—Annual = 100 µg/m^3; $PM_{2.5}$—24–hour = 65 µg/m^3 and Annual = 15 µg/m^3; PM_{10}—24-hour = 150 µg/m^3 and Annual = 50 µg/m^3.

Cumulative and project–generated maximum concentrations may occur at a different time and/or location.

** $PM_{2.5}$ annual average concentrations exceed the new NAAQS in the existing background condition; however the conformity process is not yet in effect. See Table 10– for comparison with incremental thresholds.

The total concentrations from cumulative construction of the Lower Manhattan Recovery Projects, including mitigation, are presented in Chapter 15, "Cumulative Effects."

Mesoscale Emissions Analysis

Table 9-12 shows the total project-generated emission of PM_{10}, $PM_{2.5}$, NO_x and VOCs by year with mitigation. This includes both on-site activity and related on-road emissions.

As compared to the projected regional emissions inventory in the New York ozone SIP for the same years—the on-road portion of the emissions would be less than 0.007 percent and 0.002 percent of the SIP mobile source NO_x and VOC emissions, respectively; the on-site portion of the emissions would be 0.05 percent and 0.003 percent of the non-road SIP NO_x and VOC emissions or less (depending on the year), respectively.

Table 9–12
Total Emissions from Construction of the Preferred Alternative with Mitigation (tons per year)

Pollutant	2005	2006	2007	2008
PM_{10}	0.8	1.2	0.3	0.3
$PM_{2.5}$	0.5	0.7	0.2	0.2
NO_x	34.0	36.8	8.4	8.4
VOC	1.9	2.5	0.6	0.7
Note: PM_{10} emissions include both engine emissions and resuspended road dust.				

A. INTRODUCTION

This chapter assesses the potential for noise and vibration impacts from construction and operation of the proposed Permanent World Trade Center (WTC) PATH Terminal.

This chapter includes a description of impact standards and criteria, a description of existing conditions, an assessment of construction impacts, an assessment of permanent impacts once the Permanent WTC PATH Terminal is operational, and a description of potential mitigation measures. Although the analyses and corresponding mitigation measures for these two assessments contain similar language, the analyses actually assess two different types of potential impacts.

Airborne noise is what most people think of when they hear the word "noise." It is noise that travels through the air—such as the sound of traffic on a nearby roadway, or children playing in a playground. *Ground-borne noise* is the rumbling sound caused by *vibration* (or oscillatory motion). With ground-borne noise, buildings and other structures act like speakers for low-amplitude noise. As an example, ground-borne noise is the low rumbling sound that occurs within a building as a train passes beneath.

Appendix E of this Environmental Impact Statement (EIS) provides supporting information for the various analyses, including descriptive information on how noise and vibrations are perceived, and details on the assessment methodologies and conclusions.

B. METHODOLOGY

AIRBORNE NOISE

The analysis of airborne noise for the Preferred Alternative was performed using the procedures set forth in the U.S. Department of Transportation, Federal Transit Administration (FTA) guidance manual, *Transit Noise and Vibration Impact Assessment* (April 1995). This FTA document sets forth methodologies for analyzing airborne noise during construction and operation. It also provides the criteria for assessing impacts as well as suggested mitigation measures.

Airborne noise levels from construction and operation of the Permanent WTC PATH Terminal are subject to the criteria defined by the FTA. In addition, noise levels from some construction equipment are regulated by the Noise Control Act of 1972 (49 USC §§4901 et. seq.)

The FTA guidance does not present standardized impact criteria for assessing airborne, construction-period noise impacts. However, it does contain levels that if exceeded may result in adverse community reactions, which were applied in this EIS for the assessment of potential adverse impacts. Sensitivity to noise is a function of land use, time of day, and duration. Thus, the FTA criteria provides for levels by type of use, time of day, and duration. The L_{eq} noise level

represents the constant equivalent sound level of a fluctuating source, usually for a 1-hour period. The L_{dn} is a descriptor for the cumulative 24-hour, day-night noise level and accounts for greater sensitivity to noise during nighttime hours. (See Appendix E for a more detailed description of the FTA criteria.)

Table 10-1 shows the FTA impact criteria for the detailed construction noise assessment conducted in accordance with FTA methodologies. For purposes of impact assessment, an airborne noise impact would occur if noise levels during construction exceed the FTA recommended values in Table 10-1. The residential and commercial use categories are most relevant to this EIS.

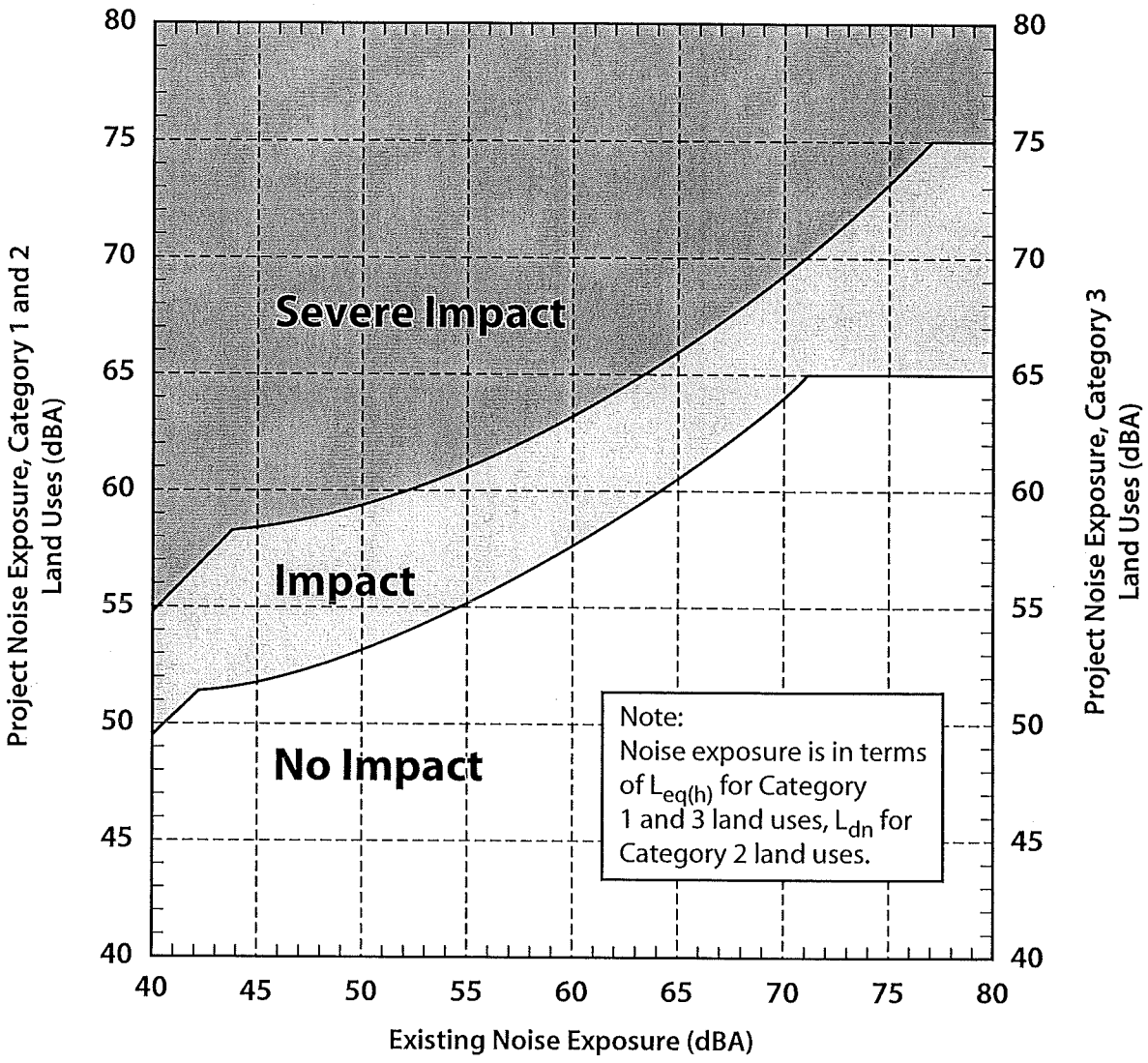
Table 10-1
FTA Impact Criteria for Detailed Assessment of Airborne Construction Noise (in dBA)

Land Use	Descriptor	Day	Night
Residential	8-hour L_{eq}	80	70
	30-day average L_{dn}	75[1]	
Commercial	8-hour L_{eq}	85	85
	30-day average $L_{eq(24)}$	80	
Industrial	8-hour L_{eq}	90	90
	30-day average $L_{eq(24)}$	85	

Note: [1] In urban areas with existing ambient L_{dn} greater than 65 dB, the impact criterion is existing ambient L_{dn} + 10 dB.

For airborne operational noise, the FTA guidance manual defines noise criteria based on the specific type of land use that would be affected, with explicit operational noise impact criteria for three land use categories. These impact criteria are based on either peak 1-hour L_{eq} or 24-hour L_{dn} values. Table 10-2 describes the land use categories defined in the FTA guidance manual, and provides noise metrics used for determining operational noise impacts. As described in Table 10-2, Categories 1 and 3—which include land uses that are noise-sensitive, but where people do not sleep—require examination using the 1-hour L_{eq} descriptor for the noisiest peak hour. Category 2, which includes residences, hospitals, and other locations where nighttime sensitivity to noise is very important, requires examination using the 24-hour L_{dn} descriptor.

As shown in Figure 10-1, the FTA impact criteria for airborne operational noise are keyed to the noise level generated by the Preferred Alternative (called "project noise exposure"). Two types of impacts—"severe impact" and "impact"—are defined for each land use category, depending on existing ambient noise levels. The difference between "severe impact" and "impact" is that a severe impact occurs with a change in noise that a substantial percentage of people find annoying, while an impact occurs when a change in noise is noticeable to most people but not necessarily sufficient to result in strong adverse reactions from the community. Equations defining the relationship between existing ambient noise levels and the "impact" and "severe impact" thresholds are presented in Appendix E, "Noise Analysis."



Source: Transit Noise and Vibration Impact Assessment, DOT-T-95-16, April 1995

Figure 10-1
FTA's Noise Impact Criteria for Transit Projects

Table 10-2
FTA's Land Use Categories and Metrics for Operational Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq(h)}$[1]	Tracts of land where quiet is an essential element in the intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with substantial outdoor use.
2	Outdoor L_{dn}[2]	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels, where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq(h)}$[1]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Buildings with interior spaces where quiet is important—such as medical offices, conference rooms, recording studios, and concert halls—fall into this category. Places for meditation or study associated with cemeteries, monuments, museums. Certain historical sites, parks, and recreational facilities are also included.

Notes: [1] L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.
[2] L_{dn} for the 24-hour cumulative noise level.
Source: *Transit Noise and Vibration Impact Assessment*, FTA, April 1995.

For purposes of impact assessment, an airborne noise impact during operations would occur if noise levels fall in the "impact" or "severe impact" areas. For example, for Land Use Category 2 and an existing noise exposure of 60 dBA, a project-generated noise exposure of 65 dBA would result in "severe impact" while a project-generated noise exposure of 60 dBA would constitute an "impact." Similarly, for the same land use category and existing noise exposure, a project-generated noise exposure of 55 dBA would not constitute an impact.

NOISE PREDICTION METHODOLOGY

Following the procedures set forth in FTA's guidance manual, existing noise levels were first determined by field measurement. The project-generated noise levels from construction activities and the proposed PATH train operations were then calculated. Those levels were evaluated using the impact criteria discussed above to determine the Preferred Alternative's potential for adverse impacts. This methodology is discussed in more detail below.

DETERMINATION OF EXISTING NOISE LEVELS

Noise measurements were performed at receptor locations to establish existing conditions. Traffic on adjacent roadways and streets was the dominant noise source at each location.

Selection of Noise Receptors

Existing noise levels vary depending on local site conditions and the time of day. To determine the existing ambient noise levels in the area that could be affected by the construction or operation of the Preferred Alternative, specific analysis locations (referred to as "receptors") were chosen throughout the study area. A total of five receptor sites adjacent to the Project Site were chosen. These sites were selected to represent the range of land uses (e.g., residences, church, institution, offices) which would be particularly sensitive to noise increases, and would be likely to experience the greatest increases in noise from the Preferred Alternative's

construction and operation. The locations chosen as noise receptors are summarized in Table 10-3 (which also indicates each site's FTA land use category) and are shown in Figure 10-2. Potential noise and vibration impacts were also assessed at the site of the proposed WTC Memorial. However, the analysis is not based on existing noise levels since current construction activities in the WTC "bathtub" would result in an inaccurate assessment.

Table 10-3
Noise Receptor Sites and Locations

Site	Location	Land Use	FTA Land Use Category	Type of Measurement	Year of Measurement
1	Hilton Millennium Hotel (Church and Dey Streets)	Hotel	2	24-Hour	2003
2	114 Liberty Street (between Church and Greenwich Streets)	Residences and Offices	2	24-Hour	2003
3	World Financial Center (Route 9A between Vesey and Liberty Streets)	Offices	3	20-Minutes	2003
4	Barclay Street and Washington Street Intersection	Institution and offices	3	20-Minutes	2003
5	180 Broadway (between Dey and Cortland Streets)	Residences and Offices	2	24-Hour	2003

Note: For definition of land use categories, see Table 10-2.

Noise Monitoring

Noise monitoring was conducted at all five noise receptor sites. As shown in Table 10-3, at each site noise levels were measured for either one continuous 24-hour period or four 20-minute periods—AM, midday, PM, and nighttime. At receptor sites 1, 2, and 5, continuous 24-hour noise measurements were conducted; at receptor sites 3 and 4, 20-minute measurements were conducted. L_{dn} values for sites 3 and 4 were estimated from the 20-minute measurements as discussed below.

All measurements were performed using Type I instrumentation. Precision Sound Level Meters (SLM) were used in field measurements. The SLMs meet or exceed the requirements set forth in the ANSI S1.4-1983 Standards for Type I quality and accuracy. Acoustical calibrators were used to calibrate the SLMs before and after each measurement period. The SLMs were operated on the A-weighting network and slow-meter response as recommended by the manufacturer. Measurements were not collected if roadway pavement was wet, or if wind speed exceeded 12 miles per hour. A porous windscreen was used on each SLM during all measurement periods.

All field measurements were taken by mounting the SLMs approximately five feet above the sidewalk or ground surface at each receptor. This height is generally considered representative of the ear level of an average person. Where possible, measurement sites were located in open areas away from buildings or other potentially reflective surfaces, representative of the outdoor use area of a given receptor.

If possible, the SLMs were placed on public sidewalks in front of private properties. During measurement periods, important events and site conditions were noted, and a sketch was drawn for each receptor location showing important and permanent features of the area to aid in

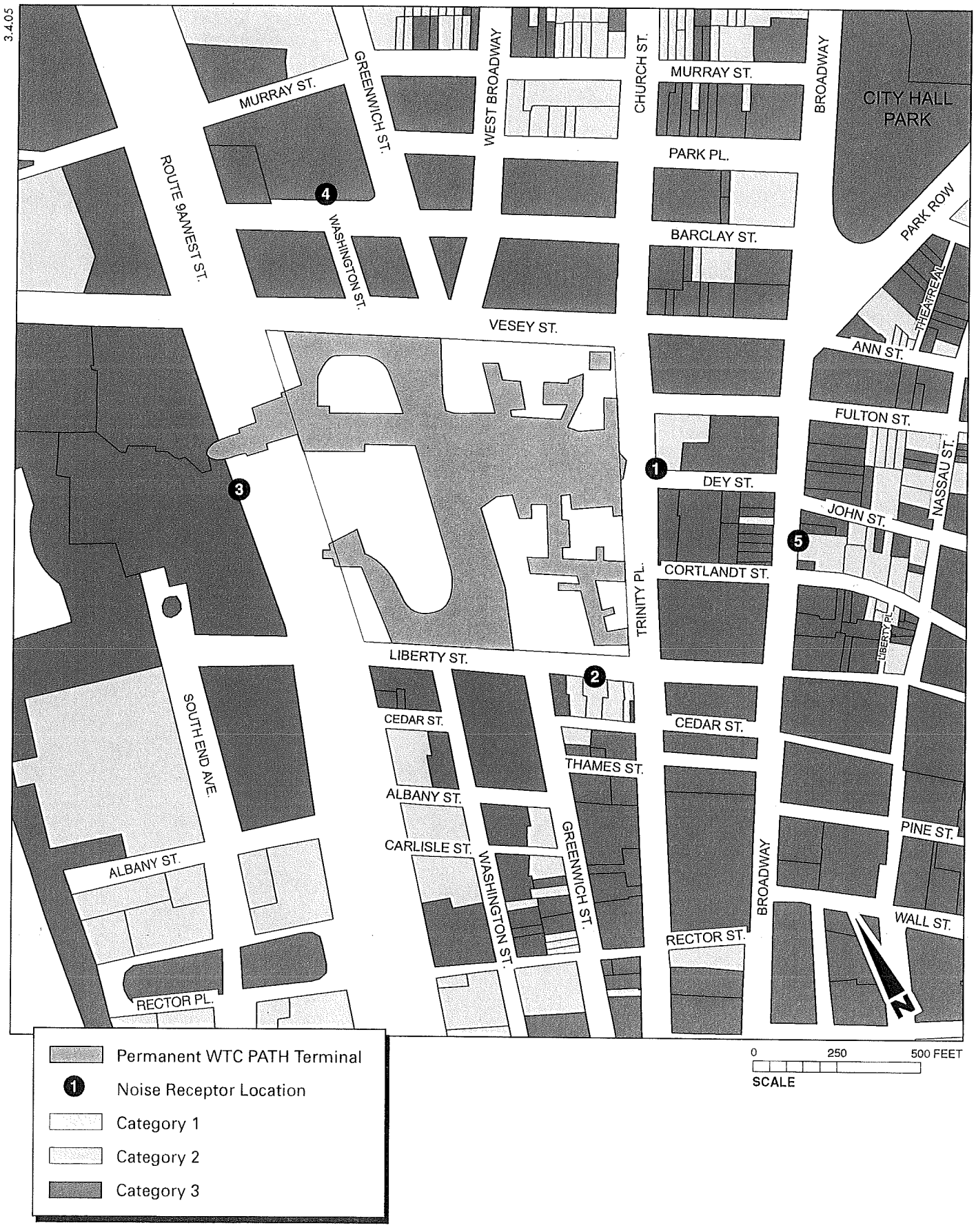


Figure 10-2

Noise Receptor Locations and FTA Land Use Categories

locating microphone positions at a later date. If an unusual noise source interrupted the measurement session, the measurement was temporarily paused until the noise source was out of range. Typical noise sources of this type include car alarms or car horns, occasional airplanes flying overhead, the roaring of motorcycles, and barking dogs.

Calculation of L_{dn} Noise Levels

L_{dn} noise levels can be calculated directly from 24-hour noise levels, but must be approximated if noise levels are not measured over a 24-hour period. The FTA guidance manual provides equations to approximate the L_{dn} noise level using either a peak, midday, and nighttime hourly L_{eq} noise level, or daytime, early nighttime, and late nighttime L_{eq} value. At receptor sites where continuous 24-hour measurement data were not available, those equations were used to calculate L_{dn} noise levels.

MODELING TO PREDICT FUTURE CONDITIONS FOR THE PROJECT ALTERNATIVES

A proportional modeling technique was used to approximate changes in noise levels from predicted changes in traffic volumes that would be independent of the Preferred Alternative. Traffic noise levels were then calculated using existing noise levels, existing traffic data, and estimated future traffic data. In general, with this technique, vehicular traffic volumes were converted into passenger car equivalent (PCE) values, for which one medium-duty truck (having a gross weight between 9,900 and 26,400 pounds) was assumed to generate the noise equivalent of 13 cars, one heavy-duty truck (having a gross weight of more than 26,400 pounds) was assumed to generate the noise equivalent of 47 cars, and each bus was assumed to generate the noise equivalent of 18 cars.

Because sound levels use a logarithmic scale, this model proportions logarithmically with traffic changes. For example, if the existing traffic volume on a street is 100 PCE with a noise level of 70 dBA, and if the future traffic volumes for No Build and Build conditions were 120 PCE and 150 PCE, respectively, then the No Build noise level would be 70.8 dBA, the Build noise level would be 71.8 dBA, and the project-generated noise level would be 64.8 dBA. This example assumes that traffic is the dominant noise source at a particular location. This assumption is true at all of the receptor locations in the vicinity of the Project Site under the baseline condition (i.e., no construction activities).

MODELING TO PREDICT IMPACTS FROM CONSTRUCTION ACTIVITIES

Noise from construction activities was estimated following the methodologies set forth in the April 1995 FTA guidance manual. The detailed noise assessment procedures were followed. The procedure is based on equations calculating noise levels from operation of each piece of construction equipment.

The combination of noise from all pieces of equipment operating during the same time period is obtained from adding the L_{eq} values for each piece of equipment. For the detailed assessment, 8-hour L_{eq} values and 30-day average L_{dn} values were calculated assuming all appropriate usage factors for the specified time periods for each element of construction as discussed in Chapter 3, "Construction Methods and Materials."

MODELING TO PREDICT IMPACTS FROM TRAIN OPERATIONS

Noise from the PATH train operations was also analyzed using the methodologies set forth in the FTA guidance manual. The analysis considered two major noise sources from PATH train

operations: noise from fixed-rail operations (i.e., noise from the PATH train operations emanating from stations, air ventilation openings, and train/subway gratings), and noise from mechanical equipment operations (i.e., substations, HVAC equipment, etc.).

The Preferred Alternative would not directly affect the operation of PATH trains (throughput or number of cars) as compared to future conditions, which were anticipated before September 11, 2001. Thus, the Preferred Alternative would not result in adverse noise impacts to existing land uses along the PATH's right-of-way. However, with the development of a memorial at the WTC site, there would be a change in land use from Category 3 to Category 1 adjacent to the proposed location of the Permanent WTC PATH Terminal. Thus a general noise assessment was performed per FTA guidance to determine operational-period noise levels and to examine potential impacts to the WTC Memorial.

Noise from rail vehicle operations would reverberate in the enclosed space of the underground tunnels and station. Reverberation effects of the tunnel and terminal would cause substantially higher noise levels resulting from source noise and reflected noise. To account for this phenomenon, noise levels were adjusted by calculating a noise level caused by the reflected portion of the fixed railway noise (which was assumed to bounce off acoustically reflective surfaces in the tunnels and terminal), and adding the noise level calculated for free-field conditions through logarithmic summation. For a conservative analysis, it was assumed that the tunnel or terminal are hard reflective surfaces with little or no sound absorption.

Based on the methods of sound propagation in enclosed spaces, i.e., the reflected effect, approximately 6dB was added to the free-field predicted noise levels and adjusted for noise receptor locations based on distance and acoustical attenuation through the terminal entrance or ventilation shaft. The analysis accounts for the fact that the Preferred Alternative's design will incorporate acoustical treatments on interior wall surfaces such as perforated metal acoustical panels containing glass fibers and spray-on mineral-based coatings. These measures would provide for 25 dBA attenuation.

VIBRATION AND GROUND-BORNE NOISE

To examine potential vibration and ground-borne impacts during construction, the FTA guidance document provides a screening procedure to project the magnitude of vibration levels to determine the potential for impacts and whether mitigation measures may be necessary. To examine potential vibration and ground-borne noise impacts during operation, the FTA guidance lays out a three-step approach: a screening procedure, a general assessment methodology, and a detailed analysis methodology. The analysis below includes a screening and general assessment. Detailed analysis is usually performed as part of the design process, when the general assessment prepared for the EIS indicates that a facility could cause potential impacts.

IMPACT CRITERIA

The vibration levels for typical human and structural responses and sources are shown in Table 10-4. Although the perceptibility threshold for ground-borne vibration is about 65 VdB, human response occurs when vibration exceeds 70 VdB.

Background vibration is usually well below the threshold of human perception, and is of concern only when the vibration affects very sensitive manufacturing or research equipment. Electron microscopes, high-resolution lithography equipment, and laser and optical equipment are typical of equipment that is highly sensitive to vibration.

Table 10-4
Typical Levels of Ground-Borne Vibration

Human/Structural Response	Velocity Level (VdB)	Typical Sources (at 50 feet)
Threshold, minor cosmetic damage fragile buildings	100	Blasting from construction projects
		Bulldozers and other heavy tracked construction equipment
Difficulty with vibration-sensitive tasks, such as reading a video screen	90	Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit rail, upper range
		Commuter rail, typical range
Residential annoyance, frequent events	70	Bus or truck over bump
		Rapid transit rail, typical range
Limit for vibration-sensitive equipment. Approximate threshold for human perception of vibration	60	Bus or truck, typical
	50	Typical background vibration

Source: *Transit Noise and Vibration Impact Assessment* (FTA, April 1995).

The FTA criteria for ground-borne vibration and noise from transit operations are based on the maximum levels for a single event. The criteria are shown in Table 10-5 and are used to determine if the Preferred Alternative would result in vibration and ground-borne noise impacts.

Table 10-5
Ground-Borne Vibration and Noise Impact Criteria

Land Use Vibration Category	Ground-borne Vibration Impact Criteria (VdB re 1 micro inch/second)		Ground-borne Noise Impact Criteria (dBA re 20 micro Pascals)	
	Frequent Events[1]	Infrequent Events[2]	Frequent Events[1]	Infrequent Events[2]
1	65 VdB[3]	65 VdB[3]	35 dBA[4]	43 dBA[4]
2	72 VdB	80 VdB	35 dBA	43 dBA
3	75 VdB	83 VdB	40 dBA	48 dBA

Notes:
1. "Frequent events" are defined as those with more than 70 vibration events per day. Most rapid transit projects fall into this category.
2. "Infrequent events" are defined as those with fewer than 70 vibration events per day. This category includes most commuter rail systems.
3. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
4. Because the vibration-sensitive equipment in typical Category 1 buildings is not sensitive to ground-borne noise, FTA does not provide a ground-borne noise impact criterion for this category. However, Category 1 buildings for this EIS include historic structures, which may include residences. Therefore Category 2 ground-borne noise criteria are used for Category 1 as well.

Source: *Transit Noise and Vibration Impact Assessment*, FTA, April 1995, pages 8-2 through 8-3.

The limits are specified for the three land use categories defined below:

- *Vibration Land Use Category 1: High Sensitivity*—Buildings where low ambient vibration is essential for the operations within the building (e.g. vibration-sensitive research, hospitals with vibration-sensitive equipment, etc.), which may be well below levels associated with human annoyance. Although the FTA methodology does not classify historic structures in this category, this analysis does. Historic buildings are potentially sensitive to architectural damage from frequent vibration levels higher than 65 VdB. Architectural damage (e.g., cracked plaster) can adversely affect a building's historic features and character.
- *Vibration Land Use Category 2: Residential*—This category covers all residential land uses and any buildings where people sleep, such as hotels and hospitals.
- *Vibration Land Use Category 3: Institutional*—This category includes schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference.

In terms of construction activities, the focus of vibration criteria is the levels that should not be exceeded to prevent architectural and structural damage to nearby buildings. The generally accepted criteria for avoidance of construction-related damage, which the FTA has adopted in its guidance manual, is 0.20 inches per second (approximately 100 VdB) for fragile buildings or 0.12 inches per second (approximately 95 VdB) for extremely fragile buildings.

CONSTRUCTION VIBRATION PREDICTION METHODOLOGY

The FTA guidance manual provides screening methodologies for determining where there is a potential for impact to sensitive structures from construction activities, such pile driving, demolition, drilling, excavation, or blasting. The procedure includes: 1) selecting the equipment and determining the vibratory levels at a reference distance of 25 feet; 2) determining peak particle velocity at a receptor location by adjusting for the actual distance; 3) applying the vibration damage threshold criterion discussed above; and 4) if consideration of annoyance or interference with vibration-sensitive activities is of concern, estimate the vibration level.

C. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The terrorist attacks resulted in disrupted traffic flows and a general decrease in traffic volumes in the Lower Manhattan area compared with pre-September 11, 2001 conditions. This likely resulted in reduced traffic noise levels, although in some areas traffic noise levels may have remained unchanged or increased, due to the increase in traffic speeds that sometimes accompanies a decrease in volume. Construction-related cleanup and recovery activities post-September 11, 2001 added to noise levels in the area.

At receptor Sites 1, 2, and 5, a continuous 24-hour noise measurement was obtained, and at receptor Sites 3 and 4, measurements were made for four 20-minute periods during the AM peak, midday, PM peak, and at night. Measured $L_{eq(1)}$ and L_{dn} noise levels for the 24-hour continuous measurement receptor sites are shown in Table 10-6, and measured $L_{eq(1)}$ for the peak periods and calculated L_{dn} noise levels for the shorter time period measurement receptor sites are shown in Table 10-7. As shown in the tables, all of the measured noise levels are relatively high and reflect the high level of vehicular activity that takes place in the study area.

Table 10-6
Post-September 11, 2001 Measured 24-Hour Noise Levels (in dBA)

Hour Starting	Site 1 (Hilton Millennium Hotel) Measured $L_{eq(1)}$ Noise Level	Site 2 (114 Liberty Street) Measured $L_{eq(1)}$ Noise Level	Site 5 (180 Broadway) Measured $L_{eq(1)}$ Noise Level
01:00 AM	65	58	72
02:00 AM	66	59	67
03:00 AM	65	57	72
04:00 AM	64	60	73
05:00 AM	68	60	73
06:00 AM	71	63	76
07:00 AM	73	71	76
08:00 AM	72	70	76
09:00 AM	70	68	74
10:00 AM	70	66	73
11:00 AM	70	67	73
Noon	72	66	76
01:00 PM	71	64	74
02:00 PM	71	64	74
03:00 PM	69	64	74
04:00 PM	71	66	75
05:00 PM	68	65	74
06:00 PM	67	64	72
07:00 PM	66	64	72
08:00 PM	66	62	74
09:00 PM	64	62	71
10:00 PM	67	62	71
11:00 PM	64	70	72
Midnight	64	68	73
L_{dn}	74	71	79

Note: Field measurements were conducted in November and December, 2003.

Table 10-7
Post-September 11, 2001 Measured 20-Minute Noise Levels (in dBA)

Receptor Site	Location	Time Period	Measure $L_{eq(1)}$ Noise Level	FTA Calculated L_{dn} Noise Level
3	World Financial Center	Peak	67	72
		Midday	67	
		Late Night	65	
4	Barclay and Washington Street Intersection	AM Peak	66	70
		Midday	73	
		Late Night	58	

Source: Measurements were conducted in November and December 2003.

Data gathered at parks in Lower Manhattan were used to approximate an existing noise level at the future memorial site. Because traffic flows in the area have changed since September 11, 2001, current noise levels are likely lower than values obtained before September 11, 2001 and would not be representative of the area's usual noise levels.

Measured Leq(1) noise levels at parks in Lower Manhattan are shown in Table 10-8. The lowest measured Leq(1) noise level of 65.3 dBA was selected to represent the existing noise level at the memorial site for noise analysis.

Table 10-8
Measured 20-Minute Noise Levels For Parks in Lower Manhattan (in dBA)

Location	$L_{eq(1)}$	Date
Vietnam Veteran Plaza	66.9	2000
A park on Water St. between Fulton and Beekman Streets	68.8	1997
Seward Park	68.0	1997
Battery Park	71.0	1995
Hudson River Park	66.1	1996
Battery Park City	65.3	1996

D. PROBABLE IMPACTS OF THE PROJECT ALTERNATIVES

CONSTRUCTION PERIOD (2006)

FUTURE COMMON TO ALL ALTERNATIVES

Noise levels in the area will be highly influenced by the construction activity that is independent of the Preferred Alternative, such as the WTC Memorial and Redevelopment Plan, Route 9A Project, and the Fulton Street Transit Center. With these projects under construction, year 2006 noise levels would be substantially higher than the measured 2003 levels shown in Table 10-6 and 10-7. (Predicted construction noise levels generated by these projects are discussed in Chapter 15, "Cumulative Effects.")

NO ACTION ALTERNATIVE

Since the No Action Alternative would not result in construction of a Permanent WTC PATH Terminal, noise levels in the study area would be unchanged as compared to the Future Common to All Alternatives.

PREFERRED ALTERNATIVE

Noise

Construction activities for the Preferred Alternative would be expected to result in increased noise above current levels. These levels would vary depending on the location of construction, the equipment and construction methods employed, and the distance between the noise source and the receptor. Construction activities would occur within close proximity to sensitive land uses (e.g., residential uses); therefore the Preferred Alternative's construction has the potential to result in perceptible changes in noise levels that may result in annoyance to nearby residents. Since construction activities, in general, could take place 10 hours a day, 6 days per week, potential impacts may occur not only during the day, but also during weekend periods. Typical noise levels for construction equipment that may be used during construction of the Preferred Alternative are presented in Table 10-9.

Table 10-9
Construction Equipment Noise Emission Levels (in dBA)

Equipment	Typical Noise Level (dBA) 50 feet from source
Air compressor	81
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Bulldozer	85
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer (Pavement Breaker)	88
Loader	85
Paver	89
Pile Driver (Impact)	101
Pile Driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rail Saw	90
Rock Drill	98
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	88

Note: Values do not incorporate potential noise reduction measures that may be included in the Construction Noise Management Plan.
Source: *Transit Noise and Vibration Impact Assessment*, FTA, April 1995.

Noise from construction equipment is regulated by EPA noise emission standards. These federal requirements mandate that: (1) certain classifications of construction equipment and motor vehicles meet specified noise emission standards; and (2) construction materials be handled and transported in such a manner as not to create unnecessary noise. These regulations would be carefully followed. In addition, appropriate low-noise emission level equipment would be used and operational procedures implemented where feasible and practicable. Specific construction noise mitigation measures are listed on Table 10-14.

In general, the surrounding area has relatively high noise levels from existing traffic volumes, and increases in noise levels caused by delivery trucks and workers traveling to and from the construction sites would not be perceptible. However, small increases in noise levels would be expected near a few defined delivery truck routes and streets in the immediate vicinity of localized construction area. Except for the area immediately adjacent to the sites, all truck trips would be restricted to truck routes.

For receptor locations immediately adjacent to the construction area, a detailed assessment was performed to examine the potential for noise impacts during construction, rather than a general assessment. The assessment was performed using the methodology previously discussed.

Table 10-10 shows maximum predicted L_{eq} and L_{dn} noise levels in the year 2006 with construction of the Preferred Alternative, but without the implementation of noise mitigation measures. The predicted levels would exceed the recommended residential land use $L_{eq(8)}$ thresholds of 80 dBA at receptor sites 1 and 2. The predicted levels would also exceed the recommended commercial land use $L_{eq(8)}$ threshold of 85 dBA, and the 30-day L_{eq} threshold of 80 dBA at Site 3. However, the predicted levels would not exceed either the $L_{eq(8)}$ or 30-day L_{eq}/L_{dn} thresholds at Sites 4 or 5. Farther than approximately one to two blocks away, noise increases from construction of the Terminal are not expected to be substantial, due to the shielding effect of intervening buildings located between the terminal construction zone and these more distant receptors, as well as the masking effect of traffic and other ambient noise in the immediate vicinity of these receptors.

Table 10-10
2006 Construction Period Noise Levels Without Mitigation for the Preferred Alternative (in dBA)

Receptor Site	Location	Land Use Category	FTA Impact Criteria		Project-Generated Noise Levels		Impact	
			8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}	8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}	8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}
1	Hilton Millennium Hotel	Residential	80	84	80	74	Yes	No
2	114 Liberty Street	Residential	80	81	80	74	Yes	No
3	World Financial Center/Dow Jones, on Route 9A	Commercial	85	80	88	81	Yes	Yes
4	Barclay Street and Washington Street Intersection	Commercial	85	80	69	62	No	No
5	180 Broadway	Residential	80	89	66	60	No	No

Notes: The 30-day L_{eq} is for commercial uses and the 30-day L_{dn} is for residential uses. At sites 1, 2, and 5 with high ambient noise levels (L_{dn} > 65 dB), the recommended residential use 30-day L_{dn} thresholds would be existing ambient + 10 dB (e.g. 74 dBA + 10 dBA = 84 dBA at Site 1).

Without the implementation of noise mitigation measures, construction operations would have an adverse noise impact at sensitive receptors immediately adjacent to receptor sites 1, 2, and 3.

Vibration

Construction activities associated with the Preferred Alternative would result in varying degrees of ground vibration, depending on the stage of construction, the equipment and construction methods employed, and the distance from the construction to buildings and vibration sensitive structures. Since much of the work would be within the WTC "bathtub" or near the 1 and 9 subway line, vibration levels would be perceptible off-site only for a portion of the construction period.

Table 10-11 shows typical construction equipment and vibration levels at distances varying from 5 feet to 50 feet. Depending on the distance, several of the values are above the 0.20 inches per second vibration damage threshold criterion for fragile buildings, and well above the 0.12 inches per second vibration damage threshold for extremely fragile buildings.

Table 10-11
2006 Construction Period Vibration Levels vs. Distance from Source for the Preferred Alternative (in dBA)

Equipment	Peak Particle Velocity (inches per second)					
	5 feet	10 feet	20 feet	30 feet	40 feet	50 feet
Pile driver (typical impact)	7.20	2.55	0.90	0.49	0.32	0.23
Clam shovel drop (slurry wall)	2.26	0.80	0.28	0.15	0.10	0.07
Hydromill slurry wall in soil	0.09	0.03	0.01	0.01	0.00	0.00
Hydromill slurry wall in rock	0.19	0.07	0.02	0.01	0.01	0.01
Large bulldozer	1.00	0.35	0.12	0.07	0.04	0.03
Caisson drilling	1.00	0.35	0.12	0.07	0.04	0.03
Loaded trucks	0.85	0.30	0.11	0.06	0.04	0.03
Jackhammer	0.39	0.14	0.05	0.03	0.02	0.01
Small bulldozer	0.03	0.01	0.00	0.00	0.00	0.00

To account for potential vibration impacts that may result from construction of the Preferred Alternative, all historic buildings located within 90 feet of the construction zone for the Project Site were identified (see Chapter 6, "Cultural Resources"). These buildings are: the Former East River Savings Bank; the Barclay-Vesey Building, the Beard Building, 114-118 Liberty Street, and St. Paul's Chapel and Graveyard. To avoid damage to these structures, a construction protection plan would be developed and mitigation measures would be implemented as described in Section E, "Mitigation."

FTA vibration-induced architectural damage thresholds are 0.20 inches per second peak particle velocity (PPV) for fragile buildings and 0.12 PPV for extremely fragile buildings. These thresholds would be adhered to during construction of the proposed project, for all applicable buildings.

OPENING YEAR (2009)

FUTURE COMMON TO ALL ALTERNATIVES

In the opening year, ambient noise in the vicinity of the Project Site would increase as compared to today. These increases would be attributed to vehicular traffic generated by residential and commercial development projects in Lower Manhattan as well as the independent construction of elements of the WTC Memorial and Redevelopment Plan. However, measures, such as the

Route 9A short bypass, could remove traffic from street level, which would lessen the projected increase in ambient noise.

NO ACTION ALTERNATIVE

Under the No Action Alternative, noise and vibration levels would primarily be a function of ongoing construction activities for elements of the World Trade Center Memorial and Redevelopment Plan. All other construction activities related to the Lower Manhattan Recovery Projects will have been completed, with the exception of the Permanent WTC PATH Terminal. Accordingly, construction noise and vibration levels would be substantially lower than the cumulative levels predicted for the 2006 peak construction year.

PREFERRED ALTERNATIVE

A general noise assessment as per FTA guidance was performed for the WTC Memorial site, assuming a Category 1 land use. The analysis assumes that all mechanical equipment would either be specified to have low noise levels, placed in acoustically shielded enclosures, or placed at locations where noise from equipment would not exceed 50 dBA at receptor locations. Examples of acoustical treatments for mechanical equipment include absorptive acoustical panels and enclosures, acoustical louvers, dampers, silencers, absorptive duct linings and plenums, and mufflers. As shown in Table 10-12, the predicted noise levels would be well below the impact criteria, and project-generated noise would not be expected to perceptibly increase ambient noise levels since the change in Build $L_{eq(1)}$ levels would be less than 0.5 dBA.

Table 10-12
Train Noise Impact Evaluation of the Preferred Alternative at the WTC Memorial Site

Noise Receptor Site	Land Use Category	Noise Receptor	Existing Noise Level	Allowable Project-Generated Noise Level	Actual Project-Generated Noise Level	Impact	Total (Build) Noise Level With the Proposed Project
WTC Memorial	1	L_{eq}	65.3	61.0	50.5	No	65.4
Note: For definition of land use categories, see Table 10-2.							

The ventilation structures for the Preferred Alternative would be located within the median of Route 9A. Exhaust/intake elevations would be approximately 40 feet. The fans within these ventilation structures would only be used during emergency situations and would not generate noise during normal operating conditions.

Table 10-13 shows project-generated vibration and ground-borne noise levels. Based upon the general vibration assessment results, PATH train operations would not produce vibration levels that would exceed the FTA impact criteria. PATH train operations would produce ground-borne noise levels exceeding FTA criteria for special buildings such as concert halls, TV studios, recording studios, auditoriums and theaters, which were used to represent the WTC Memorial site. However, the use of these criteria results in a conservative assessment of potential impact because, based on the information that is currently available, most of the WTC Memorial site would be open and subject to relatively high ambient noise levels (see Table 10-12). Furthermore, the WTC Memorial and the Preferred Alternative will be designed cooperatively to ensure that ground-borne noise from PATH operations would not adversely impact the WTC Memorial (see Section E, "Mitigation").

Table 10-13
Vibration and Ground-Borne Noise Impact Evaluation of the Preferred Alternative at the WTC Memorial Site

Land Use	FTA Criteria[1] Level		Predicted Project Exposure Level		Threshold Exceeded
	Vibration	Ground-borne Noise	Vibration	Ground-borne Noise	
Concert Halls, TV Studios, Recording Studios	65	25	60	40	Ground-borne noise
Auditoriums	65	30	60	40	Ground-borne noise
Theaters	72	35	60	40	Ground-borne noise

Note: [1] Vibration impact criteria for special buildings (i.e., concert halls, TV studios, recording studios, auditoriums, and theaters) are shown in Table 8-2 in the FTA Manual.

DESIGN YEAR (2025)

FUTURE COMMON TO ALL ALTERNATIVES

The WTC Memorial and Redevelopment Plan and other commercial and residential projects planned for Lower Manhattan will be completed before the design year, 2025. With these developments in place, ambient noise levels in the vicinity of the Project Site are expected to be similar to those that existed prior to September 11, 2001.

NO ACTION ALTERNATIVE

Under the No Action Alternative, noise levels in the study area would be slightly higher than with the Preferred Alternative, due to the increase in vehicular traffic (autos and buses) expected to result from a reduction in, or the elimination of, PATH service. However, this expected increase in vehicular traffic would not likely increase noise levels substantially above current conditions.

PREFERRED ALTERNATIVE

Similar to the opening year analysis, this alternative is not expected to result in impacts to the WTC Memorial, since the Preferred Alternative would incorporate design elements to reduce noise and ground-borne vibration, as necessary (see Section E, "Mitigation').

E. MITIGATION

PROJECT-SPECIFIC COMMITMENTS

CONSTRUCTION PERIOD

Noise

The implementation of the mitigation measures listed in Table 10-14 would eliminate all project-generated construction noise impacts. Table 10-15 shows maximum predicted L_{eq} and L_{dn} noise levels, with these mitigation measures in place. The mitigated levels would not exceed the $L_{eq(8)}$ or 30-day L_{eq}/L_{dn} thresholds at any of the five receptor sites.

Table 10-14
Summary of Noise Mitigation Measures

Construction Element [1]	Equipment Causing Impact	Mitigation Measures	Potential Noise Reduction (dBA)
1	Impact wrenches with noise emission level of 85 dBA at 50 ft	Use impact wrenches with noise emission level of 82 dBA at 50 ft [2]	3
	Pavement breakers	Install muffler on pavement breaker cylinder	13 [4]
3	Air-operated grout drills	Place drill inside acoustical enclosure	18 [4]

Notes: 1 See Chapter 3, "Construction," for descriptions of the construction elements.
Sources: 2 Goodson Tools and Supplies for Engine Builders, P.O. Box 847, Winona, MN 55987-0847
4 *Engineering Section Report* , Workers Compensation Board of British Columbia, Stuart Eaton, February 2000.

Table 10-15
2006 Construction Period Noise Levels with Mitigation (in dBA)

Receptor Site	Location	Land Use Category	FTA Impact Criteria		Project-Generated Noise Levels		Impact	
			8-hour L_{eq}	30-Day $*L_{dn}/L_{eq}$	8-hour L_{eq}	30-Day $*L_{dn}/L_{eq}$	8-hour L_{eq}	30-Day $*L_{dn}/L_{eq}$
1	Hilton Millennium Hotel	Residential	80	84	78	72	No	No
2	114 Liberty Street	Residential	80	81	79	73	No	No
3	World Financial Center/Dow Jones, on Route 9A	Commercial	85	80	84	79	No	No
4	Barclay Street and Washington Street Intersection	Commercial	85	80	67	61	No	No
5	180 Broadway	Residential	80	89	64	58	No	No

Notes: The 30-day L_{eq} is for commercial uses and the 30-day L_{dn} is for residential uses. At sites 1, 2, and 5 with high ambient noise levels (L_{dn} > 65 dB), the recommended residential use 30-day L_{dn} thresholds would be existing ambient + 10 dB (e.g. 74 dBA + 10 dBA = 84 dBA at Site 1).

PANYNJ would verify mitigation and would identify opportunities to expand its implementation as part of its ongoing oversight and auditing of the Project's construction. This would include on-site noise monitoring during construction. Furthermore, verification procedures would be implemented in accordance with decisions of the Lower Manhattan Construction Command Center, including procedures for reporting updates to the public.

At the World Financial Center (Site 3) noise levels during the peak construction year 2006 would be above 80 dBA for the 8-hour L_{eq} at the commercial receptors affected by the Preferred Alternative. The existing windows at these receptors provide a minimum 35 dBA attenuation. Therefore, construction noise levels may increase the interior noise levels above 45 dBA, the level generally considered acceptable for indoor uses. It is expected that a combination of the measures described above, as well as additional mitigation measures to be developed as

construction methods are further refined, could reduce the Preferred Alternative's construction period impacts at these locations.

Vibration

PANYNJ and FTA have executed a Memorandum of Agreement (MOA) pursuant to Section 106 of the National Historic Preservation Act (see Appendix B-2). The MOA includes protocols for developing and implementing Construction Protection Plans (CPPs) to avoid, minimize, or mitigate the project's potential construction-period vibration impacts on the Barcley-Vesey Building, Former East River Savings Bank, the Beard Building, 114-118 Liberty Street, and St. Paul's Chapel and Graveyard.

PANYNJ and FTA, in consultation with SHPO and Section 106 consulting parties, and in coordination with LMDC, NYSDOT, and MTA/NYCT, where appropriate, shall develop a Construction Protection Plan (CPP) for the Preferred Alternative. The CPP would set forth measures for the protection and avoidance of structural and architectural damage for these historic properties. The CPP would be based on requirements in the "New York City Department of Buildings Technical Policy and Procedure Notice (PPN) #10/88" regarding procedures for the avoidance of damage to historic structures resulting from adjacent construction. The PPN defines adjacent historic structures as being contiguous or within a lateral disturbance of 90 feet from a lot under development or alteration.

The CPP would describe in detail the construction procedures of the Preferred Alternative, as well as the construction procedures associated with other projects under construction in the vicinity of each of these historic properties. It would also provide for the inspecting and reporting of existing conditions at these properties, establish protection procedures, establish a monitoring program to measure vertical and lateral movement and vibration, establish and monitor construction methods to limit vibration; and establish methods and materials to be used for any repairs. The plan shall also specify the implementation of special vibration protection measures to protect these historic properties from increased vibration levels associated with construction activities. The CPP would provide for a historical architect meeting the Secretary of Interior's Standards to supervise implementation of the CPP.

The CPP would empower the historical architect, in consultation with the Chief Engineer of PANYNJ to issue "stop work" orders to prevent any damage to historic properties, and any recommencement of work shall only be permitted at such time that the Chief Engineer and historical architect have assurance that the appropriate modifications have been made to the construction technique to assure that no damage would occur to historic properties.

OPENING AND DESIGN YEARS

As described previously, the Preferred Alternative would incorporate design measures to reduce noise from PATH trains within the WTC Memorial. Examples of these measures include acoustical treatments for mechanical equipment such as absorptive acoustical panels and enclosures, acoustical louvers, dampers, silencers, absorptive duct linings and plenums, and mufflers. The Project's architects and engineers will determine the specific measures to incorporate as the Preferred Alternative's design advances. Using these measures, PANYNJ will achieve at least 25 dBA of attenuation within the Memorial, and operational noise generated by the Preferred Alternative would be far lower than FTA's impact criteria for train noise.

As described above, the Preferred Alternative would exceed FTA's impact criteria for ground-borne noise within the Memorial. However, the impact criteria may be also exceeded by high

ambient noise levels such that ground-borne noise generated by the Terminal would not be perceptible. If it is determined that ambient noise levels within the Memorial would exceed 40 dBA, then additional mitigation measures to reduce ground-borne noise would not bee needed within the Terminal itself.

If its design guidelines specify an ambient noise level within the Memorial that is below 40 dBA, PANYNJ will explore ground-borne noise mitigation measures that would meet or exceed the desired attenuation for the Memorial. Examples of mitigation that would be explored include absorptive treatment for interior wall surfaces within the Terminal as well as the use of resilient fasteners, ballast mats, resiliently supported ties, and/or floating slabs for the PATH tracks.

ENVIRONMENTAL PERFORMANCE COMMITMENTS

As described in Chapter 2, "Project Alternatives," PANYNJ, LMDC, MTA/NYCT, and NYSDOT have developed Environmental Performance Commitments (EPCs) that would be implemented as part of their respective Lower Manhattan Recovery Projects. Table 10-16 shows these commitments as well as PANYNJ's plans for their implementation.

Table 10-16
Environmental Performance Commitments

Commitment	Implementation Plan
Where practicable, schedule individual project construction activities to avoid or minimize adverse impacts.	In accordance with Governor Pataki's November 22, 2004 Executive Order, PANYNJ will coordinate the scheduling and staging of construction activities through the Lower Manhattan Construction Command Center. The Command Center will review PANYNJ's plans in conjunction with other planned activities and will recommend schedule adjustments, as appropriate.
Coordinate construction activities with projects under construction in adjacent and nearby locations to avoid or minimize impacts.	Through the ongoing coordination efforts of the LMCCG and the Command Center, adverse noise and vibration effects on sensitive receptors will be minimized through scheduling and routing of deliveries, as well as coordination of street closures and placement of truck/equipment staging areas.
Consider condition of surrounding buildings, structures, infrastructures, and utilities where appropriate.	In accordance with the Project's executed Memorandum of Agreement, PANYNJ will perform pre-construction building conditions surveys of the potentially affected historic buildings within 90 feet of the Preferred Alternative's construction zone. These efforts would be coordinated with the other appropriate Lower Manhattan project sponsors for sites that may be affected by cumulative vibration.
Prepare contingency measures in the event established limits are exceeded.	The Permanent WTC PATH Terminal construction contractor will procure the services of a qualified acoustical firm (INCE certified or licensed Professional Engineer) to assist in the implementation of a Noise Control and Abatement Plan, which will include on-site noise monitoring during construction, and implementation of mitigation measures to ensure compliance with applicable noise exposure thresholds. Vibration monitoring specifications, and corrective actions in the event threshold levels are exceeded, will be included in the Construction Protection Plan pursuant to the Stipulations of the Project's executed MOA.

Although not required for the Preferred Alternative, additional construction noise mitigation measures may be implemented. As described in Chapter 15, "Cumulative Effects," these measures may be needed to mitigate the cumulative effects of the Lower Manhattan recovery projects at receptors affected by construction of the Preferred Alternative. To adequately address these impacts, PANYNJ, in coordination with other project sponsors, and as part of the Lower Manhattan Construction Coordination Group (LMCCG), is developing and refining a range of

construction noise and vibration mitigation measures. Specific construction noise reduction measures being explored include:

- The use of acoustic barriers and walled enclosures around certain construction activities. Noise tents/enclosures could be used around workers using jackhammers. A temporary noise barrier of 20 feet in height could be installed along the fence line/property line of the Project Site to reduce noise levels. In addition, temporary barriers, such as wood panels on top of Jersey barriers could be positioned adjacent to and moved along slurry wall and other construction operations, etc.
- The placement of construction equipment in shielded locations, such as below grade in the Project Site.
- The installation of silencers on jackhammers, air compressors, generators, light plants and cranes to reduce noise levels at specific locations (e.g., adjacent to existing residential uses).
- The use of electrically operated equipment, rather than combustion equipment, wherever possible.
- The use of soil beds, timber planking and/or exterior rubber lining on truck body and aluminum carrying case to reduce rock impact noise during truck load/unloading operations.
- The use of drive-through street-level truck enclosures for truck loading and unloading.
- The use of sheds/enclosures at concrete pump sites during concrete truck unloading, and the placement of most loading/unloading inside the bathtub and away from street level noise receptors.
- The placement of most loading/unloading inside the bathtub and away from noise receptors located at street level.
- The designation of central areas for noisy activities, such as cutting steel or wood or use of noisy equipment such as impact wrenches. When feasible, use of pre-cut, pre-fabricated, or modular construction materials that minimize need for on-site fabrication or cutting methods. ✳

A. INTRODUCTION

This chapter assesses the infrastructure and energy requirements of the Preferred Alternative. It is expected that the Preferred Alternative would require all of the utilities previously used by PATH before September 11, 2001. However, new technologies and sustainable design principals proposed with the construction and operation of the new facility would result in equal or less demand for infrastructure and energy as compared to pre-September 11, 2001 conditions.

In addition to the Terminal and its pedestrian concourses, PANYNJ would construct ancillary facilities that support PATH operations and enhance the safety and security of the WTC site. As described in Chapter 2, "Project Alternatives," the ancillary facilities include two ventilation structures within the median of Route 9A, emergency egress within the WTC site, and mechanical and communications rooms. PANYNJ would also enhance security within the Terminal with the proposed structural hardening and reinforcement of the roof of the east-west concourse. The roof of the east-west concourse would eventually become the road bed for an extended Fulton Street, as proposed in the Generic Environmental Impact Statement for the World Trade Center Memorial and Redevelopment Plan.

As described in Chapter 2, "Project Alternatives," the sponsors of the Lower Manhattan recovery projects, including PANYNJ, Lower Manhattan Development Corporation (LMDC), New York State Department of Transportation (NYSDOT), and Metropolitan Transportation Authority (MTA), have coordinated to develop environmentally friendly ("green") design and sustainability principals to reduce the demand for and use of infrastructure and resources during construction and incorporated into project design and operations.

PANYNJ has been and continues to investigate sustainable strategies for the Preferred Alternative to guide the preliminary design process. These strategies would be consistent with criteria contained in the New York City Transit Environmental Guidelines and the United States Green Building Council (USGBC) Leadership in Energy Efficiency (LEED) Guidelines 2.1 and requirements of New York State Executive Order 111.

B. METHODOLOGY

The potential impacts to infrastructure from the construction and operation of the Preferred Alternative are assessed and evaluated in this section. These construction activities and future operations are then considered with regard to existing infrastructure to determine if the Preferred Alternative would impact current utilities. The evaluation of infrastructure and energy included the following review tasks:

- The physical setting of the proposed project;
- The mapping of utilities for the World Trade Center (WTC) site and surrounding areas;
- PANYNJ reports and files;

- Regulatory agency correspondence and reports pertaining to the subject site; and
- Pertinent federal and state regulatory databases and records.

The primary goal of the PANYNJ is to achieve improved environmental and sustainable attributes in the design, construction and operation of the Preferred Alternative. To achieve this, the PANYNJ has been and continues to investigate strategies that would primarily improve energy efficiency in the Preferred Alternative. The strategies would take into consideration not just the Preferred Alternative, but also its effect on the surrounding area (i.e., regional and neighborhood issues).

The analysis involves identifying infrastructure needs for the Preferred Alternative in comparison to the pre-September 11, 2001 Terminal as well as the site existing with today's temporary PATH station. The strategies include conservation and efficiency goals for water usage, energy usage and sewage and solid waste generation. The strategies to improve the environmental and sustainable attributes in the design, construction, and operation of the Preferred Alternative would include:

- A water management plan to reduce water usage and the load on the city's water supply would be considered for the Proposed PATH Terminal utilizing the 1992 Energy Policy Act. The water management plan would set baseline requirements for the buildings' water fixtures. The goal of the water management plan would be a 30 percent reduction in the use of potable water. This reduction would be applicable towards water supply and sewage generation.
- A materials management plan would pertain to solid waste collection, recycling and disposal. While there is no quantifiable measure at this time for solid waste in conjunction with pre, post and the future PATH Terminal, it is anticipated that a reduction in solid waste would occur as a result of the implementation of the materials management plan.
- An energy management plan aimed to reduce energy consumption by twenty percent below the American Society of Heating, Refrigeration, and Air Conditioning Engineers 90.1/1999 Standard (ASHRAE). The energy management plan would incorporate the use of ENERGY STAR compliant appliances as well as a central chilling plant to achieve the reduction set.

C. DESCRIPTION OF THE AFFECTED ENVIRONMENT

PRE-SEPTEMBER 11, 2001 BASELINE CONDITIONS

The Project Site is located in an area that has substantial infrastructure needs. The description of the affected environment includes the following components: water supply, sanitary sewage and stormwater disposal, solid waste, and energy under pre-September 11, 2001 conditions.

WATER SUPPLY

Three watersheds comprise New York City's water supply system: Croton, Delaware, and Catskill. The water supply system extends as far north as the Catskill Mountains and delivers approximately 1.4 billion gallons per day (gpd) of water to its customers located in the five boroughs of New York City and Westchester County. Water from these watersheds is carried to the city by means of a complex system including, reservoirs, aqueducts, and tunnels, and is distributed throughout the city by a large network of piping.

The Croton watershed collects water from Westchester and Putnam counties and delivers it to the Jerome Park Reservoir in the Bronx. From this point the New Croton Aqueduct distributes the water to the Bronx and Manhattan via underground piping.

Water consumption in the five boroughs of New York City averages approximately 1.2 billion gpd. Average consumption in Manhattan is estimated at 420 million gallons per day (mgd); peak consumption is approximately 500 mgd. The Croton system has a lower pressure than the Delaware and Catskill systems and supplies an average of 110 mgd, primarily to domestic users in the areas of lower elevation. The Delaware and Catskill systems serve the fire hydrants and domestic uses in areas where both systems exist, and average about 310 mgd.

In 1989, the City implemented a program that sought to reduce water use by utilizing a metering program, and requiring that fixtures in existing and new buildings be of low-flow design (Local Law No. 20, 1989). Further, the City approved a water-free program where, if 70 percent of fixtures located in a facility were the type that automatically conserve water, a flat fee for water use would be initiated. These programs as well as other measures were aimed at reducing water consumption in the City.

Minimal water was used for the operation of the WTC PATH Terminal prior to September 11, 2001. Specifically, city water was used for maintenance purposes and to supply the bathroom facilities located within the PATH Terminal. Additional water was drawn from the Hudson River and used for the cooling system, which provided the WTC facility and PATH Terminal with thermal comfort.

SANITARY SEWAGE AND STORMWATER DISPOSAL

The Newton Creek Water Pollution Control Plant (NCWPCP) in Brooklyn services the Project Site and surrounding area. The NCWPCP discharges its effluent into the East River. The effluent discharged by the plant is regulated by a State Pollutant Discharge Elimination System permit, which is issued by the New York State Department of Environmental Conservation (NYSDEC). The NCWPCP has been designed to treat a monthly dry-weather flow of effluent of 310 mgd. The current 12-month average flow is 221 mgd, which is well below the design capacity. The average flow in the months prior to the events of September 11, 2001, was 218 mgd, also well below the design capacity.

The NCWPCP was built in 1967 and, at that time, no specific requirements for the levels of wastewater treatment were implemented. The NCWPCP was constructed with an aeration system that removed 60 percent of biological oxygen demand and 70 percent of total suspended solids. In 1974, the Federal Clean Water Act required a secondary wastewater treatment defined to remove 85 percent of both biological oxygen demand and total suspended solids. As of December 31, 2007, the City agreed to provide this full secondary wastewater treatment. In the interim, modifications to the wastewater treatment system at the NCWPCP are ongoing until the plant is upgraded to meet the secondary wastewater treatment facility requirements.

The Project Site and surrounding area is serviced by a combination of piping that collects stormwater runoff and sewage together (i.e., combined sewers). This system collects flows along Vesey, Church, Liberty, and Greenwich Streets and delivers them to the 78-inch diameter, South Branch Interceptor that runs along Route 9A. The interceptor carries flows to a pump station located at 14th Street and the Franklin Delano Roosevelt (FDR) Drive along the East River, and is then delivered to the NCWPCP, which is located in Brooklyn. During periods of precipitation, sewers carry both stormwater runoff and sewage to the NCWPCP. However, during times of dry

periods, only sewage is transferred to the NCWPCP. When the combined sanitary sewage and the stormwater runoff exceed the interceptor's capacities, the resultant excess is discharged to the East River without benefit of treatment.

The former PATH Terminal included both public and private bathrooms and several utility closets containing sinks. The wastewater produced in these areas was transferred to the sanitary system servicing the WTC site. Further, the former PATH Terminal did not generate any stormwater independent of the overall WTC complex or the PATH system.

SOLID WASTE

Solid waste generated in New York City is transferred to landfills located in surrounding states. Solid waste is collected from commercial and manufacturing companies through the transportation and collection services of private carters. Additionally, in 1989, the City passed a law requiring residents and businesses to separate recyclable material from other solid wastes. The law also mandates that 25 percent of the city's trash must be recycled rather than landfilled.

Solid waste produced within the former PATH Terminal resulted from trash receptacles located within the Project Site. A limited number of small businesses (e.g. coffee and news stands) located also contributed to the overall solid waste stream.

ENERGY

The New York State Conservation Construction Code was promulgated on January 1, 1979, and governs the requirements of heating, ventilation, and air conditioning systems. The Code requires that all new and recycled, public, and private buildings be designed to ensure the adequate resistance to heat loss and infiltration. Further, it provides requirements for the design of electrical, mechanical, and lighting systems to be implemented within the building.

Con Edison supplies electricity to New York City and almost all of Westchester County. Further, Con Edison supplies gas, electric, and steam energy to the WTC site. However, PATH was serviced by Public Service Energy & Gas (PSE&G). PSE&G also supplied traction power for PATH train operations with a substation located on the WTC site.

CHANGES IN THE AFFECTED ENVIRONMENT SINCE SEPTEMBER 11, 2001

The September 11, 2001 attacks resulted in the collapse of the WTC complex, including the majority of the sub-grade structures located beneath the buildings. The Project Site (PATH Terminal portion of the Project Site) currently lies at a maximum depth of approximately 65 to 70 feet below street grade. The portions of the site that would contain the tracks, platforms, mezzanine, and substation of the Preferred Alternative now house the temporary station and its support facilities. The discussion of affected environment under pre-September 11, 2001, includes information on the water supply, sanitary sewage and stormwater disposal, solid waste, and energy required to operate the previous PATH Terminal. The following section discusses the same topics with respect to the Project Site limits, including the temporary station.

WATER SUPPLY

City water service has only recently been required at the Project Site following the terrorist attacks. The temporary PATH station currently has a minimal number of sanitary facilities and an emergency fire protection system. Furthermore, the temporary station is an "open air" facility and does not require the use of heating, ventilation and air conditioning systems (HVAC).

Overall, minimal quantities of city water are required in the operation of the temporary PATH station.

SANITARY SEWAGE AND STORMWATER DISPOSAL

Currently, the Project Site is tied to the city's sanitary sewage system. Several sanitary facilities are located at the temporary PATH station on the mezzanine and substation levels. Furthermore, stormwater is collected for the entire site and pumped to the city sewer connection.

SOLID WASTE

The temporary PATH station generates minimal quantities of solid waste from operations. The waste is collected in trash and recyclable receptacles located throughout the station. Given the reduced passenger loads at the temporary PATH station, quantities of solid waste generated are less than before September 11, 2001.

ENERGY

The temporary PATH station is "open air" with no cooling system. Although energy is needed for lighting, heating systems in employee-based areas, and electrical equipment (i.e., escalators, elevators, etc.), demand is less than prior to September 11, 2001, especially with consideration to the more stringent standards and use of "green" measures set for current construction. Further, similar to conditions before September 11, 2001, traction power for train operations is provided by PSE&G with a reconstructed substation on the WTC site capable of supplying energy to the station. The PANYNJ is currently working with Con Edison to provide a connection between the WTC PATH substation and the New York City power grid. Although PSE&G can adequately supply the PATH system, a connection with Con Edison would provide for redundancy allowing for backup power in the event of a shortage or other emergency.

D. PROBABLE IMPACTS OF THE PROJECT ALTERNATIVES

CONSTRUCTION PERIOD (2006)

FUTURE COMMON TO ALL ALTERNATIVES

In 2006, development activities for the WTC Memorial and Redevelopment Plan will occur on the WTC site, independent of the Preferred Alternative. Reconstruction of 7 WTC and its associated Con Edison substations will have been completed and may be used to power the temporary station in conjunction with the existing power supply from PSE&G.

Construction of the Route 9A short-bypass alternative would encounter several utilities located beneath the existing roadway. These include:

- A 66-inch city water line;
- A 78-inch city sewer main;
- A 48-inch city water main, and
- An 84-duct Verizon telephone utility.

These utilities would be relocated during construction. Other temporary relocation efforts may also be required for some minor utility lines located in the vicinity of the Route 9A. The relocation of utilities along Route 9A would be undertaken by the New York State Department

of Transportation (NYSDOT) as part of their reconstruction of Route 9A. However, if NYSDOT pursues the no action or at-grade alternative for the reconstruction of Route 9A, these utilities would remain in situ.

NO ACTION ALTERNATIVE

Under the No Action Alternative, temporary PATH service would continue to operate to the WTC site and there would be no construction activities with respect to Preferred Alternative. Thus, this alternative would not result in adverse impacts to infrastructure and energy issues during the construction period.

PREFERRED ALTERNATIVE

As described in Chapter 2, "Project Alternatives," the Preferred Alternative would include elements on the WTC site as well as connections beneath Route 9A to the World Financial Center. The following description of potential impacts to infrastructure and energy during the construction period addresses general issues for the construction of the entire Permanent WTC PATH Terminal and then specifically describes potential conflicts with existing infrastructure outside the limits of the WTC site.

Portions of the temporary PATH station would operate during the construction period. The design of the Preferred Alternative includes construction sequencing to ensure continuous PATH system operation at the Project Site. For the purpose of the infrastructure assessment, it has been assumed that the temporary WTC PATH station would use the utilities/infrastructure currently in place until the completion of the Preferred Alternative. Therefore, changes in infrastructure/utility requirements and systems for the Preferred Alternative are addressed below under the opening and design year. Therefore, utility usage associated with temporary station operations during the construction period would be essentially the same as today.

Various construction activities on the WTC site would be occurring in conjunction with the building of the Preferred Alternative. Overall, impacts to infrastructure for construction activities are anticipated to be minimal and would be addressed by the firms retained to perform construction activities. As described in Chapter 2, "Project Alternatives," and Chapter 3, "Construction Methods and Materials," PANYNJ would incorporate specifications into contracts to ensure that the following "green" and sustainable design strategies are met during the construction period. All sustainable strategies investigated for implementation, and as noted in this chapter exceed the expectations of the USGBC and the LEED Green Building Rating System.

- PANYNJ would provide for a Construction Stormwater Pollution Prevention Plan to conform to requirements of U.S. Environmental Protection Agency (EPA) 832/R-92-005.
- PANYNJ would investigate waste management strategies to reduce deposits to landfill. A minimum goal of 50 percent (calculated by weight) of construction, demolition, and land clearing debris would be recycled or salvaged.

Limited quantities of solid waste and sanitary sewage would be generated during construction. Stormwater is not anticipated to increase substantially as a result of construction activities and would continue to be addressed through previously described methods. Energy used to power on-site construction equipment would be provided by the contractor or through agreements with local power companies. Specifically, energy consumption would be a combination of; mobile sources, self-generating sources, and the New York City power grid.

During construction of the Route 9A concourse, groundwater and stormwater may be discharged. These waters would be treated (essentially requiring settling prior to discharge). This portion of the project may be undertaken by NYSDOT as part of their proposed Route 9A short bypass or by PANYNJ. Regardless, as described in NYSDOT's 1994 *Route 9A Reconstruction Final Environmental Impact Statement*, treated water would be cleaner than standard discharge and would therefore not adversely affect the City's sanitary systems.

As described above, there are numerous utilities beneath Route 9A in the vicinity of the WTC site. If NYSDOT moves forward with the short-bypass alternative for the reconstruction of Route 9A, then they would relocate these utilities prior to the construction of PATH's east-west connection to the Word Financial Center. If NYSDOT pursues an at-grade alternative, then the east-west connection would be built without utility relocation. However, in this scenario, PANYNJ would provide for construction protection measures to ensure that the utility lines would not be disturbed.

There may be minor utility conflicts in the vicinity of PATH's connection to the Dey Street Concourse of the Fulton Street Transit Center. These utilities would have to be either temporarily supported or relocated during construction to maintain existing service and minimize interference with the construction of the PATH Terminal. This work would be in cooperation with MTA as part of their construction of the Fulton Street Transit Center.

Overall, the review of infrastructure during the construction period has identified potential conflicts with existing utility lines at and along certain areas of the proposed concourses and pedestrian egress routes. In those instances where existing utilities occupy the same areas as permanent elements of the Preferred Alternative, they would be permanently relocated. Other conflicts would be addressed through temporary relocation and/or supporting utility lines. These actions would be undertaken to avoid disruption/interruption of service to sites within the vicinity of the Preferred Alternative. Furthermore, the relocation of any utility lines would be performed in coordination with the New York City Department of Environmental Protection, New York City Department of Transportation, NYSDOT, and the appropriate owner of that utility line (i.e., Verizon, Con Edison, etc.). Relocation efforts would be performed to not interrupt service to the surrounding area. Each utility interference would be assessed on an individual basis and adjusted as to limit the impacts to the utility and to the service it renders. Support of the utilities, if necessary, would be provided until the utility can be returned to its original position or until a relocation path is determined.

OPENING YEAR (2009)

FUTURE COMMON TO ALL ALTERNATIVES

Development activities will continue to occur on the WTC site as part of the WTC Memorial and Redevelopment plan. With respect to activities, current schedules for the project indicate that any conflicts with utilities will be addressed prior to the opening year for the Preferred Alternative.

NO ACTION ALTERNATIVE

Under the No Action Alternative, temporary PATH service would continue to operate to the WTC site and would not change regional fuel consumption and energy demand. Therefore, this alternative would not result in adverse impacts to infrastructure and energy issues in the opening year.

PREFERRED ALTERNATIVE

In the opening year, energy requirements for the Preferred Alternative would be consistent with or less than the energy requirements under the pre-September 11, 2001 conditions. Construction of the utility systems located in and servicing the WTC site would be completed. Additionally, the use of proposed "green" measures, such as the reuse of stormwater, would reduce energy demand as compared to a terminal without such measures.

Green Design

As described in Chapter 2, "Project Alternatives," PANYNJ would incorporate environmentally friendly ("green") and sustainable development principals into the design, management, and operation of the Permanent WTC PATH Terminal. These measures would reduce demand for resources and infrastructure. They would also integrate many of the Terminal's energy needs with those of the WTC site as a whole to result in a more efficient operation.

PANYNJ would prepare and implement a comprehensive resource management plan for the integrated consideration of water, materials, and energy resources with the goal of identifying, evaluating, and optimizing the use of all resources on the site. Specific measures to accommodate this plan are described below.

Water Supply

The Preferred Alternative would demand potable water for restroom facilities, human consumption, and station maintenance and cleaning. However, PANYNJ would implement strategies to reduce the Terminal's demand for potable water from the City's system. A combination of strategies would be employed to reduce demand as described below.

- During the Project's design phase, PANYNJ would prepare a Comprehensive Water Management Plan that evaluates the use of storm water, waste water, and potable water. This plan would identify measure for the onsite reclamation of wastewater. This study would investigate EPA's recommendations described in Executive Order 12123 (June 1999) and other Best Management Practices.
- PANYNJ would use Hudson River water for the cooling of the Terminal's HVAC system would negate the need to draw potable water for this purpose.
- PANYNJ would collect stormwater from surfaces of the Terminal Hall and adjacent plaza. A tank would be constructed with a capacity to accommodate a 2-year/24-hour storm. The collected water would be used for year-round flushing supply to urinals and toilets within the Terminal; year-round washing of the adjacent plaza and sidewalks; irrigation of plantings in summer months; and occasional use for façade washing.

Sanitary Sewage and Stormwater Disposal

As before September 11, 2001, only a limited number of facilities would be located within the Preferred Alternative that would generate sanitary sewage i.e. (public and private bathrooms, small utility closets with sinks). Given the similar magnitude of sanitary sewage and stormwater produced at the pre-September 11, 2001 terminal and the Preferred Alternative, no adverse impacts would occur.

However, PANYNJ would provide for the collection of stormwater from surfaces of the Terminal's Transit Hall and adjacent plaza for reuse on-site. Furthermore, PANYNJ would filter

this water to remove 80 percent of the total suspended solids. The implementation of these measures would reduce demand on the City's sewer system and treatment facilities.

Solid Waste

The Preferred Alternative is expected to generate nearly the same amount of solid waste as the temporary WTC PATH station resulting in equivalent/lesser quantities of solid waste as compared to pre-September 11, 2001, conditions. However, PANYNJ would strive to further reduce solid waste through an active, on-site recycling program. This would include a centralized space within the Terminal for the collection, sorting, and storage of recyclables as well as public recycling receptacles throughout the building.

Energy

Energy requirements for the Preferred Alternative would require a 20 percent reduction in demand, resulting in an energy demand equivalent to or less than the pre-September 11, 2001 terminal. Energy demands for the former PATH Terminal were met by PSE&G from a substation on the WTC site. The PSE&G substation, which was destroyed on September 11, 2001, has been reconstructed to serve the temporary WTC PATH station. This substation would be retained and would serve the Permanent Terminal. Redundancy with Con Edison would be provided from substations beneath 7 WTC that are currently under construction.

The energy needs of the Preferred Alternative are anticipated to be the same or less than they were prior to September 11, 2001. Technologies have become more energy efficient since the original PATH station was constructed. The new technological advances would be implemented during construction of the Preferred Alternative. Further, the Terminal would be constructed within the footprint of the original PATH station, with the addition of one extra platform. Moreover, the implementation of "green" measures including, but not limited to, energy-efficient lighting, heating, and ventilation systems, etc., would contribute to the conservation of energy and may lead to a decrease in the Project Site energy requirements. Further, an energy budget for the first year of operation and annual updates on budgeting and performance for energy resources for years thereafter would be examined for implementation. A building energy modeling system would also be considered. This system would allow for comparison of alternative strategies for energy efficiency and load reduction.

As described in the Chapter 2, "Project Alternatives," the Terminal would eventually use Hudson River water for the cooling of its heating, ventilation, and air conditioning (HVAC) systems. The reuse of the existing Hudson River water intakes and outfalls is an economical and energy-efficient method to provide cooling for the components of the Permanent WTC PATH Terminal. The intakes, pumps, outfalls, and associated pipelines that existed prior to September 11, 2001, remain largely intact. Furthermore, since river water, on average, provides lower supply temperature than other alternatives, greater energy efficiency during the heat transfer process would be achieved. Finally, river water cooling reduces the Terminal's demand on the city's water supply and electric grid as compared to conventional cooling methods.

A number of sustainable design measures would also reduce the Terminal's demand for energy. The abundant use of natural light within the Terminal would reduce daytime demand for energy. Furthermore, control and monitoring methods would regulate energy consumption and would help PANYNJ and PATH to periodically adjust operating procedures to reduce demand. These control measures include:

- A computerized, fully-integrated Building Management System (BMS) with energy and fluid flow measurement capabilities for all major energy consuming systems;
- A maintenance plan for ongoing measurement, verification, and maintenance of equipment efficiencies, and resource use;
- Programmable controls for devices;
- A permanent monitoring systems to track energy performance;
- Maintenance and operational continuity through manuals and staff education; and
- Continuous monitoring equipment for a representative sample of equipment (e.g., lighting systems, motors, drives, air distribution systems, and boilers);

PANYNJ would also purchase a portion of the Terminal's power from a supplier that uses renewable energy sources. A portion of the Terminal's mechanical area would also be set aside to accommodate future technologies that would provide for efficient, on-site, renewable energy.

WTC Site Infrastructure

As described in Chapter 6, "Cultural Resources," the project would include utility lines within the PATH right-of-way beneath the Terminal's platforms. Additional infrastructure, such as the existing PATH substation and mechanical rooms would also be located within the PATH right-of-way on the western portion of the WTC site. At elevation 242 (58 feet below sea level), all infrastructure associated with the PATH Terminal would be within PATH's right-of-way. At higher elevations (Elevation 264 or above), it may be necessary to construct utility lines for the coordination of infrastructure between PATH and the WTC Memorial and Redevelopment Plan. Such work would be implemented in coordination with LMDC, pursuant to the stipulations of the project's executed Memorandum of Agreement (see Appendix B).

While maintaining the ability to advance the Permanent WTC PATH Terminal's construction independent of the WTC Memorial and Redevelopment Plan, PANYNJ continues to explore opportunities for joint infrastructure to serve both the PATH Terminal and elements of the WTC Memorial and Redevelopment Plan. Examples of these opportunities include a central chiller plant for the WTC site; river water cooling; centralized recycling and waste collection; centralized security checkpoints, and a stormwater collection and distribution system. Joint infrastructure would reduce infrastructure demand through efficiencies and economies of scale that would not be achieved on a project-by-project basis. Therefore, the use of joint infrastructure in conjunction with the WTC Memorial and Redevelopment Plan would further reduce the infrastructure and energy needs of the Terminal as compared to a wholly, stand-alone facility.

DESIGN YEAR (2025)

FUTURE COMMON TO ALL ALTERNATIVES

All development efforts on the WTC site would be completed before the design year. Furthermore, any utility conflicts, such as relocation or shoring, will be resolved prior to the opening year. Although demand for infrastructure and energy will be greater following the full reoccupation of the site than it is today, advances in building construction and the sustainable design measures that will be implemented as part of the WTC Memorial and Redevelopment Plan are expected to reduce levels of consumption as compared to pre-September 11, 2001 conditions.

NO ACTION ALTERNATIVE

The No Action Alternative may result in the full disruption of PATH service to Lower Manhattan by the design year. As described in Chapter 8, Section B, "Vehicular Traffic and Parking," the absence of PATH service to Lower Manhattan would result in the diversion of PATH riders to private automobiles, buses, and vans, resulting in approximately 1,200 new vehicle trips in the AM peak hour. There may also be an increase in ferry ridership, which would necessitate additional operation of vessels between New Jersey and New York. These vehicles would require fuel and would therefore expend energy. Because these diverted trips would not be anticipated if PATH were operational, they would use energy sources that would not be needed for the Preferred Alternative.

PREFERRED ALTERNATIVE

Because the Terminal would be fully operational in both the opening and design years, its demand for infrastructure and energy would be quite similar.

Water Supply

As in the opening year, the Preferred Alternative would demand potable water for restroom facilities, drinking, and station maintenance and cleaning. Thus, combined with implementation of the previously discussed "green" measures would likely result in a reduced demand for water supply from the City in the design year as compared to pre-September 11, 2001 conditions.

Sanitary Sewage and Stormwater Disposal

Minimal changes to sanitary sewage generation or disposal method are anticipated in the design year. However, a complete system of storm drainage would be provided for surrounding plaza and roof areas. Areas located below the levels of the city sewers would drain to sump pits, which would be pumped to the storm sewers leaving the site. Drainage from the roof areas and waste steam condensate would be piped to stormwater retention tanks. All water would be filtered and pumped via non-potable piping for reuse at the site (water closets and urinals). Given the reuse of stormwater at the site through the previously described means, a reduction in stormwater disposal is anticipated for the city sewer system servicing the area in the design year. Thus, no impacts are anticipated with regard to sanitary sewage and stormwater disposal in the design year.

Solid Waste

An increase in ridership is anticipated between the opening year and the design year. As such, the quantities of solid waste expected to be generated from the resultant ridership would slightly increase. However, the implementation of "green" measures would reduce the overall amount of solid waste produced and removed from the Terminal. Therefore, this alternative would not result in impacts from solid waste generation in the design year.

Energy

Energy loads, including those needed for traction power, are expected to be similar to those in the opening year and that which was demanded prior to September 11, 2001. Thus, with the implementation of "green" measures, such as energy efficient lighting and renewable energy, and the expectations of the Con Edison and PSE&G substations to supply energy at or above previous quantities, the fully operating Permanent WTC PATH Terminal in the design year would not adversely impact energy supply in the surrounding area.

E. MITIGATION

No additional mitigation would be required for infrastructure and energy for the elements of the Preferred Alternative due to the sustainable strategies that would be implemented in the design, construction, and operation of the Preferred Alternative. These strategies would result in a reduction of water usage of the City's water supply, solid waste production, sanitary sewage production, and energy consumption. ✳

A. INTRODUCTION

As previously described, the Project Site is located in an area that has a long development history. The Project Site has undergone various phases of development, including a mixture of residential and commercial (pre-1950s), increased commercial intermixed with limited residential and light industrial (1950–1970s) and, ultimately, primarily commercial, combined commercial/residential and community uses (post-1970s to current).

Given the former uses and sustained urban history of Lower Manhattan, the potential exists that contaminated (or hazardous) materials may have been used in connection with development and/or facility operations at and in the vicinity of the Project Site. Furthermore, based on the age of the structures, building materials on the site are likely to have included asbestos (insulation, roofing, etc.) and/or lead (paint). The presence of contaminated materials is not uncommon or unexpected at urban sites and is generally regarded as a function of prior usage. The presence of any contaminated materials would be addressed prior to or in conjunction with the development of a Permanent World Trade Center (WTC) PATH Terminal and efforts would be undertaken by conducting appropriate engineering and construction practices to eliminate worker and public exposure to such materials. Further, the potential presence of contaminated materials at the Project Site has been virtually eliminated as a result of the rescue and recovery effort undertaken subsequent to the terrorist attacks of September 11, 2001.

This chapter documents the consideration and evaluation of contaminated materials impacts for the Project Alternatives including an assessment of potential risks to public health, safety, and the environment.

B. METHODOLOGY

This chapter describes the affected environment (i.e., baseline environmental conditions) of the WTC site and areas that would be affected by the proposed off-site pedestrian connections as related to contaminated materials. This chapter then provides an assessment/evaluation of impacts associated with potential or identified contamination issues, particularly with regard to construction. The objective of the assessment is to identify any contaminants, which would be disturbed during construction or facility operation, and to fully assess any potential risks to human health, safety, and the environment. As necessary, this chapter identifies measures that would be undertaken to eliminate or mitigate the potential contaminated materials impacts.

Information gained through the performance of the following tasks was relied upon in the preparation of the contaminated materials assessment:

- Review of the physical setting of the proposed project;

- Review of the historical uses within the Project Site limits, the WTC site, and at surrounding areas using aerial photographs, Sanborn Fire Insurance Maps, United States Geological Survey (USGS) topographic maps, and historical reports;
- Reconnaissance of the Project Site, WTC site, and surrounding areas;
- Review of regulatory agency correspondence and reports pertaining to the post-September 11, 2001 cleanup activities;
- Review of federal and state regulatory databases and records; and,
- Review of the New York City Building's Department Archives (file access provided on November 21, 2003) including mapping and documentation of Battery Park City development and maps presenting geologic cross sections of Route 9A and intersecting east-to-west streets.

C. DESCRIPTION OF THE AFFECTED ENVIRONMENT

PRE-SEPTEMBER 11, 2001 BASELINE CONDITIONS

The Project Site is located in an area that has a long history of various development and transportation uses. The following description of the affected environment includes its geology and landform, historical uses, and environmental conditions with respect to potential contaminants prior to September 11, 2001.

GEOLOGY AND LANDFORM

Regional Geology

The Project Site and surrounding area are located within the Manhattan Prong of the New England Upland Physiographic Province of the Northeastern United States. This vast province includes all of New England as well as parts of New York, New Jersey, and Pennsylvania. The Manhattan Prong is categorized as igneous and primarily metamorphosed bedrock. The early development of this province occurred during the early Paleozoic Era (~550 million years ago) when sediments from structural ridges and volcanic islands eroded into the Appalachian eugeosyncline. As eroded sediment accumulated in this trough-like depression, the overlying weight caused the lower most sediment to compress, thus allowing more sediment to accumulate. This process occurred repeatedly and allowed for enormous volumes of sediment to accumulate. The compression forces generated by the weight of this overlying material eventually resulted in the metamorphism of the deepest sediments. Further faulting and deformation occurred during the late Taconic Orogeny or mountain building episode of the Ordovician-early Silurian Periods (450-460 million years ago). Overlying layers of rock and sediment were eroded as the region was slowly uplifted, exposing the highly fractured metamorphic rocks below. These metamorphic rocks form the present day island of Manhattan.

Bedrock Geology

The total thickness of bedrock underlying the Project Site and surrounding area is estimated to be approximately 1,600 feet. These formations are interpreted as large northeast/southwest-oriented synclines and anticlines. The synclines are composed of the harder, more erosion-resistant Manhattan schist and Fordham gneiss while the valleys are subsequently composed of less resistant Inwood marble. The Manhattan schist (Lower Cambrian), which directly underlies

the Project Site, is predominantly well-foliated sillimanite-muscovite-biotite-kyanite schist with inter-bedded black gneiss and amphibolite. At its thickest point, this formation is approximately 200 to 750 feet thick. Throughout the Manhattan schist are zones of non-foliated granitic igneous rocks composed of quartz, feldspar, muscovite and biotite-mica. Extending into the southeast corner of the subject site is a zone of igneous quartzite. This zone is believed to have formed in place rather than being an intrusive feature. The Waloomsac Formation (Middle Ordovician) underlies the Manhattan schist. This formation is approximately 250 to 750 feet in thickness and is composed of primarily plagioclase-garnet-muscovite-biotite-quartz schist. The Waloomsac Formation lays uncomformably above the Inwood marble (Ordovician to lower Cambrian). The Inwood marble is composed primarily of un-foliated dolomitic marble and ranges in thickness from 600 to 700 feet. The Fordham gneiss (Middle Proterozoic) underlies the abovementioned formations and consists primarily of well-foliated quartz and orthoclase feldspar.

Soil Characteristics

Soils overlying the bedrock at the surrounding area consist generally of glacial till, organic silts associated with shallow marine environments, and non-native fill material. The Laurentide Ice Sheet covered all of New York State during the Wisconsinan Stage and was completely retreated from New York approximately 10,000 years ago. As the ice sheet retreated, glacial till was deposited throughout New York, including Manhattan. Layers of gravel, sand, and silt are present on site and become thicker to the west. These layers create a lateral burden on the slurry wall that presently exists on site. Above the glacial till lays silts and clays associated with shallow marine environments. Some time after 1609 but prior to 1900, the eastern bank of the Hudson River was located where Greenwich Street is located today. Thus, the present location of the Project Site was historically "under water" during the time of deposition. Fill material was used to expand the western edge of Manhattan over 500 feet, including the Project Site and the surrounding WTC site. Fill material used in the surrounding area is reported to have consisted of a wide variety of material including dredged river sediment. During the development of the WTC complex much of the soil including the fill material was removed from within the limits currently occupied by the temporary WTC PATH station as part of the construction of the subsurface elements. Prior to the construction of the WTC complex, soil at the Project Site is reported to have consisted of 5 to 40 feet of glacial outwash and till covered by 10 to 30 feet of organic marine sediment with 20 to 35 feet of fill material. Soil conditions on other portions of the WTC site (i.e., the eastern portion) are reported to be similar to that which was formerly located at the Project Site with respect to thickness and distribution. At this time, the PATH Terminal portion of the Project Site is devoid of overburden soil as a result of the removal effort performed subsequent to September 11, 2001.

Bedrock exists at 55 to 75 feet below surface grade at the Project Site and at 65–80 feet below surface grade at the remaining portion of the WTC site. Further information on the affected environment subsequent to September 11, 2001 is provided below. Conditions of the surrounding area are expected to be similar to those at the Project and WTC sites.

The sub-grade Route 9A connection would be located on the western edge of the bathtub at Route 9A and would be constructed through three surficial soil deposits. Based on geologic cross sections compiled at the former Battery Place to Harrison Street bulkheads, the uppermost unit is composed of miscellaneous fill material including mixed clay, silt, sand, gravel, cinders and occasional boulders (Moran et. al., 1942). Historical cross-sections as well as the National Academy of Engineering refer to the deposits as "fill". This material is approximately 5-20 feet

in thickness (Tamaro, 2002). The second layer of sediment is up to 20 to 35 feet in thickness and consists of native soft dark gray, organic clayey silts with trace fine sand (Moran et. al., 1942). These deposits are associated with Hudson River channel deposits. The third layer of sediment underlying this location is native medium compact to compacted gray silty fine to coarse sand, with trace to some gravel. These deposits are also Hudson River channel deposits. It has been documented by the National Academy of Engineering that a quartzite knoll intrudes on the basin in the southwest corner of the site. The depth or size of outcrop in this area is unclear.

Ground Water

Due to the proximity of the Project Site to the Hudson River, uppermost ground water would be expected to be present relatively near the surface. However, given the presence of the slurry wall, ground water is precluded from entering the physical limits of the Project Site from perimeter areas. Ground water below the Project Site, within the underlying bedrock, is anticipated at approximately 100 feet below surface grade. Ground water at the surrounding WTC site is reported to be variable and controlled by dewatering at the Hudson & Manhattan Coffer Dam, located along Church Street between Vesey and Liberty Streets. The dewatering was performed prior to September 11, 2001 to prevent ground water infiltration into the subgrade structures and will be continued permanently. Ground water resources in Manhattan are not used for potable purposes.

HISTORICAL USES

The identification of historical uses provides essential information with respect to the potential for contaminated materials to be present at or in the vicinity of the Project Site as prior operations/activities often include the use of hazardous materials and may result in impacts to environmental media. Therefore, in conjunction with the environmental review process, historical information sources were reviewed to establish existing site and area conditions. The historical information sources used for this project included historical aerial photographs, Sanborn Fire Insurance Maps, historical topographic, and United States Geologic Survey (USGS) maps. Six historical aerial photographs (1943, 1953, 1966, 1976, 1985, and 1995), 156 Sanborn Maps (1894, 1922, 1923, 1928, 1950, 1977, 1978, 1979, 1980, 1981, 1983, 1985, 1987, 1988, 1991, 1992, 1993, 1994, 1995, and 1996) and five historical topographic maps (1900, 1947, 1955, 1967, and 1981) were reviewed to document historical uses of the Project Site and surrounding area. In addition, historical Jersey City, New Jersey, USGS Topographic Quadrangle Maps depicting the Project Site and the surrounding area were reviewed to obtain additional information with regard to prior area usage. The Jersey City, New Jersey, USGS maps are based on surveys dated 1900, 1947, 1955, 1967, and 1981 photo-revised from 1967.

Overall, a review of the various historical information sources identifies primarily mixed commercial uses as well as the presence of transportation elements such as the New York City Transit (NYCT) 1 and 9 line and the Hudson and Manhattan (H&M) Railroad Terminal at the Project Site prior to the development of the WTC complex. These data sources identify that coastal features (i.e., the Hudson River) were formerly located in closer proximity to the Project Site, thus providing the technical basis for the placement of fill at the Project Site in conjunction with initial development. Generally, most of lower Manhattan was raised in grade and extended westward by the emplacement of non-native fill material. Some time after 1609 but prior to 1900, the eastern bank of the Hudson River was located at the current location of Greenwich Street. Various sources document that fill material consisted of a variety of materials ranging from dredged sediment from the Hudson River to old shoes (Tamaro, 2002).

The historical information sources identify the presence of a combination of multi-family residential uses, commercial uses including retail shops, stores and restaurants, and Washington Square, as well as some light industrial uses at the Project Site during the late 1800s and early 1900s. Mapping for this era identifies boilers and tanks at individual sites, primarily south of Dey Street. These sources reveal an increase in commercial usage with a corresponding decrease in residential uses at the Project Site and during the 1940s and 1950s. In particular, a gasoline station is identified at the northwestern portion and a gasoline filling station including several aboveground storage tanks is identified at the southwestern portion of the Project Site during this time period. Review of the historical information sources does not identify any major changes in usage at the Project Site or the adjacent area to the east until the development of the WTC site in the mid- to late-1960s. Although contaminants associated with prior uses may have impacted environmental media, construction of the WTC site included the razing of structures, removal of most soil to bedrock, and installation of a concrete slab over much of the western portion of the Project Site. As such, a low potential for residual contamination existed during the time frame of the WTC site.

DOCUMENTED ENVIRONMENTAL CONTAMINATION ISSUES

To fully characterize the affected environment of the Project Site and surrounding area, it is necessary to determine if environmental contamination has been identified at the Project Site or sites in the surrounding area. Therefore, an electronic file search of federal and state regulatory environmental databases was obtained through a commercial source, Environmental Data Resources (EDR). The report provided as a result of the search includes information related to sites included on regulatory lists as well as a map identifying the location of the listed sites with respect to the Project Site. A copy of the electronic file search is provided in Appendix F. Review of the EDR Report did not reveal the inclusion of the PATH Terminal on any of the reviewed regulatory databases. However, the Port Authority of New York and New Jersey (PANYNJ) at the 1 WTC location is included on the New York State Department of Environmental Conservation (NYSDEC) Underground Storage Tank (UST) database. The listing identifies the former presence of a 55-gallon UST, which was removed by the PANYNJ. The listing also provides information related to aboveground storage tanks (ASTs) located at the WTC site. The listing identifies the presence of six ASTs containing petroleum products. The listing does not identify any environmental contamination issues with regard to the presence or use of these ASTs or the former UST. With regard to the surrounding area, a number of sites are included in the NYSDEC UST List. The listings do not identify any environmental contamination issues at area sites that have impacted the Project Site. However, the UST and ASTs are no longer on the site and there is a low potential for residual contamination.

Review of the EDR Report identifies a number of WTC site tenants on regulatory lists associated with the permitted use and storage of certain materials considered hazardous by the EPA and/or the NYSDEC. The EDR Report also identifies that several sites within the surrounding area that are also included in regulatory databases associated with the permitted use and storage of hazardous materials. No contamination issues are identified with respect to these listings. The WTC site is also included on the NYSDEC Spills List (NY SPILLS). Several occurrences of minor petroleum product discharges are identified during the 1990s. The specific locations of the spills within the WTC site are not identified in the database listings. It should be noted that a representative of the NYSDEC has stated all open tank and spill matters associated with the WTC have been closed. Confirmation of the case closure is forthcoming.

Overall, review of environmental database information has not revealed environmental contamination issues at the Project Site or issues within the surrounding area with the potential to impact the Project Site.

The potential presence of hazardous materials subsequent to September 11, 2001, including database listings on or after that date, is further described below.

HAZARDOUS MATERIAL STORAGE AREAS

The WTC site included areas used by the PANYNJ as well as numerous tenants. A Community Right-To-Know (RTK) Survey was performed for the areas of the complex occupied or used for storage of hazardous materials by the PANYNJ. Review of the Year 2000 RTK Survey did not reveal the presence of hazardous materials used or stored in the former WTC PATH Terminal located below the WTC site. According to information gained through the survey, maintenance of the PATH trains servicing the WTC site was performed at the PATH Harrison Maintenance Facility in New Jersey.

CHANGES IN THE AFFECTED ENVIRONMENT SINCE SEPTEMBER 11, 2001

The terrorist attacks of September 11, 2001 resulted in the collapse of the WTC complex and the majority of the subgrade structures located beneath the complex, including the PATH Terminal, components of the PATH system, and associated concourse, egress routes, etc. The Project Site (PATH Terminal portion of the Project Site) currently lies at approximately 65-70 feet below street grade. No permanent buildings are located within the limits of the Project Site or the adjacent eastern portion of the WTC site. The temporary PATH station is presently located at the Project Site. The discussion of the affected environment pre-September 11, 2001 included information pertaining to geology and landform, historical uses, and environmental conditions as identified through a review of regulatory databases and other information sources. The discussion of geology and landform and historical uses is not required for this further discussion of the affected environment. However, this section provides information pertaining to hazardous materials issues as a result of September 11, 2001 and the subsequent removal effort. Although hazardous materials issues resulting from September 11, 2001 are provided in this section for completeness, the subsequent recovery effort included the removal of all material, debris, and soil from within the Project Site, thereby eliminating environmental contamination issues with respect to the Project Site.

The collapse of the WTC site resulted in the identification of the following concerns with regard to hazardous materials:

- Debris, including asbestos, LBP and PCBs, deposited on the site due to the collapse and demolition of the buildings and structures located on the WTC site;
- Dielectric oils from transformers and cables feeding the WTC complex from the former 7 WTC building;
- Hazardous materials stored at the site and used by WTC site tenants; and
- Fill material reportedly located beneath the WTC complex buildings.

These issues are related to the entire WTC site and not specifically to the Project Site as defined for this Environmental Impact Statement (EIS).

As stated above, an electronic file search of regulatory databases was performed as part of the contaminated materials assessment of the EIS process. The EDR Report provides information pertaining to listings for both pre- and post-September 11, 2001 conditions. With respect to post-September 11, 2001 conditions, the EDR Report identifies the inclusion of the WTC site in the NYSDEC Spills List for September 11, 2001. The listings are consistent with the previously described hazardous materials concerns and identify the discharge of dielectric fluid, asbestos, and transformer oil. The presence of the documented materials has been addressed in conjunction with the removal efforts performed at the Project Site. In addition, a few sites within the surrounding area are listed with spills/discharges involving petroleum products, which occurred on September 11, 2001 or shortly thereafter. Generally, these occurrences appear to be associated with discharges of petroleum products from equipment and vehicles used in recovery efforts. The listings do not identify a continuing environmental contamination issue with regard to the occurrences and the NYSDEC reportedly closed the cases in December 2003.

Subsequent to the terrorist attacks, rescue, recovery, and removal efforts were undertaken from September 11, 2001 to June 30, 2002. Generally, the area defined as the Project Site was excavated to the remaining bottom slab of the former structures. Soils near the projections of the PATH tunnels were retained; however, the top 18 inches were removed and replaced with clean fill. The eastern portion of the WTC site was excavated to depths ranging from street grade to 35 feet below street grade.

According to regulatory agencies overseeing the removal efforts, soils and hazardous materials that may have been present in the western portion of the WTC site as a result of historical operations and the terrorist attacks have been either removed or burned, or a combination of the two. However, it has been acknowledged that soils located to the east of the NYCT's 1 and 9 line may contain residual contamination from historical operations and the terrorist attacks. This area is being addressed pursuant to a separate development action as part of the *World Trade Center Memorial and Redevelopment Plan Generic Environmental Impact Statement (GEIS)*. No changes have been identified with regard to the other pedestrian egress routes that extend from the PATH Terminal and which have been included as part of the Project Site. These additional areas have not been identified as having been impacted by hazardous materials with respect to the terrorist attacks.

Materials formerly present on the Project Site were subjected to the fallout (dust and debris) generated from terrorist attacks. Analytical results presented by the U.S. Environmental Protection Agency (EPA) indicated that the dust and debris resulting from the attacks potentially contained contaminants such as asbestos, dioxins, polychlorinated biphenyls (PCBs) and certain metals (EPA 2002 and 2003 Reports). However, as noted above, removal efforts that occurred during the nine months following the terrorist attacks resulted in the excavation/removal of the materials located within the limits of the Project Site as well as from area locations. As part of the *World Trade Center Memorial and Redevelopment Plan GEIS*, the Lower Manhattan Development Corporation (LMDC) performed a Hazardous Materials Screening Study, which included the conductance of soil and ground water sampling and analysis. The sampling was performed at locations at the eastern portion of the WTC site as well as at locations beyond the limits of the WTC site.

The results of the sampling are detailed in the *WTC Memorial and Redevelopment Plan GEIS*. Briefly, the soil sampling program revealed the presence of relatively few contaminants at concentrations above regulatory thresholds. In fact, the sampling revealed the presence of only metals at concentrations in excess of regulatory guidelines. Beryllium, chromium, copper,

magnesium, lead, mercury, nickel, selenium, and zinc were detected at elevated concentrations in surficial soils collected from the eastern portion of the WTC Site as well as from soil present at the former grade at 140 Liberty Street and at intersection of Washington and Albany Streets. The metals detected at elevated concentrations are considered typical fill contaminants and consistent with background conditions at urban sites. EPA air monitoring data revealed that beryllium, mercury, and selenium were not detected in samples collected in the vicinity of WTC Site subsequent to September 11, 2001. Chromium, copper, magnesium, nickel, selenium, and zinc were detected, but at low concentrations. The EPA detected elevated concentrations of lead in air, but the concentrations fell below the EPA's benchmark within one month of September 11, 2001. Although elevated concentrations of these metals may be present in surficial and subsurface soils, their absence or low concentrations in the air subsequent to September 11, 2001 indicate that they are not an ongoing source of exposure. The lateral and vertical distribution of these metals throughout the Project Site indicates that they are not likely to be associated with historic releases; rather that these metals' concentrations are representative of background conditions in the vicinity of the Project Site.

Elevated concentrations of arsenic, chromium, lead, manganese, mercury, nickel, and selenium were detected in samples collected from the surfaces of existing structures located along the perimeter of the eastern portion of the WTC Site. The concentrations of these metals exceed the EPA's benchmarks for residences. Based on their distribution and concentrations, it is likely that these samples reflect material deposited as a result of September 11, 2001. Trace concentrations of dioxin were detected in surficial soil samples and in samples collected from the surfaces of existing structures, significantly below EPA remediation criterion.

Soil sampling did reveal trace concentrations of asbestos in surficial soil collected from the eastern portion of the WTC site. However, the concentrations detected are considered typical background conditions in urban settings such as the Project Site. Further, EPA air monitoring performed at and in the vicinity of the WTC site has not revealed concentrations of airborne asbestos above screening level. In fact, asbestos has not been detected in the vast majority of air samples.

Similar to the soil results, the ground water sampling revealed the presence of relatively few contaminants. Specifically, ground water sampling revealed the presence of only a single volatile organic compound (VOC) at a concentration marginally above the NYSDEC GA standards in one sample from the eastern portion of the WTC site, but were below NYCDEP sewer discharge requirements. Chloroform was detected in a single sample collected from the eastern portion of the WTC site. The presence of chloroform in ground water is likely to be associated with the usage of buried/subsurface water lines holding and transferring chlorinated water; chloroform is a byproduct of the chlorinating process. In addition, chloroform, toluene, and benzene were detected at concentrations above NYSDEC regulatory standards for potable water in a sample collected from the intersection of Washington and Albany Streets, south of the WTC site. The presence of toluene and benzene may be the result of a petroleum discharge unlikely to be related to the Project Site, and the presence of chloroform is likely to be attributable to the extensive subsurface water lines in this portion of Manhattan.

D. PROBABLE IMPACTS OF THE PROJECT ALTERNATIVES

CONSTRUCTION PERIOD (2006)

FUTURE COMMON TO ALL ALTERNATIVES

The Future Common to All Alternatives considers actions undertaken by others, which are independent of the Preferred Alternative. No contaminated building materials or environmental media have been identified within the limits of the west "bathtub" of the WTC site, as remaining debris and soil material were removed in conjunction with the September 11, 2001 recovery effort. Therefore, development within the west "bathtub" in association with the WTC Memorial and Redevelopment Plan would not encounter hazardous materials.

As described above, portions of the WTC site east of the 1 and 9 line have the potential for residual contamination since debris and structures remain in this area. Similar to efforts associated with the Preferred Alternative, LMDC will prepare a Health and Safety Plan (HASP) that includes remedial measures for the excavation and removal of these materials in association with their demolition and subsequent construction efforts.

There is also the potential for contamination within the limits of the Route 9A Project, which also includes the area of PATH's proposed east-west connection to the World Financial Center and the north and south ventilation structures. The New York State Department of Transportation will also prepare a Health and Safety Plan (HASP) for the Route 9A Project that would include specific measures to remove and dispose of any contaminated soils or groundwater encountered during construction. If NYSDOT pursues the short-bypass alternative for the Route 9A Project, the HASP would include the areas of PATH's east-west connection beneath Route 9A and the north and south ventilation structures..

Overall, construction activities at the Project Site are not anticipated to create or exacerbate existing contaminated material conditions at other area project sites. Further, no major contamination issues have been identified at planned development or redevelopment sites in the surrounding area. Thus, development/redevelopment actions undertaken by others at area sites are unlikely to adversely impact the project site with respect to contaminated materials.

NO ACTION ALTERNATIVE

Under the No Action Alternative for the construction period, no construction activities would be occurring with respect to the Permanent WTC PATH Terminal. However, development activities would continue to occur at surrounding areas including the WTC site (WTC Memorial and Redevelopment Plan). Given the developed nature of the surrounding area, it is unlikely that development efforts at area sites would cause any contaminated materials issues at the Project Site. This conclusion assumes that all area development projects would use appropriate construction methods and remediation. With respect to activities assumed to occur in the redevelopment of the overall WTC site, the potential exists for any contaminants in soil remaining at that location to impact the Project Site. However, recent studies conducted for the *World Trade Center Memorial and Redevelopment Plan GEIS* did not reveal major contaminant issues at that site. Additional actions for that project would include further evaluation of soil quality and the removal and appropriate disposal of soil. Therefore, no adverse impacts with respect to contaminated materials are anticipated under the No Action Alternative.

PREFERRED ALTERNATIVE

The construction of the Preferred Alternative would result in minimal changes to existing environmental media within the "west bathtub" of the WTC site. As previously described, all debris from the September 11, 2001 attacks on the WTC site and most soil present at this portion of the site were removed during recovery efforts. Soils near the projections of the PATH tunnels were retained; however, the top 18 inches were removed and replaced with clean fill.

Portions of the basement wall within the WTC site were damaged during the attacks. As a result, PANYNJ has installed pumps to discharge any ground water that leaks into the site in addition to collected stormwater. As part of this project, PANYNJ would repair portions of the basement walls (see Chapter 2, "Project Alternative"). The rehabilitated basement walls would essentially eliminate the invasion of overburden ground water through the wall into the WTC site.

The Preferred Alternative includes the construction of pedestrian egress from the Terminal to street level at several locations as well as two ventilation structures within the median of Route 9A. The construction would include excavating/tunneling to the eastern portion of the WTC site beneath the existing 1 and 9 subway tracks as well as similar activities at perimeter locations along Route 9A.

There is potential that excavation/tunneling activities associated with the proposed egress routes on the eastern portion of the WTC site may encounter fill material, which could include contaminants and/or contaminated ground water. Given the urban nature of the project site and the perimeter areas, the presence of fill material containing low levels of contaminants is expected and, if identified, will be addressed in conjunction with the proposed project. Similar actions will be undertaken with respect to ground water. Actual construction activities at the Project Site will be performed using appropriate construction and engineering practices, which include awareness of contaminant issues.

The potential also exists that excavation/tunneling activities associated with the proposed Route 9A connection and the north and south ventilation structures may encounter fill material, which could include contaminants and/or contaminated ground water. The 1994 *Route 9A Reconstruction Final Environmental Impact Statement* showed testing results for the Route 9A alignment, including the area that would contain the ventilation structures and the proposed pedestrian connection. These results showed elevated levels of polycyclic aromatic hydrocarbons (PAHs) and metals at a depth of approximately 24 feet below the surface of Route 9A, and such contaminants are typical of fill soils in New York City.

Regardless of contaminant concentrations, construction activities would be performed using appropriate construction and engineering practices, which include awareness of contaminant issues. In addition, prior to the initiation of the construction activities at the perimeter areas, a site-specific HASP would be prepared and implemented to protect the general public and workers from exposure to contaminants present in air, soil, ground water, building materials, and buried structures (utilities) encountered at the site. The HASP would include worker training and required safety courses, monitoring requirements, use of personal protection equipment (PPE), contaminant action levels, and air monitoring equipment. Further, the HASP would address preventative measures to narrow down or eliminate potential exposure pathways and corrective actions if exposure occurs. If contaminant concentrations are exceeded during the construction phase, then all activities would cease and the appropriate remedial actions would be undertaken to address the issue at hand as noted in the HASP.

As part of the HASP, management plans for soil, dust, ground water, asbestos, and PCBs would be implemented. The management plans would contain the methods to be used in handling, staging, disposal, transportation, and decontamination of equipment and personnel in accordance with local, state, and federal regulations. Further, the management plans would contain a list of licensed waste haulers and disposal facilities that could legally accept hazardous materials that may remain on the Project Site.

The potential hazardous materials on the Project Site are typical for urban sites in New York City. Some of the federal, state, and local regulations that govern their proper handling, removal, and disposal include:

- U.S. EPA, Identification and Listing of Hazardous Waste (40 CFR Part 261);
- U.S. EPA, Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262);
- U.S. EPA, Standards Applicable to Transporters of Hazardous Waste (40 CFR Part 263);
- U.S. EPA, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CRF Part 264);
- U.S. EPA, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR Part 265);
- U.S. EPA, Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (40 CFR Part 266);
- U.S. EPA, Land Disposal Restrictions (40 CFR Part 268);
- New York State Solid and Hazardous Waste Regulations (6 NYCRR Part 360) for remediation of soils that have elevated levels of metals as well as residual asbestos on the site.
- Procedures in Petroleum Cleanup and Removal (6 NYCRR Part 613 and 6 NYCRR Part 611) for removal of any storage tanks;
- Spill Technology and Remediation Series (STARS) Memo #1 for removal and disposal of petroleum contaminated soil; and
- Technical and Operations Guidance Series (TOGs) for removed of petroleum contaminated groundwater.

The Project's HASP would include procedures for the handling and disposal of any encountered materials in accordance with these regulations and with other guidance and protocols of EPA, NYSDEC, and the New York City Department of Environmental Protection.

Construction activities performed at the site are likely to include the use of petroleum products associated with equipment and machinery operations. All materials would be maintained in accordance with project health and safety plans and in conformance with the local, state, and federal regulations noted above. Adherence to applicable regulation and appropriate construction practices would avoid impacts to human health and the environment. The types of petroleum materials are similar to those used to fuel roadway vehicles present on a daily basis throughout the surrounding area. As such, it is not anticipated that the use of such materials would have a deleterious impact on the surrounding environment.

Overall, no contaminated materials issues are anticipated for this alternative during the construction period.

OPENING YEAR (2009)

FUTURE COMMON TO ALL ALTERNATIVES

Construction activities will continue in Lower Manhattan in the opening year, including the development of the WTC site as part of the WTC Memorial and Redevelopment Plan. However these area redevelopments are not anticipated to result in any contaminated materials impacts, as described in the "Construction Period" section above.

NO ACTION ALTERNATIVE

In the opening year, the temporary WTC PATH station would continue to operate in its current location. As stated above, development activities would continue in surrounding areas including the WTC site. It is unlikely that further development efforts would cause any contaminated materials issues at the Project Site based on the conclusion that all area projects would use appropriate construction methods and remediation. Therefore, no adverse impacts with respect to contaminated materials are anticipated with the No Action Alternative in the opening year.

PREFERRED ALTERNATIVE

Construction activities associated with the Preferred Alternative would be concluded by the opening year. Thus, no disturbance of environmental media would be anticipated under this scenario. If any contaminated materials were encountered during construction, such materials would have been removed or isolated in accordance with applicable regulations prior to and/or during the construction phase, and no potential would exist for workers or the public to contact same.

Operation of the PATH train system would include the use of limited quantities of hazardous materials and petroleum products. However, these materials are used for the current system and, as previously stated; such materials are not stored and would not be stored on the WTC site. The PANYNJ has not proposed any changes in materials handling for the PATH system; thus, hazardous materials storage would remain off-site. Although the general maintenance and cleaning of PATH trains would continue to occur at PATH's facilities in Jersey City and Harrison, limited emergency maintenance may occur at the WTC Terminal when trains must be pulled out of service. The PANYNJ has established a series of standard operating procedures, which include measures to be undertaken in the event of a discharge of hazardous materials or petroleum products. These procedures would continue to apply in the opening year, including future actions at the Project Site.

Thus, no adverse impacts with respect to contaminated materials are anticipated for the Preferred Alternative in the opening year.

DESIGN YEAR (2025)

FUTURE COMMON TO ALL ALTERNATIVES

Redevelopment performed at area sites in the time period between the opening year and the design year is not anticipated to result in any contaminated materials issues.

NO ACTION ALTERNATIVE

The No Action Alternative would not include the presence of a Permanent WTC PATH Terminal in the design year. Furthermore, the temporary WTC PATH station would not be in operation. All other portions of the WTC site redevelopment would be complete. With respect to these activities, any remaining contamination on the site would have been removed during the construction period. Therefore, no contaminated materials issues are anticipated under the No Action Alternative in the design year.

PREFERRED ALTERNATIVE

With respect to contaminated materials, the impact analysis for the Preferred Alternative for the design year is identical to that presented for the opening year. Thus, no adverse impacts with respect to contaminated materials are anticipated for this alternative in the design year.

E. MITIGATION

No adverse impacts with respect to contaminated materials are anticipated for the Preferred Alternative in the construction period, opening year, or design year. However, as previously stated, construction activities will be performed using appropriate construction and engineering practices, which include awareness of contaminant issues. In addition, prior to the initiation of the construction activities at the perimeter areas, a site-specific HASP will be prepared and implemented to protect the general public and workers from exposure to contaminants present in air, soil, ground water, building materials, and buried structures (utilities) encountered at the site. The HASP will include worker training and required safety courses, monitoring requirements, use of personal protective equipment (PPE), contaminant action levels, and air monitoring equipment. Further, the HASP will address preventative measures to eliminate or minimize potential exposure pathways.

The HASP will be required as part of contract documents and will be in conformance with the above described goals/objectives and will include elements outlined in the following framework:

- Identification of potential contaminants and, as necessary, development of a soil or ground water sampling plan to determine contaminant concentrations in environmental media;
- Identification of thresholds or action levels for contaminants and development of procedures for modification or cessation of work activities based on field screening result;
- Worker health and safety training including the identification of a project health and safety officer who will be responsible for overall oversight and will maintain all appropriate documentation of safe working conditions and permits/approvals for the management of construction related wastes and residuals;
- Development and implementation of field screening for contaminant detection and worker health and safety;
- Identification of PPE to be used (worn) during specified phases of construction;
- Development and implementation of a Soil Management Plan identifying the methods to be used in handling, staging, disposal, transportation, and decontamination of equipment and personnel in accordance with local, state, and federal regulations;

- Development and implementation of a Ground Water Management Plan to address dewatering actions from ground water infiltration and overland stormwater and the methods to be used in handling, staging, disposal, transportation, and decontamination of equipment and personnel in accordance with local, state, and federal regulations;
- Development and implementation of a Dust Management Plan to address dust generated through excavation or general construction activities;
- Development and implementation of management plans to address PCBs and asbestos; and,
- Identification of proposed licensed waste haulers and disposal/recycling facilities, for the transportation and disposal/recycling of waste materials generated from the project.

The project specific HASP will be in accordance with all applicable local, state, and federal regulations and will document that safe conditions relative to onsite workers and the public are maintained throughout the project. ✳

A. INTRODUCTION

This chapter assesses the potential impacts to terrestrial and aquatic natural resources from the construction and operation of the Preferred Alternative. With the exception of the terminal building, street-level entrances, emergency egress and ventilation structures, elements of the Preferred Alternative would be below ground.

The street-level terminal building would be located on the western side of Church Street between Dey and Fulton Streets (see Chapter 7, "Urban Design and Visual Resources"). As currently proposed, the above-ground terminal would comprise of an oblong glass and steel shell, the roof of which would contain two counterpoised glass wings that would rise more than 100 feet into the air and extend the length of the building (about 350 feet). The structure would allow natural light to illuminate the terminal concourse. The ceiling of the aboveground building may have the capacity to open up to the sky, between the two wing-like structures. It would not be higher than the towers proposed as part of the WTC Memorial and Redevelopment Plan that would be constructed near it. The perimeter of the street-level terminal would be landscaped.

The Terminal would include street-level access from other locations within the WTC site. These entrances would be located within the proposed offices towers and other structures associated with the WTC Memorial and Redevelopment Plan. An additional entrance would be provided west of Route 9A in front of the Winter Garden. Two ventilation structures with emergency egress would be located within the median of Route 9A. Two additional emergency egress stairways from the PATH platforms and mezzanine would be located within the WTC site west of the 1 and 9 line.

The Preferred Alternative would not involve any in-water construction in the Hudson River nor would it involve construction within a wetland. However, the Terminal would tie into the re-establishment of the river cooling system on the WTC site once it becomes available. The re-establishment of the river water cooling system is being undertaken as a separate action; therefore, as described in Chapter 2, "Project Alternatives," the Permanent WTC PATH Terminal would employ alternative cooling methods until the river water cooling system is fully operational. Additionally, the implementation of "green" design, "green" construction, and sustainable design principles described in Chapter 2, "Project Alternatives," would reduce the potential for adverse environmental impacts from the Preferred Alternative. Measures include, but are not limited to, energy-efficient lighting, heating and ventilation systems, and development of a Comprehensive Energy Management Plan, Comprehensive Resource Management Plan, and Water Management Plan, described in Chapter 11, "Infrastructure and Energy." These measures would contribute to the conservation of energy and water resources, thereby reducing potential environmental impacts associated with power generation on a regional scale, and possibly resulting in a decrease in the cooling water needs for the Preferred Alternative.

B. METHODOLOGY

DATA SOURCES

Natural resources within the affected environment (Project Site and the Hudson River in the vicinity of the WTC intake) are described for two baseline conditions: pre-September 11, 2001; and changes to the affected environment since September 11, 2001. The description of natural resources for these two baseline conditions was developed on the basis of:

- Existing information identified in literature and obtained from governmental and non-governmental agencies such as: Port Authority of New York and New Jersey (PANYNJ), NYSDEC, New York City Department of Environmental Protection (NYCDEP) Harbor Water Quality Surveys (NYCDEP 1998, 2000, 2001, 2002, 2003a and b), U.S. Environmental Protection Agency (EPA) (e.g., Regional Environmental Monitoring and Assessment Program (R-EMAP) (Adams et al. 1998)), U.S. Army Corps of Engineers (ACE), Federal Emergency Management Agency (FEMA) flood insurance rate maps, and the Interstate Environmental Commission (IEC).
- Observations made at the Project Site.
- Responses to requests for information on rare, threatened or endangered species within ½ mile surrounding the site of the Preferred Alternative and the WTC cooling water intake. These requests were submitted to the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the New York Natural Heritage Program (NYNHP). NYNHP, a joint venture of NYSDEC and The Nature Conservancy since 1985, maintains an ongoing, systematic, scientific inventory on rare plants and animals native to New York State. NYSDEC maintains the NYNHP files. The NYNHP database is updated continuously to incorporate new records and changes in the status of rare plants or animals. In addition to the state program, the USFWS maintains information for federally listed threatened or endangered freshwater and terrestrial plants and animals, and the NMFS for federally listed threatened or endangered marine organisms.

REGULATORY FRAMEWORK

The following sections briefly describe the federal and state laws and associated regulations and regulatory programs that may apply to the Preferred Alternative with respect to terrestrial resources, water quality, and aquatic resources that are found within the vicinity of the WTC site and the WTC intake and outfalls. The regulations apply to certain activities in coastal areas and surface waters, and to the protection of species of special concern.

FEDERAL

The Clean Water Act (33 USC §§ 1251 to 1387)

The objective of the Clean Water Act, also known as the Federal Water Pollution Control Act, is to restore and maintain the chemical, physical, and biological integrity of U.S. waters. It regulates point sources of water pollution such as discharges of municipal sewage and industrial wastewater, and non-point source pollution such as runoff from streets, agricultural fields, construction sites and mining that enter waterbodies, from other than the end of a pipe. Section 402 of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES) which governs the review and issuance of permits for the discharge of pollutants to

surface waters. Section 402 also allows the EPA to delegate authority to states to carry out the NPDES program once they have met the specified requirements. New York has been delegated authority to implement NPDES, which it does through the State Pollutant Discharge Elimination System (SPDES), as discussed below in the section on New York regulations.

In addition, any applicant for a federal permit or license for an activity that may result in a discharge to navigable waters must provide to the federal agency issuing a permit a certificate, either from the state where the discharge will occur or from an interstate water pollution control agency, that the discharge will comply with Sections 301, 302, 303, 306, 307, and 316 (b) of the Clean Water Act. Applicants for discharges to navigable waters in New York must obtain a Water Quality Certificate from NYSDEC.

Coastal Zone Management Act of 1972 (16 USC §§ 1451 to 1465)

The Coastal Zone Management Act of 1972 established a voluntary participation program to encourage coastal states to develop programs to manage development within the state's designated coastal areas to reduce conflicts between coastal development and protection of resources within the coastal area. Federal permits issued in New York must be accompanied by a Coastal Zone Consistency Determination that evaluates consistency with New York's federally approved coastal zone management program.

Executive Order 11988, Floodplain Management

Executive order 11988 states that, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities."

Magnuson-Stevens Act (16 USC §§ 1801 to 1883)

Section 305(b)(2)-(4) of the Magnuson-Stevens Act outlines the process for the NMFS and the Regional Fishery Management Councils (in this case, the Mid-Atlantic Fishery Management Council) to comment on activities proposed by federal agencies (issuing permits or funding projects) that may adversely impact areas designated as essential fish habitat (EFH). EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 USC §1802(10)).

Endangered Species Act of 1973 (PL 93-205; 16 USC 1531 to 1544)

The Endangered Species Act of 1973 recognized that endangered species of wildlife and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the nation and its people. The Act prohibits the importation, exportation, take, possession, and other activities involving illegally taken species covered under the Act, and interstate or foreign commercial activities. The Act also provides for the protection of critical habitats on which endangered or threatened species depend for survival. USFWS (non-marine plants and animals) and NMFS (marine plants and animals) are responsible for administering the Act. Section 7(a) of the Act requires federal agencies to consult with the Secretary of the Interior (through USFWS and/or NMFS) before project implementation to ensure that the proposed action will not jeopardize a species, or destroy or adversely modify the designated critical habitat of the species.

Migratory Bird Treaty Act (16 USC §§703 to 712)

The Migratory Bird Treaty Act implements the United States' commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. Each of the treaties protects selected species of birds and specifies basic closed and open seasons for hunting game birds. The Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations. Title 50, Section 10.13, of the Code of Federal Regulations (50 CFR 10.13) lists the bird species protected under the Act.

STATE

State Pollutant Discharge Elimination System (SPDES), Article 17 Title 8, ECL, Implementing Regulations 6 NYCRR Parts 750, 751, 752, 753, 754, 755, 756, 757.

Title 8 of Article 17, ECL, Water Pollution Control, was enacted to protect and maintain surface and ground water resources and authorized the creation of the State Pollutant Discharge Elimination System (SPDES) to regulate discharges to the state's waters. The following activities require SPDES permits: constructing or using an outlet or discharge pipe (point source) that discharges wastewater into surface or ground waters of the State; constructing or operating a disposal system (sewage treatment plant); or discharge of stormwater. Construction activities that disturb one acre or more must obtain an SPDES permit.

SPDES addresses thermal discharges in ECL §§15-0313 and 17-0301, and the implementing regulations in 6 NYCRR Parts 704 and 750. Title 3 (Powers and Duties) of Article 15 (Water Resources), ECL, and Title 3 (Jurisdiction of the NYSDEC Authority, Powers and Duties) of Article 17 (Water Pollution Control), ECL, authorizes NYSDEC to establish water quality standards for thermal discharges to the waters of New York State, as implemented in 6 NYCRR Chapter X (Division of Water Resources) Part 704 (Criteria Governing Thermal Discharges) and Part 750 (SPDES). The thermal discharge criteria established in 6 NYCRR Part 704 include general criteria for waters receiving thermal discharges; special criteria specific to different types of State waters receiving thermal discharges; mixing zone criteria; and the requirement that the location, design, construction and capacity of cooling water intake structures for a point source thermal discharge reflect the best technology available for minimizing adverse environmental impact.

Waterfront Revitalization of Coastal Areas and Inland Waterways Act (Executive Law Sections 910-921).

Under this Act, the New York State Department of State (NYSDOS) is responsible for administering the Coastal Management Program (CMP). The Act also authorizes the State to encourage local governments to adopt Waterfront Revitalization Programs (WRP) that incorporate the State's policies. New York City has a WRP administered by the Department of City Planning.

Floodplain Management Criteria for State Projects (6 NYCRR 502)

Under 6 NYCRR 502, all state agencies are to ensure that the use of state lands, and the siting, construction, administration and disposition of state-owned and state-financed projects involving any change to improved or unimproved real estate are conducted in ways that will minimize flood hazards and losses. Projects are to consider alternative sites on which the project could be

located outside the 100-year floodplain. Projects to be located within the floodplain are to be designed and constructed consistent with the need to minimize flood damage within the 100-year floodplain and include adequate drainage to reduce exposure to flood hazards. All public utilities and facilities associated with the project are to be located and constructed to minimize or eliminate flood damage. The regulations specify that for nonresidential structures, the lowest floor should be elevated or flood-proofed to not less than one foot above the base flood level so that below this elevation the structure, together with associated utility and sanitary facilities, is watertight, with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. No project may be undertaken unless the cumulative effect of the proposed project and existing developments would not cause material flood damage to the existing developments. In cities with a designated floodway, no portion of the project may be placed within the adopted regulatory floodway to result in any increases in flood levels. The only regulatory floodway in New York City is the Bronx River, which is outside the Project Site.

Endangered and Threatened Species of Fish and Wildlife; Species of Special Concern, ECL, Sections 11-0535[1]-[2], 11-0536[2], [4], Implementing Regulations 6 NYCRR Part 182.

The Endangered and Threatened Species of Fish and Wildlife; Species of Special Concern Regulations prohibit the take, import, transport, possession or selling of any endangered or threatened species of fish or wildlife, or any hide, or other part of these species as listed in Section 182.6.

C. DESCRIPTION OF THE AFFECTED ENVIRONMENT

PRE-SEPTEMBER 11, 2001 BASELINE CONDITIONS

TERRESTRIAL RESOURCES

Before the terrorist attacks, the Project Site was occupied by the WTC PATH terminal (track and platform level, mezzanine/fare-zone level, and sub-grade pedestrian connections to adjacent streets, subways, and the WTC) within the portion of the WTC complex known as the "bathtub." The terminal had no above-ground features and was accessed through buildings within the WTC complex. Overlying the WTC PATH Terminal were the WTC's office and retail space. The Project Site, including the proposed location for the street-level terminal building was characterized primarily by urban land uses that provided limited habitat for terrestrial plants and animals—mostly office space and commercial, residential, cultural, and institutional uses. The nine-story (approximately 100 feet) Northeast Plaza Building (5 WTC) was located in the northeast corner where the street-level terminal building has been proposed as part of the Preferred Alternative. Open space areas within and adjacent to the Project Site provided limited habitat for terrestrial biota. The largest open space area within the Project Site in the vicinity of the proposed location for the street-level terminal building (Church Street, between Fulton and Dey streets) was the nearly 4-acre Austin J. Tobin Plaza that was located at the center of the WTC complex (Figure 13-1). The plaza had limited access from adjacent streets, was isolated from other open spaces around the WTC complex, and was sparsely vegetated. Other open space areas on the Project Site included landscaped areas along Church, Vesey, and Liberty Streets that contained planters, and a 1.06-acre plaza at 130 Liberty Street south of the main WTC complex that contained planters with trees and a large fountain. One Liberty Plaza, a 0.64 acre plaza to the southeast of the Project Site, also had planters and trees.

The natural resources found within the open space areas of the Project Site were characteristic of those found in the urban landscape: shade trees, planters with ornamental vegetation, and wildlife tolerant of urban conditions such as house sparrows, European starlings, pigeons, and rodents such as squirrels. Breeding birds documented in western lower Manhattan (including the Project Site) in the early 1980s by the NYSDEC Breeding Bird Atlas (census block 5750B) include: pigeon (*Columba livia*), mourning dove (*Zenaida macroura*), chimney swift (*Chaetura pelagica*), blue jay (*Cyanocitta cristata*), American robin (*Turdus migratorius*), northern mockingbird (*Mimus polyglottus*), European starling (*Sturnus vulgaris*), common grackle (*Quiscalus quiscula*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*). The peregrine falcon (*Falco peregrinus*), which is listed by the State of New York as endangered, is known to occur in the vicinity of the Project Site.

Migratory birds move through New York City during spring and autumn migrations between tropical Central and South American overwintering grounds and North American nesting grounds, and were known to use the limited habitat within the Project Site and surrounding areas as a resting habitat. Peak migration occurs between March and May in spring, and August and October in autumn. Examples of songbirds and other birds reported in bird strike data compiled by the New York City Audubon Society (NYCAS) at the WTC complex during spring and autumn migratory periods pre-September 11, 2001, include: white-throated sparrow (*Zonotrichia albicollis*), common yellowthroat (*Geothlypis trichas*), ovenbird (*Seiurus aurocapillus*), dark-eyed junco (*Junco hyemalis*), American woodcock (*Scolopax minor*), song sparrow (*Melospiza melodia*), swamp sparrow (*Melospiza georgiana*), gray catbird (*Dumetella carolinensis*), black-throated blue warbler (*Dendroica caeruluscens*), and black-and-white warbler (*Mniotilta varia*). Warbler and sparrow species constituted the majority of the species recorded during the NYCAS's 1997–2001 Project Safe Flight Program, as dead or injured from collisions with WTC complex buildings. No threatened, endangered, or special concern species were found dead or injured in the area during the program (NYCAS 2003).

FLOODPLAINS

Figure 13-2 indicates the location of the 100-year and 500-year floodplains within the Project Site. Prior to the September 11, 2001 attacks, a portion of the hotel (3 WTC), the western portion of Tobin Plaza, the pedestrian tunnel to the World Financial Center (WFC), and the western portion of the WTC PATH Terminal platform and tracks, were located within the 100-year floodplain. The pedestrian tunnel and WTC PATH Terminal platform and tracks were below grade. Flood protection measures in compliance with state and federal requirements were intact and operational. These included the bathtub walls and concrete slab to prevent ground water inundation, and the use of sump pumps.

WATER QUALITY AND AQUATIC RESOURCES

The WTC cooling water intake and outfalls, which were also used for the WTC PATH Terminal, are located at Battery Park City, in the lower Hudson River Estuary. The lower Hudson River Estuary is part of the New York/New Jersey Harbor Estuary, which also includes upper and lower New York Harbor, Arthur Kill, Kill Van Kull, East River, Raritan Bay, and Jamaica Bay. The Hudson River is the largest single freshwater input to this coastal plain estuary. The Hudson River Estuary extends approximately 150 miles upriver from the Battery to the Federal Dam at Troy, New York. The river gradient within the Estuary is very low, rising only 5 feet, and is tidally influenced throughout this extent (Moran and Limburg 1986).

Source: PANYNJ

Pre-September 11, 2001 photo showing the Austin J. Tobin Plaza

Figure 13-1

Austin J. Tobin Plaza
Pre-September 11, 2001

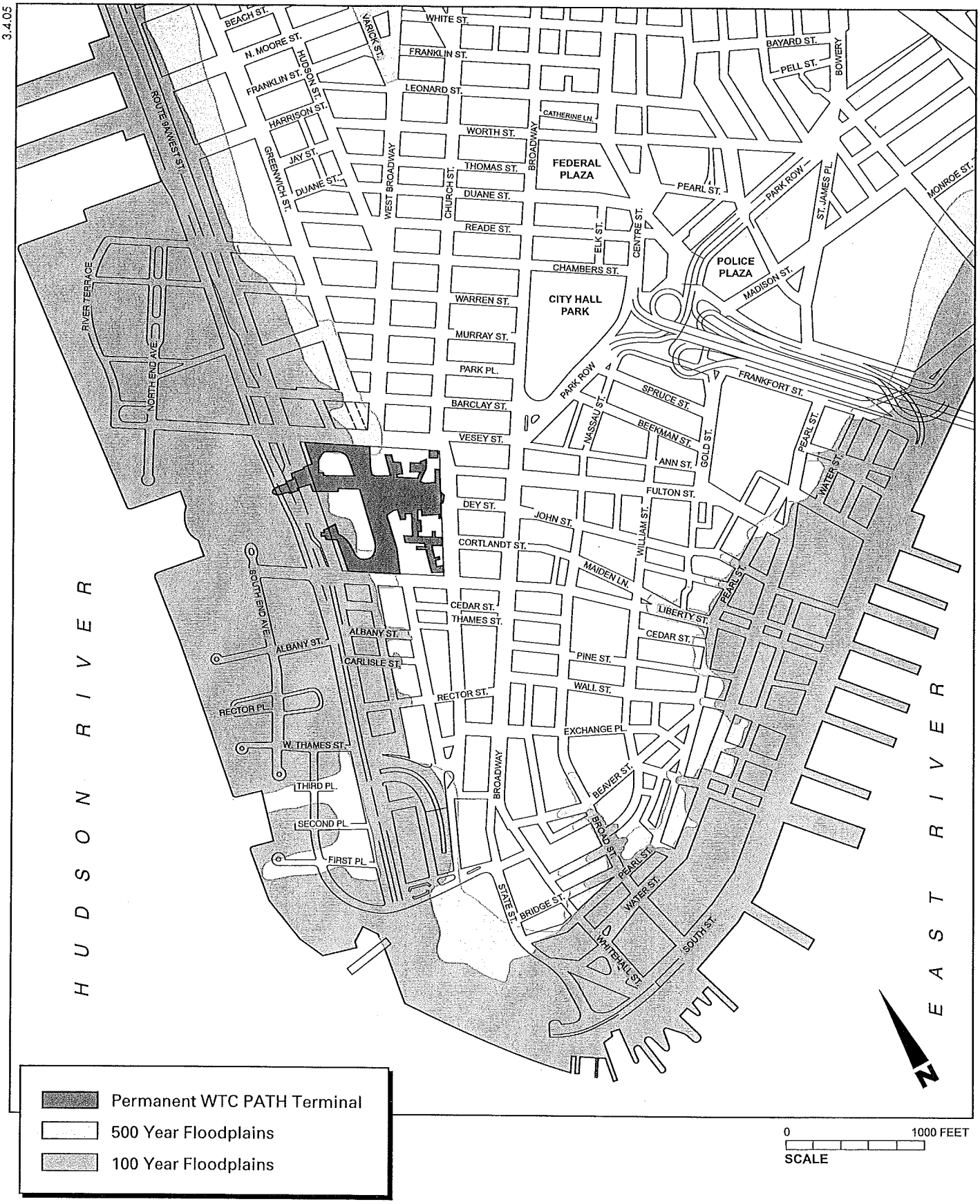


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Figure 13-2
Floodplains

Salt water and tides dominate the flows and physical characteristics of the lower Hudson River Estuary. The estuary receives salt water from Upper New York Harbor during the flood phase of a tidal cycle, discharging less saline water to the Upper Harbor during the ebb phase (Moran and Limburg 1986). The Estuary is partially stratified; more saline waters are generally found toward the bottom and fresher waters toward the surface. However, under low freshwater flow conditions the fresh and saline waters are generally well mixed (Busby and Darmer 1970).

Water Quality

The City of New York has monitored New York Harbor water quality with an annual survey (Harbor Survey) for over 90 years. NYCDEP conducts the survey by collecting water samples at stations in four designated regions: Inner Harbor Area, Upper East River-Western Long Island Sound, Lower New York Bay-Raritan Bay, and Jamaica Bay (NYCDEP 2002). The WTC cooling water intake and outfalls are located in the Inner Harbor Area, which includes the lower Hudson River to the Harlem River, the East River to the Battery, the Kill Van Kull and Arthur Kill, and the Upper New York Harbor south to the Narrows.

Major improvements to water quality of the Lower Hudson River Estuary, indicated by lower fecal coliform bacteria concentrations and higher dissolved oxygen concentrations, occurred in the mid- to late-1980s. These improvements were primarily due to regional decreases in municipal and industrial discharges that occurred through the construction and upgrading of water pollution control plants (NYCDEP 1998 and 2003). While water quality continued to improve until the early 1990s, since that time improvements have been relatively small (NYCDEP 2003). Therefore, the water quality conditions described for pre-September 11, 2001 would be expected to be similar to the post-September 11, 2001 conditions. Additionally, because the operation of the WTC cooling water intake and outfalls was in compliance with the 1999 SPDES permit conditions (EPA 2003), discharges of cooling water through the WTC outfalls would not be expected to have affected water quality.

Recent survey data from the Harbor Survey station closest to the project area, mid-stream off of Pier A just to the south, indicate that the water quality in this part of the lower Hudson River is good. Water quality usually meets the dissolved oxygen, fecal coliform, total coliform, and other water quality standards for Class I saline surface waters. NYSDEC defines Class I waters as saline surface waters that are best used for secondary contact recreation and fishing, and are suitable for fish propagation and survival. Temporary increases in fecal coliform concentrations may occur during wet weather due to increased fecal coliform loadings following a rain event. Dissolved oxygen concentrations in bottom waters occasionally fall below 4 mg/L standard for Class I waters. Secchi transparency measurements, which are used to test water clarity, indicate periodic reduced water transparency (i.e., increased cloudiness) in this area.

Sediment

Typical of any urban watershed, New York Harbor Estuary sediments are contaminated from a history of industrial uses in the area. Contaminants found throughout the New York Harbor Estuary include pesticides (i.e., chlordane and DDT), metals (i.e., mercury, cadmium, lead, and copper), polychlorinated biphenyls (PCBs), and various polycyclic aromatic hydrocarbons (Rohmann and Lilienthal 1987). Adams et al. (1998) found the mean sediment contaminant concentration for 50 of 59 chemicals measured in sediment samples from the New York/New Jersey Harbor Estuary to be statistically higher than other coastal areas on the East Coast. While the sediments of the New York Harbor Estuary are contaminated, the levels of most sediment

contaminants have decreased on average by an order of magnitude over the past 30 years (Steinberg et al. 2002).

Aquatic Biota

The New York/New Jersey Harbor Estuary, including the lower Hudson River, supports a diverse and productive aquatic community of over 100 species of finfish, more than 100 invertebrate species, and a variety of phytoplankton and zooplankton. The following sections provide a brief description of the aquatic biota found in the Harbor Estuary, focusing on the lower Hudson River. While the following description is based on studies that have been conducted in this area from the 1980s through the present, the aquatic community is generally considered to have been stable over the this period, although there is considerable annual and seasonal variability, and the description of existing conditions presented below would apply to the pre- and post-September 11, 2001 conditions.

Phytoplankton are microscopic plants whose movements within the system are largely governed by prevailing tides and currents. Light penetration, turbidity and nutrient concentrations are important factors in determining phytoplankton productivity and biomass. Diatoms such as *Skeletonema costatum* and *Thalassiosira* spp. generally dominate the phytoplankton community, with lesser contributions from dinoflagellates and green algae (Brosnan and O'Shea 1995). While nutrient concentrations in most areas of New York Harbor are very high, low light penetration has often precluded the occurrence of phytoplankton blooms. Limited light penetration also restricts the distribution of submerged aquatic vegetation in the Harbor. Benthic macroalgae are large multicellular algae that are important primary producers in the aquatic environment. Species of macroalgae that occur in the Harbor Estuary include sea lettuce, green fleece, and brown algae (*Fucus* spp.) (PBS&J 1998).

Zooplankton are an integral component of aquatic food webs—they are primary grazers on phytoplankton and detritus material, and are themselves used by organisms of higher trophic levels as food. The higher-level consumers of zooplankton typically include forage fish, such as bay anchovy, as well as commercially and recreationally important species, such as striped bass and white perch during their early life stages. Crustacean taxa (copepods *Acartia tonsa*, *Acartia hudsonica*, *Eurytemora affinis*, and *Temora longicornis)* dominate the zooplankton community, with the dominant species changing with the season (Stepien et al. 1981, Lonsdale and Cosper 1994, Perlmutter 1971, Lauer 1971, Hazen and Sawyer 1983).

The major groups of benthic invertebrates collected in the estuary include aquatic earthworms (oligochaetes), segmented worms (polychaetes), snails (gastropods), bivalves, barnacles, cumaceans, amphipods, isopods, crabs, and shrimp (EEA 1988, EA Engineering Science and Technology 1990, Coastal 1987, and PBS&J 1998).

New York City is located at the convergence of several major river systems, all of which connect to the New York Bight portion of the Atlantic Ocean. This convergence has resulted in a mixture of habitats in the Harbor Estuary and lower Hudson River that support marine, estuarine, anadromous (fish that migrate up rivers from the sea to breed in freshwater), and catadromous fish (fish that live in freshwater but migrate to marine waters to breed).

According to Woodhead (1990), populations of numerically dominant fish within the Harbor Estuary (hogchoker, tomcod, winter flounder, white perch and striped bass) remain relatively stable from year to year. Studies at Pier 76 north of the WTC cooling water intake during the winter from 1982 to 1983 and 1988 and 1992, reported that the same four species of fish (striped bass, white perch, winter flounder, and Atlantic tomcod) comprised about 88 to 90 percent of the

fishes collected (EEA 1988; Stoecker et al. 1992). Although there are differences in abundance of fish among years and seasons, field investigations conducted by Able et al. (1995) in the Lower Hudson River (Piers 40 and 76) in 1993 and 1994 found that the composition and distribution of fish were similar to those reported in previous studies such as Beebe and Savidge (1988). Nine species comprised nearly 95 percent of the total number of fish collected, with juvenile striped bass the most abundant followed by Atlantic tomcod, American eel, seaboard goby, cunner, northern pipefish, naked goby, winter flounder, and tautog (Able et al. 1995).

Researchers have also found substantial differences in the use of interpier, underpier and pile field areas by fish within the lower Hudson Estuary (EEA 1988, EA Engineering, Science and Technology 1990, Able et al. 1995, Able et al. 1998, Able et al. 1999, and Duffy-Anderson and Able 1999). In general, abundance and variety of fish species was greater in open water habitats and pile fields than under platforms, and for juvenile fish, habitat quality under platforms greater than 20,000 square meters (5 acres) appeared to be poor (Able et al. 1998).

ESSENTIAL FISH HABITAT (EFH)

An essential fish habitat (EFH) assessment was prepared for the *WTC Memorial and Redevelopment Plan GEIS* to identify EFH designations for the Lower Hudson River Estuary in the vicinity of the WTC intake and outfalls, and potential impacts from the operation of the intake and outfalls. This area has been identified as EFH for 15 species of fish: red hake (larvae, juveniles, and adults), winter flounder (eggs, larvae, juveniles, adults, and spawning), windowpane (eggs, larvae, juveniles, and adults), Atlantic herring (larvae, juveniles, and adults), bluefish (juveniles and adults), Atlantic butterfish (larvae, juveniles, and adults), Atlantic mackerel (juveniles and adults), summer flounder (larvae, juveniles, and adults), scup (eggs, larvae, and juveniles), black sea bass (juveniles and adults), king mackerel (eggs, larvae, juveniles, and adults), Spanish mackerel (eggs, larvae, juveniles, and adults), cobia (eggs, larvae, juveniles, and adults), sand tiger shark (larvae), and sandbar shark (larvae and adults).

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

Requests for information on rare, threatened or endangered species within the immediate vicinity of Project Site were submitted to USFWS, NMFS, and the NYSDEC Natural Heritage Program (NYNHP). Appendix G presents the responses from these agencies. USFWS indicated that no federally listed or proposed endangered or threatened species were currently known to exist in the vicinity of the Project Site (Stilwell 2003). NYNHP also indicated that they had no records of known occurrences of rare or state-listed animals or plants, substantial natural communities, or other substantial habitats, on or in the immediate vicinity of the Project Site (Conrad 2003). NMFS indicated that there may be seasonal use of the Hudson River by shortnose sturgeon (*Acipenser brevirostrum*), and occasional transient use by four species of marine turtle: loggerhead (*Caretta caretta*), green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*), and leatherback (*Dermochelys coriacea*) (Rusanowsky 2003). Because the information supplied by these federal and state resource agencies is based upon current and past records and habitat and water quality conditions have not changed substantially since 1990, the species identified apply to the pre-September 11, 2001 and post-September 11, 2001 conditions.

Shortnose sturgeon (New York State and federally listed endangered) have the potential to occur within the Lower Hudson River Estuary as transient individuals to and from upriver spawning and nursery grounds and overwintering areas. These fish spawn, develop, and overwinter well upriver, and prefer colder, deeper waters. Out of the more than 1,000 trawls taken in the

Westway study in both the Hudson and East River, only one shortnose sturgeon was collected, in the deep water habitat, near the Peekskill-Haverstraw section of the Hudson River. Long-term Hudson River monitoring data, collected by the New York Utilities and others since the 1970s, have also indicated that shortnose sturgeon inhabit deep-water habitats, and occur in greatest abundance north of the Tappan Zee Bridge.

The four species of marine turtles, all state and federally listed, can occur in New York Harbor. Juvenile Kemps ridley and large loggerhead turtles enter the New York Harbor and bays in the summer and fall. The other two species, green sea turtle and leatherback sea turtle, are usually restricted to the higher salinity areas of the Harbor (USFWS 1997). In general, however, these four turtle species mostly inhabit Long Island Sound and Peconic and Southern Bays. They neither nest in the New York Harbor Estuary, nor reside there year-round (Morreale and Standora 1995). Turtles leaving Long Island Sound for the winter usually do so by heading east to the Atlantic Ocean before turning south (Standora et al. 1990). It is unlikely that these turtle species would occur in the lower Hudson River except as occasional transients.

While not identified by NYNHP as occurring in the vicinity of the proposed location for the Preferred Alternative (Conrad 2003), the peregrine falcon (*Falco peregrinus*), which is listed by the State of New York as endangered, was identified by the NYNHP as occurring in the vicinity of the elements of the WTC Memorial and Redevelopment Plan (Houle 2003). Preferred habitats for this raptor include open areas such as tundra, savannah, seacoasts, and open forests, and tall buildings. Peregrine falcons feed primarily on birds that they capture in the air. Nests are built on high ledges between 50 to 200 feet off the ground. Young falcons may stay in the vicinity of the nest for about six weeks after fledging, developing their flying and hunting skills. Peregrine falcons mate for life and generally return to the same nesting territory each year. The number of breeding pairs in New York has increased steadily since the first peregrines returned to nest in New York City in 1983 (NYSDEC 2003).

CHANGES IN THE AFFECTED ENVIRONMENT SINCE SEPTEMBER 11, 2001

TERRESTRIAL RESOURCES

The limited natural resources within the Project Site were destroyed as a result of the terrorist attacks and subsequent during recovery efforts. The original WTC PATH Terminal sustained extensive damage. The Project Site is currently vacant except for the temporary WTC PATH station and the No. 1 and 9 subway line crossing the site. Construction of the temporary WTC PATH station began in July 2002 and was opened on November 23, 2003. The temporary station stands at the site of the original terminal and comprises five levels—platform, mezzanine, 1 and 9 underpass, concourse, and street level. The street level portion of the station includes an entry plaza and canopy along the west side of Church Street near Fulton Street that has little landscaping. The temporary WTC PATH station mezzanine, station platform, and rail tracks are located at the western portion of the Project Site.

The Project Site is fenced off except for the temporary WTC PATH station and a newly constructed sidewalk and viewing area on the west side of Church Street. All passengers must access and leave the temporary WTC PATH station at the street-level entrance at Church and Fulton Streets. Currently, terrestrial resources within the Project Site are limited to pioneering plant species that are capable of growing in denuded areas, and possibly occasional individual animals that are tolerant of extremely disturbed conditions. Some shade trees exist on the perimeter of the demolition area. Therefore, the Project Site and the surrounding area to be

developed as part of the WTC Memorial and Redevelopment Plan currently contain extremely limited habitat for wildlife, and would not likely be used as a stopover area by migratory birds.

FLOODPLAINS

The pedestrian tunnel leading from the WTC PATH Terminal to the WFC and the station platform and tracks were damaged as a result of the September 11, 2001 attacks. The platform and tracks were repaired as part of the temporary WTC PATH station, which was opened in November 2003. The pedestrian tunnel to the WFC remains closed. As was the case prior to September 11, 2001, the western portion of the platform and tracks for the temporary WTC PATH station are within the 100-year floodplain (Figure 13-2). Other elements of the WTC complex that were partially located within the floodplain on the Project Site prior to September 11, 2001, 3 WTC and Tobin Plaza, were removed as a result of the terrorist attacks and restoration efforts. In addition to the flood protection measures that were in place pre-September 11, 2001, additional sump pumps have been installed to minimize water on the Project Site and sandbags would be manually placed on existing truck ramps in the event of the 100-year flood.

WATER QUALITY AND AQUATIC RESOURCES

As discussed previously, because the major infrastructure improvements were completed by 1990, water quality has remained fairly consistent since the early 1990s. Therefore, the post-September 11, 2001 water quality is not expected to have changed from that described previously under the pre-September 11, 2001 condition.

Because the dominant fish in the lower Hudson River and the New York/New Jersey Harbor Estuary have remained fairly stable since the late 1980s, when the majority of the substantial infrastructure improvements occurred in New York City (Woodhead 1990, ASA 2003), the aquatic biota for the lower Hudson River described under the pre-September 11, 2001 conditions scenario would also represent the post-September 11, 2001 conditions. No changes would have occurred other than the shut-down of the WTC cooling water intake. It is not expected that the shut-down of the WTC intake on September 11, 2001 would have affected the species reported to be present in the Lower Hudson River Estuary.

Sampling programs conducted in the Lower Hudson River Estuary post-September 11, 2001 have collected similar fish species to those conducted pre-September 11, 2001. Sampling conducted within the Hudson River Park to track changes to the aquatic community over time after the post-September 11, 2001 emergency dredging that occurred near Pier 25 (Meixler et al. 2003) recorded 41 fish species within the park. The most abundant species were bay anchovy (87 percent), striped bass (4 percent), Atlantic herring (4 percent), and alewife (2 percent). Bay anchovy adults are known to occur in high numbers in the Lower Hudson River Estuary in the summer, and are generally absent from the estuary in the winter (Woodhead et al. 1992). Sampling conducted for the Hudson River Utilities (ASA 2003) in the Lower Hudson River Estuary has also found that the same dominant fish species have been collected in the monitoring program since the mid-1980s, although variations do occur from year to year. Sampling conducted by the ACE from 2002 to 2003 (LMS 2003) found the most common fish collected in the Upper Bay to be striped bass (December through January), winter flounder (February), windowpane (February through March), spotted hake (April) and bay anchovy (May through June). Atlantic menhaden, bay anchovy, windowpane, and winter flounder, species that spawn in the Harbor, occurred in high densities during their spawning period (March through July).

ESSENTIAL FISH HABITAT (EFH)

As identified in the World Trade Center Memorial and Redevelopment Plan FGEIS, no substantial changes in the EFH of the Lower Hudson River Estuary have occurred since September 11, 2001.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

No changes to potential endangered, threatened, or special concern species in the lower Hudson River are anticipated to have occurred since the events of September 11, 2001.

D. PROBABLE IMPACTS OF THE PROJECT ALTERNATIVES

CONSTRUCTION PERIOD (2006)

FUTURE COMMON TO ALL ALTERNATIVES

Terrestrial Resources

As discussed in Chapter 4, "Land Use, Neighborhood Character, and Public Policy," several projects are planned for the Project Site and immediate vicinity during the construction period for the Preferred Alternative. Noise, vehicular traffic, and other human activity associated with these projects have the potential to affect some wildlife. However, individuals using the limited resources available on the site would be expected to be tolerant of urban conditions and would not likely be affected by construction activities.

Floodplains

As described previously, certain elements of the WTC Memorial and Redevelopment Plan located on the Project Site would be constructed during the construction period for the Preferred Alternative. Of these, only the Memorial and Liberty Park North would be located within the floodplain portion of the Project Site. Both of these elements would include pervious and impervious surfaces and appropriate drainage systems. Flood protection measures present prior to September 11, 2001 would remain and continue to control flooding. In addition, all areas developed within the Project Site as part of the WTC Memorial and Redevelopment Plan would be constructed with appropriate stormwater management measures. Appropriate stormwater management measures would also be implemented during the reconstruction of the Route 9A. Therefore, these projects would not be expected to adversely affect the water retention and flood control characteristics within or adjacent to the Project Site.

Water Quality and Aquatic Resources

Potential impacts to water quality and aquatic resources associated with the projects described above would be addressed in separate environmental reviews and permitting, as necessary. Any stormwater discharges would be managed with approved Stormwater Pollution Prevention Plans (SWPPPs) and established regulatory programs to minimize potential impacts to water quality and aquatic resources.

There are proposed and ongoing projects aimed at improving water quality and aquatic resources in the New York/New Jersey Harbor Estuary, several of which are sponsored by PANYNJ, which have the potential to result in water quality and aquatic habitat improvements in the Lower Hudson River Estuary, where the WTC cooling water intake is located. These projects

are independent of the Preferred Alternative. Improvements that result from these projects would occur without the Preferred Alternative and are expected to continue through the construction period.

Several of the future water quality improvement efforts in the Lower Hudson River Estuary will be coordinated by the New York/New Jersey Harbor Estuary Program (HEP). The Final Comprehensive Conservation and Management Plan (NY/NJ HEP 1996) for the HEP included a number of goals to improve water quality and aquatic resources in the area. The plan outlines objectives for the management of toxic contamination, dredged material, pathogenic contamination, floatable debris, nutrients and organic enrichment, and rainfall-induced discharges. The HEP Habitat Workgroup has developed watershed-based priorities for identifying acquisition, protection, and restoration sites for the preservation and enhancement of tidal wetlands that will provide improved habitat for fish and macroinvertebrates as well as birds, mammals, and reptiles that depend on these habitats. No NY/NJ HEP Acquisition and Restoration Sites have been identified near the WTC intake and outfalls. NY/NJ HEP Acquisition and Restoration Sites in closest proximity to the lower Hudson River are listed below. These NY/NJ HEP will occur independent of the Preferred Alternative.

- Liberty State Park—Located in the Upper New York Bay it has been identified for restoration, including permanent protection of natural areas, enhancement of emergent habitat, and restoration of oyster beds;
- Western Manhattan Island Parks—Several parks on the western shore of Manhattan (Riverdale Park, Inwood Park, Fort Tryon, Fort Washington Park, and Riverside Park) have been selected as priority restoration sites and are targeted for non-point source pollution reduction measures in addition to habitat restoration;
- Spuyten Duyvil—Located on the Harlem River near its confluence with the Hudson River, this park was chosen as a priority restoration site for salt marsh restoration; and
- Bush Terminal—Located in Upper New York Bay on the Brooklyn shoreline, it was chosen as a priority restoration site for salt marsh restoration.

The Contamination Assessment and Reduction Project, sponsored by PANYNJ, is a component of HEP focused on understanding the fate and transport of contaminants discharged to the estuary, and using this information to develop measures that may be necessary to reduce sediment contamination. The principal chemicals of concern include dioxins/furans, PCBs, polyaromatic hydrocarbons (PAHs), metals (mercury, cadmium, and lead), and pesticides (dieldrin and chlordane). Continued research and monitoring programs are anticipated to play a role in the development of future management strategies for Harbor sediments (NY/NJ HEP undated, ACE 1999).

The Hudson-Raritan Estuary Ecosystem Restoration Project is a cooperative project being led by the ACE that was funded by a U.S. House of Representatives Resolution on 15 April 1999. PANYNJ is a co-sponsor of this project. Other agencies involved in this project include EPA, USFWS, NOAA, National Resource Conservation Service, New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Transportation (Office of Maritime Resources), NYSDEC, NYSDOS, NYCDEP, New York City Parks and Recreation, and New Jersey Meadowlands Commission. The focus of the study is to identify the actions needed to restore the Hudson-Raritan Estuary and develop a plan for their implementation. The study area for the program includes all the waters of New York and New Jersey Harbor and the tidally influenced portions of all rivers and streams that empty into the Harbor and ecologically

influence the Harbor. The program will identify measures and plans to restore natural areas within the estuary and enhance their ecological value, and address habitat fragmentation, and past restoration and mitigation efforts that were piecemeal in nature. Thirteen initial representative restoration sites in New York and New Jersey have been targeted as the first sites for inclusion as potential restoration projects for feasibility level analysis. It is anticipated that expedited restoration of these representative restoration sites will provide substantial immediate value to the ecosystem. None of these sites occur in the vicinity of the WTC intake and outfalls. Therefore, actions taken by the Hudson-Raritan Estuary Ecosystem Restoration Project with respect to these sites would occur with or without the Preferred Alternative.

The New York sites include:

- Alley Pond Park (bordering western Long Island Sound),
- Old Place Creek (a tributary to the Arthur Kill),
- Newtown Creek (a tributary to the lower East River),
- Brookville Creek (a tributary to Jamaica Bay),
- Dreier Offerman Park (bordering Coney Island Creek near The Narrows),
- Sherman Creek (a tributary to the Harlem River),
- Pelham Lagoon and Turtle Cove (a tributary to western Long Island Sound), and
- Tallapoosa (a tributary to western Long Island Sound).

The New Jersey sites include:

- Leonardo (bordering Raritan Bay),
- Rahway River (a tributary to Raritan Bay),
- Marquis Creek (a tributary to Raritan Bay),
- Liberty State Park (on western Upper New York Bay), and
- Kearny Marsh (with tributaries that drain to Newark Bay).

In addition to the 13 representative sites, three spin-off sites have been identified. These are restoration sites being evaluated in parallel to the representative sites. They include the Lower Passaic River and Hackensack Meadowlands in New Jersey, and Gowanus Canal in New York (a tributary to the Upper New York Bay).

The Comprehensive Port Improvement Plan, sponsored by PANYNJ, is a multi-agency plan for implementing economic development and environment improvement decisions for PANYNJ. Among the priority objectives for the Plan are the identification and protection of significant habitats, the investigation of innovative best management practices for reduction of non-point sources of water pollutants, and the incorporation of green technologies in port improvement projects.

NYSDEC and NJDEP, in coordination with the IEC, will continue to develop total maximum daily loads and to identify priority waterbodies in bi-annual 305(b) reports to EPA. Total maximum daily loads, once implemented, will reduce the daily inputs of various contaminants in an effort to improve water quality. New York State provided $255 million to implement wastewater improvements, nonpoint source abatement and aquatic habitat restoration projects in 1998. The State intends to continue water quality improvement projects in the Harbor for the foreseeable future.

EPA's National Combined Sewer Overflow (CSO) Strategy of 1989 requires states to eliminate dry weather overflows of sewers, meet federal and state water quality standards for wastewater discharges, and minimize impacts on water quality, plant and animal life, and human health.

CSOs are the largest single source of pollutants and pathogens to the New York Harbor. NYCDEP has taken several steps in recent years to mitigate discharges from CSOs, which, in combination with improvements that have been made to water pollution control plants (WPCP), are expected to result in future improvement in coliform, dissolved oxygen and floatables levels in the New York Harbor area. The Multi-Year Intended Use Plan of the NYC Municipal Water Financing Authority has identified several CSO improvement and abatement projects, which will be completed between 2003 and 2010. NYCDEP plans to increase the track-down and control of pollutants of concern including mercury, polychlorinated biphenyls, and solvents.

NO ACTION ALTERNATIVE

Terrestrial Resources

Under the No Action Alternative, the temporary WTC PATH station will remain operable and construction activity associated with the WTC Memorial and Redevelopment Plan will occur on the WTC site. The temporary WTC PATH station includes an entry plaza and canopy along the west side of Church Street near Fulton Street that has little landscaping. The temporary WTC PATH station is not constructed of materials such as reflective glass with the potential to affect wildlife. Therefore, the continued use of the station will not be expected to result in adverse impacts to wildlife during the construction period.

Floodplains

Under the No Action Alternative, the temporary WTC PATH station would continue to exist on the Project Site. All flood protection measures currently present on the Project Site would be maintained. The continued use of the temporary WTC PATH station would not be expected to adversely affect the floodplain.

Water Quality and Aquatic Resources

Under the No Action Alternative, the temporary WTC station would continue to exist. No adverse impacts to water quality or aquatic resources would be expected to occur due to stormwater discharge. The temporary WTC station is not heated or cooled and therefore would not require the withdrawal of Hudson River water.

PREFERRED ALTERNATIVE

Terrestrial Resources

The majority of the Preferred Alternative would be built underground in the bathtub, including the PATH tubes, tracks, platform level, mezzanine/fare-zone level, sub-grade connections to adjacent streets, New York City Transit subways, and on- and off-site developments. The street-level terminal building would be constructed in the northeast corner of the Project Site at the western side of Church Street between Dey and Fulton Streets.

The use of bright lighting associated with nighttime construction has the potential to attract some birds and may result in collisions with construction equipment. The above-grade portion of the temporary WTC PATH station, the steel beam in cross form, and the remnants of the Vesey Street stairway to plaza level are the only structures on the Project Site above street level. The temporary station, however, does not contain walls or reflective glass surfaces, and would not be expected to cause bird strikes. Because of the lack of reflective surfaces, vegetation, and tall

illuminated structures at the Project Site that might attract birds during the construction period, it is unlikely that bird collisions would occur.

Noise associated with construction activities would have the potential to deter some wildlife species from using the site. As noted above, these effects would not likely be adverse, given that the Preferred Alternative is located in a densely urban area that is populated by urban-tolerant species. Therefore, adverse impacts to terrestrial resources would not be expected to occur during construction of the Preferred Alternative.

Floodplains

Elements of the Project located in the 100-year floodplain, as delineated by FEMA, include small portions of the platform level, mezzanine level, and the east–west concourse (see Figure 13-2). All of these areas are below grade and would not adversely impact the floodplain. In addition, flood protection measures currently on the Project Site would be repaired or maintained to control the introduction of ground water and control stormwater during construction. The street-level Terminal Building would not be located within the floodplain. Construction of the Preferred Alternative would not result in adverse impacts upon the floodplain due to the grades to be reconstructed on the Project Site.

Water Quality and Aquatic Resources

During construction, stormwater management would be in compliance with the approved SWPPP. Stormwater generated within the Project Site would not be discharged directly to surface waters, but would be directed to the municipal combined sewer system, as described in Chapter 11, "Infrastructure and Energy." Groundwater recovered during dewatering activities and stormwater generated by PATH's east–west connection beneath Route 9A would be treated by NYSDOT or PANYNJ, depending upon which agency is charged with its construction (see Chapter 2, "Project Alternatives"), prior to discharge to the city's combined sewer system. Implementation of best management practices for erosion and sediment control and other measures of the SWPPP would minimize potential impacts to the municipal combined sewer system. Construction activities are not expected to substantially increase stormwater volume.

Essential Fish Habitat Assessment

Because no in-water construction activities would be required as part of this alternative, no physical alteration would occur to EFH in the vicinity of the WTC site during the construction period. There would be no need for dredging or any extensive bottom disturbing actions that could negatively affect fish habitat. In addition, no adverse impacts to water quality are anticipated from construction of the Preferred Alternative. Therefore, no adverse impacts to EFH would be expected to occur due to construction of the Preferred Alternative.

Endangered, Threatened, and Special Concern Species

As indicated by USFWS and NYNHP, no endangered, threatened, or special concern species or significant habitats are known to occur within the Project Site.

NMFS (Rusanowsky 2003) indicated that shortnose sturgeon and four marine turtle species may occur seasonally in the Hudson River. Because no in-water work would be done during construction of the project, and no stormwater generated at the project site would be discharged directly to surface waters during construction, no adverse impacts would be expected to occur to these species during the construction period of the Preferred Alternative.

OPENING YEAR (2009)

FUTURE COMMON TO ALL ALTERNATIVES

Terrestrial Resources

It is expected that all proposed open space elements of the WTC Memorial and Redevelopment Plan would be completed by 2009. The planned parks—at 7 WTC and within the WTC site—would include shade trees and other plantings. These open space areas would have the potential to provide some limited terrestrial habitat for resident birds and other urban-tolerant wildlife such as squirrels and resting habitat for migratory songbirds.

The World Trade Center Memorial and Redevelopment Plan and the Route 9A Project, which are independent from the Preferred Alternative, may introduce additional habitats within the study area. Open space areas planned on the WTC site and within the median of Route 9A could total approximately 7 acres. The Route 9A project will also include upgrades to the existing stormwater drainage system and a bikeway/walkway along the west side of the highway and features landscaping and planters.

Construction activities associated with the elements of the WTC Memorial and Redevelopment Plan planned for completion in 2015 (Towers 2, 3, 4, and 5, and hotel) would be ongoing. Noise associated with construction activities would have the potential to deter some wildlife species from using the habitats available in open space areas near the Project Site. However, most wildlife with the potential to use these areas are tolerant of urban conditions.

Brightly illuminated buildings and towers can attract birds (Schmidt-Keonig 1979) and have the potential to result in bird strikes at night during spring and autumn migratory periods. Potential impacts to birds due to collisions with buildings proposed as part of the WTC Memorial and Redevelopment Plan, and measures to reduce the potential for bird strikes, would be evaluated as part of the separate environmental review for the WTC Memorial and Redevelopment Plan.

Floodplains

By 2009, it is assumed that several of the elements of the WTC Memorial and Redevelopment Plan project would be complete, including the open space areas, Memorial, museum and cultural facilities, retail, and some office space. The WTC Memorial and Redevelopment Plan project is being addressed under a separate environmental review process. However, as discussed previously for the construction year, adverse impacts to the floodplain due to changes to the water retention and flood control characteristics of the Project Site would not be expected to occur from WTC Memorial and Redevelopment Plan project.

Water Quality and Aquatic Resources

As described above for the No Action Alternative during the construction period, proposed and ongoing projects aimed at improving water quality and aquatic habitat in the New York/New Jersey Harbor Estuary have the potential to result in water quality and aquatic habitat improvements in the Lower Hudson River Estuary. These projects are independent of the Project Alternatives. Improvements that result from these projects would occur with or without the Project Alternatives and are expected to continue through the opening year.

Implementation of approved SWPPPs would minimize stormwater impacts of the various development projects discussed previously that would be expected to occur as part of the WTC Memorial and Redevelopment Plan on and in the vicinity of the Project Site. By 2009 some

portions of these projects would be operational. Stormwater would be discharged to the combined sewer system and would not be discharged directly to surface waters.

The heated effluent discharged through the existing WTC cooling water system outfalls as part of the cooling system for the elements of the WTC Memorial and Redevelopment Plan completed in the opening year (2009) would be expected to meet the thermal criteria developed by NYSDEC and specified in 6 NYCRR Part 704 and the thermal criteria and monitoring requirements specified in PANYNJ's 1999 SPDES permit (Table 13-1). Conditions issued in the 1999 SPDES permit were developed by NYSDEC so that the WTC thermal effluent would be in compliance with surface water standard for Use I saline surface waters. Compliance with the thermal criteria specified in 6 NYCRR Part 704 and the permitting conditions would be considered protective of the designated use of the Lower Hudson River Estuary, including fish survival and reproduction. An Essential Fish Habitat (EFH) Assessment was prepared for the Lower Hudson River Estuary as part of the World Trade Center Memorial and Redevelopment Plan Final Generic Environmental Impact Statement (FGEIS). The full text of the EFH appears in Appendix I of the FGEIS, which is available at www.renewnyc.com.

Table 13-1
World Trade Center Cooling Water Outfall Discharge Limitations

Parameter	Discharge Limitations			Minimum Monitoring Frequency
	Daily Average	Daily Max	Units	
Flow	Monitor	Monitor	MGD	continuous
Discharge Temperature	Monitor	91	°F	continuous
Intake-Discharge Temperature Difference	Monitor	17	°F	daily
Total Residual Chlorine[1]	Monitor	0.2	mg/L	3 times per week
pH[2]	Monitor	Monitor	SU	2 times per month

Notes:
[1] Total residual chlorine shall not be discharged more than two hours per unit per day. There shall not be simultaneous chlorination of separable portions of a single unit more than one unit at one time.
[2] The intake pH range shall not be extended more than 0.1 pH unit.
Other Limitations:
Intake velocity at each fixed and/or traveling screen and at the first set of bar racks shall not exceed 1.8 fps.
Only one outfall may be operated at a time. Simultaneous use of Outfalls 001 and 002 is not allowed.
Source: NYSDEC State Pollution Discharge Elimination System Discharge Permit effective 05/01/99.

Potential adverse impacts to aquatic life from the operation of the WTC cooling water intake is being assessed under an independent action as part of the permit renewal process.

NO ACTION ALTERNATIVE

Terrestrial Resources

As discussed previously with respect to the construction period, because the temporary WTC PATH station is not constructed of materials such as reflective glass with the potential to affect wildlife, the continued use of the terminal would not be expected to result in adverse impacts to wildlife during the construction period.

Floodplains

Under the No Action Alternative the temporary WTC PATH station would remain and continue to operate on the Project Site. All flood protection measures currently present on the Project Site would be maintained. The continued use of the temporary WTC PATH station would not be expected to adversely affect the floodplain.

Water Quality and Aquatic Resources

Under the No Action Alternative, the temporary WTC station would continue to operate. No adverse impacts to water quality or aquatic resources would be expected to occur due to stormwater discharge. The temporary WTC station is not heated or cooled and therefore would not require withdrawal of Hudson River water.

PREFERRED ALTERNATIVE

Terrestrial Resources

Because most of the Preferred Alternative would be below street level, potential impacts to terrestrial resources would only be associated with the above-ground components that include the street-level terminal building, the headhouse adjacent to the Winter Garden, street-level entrances and emergency egress on the WTC site, and the ventilation structures in the median of Route 9A. In the opening year, landscaping around the street-level terminal building would provide limited wildlife habitat to wildlife species that tolerate urban conditions. Examples may include birds such as mourning doves, American robin, pigeon, sparrow, and chimney swifts, and small mammals such as squirrels, mice, and other rodents. The habitat provided by the landscaping around the street-level terminal building would contribute to the increased habitat resulting from the open space elements that would have been completed as part of the WTC Memorial and Redevelopment Plan. While the wildlife habitat resulting from the landscaping surrounding the street-level terminal would be small, it would be greater than what is currently available on the Project Site, and would be expected to be an enhancement compared to pre-September 11, 2001 conditions when the nine-story 5 WTC was present in this location.

The increased habitat that would be present as a result of this alternative and the proposed WTC Memorial and Redevelopment Plan would also have the potential to provide resting or stop-over habitat to migratory songbirds during the spring and autumn migrations, which is not present under current conditions. Because the open space area for the WTC Memorial and Redevelopment Plan and the Preferred Alternative in 2009 would be greater than what was present at the WTC complex pre-September 11, 2001, the resting habitat for migratory songbirds would also have the potential to increase compared to pre-September 11, 2001. However, this increase in bird habitat for resident and migratory species would have the potential to result in bird strikes on glass surfaces associated with the street-level terminal building.

As currently proposed, the street-level terminal would comprise an oblong glass and steel shell, the roof of which would contain two counterpoised glass wings that would rise more than 100 feet into the air and extend the length of the building (about 350 feet). The structure would allow natural light to illuminate the terminal concourse. The ceiling of the aboveground building may have the capacity to open up to the sky, between the two wing-like structures.

Potential impacts to resident and migratory birds associated with the Preferred Alternative would be greater than under the No Action Alternative because the above-ground portion of the temporary WTC PATH station is small and not constructed of materials that would encourage

strikes. Nighttime lighting of the building, and the proposed use of glass and steel for the street-level terminal would have the potential to result in the loss of migratory bird individuals. While the proposed design of the street-level terminal would not pose the same potential for bird strikes as the taller towers proposed for the WTC Memorial and Redevelopment Plan, it would still have the potential to attract migratory birds during the spring and fall migratory periods if brightly illuminated at night. However, measures could be considered for the Preferred Alternative that would reduce potential impacts to birds.

As discussed previously, brightly illuminated buildings and towers can attract birds (Schmidt-Keonig 1979). Nocturnal migrants, because they use primarily visual cues in the sky such as the stars and the setting sun (Moore 1987 in Ogden 1996) and topographical features on the ground (e.g., water surfaces and trees) to orient during flight, have the greatest potential to be fatally entrapped by lighted structures (Ogden 1996). Nocturnal migrants have been found to be attracted to and trapped by artificial light sources during bad weather conditions, and under good weather conditions with low clouds and no moon (Martin 1990 in Ogden 1996). Because most nocturnal migrants are normally active during the day outside the migratory period, their night vision is believed to provide poor resolution of detail, allowing them to detect only the grossest detail and a spatial resolution (Martin 1990 in Ogden 1996). Birds migrating at night have been found to enter artificially lit areas and then become trapped there by the light (Avery et al. 1976 in Ogden 1996), appearing to be disoriented. Nocturnal migrants have been observed flying around the light source to the point of exhaustion, colliding with the structure and each other (Ogden 1996).

Table 13-2 presents bird strike data compiled by the NYCAS from May 2001 to December 2003 (NYCAS 2004) for buildings near the Project Site. Data for buildings within the WTC complex are not presented because the buildings were not present through the entire data collection time frame. Birds reported in building collisions in Manhattan by NYCAS were primarily migratory songbirds, mostly warblers and sparrows, but also included representatives from other groups. During the 2001 through 2003 period the 15 bird species reported by NYCAS in highest number of bird strikes for all buildings included white-throated sparrow, common yellowthroat, dark-eyed junco, ovenbird, Nashville warbler, American woodcock, hermit thrush, ruby-crowned kinglet, blackpoll warbler, black-and-white warbler, yellow-bellied sapsucker, gray catbird, northern flicker, swamp sparrow, and golden-crowned kinglet. Although the lowest building near the Project Site with bird strikes reported for the 2001 to 2003 timeframe, the World Financial Center (WFC) Winter Garden had the highest number of reported bird strikes. The WFC Winter Garden possesses some characteristics similar to the general concept proposed for the street-level terminal building. It is a glass and metal atrium, about 125 feet high and 197 feet long. Indoor lighting is located toward the top.

Measures that have the potential to decrease bird strikes of nocturnal migrants include:

- Minimize amount of light emanating upward from the structure at night during the migratory season;
- Extinguish interior lights at night during the migratory season;
- Minimize exterior floodlighting during the migratory season; and
- Install perches on tall buildings so birds captured by nighttime lighting can rest (Ogden 1996).

Table 13-2
Bird Strike Data Compiled by NYCAS From May 2001 Through December 2003 for Buildings in the Vicinity of the Project Site

Building	Location	Height (feet)[1]	Bird Strikes
WFC Winter Garden	World Financial Center	125	83
2 WFC	NW corner West & Liberty Streets	645	66
4 WFC	SW corner Varick & Route 9A	500	40
3 WFC	200 Vesey Street	739	38
26 Federal Bldg	26 Federal Plaza	587	18
1 WFC	200 Liberty Street	577	13
Empire State Bldg	350 Fifth Ave	1250	7
1 Battery Park Plaza	Whitehall/Pearl/ State Street intersections	495	5
Embassy Suites Hotel	across Vesey St from WFC	~140	3
Gateway Plaza Bldg 200	Battery Park City	~340	3
Two Penn Plaza	Two Penn Plaza	412	2
Citibank Bldg	111 Wall Street	344	2
100 Church Street	Church Street between Barclay St & Park Place	229	1
95 Wall Street	NW corner Wall & Water Streets	~220	1
100 Wall Street	100 Wall Street	365	1

Note: [1] estimations multiplied number of stories by an average of 10 feet per story
Source: NYCAS (2004)

The use of glass as the primary material comprising the street-level terminal has the potential to result in day-time bird strikes. Klem (1989) estimated that the number of birds (resident and migratory individuals) killed by day-time window collisions at low-level structures (such as individual residences) ranges from approximately 100 million to close to one billion per year in the United States. Bird fatalities from window collisions do not necessarily occur immediately following the collision (Klem 1990a). Klem (1990b) concluded that birds do not recognize clear or reflective glass as a barrier, with those species whose activities occur on or near the ground, such as thrushes, wood warblers, and finches, being most vulnerable to daytime bird strike injury. Anything that increases the density of birds near windows would be expected to increase the daytime strike rate. Measures to reduce potential strikes are described in Section F, "Mitigation."

As described in Chapter 2, "Project Alternatives," two 40-foot-tall vent structures are necessary for the safe operation of the Preferred Alternative (piston relief and smoke evacuation). These structures would be located above Tunnels E and F within the Route 9A median. They would be buffered by trees and other plantings and would not be expected to result in losses to birds resulting from strikes. Additionally, noise levels at the vent structures resulting from the use of the vents would not be expected to exceed surrounding noise levels. Therefore, adverse impacts to terrestrial resources would not be expected to occur from the vent structures associated with the Preferred Alternative.

Other above-ground structures proposed as part of the Preferred Alternative would be one-story tall and, therefore, would not pose a substantial risk for bird strikes.

Floodplains

All of the elements of the Preferred Alternative, including the street-level entrances, emergency egress, and ventilation structures, within the floodplain would incorporate federal, state, and local regulations pertaining to flood protection measures similar to pre-September 11 conditions. A flood-proofing system would be required and would be designed so as not to require human intervention or mechanical actions. Therefore, no adverse impacts would be expected to occur to the water retention and flood control characteristics of the Project Site.

Water Quality and Aquatic Resources

During operation of the Preferred Alternative, stormwater would be diverted to the city combined sewer system. No stormwater would be discharged directly to the surface waters. In addition, stormwater systems would be constructed to reduce the post-development flow of water from the site as compared to pre-September 11, 2001 conditions. Pretreatment systems would remove approximately 80 percent of total suspended solids and 40 percent of total phosphorus before being discharged to the combined sewer system at the Project Site. The combined sewer system at the Project Site is pumped to the Newtown Creek Water Pollution Control Plant at the Manhattan Pump Station. Strategies for reuse of stormwater (see Chapter 11, "Infrastructure and Energy") would be explored in keeping with the green design, green construction, and sustainable design principles that have been developed (see Chapter 2, "Project Alternatives"). Therefore, adverse impacts to water quality or aquatic resources would not be expected to occur as a result of stormwater generated during the operation of the Preferred Alternative.

The river water cooling system includes two intakes located on the eastern shore of the Hudson River near the World Financial Center. River water cooling was used prior to September 11, 2001 and would be reestablished as part of the current redevelopment of the WTC site. The New York State Department of Environmental Conservation is currently reviewing PANYNJ's application to renew their State Pollutant Discharge Elimination System (SPDES) permit for the river water cooling system. As part of this application, PANYNJ has prepared a Best Technologies Available (BTA) study, which will be made publicly available upon the completion of NYSDEC's review. The study specifies measures to protect fish eggs and larve from entrainment and entrapment associated with the systems intake grates. These measures include:

- Using 3 gallons per minute (gpm)/ton chillers;
- Variable speed pumps; and
- Modifying the intake structure with 2 millimeter (mm) wedgewire screens to reduce the approach velocity to 0.5 feet per second (fps) with a corresponding river water flow of 120,000 gallons per minute (gpm).

While some level of impact to aquatic organisms due to entrainment of fish eggs (and much smaller numbers of larvae) is unavoidable utilizing the selected design, overall aquatic impacts are materially reduced from pre-September 11, 2001 conditions. The proposed system would eliminate the potential for impingement and would reduce entrainment of yolk-sac and post-yolk sac ichthyoplankton from pre-September 11, 2001 levels by an estimated 93 percent and 97

percent, respectively. In fact, virtually all (approximately 98 percent) of the entrained organisms are eggs, which are subject to high rates of natural mortality and fecundity. By excluding life stages of entrainable organisms with higher natural survival rates, the selected design minimizes the adverse environmental impact of the cooling water intake structures.

The river water cooling system would be closed-circuit such that water extracted from the Hudson River would not be mixed with potable water or stormwater as it travels through the system. Therefore, the system would not alter the composition of Hudson River water.

Regulations set forth at 6 NYCRR Part 704 establish water quality standards governing thermal discharges to the waters of the state. They require that "all thermal discharges to the waters of the State shall assure the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife in and on the body of water" [6 NYCRR §704.1(a)]. Part 704 also sets forth specific criteria for discharges that, if met, would assure compliance with the standard. The criteria for estuarine discharges include a maximum surface temperature of 90°F, a limit on the lateral extent of a 4°F temperature rise to two-thirds of the width of the receiving river, and a limit on the cross-sectional area with a 4°F temperature rise to one-half of the river cross section. Because of Hudson River hydrodynamics, the maximum surface temperature of 90°F is the critical criterion to be met.

The BTA study specifies that the maximum designed change in temperature (ΔT) of the proposed river water cooling system is 10°F. Therefore, cooling water flow discharges would not result in temperatures in excess of the 90°F criterion, since the maximum ambient surface water temperature is 80°F.

Therefore, the cooling water discharges would have no potential impacts to water temperature and water quality within the Hudson River.

Endangered, Threatened, and Special Concern Species

As indicated by USFWS and NYNHP, no endangered, threatened, or special concern species or significant habitats are known to occur within the Project Site. Peregrine falcons that may occur within the vicinity of the Project Site would be expected to be acclimated to the urban conditions characteristic of the Project Site and adjacent areas. Therefore, they would not likely be impacted by the operation of the few above-ground features associated with the Preferred Alternative (e.g., street-level terminal building, north and south vent structures, or access to World Financial Center).

DESIGN YEAR (2025)

FUTURE COMMON TO ALL ALTERNATIVES

Terrestrial Resources

By 2025, it is assumed that the elements of the WTC Memorial and Redevelopment Plan would be complete, comprising open space areas, Memorial, museum and cultural facilities, retail, and up to 10 million square feet of office space in the five towers. The "green" corridors would also be complete between the Battery Park City and Route 9A. Draft plans for the WTC site include plantings at all of the new parks and along the reopened Fulton and Greenwich Streets. Because the elements of the WTC Memorial and Redevelopment Plan are expected to be completed and open by 2015, landscaped areas would have matured by 2025. These areas would be expected to provide some limited habitat for urban-tolerant wildlife, which include resident birds and small

mammals, and resting habitat for migratory songbirds in the spring and autumn, as discussed previously for the Future Common to All Alternatives in the opening year.

The proposed structures for the WTC Memorial and Redevelopment Plan would fully operational. The presence of all five proposed towers by 2025 would have the potential to result in more bird strikes than in the opening year of 2009. By 2025, potential operational measures that may reduce bird strikes, such as lighting modifications, would have been explored and implemented as appropriate to reduce the potential losses associated with bird strikes.

Floodplains

By 2025, the design year, it is assumed that all of the elements of the WTC Memorial and Redevelopment Plan would be complete. As indicated above, the WTC Memorial and Redevelopment Plan project is being addressed under a separate environmental review process. However, as discussed previously for the construction year, adverse impacts to the floodplain due to changes to the water retention and flood control characteristics of the Project Site would not be expected to occur from the elements of the WTC Memorial and Redevelopment Plan.

Water Quality and Aquatic Resources

As described previously for the Future Common to All Alternatives in the opening year, the reestablished cooling system on the WTC site would not adversely impact water quality and aquatic resources. Furthermore, proposed and ongoing projects aimed at improving water quality and aquatic resources in the New York/New Jersey Harbor Estuary have the potential to result in water quality and aquatic habitat improvements in the Lower Hudson River Estuary. These improvements would occur without the Project Alternatives, and some of the previously described project activities may continue through the design year.

NO ACTION ALTERNATIVE

Terrestrial Resources

Under the No Action Alternative, by the design year it is assumed that the temporary WTC PATH station would no longer be in operation. However, the discontinued use of the temporary station would not adversely effect terrestrial resources.

Floodplains

The discontinued use of the temporary WTC PATH station would not be expected to adversely affect the floodplain.

Water Quality and Aquatic Resources

No adverse impacts to water quality or aquatic resources would be expected to occur without operation of the temporary WTC station.

PREFERRED ALTERNATIVE

Terrestrial Resources

Because the only elements of the Preferred Alternative with the potential to affect terrestrial resources—the above-ground components, including the street-level terminal building at the northeast corner of the Project Site (west side of Church Street between Fulton and Dey streets), the vent structures, and the entrance adjacent to the Winter Garden—would not have changed

from the opening year evaluation, potential impacts in the design year would be expected to be similar to those of the opening year. Therefore, adverse impacts to terrestrial resources would not be expected to occur from the operation of the Preferred Alternative in 2025. Measures to reduce potential impacts to birds striking the surface of the street-level terminal, such as lighting modifications, would be explored to minimize potential impacts to resident and migratory birds from the operation of the street-level terminal building.

Floodplains

No changes to the floodplain in the Project Site are anticipated to occur as a result of the operation of the Project Alternatives between the opening year and the design year.

Water Quality and Aquatic Resources

Stormwater management for the Preferred Alternative in the design year would be similar to that described in the opening year. Stormwater would continue to be diverted to the city combined sewer system. Pretreatment systems would remove approximately 80 percent of total suspended solids and 40 percent of total phosphorus before being discharged to the combined sewer system at the Project Site. Strategies for reuse of stormwater (see Chapter 11, "Infrastructure and Energy") would be explored in keeping with the green design, green construction, and sustainable design principles that have been developed (see Chapter 2, "Project Alternatives"). Therefore, adverse impacts to water quality or aquatic resources would not be expected to occur as a result of stormwater generated during the operation of the Preferred Alternative.

Furthermore, as described under the "Future Common to All Alternatives," the reestablished river water cooling system would not adversely impact water quality and aquatic resources in the vicinity of the WTC site. Therefore, the Preferred Alternative's continued use of this system in the design year would also not result in adverse impacts.

Endangered, Threatened, and Special Concern Species

As indicated by USFWS and NYNHP, no endangered, threatened, or special concern species or significant habitats are known to occur within the Project Site. Peregrine falcons that may occur within the vicinity of the Project Site would be acclimated to the urban conditions characteristic of the Project Site and adjacent areas. Therefore, they would not likely be impacted by the operation of the few above-ground features associated this alternative in the design year.

E. MITIGATION

TERRESTRIAL RESOURCES

The preliminary design of the terminal building poses some concern for fatal strikes by migratory birds both during the day and at night. Measures that have the potential to reduce daytime bird strikes include:

- Place attractants (such as feeders or vegetation) either within 1 foot of the glass surface so that birds that have been attracted to them do not build up enough momentum to sustain serious injury if they hit the glass upon departure, or more than 33 feet from the glass surface;
- Transform glass into a recognizable obstacle by uniformly covering glass surfaces with a decorative grid with 2- to 4-inch intervals;

- Angle windows such that the panes reflect the ground instead of surrounding vegetation and sky;
- Minimize use of reflective glass; and
- Minimize the illumination of interiors behind clear glass and the visibility of indoor plants from outside (Klem 1990b, Klem 1991 in Ogden 1996).

Measures that have the potential to decrease bird strikes of nocturnal migrants include:

- minimize amount of light emanating upward during the migratory season; and
- minimize exterior floodlighting during the migratory season.

Measures to reduce potential impacts to birds from striking the surface of the street-level terminal, such as those presented above, and to minimize the potential for birds to enter the building through an opening in the top of the structure, would be explored during final design. PANYNJ will explore all feasible, cost effective, and practical measures for reducing bird strikes that are in keeping with the Terminal's design concept.

FLOODPLAINS

Existing and rehabilitated flood protection measures would be implemented as part of the Preferred Alternative. As such, flood control would meet or exceed pre-September 11, 2001 conditions. Stormwater discharges would be managed with an approved Stormwater Pollution Prevention Plans (SWPPPs) and established regulatory programs to minimize potential impacts to floodplains, groundwater, water quality, and aquatic resources. ✳

A. INTRODUCTION

The Preferred Alternative would be located within New York City's Coastal Zone Boundary as outlined in the Department of City Planning's Coastal Zone Boundary of New York City, June 1986 (see Figure 14-1). As such, this chapter examines the compliance of the Preferred Alternative with coastal zone policies.

B. METHODOLOGY

The federal Coastal Zone Management Act (CZMA) of 1972 was established to support and protect the distinctive character of the waterfront, and set forth standard policies for reviewing proposed development projects along coastlines. The CZMA emphasizes the primacy of state decision-making regarding the coastal zone. Section 307 of the CZMA (16 USC §1456), called the Federal Consistency provision, is a tool that states use to manage coastal uses and resources, and to facilitate cooperation and coordination with federal agencies. Federal Consistency is the CZMA requirement that federal agency activities having reasonably foreseeable effects on any land or water use or natural resource of the coastal zone must be consistent with the enforceable policies of a coastal state's federally approved Coastal Management Program (CMP). Federal Consistency reviews are the responsibility of the lead state agency that implements or coordinates the state's federally approved CMP.

The program responded to city, state, and federal concerns about the deterioration and inappropriate use of the waterfront. In response, New York State adopted its own CMP, designed to balance economic development and preservation by promoting waterfront revitalization and water-dependent uses while protecting fish and wildlife, open space and scenic areas, public access to the shoreline, and farmland; and minimizing adverse changes to ecological systems and erosion and flood hazards. CMP provides for local implementation when a municipality adopts a local waterfront revitalization program, as is the case in New York City. The program encourages coordination among all levels of government to promote sound waterfront planning and requires consideration of the program's goals in making land use decisions. The New York State Department of State (NYSDOS) administers the program at the state level, and the New York City Department of City Planning (NYCDCP) administers it in the city.

The *New York City Waterfront Revitalization Program* (WRP) is the City's principal coastal zone management tool. The WRP was originally adopted in 1982 and approved by NYSDOS for inclusion in the New York State CMP. The WRP establishes the City's policies for development and use of the waterfront and provides a framework for evaluating discretionary actions in the coastal zone. The WRP was revised and was approved by the City Council in October 1999. In August 2002, the NYSDOS and federal (i.e., the U.S. Army Corps of Engineers) authorities adopted the City's 10 WRP policies for projects located within its boundaries. This chapter reviews the 10 New York City coastal zone policies, which constitute the new WRP, and assesses, where applicable, the general consistency of the Preferred Alternative with these policies.

Potential effects on coastal resources include both direct and indirect impacts. Direct effects may result from temporary (construction) or permanent activities within the coastal zone or restriction of physical or visual access. Indirect effects may include the introduction of activities that result in growth-inducing impacts or may lead to other activities that further erode coastal resources. The potential effects on coastal resources from the Preferred Alternative are assessed for their consistency with the applicable WRP policies and to determine whether they would have an adverse effect on coastal resources.

C. DESCRIPTION OF THE AFFECTED ENVIRONMENT

As shown in Figure 14-1, the majority of the Project Site is located within the coastal zone. In the vicinity of the WTC site, the coastal zone boundary generally follows Greenwich Street. However, it expands eastward along Vesey and Liberty Streets to Church Street, and therefore includes the entire WTC site. This coastal zone boundary was not changed as a result of the terrorist attacks of September 11, 2001.

D. PROBABLE IMPACTS OF THE PROJECT ALTERNATIVES

New York City's WRP includes 10 policies designed to maximize the benefits derived from economic development, environmental preservation, and public use of the waterfront, while minimizing the conflicts among those objectives. Each Project Alternative is presented below, followed by a discussion of its applicability to and consistency with the appropriate policies.

NO ACTION ALTERNATIVE

The No Action Alternative may preclude PATH operations between New Jersey and Lower Manhattan at some point in the future and would result in the increased use of other modes of travel, such as automobiles, buses, subways, ferries, and commuter rail. The lack of subgrade pedestrian concourses, which would be constructed as part of the Preferred Alternative, would limit mobility through and around the WTC site, and, thus, access to the waterfront. Specifically, the No Action Alternative would not support the following policies of the WRP.

Policy 1: Support and facilitate commercial and residential development in areas well-suited for such development.

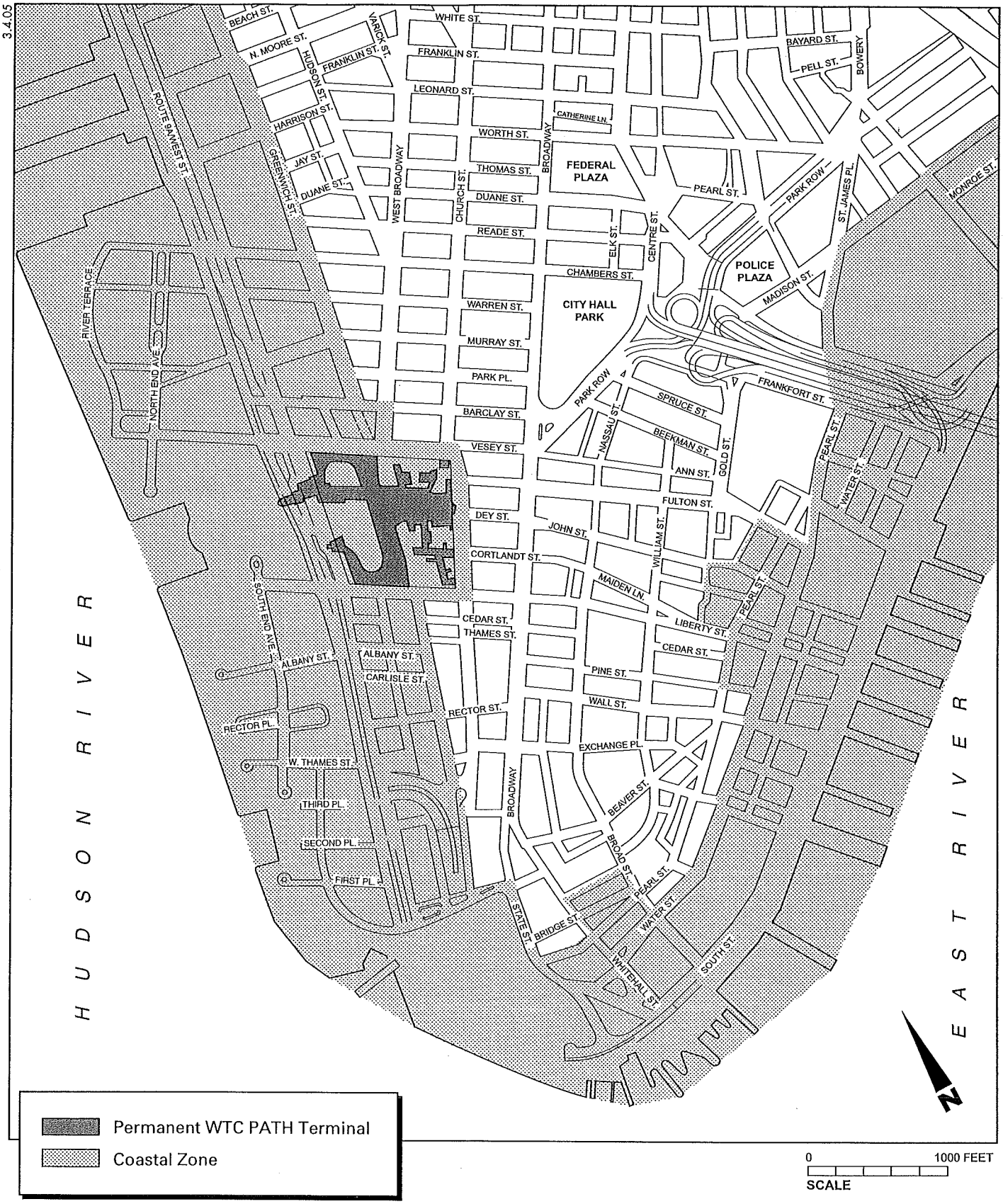
As described in Chapter 5, "Socioeconomic Conditions," the Preferred Alternative is a component of the economic revitalization and future development of Lower Manhattan.

Policy 8: Provide public access to and along New York City's coastal waters.

Although the No Action Alternative would not preclude waterfront access, it would eliminate subgrade concourses, which would improve access between the WTC site, points east, and the Battery Park City waterfront.

PREFERRED ALTERNATIVE

Policy 1: Support and facilitate commercial and residential development in areas well-suited to such development.



PERMANENT WTC PATH TERMINAL
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Figure 14-1
Coastal Zone Boundary

Policy 1.1: Encourage commercial and residential redevelopment in appropriate coastal zone areas.

The Preferred Alternative would include approximately 5,000 square feet of accessory retail within the Terminal. This alternative would help to encourage commercial and residential development in the area by facilitating the movement of workers and visitors to the Project Site and surrounding area.

Policy 1.2: Encourage non-industrial development that enlivens the waterfront and attracts the public.

The Preferred Alternative would replace and enhance the preexisting transit facility. While the Terminal itself would not enliven the waterfront, it would facilitate the movement of people to and from the Project Site to the surrounding waterfront. The Permanent Terminal's underground pedestrian connection to the World Financial Center would facilitate movement of workers and visitors to the World Financial Center and the waterfront open spaces in Battery Park City and Hudson River Park.

Policy 1.3: Encourage redevelopment in the coastal area where public facilities and infrastructure are adequate or will be developed.

The construction of the Preferred Alternative would replace and improve the preexisting infrastructure damaged during the September 11, 2001 attacks on the WTC. This alternative would reestablish the critical connection between PATH and New York City subway lines (1, 9, E, R, and W) to facilitate movement of employees, commuters, and visitors to and around Lower Manhattan. In addition to reestablishing the connections that existed before September 11, 2001, the new facility would link with the Fulton Street Transit Center, Hudson River ferries, and a proposed commuter rail connection to JFK Airport. The infrastructure to serve the operation of the Preferred Alternative is consistent with this policy.

Policy 2: Support water-dependent and industrial uses in New York City coastal areas that are well-suited to their continued operation.

Policy 2.1: Promote water-dependent and industrial uses in Significant Maritime and Industrial Areas.

The Project Site is not located in a Significant Maritime and Industrial Area; therefore, this policy is not applicable.

Policy 2.2: Encourage working waterfront uses at appropriate sites outside the Significant Maritime and Industrial Areas.

The Preferred Alternative does not have direct waterfront access. However, the terminal would aid the movement of people to and from the Project Site to the surrounding waterfront.

Policy 2.3: Provide infrastructure improvements necessary to support working waterfront uses.

Construction of the Preferred Alternative is an infrastructure improvement that would facilitate the movement of workers between New Jersey and Manhattan. While it would not specifically support working waterfront uses, this alternative would introduce a pedestrian connection to the World Financial Center, which would enhance the

movement of workers and visitors to and from commercial uses in the World Financial Center, which is located in close proximity to the waterfront.

Policy 3: Promote use of New York City's waterways for commercial and recreational boating and water-dependent transportation centers.

Policy 3.1: Support and encourage recreational and commercial boating in New York City's maritime centers.

The Project Site, which is the site of the former WTC PATH Terminal, is in close proximity to the recreational/commercial boating and ferry transportation at the World Financial Center. This alternative will promote the use of this waterfront area by providing improved pedestrian access.

Policy 3.2: Minimize conflicts between recreational, commercial, and ocean-going freight vessels.

The Preferred Alternative does not involve recreational, commercial, or ocean-going freight vessels; therefore, the project would not create conflicts among these vessels.

Policy 3.3: Minimize impact of commercial and recreational boating activities on the aquatic environment and surrounding land and water uses.

The construction and operation of the Preferred Alternative would not involve any commercial or recreational boating activities; therefore, this policy is not applicable.

Policy 4: Protect and restore the quality and function of ecological systems within the New York City coastal area.

Policy 4.1: Protect and restore the ecological quality and component habitats and resources within the Special Natural Waterfront Areas, Recognized Ecological Complexes, and Significant Coastal Fish and Wildlife Habitats.

The Project Site is not located within a Special Natural Waterfront Area or Recognized Ecological Complex. However, the Preferred Alternative would use river water cooling for its Heating, Ventilation, and Air Conditioning (HVAC) systems, which may impact aquatic habitats within the Hudson River. The river water cooling system includes two intakes located on the eastern shore of the Hudson River near the World Financial Center. River water cooling was used prior to September 11, 2001 and would be reestablished as part of the current redevelopment of the WTC site. The New York State Department of Environmental Conservation is currently reviewing PANYNJ's application to renew their State Pollutant Discharge Elimination System (SPDES) permit for the river water cooling system. As part of this application, PANYNJ has prepared a Best Technologies Available (BTA) study that specifies measures to protect fish eggs and larve from entrainment and entrapment associated with the systems intake grates. These measures include:

- Using 3 gallons per minute (gpm)/ton chillers;
- Variable speed pumps; and
- Modifying the intake structure with 2 millimeter (mm) wedgewire screens to reduce the approach velocity to 0.5 feet per second (fps) with a corresponding river water flow of 120,000 gallons per minute (gpm).

While some level of impact to aquatic organisms due to entrainment of fish eggs (and much smaller numbers of larvae) is unavoidable utilizing the selected design, overall aquatic impacts are materially reduced from pre-September 11, 2001 conditions. The proposed system would eliminate the potential for impingement and would reduce entrainment of yolk-sac and post-yolk sac ichthyoplankton from pre-September 11, 2001 levels by an estimated 93 and 97 percent respectively. In fact, virtually all (approximately 98%) of the entrained organisms are eggs, which are subject to high rates of natural mortality and fecundity. By excluding life stages of entrainable organisms with higher natural survival rates, the selected design minimizes the adverse environmental impact of the cooling water intake structures.

Policy 4.2: Protect and restore tidal and freshwater wetlands.

There are no New York State Department of Environmental Conservation (NYSDEC) or U.S. Army Corps of Engineers (ACE) mapped tidal or freshwater wetlands on the Project Site. Therefore, this policy is not applicable.

Policy 4.3: Protect vulnerable plant, fish, and wildlife species, and rare ecological communities. Design and develop land and water uses to maximize their integration or compatibility with the identified ecological community.

Requests for information on rare, threatened or endangered species within the immediate vicinity of Project Site were submitted to United States Fish and Wildlife Service (USFWS), the NYSDEC Natural Heritage Program (NYNHP), and National Marine Fisheries Service (NMFS). USFWS indicated that no federally listed or proposed endangered or threatened species were currently known to exist in the vicinity of the Project Site. NYNHP also indicated that they had no records of known occurrences of rare or state-listed animals or plants, significant natural communities, or other significant habitats, on or in the immediate vicinity of the Project Site. NMFS identified seasonal use of the Hudson River by shortnose sturgeon and occasional transient use by four species of marine turtle. However, the Terminal is not directly located along the Hudson River waterfront; therefore, these intermittent transient species would not be disturbed. As a result, this alternative is consistent with this policy (see Chapter 13, "Natural and Water Resources").

Policy 4.4: Maintain and protect living aquatic resources.

See Policy 4.1, above.

Policy 5: Protect and improve water quality in the New York City coastal area.

Policy 5.1: Manage direct or indirect discharges to waterbodies.

Potential impacts to water quality and aquatic resources associated with construction and stormwater discharge from the Terminal would be managed with an approved Stormwater Pollution Prevention Plan (SWPPP), in conformance with NYSDEC SPDES permit requirements. Construction groundwater discharges and stormwater generated within the Project Site would be directed to the municipal stormwater system. Best Management Practices for erosion and sediment control would be implemented to minimize potential impact to the municipal stormwater system (see Chapter 13, "Natural and Water Resources").

As described above, for Policy 4.1, the Preferred Alternative would employ a river water cooling system. NYCDEC is currently reviewing PANYNJ's application to renew the SPDES permit for the WTC site. The application includes a BTA study that includes strategies to reduce impacts to water quality.

The river water cooling system would be closed-circuit such that water extracted from the Hudson River would not be mixed with potable water or stormwater as it travels through the system. Therefore, the system would not alter the composition of Hudson River water.

Regulations set forth at 6 NYCRR Part 704 establish water quality standards governing thermal discharges to the waters of the state that requires. They require that "all thermal discharges to the waters of the State shall assure the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife in and on the body of water" [6 NYCRR §704.1(a)]. Part 704 also sets forth specific criteria for discharges that, if met, would assure compliance with the standard. The criteria for estuarine discharges include a maximum surface temperature of 90°F, a limit on the lateral extent of a 4°F temperature rise to two-thirds of the width of the receiving river, and a limit on the cross-sectional area with a 4°F temperature rise to one-half of the river cross section. Because of Hudson River hydrodynamics, the maximum surface temperature of 90°F is the critical criterion to be met.

The BTA study specifies that the maximum designed change in temperature (ΔT) of the proposed river water cooling system is 10°F. Therefore, cooling water flow discharges would not result in temperatures in excess of the 90°F criterion, since the maximum ambient surface water temperature is 80°F.

Therefore, the cooling water discharges would have no potential impacts to water temperature and water quality within the Hudson River.

Policy 5.2: Protect the quality of New York City's waters by managing activities that generate non-point source pollution.

See policy 5.1, above.

Policy 5.3: Protect water quality when excavating or placing fill in navigable waters and in or near marshes, estuaries, tidal marshes or wetlands.

Construction of the Preferred Alternative would not require any excavation or the placement of fill in navigable waters or near marshes, estuaries, tidal marshes, or wetlands. Therefore, this policy is not applicable.

Policy 5.4: Protect the quality and quantity of groundwater, streams, and the sources of water for wetlands.

The site does not contain any potable groundwater, nor does it contain streams or the source of water for wetlands. Therefore, this policy is not applicable.

Policy 6: Minimize the loss of life, structures, and natural resources caused by flooding and erosion.

Policy 6.1: Minimize losses from flooding and erosion by employing non-structural and structural management measures appropriate to the condition and use of the property to be protected and the surrounding area.

The Project Site is partially located within the 100-year flood plain. The 100-year floodplain is regulated by the Federal Emergency Management Agency (FEMA), and is defined as areas that have a 1 percent chance of flooding each year due to storms. The 100-year floodplain is usually characterized by dry land, but has the potential of being covered with flood water. Executive Order 11988 and its implementing regulations, 24 CFR Part 55, require federal agencies to consider alternatives to avoid adverse effects and incompatible development in the floodplains.

The Preferred Alternative would not alter the natural features of the shoreline or any structural or non-structural flood or erosion control measures. The project would not increase the amount of impervious surface on the site as compared to the pre-September 11, 2001 condition, and thus would not increase flood hazards on or adjacent to the Project Site. Therefore, the buildings and facilities would be built to withstand these flood conditions so as not to be damaged in the event of a flood. Consistent with this policy, this will minimize the potential for property damage and endangering human life (see Chapter 13, "Natural and Water Resources.")

Policy 6.2: Direct public funding for flood prevention or erosion control measures to those locations where the investment will yield significant public benefit.

The Preferred Alternative does not involve public funding for such measures; therefore, the proposed policy is not applicable.

Policy 6.3: Protect and preserve non-renewable sources of sand for beach nourishment.

There are no non-renewable sources of sand on the Project Site; therefore, this policy does not apply.

Policy 7: Minimize environmental degradation from solid waste and hazardous substances.

Policy 7.1: Manage solid waste material, hazardous wastes, toxic pollutants, and substances hazardous to the environment to protect public health, control pollution, and prevent degradation of coastal ecosystems.

As discussed in Chapter 12, "Contaminated Materials," it is not anticipated that contaminated materials will be encountered within the western portion of the Project Site during construction of the Preferred Alternative. However, excavation/tunneling activities associated with the proposed egress routes may encounter fill material, which could include contaminants and/or contaminated groundwater. Construction activities would be performed using appropriate construction and engineering practices. In addition, a Health and Safety Plan (HASP) would be prepared and implemented (see Chapter 12).

Operation of both the Permanent WTC PATH Terminal, specifically the PATH train system, would include the use of limited quantities of hazardous materials and petroleum products. These materials are used in conjunction with the current system and such materials are not stored on the WTC site. No changes in materials handling for the PATH system are anticipated with the proposed project; thus, there would continue to be no materials storage at the Project Site. The Port Authority of New York and New Jersey (PANYNJ) has established a series of standard operating procedures, which include measures to be undertaken in the event of a discharge of hazardous materials or petroleum products. These procedures would continue to apply in the future with the Preferred Alternative.

Policy 7.2: Prevent and remediate discharge of petroleum products.

See Policy 7.1, above.

Policy 7.3: Transport solid waste and hazardous substances and site solid and hazardous waste facilities in a manner that minimizes potential degradation of coastal resources.

See Policy 7.1, above. The minimal waste generated by this alternative would be hauled by a licensed waste hauler according to applicable laws and regulations (see Chapter 12).

Policy 8: Provide public access to and along New York City's coastal waters.

Policy 8.1: Preserve, protect and maintain existing physical, visual, and recreational access to the waterfront.

The Project Site is located both above and below ground on a site that was previously the WTC and PATH Terminal. The original PATH terminal had no physical, visual, or recreational access to the waterfront to be preserved, protected, or maintained. As part of the Preferred Alternative, a pedestrian connection would be constructed between the Terminal and Battery Park City. This connection would provide better access to the west side of Manhattan and the waterfront open spaces within Battery Park City and Hudson River Park.

Policy 8.2: Incorporate public access into new public and private development where compatible with proposed land use and coastal location.

See Policy 8.1.

Policy 8.3: Provide visual access to coastal lands, waters, and open space where physically practical.

The project has been planned in coordination with the redevelopment of the WTC. A master plan for the site will be implemented and includes approximately 5.5 acres of open space. The development of the Preferred Alternative would not preclude the WTC master plan.

Policy 8.4: Preserve and develop waterfront open space and recreation on publicly owned land at suitable locations.

The Preferred Alternative would be constructed on the site of the former World Trade Center and PATH Terminal. The Preferred Alternative would not preclude the construction of open space uses as part of the WTC Memorial and Redevelopment Plan.

Policy 8.5: Preserve the public interest in and use of lands and waters held in public trust by the State and City.

The Preferred Alternative would not hinder current accessibility to the waterfront nor interfere with the continued use or ownership of land and waters held in the public trust as the Preferred Alternative is not located directly along the waterfront. The underground pedestrian connection between the terminal and the World Financial Center would improve movement of workers and visitors to the waterfront. Thus, the public interest in the use of lands and water held in public trust (i.e., Battery Park City

esplanade and Hudson River Park) would be encouraged and preserved. As a result, this alternative would be consistent with this policy.

Policy 9: Protect scenic resources that contribute to the visual quality of the New York City coastal area.

Policy 9.1: Protect and improve visual quality associated with New York City's urban context and the historic and working waterfront.

The visual character of the Hudson River waterfront and Lower Manhattan consist of an urban landscape with tall commercial and industrial buildings. The only visible elements of the Permanent WTC PATH Terminal would be the terminal building, which would provide street-level access to the WTC site and to Greenwich and Church Streets and the north and south ventilation structures to be constructed in the Route 9A median. The Terminal would be modern in design and lower in height than the adjacent buildings to its north and south, and would be consistent with view corridors in the WTC master plan. The ventilation structures would replace two 12-foot ventilation structures for the original PATH terminal, would be of long and slender massing, and would stand 40 feet in height. It is anticipated that the structures would be clad in reflective material, in keeping with modern material used on buildings in the immediate area. The terminal and ventilation structures are in scale and character with existing visual resources in Lower Manhattan and would be consistent with protecting and enhancing the existing scenic values and character of the area. As discussed in Chapter 7, "Urban Design and Visual Resources," it is likely that the terminal would become an important visual resource on the Project Site.

Policy 9.2: Protect scenic values associated with natural resources.

There are no natural resources on the Project Site, nor is it located in a Special Natural Area District, Special Natural Waterfront Area, or Recognized Ecological Complex; therefore, this policy does not apply.

Policy 10: Protect, preserve, and enhance resources significant to the historical, archaeological, and cultural legacy of the New York City coastal area.

Policy 10.1: Retain and preserve designated historic resources and enhance resources significant to the coastal culture of New York City.

As discussed in Chapter 6, "Cultural Resources," to avoid, minimize, and mitigate adverse effects to historic resources during construction of the Preferred Alternative, a Memorandum of Agreement pursuant to Section 106 of the NHPA has been executed. As specified in the MOA, a Construction Protection Plan(s)—based on the requirements laid out in the "New York City Department of Buildings Technical Policy and Procedure Notice #10/88"—would be developed in consultation with the State Historic Preservation Officer (SHPO) and implemented before commencement of any excavation or construction. In addition, as described in Chapter 10, "Noise and Vibration," special vibration protection measures would be implemented to protect historic resources from increased vibration levels associated with construction activities. Implementation of the Construction Protection Plan(s) and the vibration protection measures would avoid or minimize the potential for adverse effects to historic resources during construction.

Measures to mitigate adverse effects to the National Register-eligible WTC site have been specified as part of the Memorandum of Agreement for the project (see Appendix B).

Once constructed, it is anticipated that the Preferred Alternative would continue the existing trend of modern buildings juxtaposed against the historic fabric of Lower Manhattan. The Terminal's design will also incorporate measures to avoid, minimize, or mitigate adverse impacts to remaining remnants and structures on the WTC site per the stipulations of the executed Memorandum of Agreement for the Permanent WTC PATH Terminal. The measures include the preservation of the passageway to the E train, architectural treatments on the platform level, and visual access to remaining resources, where possible. PANYNJ would coordinate with SHPO and the project's Section 106 consulting parties on the incorporation of these elements as the Terminal's design moves forward. Overall, the Terminal is not expected to have any contextual or visual effects on any known or potential historic resources (see Chapter 6, "Cultural Resources").

Policy 10.2: Protect and preserve archaeological resources and artifacts.

(See Policy 10.1, above.) PANYNJ would coordinate with the Lower Manhattan Development Corporation (LMDC) prior to the start of construction to determine whether any potentially sensitive areas have already been tested as part of the WTC Memorial and Redevelopment Plan. If necessary, Phase IB testing, which involves subsurface testing to try to determine whether any resources are actually present, would take place in potentially sensitive areas prior to the start of construction.

Construction of the pedestrian connection to the World Financial Center may affect a portion of the Hudson River Bulkhead, buried underground along the western edge of Route 9A. An agreement would be developed between PANYNJ, FTA, and SHPO in order to mitigate any adverse effects, if necessary (see Chapter 6, "Cultural Resources").

E. MITIGATION

The Preferred Alternative reflects a commitment to consistency with WRP coastal policies and the WRP's goals of enlivening the waterfront and attracting the public to the city's coastal areas. The Preferred Alternative would introduce a pedestrian connection to the World Financial Center, which would enhance the movement of workers and visitors to and from commercial uses in the World Financial Center, which is located in close proximity to the waterfront.

Under the policies of the CMP and WRP, the Preferred Alternative would not have an adverse impact on coastal resources. Therefore, the Preferred Alternative would be consistent with applicable policies in the CMP and WRP. ✳

A. INTRODUCTION

The federal Council on Environmental Quality's regulations implementing the procedural provisions of the National Environmental Policy Act (NEPA), set forth in 40 CFR Part 1500-1508, require federal agencies to consider the environmental consequences of their actions, including not only direct and indirect effects, but also cumulative effects.

The other chapters of this Environmental Impact Statement (EIS) assess the potential direct and indirect effects of the No Action Alternative and the Preferred Alternative for a range of technical areas. This chapter addresses cumulative impacts of the Preferred Alternative in combination with other reasonably foreseeable actions.

Cumulative impacts result from the incremental consequences of an action (the project) when added to other past and reasonably foreseeable future actions (40 CFR 1508.7). The cumulative effects of an action may be undetectable when viewed in the individual context of direct and indirect impacts, but when added to other actions can eventually lead to a considerable environmental change. Cumulative impacts are the net result of both the proposed project and the other projects that could affect the same resource.

The redevelopment of Lower Manhattan includes transportation and development projects being sponsored by both public and private groups. Although funded and planned separately, and having independent utility from each other, the construction and operation of these various projects would have a cumulative effect on the character and quality of Lower Manhattan and the region, as a whole, both during construction and in the long-term. Recognizing the potential impacts of such large-scale development in a relatively small geographic area, the lead federal agencies, in cooperation with the local project sponsors, developed a framework for the analysis of cumulative effects for projects being reviewed under the National Environmental Policy Act (NEPA). To guide this process, the U.S. Department of Transportation, Federal Transit Administration (FTA) prepared the *Approach to Cumulative Effects Analysis for the Lower Manhattan Recovery Effort* (July 2003).

The approach described in FTA's guidance ensures consistency among projects through a coordinated set of analysis assumptions and methodologies for all of the transportation recovery projects. As individual projects advance through the NEPA process, the analysis and any identified impacts are incorporated into the documentation of later projects to ensure a consistent, up-to-date, and comprehensive evaluation of potential cumulative effects.

This cumulative effects assessment considers the five major federally funded Lower Manhattan Recovery Projects as well as other public and private developments in the vicinity of the Port Authority of New York and New Jersey's (PANYNJ) Permanent World Trade Center (WTC) PATH Terminal (see Figure 15-1). This analysis also incorporates the assumptions and results from the following environmental documents, which are being prepared for the other, federally-sponsored Lower Manhattan Recovery Projects:

- *World Trade Center Memorial and Redevelopment Plan Final Generic Environmental Impact Statement (FGEIS)*, which was published by the U.S. Department of Housing and Urban Development (HUD) and the Lower Manhattan Development Corporation LMDC in April 2004;
- *Fulton Street Transit Center Final Environmental Impact (FEIS)* which was published by the FTA and the Metropolitan Transportation Authority (MTA) New York City Transit (NYCT) in October 2004;
- *South Ferry Terminal Environmental Assessment Statement (EA)*, which was published by the FTA and MTA/NYCT in May 2004; and
- *Route 9A Project Draft Supplemental Environmental Impact Statement (DSEIS)*, which was published by the U.S. Department of Transportation, Federal Highway Administration (FHWA) and the New York State Department of Transportation in May 2004.

This study focuses on subject areas with the most potential for cumulative adverse effects from the proposed projects in Lower Manhattan. The local project sponsors have coordinated amongst themselves and with federal agencies to develop consistent methodologies, assumptions, data sources, and impact criteria for the evaluation of impacts for the five cumulative effects subject areas: access and circulation; air quality; noise and vibration; cultural resources; and economic conditions. Furthermore, the project sponsors have agreed to a consistent set of Environmental Performance Commitments (EPCs) for these resource areas to be implemented as part of their projects in order to minimize or avoid adverse impacts during construction.

The coordination among the project sponsors began in the Spring of 2003. These efforts have included working group meetings with all of the project sponsors to address general coordination issues as well as technical subjects (e.g. construction assessment; traffic modeling; air quality emissions factors; etc.). Some of these coordination meetings have also involved participation from other local and state agencies such as the New York City Department of Transportation (NYCDOT), the New York State Historic Preservation Officer (SHPO), and the New York State Department of Environmental Conservation (NYSDEC). During the DEIS phase for the WTC Permanent PATH Terminal, these meetings were held at least weekly and sometimes two or three times per week.

Coordination efforts have continued since publication of the DEIS for the Permanent WTC PATH Terminal. As described in Chapter 9, "Air Quality" and Chapter 10, "Noise and Vibration," PANYNJ has worked with MTA/NYCT to refine EPCs and have furthered their commitment to reduce emissions, noise, and vibrations during construction. PANYNJ has also committed to the coordination of potential impacts to historic and archaeological resources through the execution of the Permanent WTC PATH Terminal Memorandum of Agreement (MOA), which was prepared pursuant to Section 106 of the National Historic Preservation Act. Furthermore, New York State Governor George Pataki has established the Lower Manhattan Construction Command Center, which will oversee coordination efforts among the Lower Manhattan Recovery Projects as efforts move forward.

B. METHODOLOGY

The cumulative effects analysis focuses on the five categories of concern identified in FTA's Approach to Cumulative Effect's for the Lower Manhattan Recovery Efforts, which are also

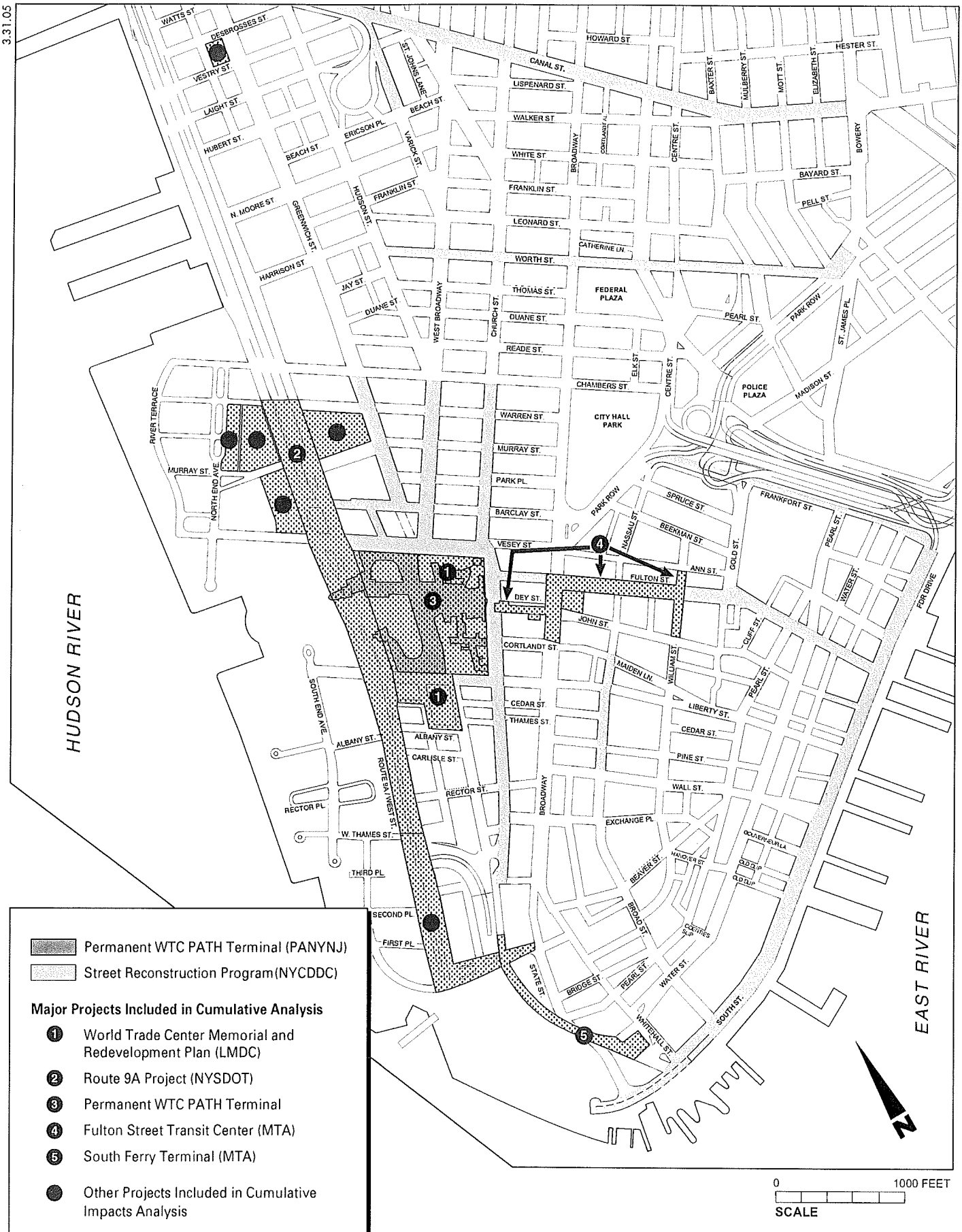

Figure 15-1

Lower Manhattan Projects Planned for Construction in the Critical Analysis Year

reflected in the Environmental Analysis Framework that was developed by PANYNJ, LMDC, MTA/NYCT and NYSDOT. As noted above, the five categories are:

- Air Quality
- Noise and Vibration
- Cultural Resources
- Access and Circulation
- Economics (e.g., Effects on Local Businesses)

It should be noted that the access and circulation category has been assessed under the typical methodology for projects in New York City of vehicular traffic, pedestrians, and transit services. Also, the nature of the cumulative effects analysis differs depending upon the category. For the transportation (i.e. traffic, pedestrians and transit), air quality and noise categories, predictive quantitative models were used extensively to determine the impacts. For cultural resources and economics a more qualitative approach was undertaken. With respect to cultural resources, the cumulative effects analysis focused on National or State Register listed or eligible and locally designated or eligible historic or archaeological resources within the Area of Potential Effect (APE) for each individual project and noted where effects may be cumulative. For the effects on local businesses, much of the analysis focused on commitments by project sponsors to maintain access during construction. Since much of these effects are site-specific (i.e., maintenance of specific sidewalk areas, curb-cuts, street closings, etc.) the necessary detail developed during the design phases was not available. As discussed in the individual environmental documents, the project sponsors are committed to developing a coordinated construction and traffic coordination plan which will ultimately mitigate potential adverse effects on access to local businesses and cultural sites during the construction period.

The cumulative effects analysis considers both the potential short-term (construction period) and long-term (operational period) beneficial and adverse impacts of the five Lower Manhattan Recovery Projects, as well as other projects that are anticipated to be undertaken in Lower Manhattan. However, it should be noted that the short-term or construction-related effects are generally adverse while the long-term effects are generally beneficial. The Lower Manhattan Recovery Projects have been planned with the specific purpose of supporting the economic recovery of Lower Manhattan while enhancing the environment of the area. This is particularly true with respect to the transportation projects that are expected to improve overall transportation service to the lower Manhattan area as compared to pre-September 11, 2001 conditions. However, to satisfy these objectives and needs, the area would experience an intense level of construction over the next several years. Therefore, in the cumulative effects analysis a greater focus has been given to the potential adverse effects during construction of these projects.

In addition, the long-term effects of the individual projects do not necessarily act in concert to the degree that the short-term effects do. For example, while undergoing construction, all of the proposed projects would lead to increases in traffic, air pollutant emissions and noise concurrently. These increases are additive and result in a higher level of impact than any project taken individually. However, the same is not necessarily true of the long-term effects since each project mostly affects different aspects of the Lower Manhattan environment. For example, the transit projects (with the exception of the No Action Alternative for the Permanent WTC PATH Terminal) would have a negligible effect on traffic and, therefore, air quality and noise levels on the major arterials (Route 9A, Church Street and Broadway) in Lower Manhattan. However, the different alternatives under study for Route 9A have a much more pronounced effect on conditions along the above-mentioned roadways. For street traffic and its related effects on noise

and air quality, the combined effect of Route 9A together with redevelopment of the WTC site would determine the long-term effects on these resources. This is not to say that the five major recovery projects do not have long-term cumulative effects that need to be considered. For example, each project affects pedestrian conditions that overlap in specific areas and need to be considered cumulatively.

With the above in mind, a coordinated effort was undertaken by the project sponsors of the Lower Manhattan Recovery Projects in an effort to provide consistency throughout the respective project's environmental reviews. While this coordination effort has resulted in very consistent findings between the documents, differences do occur. This is particularly true of the long-term effects where projects may have different future analysis years or use different criteria to evaluate their specific impacts. Some of these differences are discussed below. However, the construction impact assessment is nearly identical in each of the five documents with minor differences with respect to specific impact criteria (e.g., traffic and noise) used by the three different agencies (i.e., FTA, FHWA and HUD).

APPROACH TO CONSTRUCTION PERIOD EFFECTS

For the short-term impact assessment the analysis considered the cumulative effects of the five federally funded Lower Manhattan Recovery Projects described above. Other privately-funded initiatives were also considered but were not explicitly modeled as part of the impact assessment because these projects were either considered too small to influence the outcome or were part of the baseline (No Action) alternative on which the cumulative assessment was built.

DATA DEVELOPMENT AND BASELINE CONDITIONS

The following steps were performed to develop a consistent set of assumptions and baseline data to be used in each project's cumulative effects analysis:

Project sponsors provided information to allow development of a construction schedule for the five projects. A master schedule was developed showing major phases of construction for each project which was used in all the environmental documents.

- Once the schedules were developed, a critical analysis year was selected which was used in the modeling analyses to determine the greatest potential for construction-related impacts. For the Permanent WTC PATH Terminal DEIS, 2006 was determined as the critical analysis year and was used in the impact assessment to test the effectiveness of the EPCs and to determine whether additional mitigation was needed. As described in more detail below, the construction schedule for the Permanent WTC PATH Terminal, WTC Memorial and Redevelopment Plan, and Route 9A Project are delayed, and it is more likely that their construction would peak in 2007 or 2008, but construction of the South Ferry Terminal and Fulton Street Transit Center Projects is still expected to peak in 2006. Although the peak construction periods for the Lower Manhattan Recovery Projects would not overlap as predicted previously, this FEIS retains a critical analysis year that includes the peak construction activities for all five of the Lower Manhattan Recovery Projects.
- With the critical analysis year determined, the baseline conditions for the impact assessments were developed.
  - Access and Circulation – The project sponsors used the same set of baseline traffic, pedestrian and transit conditions to perform the impact assessment. Post-September 11, 2001 data collected by each project was assembled into one coherent set of data

representing conditions for the 2003 baseline. This included traffic volumes and speeds, pedestrian intersection and crosswalk data and usage for elements of nearby transit stations.

- Noise and Vibration – Project sponsors shared data on existing noise level measurements to develop a complete representation of existing conditions in Lower Manhattan.
- Air Quality – Project sponsors agreed upon background concentrations to be used in the impact assessment based on NYSDEC monitoring data.
- Cultural Resources – A list of resources (both historic structures and archaeological resources) were developed in concert and submitted to SHPO for concurrence. This resulted in one set of eligible resources in the study area. In addition, the federal project sponsors and the federal agencies prepared a coordinated Determination of Eligibility for the WTC site pursuant to Section 106 of the National Historic Preservation Act (NHPA).
- Economic Conditions – A comprehensive land use database was developed for existing conditions based on the NYC Real Property Assessment Database updated with field surveys. This data was then used in the MTA/NYCT's Regional Forecasting Model and shared with the project sponsors.

- Once the post- September 11, 2001 baseline conditions for 2003 were determined, the project sponsors developed the future (2006) conditions to be used in the construction impact assessment. This was accomplished by developing an agreed upon series of factors for traffic, pedestrians and transit usage based on known development projects and general background growth for the area.
- Once the 2006 critical analysis year was determined, the details of the construction activities for each project were developed. These details are necessary for completion of the traffic, air and noise impact assessment. Information for site-specific effects on local businesses was not generally available to the same level of detail. The information provided included the actual sub-phases of construction activity and what equipment would be required, for how long and where it would be generally operating. In addition, the total trucking activity for each sub-phase was determined and summed across all projects. The initial estimates were completed for the FGEIS for the WTC Memorial and Redevelopment Plan since it was published in April of 2004. Since that time, the information for the Route 9A Project has been updated by their design team. This information was shared among the project sponsors enabling the most current information on truck generation, equipment usage and placement to be used in each project's impact assessment.

IMPACT ASSESSMENT

Access and Circulation

Based on the information developed in the construction scenarios, an estimated 2,000 truck trips per day would be expected during peak conditions for the five projects. The project sponsors then developed an agreed upon set of truck routes, based on NYC truck routes, as well as the temporal distribution of the trips, for the traffic impact assessment. All traffic and pedestrian impacts were assessed based on methodologies from the Highway Capacity Manual. While some

projects employed different software versions for their analysis, the procedures were essentially the same.

For pedestrian access during construction, the project sponsors relied on the construction staging and the potential street/sidewalk closings to determine where pedestrian impacts may occur. In some cases, the issue may be related to a single project (Broadway and Fulton Street) rather than a cumulative effect (Church Street from Vesey to Liberty Streets). For the cumulative effects assessment, the analysis focused on specific corridors of movements that would be affected by more than one project. For example, the movement of pedestrians east-west from the subway stations on Church Street and Broadway to the WFC was of special concern since four projects would be working along this corridor.

One significant difference between the GEIS for the WTC Memorial and Redevelopment Plan and the four transportation projects is the criteria used in determining the severity of the traffic impacts. The four transportation projects use criteria that were originally developed for the Route 9A Reconstruction Project FEIS in 1994 and subsequently used in the EIS for the East Side Access Project and the Second Avenue Subway. The GEIS for the WTC Memorial and Redevelopment Plan uses criteria from the New York *City Environmental Quality Review (CEQR) Technical Manual.* These criteria were specifically tailored for development projects are more stringent than the criteria used on the transportation projects. The rationale for the difference in these criteria relates to a project's intended purpose and use. Transportation projects generally strive to improve or enhance the capacity of an existing system. However, development projects generate person-trips that will use a transportation system. Thus, the WTC Memorial and Redevelopment Plan applied the more stringent criteria since it would generate trips to Lower Manhattan, whereas the other recovery projects would enhance the area's transportation infrastructure. While the number of severely impacted intersections may differ between these two approaches, the need for a comprehensive construction and traffic management plan has been agreed to by the project sponsors.

Air Quality and Noise and Vibration

For the noise and air quality analysis, the project sponsors agreed upon the set of emission levels to be used for both the on-road and non-road equipment. As part of this analysis, the project sponsors reached agreement with respect to the effectiveness of the EPCs on reducing air pollutant emissions from certain pieces of construction equipment. Subsequent to the publication of the DEIS for the Permanent WTC PATH Terminal, PANYNJ and MTA/NYCT coordinated to further their commitments beyond the original EPCs in order to lower emissions of particulate matter, which was determined to be the critical pollutant.

Once emission levels were determined, each project sponsor performed the cumulative effects assessment in their respective area of potential effect. For example, due to its distance from the other projects, the analysis for South Ferry Terminal is not influenced much by other projects' construction in the critical analysis year. Therefore, in that document, the cumulative effects assessment for noise and air quality is almost entirely a result of the project itself. However, in the vicinity of the WTC site the cumulative effects of the projects are typically much greater than any individual project's effect. Though in some cases, a particular element of one project may highly influence the resultant cumulative effect.

The prediction methodologies for noise and air quality impact assessments were the same for the various projects. The same air quality emission (EPA's NONROAD, MOBILE6.2 and AP-42) and dispersion models (CAL3QHCR and ISC3) were employed for each project's cumulative

assessment. Similarly, for the noise impact assessment, roadway noise was predicted using the proportional method based on guidance from the *New York City Environmental Quality Review Technical Manual* for all projects. Each project also modeled the construction equipment using a simplified noise equation (from FTA's guidance manual) which sums each piece of equipment affecting sensitive receptors based on the agreed upon noise emission levels and hours of operation. Where the respective projects overlap the results are quite consistent.

The impact criteria for air quality were based on the NAAQS with the exception of $PM_{2.5}$ where the project sponsors employed New York City Department of Environmental Protection (NYCDEP) interim criteria.

For the noise analysis, the impact criteria are similar for the five projects but not exactly the same. The FSEIS for the Route 9A Project uses FHWA criteria for noise impacts while the transit projects use FTA's criteria. LMDC uses the FTA guidance with an additional assessment comparing noise increases to the criteria in the *New York CEQR Technical Manual.* The differences are relatively minor. FHWA uses a single definition of impact—maximum hourly noise levels (i.e., L_{eq}) should not exceed 85 dBA. FTA's criteria are more detailed and use three land use (only two apply in the area, residential and commercial) and two distinct time averaging periods (an eight-hour average and a 30-day average). For the eight-hour average, the criteria for residential and commercial land uses are 80 and 85 dBA, respectively. For the 30-day average, the criteria are 75 and 80 dBA. However, in urban areas with very high ambient noise levels, such as the project sites, the FTA guidance recommends using an increase in Ldn of 10 dBA over existing noise levels as the exceedance criterion. The net results for each project's cumulative assessment are, therefore, essentially the same with respect to the predicted noise levels and the need for mitigation.

Cultural Resources

For cultural resources the cumulative assessment considered effects on both historic structures and archaeological resources pursuant to Section 106 of the National Historic Preservation Act. For most historic structures in the vicinity of the project sites, the assessment focused on issues related to potential damage from construction-related ground-borne vibrations. For each project the area of potential effect from its construction activities was determined and shared among the sponsors. This enabled each sponsor to consider the effects of the other project's construction on buildings that may be affected by their own project. The sponsors have developed a map illustrating all of the potential ground-borne vibration effects from the projects, structures of concern, and the overlap between the various projects.

However, for the WTC site itself, this cumulative effects assessment considers both direct and indirect effects during and after the critical construction year. A coordinated assessment was undertaken by FTA, FHWA, LMDC, PANYNJ, and NYSDOT with regard to the eligibility of the WTC site. In a joint Determination of Eligibility issued in March 2004, FTA, FHWA, and LMDC determined the WTC site eligible for listing on the National Register of Historic Places. The environmental documents prepared for the Lower Manhattan Recovery Projects were consistent in noting the Site's eligibility although the determination of potential effects varies with each project. Each of the project sponsors has been and continues to coordinate with SHPO and the consulting parties, pursuant to the Section 106 Process regarding their respective potential effects to the site. LMDC and NYSDOT identified potential adverse effects with respect to the WTC site and have prepared and executed Programmatic Agreements that will guide the design and construction of their projects with respect to their potential impacts. FTA and PANYNJ have executed a Memorandum of Agreement to minimize and mitigate the

adverse effect from the construction and operation of the Preferred Alternative. The Fulton Street Transit Center and South Ferry Terminal Projects would not have an adverse impact on the WTC site.

The analysis of potential effects to historic resources considers the cumulative impacts and cumulative mitigation measures of the Lower Manhattan Recovery Projects on the historic resources within the Area of Potential Effect for the Permanent WTC PATH Terminal. The Preferred Alternative was determined to have an adverse effect.

For archaeological resources the cumulative effects analysis has been based on the data developed among project sponsors and agreed upon with SHPO. There are two areas of known or potential archaeological sensitivity within the Permanent WTC PATH Terminal's APE. The Hudson River Bulkhead (State and National Register-eligible) has been declared historic from Battery Place to 59th Street. Portions of the Bulkhead are visible, but it is buried in the vicinity of the WTC site. Therefore, it is considered an archaeological resource for purposes of these analyses (see Chapter 6, "Cultural Resources"). There is also potential for archaeological sensitivity on the eastern portion ("east bathtub") of the WTC site; which is also considered in this analysis.

Economic Conditions

Generally, the cumulative effects on local businesses in the environmental documents have been mostly qualitative. While the cumulative traffic impact assessment has been quantified, the specifics of the construction and traffic management plans have yet to be developed. Maintenance of access to businesses, whether for deliveries or customers, requires a level of detail that is not available without further engineering design. For example, the air quality and noise analysis has been conducted assuming that certain pieces of equipment are in located in a general area for several months. However, to develop the actual Maintenance and Protection of Traffic Plans (MPT), which would illustrate how access would be maintained to a specific building, requires much more specific details. Therefore, the cumulative assessment has been focusing on the general areas of concern (which streets, curbside lanes and block faces are affected) and the commitment to further develop measures to avoid or minimize adverse effects.

CUMULATIVE CONSTRUCTION ANALYSIS FRAMEWORK

As noted in Chapter 3, "Construction Methods and Materials," the construction schedule for the Permanent WTC PATH Terminal has been delayed and extended as compared to the analysis presented in the DEIS. Similarly, the schedules for the World Trade Center Memorial and Redevelopment Plan, and Route 9A have been delayed.

In April 2005, LMDC released the *World Trade Center Memorial and Redevelopment Plan Environmental Assessment for Proposed Refinements*, which reviews the analysis results from the *World Trade Center Memorial and Redevelopment Plan FGEIS* in light of recent changes to the WTC Master Plan, including its construction schedule. This document included a revised construction impacts assessment to determine if new impacts are predicted and concluded that their impacts would be similar to the analysis presented in the FGEIS.

The revised construction analysis showed that LMDC's construction schedule is delayed and that its construction is not likely to peak until 2007 or 2008. Given similar delays in the schedules for the Permanent WTC PATH Terminal and the Route 9A Project, the cumulative construction in Lower Manhattan is also not likely to peak until 2007 or 2008. However, because the construction of the South Ferry Terminal and the Fulton Street Transit Center would peak

early, the overall level of activity in 2007 is expected to be lower than was projected in the Permanent WTC PATH Terminal DEIS.

The cumulative effects analysis in the DEIS assumed construction of one or more of the Lower Manhattan Recovery Projects would begin in 2004 and that activities would peak in 2006. This analysis assumed a more fast-tracked approach for these projects. Therefore, the assumptions in the DEIS regarding construction scheduling and phasing represent higher peak daily traffic, noise, vibrations, and air pollutant emissions than would occur under the revised construction schedules. Furthermore, the mitigation measures developed with respect to these maximum predicted levels would be even more effective under the less aggressive construction schedules.

The construction period analysis presented below describes both the cumulative construction schedule developed for 2006, which considers the peak for all of the Lower Manhattan Recovery Projects. Following the detailed analysis is a qualitative description of anticipated changes with the refinement of construction schedules occurred following the Permanent WTC PATH Terminal DEIS.

Lower Manhattan Recovery Projects

The federal government is sponsoring five major Lower Manhattan Recovery Projects: Permanent WTC PATH Terminal; WTC Memorial and Redevelopment Plan; Fulton Street Transit Center; South Ferry Terminal; and Route 9A Project (see Figure 5-1). These projects are briefly described below along with the construction work that is expected to occur in the peak analysis year.

WTC Memorial and Redevelopment Plan (Figure 15-1, Reference No. 1)

Rebuilding of the WTC site would provide for the construction of a Memorial and memorial-related museum and cultural facilities, up to 10 million square feet of commercial office space, up to 1 million square feet of retail space, up to 1 million square feet of conference center and hotel facilities, new open space, and infrastructure improvements, including loading and parking facilities, advanced security systems, and new and reconstructed streets. For this cumulative effects analysis, it has been assumed that LMDC would pursue its "Proposed Action" alternative as presented in the *World Trade Center Memorial and Redevelopment Plan Final Generic Environmental Impact Statement.*

The rebuilding of the WTC would take place over approximately 11 years, from 2004 to 2015. For this analysis the following activities were assumed to occur in the peak construction year:

- Demolition of Hudson and Manhattan (H&M) Terminal and excavation of East Bathtub: This task involves the removal of existing structures between Church Street and the 1 and 9 line on the eastern portion of the WTC site to form new basement levels for the complex. Once the existing structures have been demolished and removed, a new slurry wall would be constructed and work would proceed on the basement levels of the future WTC towers. To maintain temporary WTC PATH service, the East Bathtub would be constructed in two zones: northeast and southeast. As excavation of these zones is completed and as additional access can be provided to the temporary WTC PATH station, the spoils beneath the station itself would be removed to complete the excavation of the East Bathtub.

  Subsequent to the publication of the DEIS, PANYNJ determined that portions of the east bathtub excavation, including demolition of the H&M Terminal, will be undertaken as part the Preferred Alternative for the Permanent WTC PATH Terminal (see Chapter 2, "Project Alternatives"). Excavation of some portions of the east bathtub could also be undertaken by

LMDC for the WTC Memorial and Redevelopment Plan, depending on the timing of this project and the Permanent WTC PATH Terminal. Although the scope of excavation to be undertaken by LMDC and/or PANYNJ is not certain at this time, the cumulative effect would not change. Therefore, the east bathtub excavation has been retained here as part of the cumulative construction analysis framework.

- WTC Concourse and Freedom Tower foundations: Work within the northwest quadrant of the WTC site, would include the construction of sub-grade concourses and retail as well as Freedom Tower (Tower 1) of the WTC complex. The construction of Freedom Tower is expected to follow typical skyscraper methods of construction. This would involve the construction of several floors of the tower at a given time. As the skeleton of the building moves upward, facades and interior work is conducted on lower floors. This process is repeated until top out is achieved, after which, finishing work proceeds throughout the building.
- Towers 2, 3, and 4 foundation and below grade retail: Upon completion of the East Bathtub foundations for Towers 2, 3, and 4 would be constructed. This would include preparation of spaces for below-grade retail and servicing areas, construction of concourses, and preparation of the bases for the eventual construction of the office towers.
- East Bathtub above grade retail: As the bases of the office towers within the East Bathtub are completed, work would begin on the above-grade retail levels.

Elsewhere on the site it is assumed that the expansion of the bathtub south of Liberty Street would have begun, and the sub-grade build out of that space would continue. The construction of the Memorial itself, and associated cultural and open spaces, would also commence.

Route 9A Project (Figure 15-1, Reference No. 2)

NYSDOT proposes to reconstruct Route 9A immediately to the west of the WTC site between Barclay and Albany Streets. NYSDOT is currently considering three alternatives for the reconstruction of Route 9A. A No Action Alternative would rehabilitate the existing roadway, which was reconstructed following September 11, 2001. An at-grade alternative would restore the roadway to its pre-September 11, 2001 condition with modifications to accommodate the future uses on the WTC site. The third alternative calls for approximately 75 percent of vehicular traffic to be re-routed through a short, sub-grade bypass and improve at-grade pedestrian connections between the WTC site and Battery Park City (BPC). The construction of this bypass includes the requirement to maintain access to the WTC site with four traffic lanes throughout the construction of the project. For this cumulative effects analysis, the short-bypass alternative was assumed.

For the purposes of this analysis, the Route 9A short bypass has been assumed since it would result in the highest level of construction activity along Route 9A, as compared to other alternatives, and the greatest potential for construction impacts. The project has been disaggregated into four construction stages as follows:

- Stage I; Construct temporary north and south roadways adjacent to the site of the proposed sub-grade bypass. This activity is expected to take around 6 months.
- Stage II; Construct the southbound lanes of the sub-grade bypass.

- Stage III; Construct the northbound lanes of the sub-grade bypass. Upon completion of the southbound lanes, traffic would be re-routed to create a clear zone for the construction of the northbound lanes.
- Stage IV; Surface and Tunnel Finishes. As the bypass is complete, permanent tunnel lining must be installed, and the local road surfaces reinstated at street level.

In the peak construction year for this impact assessment, Stage II would be under construction. The proposed bypass would be located in fill beneath the groundwater table. As such, the proposed structure is required to provide a contiguous hydrostatic barrier to prevent the ingress of water into the sub-grade roadway. For the purposes of assessment of environmental impacts, it is assumed that a slurry wall method of site retention would be employed. Slurry walls would be built first and then excavation and tunnel construction would proceed. The slurry wall would be excavated to bedrock to limit the drawdown of groundwater and to prevent the intrusion of Hudson River water into the excavation.

Construction of the slurry walls would be from within the Stage II Work Zone. Six traffic lanes would be maintained during the duration of this stage for the peak traffic periods. After the slurry wall is complete, the excavation for the southbound bypass tunnel would be performed. The entire width between slurry walls would be excavated to the proposed invert of the sub-grade for the tunnel. Additional excavation would occur in the location of the Preferred Alternative's Route 9A concourse. Excavated spoils would be removed from the site by dump truck following the proposed truck routes.

NYSDOT is also undertaking streetscape improvements for the portion of Route 9A south of Albany Street. This project, referred to as the Route 9A Promenade South, is being studied and designed independent of the proposed improvements in the vicinity of the WTC site. The construction of the Promenade South began in September 2004 with anticipated completion in early 2006. Since, the Promenade South would be finished before the peak construction year for the Preferred Alternative, it is not considered as part of the construction cumulative effects analysis presented below.

Fulton Street Transit Center (Figure 15-1, Reference No. 4)

This cumulative effects analysis of the Fulton Street Transit Center assumes that MTA/NYCT would pursue Alternative 10 as presented in the *Fulton Street Transit Center Final Environmental Impact Statement*. Similar to the above projects, the engineering is ongoing. However, for descriptive purpose, the project has been disaggregated into five components as follows:

- Element 1, Dey Street Passageway: This element would include the site preparation for and construction of the passageway beneath Dey Street from Broadway and Church Street linking the 4 and 5 line with the R and W line. The passageway would be constructed with cut and cover methods. Including utility relocation, passageway construction, and street reconstruction, this element has a 24-month duration.
- Element 2: Entry Facility: This element includes the demolition of existing structures on the east side of Broadway between Fulton and John Streets, site preparation, foundations, and above-grade construction of the new entry facility to the Fulton Street Transit Center. This element has a duration of 27 months.

- Element 3: A/C Mezzanine: This element includes the extension and widening of the A and C line mezzanine and includes slurry wall construction and utility relocation. The total duration of this element is 26 months.
- Element 4, Underpasses: This includes the construction of concourses beneath the R and W and 4 and 5 subway tracks to link the Dey Street Underpass with the WTC site and the new Entry Building east of Broadway. Both underpasses would require approximately 6 months for construction.
- Element 5, Other station improvements: This element includes rehabilitation of platforms and station elements on the 4 and 5, 2 and 3, and J, M and Z lines; new access to the 4 and 5, 2 and 3, and A and C lines; and a new below-grade connection between the Cortlandt Street (R and W) and WTC (E) stations. Portions of Element 5 would be undertaken throughout the duration of the Fulton Street Transit Center project.

In the peak construction year for this impact assessment, components of all elements may be under construction. The following describes the major activities included in this cumulative effects analysis.

- Tunneling For Underpasses. The current Transit Center conceptual design locates a concourse structure directly beneath the existing R and W line at Church Street and beneath the existing 4 and 5 line at Broadway. In addition, it is intended that the 4 and 5 line northbound platform be widened beneath the east side of Broadway. In order to maintain traffic on Broadway and Church Street, and to limit disruption to subway service, the tunneling operation would most likely require an incremental underpinning sequence of adjoining structures along the east side of Broadway between Fulton and John Streets, in conjunction with careful monitoring of vibration and subway track movement.
- Concourse Construction under Dey Street. The rock strata elevation below Dey Street lies beneath the proposed depth of excavation. Consequently, it is probable that the concourse would be constructed using "cut and cover" construction methods.
- Widening of A/C Line Mezzanine. The A/C line mezzanine would be widened and reconstructed using a "top-down" sequential cut and cover sequence similar to the concourse construction at Dey Street. While the amount of actual required volume of excavation is far less than that required for the Dey Street concourse, the A/C line mezzanine widening is complicated by the need to maintain operation of the A/C line platforms. In addition, the structure of the rail tunnel itself is extremely sensitive to reductions and increases of overburden stress applied to the modular tunnel rings.

Construction of this project would require staging areas that would be closed to pedestrian and vehicular traffic for the duration of the relevant construction activity. The following staging areas were assumed for this analysis:

- Fulton Street: One lane and the southern sidewalk would be reserved for truck parking and staging throughout the construction period for a distance of approximately 180 feet east of Broadway to the eastern extent of the FSTC site. The remainder of Fulton Street between Broadway and Nassau Street would be temporarily closed to vehicular traffic for the duration of the mezzanine widening. Lanes would be open for emergency traffic and deliveries, but through traffic would not be permitted.

- Dey Street: It is anticipated that full closure of Dey Street from Church Street to Broadway and sequential closure of entire segments of the north and south sidewalks would be necessary for the duration of construction. Pedestrian access would be restricted to a five-foot egress sidewalk on the north and south curbsides. Temporary track loading areas would be established on both ends of the street. A vehicle lane for emergency access and essential local deliveries would be maintained.
- John Street: Under the alternative considered for this cumulative impacts assessment, lane and sidewalk closures would not be required on John Street.
- Church Street: The eastern travel lane and sidewalk would be closed at the intersection with Dey Street and between Fulton and Dey Streets during the period of the Dey Street passageway construction. In addition, the western lane and sidewalk would need to be closed during construction of the R and W connection.
- Broadway: It is anticipated that one eastern lane and the eastern sidewalk would be closed from Fulton Street to John Street. It is expected that the sidewalk would be used for truck and equipment parking and that pedestrians would be re-routed onto the eastern traffic lane during this period. The construction of the 4 and 5 line underpass stairs at 195 Broadway would also require the closure of the entire western sidewalk of Broadway. The construction of the Dey Street underpass would also require the temporary closure of Dey Street at Broadway.
- Nassau, Dutch, and William Streets: Construction of certain elements of the FSTC would involve temporary closure of vehicle lanes and sidewalks along Nassau, Dutch, and William Streets.
- Intersection of Maiden Lane, Cortlandt Street, and Broadway: All four corners, sidewalks, and travel lanes would be subject to intermittent closure with construction of the 4 and 5 line mezzanine.

South Ferry Terminal (Figure 15-1, Reference No. 5)

The South Ferry Terminal would be constructed generally within the limits of Peter Minuit Plaza, Battery Park, and immediately north of Whitehall Ferry Terminal. Street preparation work for the South Ferry Terminal under Peter Minuit Plaza would occur first. Construction of the approach tunnels, including underpinning of the existing 1 and 9 loop track and the 4 and 5 subway tunnels in the eastern edge of Battery Park would occur next. Terminal construction would occur next and the bellmouth and fan plant construction would follow. Construction of the bellmouth would require reconstruction of about 275 feet of existing subway tunnel. The reconstruction would require demolition of portions of the subway roof and sidewalls. Finishing work would be ongoing during the project's final phase and would occur underground.

The cut and cover construction of the approach tunnels for the South Ferry Terminal would require the demolition and reconstruction of Battery Place near its intersection with Greenwich Street. MTA/NYCT, in cooperation with NYSDOT, would complete the portions of the Route 9A Promenade South between Route 9A and State Street as part of the South Ferry Terminal project. This work would occur following the construction of the bellmouth approach tunnels. MTA/NYCT and NYSDOT would also share staging areas in the vicinity of Battery Place to reduce the off-site impacts of their construction projects.

In the peak construction year for this assessment, the following elements were assumed to be under construction.

- Cut and cover tunneling operations;
- R and W Whitehall Station connection to South Ferry Station;
- Underpin of 1 and 9 line and 4 and 5 line for new station construction;
- Bellmouth construction; and
- Ventilation plant construction.

Other Lower Manhattan Projects

Lower Manhattan Street Reconstruction Program

The New York City Department of Design and Construction (NYCDDC) is undertaking an aggressive program to reconstruct the majority of local streets in Lower Manhattan. NYCDDC has prepared a preliminary phasing plan for this program, which covers the area south of Canal Street between the Hudson and East Rivers. The extent of street reconstruction varies depending on the type of roadway, its history of previous repairs, and the level of subsequent damage. In some cases streets would be repaved, but other streets would be fully reconstructed, including utility relocation, sidewalk reconstruction, and new pavement. Based on NYCDDC's preliminary program, the following streets may be reconstructed concurrent with the peak activity for the Preferred Alternative:

- Canal Street from Hudson Street to Bowery Street;
- Worth Street from Hudson Street to Park Row;
- Greenwich Street from Chambers Street to Barclay Street;
- West Broadway from Vesey Street to Chambers Street;
- Church Street and Trinity Place from Chambers Street to Morris Street;
- Barclay Street from Route 9A to West Broadway;
- Vesey Street from Route 9A to Broadway;
- Liberty Street from Route 9A to Broadway;
- Cedar Street from Route 9A to Washington Street;
- Washington Street from Liberty Street to Cedar Street;
- Washington Street from Vesey Street to Barclay Street;
- Fulton Street from Church Street to South Street Viaduct;
- Frankfort and Dover Streets from Park Row to South Street Viaduct;
- Dey Street from Church Street to Broadway, and;
- South Street Viaduct from Whitehall Street to Brooklyn Bridge.

It is assumed that the street reconstruction program would be fully coordinated with the Lower Manhattan Recovery Projects such that the rehabilitation of streets in the vicinity of the WTC site would be postponed until the major construction efforts at the site were fully or nearly completed. This coordination would avert damage from WTC and PATH construction to already reconstructed roadways. However, given the aggressive timeline for this program, it is anticipated that some street reconstructions would be underway during the construction period of the Preferred Alternative, but these activities are expected to be on a scale and at a pace similar to what was underway at the time of the existing conditions surveys for this project. Since the street reconstruction program is not anticipated to occur in the immediate vicinity of the WTC site during the construction period for the Preferred Alternative, but would occur at other locations in Lower Manhattan, it has been considered as part of the background conditions for this cumulative effects analysis.

Private Development Projects

Based on the analysis presented in Chapter 4, "Land Use, Neighborhood Character, and Public Policy," four projects may have construction activities that overlap with construction of the Preferred Alternative. These projects are as follows:

- Washington Street Urban Renewal Area (WSURA) Site 5B, a 438-unit residential building with 229,595 square-feet (sf) of retail;
- BPC Site 23, an approximately 280,000-sf residential building with ground floor retail;
- BPC Site 24, an approximately 260,000-sf residential building with ground floor retail; and
- BPC Site 26, an approximately 2.3 million sf office building with ground floor retail.

To estimate the potential cumulative impacts of these private developments, assumptions were made regarding the type, length, and stages of construction that would be required. In New York City, new commercial and residential construction typically requires 18 to 24 months from site preparation to final fit-out. To conservatively estimate peak conditions, it was assumed that the private developments shown in Figure 15-1 would have an 18-month construction period.

It is assumed that the construction of these private developments would follow typical methods and procedures for new buildings in Lower Manhattan. The *New York Stock Exchange New Facility Final Environmental Impact Statement* (December 13, 2000), described proposed activities for its construction. These general assumptions were used for the private developments identified above.

The New York Stock Exchange FEIS identified four major phases of construction: demolition, foundations, tower core and shell construction, and interior construction. The estimated truck activity for each of theses phases is presented in Table 15-1.

Table 15-1
Typical Construction Period Truck Trip Generation for Private Developments

Phase	Peak Average Daily Truck Trips (One-Way)
Demolition	30
Foundations	30
Tower core and shell construction	10 to 15
Interior construction	25 to 35

Source: *New York Stock Exchange New Facility Final Environmental Impact Statement* (December 13, 2000)

The New York Stock Exchange expansion would have been a 600,000 square foot building, which is considerably larger than is proposed for BPC Site 23 and 24 and is comparable to WSURA Site 5B. Thus, these projects would generate a similar or lesser number of trucks than is presented in Table 15-1. BPC Site 26 would be four times the size of the proposed Stock Exchange and would, therefore, generates a larger number of trips than presented in Table 15-1.

BPC Sites 23, 24, 26, and WSURA Site 5B would not require building demolition. Thus their construction would begin with the foundations phase. Based on a typical construction schedule for a high-rise building and on currently planned completion dates, it is assumed that BPC Sites 23 and 24 and WSURA Site 5B would be either nearing the end of the tower core and shell phases or in the interior phase concurrent with peak construction activity for the Preferred Alternative. Thus, only BPC Site 26 would potentially be in foundation construction.

Construction Vehicles and Truck Routes

The assessment of post-September 11, 2001 traffic conditions, which is the basis for the construction period traffic networks, was developed using counts conducted in Spring and Fall of 2003. At the time of these counts, there were several ongoing construction projects in Lower Manhattan, including the temporary WTC PATH station, Battery Park City sites, 10 Liberty Street, and 2 Gold Street. Thus, the construction period traffic associated with these projects was included in the counts and the resultant baseline traffic networks. All of the projects under construction in 2003 would be completed by the critical analysis year, meaning that they would no longer generate construction vehicles; however, these vehicles were not removed from the future baseline traffic network. Since it is expected that the private development projects described above would generate an equivalent or lesser volume of construction vehicle trips in the critical analysis year as those projects included in the base counts, the trips associated with the private developments described above are considered as part of the future baseline traffic network.

Table 15-2 presents the total peak daily construction related truck trips that would be generated by each of the Lower Manhattan Recovery Projects in the critical analysis year. The sponsors of the federally-funded, Lower Manhattan Recovery Projects have coordinated to establish routes for individual site access during construction. As shown in Figure 15-2, trucks would enter and exit Lower Manhattan from six principal gateways: Holland Tunnel, Manhattan Bridge, Route 9A, Brooklyn-Battery Tunnel, Bowery, and Broadway/Avenue of the Americas. Within Lower Manhattan, these trucks would use Route 9A, Church Street, Broadway, Water Street, and South Street.

Table 15-2
Total Peak Daily Truck Trips Generated By Lower Manhattan Recovery Projects—Critical Analysis Year

Project	Heavy Truck Trips	Light Truck Trips	Total Truck Trips
WTC Memorial and Redevelopment Plan	694	310	1004
Permanent WTC PATH Terminal	172	64	236
Route 9A Project	320	48	368
Fulton Street Transit Center	262	70	332
South Ferry Terminal	150	98	248
Total	1,598	590	2,188

On-Site Equipment

For three of the Lower Manhattan Recovery Projects–WTC Memorial and Redevelopment Plan, Route 9A Project, and Fulton Street Transit Center—that would be constructed concurrent with and in the vicinity of the Project Site, an estimate of on-site equipment was made to support the cumulative analyses. Because construction of the South Ferry Terminal would occur approximately ½ mile south of the Project Site, no overlapping effects with South Ferry Terminal's on-site sources are expected. Thus, South Ferry's on-site equipment was not included in the cumulative effects analyses for air quality, noise and vibration, and cultural resources.

Appendix D presents the on-site equipment that would be generated by the Lower Manhattan Recovery Projects identified above for the peak construction year. The table lists the work zones and the types, numbers, and durations of use for each piece of equipment. Although the duration

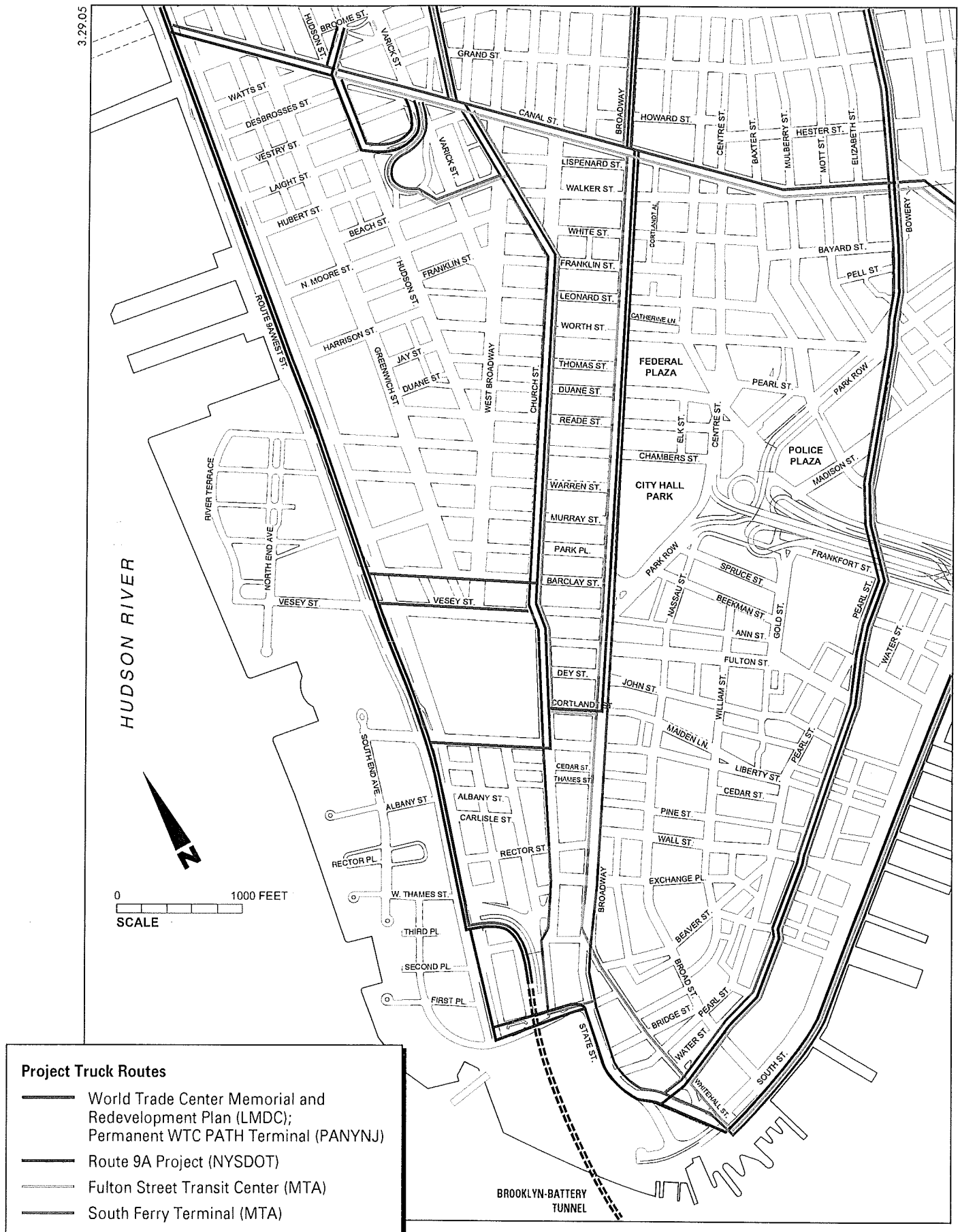

Figure 15-2

Truck Access Routes for the Lower Manhattan Recovery Projects

period (in months) is provided for summary purposes, many pieces of equipment may operate during only portions of the period. For additional details on the use of the equipment at each site, refer to Appendix D. The equipment that would be used for construction of the Preferred Alternative is presented in Chapter 3, "Construction Methods and Materials."

MITIGATION

Environmental Performance Commitments (EPCs)

The PANYNJ, LMDC, NYSDOT, and MTA/NYCT have developed a unified environmental analysis framework for the Lower Manhattan Transportation Recovery Projects, which is summarized in Chapter 2, "Project Alternatives." As part of this effort, these agencies developed EPCs that would be implemented during the construction of individual projects to avoid or minimize adverse effects to the environment. The EPCs and plans for their implementation are shown in Chapters 5, 6, 8, 9, and 10 of this FEIS for each of the five resource areas.

The EPCs that have been specified for the construction of the Preferred Alternative have been accounted for in the analysis of construction period impacts described in Chapters 4 through 14 of this EIS, where appropriate. These chapters also present mitigation measures to specifically address the potential construction-period impacts of the Preferred Alternative. However, in most cases and in particular with reference to the five resource areas identified above, the cumulative effect would result in more or greater impacts than would the Preferred Alternative alone. Thus, measures presented below to avert or minimize the adverse effects of the five Lower Manhattan Recovery Projects would also mitigate the project-specific impacts of the Preferred Alternative.

Similarly, the measures that have been committed to by the other agencies for their individual projects have been incorporated into the cumulative assessment of construction period impacts that follows below.

As part of the analysis, the project sponsors have and continue to consider the efficacy of the EPCs and additional mitigation. Leading up to the publication of this FEIS, extensive coordination and data sharing occurred among the agencies to develop a consistent set of specifications for the EPCs, as well as assumptions regarding their efficacy in reducing the adverse effects of construction. Most discussions centered on air pollution emission reduction measures, but also included traffic and noise reduction measures since the analysis shows a need to consider additional mitigation. Since the agencies were committing to measures beyond typical mitigation employed in the industry, it was necessary to make certain conservative assumptions about their effectiveness and availability. The details of these considerations are discussed in the technical analyses below. However, the result is that while the FEIS makes certain conservative assumptions, the project sponsors continue to meet to determine what can be realistically done to lower the predicted values.

Mitigation Measures under Consideration

Following the publication of the Draft EIS for the Permanent WTC PATH Terminal, the Lower Manhattan project sponsors continued to meet to further define the EPCs and their implementation. Areas of interest included:

- The development of a traffic management plan based on the current truck estimates;
- Development of a construction coordination plan focusing on individual stages of each project's plan;

- Application of diesel particulate filters (DPFs) to specific construction equipment with consideration for effectiveness and feasibility;
- Possible electrification of certain (e.g., welders, compressors, etc.) construction equipment to lessen the severity of potential adverse effects on concentrations of particulate matter and nitrogen dioxide; and
- Determining the critical equipment and activities that result in cumulative adverse noise effects at specific sensitive receptors. Based on the analysis to date, the project sponsors have now focused their concerns on specific locations.

This process has resulted in additional air quality and noise commitments as part of the Permanent WTC PATH Terminal, Fulton Street Transit Center, and South Ferry Terminal projects. The specific mitigation measures to be implemented are described in Section C, "Probable Construction Period Effects."

Also subsequent to the publication of the DEIS for the Permanent WTC PATH Terminal, FTA and PANYNJ executed a Memorandum of Agreement (MOA) pursuant to Section 106 of the National Historic Preservation Act. At the request of the Section 106 consulting parties, the MOA includes stipulations to coordinate potential cumulative effects to historic resources during and after construction. LMDC, NYSDOT, and MTA/NYCT were involved in developing these stipulations and have agreed to the process set forth in the executed MOA. Section C, "Probable Construction Period Effects," provides further information regarding the coordination commitments of the MOA.

Ongoing Coordination

The project sponsors have developed a framework for construction coordination, which includes establishing several working groups to address issues that have been identified in the individual environmental documents for the Lower Manhattan Recovery Projects and to implement the EPCs. While representatives of each of the sponsoring agencies are seated on each committee, one sponsor has been charged with coordinating the efforts of the individual working group. The following describes the construction working groups that have been formed and the principal goals and issues to be coordinated by the individual groups.

- Schedule Working Group: The schedule working group will coordinate construction schedules for the recovery projects. This group will develop and maintain and track a master construction schedule and will develop a geographic information system for Lower Manhattan to track construction activities.
- Logistics Working Group: The logistics working group will coordinate with the schedule working group to overlay construction activities, review phasing and staging plans, and to develop a master logistics plan for the recovery efforts. This group will seek opportunities to share construction facilities such as trailers, parking, and transport of workers and will coordinate the location and/or implementation of these shared facilities.
- Traffic Working Group: The traffic working group will develop the coordinated Traffic Management Plan for the Lower Manhattan Recovery Projects. This plan will compile the individual Maintenance and Protection of Traffic Plans for individual projects and will employ technologies to determine the best routes for delivery of goods and equipment and the removal of debris. This group will implement an Intelligent Transportation System (ITS)

system to communicate real time traffic information during the construction process and will coordinate the permitting of construction-related traffic issues (e.g., lane closures).

- Standards Working Group: The standards working group will coordinate the implementation of the EPCs through a consistent approach to construction contracts and specifications. The project sponsors have engaged the construction industry to determine the current and projected feasibility of the EPCs, and these efforts will be continued through the standards working group. The group will research available technologies and strive to implement appropriate advances to the extent possible during the construction process. Furthermore, this group will coordinate specifications for construction materials; will establish protocols for work hours, verification procedures, construction safety, cleanliness, signage, and public outreach; will develop requirements for construction contracts; and will centralize contract documents for the Lower Manhattan recovery efforts.

On November 22, 2004, New York State Governor George E. Pataki signed an Executive Order creating the Lower Manhattan Construction Command Center. The Command Center will administer the construction of project's within Lower Manhattan that either 1) have a construction value of more than $25 million; 2) require governmental actions or permits or; 3) require work within in a City or State street or highway. Of the projects noted above, the Command Center is expected to have oversight of the five Lower Manhattan Recovery Projects, the Route 9A Promenade South, Lower Manhattan Street Reconstruction, and the large private construction projects, including BPC Sties 24, 25, and 26, and the WSURA project.

The Command Center will coordinate community information, construction logistics, utility coordination, environmental compliance and safety, and diversity and equal opportunities in employment. The Command Center will be managed by an Executive Director to be appointed by the Governor and the Mayor of the City of New York. The Mayor will also appoint a Director of City Operations to act as a liaison between the Command Center and City officials. An Executive Committee, to be chaired by the Executive Director, will be appointed to facilitate communications between the Command Center, the Lower Manhattan Project Sponsors, and other key city and state departments and agencies.

As stated in the Executive Order, the functions of the Command Center will be:

- "Coordinating the work of the participants in the rebuilding process and ensuring that the construction in Lower Manhattan proceeds as scheduled by mediating conflicts in schedules and street and site access between construction projects, agencies, and the Lower Manhattan Community;"
- "Coordinating protocols, contract requirements and activities outside of individual project limits through planning on a daily basis throughout construction for government agencies, developers, construction managers, general contractors, and contractors;"
- "Coordinating construction projects to minimize inconvenience for residents, workers, pedestrians, vehicles, and commuters;"
- "Ensuring that the Lower Manhattan area remains neat, clean and orderly throughout construction;"
- "Communicating with residents, businesses, and the general public through a communications director working with each agency's communications and public outreach

personnel; providing a central focus on issues critical to the local community and the construction industry, by coordinating initiatives, public outreach, and information;" and

- "Utilizing technology to facilitate coordination of projects."

Governor Pataki appointed an Executive Director for the Command Center in February 2005, and the Command Center is working to formalize staff and structure. In the meantime, the Lower Manhattan project sponsors continue to coordinate through the vehicle of the Lower Manhattan Construction Coordination Group per their commitments within the Environmental Analysis Framework.

At this time, it is uncertain whether the role of the Lower Manhattan Construction Coordination Group will be assumed within the umbrella of the Command Center or if both will continue in tandem throughout the construction phase. However, one or both of these groups will ensure the coordination of construction issues between the Lower Manhattan project sponsors as their individual projects move forward.

APPROACH TO OPENING YEAR (2009) AND DESIGN YEAR (2025) EFFECTS

There are more differences among the projects with respect to the long-term assessments than what occurs with the short-term effects. In some ways, this is a result of the different types of projects and the need to focus on what each project may affect in the future and what is typically done in the environmental review process for that type of project. Some of the similarities and differences are discussed below.

While all five projects share a similar vision for the future development of Lower Manhattan and are based on the same future population, employment and land use projections, there are differences in how they are applied. The two MTA/NYCT projects use their own regional forecasting system to develop future (2025) transit ridership but the model does not include vehicular traffic forecasting. The supplemental DEIS (SDEIS) for Route 9A is more focused on roadway traffic and uses a model developed specifically for Manhattan's west side. It was developed for the 1994 *Route 9A Reconstruction FEIS*, focusing on travel patterns along Route 9A, and has been updated with the latest New York Metropolitan Transportation Council (NYMTC) forecasts. The GEIS for the WTC Memorial and Redevelopment Plan uses a methodology that is consistent with practices related to development projects in New York City. This methodology bases future traffic forecasts by adding known development projects to the baseline 2003 conditions. It does not consider modal or temporal shifts, or capacity constraints like the regional models used in the other projects. The different approaches result in differing future projections when comparing predicted traffic volumes at specific locations. However, in most cases these differences are not necessarily apparent since each project may or may not analyze the same set of circumstances as described below.

- The three transit projects would have a negligible effect on street traffic once completed and thus detailed traffic analysis for 2025 has not been conducted. The GEIS for the WTC Memorial and Redevelopment Plan analyzes traffic (and air quality) in 2009 and 2015 while the Route 9A Project provides estimates for 2007 and 2025, its opening and design year, respectively. The differences in predicted traffic volumes along Route 9A can be substantial. In addition, some street directions are different in the two EISs but the difference is more related to the timing of the analysis (and what was known at the time) rather than to any methodological difference.
- While the projections for vehicular traffic volumes in the EISs for Route 9A Project and the WTC Memorial and Redevelopment Plan differ, neither project predicts exceedances of the air quality standards as a result of cumulative effects. Furthermore, differences in predicted

noise levels are minor since it takes a doubling of traffic (which is much higher than the projected differences) to result in perceptible changes.

- Future transit ridership and pedestrian volumes in 2025 are the same in the projects since they were developed in concert by the sponsors of the transit projects (i.e., MTA/NYCT and PANYNJ). These volumes were then used in the GEIS for the WTC Memorial and Redevelopment Plan. The SDEIS for the Route 9A Project does not include a quantitative assessment of transit ridership, since this project would not directly alter existing transit service or induce new ridership. Because there would be changes in the pedestrian facilities along Route 9A, the SDEIS assesses pedestrians crossing Route 9A.

With the above in mind it should be noted that future traffic volumes along the major arterials in lower Manhattan (Route 9A, Church Street and Broadway) and their related effects on air quality and noise are more dependent upon the selection of an alternative for Route 9A than whether the FSTC or South Ferry Terminal are completed. This is also true for the Permanent WTC PATH Terminal, except under its No Action Alternative, which would have a measurable increase in traffic volumes on these roadways. Therefore, long-term future conditions of traffic, air quality, and noise are mostly a function of the commercial development of the WTC site and the selection of an alternative for the Route 9A Project.

Variations also exist for the Lower Manhattan Recovery Projects in terms of the underlying methodologies for long-term air quality and noise impacts since different agencies apply different evaluation criteria. However, these differences are inconsequential with respect to the Permanent WTC PATH Terminal FEIS since the Preferred Alternative's long-term effects on air quality are beneficial and since potential issues with respect to noise and vibration are related more to coordination with the design of the WTC Memorial and not to long-term impacts on existing and future residents and workers in Lower Manhattan.

As noted above, variations also exist in the evaluation of effects to the National and State Register-eligible WTC site. The Permanent WTC PATH Terminal DEIS identified a significant adverse impact on the site, and FTA and PANYNJ have an MOA executed to address these impacts. The Route 9A SDEIS and the World Trade Center Memorial and Redevelopment Plan FGEIS identify potential adverse effects; thus, these projects have executed Programmatic Agreements that will address effects if they are later determined to be adverse. Although the approach to identify these effects varies amongst the projects, the sponsors have agreed to stipulations, contained within the Permanent WTC PATH Terminal's executed MOA, to address cumulative effects on the WTC site. This commitment is described in more detail in Section C, "Probable Construction Period Effects."

C. PROBABLE CONSTRUCTION PERIOD EFFECTS

As described in this EIS, the No Action Alternative for a Permanent WTC PATH Terminal would not result in adverse impacts during the construction period. Thus, any cumulative adverse impacts in Lower Manhattan during this time would be attributed to other construction projects in the area. Thus, a construction period assessment for the No Action Alternative has not been addressed as part of this cumulative effects analysis.

ACCESS AND CIRCULATION

VEHICULAR TRAFFIC

Probable Impacts

The *WTC Memorial and Redevelopment Plan GEIS* contains a comprehensive examination of expected traffic conditions in the 2006 peak construction year for the combination of several major projects, including its own project's construction and that of the Fulton Street Transit Center, South Ferry Terminal, Route 9A Project, and the Permanent WTC PATH Terminal. All projects were closely coordinated with respect to construction year traffic projections and conditions. The information that follows was derived from that coordinated effort.

As described above, different traffic impact criteria were applied for the WTC Memorial and Redevelopment Plan and the Lower Manhattan Transportation Recovery Projects. The WTC Memorial and Redevelopment Plan used the *CEQR Technical Manual* guidance, which are more stringent and are typically applied to development projects that directly induce new vehicular traffic. These criteria are as follows:

- For a Level of Service (LOS) A, B, C condition, a project-generated increase in delay that results in mid-LOS D (45.0 seconds of delay) or worse is considered adverse.
- For a baseline LOS D condition, a project-generated increase of 5 seconds or more resulting in delays in excess of 45.0 seconds is considered adverse.
- For a baseline LOS E condition, a project-generated increase of 4 seconds or more of delay is considered adverse.
- For a baseline LOS F condition, a project-generated increase of 3 seconds or more of delay is considered adverse unless the baseline has more than 120.0 seconds of delay when a 1-second increase would be adverse.

To provide for consistency in this cumulative assessment, the CEQR impact criteria were used. It is expected that if the criteria described in Chapter 8, Section B, "Vehicular Traffic and Parking," had been used for this cumulative assessment, there would be fewer impact locations.

The analysis of cumulative traffic effects was conducted at a set of 24 intersections, 21 of which are signalized and three which are unsignalized. Overall, future conditions with construction of the above projects would create adverse traffic impacts at the following six intersections:

- Route 9A and Vesey Street (AM peak hour)
- Church Street and Chambers Street (AM and PM peak hours)
- Church Street and Barclay Street (AM peak hour)
- Church Street and Cortlandt Street (midday peak hour)
- Broadway and Canal Street (PM peak hour)
- Broadway and Worth Street (AM, midday, and PM peak hours)

Figure 15-3 shows the cumulative construction period truck trip generation for selected intersections in the vicinity of the Project Site. Table 15-3 shows delays and LOS for the vehicle movements that would be adversely impacted by cumulative construction based on analysis conducted for the *World Trade Center Memorial and Redevelopment Plan DGEIS*. Appendix C shows the delays and LOS results for all of the analysis locations.

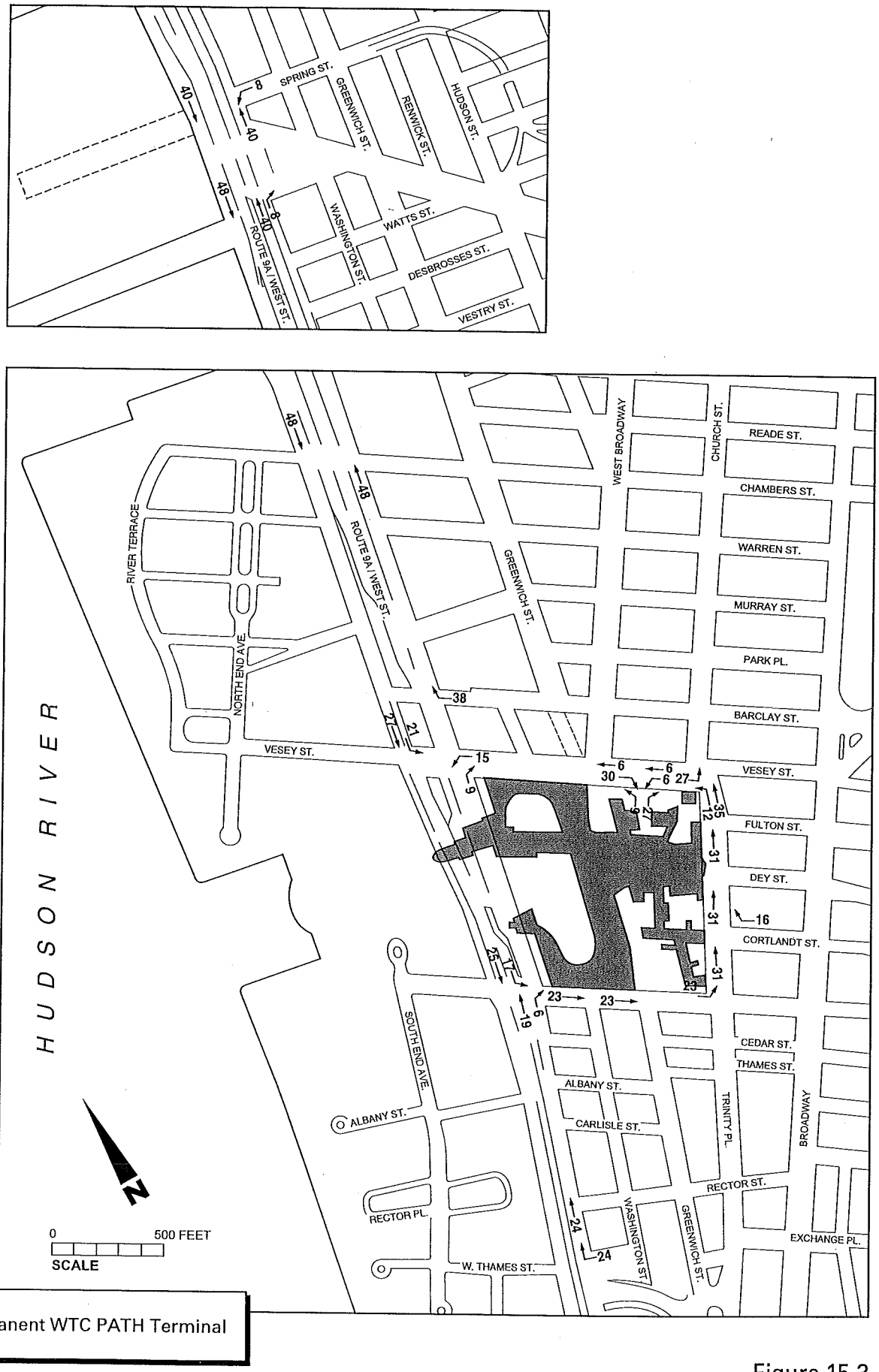

Figure 15-3

Cumulative Peak Hourly Construction Period Truck Trips

Table 15-3
2006 Construction Period: Summary of Peak Hour Adverse Impacts

Intersection	Peak Hour	Movement	Baseline LOS (Delay in seconds)	Cumulative Increase in Delay (seconds)
Route 9A and Vesey Street	AM	Northbound Thru and Right-Turn	F (150.3)	1.0
Church St and Chambers Street	AM	Northbound Approach	F (169.6)	1.8
Church St and Chambers Street	PM	Northbound Approach	F (162.7)	1.4
Church St and Barclay Street	AM	Northbound Approach	D (47.5)	12.5
Church St and Cortlandt Street	MD	Westbound Approach	F (85.5)	3.6
Broadway and Canal Street	PM	Westbound de facto Left-Turn	F (96.1)	4.3
Broadway and Worth Street	AM	Southbound Approach	F (290.2)	2.6
Broadway and Worth Street	MD	Southbound Approach	F (245.1)	5.6
Broadway and Worth Street	PM	Southbound Approach	F (295.3)	2.6

Note: The baseline LOS reflects conditions from which impacts are evaluated. Refer to Appendix C for detailed information on the baseline and cumulative Levels of Service (LOS).

Mitigation

The mitigation of cumulative traffic effects of the various Lower Manhattan construction activities would also be a coordinated effort under the auspices of both NYSDOT and NYCDOT, since both agencies have jurisdiction over the affected roadways—NYSDOT with regard to Route 9A and NYCDOT with regard to all other streets in the area.

- At Route 9A and Vesey Street, the cumulative effects of all construction vehicles (82 in the peak traffic hours) would create an adverse traffic impact along northbound Route 9A by creating a future condition with an incremental delay of one second. The Preferred Alternative's construction would contribute an estimated 12 vehicles out of the 82 and would, therefore, not be the major contributor to the impact.
- At Church Street and Chambers Street, PATH construction would generate just one vehicle through the impacted northbound approach out of the total of 24 construction vehicles expected to pass through the intersection along northbound Church Street in the AM and PM peak hours, with an increase in intersection delay of 1 to 2 seconds.
- At Church Street and Barclay Street, PATH construction vehicles would generate 8 of the 62 construction vehicles expected, with the northbound Church Street approach to the intersection deteriorating from level of service (LOS) D to LOS E.
- At Church Street and Cortlandt Street, PATH would generate 5 of the 57 construction vehicles expected along westbound Cortlandt Street in the midday peak hour, with the westbound Cortlandt Street approach expected to deteriorate by 3.6 seconds within LOS F.
- At Broadway and Canal Street, PATH would generate 2 of the 35 construction vehicles that would create an adverse impact in the PM peak hour along westbound Canal Street.
- At Broadway and Worth Street, adverse impacts are expected in the AM, midday, and PM peak hours along southbound Broadway with 27 construction vehicles generated overall.

As noted above, the cumulative construction of the Lower Manhattan Recovery Projects would require mitigation measures. These measures would be incorporated in a coordinated Maintenance and Protection of Traffic (MPT) Plan. As described in the Route 9A Project SDEIS, NYSDOT would prepare this plan on behalf of the Lower Manhattan project sponsors through either the Command Center or the Lower Manhattan Construction Coordination Group, as appropriate. The MPT Plan would include input from PANYNJ, MTA/NYCT, LMDC, and NYCDOT and would specify measures to stage construction areas (e.g., lane and sidewalk closures) while providing measures for the circulation of traffic through Lower Manhattan (e.g., traffic diversions, parking restrictions, and signal timing adjustments).

Conditions with the Revised Schedules

The refinements to the Lower Manhattan Recovery Projects' schedules would slightly alter the findings presented above. The cumulative peak hour truck trips would be approximately 9 percent lower in the peak construction year under the refined schedules as compared to the analysis presented above. As a result, the projected traffic impact at Canal Street and Broadway would not occur. However, increases in background traffic growth, combined with cumulative construction vehicle trips would result in an impact at the intersection of Canal and Hudson Streets in the AM peak hour. This impact could be mitigated with signal timing adjustments, which would be incorporated into the coordinated Maintenance and Protection of Traffic (MPT) Plan for the Recovery Projects.

PEDESTRIAN CIRCULATION

Probable Impacts

During construction of the Preferred Alternative, there would be additional construction associated with planned development in Lower Manhattan. A cumulative analysis of construction-period pedestrian level of service was conducted and the results are shown in Table 15-4.

In most cases, crosswalks would operate at LOS D or better during the critical construction year, and there would be no change in LOS as compared to baseline conditions. However, there would be deterioration to LOS E conditions at the intersections of Church Street and Dey Street and at Church Street and Cortlandt Street in the AM and PM peak hours.

Mitigation

Although no additional locations would deteriorate to LOS F due to Cumulative Construction Period effects, conditions at some locations would deteriorate to LOS E as compared to the baseline. As described above, a MPT Plan will be prepared for the Lower Manhattan Recovery Projects. This plan will include measures to ensure that safe and efficient pedestrian access and circulation is maintained throughout the construction period. Measures that may be incorporated could include signal timing adjustments; protected pedestrian walkways, and crossing guards. It is anticipated that the MPT Plan would be administered by the Command Center or the Lower Manhattan Construction Coordination Group in coordination with NYSDOT, NYCDOT, PANYNJ, LMDC, and MTA/NYCT.

Table 15-4
Comparison of Cumulative Construction Period Level-of-Service

Intersection	Crosswalk	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
		2006 Baseline	2006 Cumulative	2006 Baseline	2006 Cumulative	2006 Baseline	2006 Cumulative
Route 9A and Vesey St	North	Out of service; pedestrians are and will be diverted to the Vesey Street pedestrian bridge and adjoining Vesey Street walkway.					
	East						
	South						
Route 9A and Liberty St	North	Out of service; pedestrians are and will be diverted to the Liberty Street pedestrian bridge and adjoining Liberty Street walkway.					
	East						
	South						
West Broadway and Vesey St	North	Out of service; pedestrians are and will be diverted to the Vesey Street pedestrian bridge and adjoining Vesey Street walkway.					
	East						
	West						
Greenwich St and Liberty St	East	Out of service; pedestrians are and will be diverted to the Liberty Street pedestrian bridge and adjoining Liberty Street walkway.					
	South						
	West						
Church St and Vesey St	North	B	B	B	B	B	B
	East	C	C	C	C	C	C
	South	C	C	B	B	D	D
	West	F	F	D	D	F	F
Church St and Fulton St	North	B	B	B	B	B	B
	East	D	D	D	D	E	E
	South	D	E	D	D	C	D
Church St at Dey St	North	B	B	A	A	B	B
	East	C	E	D	D	D	D
	South	D	D	C	C	D	D
Church St at Cortlandt St	North	B	C	B	B	B	C
	East	B	E	C	D	C	E
	South	B	E	C	D	B	E
Church St at Liberty St	North	E	E	C	C	E	E
	East	C	C	B	B	D	D
	South	C	C	B	B	B	B
	West	F	F	C	C	E	E

AIR QUALITY

The analysis of the potential cumulative air quality impacts of construction of the Preferred Alternative and the other Lower Manhattan Recovery Projects uses the methodology described in Chapter 9, "Air Quality." Additional information regarding air quality in the context of the aftermath of September 11, 2001; air quality standards and benchmarks for determining the significance of impacts; background pollutant levels; and general procedures for air quality modeling also appear in Chapter 9.

This cumulative air quality assessment was modified since publication of the DEIS to reflect mitigation commitments for the WTC Memorial and Redevelopment Plan as well as to describe both alternatives for the Route 9A Project. LMDC incorporated additional mitigation measures (e.g., electrification and diesel particle filters) in their ROD for the WTC Memorial and Redevelopment Plan. These measures were included in this cumulative effects analysis. Furthermore, analysis was prepared for both the at-grade and short bypass alternatives for Route 9A since construction methods for both Route 9A and PATH's east-west concourse would vary.

Since almost all construction equipment and trucks use diesel engines, the main pollutants of concern for local analysis are particulate matter, nitrogen dioxides, emitted as engine exhaust

and fugitive dust and analyzed as $PM_{2.5}$, PM_{10}, and NO_2. Neither onsite nor offsite parking would be provided for construction workers, other than for a few delivery vehicles; thus, most construction workers would arrive by public transportation. Therefore, no significant increase in light duty gas vehicle trips is expected. Since diesel engines emit very little carbon monoxide (CO) analysis of CO from construction engines on-site was not warranted. The combined impact of construction related traffic on intersections, which could potentially impact the running speeds or idling times of background traffic and the ensuing CO concentrations was analyzed. The diesel fuels used for on-road vehicles contain low concentrations of sulfur, and pursuant to the EPCs, the on-site non-road diesel construction engines would be using ultra low sulfur diesel (ULSD). Emissions of sulfur dioxide (SO_2) from the site are therefore not of concern.

The analysis of on-site sources for the Lower Manhattan Recovery Projects in the critical analysis year considered the numbers and types of equipment in each work zone at each of the sites; the period of use (e.g., days or months); the percentage of time it would be operated during the period; and the size of the equipment.* (See "On-Site Equipment" above and Appendix D for more information on the on-site and mobile sources assumed in the analysis.)

All diesel construction engines, excluding on-road trucks, would use ULSD. Furthermore, where practicable, engines larger than 50 horsepower (HP) would include emissions reduction measures to reduce emissions of PM and volatile organic compounds (VOCs). For the purpose of this analysis, it was assumed that PM emissions from all such engines would be reduced by 40 percent—the reduction achieved by using diesel oxidation catalysts (DOC). PM emissions may be reduced by 90 percent or higher in cases where diesel particle filters (DPF) would be used. (These reductions include a reduction of approximately 14 percent due to the use of ULSD, as compared to the baseline emissions using normal fuel.) Since it is uncertain at this time what emission reduction technologies would be most efficient with each equipment type, and since DOCs are more efficient at reducing VOC emissions, which are ozone precursors and are of regional concern, the EPCs provide the flexibility to utilize either DOC or DPF control technologies. Therefore, the minimum PM emissions reduction of DOCs was assumed for this analysis.

To predict average concentrations for the time periods corresponding to the appropriate standards and impact criteria, on-site emissions were modeled for two time periods: 24-hours for PM and annual averages for PM and NO_2. These emissions were based on the construction activity predicted for each of those time scales, as described above and in Appendix D. Typical daily activity emissions were calculated for the various phases averaged over the year to produce annual emission rates for each work zone. Peak day activity emissions were calculated for each phase, and the values calculated for the period with the highest total emissions from all work zones were used for the 24-hour emission rates. A detailed description of emission factors from the various models described above and total emission rates based on construction activities in each zone is presented in Appendix D.

Background annual average $PM_{2.5}$ concentrations in New York City currently exceed the NAAQS. Until the $PM_{2.5}$ NAAQS are fully implemented and NYSDEC adopts a State Implementation Plan covering $PM_{2.5}$, the assessment of potential impacts and mitigation regarding fine particulate matter has been conducted using the NYSDEC and New York City Department of Environmental Protection (NYCDEP) interim threshold criteria.

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* Given its distance from the Permanent WTC PATH Terminal, the South Ferry Terminal was not included for the cumulative analysis of on-site equipment.

PROBABLE IMPACTS

On–Road Carbon Monoxide Analysis

Maximum predicted CO concentrations in the critical analysis year were predicted at two intersections along Route 9A, similar to the analysis for this project. These locations are of concern because of the high level of traffic currently using the roadway and the potential for construction vehicles to adversely affect traffic flow and thereby increase CO emissions at critical intersections. The analysis includes all construction vehicles from the five major Lower Manhattan Recovery Projects and total approximately 2,000 per day. Approximately, a third of the construction vehicles would use Route 9A to access the WTC, PATH, and Route 9A construction work areas. As shown in Table 15-5, maximum predicted 8–hour average CO concentrations would increase by 0.6 ppm over conditions without any activity from the five major projects. With that increase, total CO concentrations would still be well below the NAAQS.

Table 15-5
Critical Analysis Year: Maximum Predicted 8-Hour Average CO Concentrations

Site	Without Cumulative Construction	With Cumulative Construction
Route 9A and Liberty Street	5.1	5.7
Route 9A and Vesey Street	5.5	5.5
Note: National Ambient Air Quality Standard (NAAQS) for CO is 9 ppm.		

Particulate Matter and Nitrogen Dioxide Analyses

The highest predicted increase in pollutant concentrations from construction activity in the vicinity of the construction sites is presented in Table 15-6. The total predicted concentrations, including background levels and the increment from the projects, are presented in Table 15-7. The concentrations include both on–road sources and on–site construction activity emissions.

To illustrate the effects of the emissions from construction on ambient air quality in the vicinity of the project, isopleths (i.e., lines of equal concentration increases) were developed based on the results of the air quality dispersion modeling. Figures 15-4 through 15-13 show the increase in annual average PM_{10}, 24-hour average PM_{10}, annual average $PM_{2.5}$, 24-hour average $PM_{2.5}$ and annual average NO_2 concentrations from cumulative construction activity in the critical analysis year for both of the Route 9A alternatives.

Under the Route 9A short bypass alternative, the maximum increase in PM_{10} concentrations is projected to be 4.4 $\mu g/m^3$ and 86.5 $\mu g/m^3$ on an annual and 24-hour basis, respectively. When considered with background conditions, the total maximum PM_{10} concentrations would be 31.9 $\mu g/m^3$ and 146.9 $\mu g/m^3$ on an annual and 24-hour basis, respectively. Both the annual and 24-hour concentrations would be below the NAAQS. As shown in Figures 15-4 and 15-6, the maximum annual increase is predicted near the intersection of Route 9A and Vesey Street while the maximum 24-hour increase would be along the Route 9A bikeway adjacent to the World Financial Center. At residential receptors, the maximum increase would be significantly lower (17.1 $\mu g/m^3$ for the 24-hour period and 2.5 $\mu g/m^3$ on an annual basis).

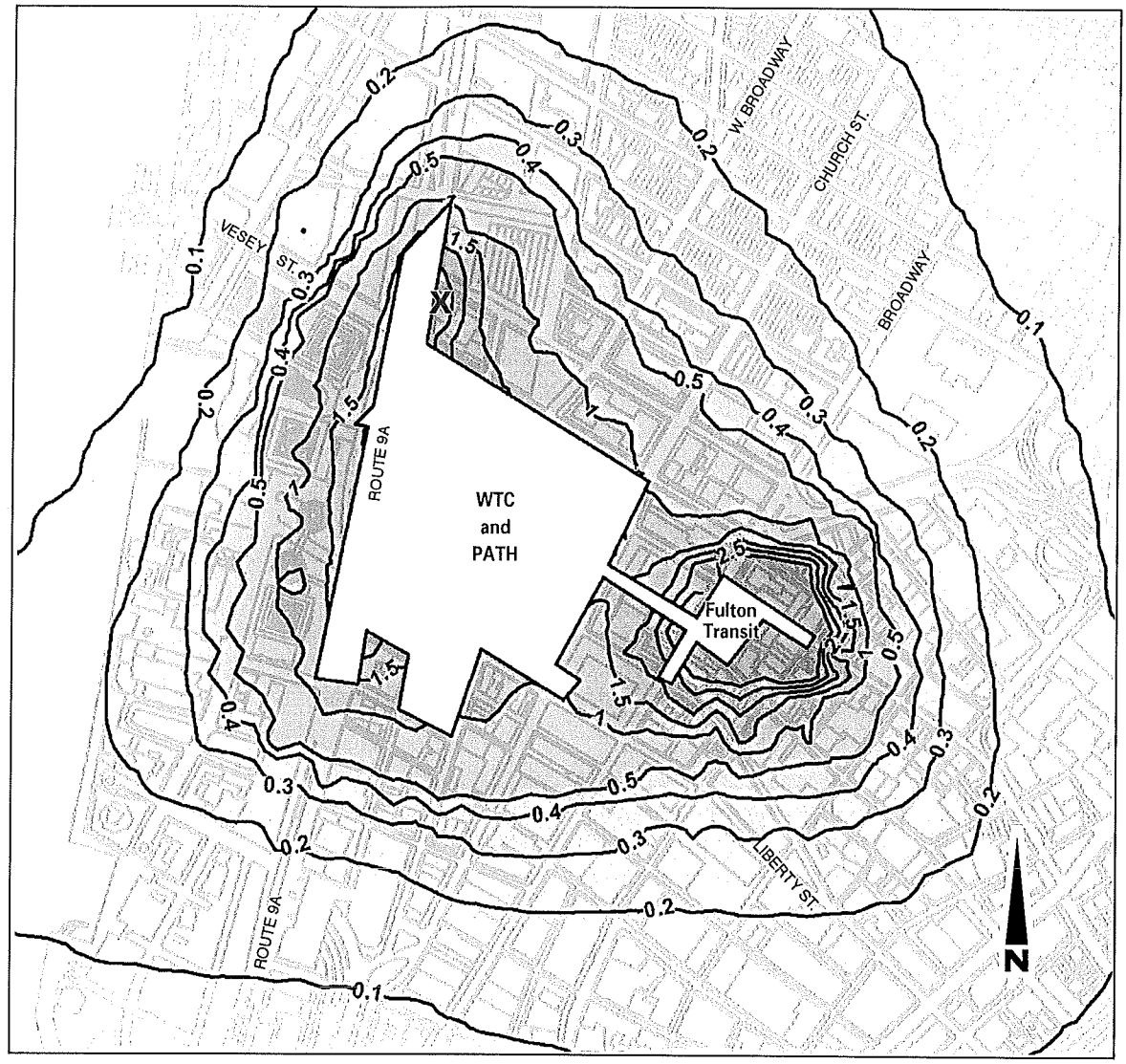
Table 15–6
Highest Predicted Increase in Pollutant Concentrations from Cummulative Construction of the Lower Manhattan Recovery Projects in the Critical Analysis Year

Pollutant	Average Period	Receptor Type	Maximum Increase [µg/m^3] With Route 9A Short Bypass	Maximum Increase [µg/m^3] With Route 9A At Grade
NO_2	Annual	Highest of All Receptors	24.3**	21.5**
		Residential Buildings / Hotel	22.2**	21.5**
$PM_{2.5}$	24–hour	Highest of All Receptors	68.4*	82.5*
		Residential Buildings / Hotel	11.3*	11.4*
		Other Locations on Access Routes	0.4	0.4
	Annual	Local Highest of All Receptors	2.4*	2.4*
		Local Highest Residential / Hotel	1.8*	1.8*
		Local on Access Routes	0.17	0.17
		Neighborhood Scale	0.42*	0.38*
PM_{10}	24–hour	Highest of All Receptors	86.5	117.9
		Residential Buildings / Hotel	17.1	26.5
		Other Locations on Access Routes	4.5	4.5
	Annual	Highest of All Receptors	4.4	4.0
		Residential Buildings / Hotel	2.5	2.5
		Other Locations on Access Routes	1.4	1.4

Notes:
Interim guidance threshold levels for $PM_{2.5}$ are 5 µg/m^3 and 0.3 µg/m^3 for 24–hour and annual increases respectively, and 0.1 µg/m^3 for neighborhood scale annual average. For determination of adverse impacts, these values are applied in the absence of specific criteria.

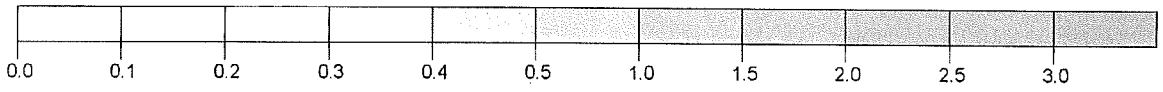
* Indicates substantial adverse impact–exceeding the interim guidance thresholds.

** Substantial adverse impact due to high increment predicted where existing background concentrations are high—not exceeding NAAQS (see table 15–7).



X Predicted Maximum Concentration

0 400 800 FEET
SCALE

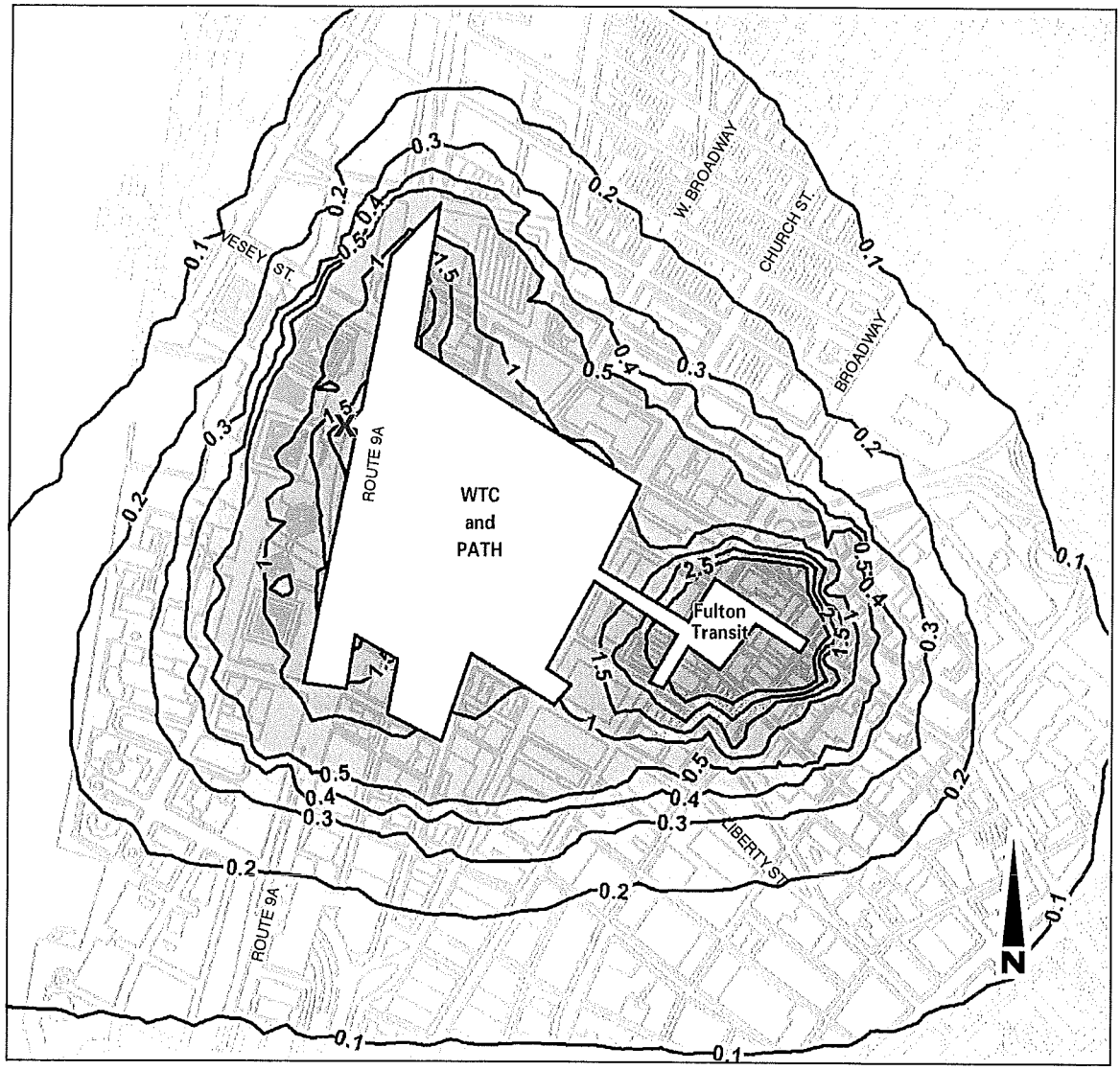


Increase in Concentration ($\mu g/m^3$)

Figure 15-4

Maximum Predicted Annual Average PM_{10} Construction Increment

Cumulative with Route 9A Short Bypass Tunnel Alternative



X Predicted Maximum Concentration

0 400 800 FEET
SCALE

0.0 0.1 0.2 0.3 0.4 0.5 1.0 1.5 2.0 2.5

Increase in Concentration ($\mu g/m^3$)

Figure 15-5

Maximum Predicted Annual Average PM_{10} Construction Increment

Cumulative with Route 9A At-Grade Alternative

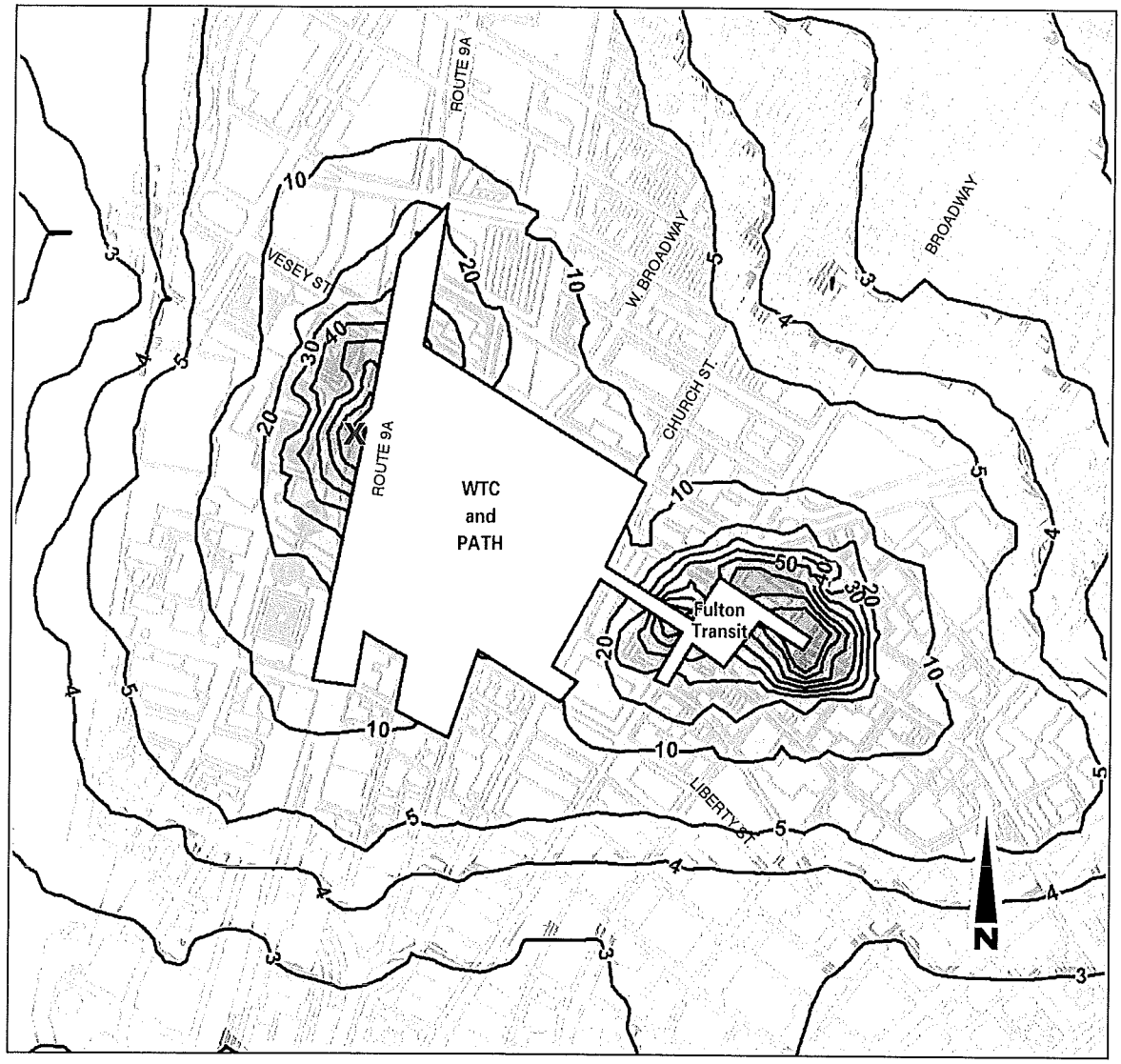


Figure 15-6

Maximum Predicted 24-Hour Average PM_{10} Construction Increment

Cumulative with Route 9A Short Bypass Tunnel Alternative

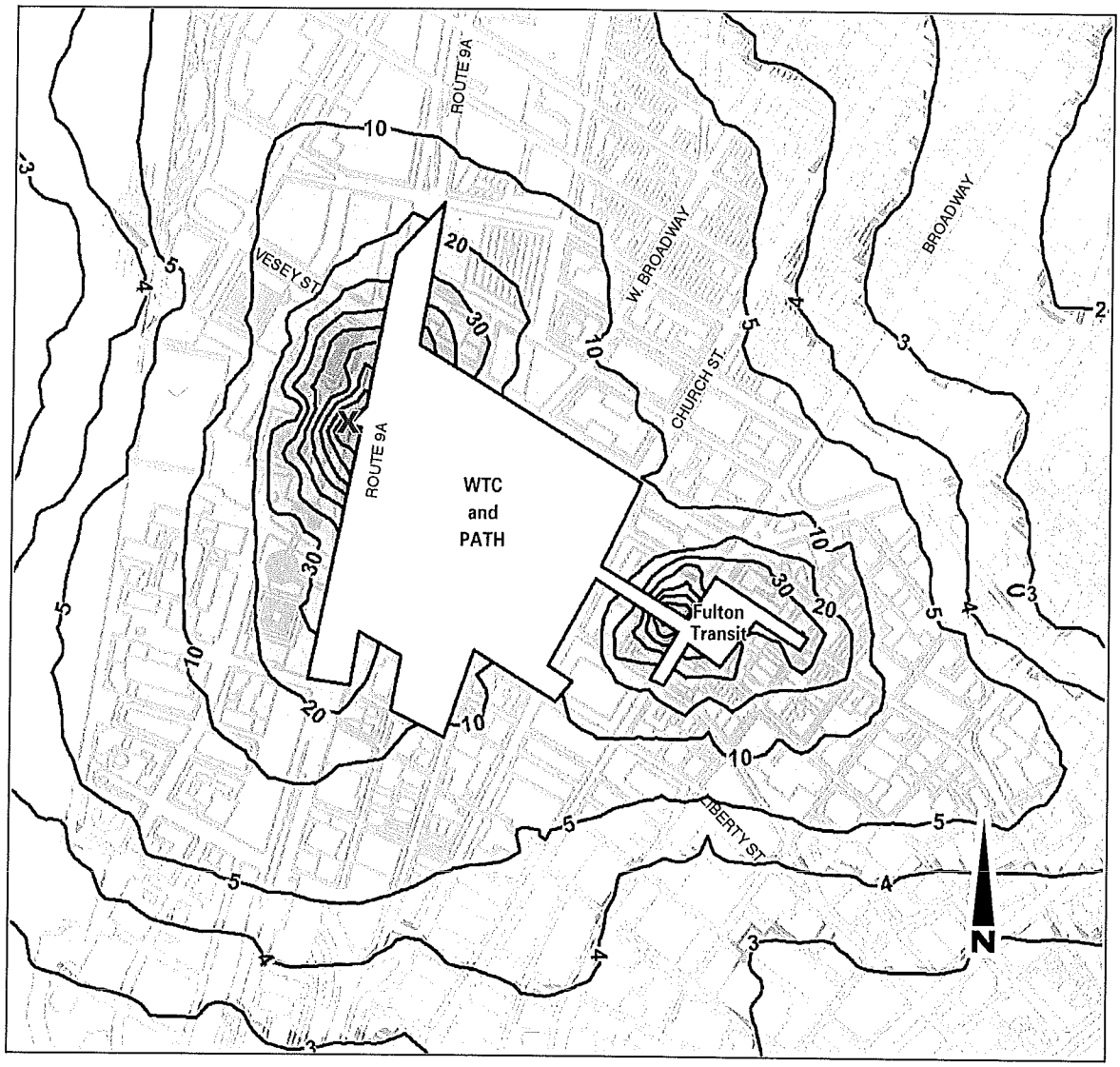


Figure 15-7

Maximum Predicted 24-Hour Average PM_{10} Construction Increment

Cumulative with Route 9A At-Grade Alternative

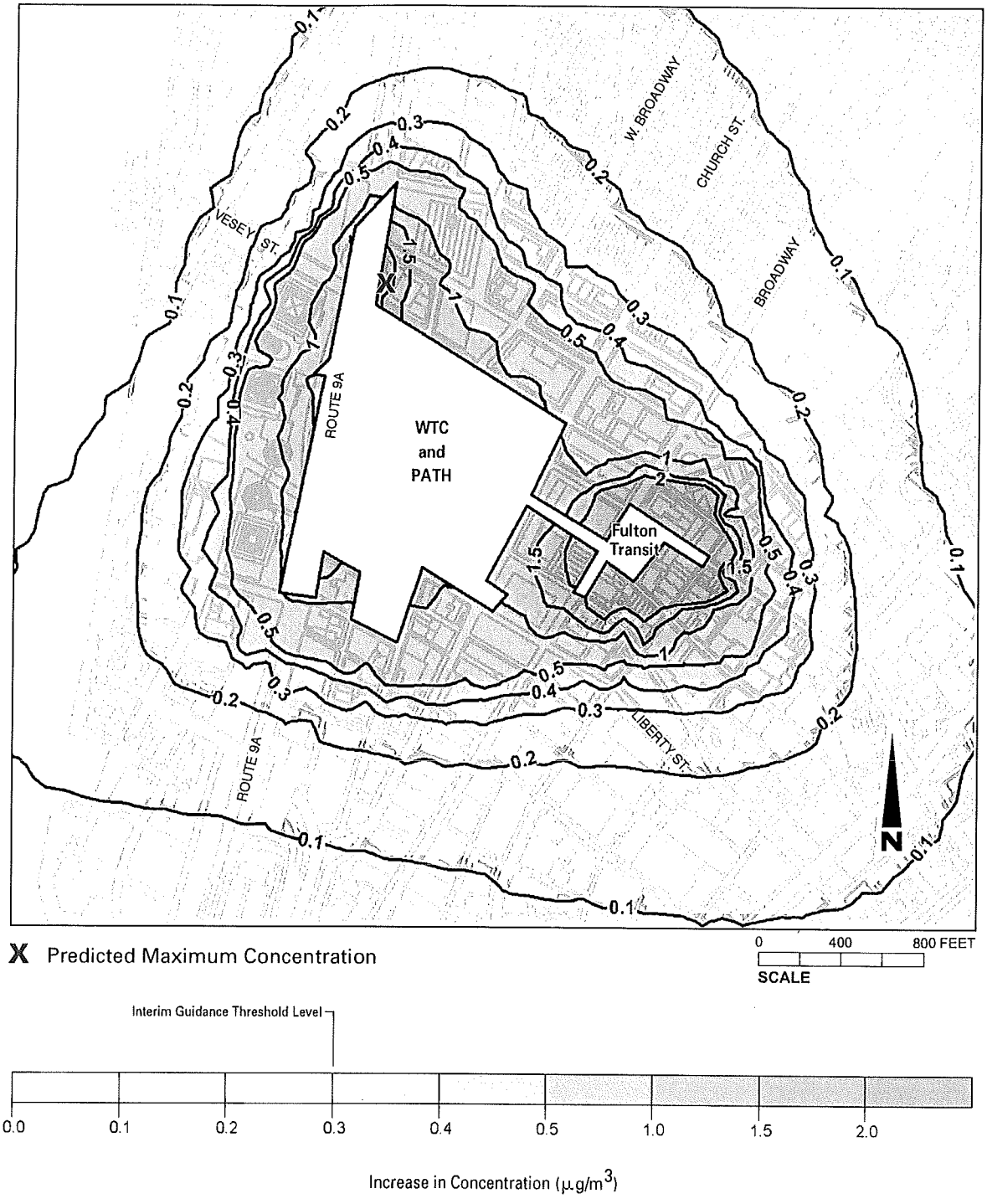
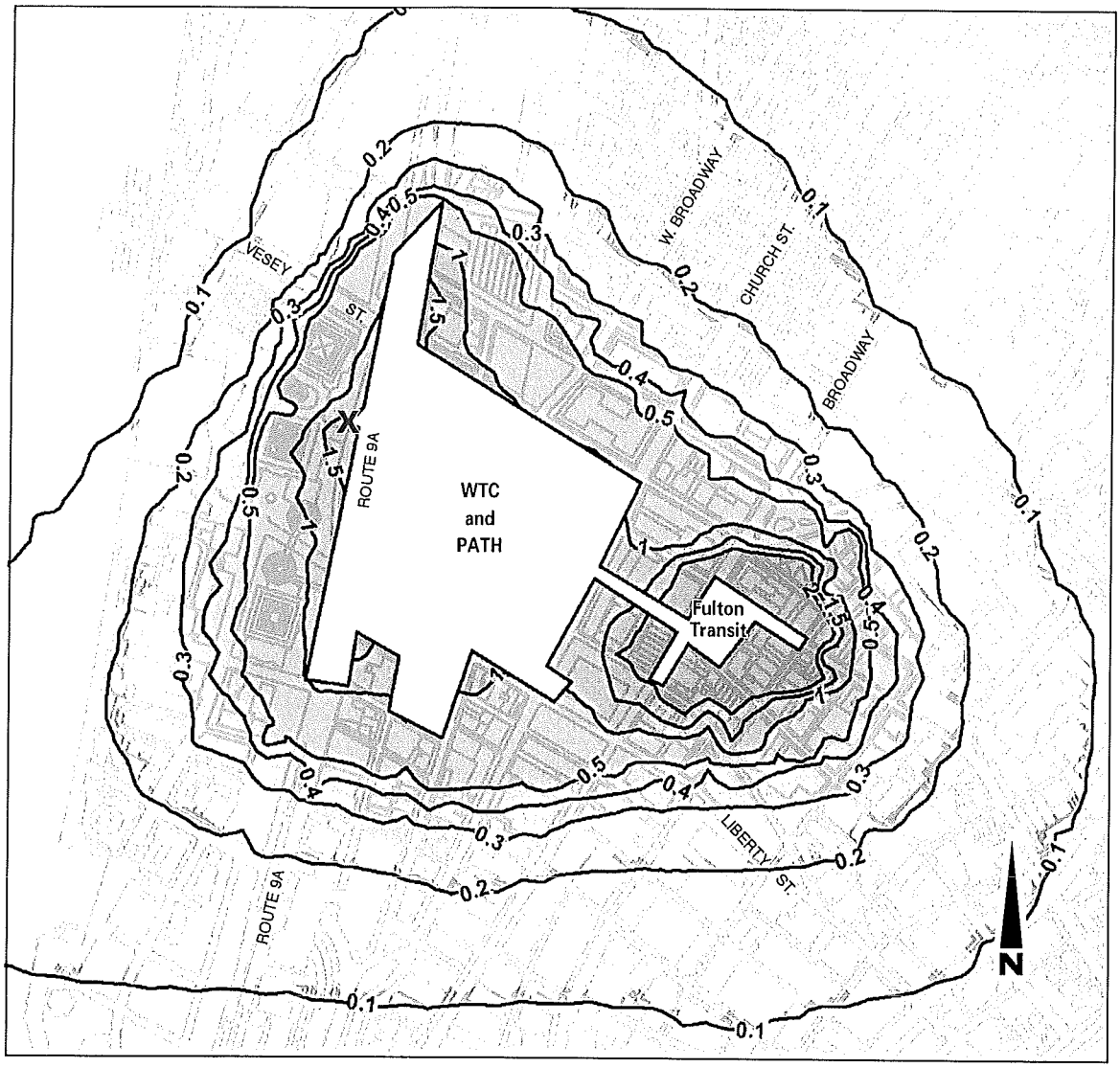


Figure 15-8

Maximum Predicted Annual Average $PM_{2.5}$ Construction Increment

Cumulative with Route 9A Short Bypass Tunnel Alternative



X Predicted Maximum Concentration

0 400 800 FEET
SCALE

Interim Guidance Threshold Level

0.0 0.1 0.2 0.3 0.4 0.5 1.0 1.5 2.0

Increase in Concentration ($\mu g/m^3$)

Figure 15-9

Maximum Predicted Annual Average $PM_{2.5}$ Construction Increment

Cumulative with Route 9A At-Grade Alternative

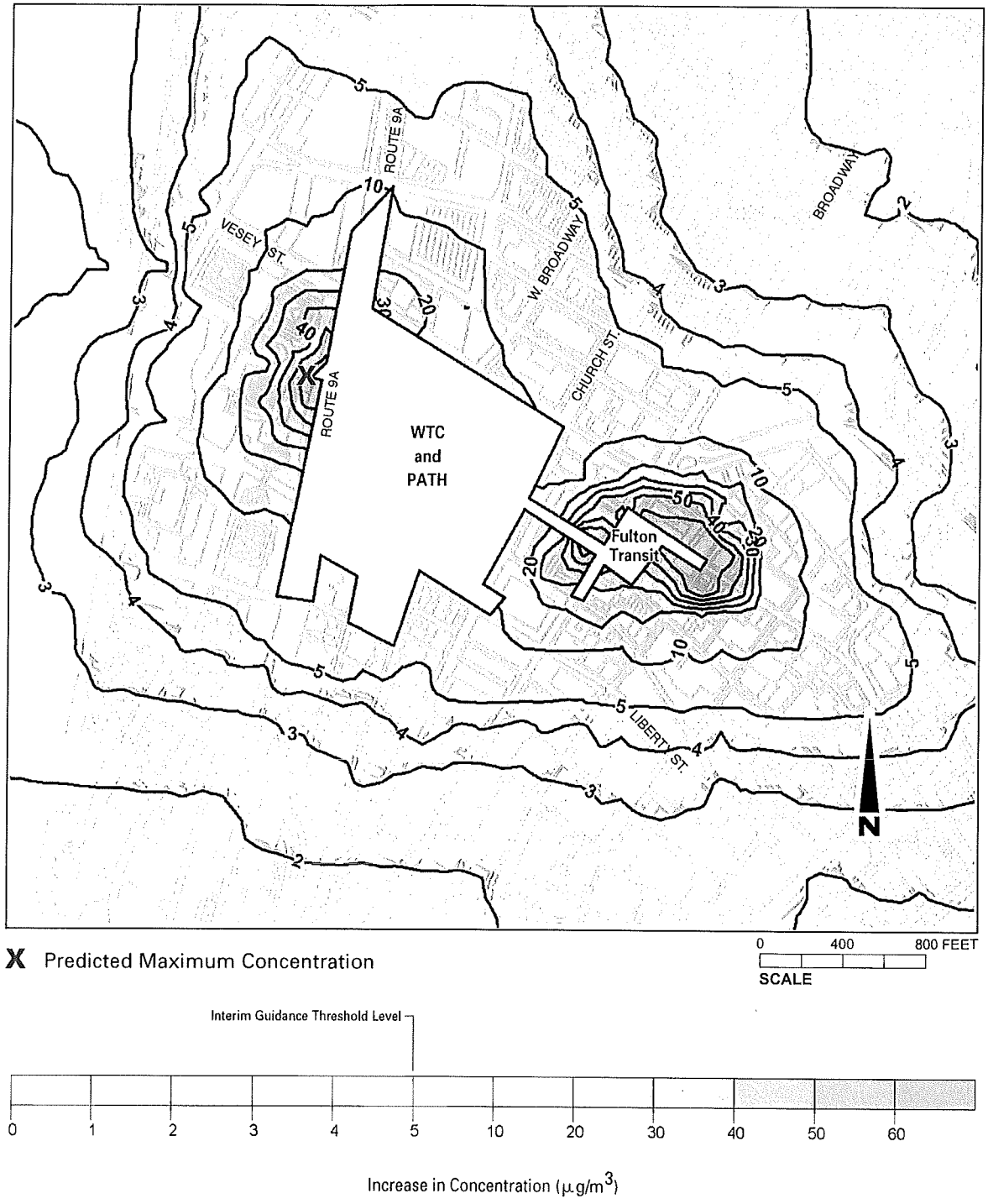


Figure 15-10

Maximum Predicted 24-Hour Average $PM_{2.5}$ Construction Increment

Cumulative with Route 9A Short Bypass Tunnel Alternative

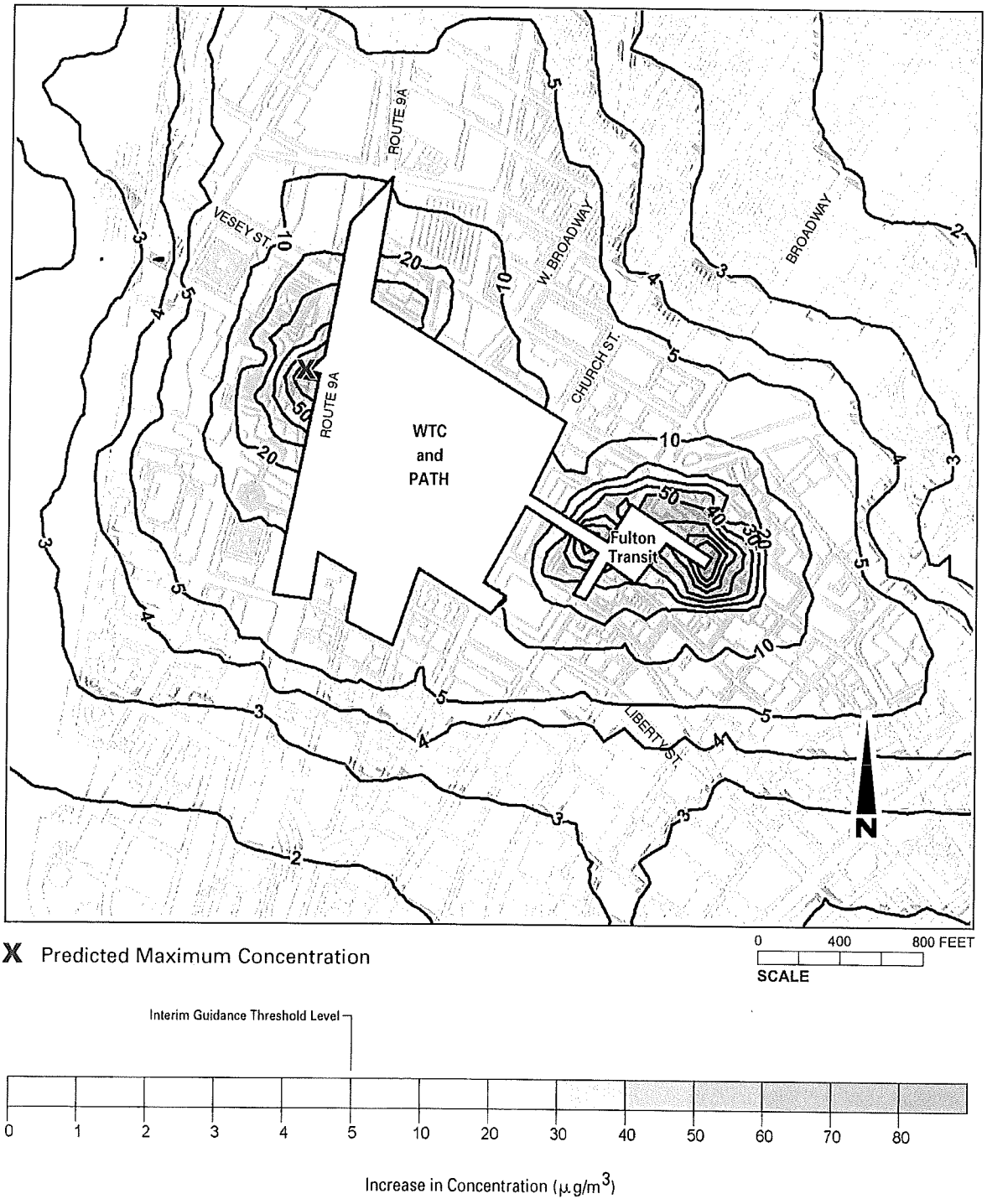


Figure 15-11

Maximum Predicted 24-Hour Average $PM_{2.5}$ Construction Increment

Cumulative with Route 9A At-Grade Alternative

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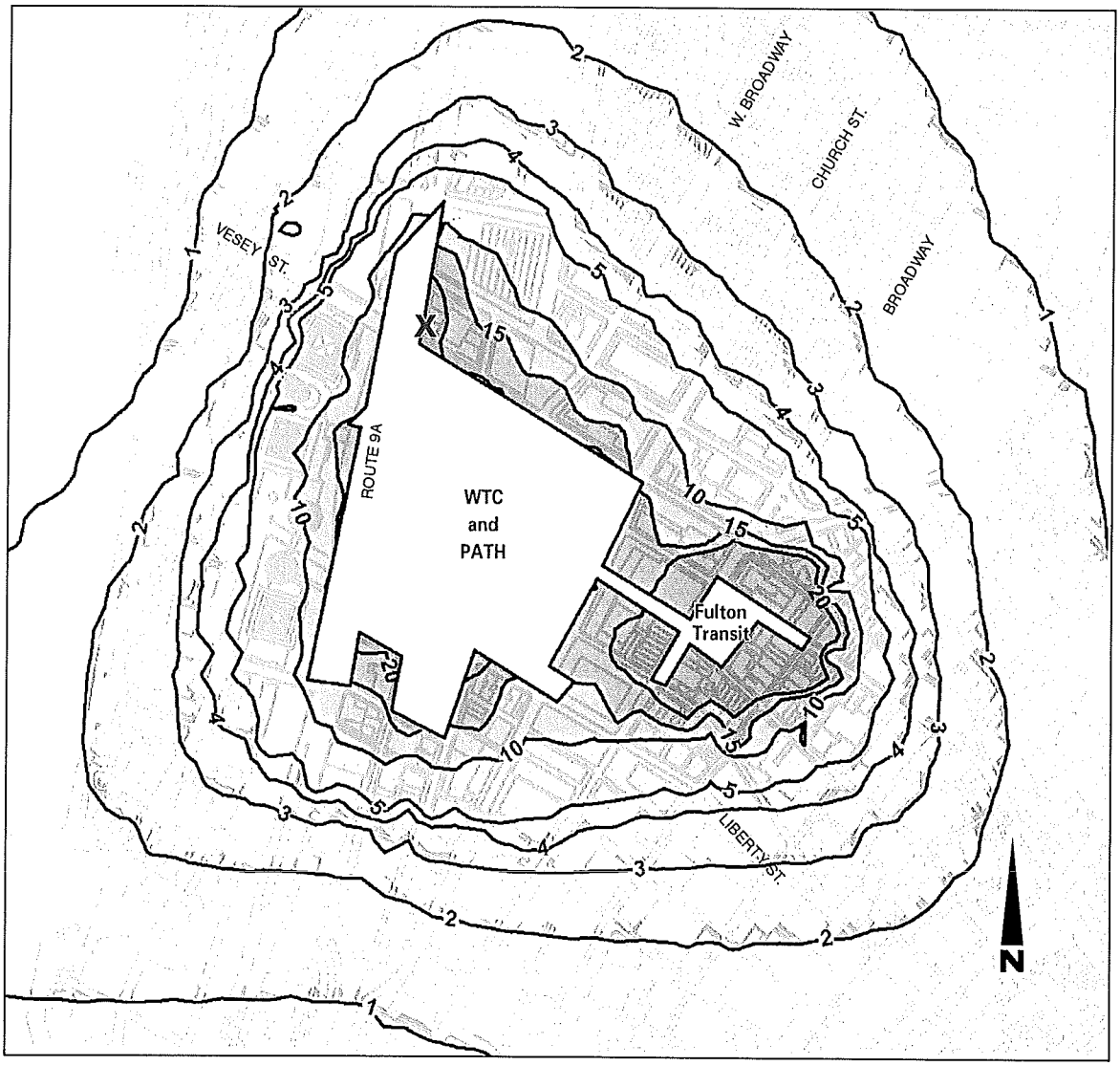

Figure 15-12

Maximum Predicted Annual Average NO_2
Construction Increment

Cumulative with Route 9A
Short Bypass Tunnel Alternative

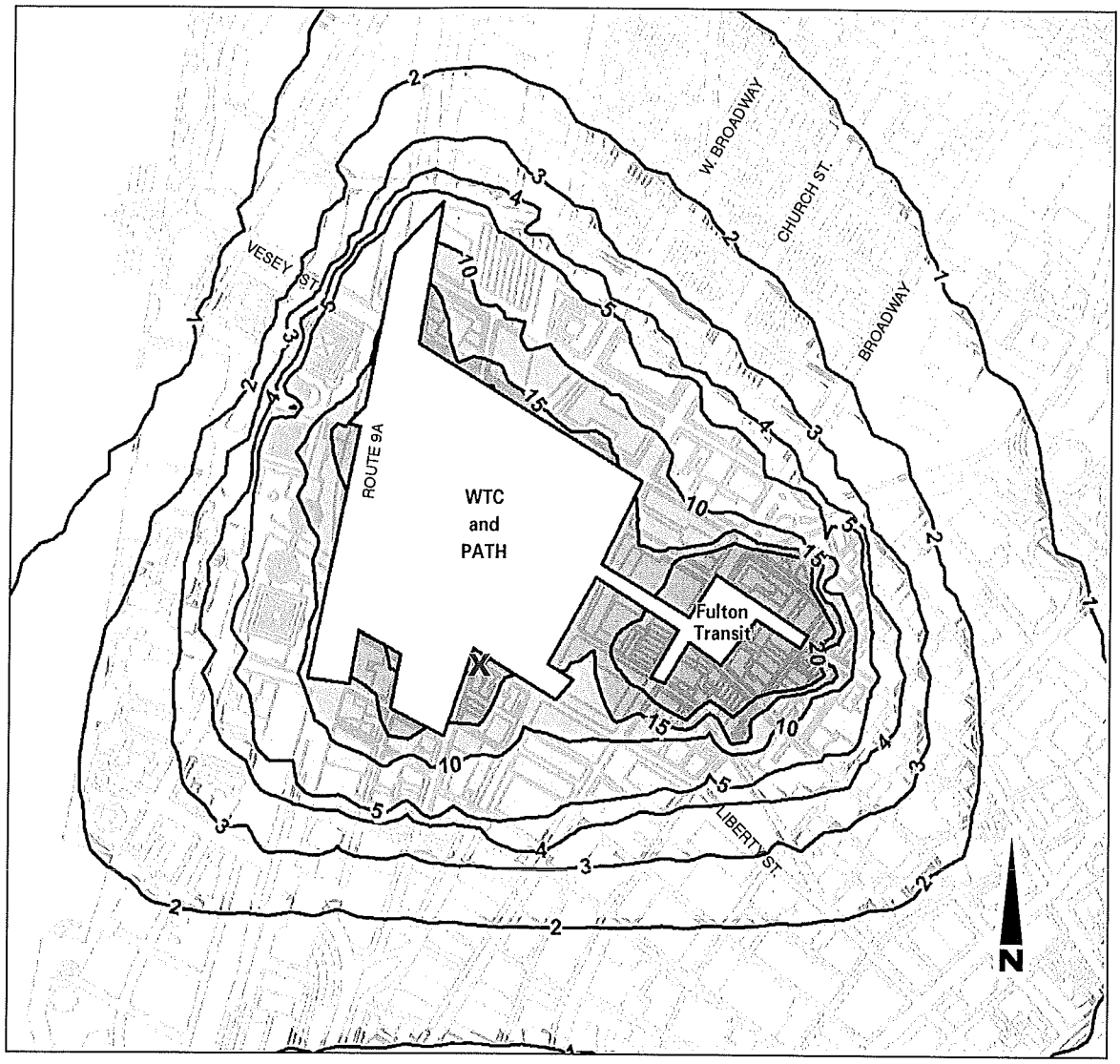

Figure 15-13

Maximum Predicted Annual Average NO_2 Construction Increment

Cumulative with Route 9A At-Grade Alternative

Table 15-7
Highest Predicted Total Pollutant Concentrations from Cumulative Construction of the Lower Manhattan Recovery Projects in the Critical Analysis Year

Pollutant	Average Period	Receptor Type	Maximum Increase [µg/m³]	
			With Route 9A Short Bypass	With Route 9A At Grade
NO_2	Annual	Highest of All Receptors	96.3	93.5
		Residential Buildings / Hotel	94.2	93.5
$PM_{2.5}$	24–hour	Highest of All Receptors	115.4*	129.5*
		Residential Buildings / Hotel	58.5	59.2
		Other Locations on Access Routes	47.3	48.1
	Annual	Highest of All Receptors	20.5**	20.5**
		Highest Residential / Hotel	19.7**	19.8**
PM_{10}	24–hour	Highest of All Receptors	146.9	178.3*
		Residential Buildings / Hotel	77.5	86.4
		Other Locations on Access Routes	63.6	63.6
	Annual	Highest of All Receptors	31.9	31.5
		Residential Buildings / Hotel	29.7	29.6
		Other Locations on Access Routes	28.8	28.8

Notes:

All total concentrations include calculated background contributions from local mobile sources, as well as measured regional background values as follows: NO_2—Annual average 72 µg/m³; $PM_{2.5}$—Annual average 17.1 µg/m³ (highest of 2000-2002 annual values); 24-hour average 44.0 µg/m³ (highest of the three 2nd highest 24-hour averages in 2000-2002); PM_{10}—Annual average 24 µg/m³; 24–hour average 50 µg/m³.

The NAAQS are as follows: NO_2—Annual = 100 µg/m³; $PM_{2.5}$—24–hour = 65 µg/m³ and Annual = 15 µg/m³; PM_{10}—24–hour = 150 µg/m³ and Annual = 50 µg/m³.

Cumulative and project–generated maximum concentrations may occur at a different time and/or location.

* Indicates predicted exceedance of new NAAQS for which the conformity process is not yet in effect.

** $PM_{2.5}$ annual average concentrations exceed the NAAQS in the existing background condition. See Table 15–5 for comparison with incremental thresholds.

Under the Route 9A at-grade alternative, the maximum increase in PM_{10} concentrations would be 117.9 µg/m³ on a 24-hour basis and 4.0 µg/m³ on an annual basis. These potential maximums could occur at the temporary bikeway along Route 9A (see Figures 15-5 and 15-7). As shown in Table 15-7, the maximum total 24–hour average PM_{10} concentration along the temporary bikeway could exceed the annual NAAQS under the at-grade alternative. However, this would only occur if peak construction occurs near that receptor when background levels actually reach 50 µg/m³. Increases at residential receptors would be significantly lower with a maximum of 26.5 µg/m³ and 2.5 µg/m³ on a 24-hour and annual basis, respectively.

Under the Route 9A short bypass alternative, the predicted increase in $PM_{2.5}$ concentrations in the immediate vicinity of the sites would be a maximum of 66.4 µg/m³ and 2.4 µg/m³ on a local 24-hour average and annual average basis, respectively. On a neighborhood scale, the maximum

annual increase would be 0.42 $\mu g/m^3$. These maximum predicted increases in $PM_{2.5}$ concentrations would exceed the interim guidance threshold values. As shown in Figures 15-8 and 15-10, the increase in $PM_{2.5}$ concentrations would exceed the 0.3 $\mu g/m^3$ annual and the 5 $\mu g/m^3$ 24–hour thresholds over a much larger area than shown previously for construction of the Preferred Alternative alone. The concentrations decrease rapidly with the distance from the sites, and no exceedance of the threshold values would be expected at a distance of approximately 1,300 feet from the sources.

Under the Route 9A at-grade alternative, the predicted increase in $PM_{2.5}$ concentrations in the immediate vicinity of the sites also exceed the interim guidance thresholds and would be a maximum of 82.5 $\mu g/m^3$ and 2.4 $\mu g/m^3$ on a local 24-hour average and annual average basis, respectively. On a neighborhood scale, the maximum annual increase would be 0.38 $\mu g/m^3$. However, similar to the short bypass alternative, the concentrations decrease rapidly with the distance from the sites, and no exceedance of the threshold values would be expected at a distance of approximately 1,300 feet from the sources (see Figures 15-9 and 15-11).

Without further mitigation, cumulative construction of the Lower Manhattan Recovery Projects would result in an adverse impact on $PM_{2.5}$ concentrations. However, the total $PM_{2.5}$ concentrations presented are conservative since they are based on the highest monitored level in the years 2000-2002. Based on the highest monitored annual average $PM_{2.5}$ concentration of 17.1 $\mu g/m^3$, the annual local $PM_{2.5}$ concentration could total a maximum of 20.5 $\mu g/m^3$, and the annual neighborhood scale $PM_{2.5}$ concentration could increase to 19.8 $\mu g/m^3$. It should be noted that the current annual measured background levels of $PM_{2.5}$ exceed the NAAQS of 15 $\mu g/m^3$.

Based on the highest measured 24-hour background concentration of 44 $\mu g/m^3$, the predicted 24-hour average $PM_{2.5}$ concentrations at locations immediately adjacent to the site could potentially exceed 129.5 $\mu g/m^3$ without further mitigation. As shown in Figure 15-10 and 15–11, these exceedances would not be expected at residential locations surrounding the WTC site, but would occur at two locations—along Route 9A and near the Fulton Street Transit Center.

The 24-hour average PM concentrations exhibit local maximums, reflecting specific wind directions and local activity; thus, they are much more influenced by a single activity that may produce higher short–term concentration increases. Annual average PM concentrations, however, are more uniform over the study area. This is expected, since over the long-term, the influence of wind directions and the scattering of construction equipment throughout the area would result in a more uniform distribution of the concentrations. In any event, these results indicate that additional mitigation is necessary to decrease concentrations of particulate matter beyond the 40 percent reduction assumed with the use of DOCs in order to minimize impacts and to ensure that 24–hour concentrations of $PM_{2.5}$ and PM_{10} do not exceed the NAAQS.

Annual average NO_2 concentrations were predicted to increase substantially by up to a maximum of 24.3 $\mu g/m^3$ in the immediate vicinity of the site, with the total concentration, including background levels, potentially reaching 96.3 $\mu g/m^3$. As described above, the maximum NO_2 concentrations are conservatively high since they assume a NO to NO_2 conversion rate which is higher than that which would occur at the nearest receptors where the highest values were predicted. Although exceedance of the NO_2 standard is not predicted, mitigation proposed to reduce PM (e.g. electrification) may also reduce NO_2 emissions.

Mesoscale Emissions Analysis

The total predicted emission of PM_{10}, $PM_{2.5}$, NO_2 and VOCs by year due to the proposed construction activity with implementation of the EPCs, including both on–site activity and

related on–road emissions, are presented in Table 15-8. Of the total construction period emissions, approximately 50 to 60 percent of VOC, 70 to 85 percent of NO_2, 60 to 70 percent of PM_{10} and 80 to 90 percent of $PM_{2.5}$ would be from on–site sources.

Table 15–8
Total Mesoscale Direct and Indirect Emissions from Cumulative Construction of the Lower Manhattan Recovery Projects in the Critical Analysis Year

Pollutant	2005	2006	2007	2008
PM_{10}	8.3	9.9	2.7	2.3
$PM_{2.5}$	5.3	5.5	1.4	1.1
NO_2	267.2	287.5	70.4	58.2
VOC	19.3	19.2	6.2	4.9

Notes:
The above results were estimated using the construction analysis framework developed for the Permanent WTC PATH Terminal DEIS. This analysis framework considered 2006 as the peak cumulative construction year for the Lower Manhattan Recovery Projects.

The results presented in Table 15-8 for the PM_{10} emissions include both engine emissions and resuspended road dust. The results also reflect only the Short Bypass Alternative for Route 9A. The South Ferry Terminal construction emissions are estimate based on the worst-case emissions published in the Environmental Assessment, which were based on the assumption that all of the most intense construction activities will take place within one 12-month period in 2005–2006. However, these emissions would not actually occur during one calendar year, and would not persist at the same level over both years as presented here. Therefore, emissions presented in Table 15-8 are a conservative annual estimate for the peak construction year.

As compared to the projected regional emissions inventory in the New York ozone SIP for the same years—the on-road portion of the emissions is estimated at less than 0.06 percent and 0.02 percent of the SIP mobile source NO_2 and VOC emissions, respectively; the on-site portion of the emissions would be 0.4 percent and 0.03 percent of the non-road SIP NO_2 and VOC emissions or less (depending on the year), respectively.

MITIGATION

The EPCs and LMDC's enhanced mitigation commitments were incorporated into the baseline analysis of construction period air quality described above. As described, Chapter 9, "Air Quality," PANYNJ would also commit to additional mitigation measures to reduce the potential construction-period impacts of the Preferred Alternative. Similarly, since publication of the Permanent WTC PATH Terminal DEIS, MTA/NYCT, and NYSDOT have committed to a higher level of mitigation than originally contemplated with the EPCs. The following describes these commitments.

- Electrification: Certain construction engines that operate in a fixed or temporarily fixed position, such as welding machines and compressors, could potentially be connected to the City's power grid if available by Con Edison at the start of construction. The electrification of this equipment would eliminate the on–site diesel exhaust from these sources. However, in some cases, electrification may not prove effective due to the need for mobility, and some local power generation may be needed when access to connection points is not feasible. PANYNJ and MTA/NYCT would require all contractors and subcontractors to use

electrically powered equipment wherever technically feasible, for air compressors, pumps, mixing, desanding and grout plants, welding machines, and any other diesel powered equipment that can be replaced with an electrically powered version. However, this does not apply to PATH's pedestrian concourse beneath Route 9A since NYSDOT has not yet finalized what level of electrification would be possible for its projects.

- Diesel Particle Filters: Technologies are available that can achieve greater reductions in particulate matter emissions as compared to DOCs. DPFs, for example, can reduce particulate matter emission by at least 85 percent and as high as 98 percent. However, DPFs are not effective for every type of engine operation, and there may be technical difficulties in applying DPFs to some engines. The Lower Manhattan project sponsors would require the use of DPFs or other measures with equivalent PM removal efficiency for all nonroad diesel engines of 50 horsepower or greater wherever the implementation of such a device is available and practical. It is assumed that DPFs can be practically used on 75 percent of nonroad diesel engines and that the remaining 25 percent could employ DOCs.

- Newer Engines: The use of new construction engines would ensure that older, higher emitters are not operating on–site and would make the operation of added control technologies easier and more efficient. The Lower Manhattan project sponsors would require the use of post-1995 fuel injection engines, which meet the Tier II engine emissions standards, as defined in Title 40, Part 89.112. Exceptions will be made only for specific engines that are not yet available as Tier II, where the task cannot be reasonably accomplished using alternative engines or means comply with these demands. However, given current technology, it is assumed that all engines would be Tier II compliant.

- The Lower Manhattan project sponsors are investigating the use of other methods to reduce NO_2 emissions. However, given the current uncertainty, additional NO_2 reduction techniques were not assumed as part of the cumulative mitigation analysis.

To model the effectiveness of these enhanced mitigation measures, it was assumed that all engines used for construction of the Fulton Street Transit Center, Route 9A, and the Permanent WTC PATH Terminal construction would be Tier II compliant. Furthermore, it was also assumed that by the critical analysis year, half of all air compressors, pumps, mixing, desanding and grout plants, and welding machines used to construct the Permanent WTC PATH Terminal, excluding the pedestrian concourse beneath Route 9A, would be electrically operated.

Table 15-9 and Figures 15-13 through 15-23 show the predicted increase in pollutant concentrations at Lower Manhattan receptors accounting for the enhanced mitigation measures described above. Total concentrations, including background levels, are presented in Table 15-10. The concentrations at locations adjacent to the construction sites include contributions from both on-road sources and on-site construction activity. The concentrations marked "Other locations Along Access Routes" represent the highest predicted impacts from on-road sources at more distant locations that would not be impacted by the construction activity on-site.

The maximum predicted $PM_{2.5}$ increments with enhanced mitigaiton are significantly lower than those predicted without the further commitments of PANYNJ, MTA/NYCT, and NYSDOT.

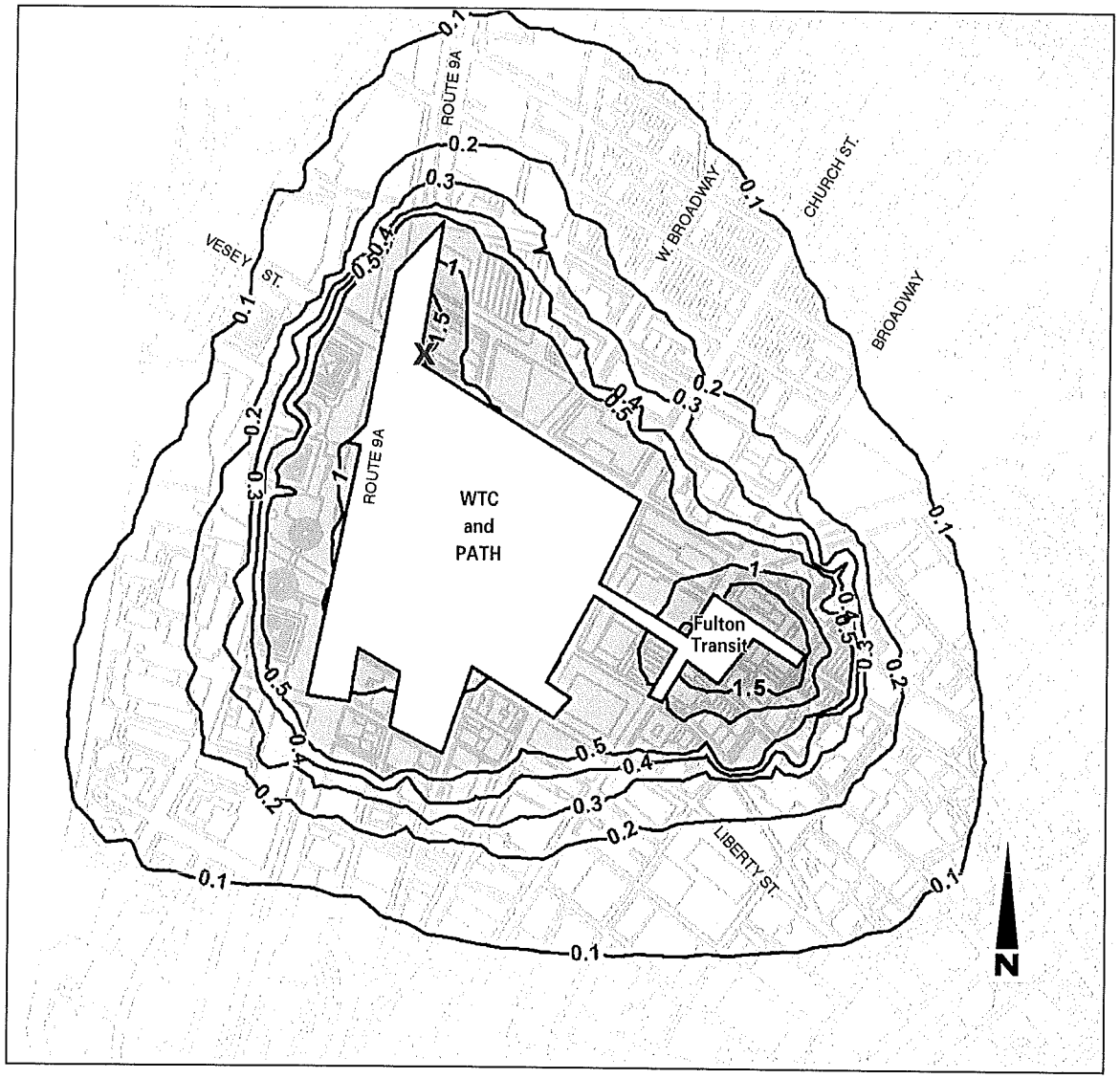

Figure 15-14

Maximum Predicted Annual Average PM_{10} Construction Increment

Cumulative with Route 9A Short Bypass Tunnel Alternative and Mitigation

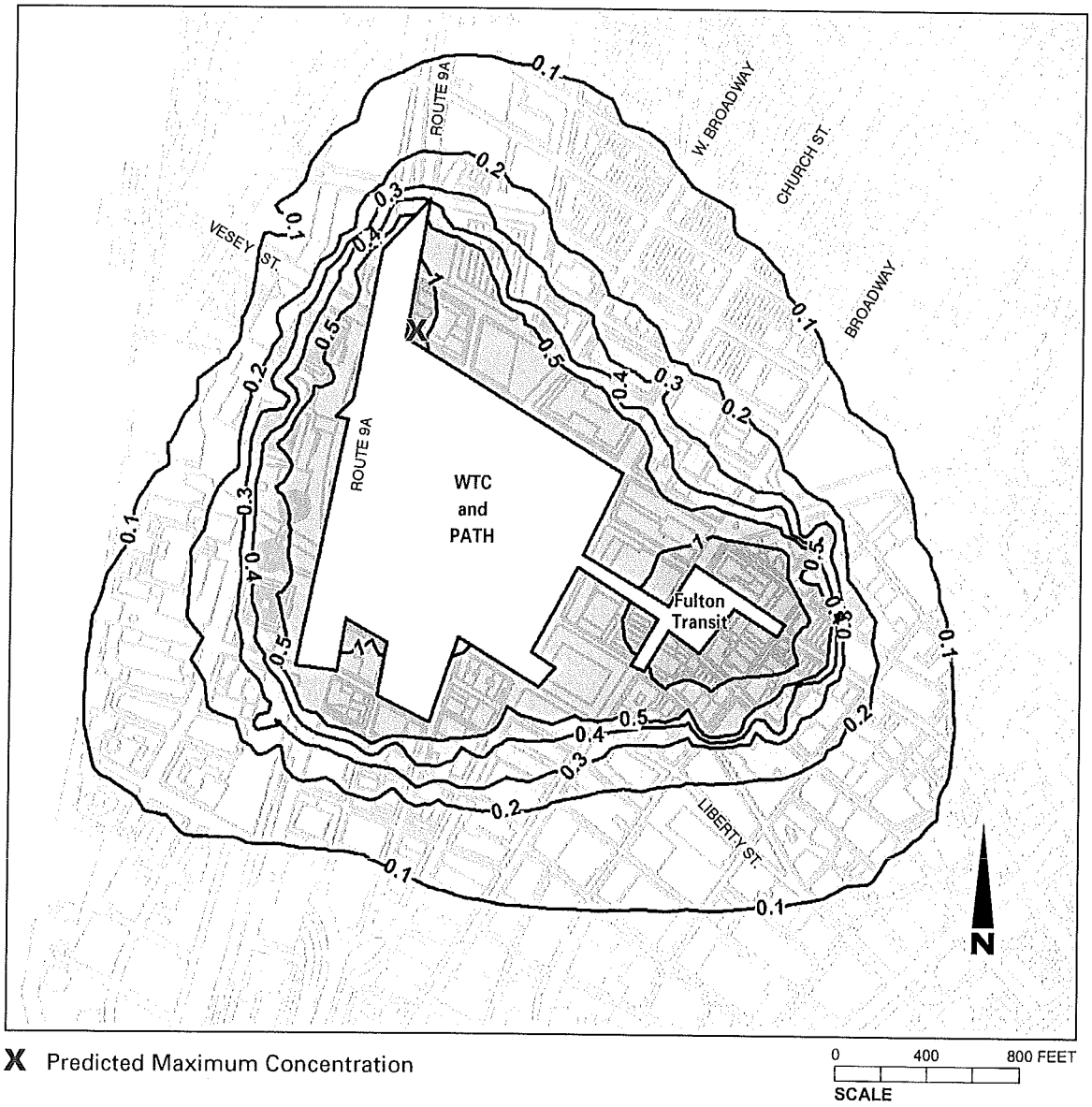

Figure 15-15

Maximum Predicted Annual Average PM_{10} Construction Increment

Cumulative with Route 9A At-Grade Alternative and Mitigation

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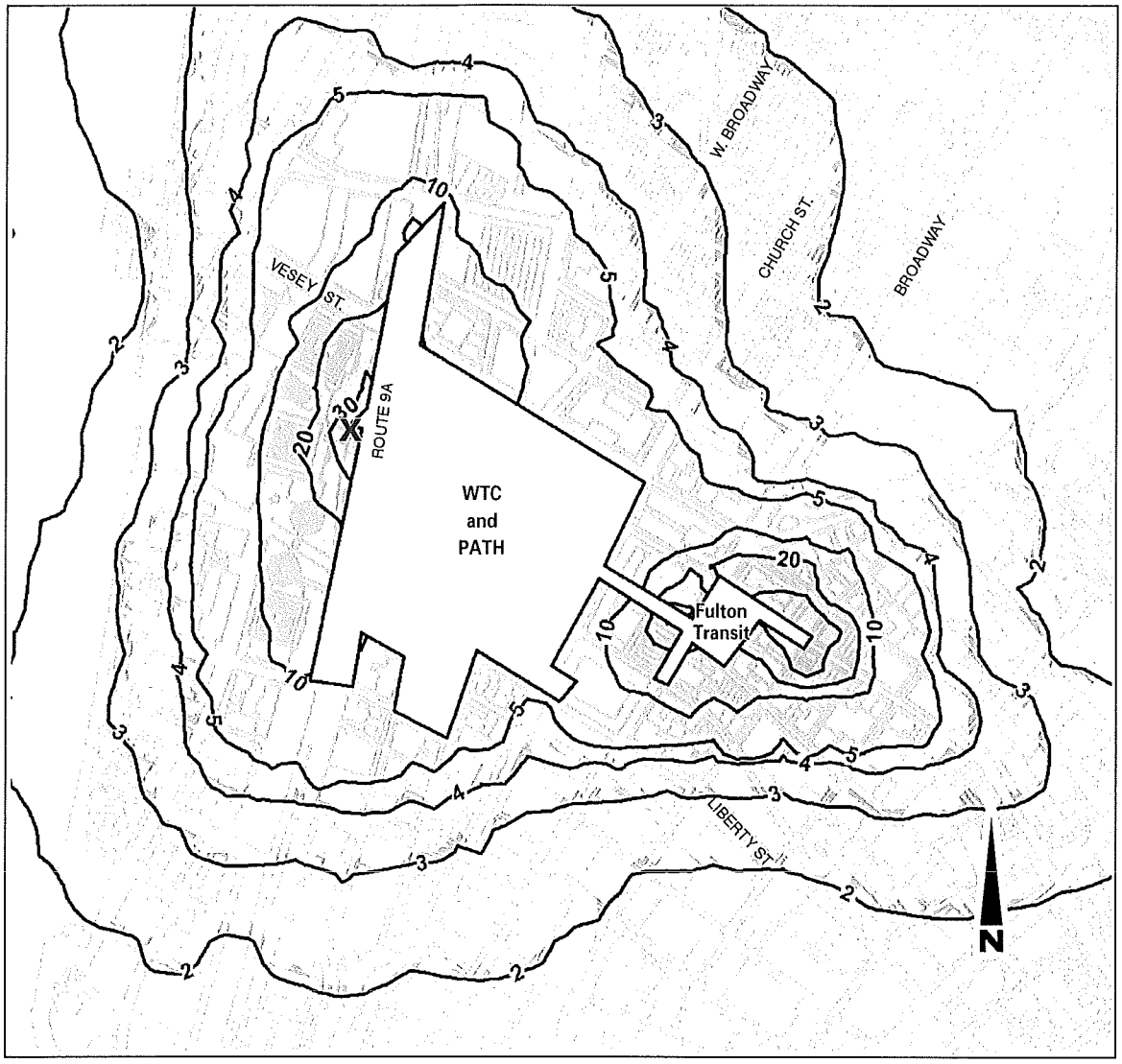


Figure 15-16

Maximum Predicted 24-Hour Average PM_{10} Construction Increment

Cumulative with Route 9A Short Bypass Tunnel Alternative and Mitigation

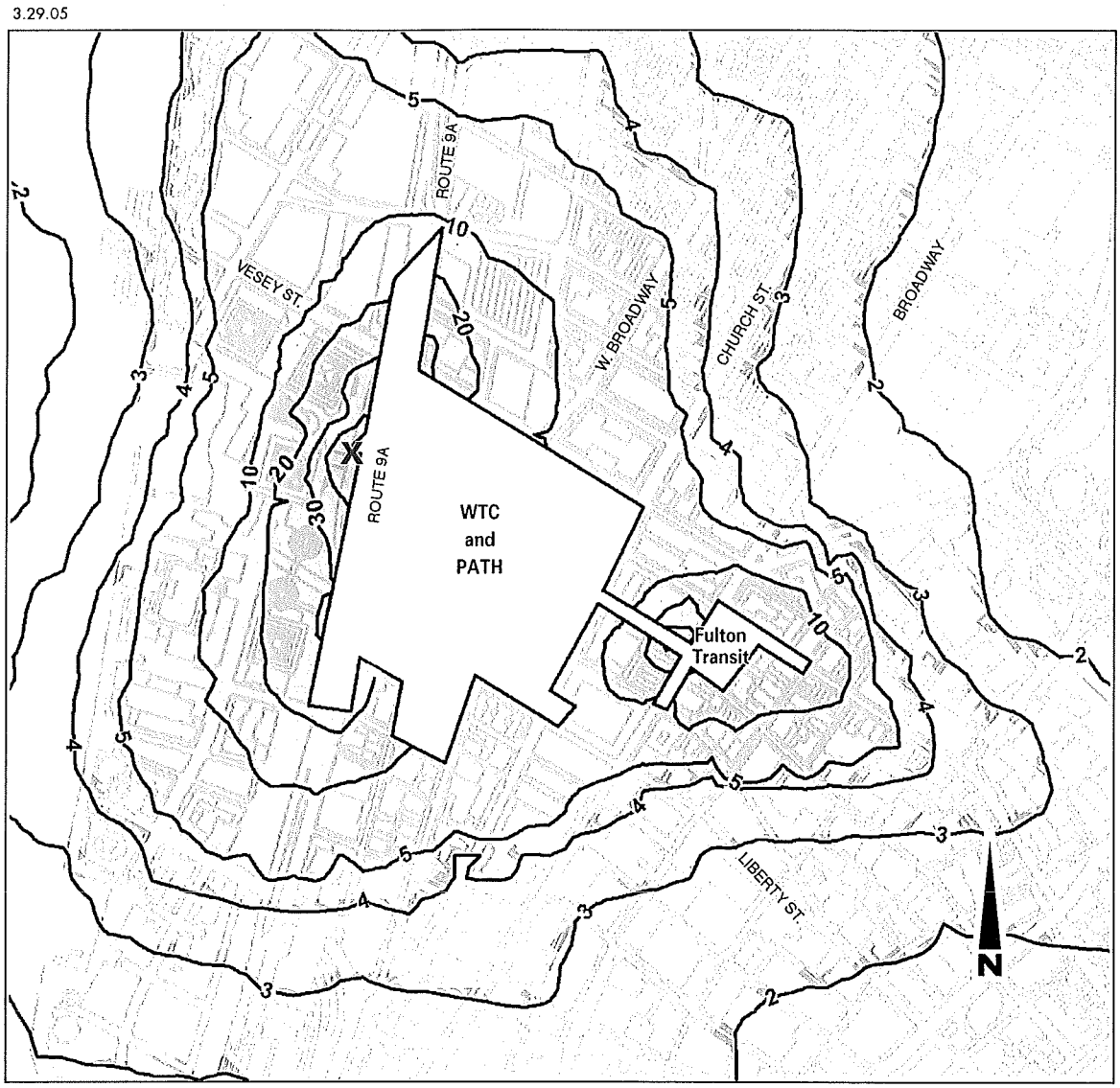


Figure 15-17

Maximum Predicted 24-Hour Average PM_{10} Construction Increment

Cumulative with Route 9A At-Grade Alternative and Mitigation

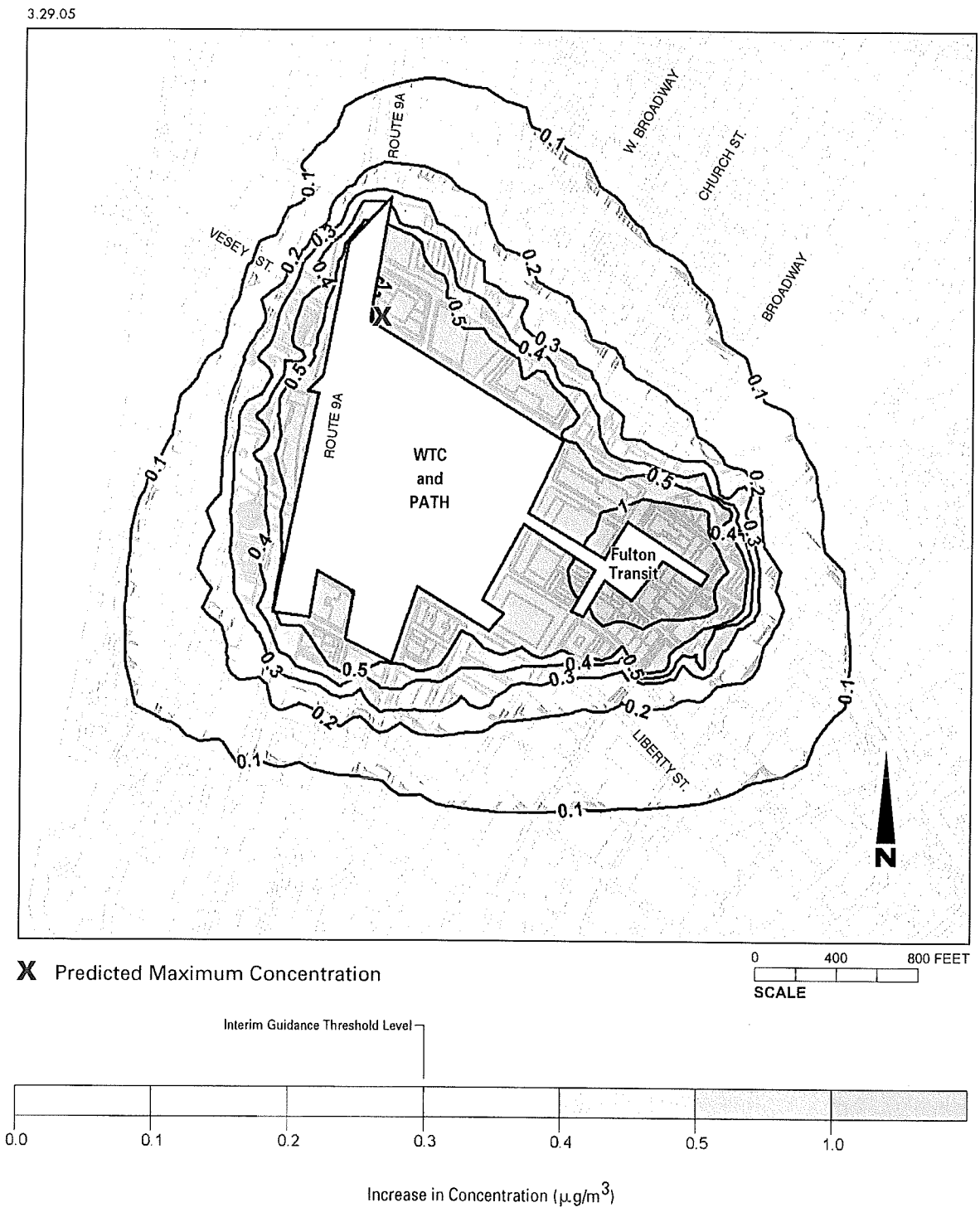
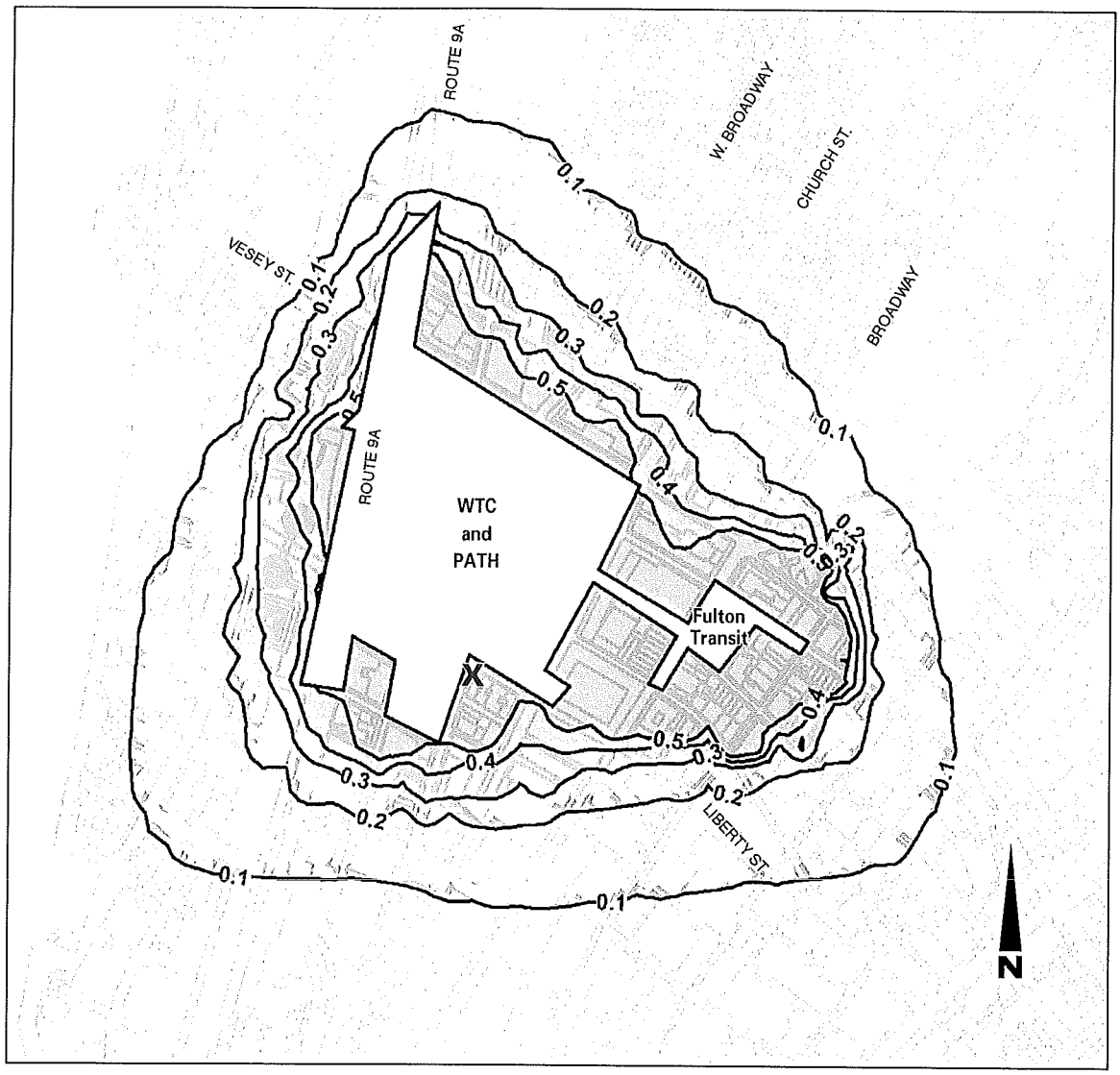


Figure 15-18

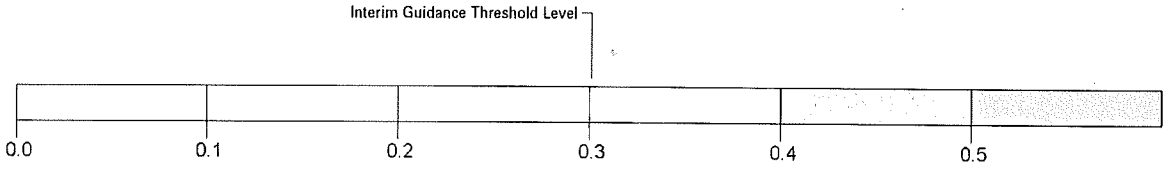
Maximum Predicted Annual Average $PM_{2.5}$ Construction Increment

Cumulative with Route 9A Short Bypass Tunnel Alternative and Mitigation



X Predicted Maximum Concentration

0 400 800 FEET
SCALE



Increase in Concentration ($\mu g/m^3$)

Figure 15-19

Maximum Predicted Annual Average $PM_{2.5}$ Construction Increment

Cumulative with Route 9A At-Grade Alternative and Mitigation

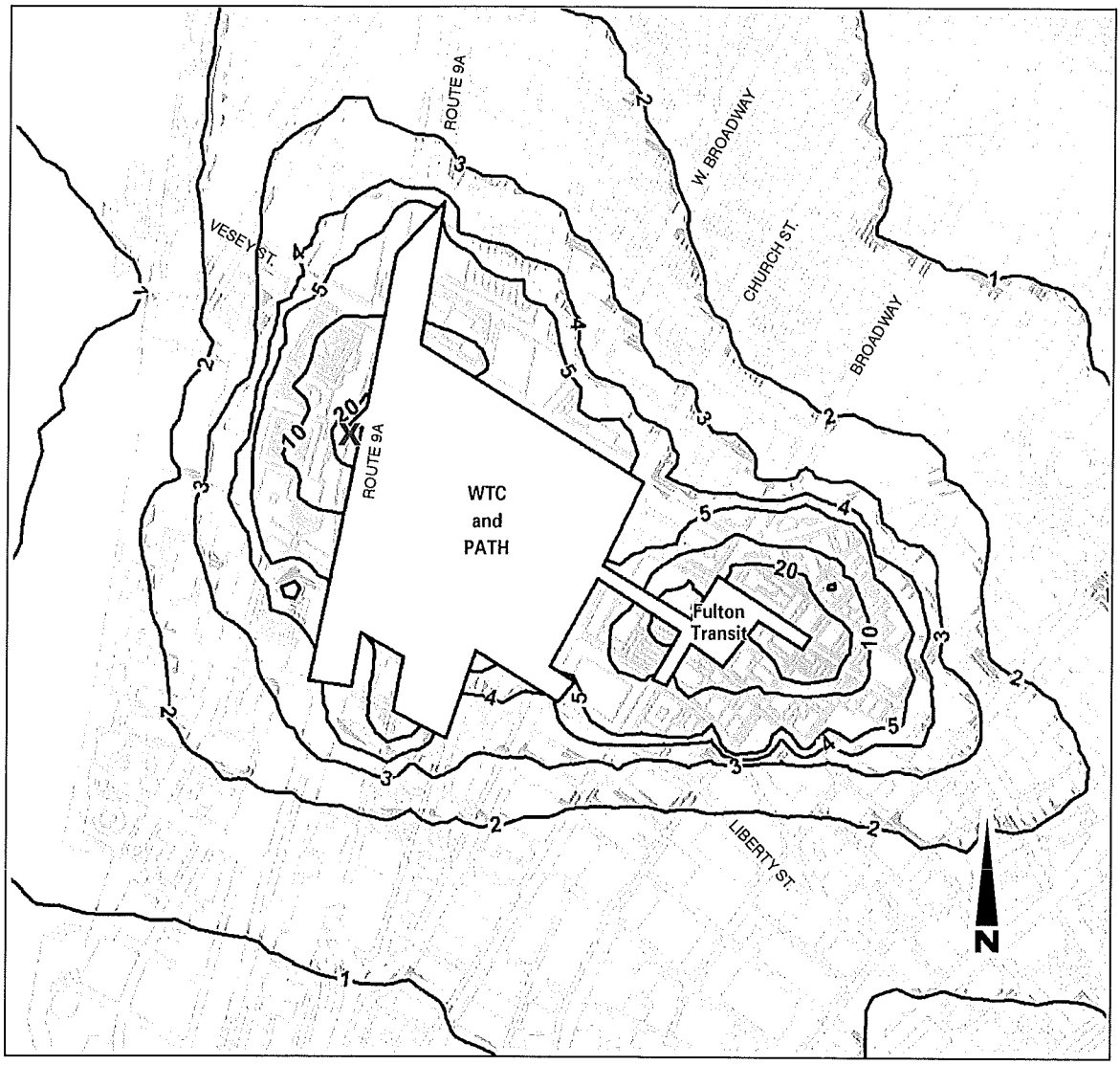


Figure 15-20

Maximum Predicted 24-Hour Average $PM_{2.5}$ Construction Increment

Cumulative with Route 9A Short Bypass Tunnel Alternative and Mitigation

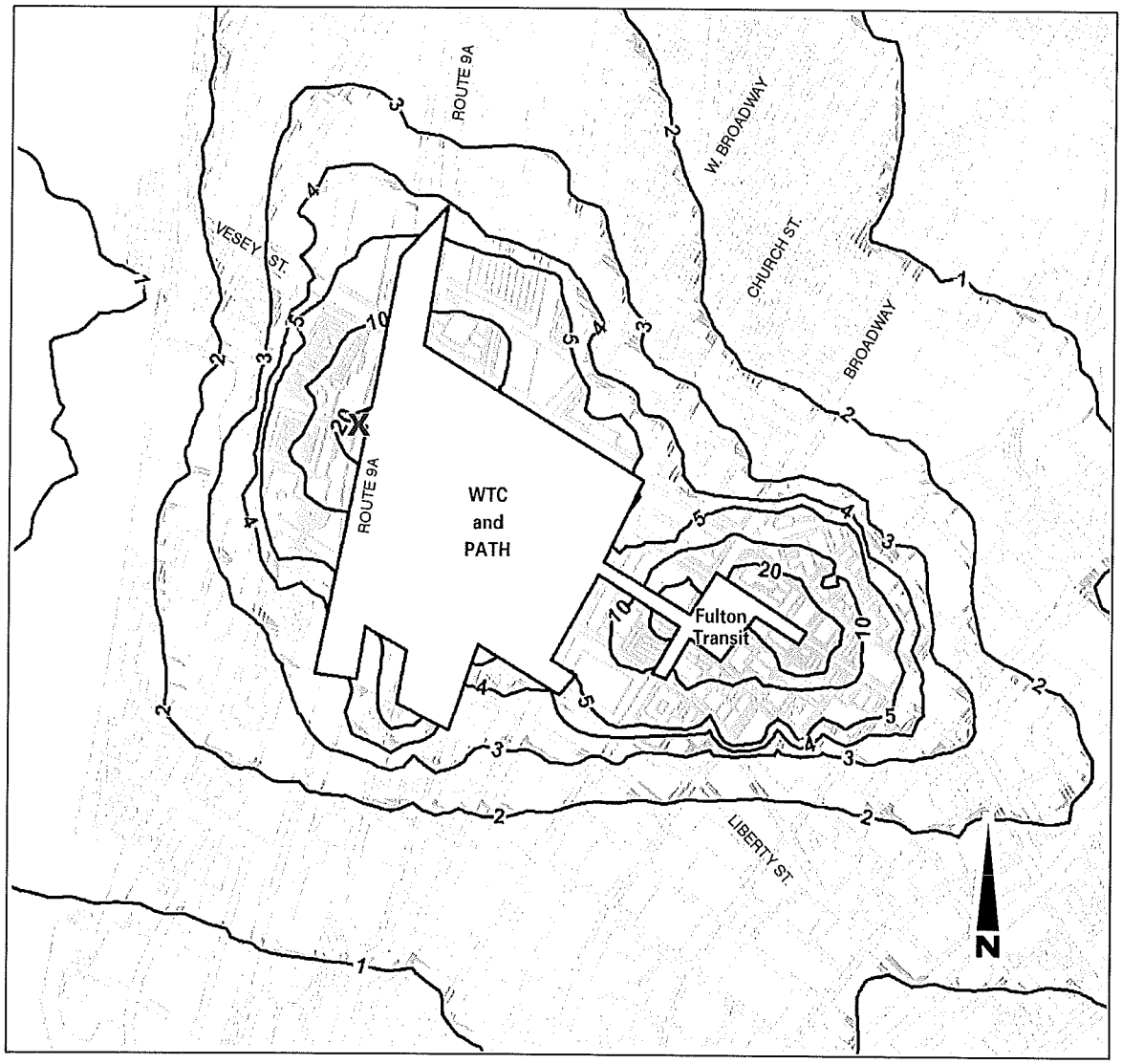


Figure 15-21

Maximum Predicted 24-Hour Average $PM_{2.5}$ Construction Increment

Cumulative with Route 9A At-Grade Alternative and Mitigation

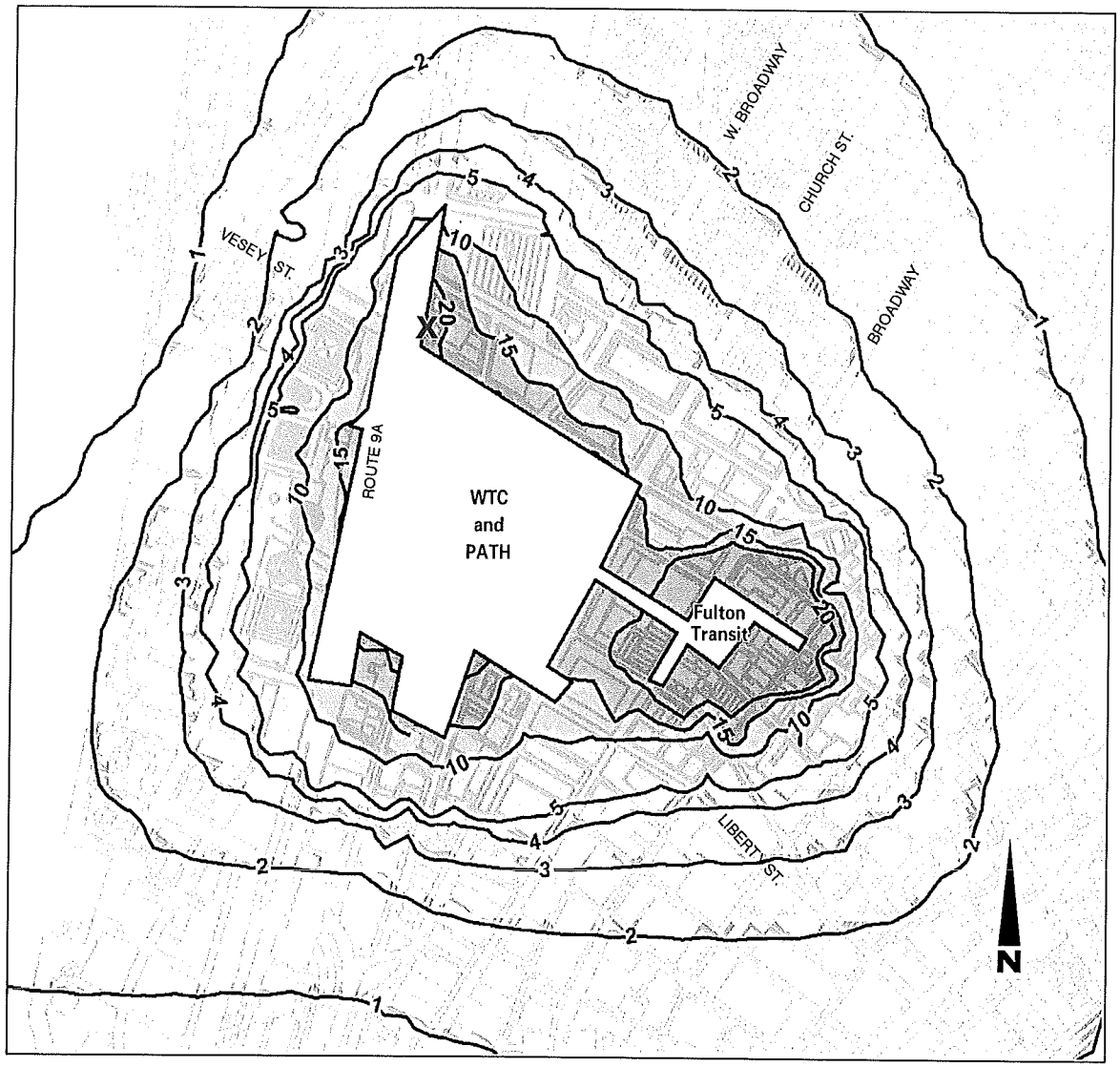


Figure 15-22

Maximum Predicted Annual Average NO_2
Construction Increment

Cumulative with Route 9A
Short Bypass Tunnel Alternative and Mitigation

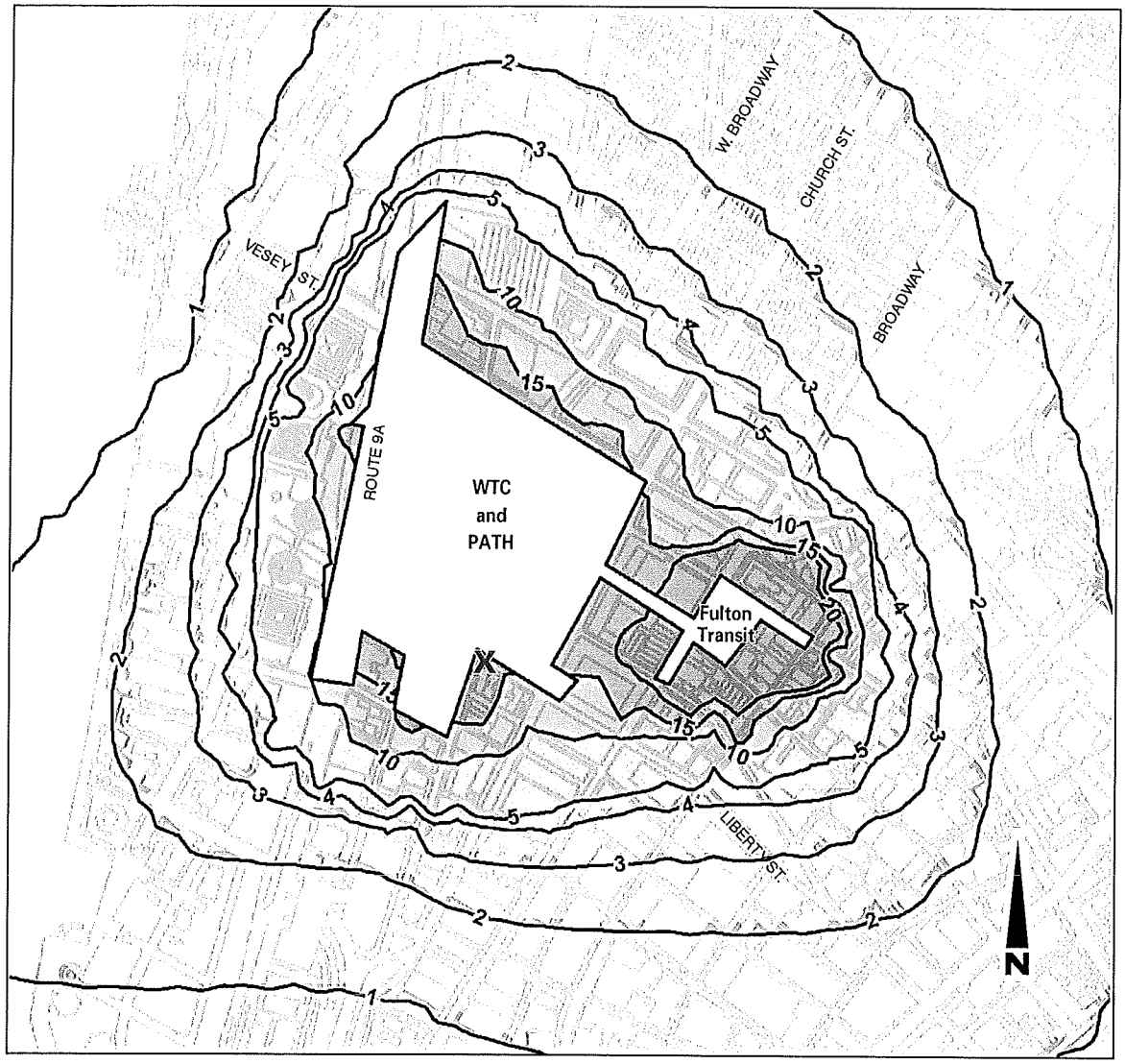


Figure 15-23

Maximum Predicted Annual Average NO_2 Construction Increment

Cumulative with Route 9A At-Grade Alternative and Mitigation

Table 15–9
Highest Predicted Increase in Pollutant Concentrations from Cumulative Construction of the Lower Manhattan Recovery Projects with Mitigation in the Critical Analysis Year

Pollutant	Average Period	Receptor Type	Maximum Increase [µg/m³]	
			With Route 9A Short Bypass	With Route 9A At Grade
NO_2	Annual	Highest of All Receptors	24.1**	21.3**
		Residential Buildings / Hotel	21.9**	21.3**
$PM_{2.5}$	24–hour	Highest of All Receptors	24.7*	28.2*
		Residential Buildings / Hotel	5.8*	5.7*
		Other Locations on Access Routes	0.4	0.4
	Annual	Local Highest of All Receptors	1.2*	1.1*
		Local Highest Residential / Hotel	1.0*	1.0*
		Local on Access Routes	0.17	0.17
		Neighborhood Scale	0.24*	0.25*
PM_{10}	24–hour	Highest of All Receptors	41.3	58.8
		Residential Buildings / Hotel	10.9	26.5
		Other Locations on Access Routes	4.5	4.5
	Annual	Highest of All Receptors	3.1	2.7
		Residential Buildings / Hotel	2.2	2.2
		Other Locations on Access Routes	1.4	1.4

Notes:
Interim guidance threshold levels for $PM_{2.5}$ are 5 µg/m³ and 0.3 µg/m³ for 24–hour and annual increases respectively, and 0.1 µg/m³ for neighborhood scale annual average. For determination of adverse impacts, these values are applied in the absence of specific criteria.

* Exceeds the interim guidance thresholds.

** Substantial adverse impact due to high increment predicted where existing background concentrations are high—not exceeding NAAQS (see table 15–10).

With mitigation, the maximum cumulative $PM_{2.5}$ increments would be reduced by approximately 66 percent. More importantly, the exceedance of the PM_{10} 24–hour NAAQS would be eliminated.

As shown in Figures 15-20 and 15–21, the extent of increments above local threshold levels would be significantly reduced, and the potential for exceedance of the $PM_{2.5}$ 24–hour NAAQS would be limited to a single location along the Route 9A bikeway. However, the occurrence of such high levels would depend on the coincidence of peak background levels above the 98th percentile together with peak construction activity and the extreme meteorological conditions that led to the concentration predicted in the model. Such an occurrence, although possible, would be rare. Furthermore, it would be a temporary situation, limited to a small area immediately adjacent to the Route 9A construction site and would not be expected to occur in subsequent years when construction activity would be reduced.

Table 15–10
Highest Predicted Total Pollutant Concentrations
from Cumulative Construction of the Lower Manhattan Recovery Projects with Mitigation in the Critical Analysis Year

Pollutant	Average Period	Receptor Type	Maximum Increase [µg/m³]	
			With Route 9A Short Bypass	With Route 9A At Grade
NO_2	Annual	Highest of All Receptors	96.1	93.3
		Residential Buildings / Hotel	93.9	93.3
$PM_{2.5}$	24–hour	Highest of All Receptors	71.7*	75.2*
		Residential Buildings / Hotel	52.8	52.9
		Other Locations on Access Routes	47.3	47.3
	Annual	Highest of All Receptors	19.3**	19.3**
		Highest Residential / Hotel	19.2**	19.2**
PM_{10}	24–hour	Highest of All Receptors	101.7	119.2
		Residential Buildings / Hotel	70.5	86.4
		Other Locations on Access Routes	63.6	63.6
	Annual	Highest of All Receptors	30.6	30.2
		Residential Buildings / Hotel	28.8	28.6
		Other Locations on Access Routes	28.8	28.8

Notes:

All total concentrations include calculated background contributions from local mobile sources, as well as measured regional background values as follows: NO_2—Annual average 72 µg/m³; $PM_{2.5}$—Annual average 17.1 µg/m³ (highest of 2000-2002 annual values); 24-hour average 44.0 µg/m³ (highest of the three 2nd highest 24-hour averages in 2000-2002); PM_{10}—Annual average 24 µg/m³; 24–hour average 50 µg/m³.

The NAAQS are as follows: NO_2—Annual = 100 µg/m³; $PM_{2.5}$—24–hour = 65 µg/m³ and Annual = 15 µg/m³; PM_{10}—24–hour = 150 µg/m³ and Annual = 50 µg/m³.

Cumulative and project–generated maximum concentrations may occur at a different time and/or location.

* Indicates predicted exceedance of new NAAQS for which the conformity process is not yet in effect.

** $PM_{2.5}$ annual average concentrations exceed the NAAQS in the existing background condition. See Table 15–9 for comparison with incremental thresholds.

Without enhanced mitigation measures, the predicted cumulative increase in NO_2 would not exceed the NAAQS. However, the use of electrification would reduce mesoscale NO_2 emissions substantially. Should this strategy be applied to the Route 9A Project, additional reductions in maximum NO_2 concentrations would be expected.

CONDITIONS WITH THE REVISED SCHEDULES

As described above, maximum $PM_{2.5}$ concentrations, including background and emissions from all construction projects, would increase significantly during construction, and in rare circumstances would exceed the 24-hour standard. NO_2 concentrations were also predicted to increase significantly but would not exceed the NAAQS. These results were predicted both with and without the additional mitigation measures.

Under the revised construction schedules, overall annual NO_x emissions would be lower. PM emissions from the construction of the WTC Memorial and Redevelopment Plan may be 8 percent higher than projected above; however, cumulative short-term PM concentrations should be somewhat lower since peak construction for the Fulton Street Transit Center would not overlap with peak construction for the WTC Memorial and Redevelopment Plan, Permanent WTC PATH Terminal, and Route 9A.

Annual PM emissions from the WTC Memorial and Redevelopment Plan would also be somewhat higher in the peak construction year. However, much of those emissions would be from equipment used to construct the towers, and the vertical dispersion of these emissions throughout the towers would result in lower ground-level results than if construction were concentrated at-grade. When considered cumulatively, the net result would likely be maximum annual $PM_{2.5}$ concentrations similar to those predicted above.

Therefore, the mitigation measures presented above would still be needed to ensure that potential exceedances are limited to the smallest area and shortest duration possible.

NOISE AND VIBRATION

PROBABLE IMPACTS

As discussed in Chapter 10, "Noise and Vibration," construction of the Preferred Alternative would result in adverse noise impacts at sensitive land uses in close proximity to the construction site. These results were based on an analysis of the expected construction activities and duration for the year 2006. The combination of noise from all pieces of equipment operating during the same time period was obtained from adding the L_{eq} values for each piece of equipment. Similarly, a cumulative noise analysis for the Lower Manhattan Recovery Projects has been conducted for a series of receptor locations, which are shown in Figure 15-24. (See Appendix D for information on the on-site and mobile sources assumed in the analysis.)

Table 15-11 shows maximum predicted 8-hour L_{eq} and 30-day L_{dn}/L_{eq} noise levels resulting from construction of the Lower Manhattan Recovery Projects, without mitigation. The predicted construction noise levels generated by the Preferred Alternative, without mitigation, are also shown for comparison. The predicted cumulative levels would exceed the recommended 8-hour L_{eq} and 30-day L_{dn}/L_{eq} thresholds at Sites 1, 2 and 3 but would not exceed the thresholds at Sites 4 and 5.

Table 15-12 shows the cumulative analysis at receptors further from the Project Site. The results at PS 89 indicate that construction traffic along Route 9A in conjunction with equipment several blocks away would not adversely affect ambient noise levels. Similarly, the results at the Embassy Suites and Gateway Plaza indicate that levels one block from the WTC site, west of Route 9A, would also not be adversely affected. The results do indicate that cumulative construction noise levels would exceed impact thresholds at 4 Albany Street and St. Peter's Church. However, the Permanent WTC PATH Terminal's construction would not be a major generator of these noise levels.

The cumulative analysis shows that construction operations would have adverse noise impacts at sensitive receptors adjacent to the various construction sites. In addition, these impacts would occur for a considerable period of time. Similarly, these projects would result in varying degrees of ground vibration, depending on the stage of construction, the equipment and construction

Table 15-11

2006 Cumulative Construction Noise Impacts at Permanent WTC PATH Terminal Receptors (in dBA)

Receptor Site	Location	Land Use Category	FTA Impact Criteria		Cumulative Noise Levels		PATH-Generated Noise Levels		Cumulative Impact	
			8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}	8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}	8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}	8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}
1	Hilton Millennium Hotel	Residential	80	84	95	93	80	74	Yes	Yes
2	114 Liberty Street	Residential	80	81	88	82	80	74	Yes	Yes
3	World Financial Center/Dow Jones, on West Street	Commercial	85	80	88	82	88	81	Yes	Yes
4	Barclay Street and Washington Street Intersection	Commercial	85	80	71	67	69	62	No	No
5	180 Broadway	Residential	80	89	79	77	66	60	No	No

Notes: The 30-day L_{eq} is for commercial uses and the 30-day L_{dn} is for residential uses. At sites 1, 2, and 5 with high ambient noise levels (L_{dn} > 65 dB), the recommended residential uses 30-day L_{dn} thresholds would be existing ambient + 10 dB (e.g. 74 dBA + 10 dBA = 84 dBA at Site 1).

Table 15-12

2006 Cumulative Noise Impacts at Other Nearby Receptors (in dBA)

Site	Location	Land Use Category	FTA Impact Criteria		Cumulative-Generated Noise Levels		Impact	
			8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}	8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}	8-hour L_{eq}	30-Day *L_{dn}/ L_{eq}
6	PS89 Playground	Public Facility	80	87	66	62	No	No
7	Embassy Suites	Hotel	80	81	75	71	No	No
8	Gateway Plaza	Residential	80	77	69	65	No	No
9	4 Albany Street	Residential	80	79	92	87	Yes	Yes
10	95 Trinity	Institutional	80	88	72	66	No	No
11	St Peter's	Church	80	85	81	76	Yes	No
12	West Broadway/Park Place	Residential	80	83	68	63	No	No

Notes: L_{eq} for commercial uses and L_{dn} for residential uses. Results are cumulative without mitigation measures.

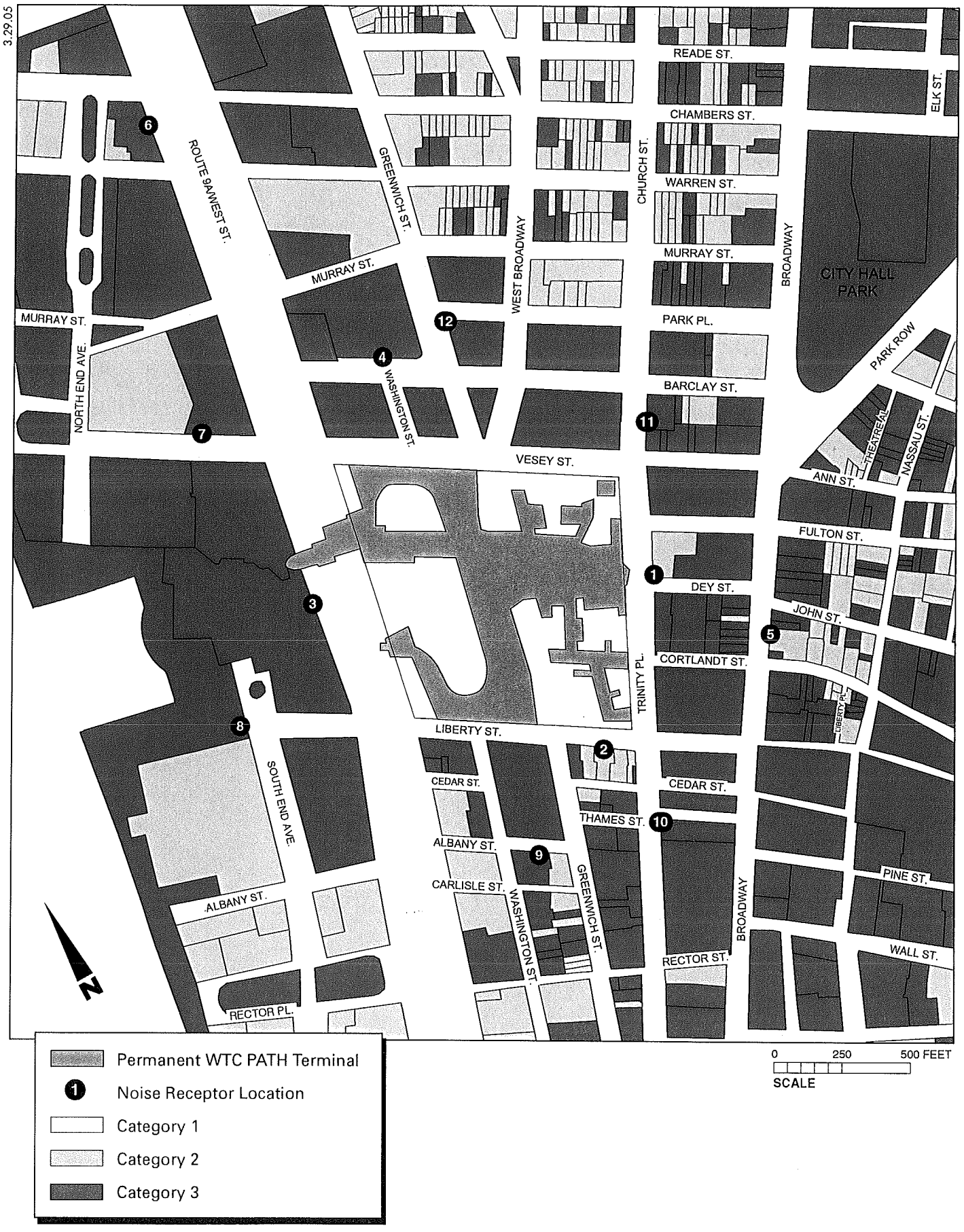


Figure 15-24

Cumulative Noise Receptor Locations and FTA Land Use Categories

methods employed, and the distance from the construction to buildings and vibration sensitive structures. Construction equipment such as pile drivers can produce levels that exceed the 0.12 and 0.20 inches per second vibration damage threshold criterion for fragile buildings at distances of 50 feet. At distances closer to the construction equipment (20 feet or less), additional equipment such as clam shovel drop, caisson drilling, and large bulldozers can produce levels exceeding the vibration threshold criterion for fragile and some extremely fragile buildings.

Figure 15-25 shows the historic/fragile buildings within a 90 foot radius from the Project Site, which captures any potential vibration problems from construction activity.

MITIGATION

As described in Chapter 10, "Noise and Vibration," the implementation of the mitigation measures listed in Table 10-15 would eliminate all construction noise impacts generated by the Preferred Alternative. As described in the executed MOA for the Permanent WTC PATH Terminal, PANYNJ, in consultation with the State Historic Preservation Officer (SHPO) and in coordination with other Lower Manhattan project sponsors, as appropriate, would develop a Construction Protection Plan (CPP) based on the requirements laid out in the "New York City Department of Buildings Technical Policy and Procedure Notice #10/88."

PANYNJ and the other Lower Manhattan project sponsors are also developing construction noise and vibration mitigation measures, examples of which are provided below. Implementation of these mitigation measures is expected to minimize or eliminate construction-related individual and cumulative noise and vibration impacts. The sponsors of the Lower Manhattan Recovery Projects—LMDC, MTA/NYCT, NYSDOT and PANYNJ—are coordinating their efforts through the Lower Manhattan Construction Coordination Group.

- The use of acoustic barriers and walled enclosures around certain construction activities. For example, noise tents/enclosures could be used around workers using jackhammers. A temporary noise barrier of 20-foot in height could be installed along the fence line/property line of the construction zone to reduce the noise levels. In addition, temporary barriers (e.g., wood panels on top of Jersey barriers) could also be positioned adjacent to and moved along slurry walls and other construction operations, etc.;
- The placement of construction equipment in shielded locations, such as below grade in the Project Site;
- The installation of silencers on jackhammers, air compressors, generators, light plants, and cranes to reduce noise levels at specific locations (i.e., adjacent to existing residential);
- The use of electrically operated equipment, rather than combustion equipment;
- The use of soil beds, timber planking and/or exterior rubber lining on truck body and aluminum carrying case to reduce rock impact noise during truck load/unloading operations;
- The use of drive-through street-level truck enclosures for truck loading and unloading;
- The use of sheds/enclosures at concrete pump sites during concrete truck unloading; and
- The placement of most loading/unloading inside the bathtub and away from areas at street level.
- The designation of central areas within projects for noisy activities, such as cutting steel or wood or use of noisy equipment such as impact wrenches. Use of pre-cut, pre-fabricated, or

modular construction materials that minimize need for on-site fabrication or cutting methods.

Measures to monitor construction noise levels would be undertaken throughout the construction period. These programmatic measures would be administered through either the Command Center and/or the Lower Manhattan Construction Coordination Group. These actions may include:

- Enforcement of designated truck routes during construction;
- Adherence to construction equipment noise performance standards specified by EPA and possible development of additional standards by the Lower Manhattan Construction Coordination Group;
- Noise monitoring before construction begins, to establish baseline noise levels, and ongoing monitoring during the various construction phases; and
- Evaluation of the noise reduction potential, and cost effectiveness, of alternative construction methods and/or changes to the sequencing of construction activities.

CONDITIONS WITH THE REVISED SCHEDULES

The analysis presented above showed 5 receptor sites that would experience significant adverse 8-hour L_{eq} noise impacts in the peak construction year without mitigation. Under the schedule refinements (see page 15-8), two of these sites, 4 Albany Street and 114 Liberty Street, would experience higher 8-hour L_{eq} noise levels than predicted above. However, there would be a slight decrease or no change in predicted levels for the World Financial Center, the Millennium Hotel, and St. Peter's Church; however, these sites would continue to exceed the FTA impact criteria.

The 30-day L_{dn}/L_{eq} noise levels would be higher with the schedule refinements at the 4 Albany Street, 114 Liberty Street, and 95 Trinity Street receptors as compared to the analysis presented above. These increases likely result from activities on the Deutsche Bank site that would occur in the peak year. Although the schedule refinements would result in some modest increases in noise levels, there would be no change in the number or location of 30-day, cumulative noise impacts in the peak construction year.

CULTURAL AND HISTORIC RESOURCES

PROBABLE IMPACTS

The EPCs specify that individual project sponsors consider the cumulative construction-period impacts to cultural resources within their respective Areas of Potential Effect (APEs). As described in Chapter 6, "Cultural Resources," the Permanent WTC PATH Terminal's APE contains 21 resources that are listed or are eligible for listing on the State or National Register of Historic Places. The assessments presented in Chapter 6 identified seven resources within the APE that may be impacted by the facility's construction. These resources are shown in Table 15-13 along with the potential impacts from the other Lower Manhattan Recovery Projects.

MITIGATION

Pursuant to the executed MOA for the Permanent WTC PATH Terminal, PANYNJ would prepare Construction Protection Plans (CPPs) for historic structures that may be impacted by construction period vibrations (see Appendix B). As stipulated in the MOA, these plans would

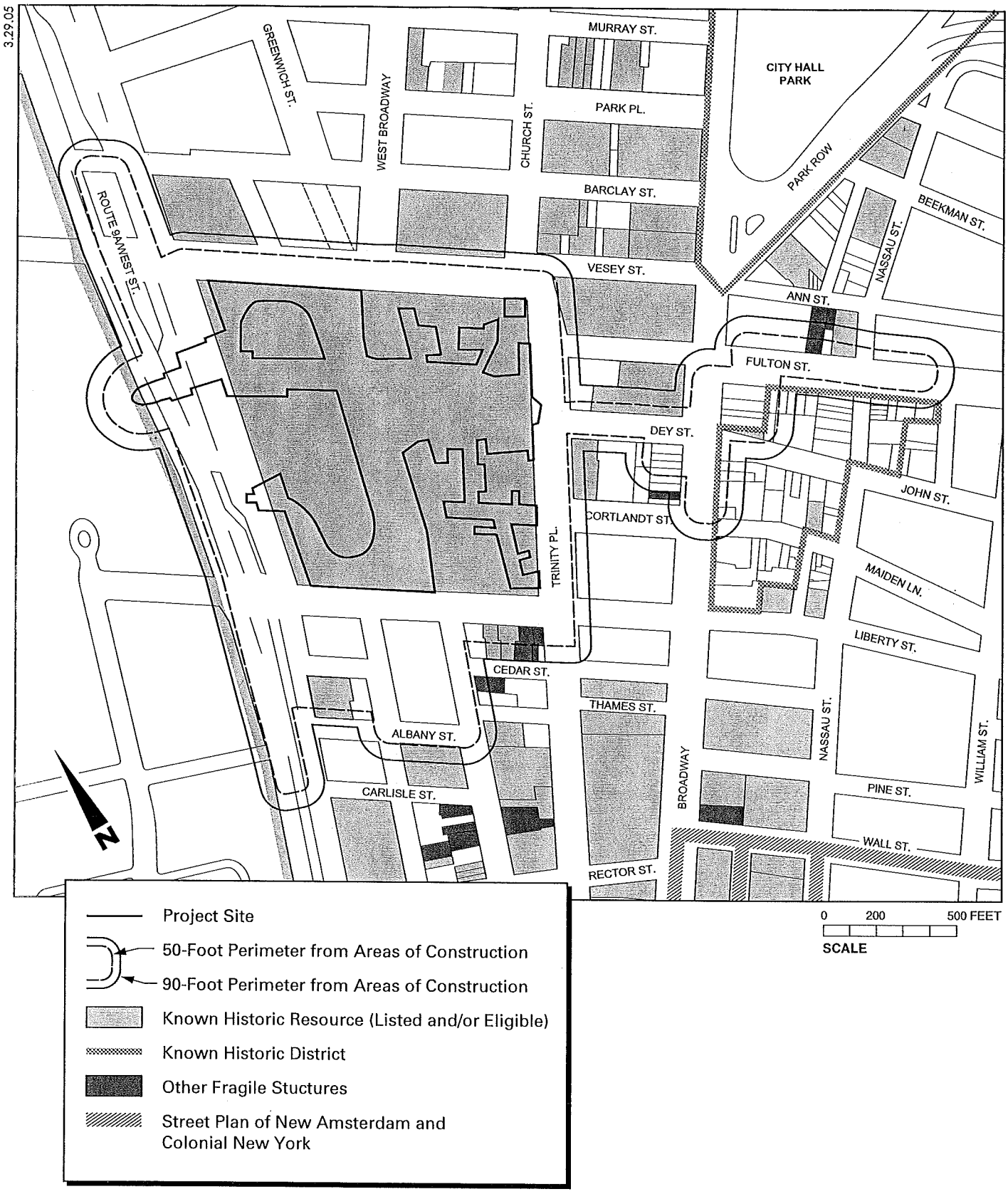


Figure 15-25

Known or Potential Historic Structures and Potential Vibration Areas from Cumulative Construction Activities

Table 15-13
Cumulative Effects to Known Historic Resources within the Area of Potential Effect for the Permanent WTC PATH Terminal

Resource	Project	Potential Impact
Hudson River Bulkhead Battery to West 59th St.	PATH	Potential disturbance during construction of the Route 9A pedestrian concourse
	Route 9A	Potential disturbance during utility relocation and potential vibration impacts
Barclay-Vesey Building 140 West Street	PATH	Potential vibration impacts
	Route 9A	Potential vibration impacts
	LMDC	Potential vibration impacts
St. Paul's Chapel and Graveyard	PATH	Potential vibration impacts
	LMDC	Potential vibration impacts
	FSTC	Potential vibration impacts
Former East River Savings Bank 26 Cortlandt Street	PATH	Potential vibration impacts
	LMDC	Potential vibration impacts
	FSTC	Potential vibration impacts
114-118 Liberty Street	PATH	Potential vibration impacts
	LMDC	Potential vibration impacts
Beard Building 125 Cedar Street	PATH	Potential vibration impacts
	LMDC	Potential vibration impacts
WTC Site	PATH	The Terminal's construction has an adverse effect on the WTC site; Potential archaeological sites in the eastern portion of the WTC site may be disturbed.
	Route 9A	The project has the potential to impact the site's west bathtub wall.
	LMDC	Potential archaeological sites in the eastern portion of the WTC site may be disturbed. The project has the potential to affect other remaining remnants and structures on the site.
	FSTC	The project would abut the Church Street frontage of the site.

Notes: PATH = Permanent WTC PATH Terminal (PANYNJ)
LMDC = World Trade Center Memorial and Redevelopment Plan (LMDC)
Route 9A = Route 9A Project (NYSDOT)
FSTC = Fulton Street Transit Center (MTA/NYCT)

be coordinated with NYSDOT, LMDC, and/or MTA/NYCT, as appropriate, for sites that may be cumulatively affected by construction. The CPPs would avoid or minimize the potential cumulative effects on seven of the nine historic properties identified in Table 15-13.

The Hudson River Bulkhead may be cumulatively affected by the construction of PATH's east-west concourse and by construction of Route 9A. As described in the executed MOA for the Permanent WTC PATH Terminal, PANYNJ would develop and implement a plan to locate and identify intact portions that would be affected by the concourse's construction. This plan would be developed in consultation with SHPO and in coordination with NYSDOT. In the event that intact portions of the Bulkhead are identified within the vicinity of the east-west pedestrian concourse, PANYNJ, in consultation with SHPO and in coordination with NYSDOT, would prepare a treatment plan for these portions of the Bulkhead.

The executed MOA also provides for stipulations to address potential cumulative effects from construction on the WTC site. As described in the MOA, PANYNJ would request that all agencies constructing projects within the WTC site submit preliminary and pre-final design documents to PANYNJ. PANYNJ and its designated historic preservation consultant would consult with SHPO and the Lower Manhattan Emergency Preservation Fund to asses whether there would be potential for a cumulative adverse effect from the Permanent WTC PATH Terminal and other WTC site projects based on the preliminary and pre-final plans. If SHPO and PANYNJ, agree that planned or completed activities would result in cumulative adverse effects on the WTC site, then PANYNJ would consider measures with respect to the Permanent WTC PATH Terminal to mitigate or minimize these effects, including technical or financial measures for the protection, stabilization, or repair of resources and/or modifications to the Preferred

Alternative's design. PANYNJ would make its documentation of potential cumulative effects and accompanying mitigation plans available for review by the National Park Service, the Advisory Council on Historic Preservation, the Lower Manhattan project sponsors, and the Section 106 consulting parties. PANYNJ's plans to minimize or mitigate adverse cumulative effects would also consider the stipulations within the Programmatic Agreements for the WTC Memorial and Redevelopment Plan, the Route 9A Project, and the Fulton Street Transit Center.

CONDITIONS WITH THE REVISED SCHEDULES

The refinements to the construction schedules would not alter the APEs for the Lower Manhattan Recovery Project or their potential impacts to the historic and archaeological resources identified in Table 15-13. Therefore, the cumulative effects findings presented above would not change with the schedule refinements.

ECONOMIC CONDITIONS

PROBABLE IMPACTS

The five Lower Manhattan Recovery Projects would create thousands of jobs during the construction period. Not only would these projects spur employment within Lower Manhattan, but they would provide jobs for the region, as a whole, with the off-site production of materials. These projects would also directly enhance the local economy with the expenditure of dollars for labor and materials and with the generation of tax revenues.

In addition to the effects on the local economy, businesses in Lower Manhattan would benefit from daily expenditures by the construction workforce induced by the recovery projects. This would provide an expanded customer base for retail and convenience stores, restaurants, delicatessens, and pharmacies.

Construction activities in general have the potential to disrupt business and retail operations as a result of restricted access for pedestrians (customers) and vehicles (deliveries). Construction of the Preferred Alternative itself is unlikely to directly restrict access for extended periods of time during its construction stage since most activities would be contained within the WTC site. Some access restrictions may occur on streets surrounding the WTC site with construction of the Route 9A pedestrian connection, but PANYNJ would work with NYSDOT and the NYCDOT to implement a Maintenance and Protection of Traffic (MPT) Plan to maintain movement through these areas to the extent possible (see Chapter 8, Section B, "Vehicular Traffic and Parking.")

Construction of the WTC Memorial and Redevelopment Plan is not expected to result in the long-term, full-closure of streets in Lower Manhattan because most construction activities would be within the WTC site itself. For activities that may require disruption to traffic, LMDC would develop a MPT Plan in coordination with the other project sponsors to ensure that access to local businesses is maintained throughout the construction period.

The Fulton Street Transit Center would include construction of the Dey Street Passageway between Broadway and Church Street and the pedestrian connector between the Cortlandt Street (R and W) subway station at Church Street and the E subway terminal on the WTC site. The construction at Dey Street would affect deliveries to Dey Street and in particular Century 21, a major department store in the area. Access to Century 21 could also be affected by construction truck traffic associated with the Preferred Alternative as well as the Fulton Street Transit Center,

the WTC Memorial and Redevelopment Plan, and NYCDDC's proposed reconstruction of Church Street.

Vehicular access to portions of Fulton Street would also be temporarily disrupted in certain locations; however, alternate access points would be made available for service and deliveries. For example, alternative loading areas could be established on the north side of Cortlandt Street during construction to enable truck access to Century 21.

As currently planned, NYSDOT would maintain four lanes of traffic through their construction zone during most periods of the day. In addition, NYSDOT has completed a pedestrian bridge across Route 9A at Vesey Street that would connect to an at-grade, protected pedestrian walkway along Vesey Street. Together these temporary measures would maintain access between Church Street and Battery Park City for businesses, workers, commuters, and residents.

MITIGATION

Chapter 5, "Socioeconomic Conditions," shows the EPCs and proposed implementation plans that pertain to business access and economic conditions. As per the guidance of the EPCs, the sponsors of the Lower Manhattan Recovery Projects are working with NYSDOT and NYCDOT to develop a Construction Management Plan (CMP) for Lower Manhattan that would coordinate the MPT plans of the individual projects. The CMP would ensure access is maintained through the area as individual projects proceed into their construction phases. This coordinated plan would help to minimize the potential adverse economic effects to business during the construction period.

The sponsors of the Lower Manhattan Recovery Projects would also provide for temporary signage to direct vehicles and pedestrians to businesses within the construction zone. These efforts would be coordinated between the sponsors and with the effected businesses to ensure that the maximum visibility for these businesses would be achieved.

CONDITIONS WITH THE REVISED SCHEDULES

The schedule refinements would delay construction of three of the five Recovery Projects, which could result in fewer cumulative effects in the peak construction year. However, these refinements would not alter the limits of the project site nor the necessary construction staging areas. As such, the effects to local businesses presented above would not change substantially with the schedule refinements.

D. PROBABLE OPENING YEAR (2009) AND DESIGN YEAR (2025) EFFECTS

The federal government has committed billions of dollars for the redevelopment and revitalization of Lower Manhattan. These funds recognize the devastating short- and long-term effects of the terrorist attacks to Lower Manhattan and the region, as a whole. As such, the five major Lower Manhattan Recovery Projects have been planned and coordinated to provide for the short-term recovery of facilities that were damaged or lost and the long-term economic vitality of Lower Manhattan, New York City, and the region as a whole.

Within the framework of each individual project's environmental review processes, alternatives are being evaluated for their potential direct and indirect environmental impacts. When considered cumulatively, some of these alternatives may limit the long-term benefits of the

Lower Manhattan recovery efforts. The assessment of short-term, construction-period impacts considered the cumulative effect of the Preferred Alternative, with the other Lower Manhattan Recovery Projects since this alternative would generate a greater number of impacts during the construction period than would the No Action Alternatives. Thus the above analysis is the most conservative of the alternatives for the Permanent WTC PATH Terminal. In the long-term, however, each of the alternatives for a Permanent WTC PATH Terminal has the potential for considerably different effects in the opening year (2009) and design year (2025). Thus, the long-term, operational effects discussion below provides a description of the potential benefits and limitations of both the No Action and Preferred Alternatives for the cumulative effects on the resource areas defined above.

NO ACTION ALTERNATIVE

In the long-term, the No Action Alternative would result in the full disruption of PATH service to Lower Manhattan at some point between 2009 and 2025. As such, the cumulative effect of the No Action Alternative on and with the other Lower Manhattan Recovery Projects would be detrimental.

The No Action Alternative could generate up to 1,200 new vehicle trips into Manhattan in the AM peak hour by 2025. These new vehicle trips would congest area roadways and would limit access to businesses for customers and deliveries. The No Action Alternative would also increase on-street pedestrian congestion since it would not provide for sub-grade concourses through the WTC site. Thus, there would be substantial crowding of crosswalks and sidewalks on and near the WTC site, resulting in reduced traffic flow. Furthermore, the larger volume of pedestrians that would cross Route 9A would limit the future roadway's ability to process vehicular traffic and may necessitate the construction of a pedestrian bridge.

Because the No Action Alternative would increase vehicular traffic in Lower Manhattan, it would increase emissions and noise levels. The cumulative effect of a No Action Alternative for the Permanent WTC PATH Terminal may degrade air quality and noise levels as compared to pre-September 11, 2001 conditions. Over the long-term, increased traffic congestion, reduced air quality, and higher noise levels would degrade the quality of life for Lower Manhattan's residents and workers.

Increased congestion associated with the No Action Alternative would limit access to, from, and within Lower Manhattan. This would degrade the ability of visitors to access the area's many cultural sites and would reduce the capabilities of local businesses to serve customers and get deliveries. Because the No Action Alternative may limit or fully disrupt direct transit service between Lower Manhattan and New Jersey, it may force residents, commuters, and visitors to use more costly or more time consuming modes of travel. By reducing access to and from Lower Manhattan, the No Action Alternative has the potential to stagnate the overall recovery of Lower Manhattan, including the full redevelopment of the WTC site.

PREFERRED ALTERNATIVE

The Preferred Alternative has been planned and designed in cooperation with the Lower Manhattan Recovery Projects in its vicinity including the Fulton Street Transit Center, Route 9A Project, and the WTC Memorial and Redevelopment Plan. In the long-term, these projects would collectively provide for the integration of land use and transportation in the vicinity of the WTC site and would be an enhancement over pre-September 11, 2001 conditions.

The Preferred Alternative would form a critical sub-grade pedestrian link between BPC, the WTC Site, PATH trains, and the Fulton Street Transit Center's Dey Street Underpass to provide all-weather access between Tran-Hudson Ferries and the World Financial Center and the majority of the subway lines that serve Lower Manhattan. Furthermore, the Route 9A connection would reduce at-grade pedestrian trips during peak commuter periods. As a result, traffic circulation would be improved in the vicinity of the WTC site, which has resultant economic, traffic, air quality, and noise benefits.

The collection of transit services that would be offered by the Preferred Alternative in concert with a new trans-Hudson ferry terminal; a Fulton Street Transit Center; and other potential transportation projects, such as JFK airport access, would strengthen Lower Manhattan's role as a regional transit hub. As such, the area would attract scores of daily commuters and visitors who would frequent local retail establishments such as shops and restaurants. Furthermore, the integration of numerous transit services with the ability to serve residents throughout the region would increase the attractiveness of Lower Manhattan as a center of commerce. ✳

A. INTRODUCTION

In accordance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality's implementing procedures under 40 CFR Part 1502, any environmental impact statement (EIS) prepared pursuant to NEPA must include an analysis of both the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and of any irreversible or irretrievable commitments of resources that would occur should the action be implemented (40 CFR 1502.16). This chapter addresses these concepts for the No Action and the Preferred Alternative. First, the permanent commitment of resources as compared to the benefits of the project is assessed. This analysis is followed by an analysis of the relationship between expending environmental resources in the short-term and gaining productivity in the long-term. This chapter ends with a description of the funding sources for the project and describes how the commitment of these funds may affect other proposals within the New York City region or elsewhere.

B. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The No Action Alternative, by definition, would not irreversibly or irretrievably commit resources for construction. However, this alternative would require a greater commitment of a variety of resources in the future due to its failure to improve the accessibility and efficiency of the Region's transportation system.

Resources that may be irreversibly and irretrievably committed to the Preferred Alternative include construction materials, energy, labor, funds, and land. Materials, energy supplies, and labor used to construct the Preferred Alternative are not in short supply, and their use would not have an adverse impact on their continued availability for other projects. Furthermore, construction expenditures are consistent with public policy initiatives to revitalize Lower Manhattan (see Section C, "Cost and Funding").

The total commitment of funds required for construction of the Preferred Alternative, including its pedestrian connections, is estimated at $2,138 billion in 2003 dollars. As described in Chapter 5, "Socioeconomic Conditions," this commitment of financial resources would add to local and regional economic activity and thus add employment and tax revenues in the region.

As shown in Table 16-1 the Preferred Alternative would generate 19,965 person-years of employment during the construction period, which would translate to $1,184.9 million in wages and salaries. The direct expenditures for construction combined with induced expenditures within the region from the employment it would generate would result in $3,970.6 million in expenditures within New York State. Government entities would also benefit from increased tax

Table 16-1
Employment and Fiscal Benefits from Construction of the Preferred Alternative

Employment (in person-years)*	
Direct (Construction)	10,533
Indirect (Secondary and Induced)	9,432
Total	19,965
Wages and Salaries (in millions of dollars)	
Direct (Construction)	$661.5
Indirect (Secondary and Induced)	$523.4
Total	$1,184.9
Total Economic Output or Demand** (in millions of dollars)	
(Millions)	
Direct (Construction)	$2,138.0
Indirect (Secondary and Induced)	$1,832.6
Total	$3,970.6
Tax Revenues***	
New York City Taxes	$46,485.5
MTA Taxes	$2,963.0
New York State Taxes	$96,809.5
Total	$146,258.0

Notes:

* A person-year is the equivalent of one person working full-time for a year.

** The economic output or total effect on the local economy derived from the direct construction spending.

*** Includes personal income taxes, corporate and business taxes, sales tax on indirect expenditures, and numerous other taxes on construction and secondary expenditures. Values are expressed in constant 2003 dollars.

Sources: The characteristics and construction cost of the Project Alternative; the Regional Input-Output Modeling System (RIMS II), U.S. Department of Commerce, Bureau of Economic Analysis; and the tax rates by applicable jurisdiction.

revenues resulting from construction. Under the Preferred Alternative, more than $146 million in tax revenues would be generated by construction-period payroll taxes, sales taxes, and other tax revenue sources.

As described in this EIS, construction of the Preferred Alternative would or potentially would adversely impact historic and archaeological resources, vehicular traffic circulation, access to local businesses, air quality, and noise and vibration.

The Port Authority of New York and New Jersey (PANYNJ) would endeavor to minimize impacts wherever practicable. To that end, it has established and implemented Environmental Performance Commitments (EPCs) and is developing Sustainable/"Green" Design Standards. Furthermore, the Federal Transit Administration (FTA) and PANYNJ have executed a Memorandum of Agreement (MOA) that stipulates measures to avoid, minimize, or mitigate specific impacts to historic resources during the project's construction.

As described in Chapter 2, "Project Alternatives," and Chapter 3, "Construction Methods and Materials," PANYNJ has coordinated with the Lower Manhattan Development Corporation (LMDC), New York State Department of Transportation (NYSDOT), and Metropolitan

Transportation Authority (MTA) to develop EPCs that would avoid or minimize the impacts to the environment during construction of their respective projects. These EPCs specifically address five key environmental concerns: air quality, noise and vibration, cultural and historic resources, access and circulation, and economic effects. Collectively, the EPCs would reduce traffic delays, air quality emissions, noise, and vibration and would minimize effects to the surrounding environment through efforts to maintain access to local businesses, residences, and cultural institutions and resources during the construction period.

The EPCs also established general guidance for the preparation of "green" design and sustainability principals to reduce the demand for and use of resources during construction and once projects are complete. As described in Chapter 2, "Project Alternatives," PANYNJ is developing sustainable design guidelines for the Preferred Alternative. Proposed principals and actions will be organized into six component areas: urban considerations, site, water, energy, materials, and indoor environment. These guidelines are consistent with criteria contained in the New York City Transit Environmental Guidelines, the U.S. Green Building Council's Leadership in Energy Efficiency (LEED) Guidelines 2.1, and requirements of New York State Executive Order 111 and the New York State Green Building Tax Credit. The guidelines would facilitate reuse of or reduced demand for water, energy, and solid waste when the Preferred Alternative is operational. Other measures would promote development that is sensitive to the environment by encouraging users to decrease their demand for nonrenewable resources. PANYNJ's would achieve these guidelines by implementing a number of plans and protocols to minimize demand for and use of resources during and after construction (see Chapter 2, Project Alternatives," and Chapter 11, "Infrastructure and Energy").

In the long-term, the Preferred Alternative would occupy land within and outside the WTC site. The proposed Terminal building and most of its sub-grade concourses would be located within the WTC site, which is owned by PANYNJ. The proposed Route 9A pedestrian connection would extend below Route 9A to a new head house in front of the World Financial Center. The Route 9A connection would occupy land that is not currently controlled by PANYNJ. However, PANYNJ would establish easements and agreements with the property owners prior to construction. The only portion of the Route 9A connection that would be located above-grade would be within the lawn in front of the Winter Garden. Although the new head house would irreversibly commit land to the project, it would provide for substantial benefits to current and future users of Battery Park City and the World Financial Center.

The Permanent WTC PATH Terminal would permanently occupy portions of the approximately 16-acre WTC site. Thus, the Preferred Alternative would irreversibly commit historic land to the project. However, the executed MOA provides for measures to avoid, minimize, or mitigate the project's long-term impacts to the WTC site. As described in Chapter 6, "Cultural Resources," the MOA includes stipulations to preserve certain remnants and structures that remain and to mitigate the project's impacts to other remnants and structures.

The Preferred Alternative would require the irreversible and irretrievable commitment of energy sources both during and after construction.

C. SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

Short-term effects on the environment result from construction impacts. Long-term effects relate to the maintenance and enhancement of long-term productivity—in particular, the consistency of the project with long-term economic, social, and regional and local planning objectives,

including sustainability. The short- and long-term effects of the Preferred Alternative are summarized below.

SHORT-TERM USES

As described elsewhere in this EIS, the Preferred Alternative would have greater "short-term" impacts during construction than the No Action Alternative. Generally, the short-term construction impacts of the Preferred Alternative would be associated with traffic circulation, noise and vibration, air quality emissions, and access to local businesses. PANYNJ would endeavor to reduce these impacts through the EPCs, stipulations of its MOA, and sustainable construction techniques identified in the design guidelines. The Project's construction would create economic benefits in the form of jobs and the subsequent direct and indirect demand for goods and services (see Table 16-1).

LONG-TERM PRODUCTIVITY

The ability of transportation systems to conveniently serve major residential and employment centers is one of the essential components in economic growth and productivity as well as a key factor in improving the livability of neighborhoods; this is particularly true for the New York metropolitan area, and for the economic engine represented by Lower Manhattan.

Before September 11, 2001, nearly 426,000 people worked south of Canal Street, representing 19 percent of Manhattan's total of 1.9 million private sector jobs. However, the terrorist attacks resulted in the loss more than 71,000 jobs south of Canal Street. The renovation and reoccupation of damaged buildings, construction of new buildings, and redevelopment of the WTC site would result in a total of approximately 422,000 jobs south of Canal Street by 2025, which represents a very slight decrease in Lower Manhattan's employment as compared to pre-September 11, 2001 conditions.

The anticipated return of Lower Manhattan's employment is dependent on access to the area from the region's major residential areas. As described in Chapter 1, "Purpose and Need," approximately 16 percent of Lower Manhattan's workforce resided in New Jersey before September 11, 2001, the majority of which traveled by PATH. By improving the transportation infrastructure, the Preferred Alternative would help maintain Lower Manhattan's attractiveness as a global center of finance and commerce. Furthermore, since Lower Manhattan and the City contribute greatly to the economy of the tri-state area, the region would see long-term productivity benefits from the project.

As described in Chapter 8, Section B, "Vehicular Traffic and Parking," the absence of a Permanent WTC PATH Terminal, the No Action Alternative, has the potential to generate new vehicle trips from the diversion of PATH customers to other modes of transit, private automobiles, buses, and commuter vans. By 2025, it is estimated that absent the Preferred Alternative, a total of 1,194 AM peak hour new vehicle trips may be generated. These new vehicle trips would contribute to congestion on local roads as well as at the major portals to Lower Manhattan from New Jersey. Thus, the No Action Alternative may have adverse impacts on regional traffic flow.

Absent the Preferred Alternative, new vehicle trips would contribute to degradation in air quality and noise in Lower Manhattan and the region as a whole. If PATH service between New Jersey and Lower Manhattan is not available in 2025, it is estimated that vehicle trips by diverted PATH customers would emit approximately 15.7 tons per year of volatile organic compounds,

18.0 tons per year of nitrous oxides, 1.5 tons per year or more of particulate matter, and 236.0 tons per year of carbon monoxide in 2025. These new vehicle trips would also increase noise levels near the major portals between New Jersey and Lower Manhattan as well as on the local streets in the vicinity of the WTC site.

As described in Chapter 8, Section A, "PATH" and Chapter 8, Section C, "Transit," the No Action Alternative may result in the overcrowding of the other transit modes that serve or conveniently connect with Lower Manhattan. By 2025, it is estimated that diverted PATH customers could increase ridership on the uptown PATH routes by 4,583, on New York City Tranist subways by 11,611, on New Jersey Transit Commuter rail by 5,500, on buses by 7,495, and on trans-Hudson ferries by 10,694. In order to accommodate this demand, operators would need to provide additional trains, buses, and vessels. Furthermore, the increased crowding of transit vehicles and stations would have adverse impacts to their operation.

The Preferred Alternative would not only avert the adverse impacts of the No Action Alternative but would also provide for improved PATH service as compared to the pre-September 11, 2001 and temporary WTC facilities.

- It would provide for an additional platform to increase capacity and reduce crowding during peak periods.
- It would fully restore the pedestrian connections that existed before September 11, 2001 and provide for new concourses to trans-Hudson ferries, and the Fulton Street Transit Center.
- It would replace the temporary station's 8-car platforms with 10-car platforms, which would allow PANYNJ to operate 10-car trains on the Newark-WTC route.
- It would provide for the operational flexibility to support PATH's long-term service plans.
- Its design would incorporate advanced technologies to enhance security and reduce energy demand.

As described above, the long-term benefits to productivity and related long-term increases in productivity, addressed by the Preferred Alternative, would include the following:

- Support the region's economic development;
- Improved regional and local accessibility;
- Reduced vehicle trips;
- Reduced congestion and overcrowding on other transit systems;
- Reductions in mobile source air pollutants;
- Reductions in traffic generated noise; and
- Improved PATH service.

Overall, the resources to construct and operate the Preferred Alternative would be committed to benefit commuters to and residents of Lower Manhattan. The Preferred Alternative would benefit the New York region by improving access to, from, and within Lower Manhattan. It would offer reductions in station crowding and operational delays as compared to pre-September 11, 2001 conditions. Furthermore, the Preferred Alternative would result in overall reductions in travel time and cost, vehicle trips, and air quality emissions as compared to the No Action Alternative.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

Local short-term impacts in use of resources resulting from the construction of the Preferred Alternative would be consistent with the maintenance and enhancement of long-term productivity for the city, state, and region. Some resources that would be valuable in the short term are being spent to achieve higher productivity in the long term. By investing these resources in future productivity, and over the long term, fewer resources would be needed to achieve the same level of productivity than if a No Action Alternative were pursued.

D. COST AND FUNDING

As described in Chapter 2, "Project Alternatives," the estimated cost to construct the Preferred Alternative is $2,138 billion. This cost includes constructing the terminal house; four sub-grade levels; rehabilitation of the tracks and platforms; off-site pedestrian connections; ventilation structures; and the necessary infrastructure work to support the PATH Terminal. The project cost also accounts for the advanced security measures that would be incorporated into the design as well as the sustainable design standards and mitigation of the adverse impacts of the Preferred Alternative.

A total of $1.75 billion would be funded by the Federal Transit Administration as part of the $4.55-billion dollar transportation recovery package, which was committed by the federal government to the City following the terrorist attacks of September 11, 2001. The remaining $388 million would be funded by PANYNJ through their capital improvement program.

The $4.55-billion transportation recovery package was committed to New York City by the federal government to fund transportation projects that support the City's long-term, economic recovery from the terrorist attacks. New York State Governor George Pataki identified four projects for early funding under the transportation recovery package as follows:

- Permanent WTC PATH Terminal;
- Fulton Street Transit Center;
- South Ferry Terminal; and
- The Route 9A Project.

Although Governor Pataki has identified other projects within New York City that may be supported with these funds, the four priority projects are being advanced first.

Because the transportation recovery package is dedicated to New York City, funds must support transportation projects that directly benefit the City. Should any of the four priority projects not advance as planned or if actual costs are lower than currently projected, the additional funds would be used to support the other transportation improvements that have been identified by Governor Pataki.

PANYNJ has planned for contingency costs within the project's budget should construction overruns occur. In the event that the project exceeds the estimated $2,138 budget, PANYNJ, the State of New York, and the federal government would cooperate to ensure that the project is completed. ✳

A. INTRODUCTION

This chapter identifies safety and security considerations related to the design, construction, and operation of the Preferred Alternative. The project would feature advanced safety and security systems and procedures to protect passengers, workers, and the local community. The chapter addresses procedures to be implemented both during the project's construction and once the Terminal is in operation.

B. CONSTRUCTION PERIOD (2006)

The Port Authority of New York and New Jersey (PANYNJ) and the Port Authority Trans-Hudson (PATH) Corporation have extensive experience managing safety and security in both the construction and operation of complex projects. Using this experience, as an initial and key step in the development of the construction plan for the Preferred Alternative, PANYNJ would develop a detailed, overall Health and Safety Program (HASP), which would consist of several individual HASP plans to be implemented throughout all aspects of the project's construction.

The HASP plans developed and implemented by each contractor would require that detailed work scopes be reviewed and approved by PANYNJ to ensure safety in each task, and that equipment, materials, controls, crew size, job responsibilities, operating procedures, and maintenance practices be addressed, implemented, and audited for safety. The HASP plans would identify potential safety concerns and describe methods to protect construction workers and the general public from exposure to contaminants present in air, soil, ground water, building materials, and buried structures encountered at the site. The management plans would contain the methods to be used in handling, staging, disposal, transport, and decontamination of equipment and personnel in accordance with local, state, and federal regulations. Further, the management plans would contain a list of licensed waste haulers and disposal facilities that would accept each of the above noted hazardous materials.

The HASP will include worker training and required safety courses, monitoring requirements, use of personal protection equipment (PPE), contaminant action levels, identification of potential contaminants, Soil Management Plan, Groundwater Management Plan, Dust Management Plan, development and implementation of management plans to address polychlorinated biphynels (PCBs) and asbestos, and air monitoring equipment. Further, the HASP will address preventative measures to narrow down or eliminate potential exposure pathways and corrective actions if exposure occurs. If contaminant concentrations are exceeded during construction, then all activities will cease and the appropriate remedial actions would be undertaken as noted in the HASP.

As described in Chapter 12, "Contaminated Materials," additional protocols would be established to protect the general public and the environment throughout the construction period with respect to the disturbance of any contaminants and/or hazardous materials. In addition, the

HASP plans would include and acknowledge compliance with specialized training requirements for track safety as set forth by PATH System Safety requirements for any construction along or adjacent to active PATH property. PANYNJ, through its contractors, would use preventative as well as responsive measures in managing and controlling hazards. These would include inspections, self-assessments, and testing to identify problem areas. PANYNJ would implement an audit program to ensure all contractors are in conformance with their individual HASP plans and the project-wide HASP. Contractors will also comply with safety aspects as they pertain to U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) or Mining Safety and Health Administration (MSHA) regulations.

The construction of the Preferred Alternative would occur within, above, and around the temporary WTC PATH station. PANYNJ has been and would continue to develop a detailed staging plan to both maintain and protect PATH operations during the construction period. This would include a Maintenance and Protection of Traffic (MPT) plan that provides specific measures to protect riders using the temporary WTC PATH station. Specific measures may include scaffolding, safety barriers, detour routes, safety officers, and informational and directional signage. Activities that pose greater risk to PATH customers would be conducted at night or on weekends with an adjusted service schedule to ensure the protection of riders. With these measures, access to the temporary PATH station would generally be maintained throughout the construction of the Preferred Alternative.

During the construction period, PANYNJ would maintain off-site pedestrian patterns similar to current conditions in Lower Manhattan. The existing perimeter wall surrounding the WTC site would be maintained both for public viewing of the site and the protection of pedestrians. Pedestrian diversions to Cortlandt or Cedar Street would be facilitated, if necessary, with traffic control officers, signage, and barricades, focusing on the safety of pedestrians crossing Church Street. For construction activities on Route 9A associated with the Permanent WTC PATH Terminal, PANYNJ would coordinate with New York State Department of Transportation (NYSDOT) to develop a plan to maintain and protect pedestrian access during the construction period, similar to methods that would be employed for the protection of pedestrians on Church Street.

Since September 11, 2001, PANYNJ and its contractors have implemented strict security procedures for access to the WTC site. These procedures include pre-clearance and photo identification for all personnel that visit the site, checkpoints and inspections of materials being delivered to the site, and 24-hour monitoring of activities on and near the site. PANYNJ would continue to use these procedures to protect the PATH riders, the general public, and construction workers during and after construction of the Permanent Terminal.

C. OPENING YEAR (2009) AND DESIGN YEAR (2025)

The terrorist attacks of September 11, 2001 have elevated national attention toward personal safety, and the security of the Preferred Alternative and the WTC site is of paramount concern to PANYNJ. From the inception of the design process, the development of the project has included safety security operations as a fundamental planning and programming element. Plans for all aspects of train safety, station safety, and safety in other facilities are a key component of the design for the Terminal. The safety and security benefits to be provided by the project would contain pre-September 11, 2001 standard security measures such as surveillance, lighting, emergency communications, and egress, but would also include advanced systems such as structural hardening, redundancy, and air monitoring and detection systems.

PANYNJ commissioned the creation of a security master plan document. This document was developed through the partnership of a team, which consisted of PANYNJ, architects, civil engineers, geotechnical engineers, structural engineers, landscape architects, electrical engineers, mechanical engineers, fire protection engineers, security engineers, transportation and traffic engineers, and numerous other specialists. The purpose was to reach an informed consensus of rational and justifiable threats, vulnerabilities, and mitigating strategies to be included as part of the design guidelines for the Preferred Alternative and the WTC Memorial and Redevelopment Plan. Absent the Preferred Alternative (the No Action Alternative), elements of the WTC Memorial and Redevelopment Plan, including their associated security measures, would be developed at the WTC site. However, the advanced security measures intended as part of the coordinated master plan may not be fully realized.

Safety and security considerations would be embodied in the Preferred Alternative's civil designs through consideration of vehicular access, control, and careful validation of their cargo. Utility type, redundancy, locational placement, and protection would also be managed under the security master plan guidelines. Control and management of vehicular access and approach to pedestrian plazas would be carefully regulated by urban-sensitive designed streetscape. The enforcement of vehicular standoff distances to critical utilities, infrastructure, and the iconic structures would be provided through integrated site civil and landscape design elements.

Architectural designs would include the specification of façade and exterior glazing systems responsive to exceptional natural events, as well as the additional design loads created by explosive events delivered by vehicles and/or persons with the consequent capability of greatly enhancing life safety. These designs would also respond to emergency evacuation and crowd management protocols based on historical experiences, governing codes, and security master plan guidelines that acknowledge a need for anticipating the failure of normally available systems, protective designs, and human management intervention. This would be achieved by the implementation of carefully planned emergency egress, including areas of refuge, increased stair and exit path sizing, exiting route locational diversity and redundancy, airborne contaminant compartmentalization and purging, way finding clarified through sight lines and destination recognition, signage, graphics, and other remaining architectural design features.

Mechanical, electrical, and fire protection systems shall be provided to achieve an enhanced level of fault tolerance, in excess of code requirements. This would be achieved through additional pressurization and purging of pedestrian environments and the implementation of additional heating, ventilation, and air conditioning (HVAC) control zones for unique areas that would be at an elevated level of risk, including vehicle screening areas, command and control centers, car parking areas, loading docks, mailrooms, messenger centers, and lobbies. Fire protection, detection, and associated emergency voice communication systems would have enhanced fault tolerant operational capabilities through the application of redundant water sources, pumps, distribution and control apparatus, bi-directional communication systems, and linkage to backup monitor and control sources. The roof of the Terminal's east-west connection to the World Financial Center, which is below the proposed extension of Fulton Street, will be reinforced to support the future roadbed. The hardened road bed of Fulton Street would provide for enhanced security within the Terminal's east-west concourse. The road bed would protect the concourse in the event of a fire or explosion at street level.

Electronic security countermeasures, including video surveillance, intrusion detection, control of both vehicular and pedestrian access, badge/identity authentication, and emergency voice communications are envisioned to be included as part of each stakeholder occupancy

(transportation terminal, commercial, retail, hospitality, cultural, memorial, and support infrastructure), as well as being centrally coordinated so that individual stakeholder facility security systems are competently managed as part of a WTC site-wide electronic campus master plan. This would provide the opportunity for each stakeholder's investment in security systems and staffing to be added to the collective investment made by all other WTC facilities, including the Permanent WTC PATH Terminal, essentially creating an efficiently managed security precinct. This would exceed the crime prevention performance of similar security programs embodied in the Business Improvement Districts (BIDs) currently in operation elsewhere in Manhattan.

The security design criteria to be incorporated at the WTC site, including the Preferred Alternative, is based on nationally recognized and accepted standards used by the U.S. General Services Administration, U.S. Department of State, U.S. Department of Interior, U.S. Department of Justice, U.S. Department of Homeland Security, U.S. Department of Transportation, Standard for Testing and Materials, American National Standards Institute, and other similar testing agencies and standard setting institutions. Criteria will also consider principles of Crime Prevention through Environmental Design.

The entire PATH system must conform to U.S. Department of Transportation Federal Railroad Administration (FRA) standards for safety and security. The system is regularly inspected; staff is frequently trained, and safety is a key component of PATH's operating and maintenance procedures. Recently, PATH underwent close inspection of its cars, equipment, and infrastructure as part of the restoration of service to the WTC site. PANYNJ and PATH collaborated with FRA through this process and results were positive, allowing for the station's opening.

PANYNJ commissioned training and coordination of communications and life safety systems prior to the opening of the temporary WTC PATH station. Similar procedures would be conducted as part of the planning, development, and opening of the Preferred Alternative.

The Preferred Alternative would meet National Fire Protection Association (NFPA) 130 standards for fixed guideway transit systems for fire protection and egress; and PANYNJ, in coordination with city, state, and federal law enforcement agencies, would develop detailed security plans for the Terminal. It is anticipated that the PANYNJ Police Department would be responsible for normal policing of the Terminal and that the New York City Police Department (NYPD) would provide support and/or command and control for exceptional emergency situations as determined by PANYNJ and the New York City Office of Emergency Management. To increase the effectiveness of police activities, it is envisioned that the resources of the PANYNJ Police Department, NYPD, Fire Department of New York, New York City Department of Transportation, NYSDOT, Metropolitan Transportation Authority, and other established law enforcement, transportation, emergency response, and planning agencies would contribute through an interactive process of standards development and design review, as facilities emerge from their respective design phases to implementation. The intention is to provide an unprecedented level of interagency interoperability, which would be more effectively managed by the design and construction of an innovative New York City neighborhood whose conception included security and safety design principle developed by a consortium of design, security, planning, law enforcement, and emergency response professionals. ✳

Chapter 18: Agency Coordination, Process, and Public Participation

A. INTRODUCTION

This chapter presents a summary of the process used to encourage public participation performed to date for the Permanent World Trade Center (WTC) PATH Terminal environmental review, including forums for agency and public participation. This chapter also describes the various regulatory approvals that are required by federal, state, and local agencies to construct and operate the Permanent WTC PATH Terminal. Finally, contacts are provided for the solicitation of further information.

B. PUBLIC INVOLVEMENT PROGRAM

A comprehensive public involvement program has been implemented for this project. The public involvement effort has been designed to help provide complete information, be early and continuing, timely in public notice, broad in public outreach, and responsive. The public participation process is one that requires extensive and intensive outreach to private citizens, local businesses and associations, development authorities, elected officials, affected government agencies and others in New York and New Jersey.

The overriding goal of the public participation process is to engage a diverse group of public participants in order to provide timely information and solicit relevant input throughout the environmental review process. In order to best accomplish this, the following objectives have been pursued:

- Establish ongoing, inclusive and meaningful two-way communication with stakeholders and the public.
- Inform the public about the environmental review process and the role of government, stakeholders and the general public.
- Clarify the role of this project relative to other Lower Manhattan projects and studies, while at the same time coordinate outreach activities with those efforts in order to best utilize the public's involvement.

MAILING LIST

The project mailing list was developed for the distribution of outreach materials related to the environmental review process for the Permanent WTC PATH Terminal. The mailing list currently contains more than 900 addressees representing elected officials; federal, state, and local agencies; Technical Advisory Committee (TAC) members; Section 106 consulting parties; community and interest groups; local property owners and managers; and any members of the public who have requested mailings, including those who attended the public scoping meetings and public hearings on the DEIS.

FLYERS

More than 8,000 flyers advertising the October 2003 scoping meetings and June 2004 public hearings in Jersey City and Lower Manhattan were distributed at key public facilities (i.e., libraries, municipal buildings, etc.) and at several PATH stations. The flyers were also available on the project web site at www.panynj.gov/pathrestoration.com. Flyers were available in both English and Spanish.

MOBILE PUBLIC INFORMATION CENTERS

The project's outreach plan included mobile public information centers. These centers were held at PATH stations and provided easy access to interested members of the community wishing to learn more about the study and its progress. Flyers advertising public meetings were distributed at these centers and personnel from the Port Authority of New York and New Jersey (PANYNJ) and PATH were on hand to answer questions. Four mobile information centers were held in September 2003 in New Jersey to advertise the public scoping meetings. A mobile information center was also held at the temporary WTC PATH station in June 2004 to advertise the public hearing on the DEIS.

NEWSLETTERS

The first in a series of project newsletters was published in October 2003. The newsletter was distributed via the project mailing list and at the scoping meetings, as well as being made available online. The newsletters will help keep the public and other stakeholders apprised of the progress of this project and inform them of how they can stay involved.

A second newsletter was published in June 2004, concurrent with the release of the DEIS. It was distributed to the project's mailing list and was made available at the public hearings. The newsletter described the scoping process for the DEIS, the Section 106 review process, and the temporary WTC PATH station. It also provided information on the public review process for the DEIS.

WEBSITE

Information about the project has been and will continue to be available on the project's website (www.panynj.gov/pathrestoration.com). The website includes the project's environmental documents including the scoping document, the DEIS, and the FEIS. The website was also used during the project's scoping and DEIS comment periods as a medium for the public to e-mail comments. In the future, the website will provide information to the project's Section 106 consulting parties and the general public regarding construction plans and protocols as well as the Terminal's design. The site will allow for an ongoing opportunity to submit comments and contact key project representatives.

C. PUBLIC INVOLVEMENT ACTIVITIES

AGENCY AND STAKEHOLDER COORDINATION

FEDERAL INTER-AGENCY REVIEW TEAM

As described in Chapter 1, "Purpose and Need," and Chapter 2, "Project Alternatives," the U.S. Department of Transportation, Federal Transit Administration (FTA) and PANYNJ have

organized and/or participated in several efforts to coordinate the planning and environmental review of projects in Lower Manhattan. On the federal level, the FTA has formed the Interagency Review Team (IRT). An outgrowth of the Memorandum of Understanding among the federal partners (August 2002) and Executive Order 13274 on Environmental Stewardship and Transportation Project Delivery, the IRT includes various federal oversight agencies involved in the review and approval of the environmental documents for the Lower Manhattan recovery efforts. The IRT continues to coordinate on the progress and results of ongoing environmental reviews in order to communicate and resolve issues throughout the process. This forum helps to expedite the formal review of these environmental documents by the respective oversight agencies.

LOWER MANHATTAN PROJECT SPONSORS

Community involvement has been considered crucial to developing a plan that addresses community concerns while addressing the transportation needs of an ever changing and evolving Lower Manhattan. On the local level, the project sponsors for the Lower Manhattan recovery efforts have been coordinating the planning and analysis of these projects. A bi-weekly meeting is held between project sponsors including the PANYNJ, Metropolitan Transit Authority (MTA), New York State Department of Transportation (NYSDOT), New York City Department of Transportation (NYCDOT), Lower Manhattan Development Corporation (LMDC), community board members, interest groups and the consultant teams to coordinate and consolidate data collection, analyze methodologies and assumptions, impact criteria, and technical results for the environmental documents being prepared under the National Environmental Policy Act (NEPA). This proactive effort is aimed at expediting the preparation of individual documents and ensuring the consistency of the environmental findings.

As described in the DEIS, the project sponsors developed a framework for construction coordination, which included several working groups to address issues that have been identified in the individual environmental documents for the Lower Manhattan recovery projects and to implement the EPCs. The sponsors established a Schedule Working Group, a Logistics Working Group, a Traffic Working Group, and a Standards Working Group. Through this coordinated approach to the construction of individual projects, the project sponsors strove to meet or exceed the EPCs to the extent possible and to investigate and remediate issues and concerns that could arise during the construction process.

As described in Chapter 2, "Project Alternatives," Governor Pataki has established, by way of an Executive Order, the Lower Manhattan Construction Command Center. This entity will coordinate the construction of the Lower Manhattan Recovery Projects but will also coordinate any other construction projects in Lower Manhattan with a value in excess of $25 million through 2010. The Command Center will have an Executive Committee consisting of representatives from the various project sponsors, including PANYNJ, MTA, LMDC, and NYSDOT, as well as other key state and local agencies. The Command Center and its Executive Committee will be managed by an Executive Director, who will be appointed by the Governor and the Mayor.

As the entity responsible for construction coordination, the Command Center will establish a master schedule for the Lower Manhattan projects and will work with project sponsors, contractors, and the public to alleviate potential conflicts.

TECHNICAL ADVISORY COMMITTEE

PANYNJ has established a Technical Advisory Committee (TAC) for the Permanent WTC PATH Terminal. The TAC provides federal, state, and local officials and agencies with an opportunity to learn the status of the project, and it serves as a forum to provide input and raise issues of coordination between this project and the other large projects in Lower Manhattan. To date, there have been two meetings for the project, one on Tuesday, September 30, 2003 and one on Tuesday, June 15, 2004. The following is a list of agencies that have been asked to participate in the TAC.

- Battery Park City Authority
- Empire State Development Corporation
- Lower Manhattan Development Corporation (LMDC)
- Metropolitan Transportation Authority (MTA)
- MTA, New York City Transit
- New Jersey Department of Transportation
- New Jersey Transit
- New York City Department of City Planning
- New York City Department of Environmental Protection
- New York City Department of Transportation
- New York City Economic Development Corporation
- New York City Fire Department
- New York City Landmarks Preservation Commission
- New York City Mayor's Office
- New York City Police Department
- New York Metropolitan Transportation Council
- New York State Department of Environmental Conservation
- New York State Department of Transportation
- New York State Office of General Services
- New York State Office of Parks, Recreation and Historic Preservation
- North Jersey Transportation Planning Authority
- U.S. Army Corps of Engineers
- U.S. Department of Housing and Urban Development
- U.S. Department of Transportation, Federal Highway Administration (FHWA)
- U.S. Department of Transportation, Federal Railroad Administration
- U.S. Environmental Protection Agency, Region 2

OTHER AGENCY/STAKEHOLDER OUTREACH

PANYNJ Offices of Government Affairs and Priority Capital Programs continue to conduct informal briefings with elected officials, Community Board members, and other key stakeholders to provide updates on the process, and to solicit their input. Efforts to date have included formal congressional briefings, presentations to Community Board #1 and its subcommittees, informal and formal project briefings to New York City agencies, and meetings with the Lower Manhattan Transportation Task Force. PANYNJ will continue to communicate with these groups as project planning and construction moves forward.

PUBLIC INVOLVEMENT MEETINGS

PUBLIC SCOPING

Public scoping first introduced the project formally and its purpose and need to the community. The scoping document, which was prepared as part of this process, outlined the project's purpose and need, its goals and objectives, alternatives under consideration, and the framework for the environmental analysis. The scoping document for this EIS was released on September 26, 2003, and on October 8 and 9, 2003, the FTA and PANYNJ held public scoping meetings in Jersey City and Lower Manhattan to present information and solicit comments on the environmental review of the Permanent WTC PATH Terminal. The meetings were promoted through the TAC, newspaper advertisements, media releases, newsletter, mailings, the web site, and the mobile public information centers.

The public was encouraged to submit comments at the scoping meetings or by mail, phone, fax, and e-mail. The close of the public comment period was Wednesday October 29, 2003. A total of 71 people submitted comments during scoping.

The key issues raised by the public during scoping were:

- The project's role in the revitalization of Lower Manhattan;
- Coordination with LMDC and other Lower Manhattan recovery projects;
- Preservation of the footprints of the former twin towers;
- Air quality, noise, and traffic and pedestrian circulation during construction; and
- Secondary and cumulative effects during construction.

Members of the public also commented specifically on the draft scoping document and the project alternatives that were presented at the scoping meetings. Some requested additional public information such as:

- Clearer demarcation of the World Trade Center 1 and 2 footprints on any graphics;
- Identification of what elements of the station might be within the footprints; and
- Blueprints of the original PATH train configuration.

Comments from public interest groups and the New York City Department of City Planning proposed two additional alternatives. The first requested that project team consider routing a new track connection between the Downtown PATH under Fulton Street and constructing a new PATH No. 6 station. As described in Chapter 2, "Project Alternatives," this alternative was considered but was eliminated due to engineering and other constraints. The second alternative recommended that the Terminal not include a connection to Liberty Plaza. As described in Chapter 2, "Project Alternatives," of this FEIS, this has become the Preferred Alternative for the Permanent WTC PATH Terminal.

Comments received during the scoping process were addressed within the DEIS. Appendix H of this FEIS includes the list of comments and responses from the public scoping process.

PUBLIC HEARINGS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

Public hearings on the DEIS were held at City Hall in Jersey City, New Jersey on June 23, 2004 and at Saint John's University-Manhattan Campus in Lower Manhattan on June 24, 2004. The public was notified of the hearing locations, dates, and times through the variety of media including newspaper advertisements, posters and flyers at PATH stations, mobile public

information centers, and direct mailers. To maximize attendance from regional residents, stakeholders, commuters, and public officials, the meetings were held from 4PM to 8PM. PANYNJ staff made a presentation on the project at 4:30PM and 6:30PM during each of the hearing dates. A stenographer recorded all public comments, and the hearings were video taped. Presentation boards and computer animations were prepared for the public to view project plans and the findings of the DEIS, and PANYNJ and consultant staff were on hand to informally address questions.

A total of 15 persons spoke at the public hearings, and two members of the audience submitted written comments at the hearings. An additional 26 parties sent letters, e-mails, or faxes during the DEIS comment period. Comments addressed the alternatives considered for the project; methods of fare collection; integration of transit systems; air quality impacts and mitigation; preservation of historic resources; and overall project benefits. Comments made during the DEIS comment period have been summarized in Chapter 19, "Public Comments on the DEIS and Responses." The written transcript of the hearings as well as the letters, e-mails, and faxes sent during the DEIS comment period is shown in Appendix H.

THE SECTION 106 PROCESS

The National Historic Preservation Act (NHPA, 16 USC §470) of 1966 requires federal agencies to take into account the effects of their undertakings on properties either listed in or determined eligible for listing in the National Register of Historic Places. This process, commonly referred to as the Section 106 process, provides for review of any federally licensed, financed, or assisted undertaking. The FTA is the federal agency concerned in the case of the Permanent WTC PATH Terminal. In order to comply with the law, federal agencies follow Section 106 of the NHPA and their implementing regulations developed by the Advisory Council on Historic Preservation (36 CFR part 800). The process includes identifying historic properties, assessing adverse effects, and resolving adverse effects. The process involves consultation with State Historic Preservation Officers (SHPO), local governments, and members of the public.

The Section 106 review process for the Permanent WTC PATH Terminal began concurrent with its public scoping in September 2003. In order to facilitate the process for three of the Lower Manhattan Recovery Projects, FTA entered into a coordinated Section 106 review process with FHWA (lead agency for the Route 9A Project) and LMDC (lead agency for WTC Memorial and Redevelopment Plan) in December 2003. The three federal agencies jointly notified the SHPO and Advisory Council on Historic Preservation (ACHP) concerning these three Lower Manhattan undertakings and identified potential consulting parties to the Section 106 process. In January and February 2004, FTA, FHWA and LMDC hosted two meetings with consulting parties to discuss the projects and in particular the evaluation of the WTC site for eligibility for inclusion in the National Register of Historic Places. Consulting parties were also offered opportunities to comment on draft versions of the Coordinated Determination of Eligibility for the WTC site, which was issued in final form on March 31, 2004. At that time, the coordinated process effectively ended, leaving each lead agency to meet the remainder of its Section 106 responsibilities separately as appropriate to its respective undertaking.

Subsequently, the FTA has determined that the Permanent WTC PATH Terminal would have an adverse effect on the National Register-eligible WTC site and the National and State Register-eligible Hudson River Bulkhead. The FTA has also determined that the Permanent WTC PATH Terminal may have adverse effects to off-site historic resources during its construction (see Chapter 6, "Cultural Resources"). As such, PANYNJ and FTA prepared a draft Permanent WTC

PATH Terminal Finding of Effects pursuant to Section 106 of the National Historic Preservation Act, which was published as part of the DEIS. Consulting parties and the general public had the opportunity to comment on this draft Finding of Effects concurrent with the public comment period for this DEIS. FTA and PANYNJ hosted two Section 106 consulting parties meetings, one on June 14, 2004, and one on July 20, 2004. FTA and PANYNJ provided information at these meetings to further clarify the project's effects on historic resources. The consulting parties commented on the Finding of Effects and provided discussion on measures to minimize or mitigate these effects.

Following the close of the public comment period on the DEIS, FTA and PANYNJ continued coordination with the Advisory Council on Historic Preservation (ACHP), SHPO, and the other Section 106 consulting parties to develop measures to avoid, minimize, or mitigate adverse effects on the resources identified in the Finding of Effects. One consulting party meeting was held on August 19, 2004, one on November 4, 2004, and one on November 15, 2004 to solicit comments on the draft Memorandum of Agreement (MOA). Another draft version of the MOA was distributed to the consulting parties on December 16, 2004, and the consulting parties were invited to comment in writing.

The consulting parties provided input on the Draft MOA both at the meetings and in writing. The full transcripts of the meetings and the written comment letters appear in Appendix H of this FEIS. The following is a summary of the major issues raised by the consulting parties and how they are addressed in the executed MOA.

- ***Perimeter Column Remnants Outlining North Tower and South Tower Footprints and the Tower Footprint Areas:*** The treatment and accessibility of the perimeter column remnants and footprint areas in the context of the Permanent WTC PATH Terminal was raised at each of the meetings. In response, the MOA contains a set of stipulations regarding FTA and PANYNJ's commitment that, to the maximum extent feasible given project implementation requirements, the design of the Terminal will preserve in place 84 column base remnants in the North Tower and 39 column base remnants in the South Tower at the existing floor at elevation 242 (58' below Sea Level) that outline the footprints of the former Twin Towers at the WTC site and are not located in the PATH right-of-way. The MOA also sets forth the total, not-to-exceed, extent of each of the tower footprints that will be permanently occupied by any portion of the project, and specifies that the east-west pedestrian corridor will be constructed outside the North Tower footprint. The tower perimeter column bases that would remain in place but may be covered by the platform will have symbolic representation, through architectural treatments, of column remnants that may be obscured or permanently removed by the Terminal's platforms.

- ***Cumulative Effects:*** Consulting parties expressed concern about the cumulative effects of multiple undertakings in this area of Lower Manhattan on the WTC site and on other historic properties in the vicinity. Initial drafts of the MOA, as well as the DEIS and FEIS, specified that Construction Protection Plans (CPPs) would be prepared in advance of construction to ensure that buildings adjacent to areas of construction for the Permanent WTC PATH Terminal would not be inadvertently harmed by a variety of factors, including ground-borne vibration. The final MOA takes into account the need to coordinate development and implementation of the CPPs with LMDC, MTA/NYCT and NYSDOT. It also specifically provides for development and implementation of a plan for protection of historic elements of the WTC site during construction activities within the Site, including construction associated with the WTC Memorial and Redevelopment Plan and, as necessary, with the Fulton Street

Transit Center and Route 9A. The MOA also sets forth a detailed process for PANYNJ to address cumulative effects on the WTC site during design, and through the first six months of the Terminal's operation.

- ***WTC Site Artifacts:*** A number of consulting parties were concerned about "off-site" artifacts from the WTC site, many of which are in the interim care and custody of PANYNJ at Hangar 17 at JFK International Airport. The inventory and treatment of these off-site artifacts is not a part of the Permanent WTC PATH Terminal, and their possible use in the WTC Memorial will be coordinated by LMDC. However, the MOA provides a process to be followed in the event that elements now on the WTC site must be removed during construction of the Permanent WTC PATH Terminal.
- ***E-Train Subway Entrance:*** Responding to a number of comments regarding the E-train subway entrance, the MOA specifies that the remains of the pre-September 11, 2001 entrance to the E subway line from the WTC site will be incorporated, to the greatest extent possible consistent with current building codes and Americans with Disabilities Act requirements, into the new pedestrian connection between the Terminal and the subway.
- ***Recordation of the WTC site:*** Consulting parties were very interested in a comprehensive documentation of current conditions on the WTC site prior to construction, As such, recordation of the WTC site is a stipulation of the Permanent WTC PATH Terminal MOA.
- ***Continued Participation of Consulting Parties:*** Consulting parties raised concerns regarding their continued involvement following the execution of the MOA. Consistent with the regulations implementing Section 106 of NHPA, the MOA explicitly provides for continued participation of consulting parties throughout the design process and treatment plans development following the execution of the MOA.

The MOA among the FTA, ACHP, SHPO, PANYNJ, and concurring consulting parties was executed in April 2005. Chapter 6, "Cultural Resources" of this FEIS summarizes the measures specified in the MOA, which appears in full in Appendix B. A total of 69 organizations have participated in this process as consulting parties. The "List of Agencies and Organizations" section of this FEIS identifies the specific groups and individuals that have been consulting parties for this project.

D. ENVIRONMENTAL AND REGULATORY AGENCIES

During project scoping, preparation of the environmental documentation, and the public review process, PANYNJ has regularly coordinated with the relevant environmental and regulatory agencies with jurisdiction over issues of concern for the project. Further, as mentioned earlier, representatives of these and other federal, state, and local agencies are members of the project's TAC. Agencies with which consultation has occurred include:

- U.S. Environmental Protection Agency—Coordination related to EIS analyses.
- U.S. Department of Interior, U.S. Fish and Wildlife Service—Analysis of natural resources.
- U.S. Department of Transportation, Federal Railroad Administration (FRA)—As a commuter rail system, PATH operates according to policies and procedures set forth by the FRA.
- U.S. Department of Commerce, National Marine Fisheries Service (NMFS)—Analysis of essential fish habitats.

- U.S. Department of Interior—Review of potential effects on historic resources/and parklands under Section 4(f) of the U.S. Department of Transportation Act.
- Federal Interagency Review Team for Lower Manhattan Recovery Projects—Coordinated Assessment of Lower Manhattan Recovery Projects.
- Advisory Council on Historic Preservation—Review of effects on historic and archaeological resources.
- State Historic Preservation Office (SHPO) at the New York State Office of Parks, Recreation and Historic Preservation—Review of effects on historic and archaeological resources and agreements under Section 106 of the National Historic Preservation Act.
- New York State Department of State (NYSDOS)—Consistency with New York State's Coastal Management Program.
- New York State Department of Environmental Conservation (NYSDEC)—Issues related to hazardous materials, air quality, and natural resources.
- New York City and New York State Departments of Transportation (NYCDOT, NYSDOT)—Coordination related to potential construction activities. This includes detailed Maintenance and Protection of Traffic (MPT) plans that would be developed and provided to NYSDOT and NYCDOT for review and approval to ensure safe, efficient, and timely construction.
- New York City Landmarks Preservation Commission (LPC)—Review of effects on historic and archaeological resources.
- New York City Department of City Planning (NYCDCP, including in its role as administrator of the Coastal Management Program with the NYSDOS)—Review of zoning issues and consistency with New York State's Coastal Management Program and New York City's Local Waterfront Revitalization Program.

Descriptions of the relevant outreach and coordination are provided in the technical chapters of this FEIS. Copies of correspondence are included in the respective technical appendices that accompany those chapters.

E. LAWS, PERMITS, AND REGULATORY REQUIREMENTS

Numerous environmental and regulatory approvals will be required to construct the Permanent WTC PATH Terminal. A preliminary list of these permits and requirements is provided below. This list focuses on federal and state requirements, since New York State's Public Authorities Law Section 1266(8) exempts PANYNJ from local permit requirements. In addition to these items, the project must also comply with laws and policies regulating worker and public safety, and the project may require city franchises.

FEDERAL

- National Environmental Policy Act (NEPA) (42 USC §§4321 et seq.; 40 CFR Parts 1500-1508; 23 CFR Part 771; 49 CFR 622). NEPA requires federal agencies to assess the environmental impacts of major federal actions that may affect the environment before taking such an action through an environmental assessment or EIS unless the action is excluded or

exempt from NEPA. FTA is the lead federal agency for the NEPA review for the Permanent WTC PATH Terminal.

- Coastal Zone Management Act (16 USC §§1451 et seq.; 15 CFR Part 930; NY Executive Law Art. 42; 19 NYCRR Part 600). Projects affecting New York's coastal zone must be consistent with the Coastal Zone Management Act, through the New York State Department of State's Coastal Management Program and New York City's approved Local Waterfront Revitalization Plan. The New York State Department of State, in consultation with the New York City Department of City Planning, makes a determination of the project's consistency with the Coastal Zone Management Act.
- National Historic Preservation Act (16 USC §470A; 36 CFR Part 800). Projects potentially affecting historic and archaeological resources must comply with the National Historic Preservation Act Section 106 review process. FTA is responsible for carrying out the Section 106 review for the Permanent WTC PATH Terminal.
- Department of Transportation Act Section 4(f) (49 USC §303; 23 CFR 771.135). Section 4(f) prohibits the Secretary of Transportation from approving any program or project that uses any publicly owned land from a public park, recreation area, wildlife and waterfowl refuge, or historic site of national, state, or local significance unless there is no feasible and prudent alternative to the use of such land, and unless the program includes all possible planning to minimize harm to the site or resource. FTA will make the determination to reflect a Section 4(f) finding.
- Environmental Justice (Executive Order 12898 of 1994, 59 CFR 7629 (Feb. 16, 1994); 1997 USDOT "Order to Address Environmental Justice in Minority Populations and Low-Income Populations," 62 CFR 18377 (April 15, 1997)). These Orders require that impacts and benefits from a federal transportation project are equitably distributed among all population groups and that minority or low-income areas are not overburdened with the adverse aspects of proposed project alternatives. FTA is responsible for complying with this Executive Order.
- Endangered Species Act (16 USC §§1531-1544; 50 CFR Part 402). The act requires FTA to consult with the U.S. Fish and Wildlife Service for projects that may jeopardize threatened or endangered species, or destroy or adversely modify their critical habitat.
- Floodplains (Executive Order 11988 of 1977; USDOT Order 5650-2, "Floodplain Management and Protection," April 23, 1979). Federal and state agencies must regulate and limit the location of a project in a floodplain to avoid any adverse impacts associated with the occupancy and modification of floodplains. FTA will make the determination.
- Wetlands (Executive Order 11990 of 1977; USDOT Order 5660.1A, "Preservation of the Nation's Wetlands", August 24, 1978). An order for federal and state agencies to avoid the adverse impacts associated with the destruction or modification of wetlands. USDOT agencies are required to make a formal wetland finding for major projects.
- Clean Air Act and state air permits (42 USC §7506(c); 40 CFR Part 93; ECL Article 19; 6 NYCRR Parts 201). New transportation projects must conform to the applicable state implementation plan. However, as a result of the terrorist attacks of September 11, 2001, and the loss of New York Metropolitan Transportation Council (NYMTC's) files containing regional transportation and air quality data, combined with the damage incurred to the downtown mass transit system, the conformity requirements for the NYMA have been temporarily waived until September 30, 2005, pursuant to Public Law 107–230; Stat. 1469,

enacted October 1, 2002. As part of the waiver process, project sponsors are to consult with the Interagency Consultation Group (ICG) to determine if the project would be considered regionally significant and if additional data is required during the waiver period.

- Resource Conservation and Recovery Act (40 CFR Parts 260-281). Compliance is required with this Act, which regulates hazardous and solid waste activities and underground storage tanks, which may be required during project construction and operation. EPA delegates compliance to NYSDEC.
- Environmental Stewardship and Transportation Infrastructure Project Reviews (Executive Order 13274 of 2002). The Order requires federal agencies to take appropriate actions to promote environmental stewardship in the Nation's transportation system and expedite environmental reviews of high-priority transportation projects. USDOT is responsible for monitoring and reviewing the priority of transportation projects.

STATE

- State Pollutant Discharge Elimination System (SPDES) (ECL §17-0801 et seq.; 6 NYCRR Part 751). A SPDES permit is necessary for all industrial activity related storm water discharges, construction activity related water and storm water discharges, and other discharges into the waters of New York State. NYSDEC will issue SPDES permits for the project.
- Beneficial Determination (6 NYCRR Part 360) PANYNJ will apply to NYSDEC for a Beneficial Use Determination (BUD) for spoils material. Materials that will be beneficially reused and that receive a BUD designation are not under the jurisdiction of Part 360 Solid Waste Management facilities regulations.

F. FTA AND PANYNJ CONTACTS

For further information regarding this document, please contact:

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Port Authority of New York and New Jersey
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Chapter 19: Public Comments on the DEIS and Responses

A. INTRODUCTION

This chapter summarizes and responds to all substantive comments on the Draft Environmental Impact Statement (DEIS). The public comment period for the DEIS began on June 4, 2004 with the publication of a Notice of Availability in the Federal Register. The U.S. Department of Transportation, Federal Transit Administration (FTA) and the Port Authority of New York and New Jersey (PANYNJ) held public hearings on the DEIS on June 22, 2004 in Jersey City, New Jersey and on June 23, 2004 in New York City, New York. The public comment period closed on July 21, 2004 although comments received through the publication of this Final EIS (FEIS) have been incorporated herewith.

Hard copies and/or CD-ROM copies of the DEIS were circulated to involved and interested agencies, community and civic groups, elected officials, local property owners and residents, and other interested parties. In addition, more than 400 letters were mailed to advertise the availability of the DEIS. The DEIS was posted to PANYNJ's website and copies were made available at a total of seven (7) libraries in Manhattan and New Jersey.

A flyer and newsletter advertising the public hearings was sent to the 800 persons on the project's mailing list. The public hearings were also advertised in nine (9) local newspapers including *The New York Times, The Battery Park City Broadsheet, El Nuevo Hudson,* and *The Star Ledger* beginning on June 2, 2004. The PANYNJ and its consultants conducted a mobile information center at the temporary WTC PATH station to distribute over 7,000 flyers advertising the public hearings, and PANYNJ posted notices on PATHVision and in PATH stations.

This chapter identifies the organizations and individuals who commented on the DEIS, then summarizes and responds to their comments. The comments have been organized according to the pertinent subject area with the DEIS. Where comments did not specifically pertain to the scope of the Permanent WTC PATH Terminal, they have been grouped as "Other." All commenters are noted but individual comments have been consolidated where appropriate. The transcripts of the public hearing and all written comments have been included in Appendix H of this document. Where revisions to this document have been made to address specific public comments as well as new or refined information about the project, text has been double-underlined in this Final Environmental Impact Statement (FEIS).

B. LIST OF COMMENTERS

A total of 41 parties commented on the DEIS. Fifteen parties spoke at the public hearings for the DEIS. The remaining comments were mailed, e-mailed, or faxed to PANYNJ during the public comment period. The following is a list of the commenters, their affiliation, and the date and method in which their comments were received.

- Adler, Steve. Speaker at public hearing dated June 23, 2004.

- Anonymous 1. Facsimile dated June 16, 2004.
- Ayer, Sarah M, AT&T. Letter dated July 21, 2004.
- Bachmore, John, Verizon Communications, Inc. Letter dated July 21, 2004.
- Barzilai, Tal, E-mail dated July 21, 2004.
- Blackman, Laura, Hudson River Park Trust. E-mail dated July 8, 2004.
- Bowen, Douglas John. Speaker at public hearing dated June 22, 2004.
- Butziger, Alexander. E-mail dated July 21, 2004.
- Carey, Timothy S., Battery Park City Authority. Letter dated July 14, 2004.
- Coangelo, Kelly. Speaker at public hearing dated June 23, 2004.
- Epstein, Louis, The World Trade Center Restoration Movement. Speaker at public hearing dated June 23, 2004 and letter dated July 21, 2004.
- Gardner, Anthony, Coalition of 9/11 Families. Letter dated July 27, 2004. (Comments are herein noted as Gardner.)
- Gardner, Anthony, Coalition of 9/11 Families; Fetchel, Mary, Voice of September 11; Sally Regenhord, Sally, Skyscraper Safety Campaign. Letter dated July 16, 2004. (Comments are herein noted as Gardner et al.)
- Gaull, Marilyn. E-mail dated July 6, 2004.
- Goetz, Bernard. Speaker at public hearing dated June 23, 2004; written comments dated June 23, 2004.
- Gorsky, Steven, Barclay's. Written comments dated June 16, 2004.
- Haikalis, George, Regional Rail Working Group. Speaker at public hearing dated June 23, 2004; written comments dated June 23, 2004; e-mail comments dated August 4, 2004.
- Hargrove, Robert W., U.S. Environmental Protection Agency. Letter dated July 21, 2004.
- Hensley, Jen, The Alliance for Downtown New York, Inc. Speaker at public hearing dated June 23, 2004; written comments dated June 23, 2004.
- Hemric, Benjamin. Letter dated July 20, 2004.
- Jackson, Don, Local Union #3 IBEW. Written comment sheet dated June 23, 2004.
- Kornfeld Jr., Robert, The Historic Districts Council. Written comments dated July 6, 2004.
- Lachman, Seymour P., New York State Senate District 23. Letter dated July 21, 2004.
- Lictro, John. D. E-mail dated July 20, 2004.
- Love, Bill, Coalition to Save West Street. Letter dated July 5, 2004.
- Lustbader, Ken, Lower Manhattan Emergency Preservation Fund. Speaker at public hearing dated June 23, 2004; written comments dated June 23, 2004.
- Mason, Alan, Local Union #3 IBEW. Speaker at public hearing dated June 23, 2004.

- McArdle, Frank, General Contractors Association of New York. Speaker at public hearing dated June 23, 2004.
- Morrow, Yvonne. Written comments submitted on July 21, 2004.
- O'Shea, James P. Facsimile dated June 28, 2004.
- Olsen, Olaf, Local 14, Union 1456. Speaker at public hearing dated June 23, 2004.
- Orkin, Jenna. Speaker at public hearing dated June 23, 2004.
- Ormsby, Chris, Local Union #3 IBEW. Speaker at public hearing dated June 23, 2004.
- Papp Jr., Albert, New Jersey Association of Railroad Passengers. Speaker at public hearing dated June 23, 2004; e-mail comments dated August 4, 2004.
- Pasternack, Scott. E-mail dated June 21, 2004.
- Sanchis III, Frank E., Municipal Art Society; Breen, Peg, New York Landmarks Conservancy; Burnham, Bonnie, World Monument Fund; Merritt, Elizabeth, National Trust for Historic Preservation; Heyl, Scott, Preservation League of New York State. Letter dated July 8, 2004. ((Comments are herein noted as Sanchis III et al 1.)
- Sanchis III, Frank E., Municipal Art Society; Fenollosa, Marilyn, National Trust for Historic Preservation; Breen, Peg, New York Landmarks Conservancy; Burnham, Bonnie, World Monument Fund; Merritt, Elizabeth, National Trust for Historic Preservation; Heyl, Scott, Preservation League of New York State. Letter dated August 2, 2004. ((Comments are herein noted as Sanchis III et al 2.)
- Scian, Paul. E-mail dated June 21, 2004.
- Stilwell, David A., U.S. Department of the Interior, Fish and Wildlife Service. Letter dated June 15, 2004.
- Sulphin, Amanda, New York City Landmarks Preservation Commission. Letter dated June 17, 2004.
- Taylor, Willie R., U.S. Department of the Interior. Letter dated July 30, 2004.
- Todorovich, Petra, Regional Plan Association. Speaker at public hearing dated June 23, 2004.
- Yaro, Robert D., Regional Plan Association. Letter dated July 21, 2004.

C. COMMENTS AND RESPONSES

PURPOSE AND NEED

Comment 1: The World Trade Center Transportation Hub will restore long-term access to Lower Manhattan and connectivity to the New York City subway system, contributing to the revitalization and economic recovery of Lower Manhattan. The Santiago Calatrava design of the PATH Station could not be more fitting for the site of the former World Trade Center, a bird-like, fully functional structure with movable wings that look ready to soar. The Permanent WTC

PATH Terminal will be a grand and proper entrance to Lower Manhattan. It will create countless temporary construction jobs and countless permanent jobs, and its timely completion will demonstrate America's strength in the wake of tragedy. (Olsen, Todorovich, Ormsby, Mason, Hensley, Jackson, Carey)

Response: Comment noted.

PROJECT ALTERNATIVES

Comment 2: Since master plan seems to be in flux it may be prudent to wait upon finalization before building this hub.(O'Shea)

Response: As of September 15, 2003, the Lower Manhattan Development Corporation (LMDC), PANYNJ, and Studio Daniel Libeskind agreed to a plan for the programming of commercial, retail, cultural, and transportation spaces within the WTC site. As the site's owner, PANYNJ continues to be involved as plans move forward to ensure that the programming of uses on the WTC site can fully accommodate the spatial and infrastructure needs of the Permanent WTC PATH Terminal.

Comment 3: The Permanent WTC PATH Terminal needs at least two bathrooms for the convenience of the public. (Anonymous)

Response: The design of the Terminal's interior facilities will be closely coordinated with the amenities provided as part of the WTC retail complex. It is anticipated that adequate restroom facilities will be provided to accommodate both transit commuters and shoppers who visit the WTC Transportation Hub and its adjoining retail stores.

Comment 4: Drawings of the Permanent WTC PATH Terminal do not show integration of the existing subways into a regional subsurface transportation hub. Is the future integration of the various subway stations and PATH station with subsurface people movers no longer planned? If so, it would be a tremendous loss to the rebirth and economic vitality of both downtown and NYC as a whole. (Scian)

Response: Figures 2-4 and 2-5 show the all-weather connections between the Permanent WTC PATH Terminal and the Dey Street Concourse of MTA/NYCT's Fulton Street Transit Center (2, 3, 4, 5, A, C, E, J, M, and Z trains); MTA/NYCT's Cortlandt Street (R and W) station; MTA/NYCT's Cortlandt Street (1 and 9) station; and MTA/NYCT's World Trade Center (E) station. The Terminal also provides a connection to the trans-Hudson ferry terminal at Battery Park City. A multi-agency feasibility study completed in May 2004 identified two alignments for a possible Jamaica-JFK-Lower Manhattan transit route. The terminals of these proposed alignments were proximate to the Permanent WTC PATH Terminal. However, future planning and design efforts will refine these initial

concepts and could result in a new terminal location. It is premature to make specific design commitments for the integration of the Permanent WTC PATH Terminal and the Jamaica-JFK-Lower Manhattan Terminal; however, PANYNJ will coordinate with the other sponsors of the Jamaica-JFK-Lower Manhattan project as its future planning and design efforts move forward. Overall, the PATH Terminal will improve connectivity and wayfinding for the various transit services in the vicinity of the WTC site and Lower Manhattan in general.

Comment 5: It is imperative that the new station avoid hidden spaces, narrow corridors, steep stairwells, low ceilings and poor ventilation, all mistakes of the pre-September 11, 2001 PATH Terminal—the past station that we now have an opportunity to correct. (Todorovich)

Response: The preliminary design of the Preferred Alternative calls for the use of natural light on all levels, for the use of modern heating, ventilation, and air conditioning systems, and for the creation of well lit, visually-appealing pedestrian corridors that provide for safe and convenient circulation throughout the complex.

Comment 6: The design is too costly at $2 Billion. (Butziger; Epstein; O'Shea; Barzilai)

Response: In addition to the elements of the Permanent WTC PATH Terminal, such as tracks, platforms, mezzanine, concourses, and the Terminal Hall, the Preferred Alternative includes site preparation and repair work that is needed to support the WTC site's overall redevelopment. This includes repairs to portions of the WTC bathtub walls and portions of the demolition within the eastern portion of the WTC site. FTA and PANYNJ may fund these elements as part of the Permanent WTC PATH Terminal project.

Comment 7: The Libeskind plan will make the station nearly impossible to use. (Barzilai)

Response: FTA, PANYNJ, MTA, and the project's design team have been coordinating to develop a Terminal plan that will provide for easy navigation by its users. This plan has been closely coordinated with master planning for the WTC site and will result in the creation of an east-west concourse between the World Financial Center and the Dey Street concourse of the Fulton Street Transit Center and a north-south concourse between the World Trade Center (E) subway station and the southeast quadrant of the WTC site. The east-west and north-south concourses will cross within the transit hall. The concourses will have visual access to the outdoors to help guide pedestrians as they travel through the complex, and wayfinding signage will be provided throughout the complex.

Although being planned separately, the Permanent WTC PATH Terminal elements have been and will continue to be well coordinated with the WTC

Memorial and Redevelopment Plan to ensure easy access to the memorial, cultural centers, offices buildings, and retail that will be constructed on the WTC site. The concourses of the Terminal will provide sub-grade access to most of the uses planned for the site.

In addition, elements of the Permanent WTC PATH Terminal and the WTC Memorial and Redevelopment Plan will provide superior above grade access to PATH as compared to the pre-September 11, 2001 condition. The newly constructed transit hall in combination with the newly constructed Fulton and Greenwich Streets through the WTC site will provide much better visual and physical access to PATH and MTA/NYCT subway stations than the plaza level of the pre-September 11, 2001 WTC complex.

Comment 8: A location to the east of the planned Terminal in the original location of the Hudson Terminal would have greater connectivity to financial district, Fulton Street Transit Center, and transfer point to N and R subway line. (Epstein, O'Shea)

Response: As described in Chapter 2, "Project Alternatives," of the DEIS, the reconstruction of a Terminal immediately west of Church Street would be physically closer to MTA/NYCT"s Cortland Street (R and W) station and the Financial District. However, given the depth of the PATH platform level, a terminal at this location would require a less favorable pattern of vertical circulation as compared to the Preferred Alternative. Under the Preferred Alternative, patrons ascend toward street-level in their direction of travel. Thus, although the platforms are physically further from the Corlandt Street subway station and the Financial District, the ascension from platform level will be similar.

Comment 9: The Hudson River Park Trust requests to be included in any discussions involving the exact placement/location of pedestrian bridges, escalators and/or staircases adjacent to the Hudson River Park, which includes the bikeway west of Route 9A. (Blackman)

Response: The pedestrian bridge over Route 9A was studied as an option to a subgrade concourse. However, subsequent to the publication of the DEIS, PANYNJ has selected the sub-grade concourse as a component of the Preferred Alternative. However, PANYNJ will coordinate the location of the future entrance to the concourse with affected property owners including Brookfield Properties, the Battery Park City Authority, Hudson River Park Trust, and the New York State Department of Transportation (NYSDOT).

Comment 10: The success of Lower Manhattan's revitalization will depend greatly on the quality of the pedestrian experience at street level; therefore, PANYNJ should

pay great attention to the design of the public places surrounding the PATH pavilion as well as the public spaces throughout the WTC site. (Todorovich)

Response: PANYNJ and LMDC have been coordinating to develop design guidelines for the buildings and open space planned for the WTC site, including the Permanent WTC PATH Terminal. The approved Master Plan for the WTC site includes more than 7 acres of new open space as well as a streetscape plan for the extension of Fulton and Greenwich Streets. The proposed plaza adjacent to the Preferred Alternative's transit hall will comply with the design standards set forth for the open space contained in the approved Master Plan.

Comment 11: The Permanent WTC PATH Terminal is supposed to be a full-service hub, but on the proposed site plan both Church and Fulton streets are narrow without room for bus parking. Site plan changes should be implemented that widen Fulton and Church streets to provide adequate room for bus parking. (Goetz)

Response: The dimension of Church Street is not being changed as part of the World Trade Center Memorial and Redevelopment Plan or Permanent WTC PATH Terminal projects. Although not a part of the Permanent WTC PATH Terminal project, Fulton Street is being proposed as a new 30-foot, two-way roadway that adheres to the street grid east of Church Street. It is anticipated that buses will continue to operate along Church Street; however, at this time, a formal plan for routes along Fulton Street has not been decided.

Comment 12: The Permanent WTC PATH Terminal would be more environmentally appropriate if it did not seek to accommodate the Daniel Libeskind site plan. A new transportation system should be with the aim of furthering the "devehicularization" of Lower Manhattan, not opening more streets. Scrapping the official plan in favor of one centered on fewer taller buildings which would have their construction impact more localized and more in the spirit of what was destroyed in 2001 would be more appropriate. A more understated and physically responsible terminal would free valuable public resources for better use of the site. (Butziger; Epstein; Lictro)

Response: The scope of this environmental review process does not include the programming of streets and buildings within the WTC site. The plan for the Permanent WTC PATH Terminal incorporates pedestrian connections that will not only serve PATH users but will also provide access to, from, and within the WTC site for residents, workers, and visitors. The creation of a grand transportation hall will provide for a highly visible gateway to a revitalized Lower Manhattan.

Comment 13: The alternative with the Liberty Plaza connection is desirable. Prior to September 11, 2001, more than 40 percent of PATH users exited the WTC site

at the southeast corner, resulting in traffic and pedestrian congestion during rush hours. (Coangelo; Morrow)

Response: Although it is projected that 40 percent of the future PATH users will exit the Terminal in the direction of the Financial District, the Terminal with a Liberty Plaza Connection has not been selected as the Preferred Alternative for the Permanent WTC PATH Terminal. During and after the public comment period on the DEIS, FTA and PANYNJ considered local government and community concerns that the Liberty Plaza Connection would detract from the street-life and retail vitality of Lower Manhattan. Furthermore, the Terminal with a Liberty Plaza Connection was anticipated to result in higher or more intense air quality, noise, and vibration impacts during the construction period than the Preferred Alternative. Although additional pedestrian mitigation will be required with the Preferred Alternative, it has been determined to have greater short-term benefits to the community than the Terminal with a Liberty Plaza Connection Alternative.

Comment 14: While the EIS has demonstrated poor pedestrian levels of service at Church and Liberty streets without the Liberty Plaza Connection, the proposed mitigation measures of widening sidewalks and crosswalks are, in fact, extremely desirable. The Liberty Plaza connection if built would undermine the viability of street level retail. The Liberty Plaza connection would also require the appropriation of public open space in Liberty Plaza and would cost $81 million, which is not justified by its relatively slim benefit. (Todorovich)

Response: FTA and PANYNJ propose a Terminal without a Liberty Plaza Connection Alternative for the Permanent WTC PATH Terminal based on comments received during the public review of the DEIS. The selection of this alternative considered all of the issues raised by the above comment.

Comment 15: The No Build Alternative does not restore the capacity that existed previously nor does it enhance service to New Jersey. (McArdle)

Response: Comment noted.

Comment 16: The description of the No Action Alternative states that the temporary station would remain in operation until 1) its operation would be precluded by elements of the WTC Memorial and Redevelopment Plan, 2) it cannot safely accommodate passenger demand, or 3) its exceed its useful life. Since the LMDC has not yet completed detailed design, FTA should coordinate to ensure that their design leaves the option for future improvements to the temporary facility as to not limit alternatives for the Permanent WTC PATH Terminal. (Gardner)

Response: The No Action Alternative was prepared assuming the implementation of the September 15, 2003 master plan for the WTC site. The master plan has programmed spaces for the site, including the memorial and a PATH Terminal. As an independent action, this Environmental Impact Statement must consider the other proposed uses of the WTC site as part of the "Future Common to All Alternatives" for a Permanent WTC PATH Terminal. As such, the memorial is considered as part of the background condition in the location and configuration proposed in the September 15, 2003 Master Plan. The current, temporary PATH facility was constructed prior to the implementation of the master plan, and it cannot accommodate construction above its mezzanine level. Furthermore, the current alignment and configuration of PATH tracks and other PATH infrastructure within the west bathtub limits the placement of the memorial and memorial-related uses. Thus, certain elements of the temporary station must be removed or altered to successfully accommodate all of the uses intended for the WTC site as part of its approved Master Plan.

Comment 17: The EIS should reconsider a proposal to construct a physical track connection between PATH and the New York City Transit (MTA/NYCT) No. 6 Lexington Avenue subway line. This would require that PANYNJ and MTA/NYCT build a track, 3,000 feet in length, between the now refurbished PATH line and the No. 6 local subway in concert with the rebuilding of the World Trade Center site. Despite the comments expressed in the DEIS and correspondence with PANYNJ, we believe that construction of either a track connection or an across the platform transfer be named a viable option to enhance Trans-Hudson mobility and provide new transportation pathways to the residents of both New Jersey and New York. (Papp, Jr., Haikalis, Bowen)

Response: As described in Chapter 2, "Project Alternatives," and in Appendix H-1, "Response to Comments on the Draft Scope," the proposed direct track connection between PATH and MTA/NYCT's 6 subway line (Lexington Avenue Local) was eliminated from further consideration following scoping for the Permanent WTC PATH Terminal. The decision to eliminate this alternative was based on its cost, its engineering feasibility, and on its potential construction-period and long-term effects to the environment. Furthermore, a planned connection between PATH and the Dey Street concourse of the Fulton Street Transit Center will allow for a transfer between PATH and MTA/NYCT's 4 and 5 subway lines, which provide express service along Lexington Avenue to Manhattan's east side, and the recently approved Second Avenue Subway would also link between Lower Manhattan and the Upper East Side.

Comment 18: FTA, PANYNJ, and the other Lower Manhattan project sponsors should establish a coordinated planning approach to the World Trade Center Memorial

and Redevelopment Plan, the Route 9A Project, the Permanent WTC PATH Terminal, and the Fulton Street Transit Center. (Ayer; Carey)

Response: While planning for their independent projects, PANYNJ, MTA, LMDC, and NYSDOT have been continuously coordinating project designs, construction, and environmental review. For the Permanent WTC PATH Terminal, this coordination has led to modifications in the design and location of the Terminal's ventilation structures; accommodations within the concourse level to address modifications in the WTC Master Plan; a coordinated approach to design guidelines for the Terminal and the FSTC's Dey Street Concourse; a coordinated Determination of National-Register eligibility for the WTC site; and a coordinated set of Environmental Performance Commitments and refined mitigation measures. This coordinated planning will continue throughout design and construction of the Preferred Alternative via mediums such as the Lower Manhattan Construction Coordination Group and the Lower Manhattan Construction Command Center.

Comment 19: The DEIS does not seem to explain why a more permanent version of the current temporary terminal, one that would be in essence an upgrade of the pre-September 11, 2001 terminal concept but would fit into the present day plans for the site, was not analyzed for its environmental impacts and used as a point of comparison with the proposed action. (Hemric, Gardner, Kornfeld)

Response: Chapter 1, "Purpose and Need," describes various deficiencies of the temporary WTC PATH station over the long-term. The Permanent WTC PATH Terminal will reuse elements of the temporary station, where possible. However, the station would not allow for development above, as is planned for the WTC Memorial and Redevelopment Plan nor would it provide for sufficient access and egress points to meet growth. Furthermore, the temporary station would not allow for 10-car service on PATH's Newark-WTC Line nor sufficient platform capacity as planned to meet ridership growth. Thus, an expanded facility is needed to ensure the long-term accessibility and viability of PATH service to Lower Manhattan.

Comment 20: The DEIS does not evaluate the many feasible and constructible design alternatives that would result in the avoidance or reduction of effects to historic properties. The evaluation of alternatives to avoid or minimize Project impacts to the E-train passageway is an excellent example of alternatives that should be considered in regard to other historically significant features on the WTC site, notably the tower footprints. (Gardner, Sanchis III et al 2)

Response: The EIS considers alternatives for a Permanent WTC PATH Terminal and their potential effects. Design modifications have been proposed as part of the project's Section 106 consultation process. These modifications have been

implemented through the Project's Memorandum of Agreement and have been incorporated into the Preferred Alternative presented in this FEIS.

Comment 21: The DEIS should have considered an alternative that would not include a fourth platform. The DEIS should examine the degree to which this relatively modest increase in peak hour ridership can be accommodated through improved signalization, use of 10-car PATH trains, lengthening of platforms beyond pre-September 11, 2001 lengths, widening of platforms beyond pre-September 11, 2001 widths, and an increase in the size, number, and capacity of vertical elements beyond pre September 11, 2001 levels. These measures could preclude the need for a fourth PATH platform, which would reduce the project's effects on the Tower footprints. (Gardner, Epstein, O'Shea)

Response: The Preferred Alternative is being planned to support the PATH's system-wide improvements, PATH's operating requirements, and future ridership demand. Each of these factors results in specific requirements for the design of the Terminal's platforms and tracks, and as such, it has been determined that a 5-track, 4-platform station is needed. This configuration was selected after a careful consideration of several track and platform layouts as detailed in Appendix C of this FEIS.

PATH will implement improvements to increase capacity on trains operating between Newark and the WTC, by increasing their length from 8 to 10 cars. Not only will this improvement require that the WTC Terminal support 10-car operations but a consequence will be that more people will use the WTC PATH Terminal's platforms during peak travel periods.

All new PATH cars will have 3-doors per side allowing PATH to retire the portions of its current fleet with 2-doors per side. Three-door cars will decrease the boarding/alighting times of trains by 50 percent, which will improve dwell times at intermediate stations along the PATH route and could reduce the overall run time of trains. However, the new cars are not expected to improve the platform clearance time for passengers since they will not directly affect platform area or the provision or operation of stairways and escalators.

While PATH currently maintains 3-minute headways on its Newark-WTC Line and 4-minute headways on its Hoboken-WTC Line during portions of the peak hour, Communication-Based Train Control (CBTC) will facilitate such headways over a longer period with greater reliability and less potential for delays. CBTC in conjunction with the 10-car train program will have the ability to increase the throughput of the PATH system, to meet or exceed ridership demand and provide a higher frequency of service at the WTC Terminal than before September 11, 2001. As such, platforms at the WTC Terminal will need to clear more swiftly in the future in order to maintain safe and efficient operations.

PATH must plan for failure management to maintain reliable, on-time peak period service. Because the WTC is a terminal station, trains dwell for short periods to maintain the operating schedule. Thus, to maintain the headway and allow for the arrival of a subsequent train, PATH requires two tracks for each the Hoboken-WTC and Newark-WTC Lines. In the event that a train becomes disabled, a fifth track is needed. The fifth track allows the disabled train to remain in the Terminal while the remaining four actives tracks can be used to continue service.

PATH has limited capacity for train storage at its Newark, Harrison, and Journal Square Yards. Therefore, PATH would use the WTC Terminal for the overnight storage of 6 Hoboken-WTC trains. Four tracks are required for this overnight storage and a 5th track is needed for revenue service on the Newark-WTC Line. The overnight storage of Hoboken-WTC trains at the WTC Terminal would allow for a more efficient ramp-up to AM peak period revenue service and decreases the potential for weather-related delays on the Hoboken-WTC Line.

A principal consideration for the planning of the Terminal is the ability of platforms to safely accommodate peak period ridership. Because PATH is primarily a commuter system, the platform design must accommodate both AM and PM peak patterns of travel.

In the AM peak hour, trains unload passengers to the platform who must then ascend to mezzanine level. For this condition, the principal design criterion is the targeted time period within which all passengers exiting a train alight from the platform. As stairways and escalators become congested, passengers queue at the foot before they can ascend. Therefore, to avoid a lengthening of this back-up, it is important that all passengers clear the platform before arrival of the next train. The Transit Capacity and Quality of Service Manual states that a platform (and vertical circulation) should be planned to ensure full clearance of the platform before the next train arrives. However given that passengers may not use or may not be able to use all available exits, a safety factor of 20 to 30 percent is applied. Thus, a platform should clear fully within 70 to 80 percent of the scheduled headway.

The proposed frequency of Newark-WTC Line service requires that its platform clear within 126 to 144 seconds. However, based on projected ridership, a single Newark-WTC platform would require 213 seconds to clear. Thus, two Newark-WTC Line platforms are needed to meet platform clearance guidelines. A single Hoboken-WTC platform is sufficient to meet platform clearance criteria.

For the PM peak period, the planning of the platforms must also consider failure management in the event of a missed headway and subsequent delay in service. Thus, the platform must provide for adequate room to queue passengers waiting for the next arriving train.

Given ridership levels in 2025 and level of service standards, a minimum 15,264 square feet of platform area would be required for the Newark-WTC service in the event of a missed headway while 10,385 square feet would be required for the Hoboken-WTC service. However, accounting for the unusable areas of the platform (e.g., spaces occupied by escalators and elevators and the safety buffer along the platform edge), the Terminal's platforms would each provide for an effective area of 10,416 square feet. Thus, a single platform would be adequate for the Hoboken-WTC Line but more than one platform would be needed for Newark-WTC Line.

In order to maintain temporary PATH service during construction of the Preferred Alternative, PANYNJ would not relocate the existing PATH tracks. As such, Platform A cannot be widened beyond its current configuration, which is not adequate for normal revenue service. Since three full-size platforms are needed for peak period service, the Preferred Alternative would include a total of 4 Platforms. The 5 tracks that are currently part of the temporary station would be retained in their current alignment, which is adequate to meet PATH's operating requirements.

Comment 22: PANYNJ should not exclude other alternatives such as platforming on a higher level or east of the slurry wall, based on a subjective judgment on cost, or because it would necessitate design modifications. (Kornfeld)

Response: Platforming at a higher level is not feasible within the WTC "Bathtub" since there would not be sufficient space between the projections of the Hudson River tunnels and the Terminal to achieve PATH's design guidelines for grade and curvature.

As described in Chapter 2, "Project Alternatives," PANYNJ explore four alternative locations for the Permanent WTC PATH Terminal: Location 1, WTC "Bathtub"; Location 2, Church Street; Location 3, Broadway-Nassau; and, Location 4, Vesey Street. Locations 3 and 4 were determined to be flawed since they would fully disrupt temporary PATH service during construction. Furthermore, Location 3 would not meet the operational requirements for PATH. Locations 1 and 2 were evaluated more closely. Location 1 was considered advantageous for constructability, cost, and customer wayfinding, but it would result in a headhouse within the planned WTC Memorial zone. Location 2 would maximize train operations and would not require a headhouse within the Memorial zone, but it would have an inconvenient means of vertical circulation, would require the reprogramming of uses on the WTC site, and may have resulted in adverse contextual effects on the planned Memorial.

PANYNJ considered the advantages of Locations 1 and 2 and developed a "hybrid" alternative. The "hybrid" alternative combines the subgrade platform and mezzanine levels within the WTC bathtub with an above-grade headhouse east of MTA/NYCT's 1 and 9 subway line. It provides for the constructability,

cost, and wayfinding benefits of Location 1 without a headhouse in the Memorial zone. Because the platform and mezzanine levels would be located within the WTC bathtub, subgade levels east of MTA/NYCT's 1 and 9 line would be available for building services. This would eliminate the adverse contextual impacts to the Memorial zone that may have occurred with Location 2. PANYNJ advanced the "hybrid" alternative for detailed study in the Project's Draft and Final EIS.

Comment 23: PANYNJ should seriously consider a pedestrian bridge over West Street as an additional means to provide all-weather access between the World Financial Center and the Permanent WTC PATH Terminal. The bridge would supplement the proposed Route 9A connection. (Love)

Response: As described in Chapter 2, "Project Alternatives," a pedestrian bridge would not have the same level of customer convenience as a subgrade concourse since additional vertical moves would be required to travel between PATH and the WFC and Battery Park City. Furthermore, the subgrade concourse could fully accommodate the anticipated demand; thus, additional access across Route 9A is not considered necessary as part of the Preferred Alternative.

Comment 24: The DEIS discards Location 1, WTC "Bathtub", in favor of the Terminal with Liberty Plaza Connection ("Hybrid")Alternative despite the fact that the latter would be more expensive, require a longer construction duration, would have more below-grade infrastructure in the WTC bathtub, and would not allow for as much commercial development on the WTC site. The Location 1 alternative, which would not impinge upon the footprint of One World Trade Center is clearly "feasible" and should be considered as part of the DEIS. (Gardner)

Response: Location 1 would not meet the Purpose and Need of this project since 1) it would have 3 platforms and 5 tracks, which would not be adequate to serve future ridership on the PATH system and 2) its above-grade structures would be located west of Greenwich Street within the memorial zone, which is inconsistent with the WTC Memorial and Redevelopment Plan. As defined in Chapter 1, "Purpose and Need," the Preferred Alternative must meet the project's purpose and need. Specifically, Location 1 would not meet the following objectives:: Provide for additional capacity to support ridership growth; improve street-level visibility and access; construct a facility that is coordinated with the master plan for the WTC site; provide for connections to future WTC buildings and facilities, including the memorial; and coordinate PATH facilities with other sub-grade uses on the WTC site.

Comment 25: The encroachment of the upper level of the PATH station over the footprints and the potential of a support column within the footprints is not acceptable. (Kornfeld)

Response: As stated in the executed Memorandum of Agreement for the Permanent WTC PATH Terminal, the east-west pedestrian concourse to the World Financial Center would be designed and built in a manner that avoids the column remnants projecting above the concrete slab that outline the north perimeter of the North Tower. This corridor would be at least five (5) feet outside the North Tower footprint as measured from the center line of each projecting column base to the face of the nearest structural support wall.

The mezzanine level would be fully supported by the platform level below. As stated in the executed Memorandum of Agreement, the total extent of the North Tower footprint at this to be permanently occupied by any portion of the Project will be approximately 1,600 square feet and will not exceed 4 percent of the North Tower footprint area. The total extent of the South Tower footprint to be permanently occupied by the mezzanine will be approximately 21,615 square feet currently occupied by the WTC PATH facility, plus an additional 2,000 square feet required by the Project, and will not exceed 53 percent of the South Tower footprint area.

Up to a total of 5 column bases in the North Tower and up to a total of 3 column bases in the South Tower may be temporarily or permanently removed to construct PATH Platform D. Where Platform D would intersect the northeast corner of the North Tower footprint, the platform would be clear of vertical obstructions and architectural treatments would be used to symbolically represent the location of the footprint.

In addition, up to 4 column bases in the North Tower could be temporarily removed to install the foundation for the Terminal's support column. Those column bases that remain in situ undisturbed or are temporarily removed and returned to their original locations would be accessible following the completion of these foundations.

CONSTRUCTION METHODS AND MATERIALS

Comment 26: The construction of the Permanent WTC PATH Terminal should be coordinated by the forthcoming Lower Manhattan Construction Command Center. It is critical that issues such as worker transportation to and from the construction site, permitting, movement of materials and other logistical concerns be coordinated with the many other development projects happening in Lower Manhattan at the same time. (Hensley; Morrow)

Response: As part of the Lower Manhattan Construction Coordination Group, PANYNJ is working closely with the other Lower Manhattan Recovery Project sponsors to develop coordinated plans for individual project construction. The construction of the Permanent WTC PATH Terminal will be undertaken according to the coordinated efforts of the Lower Manhattan Construction Coordination Group and under the direction of a Lower Manhattan Construction Command Center.

(Refer to Chapter 3, "Construction Methods and Materials," for a description of the Lower Manhattan Construction Coordination Group and the Lower Manhattan Construction Command Center.)

Comment 27: Construction of the Permanent WTC PATH Terminal should occur with minimum disruption to existing PATH service, particularly during the weekday rush hours. (Hensley)

Response: PANYNJ has made provisions to allow for the uninterrupted operation of temporary PATH service during peak periods while the Permanent WTC PATH Terminal is under construction.

Comment 28: PANYNJ and the other Lower Manhattan project sponsors should work with the construction community to develop and implement noise plans and other protocols that will allow construction to move forward in an environmentally sound fashion. (McArdle)

Response: As part of the Lower Manhattan Construction Coordination Group, PANYNJ is and will continue to work closely with the other Lower Manhattan Recovery Project sponsors to develop coordinated noise monitoring and mitigation plans to alleviate potential impacts during the Preferred Alternative's construction.

To mitigate the Preferred Alternative's construction period noise impacts, PANYNJ would require contractors to use specific equipment during phases of construction to reduce noise levels below the FTA impact criteria. During the permanent track, platform, and mezzanine construction contractors would be required to use Impact wrenches with noise emission level of 82 dBA at 50 ft^2 and mufflers on pavement breaker cylinder. During the construction of the east-west concourse, contractors would be required to place drill inside acoustical enclosure. Although not required for the Preferred Alternative, PANYNJ is coordinating with the other Lower Manhattan Recovery Project sponsors to explore additional construction noise mitigation measures. These include:

- The use of acoustic barriers and walled enclosures around certain construction activities. Noise tents/enclosures could be used around workers using jackhammers. A temporary noise barrier of 20 feet in height could be installed along the fence line/property line of the Project Site to reduce noise levels. In addition, temporary barriers, such as wood panels on top of Jersey barriers could be positioned adjacent to and moved along slurry wall and other construction operations, etc.
- The placement of construction equipment in shielded locations, such as below grade in the Project Site, if possible.
- The installation of silencers on jackhammers, air compressors, generators, light plants and cranes to reduce noise levels at specific locations (e.g., adjacent to existing residential uses).

- The use of electrically operated equipment, rather than combustion equipment, wherever possible.
- The use of soil beds, timber planking and/or exterior rubber lining on truck body and aluminum carrying case to reduce rock impact noise during truck load/unloading operations.
- The use of drive-through street-level truck enclosures for truck loading and unloading.
- The use of sheds/enclosures at concrete pump sites during concrete truck unloading, and the placement of most loading/unloading inside the bathtub and away from street level noise receptors, if possible.
- The placement of most loading/unloading inside the bathtub and away from noise receptors located at street level.
- The designation of central areas for noisy activities, such as cutting steel or wood or use of noisy equipment such as impact wrenches. When feasible, use of pre-cut, pre-fabricated, or modular construction materials that minimize need for on-site fabrication or cutting methods.

Construction specifications will be developed for the project in coordination with the Lower Manhattan Construction Coordination Group and the Lower Manhattan Construction Command Center that will include the protocols required for site contractors. As per the Executive Order forming the Lower Manhattan Construction Command Center, this process will include consultation with and input from the construction community.

Comment 29: PANYNJ should strengthen the Environmental Performance Commitments to mitigate air pollution, noise and vibration during construction. (Todorovich)

Response: As described in Chapter 9, "Air Quality" and Chapter 10, "Noise and Vibration," PANYNJ has committed to additional measures beyond the Environmental Performance Commitments to avoid, minimize, or mitigate the potential construction-period impacts of the Preferred Alternative.

To reduce potential air quality emissions during construction: PANYNJ would implement mitigation as follows:

PANYNJ would implement the following mitigation measures to reduce project-generated emissions during the construction period. These measures include those previously identified as EPCs.

- Ultra Low Sulfur Diesel Fuel (ULSD): As described in the EPCs, PANYNJ would require that contractors use ULSD for all non-road vehicles that operate with diesel engines.
- Electrification: PANYNJ or its contractor would develop a plan, in consultation with Con Ed, as appropriate, to disperse grid power throughout the contraction zone for the Preferred Alternative. In its contract documents,

PANYNJ would require all contractors and subcontractors to use electrically powered equipment for air compressors, pumps, mixing, desanding and grout plants, welding machines, and any other diesel powered equipment that can be replaced with an electrically powered version. However, this does not apply to the east-west pedestrian concourse beneath Route 9A if the concourse is built by NYSDOT, since NYSDOT has not yet finalized what level of electrification would be possible for its projects. Given current conditions, it is expected that at lest 50 percent of the air compressors, pumps, mixing, desanding and grout plants, welding machines, and other diesel powered equipment that can be replaced with an electrically powered version would operate on electric power sources.

- Tailpipe Reduction Measures: In its contract documents, PANYNJ would require the use of Diesel Particle Filters (DPFs) or other measures with equivalent Particulate Matter (PM) removal efficiency for all nonroad diesel engines of 50 horsepower or greater wherever the implementation of such a device is feasible. However, there may be cases where DPFs would not be feasible for safety considerations, mechanical reasons, or where the technology would not function properly. In such cases, the constructor would submit a request for an exception for review and approval by PANYNJ prior to implementation, and in these cases, Diesel Oxidation Catalysts (DOCs) may be used. Only in cases where, for technical reasons, neither DPFs or DOCs can be used effectively, and where the operation cannot be performed by another engine or other means, would the use of diesel engines greater than 50 horsepower be allowed without tailpipe reduction measures, subject to the above-described approval process.

- Newer Engines: In its contract documents, PANYNJ would require the use of post-1995 fuel injection engines, which meet the Tier II engine emissions standards, as defined in Title 40, Part 89.112. Exceptions will be made only for specific engines that are not yet commercially available as Tier II, and where the task cannot be reasonably accomplished using alternative engines or means which do comply with these demands. In such cases, the contractor would submit a request for an exception for review and approval by PANYNJ prior to implementation.

- Diesel Emission Mitigation (DEM) Plan: PANYNJ would require contractors to prepare a DEM Plan that shall address the control of emissions from all engines and vehicles including those that are not equipped with emission control devices. As described in the EPCs, the DEM Plan would limit idling times on diesel powered engines to 3 minutes and would require that contractors locate diesel powered engines away from fresh air intakes.

- Dust Control Plan: As described in the EPCs, PANYNJ would require contractors to submit a Dust Control Plan. Among other things, the plan

would contain protocols and procedures for the spraying of dust piles, containment of fugitive dust, and appropriate adjustment measures to accommodate changes in meteorological conditions.

- Verification: The effectiveness of measures to reduce construction period emissions depends on compliance. To that end, verification procedures would be implemented through construction specifications and contract documents. PANYNJ would verify mitigation and would identify opportunities to expand its implementation as part of its ongoing oversight and auditing of the Project's construction. Furthermore, verification procedures would be implemented in accordance with decisions of the Lower Manhattan Construction Command Center, including procedures for reporting updates to the public.
- Other Emissions Reduction Technologies: PANYNJ is and will continue to investigate additional means (e.g., fuel emulsions) to reduce NOx (NO and NO2) emissions, but it is not yet known whether these measures would reduce the effectiveness of the above described mitigation. Therefore, specific means to further reduce NOx have not been identified in the mitigation plan for the Preferred Alternative at this time. If this investigation results in additional means to reduce NOx without jeopardizing the PM reducction measures and if other constraints such as technological availability are resolved, then PANYNJ would implement these additional mitigation techniques, as appropriate.

In addition to the noise mitigation measures identified in the above response to Comment 28, PANYNJ would require contractors to use specific equipment during phases of construction to reduce noise levels below the FTA impact criteria. During the permanent track, platform, and mezzanine construction contractors would be required to use Impact wrenches with noise emission level of 82 dBA at 50 ft^2 and mufflers on pavement breakers-+. During the construction of the east-west concourse, contractors would be required to place drill inside acoustical enclosure.

Per the stipulations of the executed Memorandum of Agreement for the Permanent WTC PATH Terminal, PANYNJ would prepare a Construction Protection Plan (CPP) for historic structures within 90 feet of the construction zone based on requirements in the "New York City Department of Buildings Technical Policy and Procedure Notice (PPN) #10/88" regarding procedures for the avoidance of damage to historic structures resulting from adjacent construction.

The CPP would describe in detail the construction procedures of the Preferred Alternative, as well as the construction procedures associated with other projects under construction in the vicinity of each of these historic properties. It would also provide for the inspecting and reporting of existing conditions at these properties, establish protection procedures, establish a monitoring program to

measure vertical and lateral movement and vibration, establish and monitor construction methods to limit vibration; and establish methods and materials to be used for any repairs. The plan shall also specify the implementation of special vibration protection measures to protect these historic properties from increased vibration levels associated with construction activities. The CPP would provide for a historical architect meeting the Secretary of Interior's Standards to supervise implementation of the CPP.

The CPP would empower the historical architect, in consultation with the Chief Engineer of PANYNJ to issue "stop work" orders to prevent any unanticipated damage to historic properties, and any recommencement of work shall only be permitted at such time that the Chief Engineer and historical architect have assurance that the appropriate modifications have been made to the construction technique to assure that no damage would occur to historic properties.

Comment 30: PANYNJ needs to ensure the implementation of the aggressive Environmental Performance Commitments established in the DEIS. (Carey)

Response: As described in Chapter 5, "Socioeconomic Conditions," Chapter 6, "Cultural Resources," Chapter 8, "Transportation," Chapter 9, "Air Quality," and Chapter 10, "Noise and Vibration," PANYNJ has committed to measures that would implement the EPCs. As appropriate, PANYNJ's implementation plans for the EPCs would be coordinated with the Lower Manhattan Construction Command Center.

Comment 31: As part its Environmental Performance Commitments, PANYNJ should include the Section 106 Consulting Parties in future discussions regarding potential impacts to historic resources. (Gardner)

Response: PANYNJ has committed to continued coordination with the Section 106 Consulting Parties per the stipulations of the executed MOA. The EPCs were intended primarily to protect access to cultural resources throughout the construction process. This will likely be coordinated through the LMCCC, which will provide for a public outreach officer to communicate with the local community and all other interested groups, including the Section 106 Consulting Parties.

LAND USE, NEIGHBORHOOD CHARACTER, AND PUBLIC POLICY

Comment 32: The DEIS should have examined how the occupation of a portion of the WTC site by the Terminal building limits the ability to develop the maximum commercial floor area on the WTC site. (Hemric)

Response: PANYNJ previously reviewed schemes for the development of a Permanent WTC PATH Terminal within the envelope of an office tower on the WTC site

or as part of a museum or cultural facility. However, consistent with the goals and objectives of this project, PANYNJ felt that the new terminal should have a visible, street-level presence to create a transportation gateway to Lower Manhattan. Thus, through a public planning process, PANYNJ and LMDC opted for a plan that would result in a separate PATH Terminal building and five office towers on the WTC site.

Comment 33: The DEIS did not examine how the Terminal building's lack of exterior street-level retail would negatively affect street life in the area (Hemric)

Response: Although the Terminal will have access to the street-level retail being planned as part of the WTC Memorial and Redevelopment Plan, street-level commercial space will not exist within the Terminal building itself. However, street-level retail will be located within the buildings immediately north and south of the Terminal. The area surrounding the Terminal building will be open space with amenities to serve the public. It is envisioned that the combination of street-level retail to the north and south of the Terminal and the plaza that will surround the Terminal building will create an active street life with functions that serve more than just retail.

Comment 34: The Permanent WTC PATH Terminal is primarily an underground infrastructure when complete and should not interfere with surface recreation such as park land, except at access or egress portals. For these locations, it would be appropriate to consider safety and resource loss mitigation during construction. (Taylor)

Response: The Preferred Alternative would not occupy public park land. The proposed headhouse adjacent to the Winter Garden would occupy private open space, and the location and construction of this headhouse is being coordinated with the property owner. The Project's Maintenance and Protection of Traffic (MPT) Plan will address pedestrian safety and access during the construction period.

Comment 35: The retail plan for the Terminal should complement the other retail components on the World Trade Center site and in the surrounding areas. Lower Manhattan should have a complete retail complex with shops and restaurants that serve the worker and residential populations Downtown, as well as commuters and the many visitors that will come to use the cultural and memorial spaces on the site and other attractions throughout the neighboring community. (Hensley)

Response: The Permanent WTC PATH Terminal, itself, will only include approximately 5,000 square feet of retail on its mezzanine level. This retail will cater to PATH users with services such as newsstands, sundries, and other convenience goods. The larger retail complex planned as part of the WTC Memorial and Redevelopment Plan will be closely coordinated with the Terminal's spaces to provide both above-grade and sub-grade access between the Terminal, its

concourses, office and cultural institutions on the WTC site, and the site's retail stores and restaurants.

SOCIOECONOMIC CONDITIONS

Comment 36: The DEIS should include an examination of "spontaneous", market-driven revitalization in Lower Manhattan and used that analysis to determine if an enlarged or enhanced PATH Terminal would be necessary. (Hemric)

Response: The DEIS applies an approach consistent with methodologies used for the environmental assessment of public and private projects in New York City. This approach develops a future population and employment projection based on a general background growth rate as well as any reasonably foreseeable residential and commercial development projects within the land use study area. The projections presented in the DEIS were based on land use projections prepared by the MTA on behalf of the Lower Manhattan Project Sponsors, and these projections have been used consistently in the environmental documents prepared for the Recovery Projects.

CULTURAL RESOURCES

Comment 37: FTA did not begin its Section 106 process in September 2003 concurrent with scoping for the Permanent WTC PATH Terminal project as stated in the DEIS. The first step in the Section 106 process is the identification of Section 106 Consulting Parties and the definition of an Area of Potential Effect. Section 106 Consulting Parties were not defined until January of 2004 and the APE was not defined until March 2004. (Gardner)

Response: FTA published its intent to prepare an EIS pursuant to the National Environmental Protection Act, Section 106 of the National Historic Preservation Act, and Section 4(f) of the U.S. Department of Transportation Act in its Notice of Intent, which was published in the *Federal Register* on September 26, 2003. The New York State Historic Preservation Officer (SHPO) was advised of the Notice of Intent and the scoping process for the DEIS at that time. Furthermore, public scoping meeting notices were sent to the project's mailing list, which included many of the individuals and organizations that would later serve as Section 106 consulting parties. FTA and PANYNJ received comments during scoping regarding potential effects to historic resources, which led to the formal solicitation of consulting parties pursuant to the preparation of a coordinated Determination of Eligibility, which began in December 2003.

Comment 38: The DEIS does not reference recent geoarchaeological research in Lower Manhattan that identifies a buried soil horizon. This soil horizon is believed to extend the length of Lower Manhattan and dates to approximately 2000 Before

Present. A determination of whether this soil horizon is present or has been intersection and removed by modern construction is essential to evaluating the archaeological sensitivity of the project outside the limits of the WTC bathtub. (Gardner)

Response: According to the geoarcheological report generated for the Worth Street site, which summarizes the studies conducted for the Foley Square project (Schuldenrein 2002), the buried soil horizon in question was found only in discontinuous locations within a geographically circumscribed portion of Lower Manhattan, bounded roughly by Broadway on the west, Worth Street on the north, and the Foley Square/Five Points area on the south and east. Furthermore, the report associates this buried soil horizon with specific geological formations (such as glacial kames, or low and steep-sided hills), found within the Worth Street study area vicinity, but not necessarily across all of lower Manhattan. Although the report claims that this soil horizon might be found throughout lower Manhattan, there is no evidence presented that confirms its location beyond the particular sites that were investigated. Last, it should be noted that although this buried soil horizon was documented at several locations, no precontact period archaeological resources were found in association with this soil in any of the samples. Thus, it appears that the possible presence of this soil horizon within the Project Site cannot necessarily be assumed, nor is there any evidence to date that confirms the presence of this soil horizon is directly related to the recovery of precontact archaeological resources.

The DEIS does specify potential adverse impacts to the Hudson River Bulkhead and yet underdetermined archaeologically sensitive areas on the eastern portion of the WTC site. As such, FTA and PANYNJ have developed measures to mitigate these potential impacts pursuant to Section 106 of the National Historic Preservation Act.

Comment 39: The DEIS fails to acknowledge that the physical remains of the World Trade Center, including the truncated box beam column that form the perimeter of the tower footprints are archaeological resources. Thus, studies presented in Appendix B are inadequate to make the assumption that the current potential for archaeological resources on the WTC site is the same as prior to September 11, 2001. (Gardner)

Response: The remaining remnants and structures on the WTC site were evaluated as historic resources under Section 106 of the National Historic Preservation Act since these resources are presently unearthed.

Comment 40: The DEIS fails to describe the possibility that remnants of the *Tyjger* may exist in the spaces between the east slurry wall of the WTC "bathtub" and the west wall of the IRT subway tunnel. (Gardner)

Response: According to PANYNJ drawings and a field visit, it appears that the slurry wall abuts the IRT subway wall. Based on documents referenced in PANYNJ"s 2003 Phase 1A reports, the slurry wall was constructed as a solid wall of concrete which replaced the soil once located there.

Comment 41: It cannot be certain that prior utility and subway construction have fully disturbed or removed archaeological resources beneath Church Street and Liberty Plaza. It is recommended that additional research be conducted to substantiate the DEIS finding regarding archaeological resources in the vicinity of Church Street and Liberty Plaza Park. (Suphin)

Response: The Preferred Alternative for the Permanent WTC PATH Terminal would not result in a subgrade concourse beneath Church Street to Liberty Plaza. Therefore, the project would not disturb any potential, remaining archaeological resources beneath the roadway or within the Plaza.

Comment 42: The analysis presented in the DEIS assumes that the Coordinated Determination of Eligibility (March 31, 2004) provides a proper basis for the evaluation of the project's potential effects on historic resources. The Coordinated Determination of Eligibility is faulty in many regards, including its failure to properly define the period of significance, its failure to acknowledge the significance of the site under more than one National Register eligibility criteria, and its improper application of the concepts of integrity. The FTA should request a formal determination from the Keeper of the National Register and that the Determination of Eligibility is revised appropriately. (Gardner)

Response: FTA does not plan on making such a referral. FTA believes that the Coordinated Determination of Eligibility provides a proper basis for the Section 106 review process. FTA and PANYNJ have provided additional information about the WTC site and the potential impacts of the Preferred Alternative through meetings and correspondence with the Section 106 consulting parties throughout the process to develop a Memorandum of Agreement. Therefore, the recommended mitigation measures were not limited by the Coordinated Determination of Eligibility. FTA and PANYNJ believe that the Memorandum of Agreement provides for appropriate measures and treatments with respect to the WTC site.

Comment 43: In discussing the setting of the WTC Site, the DEIS fails to distinguish between the Area of Potential Effect for historic remains and archaeological remains. A discussion of the setting associated with the World Trade Center ruins and remains should be included. Furthermore, the DEIS should include "setting" among the characteristics of the WTC Site that will be diminished. (Gardner et al)

Response: The Areas of Potential Effect for Historic and Archaeological resources are shown in Figure 6-1, and Chapter 6, "Cultural Resources" of the DEIS and this FEIS, and the corresponding text describes them separately.

With respect to the setting of the WTC site, the Draft Finding of Effects, which was presented as Appendix B of the DEIS concluded the following:

The project will introduce a new building and several small structures (such as vents and street access to concourses) into an APE that already contains a wide variety of historic and modern buildings ranging in height from one to 60 stories. Although the construction is new, the terminal, multiple accesses to the street level, and ventilation shafts functionally replace the same uses that existed prior to September 11, 2001. The proportions and architectural styles of the adjacent buildings vary greatly, reflecting the various periods in which they were designed and constructed. Historic masonry-clad buildings stand beside contemporary buildings constructed of glass, concrete, and metal in the APE north, east, and south of the project site; the entirety of Battery Park City on the west dates to the 1970s. The WTC itself initiated the introduction of modern (1960s) skyscrapers to the neighborhood. Redevelopment of the WTC Site, which will be underway independently of the Permanent WTC PATH Terminal, will again bring skyscrapers to the site of the WTC, including the Freedom Tower at the northwest quadrant of the WTC Site, and several somewhat shorter but still prominent office towers on the eastern portion of the site. The proposed Permanent WTC PATH Terminal will also be of contemporary design but of smaller scale than the other buildings proposed for the WTC Site under the Redevelopment Plan. Each of the two vent structures currently proposed to be located in the Route 9A median, west of the WTC Site, would be of long and slender massing and would stand approximately 40 feet tall. It is anticipated that the structures would be clad in reflective material, in keeping with modern material used on buildings in the immediate area.

The urban environment forming the setting of the WTC Site will continue to possess its distinguishing variety. Therefore, the introduction of the new Permanent WTC PATH Terminal and associated vent and access structures will not diminish the integrity of the WTC Site's setting.

Comment 44: The DEIS consistently employs words such as "could" and "may" when discussing effects to specific historically significant elements of the WTC site. Such words suggest uncertainty as to the exactly if and/or how various elements will be affected. Not only is this because of the insufficiently detailed description of the project but also because a complete inventory (with maps) of the historically significant elements at the WTC site was never prepared as part of the Coordinated Determination of Eligibility. A complete inventory of both site features and off-site artifacts should be conducted. In the absence of a

complete inventory, any assessments of effects or proposals for mitigation are premature. (Gardner, Gardner et al)

Response: The Permanent WTC PATH Terminal is currently in its design stage. It is known that the project will impact the approximately 16-acre, National Register-eligible WTC site, but the extent of this impact to specific remaining remnants and structures on the WTC site was uncertain at the time of the publication of the DEIS. Subsequent to publication of the DEIS, FTA and PANYNJ held four meetings with the project's Section 106 consulting parties. At these meetings, FTA and PANYNJ provided additional information regarding the Terminal's design and its potential impacts on remaining remnants and structures within the WTC site. Where specific effects are known, the findings presented in the FEIS have been updated, and mitigation measures have been developed. In cases where effects remain uncertain, the executed Memorandum of Agreement provide for stipulations to address these potential impacts should they occur.

PANYNJ is currently conducting HABS/HAIR Level II documentation of the WTC site pursuant to the stipulations of the executed Memorandum of Agreement. PANYNJ has also conducted a detailed inventory, including a photographic log, of all artifacts located within Hanger 17 of John F. Kennedy Airport.

Comment 45: FTA and PANYNJ should make attempts to preserve and/or incorporate remaining remnants on the WTC site into the project's design. FTA and PANYNJ should immediately prepare specific plans to incorporate the viewing and access of historic elements into the everyday experience of the Permanent WTC PATH Terminal. In cases, where adverse impacts to certain elements are absolutely unavoidable, the FTA and PANYNJ should immediately share plans with the Section 106 Consulting Parties for the mitigation of these impacts. Specifically the elements that should be incorporated into the design include: box beam column remnants marking the tower perimeter; northwest remnant sub-grade structures; passageway to E-train; steel beams in cross form; plaza; and subway entrance to Vesey Street. (Lustbader, Todorovich, Yaro; Sanchis III et al 1, Sanchis III et al 2)

Response: Subsequent to publication of the DEIS, FTA and PANYNJ held four meetings with the project's Section 106 consulting parties. At these meetings, FTA and PANYNJ provided additional information regarding the Terminal's design and its potential impacts on remaining remnants and structures within the WTC site. Based on consulting party comments, FTA and PANYNJ developed alternatives for components of the Terminal to minimize or avoid adverse effects, and alternatives were selected based on consulting party input. Subsequent to this process, FTA and PANYNJ developed a Memorandum of Agreement that contains the design measures developed through the Section 106 consultation

process. The project's consulting parties were given multiple opportunities to comment on a draft Memorandum of Agreement prior to its execution. Thus, FTA and PANYNJ believe that the Section 106 consultation process has provided a sufficient level of investigation to avoid, minimize, or mitigate the Preferred Alternative's adverse impact on the 16-acre WTC site.

Comment 46: PANYNJ should respect the wishes of many family members of the victims of the terrorist attacks and should not construct atop the tower footprints. (Lachman)

Response: Through its Section 106 review process, the FTA and PANYNJ have been working closely with Section 106 Consulting Parties, which include groups representing the victims' families. This process has resulted in a Memorandum of Agreement that specifies measures to minimize and mitigate the adverse effects of the Terminal to the tower footprints.

Comment 47: The discussion of the tower perimeter column bases implies that it is the column bases that constitute the footprints of the Twin Towers. The DEIS never discusses the footprints of the Twin Towers as a holistic entity. The tower perimeter column bases are discussed separately from other features located within the footprints proper. A discussion of how the footprints in their entirety will be affected is essential to properly evaluate the effects to them and to properly evaluate the project with respect to Section 4(f) of the U.S. Department of Transportation Act. (Gardner, Gardner et al, Kornfeld)

Response: The Memorandum of Agreement acknowledges that the column bases delineate the north and south tower footprints. The Memorandum of Agreement also stipulates measures to avoid, minimize, or mitigate the Preferred Alternative's effects to the columns bases and the spaces that they define.

Comment 48: The DEIS implies that physical disturbance of the truncated box beam columns is the only way they will be affected. The statement that the project would impact "some" of the columns is incorrect. They will all be affected in that their associated setting will be altered. The statement that some of the column bases while being made inaccessible could remain in situ is not very meaningful. If they become inaccessible they will be adversely affected. (Gardner et al)

Response: The DEIS describes the direct alteration or removal of remaining structures and elements on the WTC site resulting from the construction and operation of the Permanent WTC PATH Terminal. As described in Chapter 6, "Cultural Resources," collectively, the alteration or removal of these remaining structures and remnants would alter the integrity of feeling of the WTC site, which is noted as an adverse impact.

With regard to setting, the project will introduce a new building and several small structures (such as vents and street access to concourses) into an APE that already contains a wide variety of historic and modern buildings ranging in height from one to 60 stories. Although the construction is new, the terminal, multiple accesses to the street level, and ventilation shafts functionally replace the same uses that existed prior to September 11, 2001. The proportions and architectural styles of the adjacent buildings vary greatly, reflecting the various periods in which they were designed and constructed. Historic masonry-clad buildings stand beside contemporary buildings constructed of glass, concrete, and metal in the APE north, east, and south of the project site; the entirety of Battery Park City on the west dates to the 1970s. The WTC itself initiated the introduction of modern (1960s) skyscrapers to the neighborhood. Redevelopment of the WTC Site, which will be underway independently of the Permanent WTC PATH Terminal, will again bring skyscrapers to the site of the WTC, including the Freedom Tower at the northwest quadrant of the WTC Site, and several somewhat shorter but still prominent office towers on the eastern portion of the site. The proposed Permanent WTC PATH Terminal will also be of contemporary design but of smaller scale than the other buildings proposed for the WTC Site under the Redevelopment Plan. Each of the two vent structures currently proposed to be located in the Route 9A median, west of the WTC Site, would be of long and slender massing and would stand approximately 40 feet tall. It is anticipated that the structures would be clad in reflective material, in keeping with modern material used on buildings in the immediate area.

Comment 49: How many box beam column bases will be "temporarily" covered during construction? For how long? How will they be affected and protected during construction? (Gardner et al)

Response: All of the box beam column bases that are not currently covered and that would remain on-site would be covered during the construction period for their protection. Per the stipulations of the Project's Memorandum of Agreement, PANYNJ will develop a Resource Protection Plan for the WTC site that will include measures to protect the box beam column bases during the construction period.

Comment 50: There is an urgent need to remove the few inches of dirt that obstruct the remains of the footprints so that they can be properly inventoried, identified, documented, and photographed. (Gardner et al)

Response: PANYNJ removed the few inches of dirt that obstruct the remains and have documented and photographed remaining features. Upon completion, this documentation will be circulated to the project's Section 106 Consulting Parties.

Comment 51: The DEIS states that "obscuring the features from public view would not necessarily diminish the site's integrity of feeling." The present setting includes full access to and visibility of the north tower footprint and much of the south tower footprint. The ability to see and possibly touch the remains of the WTC is integral to the feeling associated with the site. The post-Terminal construction site will look very different from today. It will evoke less of a feeling of the effects of the events of September 11, 2001. The covering of portions of the footprints by tracks and portions of air space above the footprints by the Terminal structure will alter the setting of the WTC site. (Gardner et al, Sanchis III et al 1, Sanchis III et al 2)

Response: Refer to the response to Comment 48 above.

Comment 52: The statement that "all of these Tower perimeter columns were removed" is incorrect and contradicts the following phrase which states that the bases of the columns remain. (Gardner et al)

Response: The statement in Chapter 6, "Cultural Resources" of this FEIS was revised for clarification as follows: "During the post-September 11, 2001 emergency recovery operations conducted by the City of New York, all of these Tower perimeter columns were truncated such that only the bases remain."

Comment 53: The fact that construction of various proposed infrastructure elements will not physically destroy any of the truncated box beam columns is not meaningful in itself. The DEIS notes that proposed infrastructure "may somewhat impact visibility and accessibility." Exactly what does this mean? Much more specific information is needed. (Gardner et al)

Response: There would be various site infrastructure elements supporting the Preferred Alternative within the PATH right-of-way. The Preferred Alternative may also include utility lines that cross the footprints of the former North and South Towers at an elevation above the existing floor of the WTC site (Elevation 242 or 58 feet below Sea Level). Under current plans, these utilities would be at Elevation 264 (36 feet below Sea Level). These utility lines would serve the joint infrastructure needs of both the Permanent WTC PATH Terminal and the WTC Memorial and Redevelopment Plan.

The Preferred Alternative platforms and supporting infrastructure may permanently obscure 5 to 7 of the North Tower perimeter column bases and up to 3 of the South Tower perimeter column bases that currently exist outside of the PATH right-of-way. Given safety considerations, these column bases would be inaccessible to the general public. However, as described in the executed Memorandum of Agreement, PANYNJ will provide for architectural treatments within the Terminal such that a minimum of 5 to a maximum of 7 column bases of the east column line of the North Tower would be visible from Platform D.

Comment 54: Exactly what alterations that would be "additive in nature" are being referred to? While they may not "result in diminution of the physical characteristics of features," they still may adversely affect these features in other ways. (Gardner et al)

Response: As described in Chapter 2, "Project Alternatives," a fourth platform, an east-west concourse, a north-south concourse, and an above-ground Terminal Building will be constructed within the WTC site beyond the limits of the temporary WTC PATH station. The analysis indicates that such "additive" alterations will change the existing environment within the site through the introduction of new elements, thereby diminishing the Site's integrity.

Comment 55: The need for an additional track should be qualified and its adverse effects on the historic site should be considered. (Kornfeld)

Response: As described in Appendix C-2 of this FEIS, PATH requires a five-track operation at the WTC Terminal to support daily operations on the Newark-WTC and Hoboken-WTC routes, to allow for overnight train storage, or to provide for failure management.

In order to maintain reliable operations for its customers, PATH must plan for system failures that result in service disruptions. Disruptions can occur for a number of operational and maintenance reasons such as police actions, medical emergencies, equipment failures, routine maintenance and construction; and special operations. In the event of car equipment failure, PATH must have facilities to layover trains if they become fully disabled. Because PATH's WTC facility is a terminal station, trains dwell at the station in order to maintain the scheduled headways. Thus, each of the Hoboken-WTC and Newark-WTC routes require two active tracks such that an incoming train can arrive before an outgoing train departs. However, if a train becomes disabled, an additional track is needed to serve the next or multiple incoming trains.

Because of system-wide limitations and to allow for a more efficient operation during the start of early morning service, PATH uses four of the five tracks at the WTC for overnight storage of 6 Hoboken-WTC trains. The Terminal's fifth track is retained for revenue service on the Newark-WTC Line. Beginning at approximately 5:40 AM each morning, PATH begins revenue service on the Hoboken-WTC Line by bringing the train stored at Journal Square into the WTC Terminal. Trains are then moved from storage at the WTC to revenue service every 10 minutes following the departure of the first train until all 7 consists are operational. This plan allows PATH to more efficiently manage its labor hours and decreases the time that Hoboken-WTC trains are in non-revenue operation. During winter months, the overnight storage of trains at the WTC facility allows PATH to establish AM peak Hoboken-WTC service without first removing snow or ice from the trains and tracks.

During construction of the Preferred Alternative, the existing Tracks 1 through 5 would be taken out of service one at a time to allow for permanent track and platform installation. Thus, a temporary Track 6 is needed during construction to maintain PATH's minimum operating requirements.

As stipulated in the executed Memorandum of Agreement, the temporary PATH track (in addition to the existing 5 tracks) and associated ballast that would be installed on a temporary basis during construction of the Project tracks and platforms would be removed upon completion of the permanent tracks and platforms to re-expose the North Tower perimeter column remnants and portions of the North Tower footprints that may be covered by the temporary track and ballast.

Comment 56: The Memorandum of Agreement should incorporate a specific commitment to loop utilities and other infrastructure outside the tower footprint. (Sanchis III et al 2)

Response: As described in Chapter 6, "Cultural Resources" of this FEIS, the Preferred Alternative may also include utility lines that cross the footprints of the former North and South Towers at an elevation above the existing floor of the WTC site (Elevation 242 or 58 feet below Sea Level). Under current plans, these utilities would be at Elevation 264 (36 feet below Sea Level). These utility lines would serve the joint infrastructure needs of both the Permanent WTC PATH Terminal and the WTC Memorial and Redevelopment Plan..

Comment 57: The DEIS states that "the tower perimeter column bases would be preserved in place to the maximum extent possible." It is unclear what the phrase "to the maximum extent possible" means. FTA and PANYNJ should acknowledge their commitment to preserve 97 percent of the north tower footprint and 50 percent of the south tower footprint. (Gardner)

Response: As described in the executed MOA, the total extent of the North Tower footprint at elevation 242 (58 feet below Sea Level) to be permanently occupied by any portion of the Project would be approximately 1,600 square feet and would not exceed 4 percent of the North Tower footprint area. The total extent of the South Tower footprint at elevation 242 (58 feet below Sea Level) to be permanently occupied by any portion of the Project would be approximately 23,615 square feet (21,615 currently occupied by the temporary WTC PATH station plus 2,000 additional square feet for the Permanent WTC PATH Terminal) and would not exceed a total of 53 percent of the South Tower footprint area..

Comment 58: The discussion of how the remains of the Hudson and Manhattan tubes and terminals will be affected needs to be much more detailed. (Gardner et al)

Response: As stated in Chapter 2, "Project Alternatives," of this FEIS, construction of the Terminal may also require the demolition and excavation of remaining structures within the eastern portion of the WTC site between MTA/NYCT's 1 and 9 line and Church Street, which includes all portions of the former H&M Terminal. This work would also support the future development of the site by others. Per the stipulations of the executed Memorandum of Agreement, PANYNJ would fully document the remains of the former H&M Terminal to HABS/HAER Level II Standards prior to demolition.

Comment 59: The DEIS states that the remaining portions of the former Hudson & Manhattan (H&M) Terminal and the cast-iron tubes leading from the station do not meet criteria for listing on the National Register due to a loss of historic integrity. This statement is inconsistent with other findings, specifically the Coordinated Determination of Eligibility and the LMDC's Programmatic Agreement. (Gardner)

Response: Prior to the Coordinated Determination of Eligibility for the WTC site, SHPO determined that the remaining portions of the former H&M Terminal and the cast-iron tubes leading from the station do not meet the criteria for listing on the National Register as an entity onto itself due to a loss of historic integrity (letter dated October 16, 2003). However, given its location within the 16-acre WTC site, the former H&M Terminal was listed as a remaining remnant and structure in the Coordinated Determination of Eligibility. As such, the Preferred Alternative's effects on the H&M Terminal remnants were reviewed pursuant to Section 106 of the National Historic Preservation Act.

Comment 60: All of the slurry walls should be considered equally significant, and the DEIS must identify whose undertaking is associated with effects to the west slurry wall. Furthermore, FTA must determine whether or not bathtub wall reinforcement is or is not part of their project. If it is not, then presumably it is part of LMDC's project. Yet, the LMDC never discussed it in their Final Generic Environmental Impact Statement or Record of Decision for the WTC Memorial and Redevelopment Plan. (Gardner et al)

Response: As described in Chapter 2, "Project Alternatives," of this FEIS, the Preferred Alternative includes funds for the reinforcement of the basement ("slurry") walls, which form the "bathtub" within the WTC site. This work is necessary to ensure the structural integrity of the walls and to support future redevelopment of the WTC site, including the Permanent WTC PATH Terminal. As part of the Permanent WTC PATH Terminal's construction, PANYNJ could reinforce the entire west bathtub wall except for portions that would remain visible as part of the WTC Memorial. PANYNJ would also reinforce portions of the east bathtub wall abutting NYCT's 1 and 9 line that were not previously reinforced. If other development on the WTC site does not move forward according to current

schedules or plans, it may also be necessary to reinforce portions of the north bathtub wall east of Freedom Tower and portions of the south bathtub wall above the existing PATH substation. It is currently estimated that approximately 30 percent of the required slurry wall repairs would be undertaken as part of the Preferred Alternative.

Comment 61: The removal of the recovery and reconstruction ramp, although necessary and unavoidable, should be acknowledged as an adverse effect. Preservation plans for the ramp should be considered. (Gardner et al)

Response: The support foundation for the ramp would be relocated to allow for construction of a temporary track. The ramp would remain during early construction of the Preferred Alternative and would then be removed. Pursuant to the executed Memorandum of Agreement, the ramp would be documented to HABS/HAER Level II Standards prior to its removal.

Comment 62: The inclusion of a discussion of the "Northwest Remnant Subgrade Structures" as part of the project would seem to contradict numerous statements by PANYNJ that demolition of these structures is not part of the PATH project. (Gardner et al)

Response: Since publication of the DEIS, PANYNJ and the LMDC have pursued the removal of the Northwest Remnant Subgrade Structures under an independent action from the Permanent WTC PATH Terminal project. Therefore, this FEIS considers the Northwest Remnant Subgrade Structures as part of the Future Common to All Alternatives for the Permanent WTC PATH Terminal.

Comment 63: PANYNJ should consult with museum curators and investigate the possibility of salvaging more than three elements from the northwest remnant subgrade structures. Additional elements, along with the recently photographed Tito Dupret images, could provide for a more effective interpretation of the World Trade Center site. (Lustbader, Sanchis III et al 1, Sanchis III et al 2)

Response: Since publication of the DEIS, PANYNJ and the LMDC have pursued the removal of the Northwest Remnant Subgrade Structures under an independent action from the Permanent WTC PATH Terminal project. Thus mitigation measures pursuant to its removal are not part of this project.

Comment 64: The DEIS states that the entrance to the E train would be reconfigured and that certain elements associated with the existing E train passageway may be relocated. No description or drawings of the planned reconfiguration are provided, and no mention is made of which elements "may" be relocated. The passageway to the E train was recently restored and is one of the last surviving elements of the World Trade Center site. PANYNJ should conduct additional

analysis to incorporate the passageway into the Permanent WTC PATH Terminal's design. (Gardner et al, Lustbader; Love, Sanchis III et al 1, Sanchis III et al 2)

Response: As stipulated in the Project's MOA, the new pedestrian connection between the Permanent WTC PATH Terminal and the MTA/NYCT WTC E Subway Station would incorporate the existing E subway entrance, in its current location, in a manner that retains existing materials and features of this entrance, including, but not limited to, the handrails, the travertine flooring, the steps and doors separating the E train from the pedestrian connection, and overhead signage, to the extent possible and in accordance with current building codes and Americans with Disabilities Act requirements. The design would include, at a minimum, a plaque identifying the historic features of the E subway entrance. During construction of the new pedestrian connection between the Permanent WTC PATH Terminal and the E Subway Entrance, doors may need to be carefully removed and stored until they can be reinstalled within the new connection.

Comment 65: The steel beam in cross form should be moved temporarily within the World Trade Center site. If it needs to be moved off-site, proper public notification should be given, and it should be carefully preserved at JFK Hangar 17. (Lustbader, Sanchis III et al 1, Sanchis III et al 2)

Response: As stipulated in the executed MOA, PANYNJ would relocate the steel column and crossbeam mounted on a concrete pedestal and currently situated within the WTC site near Church Street in accordance with Stipulation VI of the MOA (see Appendix B). The object would remain in the custody and control of PANYNJ pending final disposition.

Comment 66: The steel beams in cross form should be removed from the site since it would be inappropriate as a permanent part of the site. The "steel cross" has an association with a particular religion on a site where people of many different religions perished. (Love)

Response: Refer to the response to Comment 65 above.

Comment 67: FTA and PANYNJ should not preserve everything that might be deemed a "ruin" by future generations. While most local residents are sensitive to victims' families and preservationist concerns, the primary focus has to be on the redevelopment of the site and economic revitalization of Lower Manhattan. (Gaull, Love)

Response: Through its Section 106 review process, the FTA and PANYNJ have been working closely with Section 106 Consulting Parties, which include groups representing the victims' families and local residents. This process has resulted

in a Memorandum of Agreement that specifies measures to avoid, minimize, and mitigate the Preferred Alternative's adverse effects to remaining remnants and structures on the WTC site.

Comment 68: The plaza and subway entrance at Vesey Street are the only surviving above ground elements of the World Trade Center site. The removal of these stairs is an avoidable adverse effect. The non-functionality and current instability of the stairs is given as a justification for their removal, which is unacceptable. Their non-functionality does not diminish their historical significance. FTA should identify the feasibility of stabilizing these remains and consider design modifications that would permit their preservation in place so they will not be adversely affected. (Gardner et al, Lustbader, Sanchis III et al 1)

Response: Subsequent to the publication of the DEIS, FTA and PANYNJ have determined that a proposed Permanent WTC PATH Terminal entrance in the location of the plaza and subway entrance to Vesey Street can be moved. As such, the Permanent WTC PATH Terminal would not impact the plaza and subway entrance to Vesey Street.

Comment 69: The decision to remove the structural remnants of the Vesey Street stairway is acceptable given its heavy damage and lack of permanent stability or functionality. (Love)

Response: As noted in the response to Comment 68, the Preferred Alternative would not alter the plaza and subway entrance to Vesey Street.

Comment 70: Avoidance of archaeological resources and data recovery are not the only forms of mitigation available for dealing with archaeological resources. (Gardner)

Response: The executed MOA includes the process to address the Preferred Alternative's impacts on the Hudson River Bulkhead and its potential impacts to as yet determined archaeological resources that may be located within the eastern potion of the WTC site. Because the Hudson River Bulkhead is also located within the APE for the Route 9A Project, PANYNJ would coordinate its treatment plan with NYSDOT. Similarly because the potential archaeological resources within the WTC site are also located within the APE for the WTC Memorial and Redevelopment Plan, PANYNJ would coordinate its treatment plan, if necessary, with LMDC.

In consultation with SHPO, and FHWA and NYSDOT, PANYNJ would develop and implement a plan to locate and identify intact portions of the Hudson River Bulkhead that would be affected by construction of the Permanent WTC PATH Terminal's east-west pedestrian connection. In the event that the intact portions of the Hudson River Bulkhead are identified, PANYNJ would, in consultation with the SHPO and NYSDOT, prepare a

treatment plan for those portions of the Hudson River Bulkhead to be affected by the Project. The plan would be submitted to SHPO and Section 106 consulting parties for their review and comment prior to implementation.

Prior to any Project-related subsurface disturbance at any of the locations that have been determined to be sensitive for historic archaeological resources, PANYNJ will, in consultation with the SHPO, and LMDC as appropriate, identify and evaluate the National Register eligibility of any archaeological resources at these locations in accordance with 36 CFR 800.4.

In the event that FTA, in consultation with SHPO, determines that National Register-eligible archaeological resources will be adversely affected by construction of the Preferred Alternative, PANYNJ would, in consultation with FTA, SHPO, and LMDC as appropriate, and the Section 106 consulting parties, develop and implement a Archaeological Resource Treatment Plan for the Project. The Archaeological Resource Treatment Plan and documentation will adhere to the standards established by the Secretary of the Interior's Standards and Guidelines for Archaeology (48 FR 44716), including the standards therein for professional qualifications. The plan will be submitted to SHPO and Section 106 consulting parties for their review and comment prior to approval.

Comment 71: The proposed photographic documentation of the entire WTC site should be done to HABS/HAER Level 1 Standards and the documentation plan should be subject to the review and approval of the National Park Service. (Gardner)

Response: Per the stipulations of the executed MOA, PANYNJ would document the WTC site and its historic features to Level II standards of the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) prior to the removal or alteration of any historic features from the WTC site. This documentation will consist of large-format, black-and-white photography of the site and its historic features as they currently exist; large-format photographic reproduction of selected existing drawings of current conditions and of pre-September 11, 2001 conditions; and a written history and description of the site and its historic features using information previously generated for the Coordinated DOE for the WTC site as well as the Permanent WTC PATH Terminal's DEIS and FEIS. The completed documentation would be submitted to SHPO and HABS/HAER.

Comment 72: FTA should explore the desirability of inviting LMDC as a signatory to any Programmatic Agreement developed for the Permanent WTC PATH Terminal project given the high interrelationship with between this project and the World Trade Center Memorial and Redevelopment Plan. (Gardner)

Response: The LMDC signed the Permanent WTC PATH Terminal Memorandum of Agreement as a concurring party. (See Appendix B.)

Comment 73: The Hudson River Park Trust would like to be included in future discussions related to any impacts to the Hudson River Bulkhead and consistency with the existing Programmatic Agreement. (Blackman)

Response: As a consulting party to the Section 106 review process for the Permanent WTC PATH Terminal, the Hudson River Park Trust has been notified of all consulting party meetings including those that have outlined the project's Memorandum of Agreement. As a consulting party, the Hudson River Park Trust will be invited to review and comment on the Archaeological Resource Treatment Plan that will be developed for the project's potential impacts on the Hudson River Bulkhead.

Comment 74: The DEIS states that PANYNJ will coordinate with the other Lower Manhattan project sponsors "to minimize disruption in access to cultural and historic sites." The WTC site is considered a historic resource. If the LMDC, through its Programmatic Agreement, will control access to the tower footprints, then how can such coordination be possible? (Gardner)

Response: The above-referenced text refers to an Environmental Performance Commitment, which will be implemented during the construction period. The full text of this EPC states that the Lower Manhattan Recovery Project sponsors will "establish coordination among projects to avoid or minimize interruption in access to cultural and historic sites." The Environmental Performance Commitment pertains to off-site cultural resources including historic sites, community and religious institutions, museums, and other attractions. During the construction period, the WTC site will not be publicly accessible beyond public viewing areas that will be provided by PANYNJ and the LMDC. In the long-term, access will be controlled by LMDC and PANYNJ pursuant to the stipulations of their respective agreements that were developed in accordance with Section 106 of the National Historic Preservation Act.

URBAN DESIGN AND VISUAL RESOURCES

Comment 75: The DEIS assessment of the Terminal building's effects to visual resources is extremely cursory, one-sided, and based on highly dubious assumptions. The proposed Terminal building is an iconic, modernist structure that would have adverse effects on the visual character and heritage of Lower Manhattan. (Hemric)

Response: As described in Chapter 7, "Visual Resources," the Terminal building would be located on a site that contained modern structures prior to September 11, 2001 and modern structures will be constructed on the WTC site as part of the WTC Memorial and Redevelopment Plan. While Chapter 6, "Cultural Resources," identified historic structures in the vicinity of the project site, the area has a mix of both older and modern skyscrapers, including One Liberty Plaza and the

Hilton Millennium Hotel. Thus, a modern terminal building is in keeping with the urban context of this area. Furthermore, Church Street does not have a contiguous street wall in the vicinity of the World Trade Center site since newer structures are set back with exterior plazas. Thus, the shape and position of the Terminal will not adversely effect the urban design of the urea.

The density and patterns of development in New York City has resulted in adjacent iconic structures for some time. For example, Grand Central Terminal and the Chrysler Building are adjacent as is Rockefeller Center and Saint Patrick's Cathedral. The location of an "iconic" Terminal building in Lower Manhattan is in keeping with New York's history and patterns of development.

TRANSPORTATION

Comment 76: The DEIS should have noted how the plans for a Permanent WTC PATH Terminal would have a negative impact on passenger mobility and comfort when compared to the pre-September 11, 2001 PATH Terminal and concourse since the previous concourse was essentially at street level on all sides. (Hemric)

Response: While the Terminal's platforms and tracks would have a similar configuration to the pre-September 11, 2001, vertical and horizontal circulation would be much improved. Two concourses would provide for east-west and north-south access through the WTC site. These corridors would converge within the transportation hall, which would provide access to street-level, the Dey Street concourse of the Fulton Street Transit Center, and the Cortlandt Street (1 and 9), Cortlandt Street (N and R), and World Trade Center (E) subway stations. The concourse would also connect to elements of the WTC Memorial and Redevelopment Plan, including the memorial, cultural centers, offices, and retail on the WTC site. The east-west concourse would extend beneath Route 9A to a new entrance in front of the Wintergraden of the World Financial Center. This new Route 9A connection would allow for east-west travel between the WTC and World Financial Center without a major change in vertical grade, which was the case with the former north bridge of the WTC. The linear design of the concourses would provide for visual access to destinations and wayfinding signage would be provided throughout the complex. The proposed design of the concourses would provide for easier and more direct connections to transit stations and uses on and off the WTC site than was provided prior to September 11, 2001.

Comment 77: The DEIS should examine how the transformation of Lower Manhattan to a more well-rounded, 24-hour district might actually lessen the need for peak hour transit service. (Hemric)

Response: By 2025, employment in Lower Manhattan is projected to total nearly 422,000, which will be less than 1 percent fewer employees than existed prior to September 11, 2001. Although the residential population of Lower Manhattan

will increase by a much greater proportion than its commuter population, there will continue to be a substantial number of jobs in this area. Furthermore, prior to September 11, 2001, new and expanded office development in Jersey City, Newark, and Hoboken result in a rapidly increasing trend toward reverse-commuting by PATH. Currently, several office projects are planned in these areas that will likely result in more reverse-commuters in coming years. Thus, commuters between New Jersey and Lower Manhattan and those between Lower Manhattan and New Jersey will continue to constitute a substantial number of peak hour trips, and it is not anticipated that demand for peak hour transit service will lessen as compared to the pre-September 11, 2001 volumes.

Comment 78: The proposed connections between the Cortlandt Street (R and W) station and the World Trade Center (E) station should be integrated into the design of the Permanent WTC PATH Terminal as should the western end of the Dey Street passageway and the eventual connection to the Cortlandt Street (1 and 9) station. These connections should be designed to allow for fare-free transfers should MTA/NYCT subways and PATH adopt an integrated fare structure in the future. (Lachman)

Response: PANYNJ is coordinating with MTA to provide for a seamless connection between the Permanent WTC PATH Terminal and the Fulton Street Transit Center's Dey Street Concourse, the Cortlandt Street Station (1 and 9), the Cortlandt Street Station (R and W); and the World Trade Center Station (E). While these connections will allow for transfers between PATH and NYCT subways, they will also provide subgrade access between future uses on the WTC site. Therefore, these connections are not being planned as fare-free transfers. However, PANYNJ and MTA continue to work toward an integrated fare system that would allow for transfers between PATH and NYCT using a single fare-card. This system would be implemented for the transit connections within the WTC Transportation Hub when it becomes available.

Comment 79: The sound system for announcements at the WTC facility is absolutely terrible and messages are difficult to understand. (Gorsky)

Response: The Preferred Alternative would include a modern public address system to provide for announcements can be heard by commuters throughout the complex.

Comment 80: Before considering the design of the various subway stations involved, PANYNJ should consider methods of barrier-free fare collection. (Adler)

Response: As described in Chapter 8, Section A, "PATH," PANYNJ and MTA/NYCT are currently coordinating to develop an integrated fare collection system. However, the enhancement of fare collection for subways is a separate undertaking from the Permanent WTC PATH Terminal.

Comment 81: The PANYNJ should continue its work with the LMDC, the City, and the State to bring direct, one-seat access from Long Island and John F. Kennedy Airport to Lower Manhattan. These transportation improvements are critical to maintaining and enhancing Downtown's role as a central business district and a thriving part of the region's economy. (Hensley)

Response: PANYNJ in corporation with LMDC, MTA, and the New York City Economic Development Corporation are currently studying alternatives for a direct, rail connection between John F. Kennedy Airport and Lower Manhattan. However, this undertaking is independent from the Permanent WTC PATH Terminal.

Comment 82: The Permanent WTC PATH Terminal and a direct, high-speed connection to Newark Liberty International Airport presents an opportunity for Lower Manhattan to compete more effectively for job growth and development in the New York City metropolitan area. (McArdle)

Response: As described in Chapter 8, Section A, "PATH," of the DEIS, PANYNJ is studying PATH expansion projects including an extension from Newark Penn Station to Newark Liberty International Airport. However, this project is independent from the Permanent WTC PATH Terminal. The Preferred Alternative would support the future expansion of PATH to Newark Liberty International Airport.

Comment 83: To encourage greater ridership (particularly on nights and weekends) and to lessen use of automobiles, PANYNJ and MTA should agree to a ticket arrangement that would allow the user to pay one price for a combined PATH/MTA ride and should also consider combined unlimited PATH/MTA tickets similar to MTA/NYCT's current unlimited monthly subway pass. (Pasternack)

Response: As described in Chapter 8, Section A, "PATH," PANYNJ, and MTA/NYCT are currently coordinating to develop an integrated fare collection system. Presently, MTA pay-per-ride MetroCards are accepted at the temporary WTC PATH station and similar integration will be implemented at other PATH stations in the near future. In the long-term, the agencies hope to develop systems that allow for compatibility of other types of fare cards. However, the enhancement of fare collection is a separate undertaking from the Permanent WTC PATH Terminal.

Comment 84: The E train at the World Trade Center Station should be linked to the R and W line at Cortland Street, about a 100-foot distance to carry more passengers to the south at Whitehall/Water streets or even further to Brooklyn. (O'Shea)

Response: MTA/NYCT is considering a sub-grade connection between the World Trade Center (E) and Cortlandt Street (R and W) stations as part of the Fulton Street

Transit Center. However, this undertaking is independent from the Permanent WTC PATH Terminal.

Comment 85: The DEIS does not provide a sufficient explanation or appropriate backup for the 2025 ridership estimates. It is impossible for the reviewer to evaluate the legitimacy of the methodology or assumptions used to arrive at these estimates. An accurate estimate is imperative to justify the expansion of the facility beyond its pre-September 11, 2001 and current temporary capacity. (Gardner)

Response: A ridership appendix is included as Appendix C-1 of this FEIS. The appendix incorporates modifications to the ridership forecasts made subsequent to publication of the DEIS. These modifications reflect current ridership trends at the temporary WTC PATH station as well as development proposals and other planning efforts in both Lower Manhattan and New Jersey that may result in changes to future PATH ridership. This appendix was circulated in draft form for review by the project's Section 106 consulting parties in August 2004.

Comment 86: The PANYNJ recently announced that it will procure 246 new PATH cars that will have three doors on each side, which will allow for faster loading and unloading of passengers. The DEIS does not consider the potential of these cars to increase capacity and the degree to which improved loading and unloading will improve platform operations at the Permanent WTC PATH Terminal. (Gardner)

Response: As described in Appendix C-2 of this FEIS, three-door cars will decrease the boarding/alighting times of trains by 50 percent, which will improve dwell times and could reduce the overall travel time on PATH routes. However, the new cars are not expected to improve the station clearance time for passengers since they would not directly affect platform area or vertical circulation elements. Furthermore, since the WTC Terminal is a terminal station, passenger circulation at this facility is not highly influenced by the dwell times of trains.

Comment 87: The discussion of probable impacts associated with the various design options for a Permanent WTC PATH Terminal must include an evaluation of how these alternatives will affect historic resources, especially the WTC site. (Gardner)

Response: Chapter 6, "Cultural Resources," details the impacts of the Preferred Alternative on historic resources, including the WTC site. Additional analysis is provided in the Section 4(f) Evaluation.

Comment 88: As a result of the WTC Memorial, there will be no access to the transportation center, for residents living west of West Street. Reaching the Terminal will be a major obstacle since no one will be able to cross the Memorial. Because

NYSDOT proposes a tunnel under West Street, the PATH Route 9A connection will be deep and will pose a great hardship for those who use it. (Gaull)

Response: As currently planned, street-level access to the Terminal for those west of Route 9A could be achieved via the Route 9A Connection adjacent to the World Financial Center. The entrance to this connection would have vertical circulation including escalators and elevators. The connection below Route 9A will provide for easier movement between the concourse and the PATH mezzanine level than existed prior to September 11, 2001. Alternatively, those accessing the Terminal from west of Route 9A could cross Route 9A at grade and enter the Terminal via Freedom Tower, Greenwich Street, or Liberty Street.

AIR QUALITY

Comment 89: Air quality monitoring should be conducted within the WTC bathtub where PATH riders are walking and standing. (Coangelo)

Response: The National Ambient Air Quality Standards (NAAQS) standards are based on 24-hour and annual averaging periods, but the potential exposure time of PATH patrons within the "bathtub" would be considerably shorter. Thus, monitoring would be ineffective since these sort-term exposures would not have a relative basis for comparison.

Comment 90: Air quality monitoring results should be posted on a Website on a daily basis for residents and workers to obtain. (Coangelo)

Response: The Lower Manhattan Project Sponsors are currently investigating verification procedures and protocols for the Lower Manhattan Recovery Projects. This process will involve input from the New York State Department of Environmental Conservation to determine best practices for necessary data collection and reporting. The resultant, coordinated verification plan, including reporting methods, would be administered through the Lower Manhattan Construction Coordination Group or the Lower Manhattan Construction Command Center.

Comment 91: The EIS identified construction-period exceedance in particulate matter (PM) 2.5, which is the highly respirable kind. Where you have exceedance in $PM_{2.5}$, you can also have exceedance in very ultra-fine particulates, which may be even more dangerous to human health. The DEIS proposes to reduce or mitigate harmful effects to the extent possible, but who will determine what is possible and according to what criteria. (Orkin)

Response: PANYNJ would implement the following mitigation measures to reduce project-generated emissions during the construction period. These measures include those previously identified as EPCs.

- Ultra Low Sulfur Diesel Fuel (ULSD): As described in the EPCs, PANYNJ would require that contractors use ULSD for all non-road vehicles that operate with diesel engines.

- Electrification: PANYNJ or its contractor would develop a plan, in consultation with Con Ed, as appropriate, to disperse grid power throughout the contraction zone for the Preferred Alternative. In its contract documents, PANYNJ would require all contractors and subcontractors to use electrically powered equipment for air compressors, pumps, mixing, desanding and grout plants, welding machines, and any other diesel powered equipment that can be replaced with an electrically powered version. However, this does not apply to the east-west pedestrian concourse beneath Route 9A if the concourse is built by NYSDOT, since NYSDOT has not yet finalized what level of electrification would be possible for its projects. Given current conditions, it is expected that at lest 50 percent of the air compressors, pumps, mixing, desanding and grout plants, welding machines, and other diesel powered equipment that can be replaced with an electrically powered version would operate on electric power sources.

- Tailpipe Reduction Measures: In its contract documents, PANYNJ would require the use of Diesel Particle Filters (DPFs) or other measures with equivalent Particulate Matter (PM) removal efficiency for all nonroad diesel engines of 50 horsepower or greater wherever the implementation of such a device is feasible. However, there may be cases where DPFs would not be feasible for safety considerations, mechanical reasons, or where the technology would not function properly. In such cases, the constructor would submit a request for an exception for review and approval by PANYNJ prior to implementation, and in these cases, Diesel Oxidation Catalysts (DOCs) may be used. Only in cases where, for technical reasons, neither DPFs or DOCs can be used effectively, and where the operation cannot be performed by another engine or other means, would the use of diesel engines greater than 50 horsepower be allowed without tailpipe reduction measures, subject to the above-described approval measures.

- Newer Engines: In its contract documents, PANYNJ would require the use of post-1995 fuel injection engines, which meet the Tier II engine emissions standards, as defined in Title 40, Part 89.112. Exceptions will be made only for specific engines that are not yet commercially available as Tier II, and where the task cannot be reasonably accomplished using alternative engines or means which do comply with these demands. In such cases, the contractor would submit a request for an exception for review and approval by PANYNJ prior to implementation.

- Diesel Emission Mitigation (DEM) Plan: PANYNJ would require contractors to prepare a DEM Plan that shall address the control of emissions from all engines and vehicles including those that are not

equipped with emission control devices. As described in the EPCs, the DEM Plan would limit idling times on diesel powered engines to 3 minutes and would require that contractors locate diesel powered engines away from fresh air intakes.

- Dust Control Plan: As described in the EPCs, PANYNJ would require contractors to submit a Dust Control Plan. Among other things, the plan would contain protocols and procedures for the spraying of dust piles, containment of fugitive dust, and appropriate adjustment measures to accommodate changes in meteorological conditions.
- Verification: The effectiveness of measures to reduce construction period emissions depends on compliance. To that end, verification procedures would be implemented through construction specifications and contract documents. PANYNJ would verify mitigation and would identify opportunities to expand its implementation as part of its ongoing oversight and auditing of the Project's construction. Furthermore, verification procedures would be implemented in accordance with decisions of the Lower Manhattan Construction Command Center, including procedures for reporting updates to the public.
- Other Emissions Reduction Technologies: PANYNJ is and will continue to investigate additional means (e.g., fuel emulsions) to reduce NOx (NO and NO2) emissions, but it is not yet known whether these measures would reduce the effectiveness of the above described mitigation. Therefore, specific means to further reduce NOx have not been identified in the mitigation plan for the Preferred Alternative at this time. If this investigation results in additional means to reduce NOx without jeopardizing the PM reducction measures and if other constraints such as technological availability are resolved, then PANYNJ would implement these additional mitigation techniques, as appropriate.

As described in Chapter 9, "Air Quality,' these measures would reduce the maximum $PM_{2.5}$ increments of the Preferred Alternative by approximately 66 percent, and neighborhood scale increments would be reduced by half to below the threshold level of 0.1 $\mu g/m^3$,

Comment 92: The FTA and PANYNJ should have an objective, third-party for air quality monitoring. Otherwise, it may be a conflict of interest. (Orkin)

Response: Verification procedures would be implemented through construction specifications and contract documents to ensure the use of ULSD, maintenance of reduction technologies, dust suppression programs, and the use of grid power. PANYNJ would verify mitigation and would identify opportunities to expand its implementation as part of its ongoing oversight and auditing of the Project's construction.

Furthermore, as noted in the response to Comment 90 above, the Lower Manhattan Project Sponsors are currently investigating verification procedures and protocols for the Lower Manhattan Recovery Projects. This process will involve input from the New York State Department of Environmental Conservation to determine best practices for necessary data collection and reporting. The resultant, coordinated verification plan would be administered through the Lower Manhattan Construction Coordination Group or the Lower Manhattan Construction Command Center.

Comment 93: If exceedances of $PM_{2.5}$ occur during construction, how will PANYNJ address them? (Orkin)

Response: As described in the Response to Comment 91 above, PANYNJ has committed to mitigation that would reduce PM emissions by 66 percent as compared to the analysis presented in the DEIS. As such, exceedance is predicted only for a very small area immediately adjacent to Route 9A. The occurrence of such high levels would depend on the coincidence of peak background levels above the 98th percentile together with peak construction activity and extreme metrological conditions. At a very conservative maximum, this could occur on up to six days of the peak construction year. Such an occurrence, although possible, is not likely, and it would be a temporary situation, limited to a small area. Furthermore, this exceedance would not be expected to occur outside the peak construction year since activity would be reduced. Construction activity will be monitored in this area to ensure that emissions from construction equipment and extreme meteorological conditions are prevented from occurring concurrently.

Comment 94: The FEIS should provide a breakdown of the on-road and off-road emissions. (Hargrove)

Response: Chapter 9, "Air Quality" of the FEIS includes a distribution of on-road and off-road emissions. Of the total predicted project-generated emissions, 50 to 61 percent of VOC, 77 to 91 percent of NOx, 40 to 61 percent of PM_{10} and 78 to 88 percent of $PM_{2.5}$ would be from on–site sources.

Comment 95: The FEIS should provide a more detailed discussion of the NO_2 emissions and the technical data to support the conclusion that the analysis of NO_2 emissions is conservatively high as well as which other measures can be implemented to further minimize the emissions of $PM_{2.5}$ (Hargrove)

Response: The discussion of NO_2 emissions and their modeling assumptions have been expanded in Chapter 9, "Air Quality" and Chapter 15, "Cumulative Effects" of this FEIS. Since publication of the Draft Environmental Impact Statement, PANYNJ has worked with the Metropolitan Transportation Authority to further expand the Environmental Performance Commitments pursuant to construction-

period emissions. As described in this FEIS, PANYNJ has committed to the use of ultra-low sulfur fuel for all non-road equipment, limitation of unnecessary idling time on diesel powered engines to 3 minutes, Tier II standards for all non-road equipment, tailpipe reduction technologies for non-road engines of 50HP or greater, and the use of grid power, wherever possible, for engines that can operate on electric power such as welders; pumps; air compressors; and slurry, desanding, and grout mixers. Furthermore, PANYNJ is investigating the use of fuel emulsions. As noted in Chapter 9, "Air Quality," these combined measures would result in a substantial reduction in NO_2 emissions.

Comment 96: The mitigation measures identified in the DEIS do not affect the emissions of NO_2. The FEIS should assess a scenario that includes all of the stated mitigation measures from the DEIS as well as other measures that will significantly reduce emissions of particulate matter as well as NO_2 and NOx, in general. (Hargrove)

Response: PANYNJ has committed to the use of Tier II engines and the electrification of the equipment, such as welders; pumps; air compressors; and slurry, desanding, and grout mixers, that can operate on electric power, wherever feasible. These measures will substantially reduce the emission of NO_2. Furthermore, PANYNJ is investigating the use of other means (e.g., fuel emulsions) to reduce NO and NO_2 emissions.

Comment 97: The FEIS should be as definitive as possible on opportunities to reduce the emissions of NO_2 as the DEIS was for $PM_{2.5}$ emissions. This should include a description of the equipment that would be electrified and the degree to which electrification would reduce NO_2 emissions. (Hargrove)

Response: Refer to the above response to Comment 96.

Comment 98: Given that the New York Metropolitan Region is a nonattainment area for ozone, a cumulative inventory of emissions of NOx and VOC, as precursors to ozone formation, would be appropriate. (Hargrove)

Response: No emissions are expected under the Preferred Alternative in either the opening or design years. A mesoscale analysis of both on-road and off-road construction equipment and vehicles was prepared for this FEIS to identify the project's incremental increase in Nitrogen Dioxide (NO_2) and Volatile Organic Compounds (VOCs) during its construction. As compared to the projected regional emissions inventory in the New York ozone SIP for the same years—the on–road portion of the emissions would be less than 0.007 percent and 0.002 percent of the SIP mobile source NOx and VOC emissions, respectively; the on-site portion of the emissions would be 0.06 percent and 0.004 percent of the non-road SIP NOx and VOC emissions or less (depending on the year), respectively. The proposed mitigation for construction emissions, aimed at

reducing impacts in the immediate vicinity of the construction sites would also reduce the total region-wide emissions related to the Preferred Alternative.

NOISE AND VIBRATION

Comment 99: It is absolutely necessary that FTA and PANYNJ prevent and mediate potential construction-period vibration impacts to historic structures near the WTC site. It is recommended that state-of-the-art monitoring and stringent vibration standards be implemented. (Lustbader, Morrow)

Response: The executed Memorandum of Agreement includes protocols to prepare a CPP for historic structures that may be affected by construction-period vibration. Furthermore, the Memorandum of Agreement stipulates that PANYNJ would prepare a Resource Protection Plan for construction of the Project. (Refer to Chapter 6, "Cultural Resources" and Chapter 10, "Noise and Vibration" for more details regarding the components of these plans.)

Comment 100: Noise monitoring should be undertaken during construction. (Coangelo)

Response: PANYNJ would verify its noise mitigation measures and would identify opportunities to expand its implementation as part of its ongoing oversight and auditing of the Project's construction. This would include on-site noise monitoring during construction. Furthermore, verification procedures would be implemented in accordance with decisions of the Lower Manhattan Construction Command Center, including procedures for reporting updates to the public.

INFRASTRUCTURE AND ENERGY

Comment 101: FTA, PANYNJ, and the other Lower Manhattan project sponsors should implement an achievable time frame for the completion of infrastructure construction related to these projects. (Ayer)

Response: Supporting infrastructure for the Preferred Alternative would be constructed in phases. Most major infrastructure work associated with the Terminal would be complete in 2009.

Comment 102: FTA and PANYNJ should avoid any permanent impairment of utility infrastructure along the Route 9A pathway. (Ayer)

Response: The Preferred Alternative's concourse would traverse Route 9A below existing utility conduits. If these utilities are not relocated by NYSDOT as part of the Route 9A Project, PANYNJ would stabilize utility conduits as necessary to ensure that they would not be impacted during or after the concourse's construction.

Comment 103: FTA and PANYNJ should avoid any unnecessary additional costs to carriers associated with any infrastructure relocation or construction, to the extent carriers may be responsible for such costs. This would include avoiding multiple relocations, identifying any new routes as quickly as possible, providing adequate notice to all affected utilities, enlisting cooperation from building owners, and minimizing any disruption of telecom services to businesses and residential consumers. (Ayer)

Response: The construction of the Preferred Alternative would involve limited utility relocation within the WTC site and potentially along the west side of Church Street. PANYNJ would assume the cost for any utility relocation required to construct the Preferred Alternative. PANYNJ would coordinate with utility carriers prior to any necessary relocation.

Comment 104: FTA and PANYNJ must treat all carriers with infrastructure in the project areas in a non-discriminatory manner. This would include (but not be limited to) extending to these carriers any benefits Verizon receives with regard to easements, access to facilities, and recovery of restoration costs resulting from reconstruction projects under the Partial Action Plan for Utility Restoration and Infrastructure Rebuilding. (Ayer)

Response: PANYNJ would assume the cost for any utility relocation required to construct the Preferred Alternative. Operators will be properly informed of necessary utility work throughout the construction of the Permanent WTC PATH Terminal.

Comment 105: The DEIS described, as a benefit, the energy savings generated by a glass pavilion with natural illumination. However, the DEIS should have also examined the energy demanded by a subgrade pedestrian concourse, including a connection below Route 9A since the pre-September 11, 2001 concourse was not below-grade and since the former North Bridge was naturally illuminated. (Hemric)

Response: The pre-September 11, 2001 concourse was mostly enclosed with only a few access points directly to the street. Thus, the concourse itself did not benefit from natural illumination in most areas. The design of the Permanent WTC PATH Terminal will incorporate natural light from street-level through to the platform-level, which will reduce the need for artificial illumination as compared to the pre-September 11, 2001 facility.

While a pedestrian bridge over Route 9A would require less illumination than would a subgrade concourse during daytime hours, a major reduction in energy demand would not be realized. A bridge would be subject to natural heating during summer months and natural cooling during winter months, whereas, a subgrade concourse would have less variation in temperature throughout the

year. Thus, a bridge would require more energy for climate-control than would a subgrade concourse.

Comment 106: Telecommunications service, including emergency services, to Lower Manhattan may be disrupted or degraded, unless: PANYNJ ensures that the proposed underground pedestrian concourse does not disrupt or prevent Verizon's use of Route 9A or Church Street as a utility pathway. The proposed underground concourse has the potential to permanently impair Verizon's use of the Route 9A utility pathway. (Bachmore)

Response: The Preferred Alternative would not result in the relocation of utilities under Route 9A. There may be limited utility relocation along the west side of Church Street, but alternative pathways would be provided.

Comment 107: Since the various alternatives for the Lower Manhattan recovery projects each require a different relocation plan, it is imperative that the alternatives be narrowed and that any decisions regarding the relocation of the utilities be made be final and permanent. (Bachmore)

Response: Construction of the Preferred Alternative may require limited utility relocation along the eastern portion of the WTC site at the proposed location of the Terminal's connection with FSTC's Dey Street Concourse. PANYNJ would coordinate this relocation with efforts being undertaken by LMDC and MTA/NYCT to minimize any disruption to local utility operators.

Comment 108: The EIS does not disclose the adverse effects such as timing delays, service disruptions, disruptions to vehicular and pedestrian traffic, inconvenience to Lower Manhattan community, and wasted cost, if the utility relocation measures proposed by Verizon are not implemented. (Bachmore)

Response: The Preferred Alternative would not result in the relocation of Verizon's utility pathways beneath Route 9A. There may be limited utility relocation along the west side of Church Street. If Verizon utilities would be relocated, PANYNJ would coordinate relocation plans with the utility operator prior to their implementation.

CONTAMINATED MATERIALS

Comment 109: I am concerned that the DEIS finding that little hazardous materials remain in the project site is based on EPA data. (Orkin)

Response: USEPA data was not used to substantiate the finding presented in the DEIS. PANYNJ and LMDC have conducted Phase I and Phase II hazardous materials testing throughout the WTC site. NYSDOT has also conducted testing along Route 9A, in the vicinity of the proposed east-west connection for the

Permanent WTC PATH Terminal. All of these tests were conducted by licensed consultants under contact with the respective project sponsors.

NATURAL AND WATER RESOURCES

Comment 110: The PANYNJ should contact the National Oceanographic and Atmospheric Administration/Fisheries for information on Essential Fish Habitats and Federally-listed species and the New York State Department of Environmental Conservation for information on State-listed species. (Stilwell)

Response: Federal and state oversight agencies were contacted during the scoping process for the Permanent WTC PATH Terminal and the resultant correspondence is shown in Appendix G, "Natural and Water Resources." The reinstatement of the river water cooling system at the WTC site would be undertaken by LMDC and PANYNJ as part of the WTC Memorial and Redevelopment Plan. LMDC prepared an Essential Fish Habitat (EFH) Assessment of the Lower Hudson River estuary as part of its Final Generic Environmental Impact Statement (April 2004). (As noted in Chapter 13, "Natural and Water Resources," the EFH is available at LMDC's website, www.renewnyc.com). Subsequently, PANYNJ has filed a renewal application for the river water cooling system with the New York State Department of Environmental Conservation under a separate undertaking.

Comment 111: Given the importance of the Lower Hudson River estuary for aquatic species resources, it is recommended that a closed cooling system or one of the dry-cool technologies be used in the Permanent WTC PATH Terminal. If river water cooling is used, best management practices should be implemented to avoid impacts associated with impingement/entrainment and thermal discharge. (Stilwell)

Response: The river water cooling system includes two intakes located on the eastern shore of the Hudson River near the World Financial Center. River water cooling was used prior to September 11, 2001 and would be reestablished as part of the current redevelopment of the WTC site. The New York State Department of Environmental Conservation is currently reviewing PANYNJ's application to renew their State Pollutant Discharge Elimination System (SPDES) permit for the river water cooling system. As part of this application, PANYNJ has prepared a Best Technologies Available (BTA) study that specifies measures to protect fish eggs and larve from entrainment and entrapment associated with the systems intake grates. These measures include: 1) Using 3 gallons per minute (gpm)/ton chillers; 2) Variable speed pumps; and 3) Modifying the intake structure with 2 millimeter (mm) wedgewire screens to reduce the approach velocity to 0.5 feet per second (fps) with a corresponding river water flow of 120,000 gallons per minute (gpm).

While some level of impact to aquatic organisms due to entrainment of fish eggs (and much smaller numbers of larvae) is unavoidable utilizing the selected design, overall aquatic impacts are materially reduced from pre-September 11, 2001 conditions. The proposed system would eliminate the potential for impingement and would reduce entrainment of yolk-sac and post-yolk sac ichthyoplankton from pre-September 11, 2001 levels by an estimated 93 percent and 97 percent respectively. In fact, virtually all (approximately 98 percent) of the entrained organisms are eggs, which are subject to high rates of natural mortality and fecundity. By excluding life stages of entrainable organisms with higher natural survival rates, the selected design minimizes the adverse environmental impact of the cooling water intake structures.

The river water cooling system would be closed-circuit such that water extracted from the Hudson River would not be mixed with potable water or stormwater as it travels through the system. Therefore, the system would not alter the composition of Hudson River water.

Regulations set forth at 6 NYCRR Part 704 establish water quality standards governing thermal discharges to the waters of the state that requires. They require that "all thermal discharges to the waters of the State shall assure the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife in and on the body of water" [6 NYCRR §704.1(a)]. Part 704 also sets forth specific criteria for discharges that, if met, would assure compliance with the standard. The criteria for estuarine discharges include a maximum surface temperature of 90°F, a limit on the lateral extent of a 4°F temperature rise to two-thirds of the width of the receiving river, and a limit on the cross-sectional area with a 4°F temperature rise to one-half of the river cross section. Because of Hudson River hydrodynamics, the maximum surface temperature of 90°F is the critical criterion to be met.

The BTA study specifies that the maximum designed change in temperature (ΔT) of the proposed river water cooling system is 10°F. Therefore, cooling water flow discharges would not result in temperatures in excess of the 90°F criterion, since the maximum ambient surface water temperature is 80°F.

Comment 112: It is recommended that measures be implemented to avoid or reduce the likelihood of impacts to migratory birds. Examples of these measures that would be applicable to this project include 1) minimizing window lighting and using strobes on aerial towers/antenne for aircraft beacons and orientating reflective window surfaces by using etched glass or adhesive films. (Stillwell)

Response: As described in the FEIS, PANYNJ will incorporate architectural and landscaping features into the project's design that will reduce the potential for both daytime and nighttime bird strikes. The measures identified above have been included in the proposed mitigation plan.

COASTAL ZONE MANAGEMENT

Comment 113: The evaluation of the project's consistency with Policy 10 of New York City's Waterfront Revitalization Program is inaccurate. The DEIS should discuss the adverse impact of the project on the WTC site and the project's failure to "retain and preserve designated historic resources." (Gardner)

Response: The full Policy 10 of the New York City Waterfront Revitalization Program states that a project should "protect, preserve, and enhance resources significant to the historical, archaeological, and cultural legacy of the New York City coastal area." Furthermore, Policy 10.1 states that the project should "retain and preserve designated historic resources and enhance resources significant to the coastal culture of New York City." The WTC site was not been determined historically significant for its role in the "coastal culture of New York City." Therefore, the finding presented in the DEIS is considered appropriate as it pertains to the Local Waterfront Revitalization Program.

Comment 114: The statement that the project "would not have an adverse impact on coastal resources" is incorrect and inconsistent with the finding that historic properties would be adversely impacted by the project. (Gardner)

Response: Refer to the above response to Comment 113.

CUMULATIVE EFFECTS

Comment 115: It would be advisable to produce a composite drawing to help the public understand the complete vision for the area and to keep them informed on a daily basis during construction. (Carey)

Response: In an April 2003 speech to the Alliance for Downtown New York, Inc., Governor Pataki laid out the vision for the redevelopment of Lower Manhattan. The vision was the Libeskind plan for the WTC site, which resulted in the programming of spaces for the World Trade Center Memorial and Redevelopment Plan, the Fulton Street Transit Center, the Route 9A Project, and the Permanent WTC PATH Terminal. Subsequently, PANYNJ has been coordinating with NYSDOT, LMDC, and MTA/NYCT to program spaces as specific project plans evolve. These plans have been made available to the public through the news media, public exhibitions, and the internet.

In accordance with Governor Pataki's November 22, 2004 Executive Order, the Lower Manhattan Construction Command Center will communicate with residents, businesses, and the general public through a communications director working with each agency's communications and public outreach personnel; providing a central focus on issues critical to the local community and the

construction industry, by coordinating initiatives, public outreach, and information.

Comment 116: The DEIS fails to adequately account for the cumulative effects of other planned and on-going projects on the WTC site. Of special concern is the relationship between the Permanent WTC PATH Terminal and the WTC Memorial and Redevelopment Plan. The LMDC's Programmatic Agreement is legally bound to provide "reasonable and appropriate access" to the tower footprints, but FTA and PANYNJ are not signatories. The final design of the Permanent WTC PATH Terminal will be a major factor in determining the extent and quality of access to the footprints. Thus, actions taken by the FTA and PANYNJ under the Memorandum of Agreement to minimize disturbance to the tower footprints, enhance the amount and quality of access, and/or avoid or minimize "use" of the footprints may be rendered moot by actions taken by the LMDC pursuant to their Programmatic Agreement. (Gardner, Gardner et al, Sanchis III et al 1, Sanchis III et al 2)

Response: The executed Memorandum of Agreement provides for stipulations to address potential cumulative effects on the WTC site. As described in the Memorandum of Agreement, PANYNJ would request that all agencies constructing projects within the WTC site submit preliminary and pre-final documents to PANYNJ. PANYNJ and its designated historic preservation consultant would consult with SHPO and the Lower Manhattan Emergency Preservation Fund to asses whether there would be the potential for a cumulative adverse effect from the Permanent WTC PATH Terminal and other WTC site projects based on the preliminary and pre-final plans. If SHPO and PANYNJ, agree that Project plans or completed activities have resulted in or are likely to result in cumulative adverse effects on the WC site, then PANYNJ shall consider measures with respect to the Permanent WTC PATH Terminal to mitigate or minimize these effects, including technical or financial measures for its protection, stabilization, or repair and Project design modifications. PANYNJ would make its documentation of potential cumulative effects and accompanying mitigation plans available for review by the National Park Service, the Advisory Council on Historic Preservation, the Lower Manhattan project sponsors, and the Section 106 consulting parties. PANYNJ's plans to minimize or mitigate adverse cumulative effects would also consider the stipulations within the Programmatic Agreements for the WTC Memorial and Redevelopment Plan, the Route 9A Project, and the Fulton Street Transit Center.

Comment 117: FTA, the Federal Highway Administration, and the LMDC should request a formal determination of National Register eligibility for the WTC site from the Keeper of the National Register of Historic Places. The existing determination is a "lowest common denominator" document that is badly flawed by the

reluctance of at least one of the agency/authors to even acknowledge that the WTC site is historic in any way. (Gardner)

Response: See the above response to Comment 42.

Comment 118: The statement that LMDC identified no adverse effects with respect to the WTC site is incorrect. Although LMDC did not make such a determination, it was effectively superseded when they entered a Programmatic Agreement with the SHPO and the Advisory Council on Historic Preservation, the purpose of which was to address "adverse effects on historic properties." (Gardner)

Response: Chapter 15, "Cumulative Effects," of this FEIS reflects LMDC's determination as follows: "LMDC identified potential adverse effects with respect to the WTC site and prepared and executed Programmatic Agreements that will guide the design and construction of their project with respect to potential impacts."

Comment 119: FTA and PANYNJ have attempted to minimize encroachment over the perimeter column bases which outline the footprints of towers one and two of the World Trade Center, but the cumulative impact of additional construction activities could minimize access to these bases. The FTA and PANYNJ should adhere to the design and construction goals outlined in the DEIS. (Lustbader, Sanchis III et al 1, Sanchis III et al 2)

Response: The Memorandum of Agreement for the Permanent WTC PATH Terminal provides for specific measures to minimize the short- and long-term effects of the Terminal on the perimeter column bases. These commitments consider the provisions set forth in the Programmatic Agreement among LMDC, the Advisory Council on Historic Preservation, and SHPO for the WTC Memorial and Redevelopment Plan.

Comment 120: Chapter 6, "Cultural Resources" and Chapter 10, "Noise and Vibration" state that the construction protection plan will be based on the requirements laid out in the New York City Department of Buildings Technical Policy and Procedure Notice #10/88. The Notice deals with procedures for avoiding damage to adjacent structures resulting from adjacent construction of a single project. It does not include procedures, vibration standards, and monitoring programs for cumulative construction projects. (Sanchis III et al 2)

Response: Pursuant to the stipulations of the Project's executed Memorandum of Agreement, PANYNJ would coordinate its Construction Protection Plan for the Barclay-Vesey Building with LMDC. It would coordinate its construction Protection Plan for St. Paul's Chapel and Graveyard and the Former East River Savings Bank with MTA/NYCT and LMDC. PANYNJ's Construction Protection Plans for the Beard Building and 114-118 Liberty Street would be coordinated with LMDC.

Comment 121: It is recommended that the Terminal's construction be coordinated through a single entity charged with overseeing all of the Lower Manhattan construction to reduce the potential cumulative impacts on surrounding historic properties. (Lustbader, Sanchis III et al 2)

Response: On November 22, 2004, New York State Governor George E. Pataki signed an Executive Order creating the Lower Manhattan Construction Command Center. The Command Center will administer the construction of project's within Lower Manhattan that either 1) have a construction value of more than $25 million; 2) require governmental actions or permits or; 3) require work within in a City or State street or highway.

The Command Center will coordinate community information, construction logistics, utility coordination, environmental compliance and safety, and diversity and equal opportunities in employment. The Command Center will be managed by an Executive Director to be appointed by the Governor and the Mayor of the City of New York. The Mayor will also appoint a Director of City Operations to act as a liaison between the Command Center and City officials. An Executive Committee, to be chaired by the Executive Director, will be appointed to facilitate communications between the Command Center, the Lower Manhattan Project Sponsors, and other key city and state departments and agencies.

As stated in the Executive Order, the functions of the Command Center will be:

- "Coordinating the work of the participants in the rebuilding process and ensuring that the construction in Lower Manhattan proceeds as scheduled by mediating conflicts in schedules and street and site access between construction projects, agencies, and the Lower Manhattan Community;"
- "Coordinating protocols, contract requirements and activities outside of individual project limits through planning on a daily basis throughout construction for government agencies, developers, construction managers, general contractors, and contractors;"
- "Coordinating construction projects to minimize inconvenience for residents, workers, pedestrians, vehicles, and commuters;"
- "Ensuring that the Lower Manhattan area remains neat, clean and orderly throughout construction;"
- "Communicating with residents, businesses, and the general public through a communications director working with each agency's communications and public outreach personnel; providing a central focus on issues critical to the local community and the construction industry, by coordinating initiatives, public outreach, and information;" and
- "Utilizing technology to facilitate coordination of projects."

Furthermore, pursuant to the stipulations of the executed Memorandum of Agreement for the Permanent WTC PATH Terminal, PANYNJ is committed to

coordinating with the appropriate Lower Manhattan Project Sponsors for potential cumulative effects on the WTC site, the Hudson River Bulkhead, the Barclay-Vesey Building, St. Paul's Chapel and Graveyard, the Former East River Savings Bank, the Beard Building, and 114-118 Liberty Street.

COMMITMENT OF RESOURCES

Comment 122: The DEIS should identify that the project's use of the WTC site constitutes a permanent, irretrievable and irreversible commitment of a historic resource. (Gardner)

Response: Chapter 16, "Commitment of Resources" of the DEIS identified the short-term use of historic and archaeological resources during the construction period. This FEIS also notes the Project's long-term use of the WTC site, which is a National Register-eligible historic resource. The FEIS also references the Memorandum of Agreement and its stipulations to avoid, minimize, or mitigate both the short- and long-term use of historic resources.

DRAFT SECTION 4(F) EVALUATION

Comment 123: The Draft Section 4(f) Evaluation describes 4 (five if one counts a variation) avoidance alternatives. Three of these (no action, relocation of PATH projections, and locate terminal off-site) are clearly not serious alternatives. Real alternatives include the Location 1 alternative described in Chapter 2 and a variety of alternatives involving design variations to the latter must be discussed. All of these alternatives would result in a reduction in the "use" of the WTC site. (Gardner, Sanchis III et al 2)

Response: As noted in the Final Section 4(f) Evaluation, which is included in this FEIS, the U.S. Department of Interior has agreed that there are no reasonable and prudent alternatives to the use of the historic property, which is defined as the 16-acre WTC site, to meet the transportation purpose and need of the project. Therefore, FTA and PANYNJ have developed measures to minimize harm through the project's Section 106 consultation process.

Comment 124: The Draft Section 4(f) Evaluation should clearly state that the project "would" rather than "may" use historic properties. (Gardner)

Response: The findings presented in the Section 4(f) Evaluation reflect specific impacts to cultural resources where known and includes the stipulations of the Project's Memorandum of Agreement that minimize harm to these resource. For yet determined impacts, the Final Section 4(f) Evaluation describes the potential impact and appropriate measures to minimize harm should impacts occur.

Comment 125: The description of the project's effects on historic resources and potential mitigation are identical to text presented in Chapter 6, "Cultural Resources." The Section 4(f) Evaluation should incorporate comments made on Chapter 6. (Gardner)

Response: The Final Section 4(f) Evaluation is updated to reflect changes made to Chapter 6, "Cultural Resources," in response to public comments on the DEIS.

Comment 126: The Section 4(f) Evaluation identifies physical remnants from the site that were listed in the Coordinated Determination of Eligibility. However, the list is incomplete. Furthermore, this list should be expanded to compensate for deficiencies in the Coordinated Determination of Eligibility that resulted from the incorrect application of the integrity standard and the failure to include the area within the tower footprints. (Gardner)

Response: The list of effects presented in the Draft Section 4(f) Evaluation reflects the findings presented in the Draft Finding of Effects pursuant to Section 106 of the National Historic Preservation Act. The Project's Section 106 Consulting Parties were invited to comment on the Draft Finding of Effects and changes were made in the FEIS pursuant to these comments. The FEIS discloses the Preferred Alternative's effects on the WTC site, including the footprint areas of the former North and South Towers.

Comment 127: The Draft Section 4(f) Evaluation states that the No Action Alternative still has the potential to remove or alter contributing elements of the WTC site. However, this is the case only because it is assumed that the World Trade Center Memorial and Redevelopment Plan would result in the need for additional egress and access locations and ventilation structures. If FTA and PANYNJ are coordinating with the LMDC as claimed, then it should be possible to develop a "no action" alternative that would not require the "use" of the historically significant WTC site features and still accommodate a Memorial. (Gardner)

Response: The No Action Aclternative for the Permanent WTC PATH Terminal has been clarified, and this alternative would not physically alter or remove historic structures or remnants on the WTC site. However, other changes in the WTC site could potentially occur as a result of the No Action Alternative, but the impacts of these changes are speculative at this time.

Comment 128: Figure 4(f)-2 should be modified to clearly show that the tower footprints in their entirety, not just the perimeter box beam columns, are the contributing elements to the significance of the WTC site, and a second figure should be provided that shows remnant structures within the footprints should be included. (Gardner)

Response: Figure 4(f)-2 identifies some of the remaining remnants and structures listed in the Coordinated Determination of Eligibility. Other column remnants and infrastructure on the WTC site are identified in the Determination of Eligibility. Furthermore, the revised finding of effects in the Final Section 4(f) Evaluation discloses the Preferred Alternative's effects on the footprints.

Comment 129: Avoidance alternatives 4A and 4B are incorrectly labeled in Figure 4(f)-3. (Gardner)

Response: Figure 4(f)-3 of the Final Section 4(f) Evaluation reflects the correct labeling of Alternative 4A, "Church Street" and Alternative 4B, "Vesey Street."

APPENDIX B: DRAFT FINDING OF EFFECTS

The following comments were submitted by Section 106 Consulting Parties pursuant to the Draft Finding of Effects document that was included as part of the DEIS. The Draft Finding of Effects document was incorporated into analysis presented in Chapter 6, "Cultural Resources," Chapter 15, "Cumulative Effects," and the Draft Section 4(f) Evaluation of the DEIS. Therefore, many of the comments made on the Finding of Effects have been noted above under the appropriate technical chapter. The comments below, however, are specific to the document that appears in Appendix B of the DEIS. This document was not updated as part of the preparation of the FEIS; however, applicable text and graphics in Chapter 6, "Cultural Resources," and the Final Section 4(f) Evaluation reflect these comments, as appropriate.

Comment 130: The description of the undertaking is not detailed enough to permit an independent evaluation of how, and to what degree, the historic resources within the project's Area of Potential Effect will be affected. While the figures in the Draft Finding provide some information, it is not possible to relate how what is being proposed will affect individual resources that contribute to the significance of the WTC Site. Much more detailed descriptions are necessary. For example, in referring to the E-Train passageway, the Draft Finding only says that the station will be reconfigured and that certain elements may be relocated. No description or drawings of the planned reconfiguration are provided, and no mention is made of which elements "may" be relocated. The fact that the FTA and the PANYNJ cannot state with certainty which elements are proposed for relocation suggests that any finding of effect is premature. (Gardner et al, Gardner)

Response: The Permanent WTC PATH Terminal is currently in its design stage. It is known that the project will impact the approximately 16-acre, National Register-eligible WTC site, but the extent of this impact to specific remaining remnants and structures on the WTC site was uncertain at the time of the publication of the DEIS. Subsequent to publication of the DEIS, FTA and PANYNJ held four meetings with the project's Section 106 consulting parties. At these meetings, FTA and PANYNJ provided additional information regarding the Terminal's design and its potential impacts on remaining remnants

and structures within the WTC site. Where specific effects are known, the findings presented in the FEIS have been updated, and mitigation measures have been developed. In cases where effects remain uncertain, the executed Memorandum of Agreement provide for stipulations to address these potential impacts should they occur.

Comment 131: It is unclear where the ventilation which may be constructed "adjacent to Route 9A" would be located. A graphic showing the location would be helpful, as would a description of the ventilation structure. (Gardner et al)

Response: As reflected in Chapter 2, "Project Alternatives" of this FEIS, the ventilation structures would be located within the median of Route 9A atop Tunnels E and F of the PATH system.

Comment 132: There is no discussion of what mitigative measures the FTA is proposing to avoid or minimize adverse effects to the WTC Site. Mitigative measures that have been considered and discarded, if any, should be identified. (Gardner et al)

Response: A discussion of preliminary mitigation measures was provided in Chapter 6, "Cultural Resources" of the DEIS. Since publication of the DEIS, FTA and PANYNJ have executed a Memorandum of Agreement with specific commitments to avoid, minimize, and/or mitigate adverse impacts to the WTC site. The full text of the MOA is presented in Appendix B of this FEIS, and Chapter 6, "Cultural Resources," summarizes the commitments.

Comment 133: It is unclear exactly what this Figure 2 is attempting to show. (Gardner et al)

Response: Figure 2 reflects the programming of spaces within and immediately adjacent to the WTC site at street-level.

Comment 134: Figure 4 should clearly identify the entire area occupied by the footprints of the Twin Towers as a historic resource. (Gardner et al)

Response: Figure 4 identifies the remaining remnants and structures listed in the Coordinated Determination of Eligibility. Although the Coordinated Determination of Eligibility did not specifically reference the footprints as a remaining remnant or structure on the WTC site, the revised finding of effects presented in Chapter 6, "Cultural Resources," of this FEIS discloses the Preferred Alternative's effects on the footprints. ✳

A. INTRODUCTION AND METHODOLOGY

Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966 (49 USC §303) prohibits the Secretary of Transportation from approving any program or project that requires the "use" of 1) any publicly owned land in a public park, recreation area, or wildlife and waterfowl refuge of national state, or local significance, or 2) any land from a historic site of national, state, or local significance (collectively "Section 4(f) resources"), unless there is no feasible and prudent alternative to the use of such land and the project includes all possible planning to minimize harm to the resource.

With respect to the term "use", the USDOT, Federal Transit Administration (FTA) considers three possible ways in which a project could involve a "use" of a resource:

- When land is permanently incorporated into a transportation facility;
- When there is a temporary occupancy of land that is adverse in terms of the statute's preservation purpose; or,
- When there is a constructive use of land.

Constructive use occurs when the project does not directly incorporate land from a Section 4(f) resource, but the project's impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only when the protected activities, features, or attributes of the resource are substantially diminished.

With respect to historic sites, no constructive use would occur when:

- Compliance with the requirements of Section 106 of the National Historic Preservation Act (NHPA; 16 USC §470) results in an agreement with the State Historic Preservation Officer (SHPO) of "no effect" or "no adverse effect";
- The projected noise and vibration levels of the proposed transit project do not exceed the relevant noise and vibration impact criteria; or
- The projected noise levels exceed the thresholds because of existing noise, but the increase in noise due to the project is barely perceptible.

This Section 4(f) evaluation has been prepared pursuant to the finding that the Preferred Alternative for the Permanent WTC PATH Terminal would have an adverse effect on the National Register-eligible WTC site and the Hudson River Bulkhead. The Project may also have temporary vibration impacts to nearby historic structures during its construction and may disturb as yet unverified archaeological resources that could remain on the WTC site.

The sections below describe:

- The applicability of Section 4(f) to the Project;
- The Section 4(f) properties;
- The probable use of the Section 4(f) properties by the Project Alternatives;
- Avoidance alternatives to the use of Section 4(f) properties; and
- Planning efforts to minimize harm to the Section 4(f) properties where avoidance is not feasible or is not prudent.

B. APPLICABILITY OF SECTION 4(f) TO THE PROJECT

As described above, a Section 4(f) evaluation is prepared when a transportation project proposes using land from a publicly owned park, recreation area, wildlife or waterfowl refuge, or from a historic site of national, state, or local significance. Since this Project would not use publicly owned parkland, recreational areas, or wildlife or waterfowl refuges, Section 4(f) does not apply for these types of potential resources. However, the Section 4(f) properties described below may be used during construction and/or operation of the Permanent WTC PATH Terminal.

- The Preferred Alternative would be constructed within the boundaries of the approximately 16-acre WTC site (National Register-eligible) and would therefore use this historic resource;
- The Preferred Alternative would require the use of the Hudson River Bulkhead (State and National Register-eligible);
- The Preferred Alternative may require alteration or removal of as yet determined archaeological resources within the eastern portion of the WTC site.
- The Preferred Alternative's construction may result in vibration impacts to known or potential historic buildings within 90 feet of the Project's construction zone.

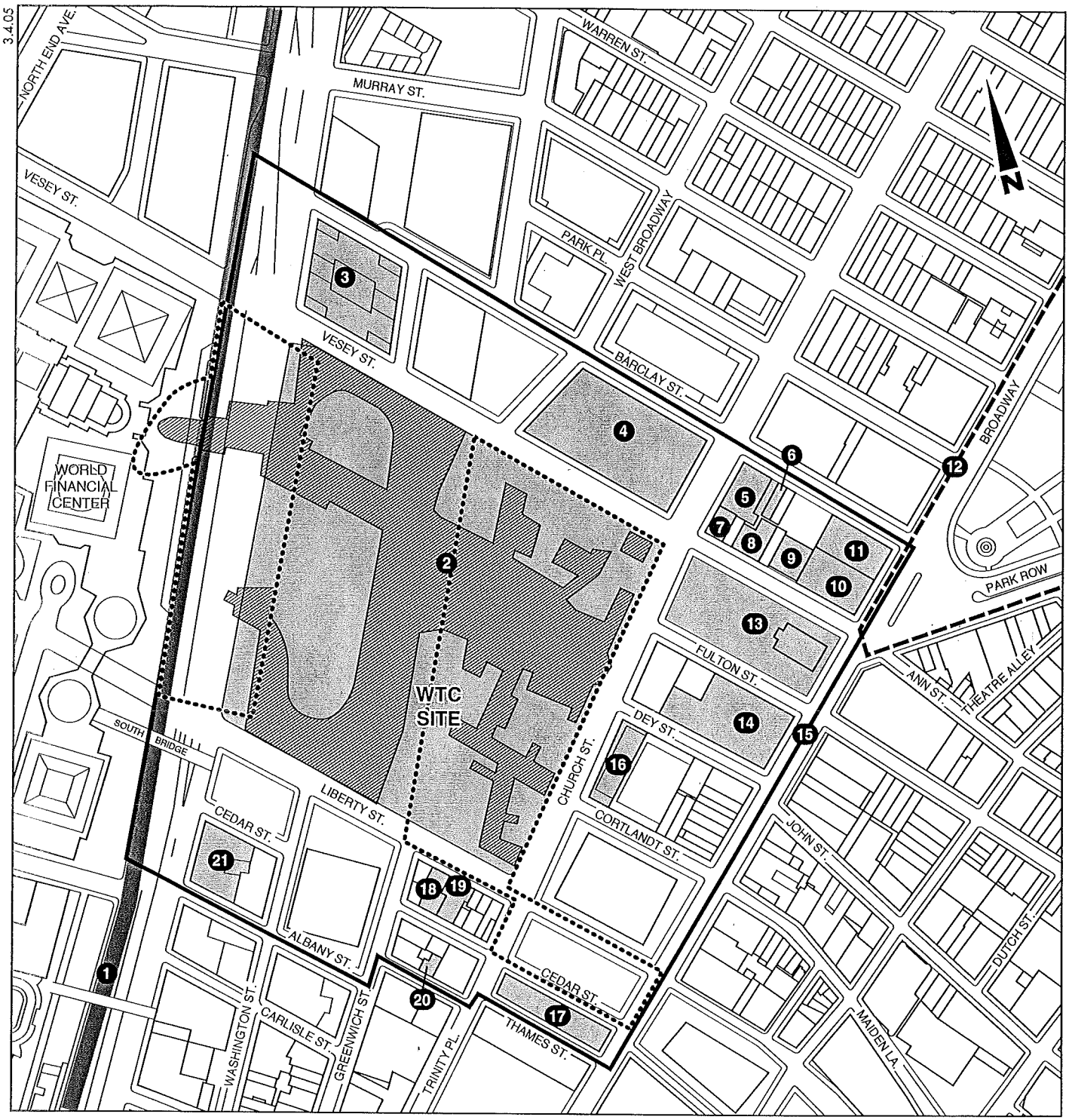
These resources are shown in Figure 4(f)-1

WTC SITE

DESCRIPTION OF THE SECTION 4(f) PROPERTY

The WTC site meets National Register criteria for its association with the September 11, 2001 terrorist attacks on the WTC's two 110-story towers, which on a national level constitute "historic events that have made a significant contribution to the broad patterns of our history." As stated in the Coordinated Determination of Eligibility (DOE) for the WTC site, "the significance of the WTC site is reflected by its integrity of location, setting, feeling, association, and materials" (see Appendix B). The Coordinated DOE also states that some physical remnants on the WTC site possess integrity of materials, including the bathtub, basement walls, and the surviving bases of steel structural columns.

The boundaries of the eligible property are Route 9A, Vesey Street, Church Street, and Liberty Street. Within these boundaries, the site retains various remnants of the former WTC complex and temporary structures introduced as part of the rescue and recovery operations that followed the attacks. As described in the Coordinated DOE, these physical features of the site contribute to its significance. These items include:



Permanent WTC PATH Terminal

Area of Potential Effect for Archaeological Resources

Area of Potential Effect for Historic Resources

Known Historic Resource

Known Historic District

0 200 500 FEET

SCALE

Refer to Table 4(f)-1 for Site Numbers

PERMANENT WTC PATH TERMINAL
Final Environmental Impact Statement

Figure 4(f)-1
Area of Potential Effect

- Tower Perimeter Column Bases (constructed pre-September 11, 2001);
- Bathtub Slurry Walls (constructed pre-September 11, 2001) and Tiebacks (constructed post-September 11, 2001/temporary);
- Northwest Remnant Subgrade Structures (constructed pre-September 11, 2001);
- Recovery and Construction Ramp (constructed post-September 11, 2001/temporary);
- North and South Tunnel Projections from West Wall (constructed pre-September 11, 2001);
- H&M (Hudson & Manhattan) Remnants (constructed pre-September 11, 2001);
- Other Vehicular Ramps (constructed pre-September 11, 2001);
- PATH Tracks and Substation (reconstructed post-September 11, 2001);
- Existing WTC PATH Main Entrance and Concourse, Sidewalks, Fencing, Existing PATH Platforms/Mezzanine (constructed post-September 11, 2001/temporary);
- Passageway to the NYCT WTC Subway Station (E-Train) (constructed pre-September 11, 2001);
- Steel Beams in Cross Form (constructed post-September 11, 2001);
- Plaza and Subway Access from Vesey Street (constructed pre-September 11, 2001); and
- Cooling Water Pipes (constructed pre-September 11, 2001).

PROBABLE USE OF THE SECTION 4(f) PROPERTY

No Action Alternative

Under the No Action alternative, the temporary PATH station would remain in service until either 1) elements of the WTC Memorial and Redevelopment Plan would preclude operations, 2) the station would not safely accommodate passenger demand, or 3) the major elements of the station would exceed their useful service life. In each case, it is assumed that as redevelopment efforts occur in and around the WTC site, modifications to the physical characteristics and operation of the station would be required to maintain temporary PATH service to the extent possible. These modifications may include additional access and egress locations and the construction of ventilation structures should the tracks and platforms be enclosed by the above-construction of the WTC Memorial and Redevelopment Plan.

Preferred Alternative

The Preferred Alternative for a Permanent WTC PATH Terminal would consist of five levels—track and platform, mezzanine, concourse (main), concourse (balcony), and street-level. Elements of the Terminal would be located throughout the WTC site. The proposed tracks and platforms would be in essentially the same location as the temporary WTC PATH station but would be expanded and configured to accommodate a fourth platform and 10-car trains. A mezzanine would be constructed immediately above the tracks and platforms. The concourse would extend in an east-west direction through the site from Route 9A to Church Street with intermediate connections to the Freedom Tower and other elements of the WTC Memorial and Redevelopment Plan. It would also extend in the north-south direction east of the 1 and 9 subway line from the northeast quadrant of the site to Liberty Street. The concourse would provide connections to the Cortlandt Street (R and W), Cortland Street (1 and 9), and World Trade Center (E) subway stations. A street-level terminal building would be constructed west of Church Street between Fulton and Dey Streets.

The Preferred Alternative is being planned to support PATH's system-wide improvements, PATH's operating requirements, and future ridership demand. Each of these factors results in specific requirements for the design of the Terminal's platforms and tracks, and as such, it has been determined that a 5-track, 4-platform station is needed. Further details on the selection of 5-track, 4-platform configuration as well as alternative track and platform schemes evaluated in conjunction with project planning are provided in Appendix C of the FEIS.

The DEIS noted that the removal of portions of the northwest remnant sub-grade structures on the WTC site may be undertaken as part of the Terminal's construction. However, subsequent to the publication of the DEIS, the removal of the northwest remnant sub-grade structures have been undertaken as an independent action pursuant to the stipulations of the Programmatic Agreement prepared for the WTC Memorial and Redevelopment Plan.

The construction of the Preferred Alternative would not alter the location or setting of the WTC site. However, because it may result in the removal or alteration of remaining remnants and structures on the site, it could diminish the site's integrity of feeling, association, and materials (see Appendix B). The following describes the specific impacts of the Preferred Alternative on the various elements of this Section 4(f) resource. The location of these remaining remnants and structures is shown in Figure 4(f)-2.

- ***Tower Perimeter Column Bases with Other Column Bases and Infrastructure*** (constructed pre-September 11, 2001): There were 84 perimeter columns extending into the bedrock that would outline the North Tower façade, and 73 perimeter columns extending into bedrock that would outline the South Tower façade. The original subgrade column grid in the WTC bathtub was configured to span above the former Hudson & Manhattan tunnels traversing the bathtub, as well as the new PATH tracks (there were 84 perimeter columns for the South Tower appearing above grade). In addition, approximately 34 of the South Tower columns were within the existing PATH right-of-way area (interspersed with tracks, electrical equipment, and other infrastructure), and 39 were outside the PATH right-of-way area. During the post-September 11, 2001 emergency recovery operations conducted by the City of New York, all of these Tower perimeter columns were truncated such that only the bases remain. During subsequent construction of the temporary WTC PATH station, all of the column bases within the PATH right-of-way were either obscured to some extent or removed for installation of the temporary WTC PATH station's track sheds, utilities, duct banks, conduits, and other PATH infrastructure.

  As described in the project's Memorandum of Agreement (MOA), PANYNJ shall, to the maximum extent feasible, preserve in place 84 column base remnants in the North Tower and 39 column base remnants in the South Tower at the existing floor at elevation 242 (58 feet below Sea Level) that outline the footprints of the former Twin Towers at the WTC site and are not located in the PATH right-of-way. However, up to 16 column bases in the North Tower and 3 column bases in the South Tower would be temporarily or permanently removed.

  There would be various site infrastructure elements supporting the Preferred Alternative within the PATH right-of-way, including utility lines traversing the outline of the Tower perimeter column bases, and utility rooms and structures located within the area outlined by the perimeter column bases. Although these would not disturb the perimeter column bases themselves, these elements may somewhat impact visibility and accessibility to the Tower perimeter column bases. The Preferred Alternative may also include utility lines that cross the footprints of the former North and South Towers at an elevation above the existing floor

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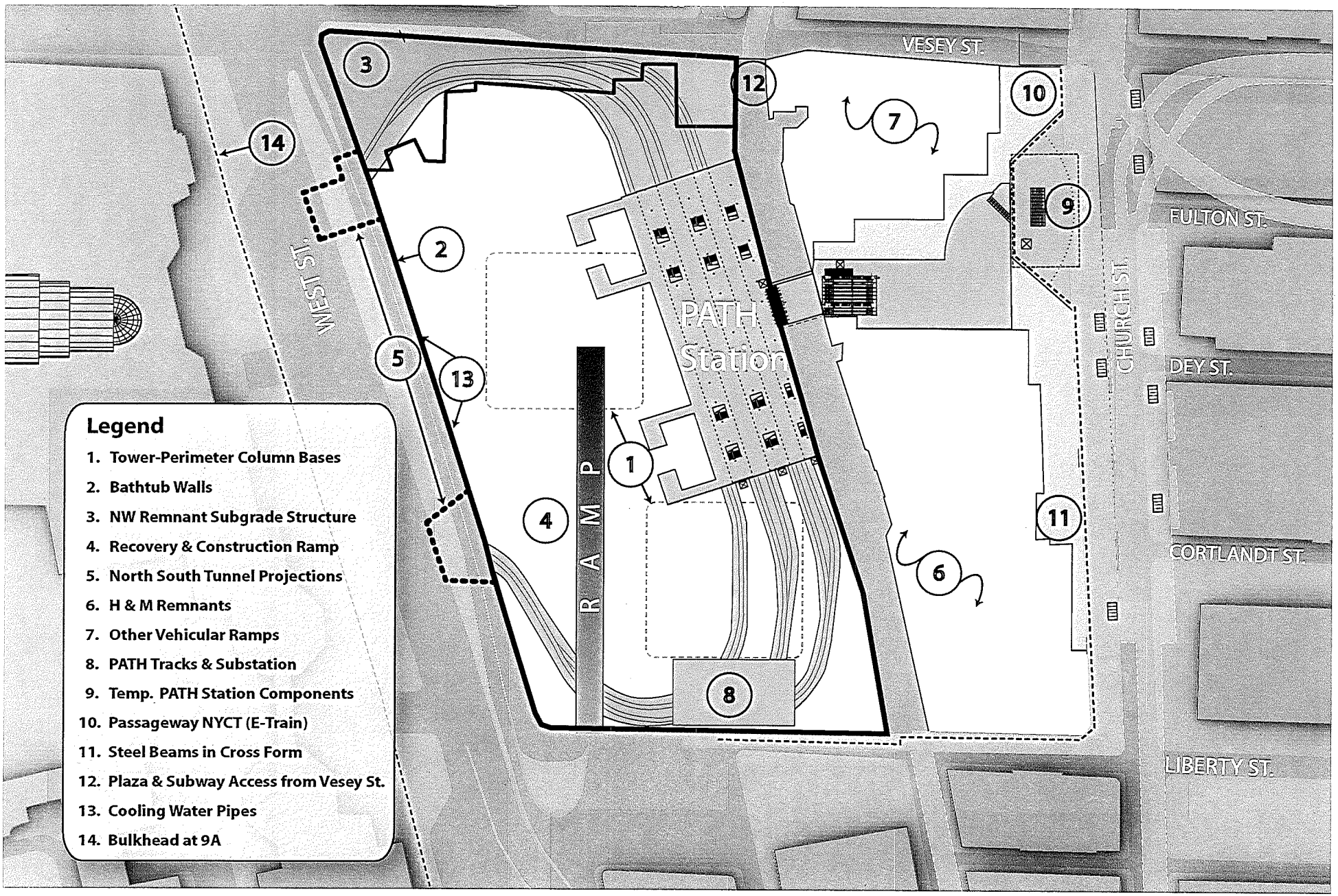


Figure 4(f)-2

Remaining Remnants and Structures on the WTC Site

of the WTC site (Elevation 242 or 58 feet below Sea Level). Under current plans, these utilities would be at Elevation 264 (36 feet below Sea Level). These utility lines would serve the joint infrastructure needs of both the Permanent WTC PATH Terminal and the WTC Memorial and Redevelopment Plan.

The total extent of the North Tower footprint at the lowest level, at approximately elevation 242 (58 feet below sea level) to be permanently occupied by any portion of the Project will be approximately 1,600 square feet and will not exceed 4 percent of the North Tower footprint area. The total extent of the South Tower footprint at the lowest level, at approximately elevation 242 (58 feet below sea level) to be permanently occupied by any portion of the Project will be approximately 21,615 square feet currently occupied by the WTC PATH facility, plus an additional 2,000 square feet required by the Project, and will not exceed 53 percent of the South Tower footprint area.

During the construction of the Preferred Alternative, PANYNJ would install a temporary track west of the existing Track 5. This temporary track would be used to maintain PATH operations while rehabilitation work is undertaken on other PATH tracks. The temporary track would cover column bases and footprint area outside the existing PATH right-of-way during the construction period, but the track would be removed upon completion of the permanent tracks.

- ***Bathtub Walls*** (constructed pre-September 11, 2001) and Tiebacks (constructed post-September 11, 2001/temporary): All four of the slurry walls forming the "bathtub" would require some modification in order to ensure their continued structural function, which is to secure the "basement" of this portion of the WTC site from the high water table resulting from the site's proximity to the Hudson River.

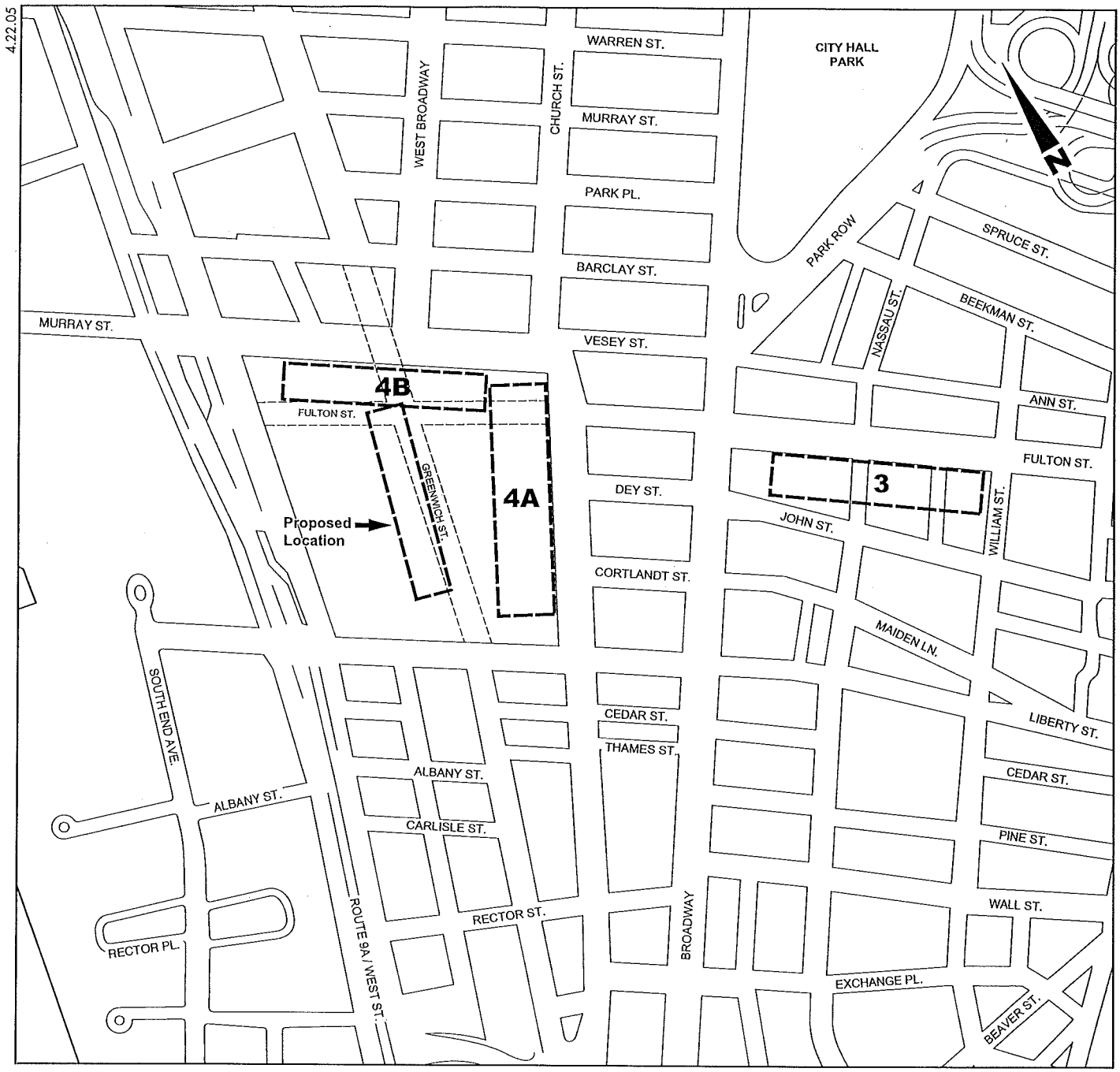
  The Preferred Alternative includes the reinforcement of portions of the basement walls to ensure their structural integrity and to support future redevelopment of the WTC site, including the Permanent WTC PATH Terminal. A portion of the approximately 70 foot high west slurry wall, with tieback caps exposed, is proposed to remain visible and accessible to the public (a separate undertaking), and another portion of the west wall would be pierced (in a location away from the proposed exposed section) for the east-west pedestrian concourse below Route 9A. The remainder of the west wall would be protectively lined as part of the Preferred Alternative. PANYNJ would also reinforce portions of the east bathtub wall abutting NYCT's 1 and 9 line that were not previously reinforced. If other development on the WTC site does not move forward according to current schedules or plans, it may also be necessary to reinforce portions of the north bathtub wall east of Freedom Tower and portions of the south bathtub wall above the existing PATH substation. Where liners are installed, existing tieback caps would remain although their projections would be subsumed within the concrete of the liners.

- ***Recovery and Construction Ramp*** (constructed post-September 11, 2001/temporary): The support foundation for the ramp would be relocated to allow for temporary relocation of an existing track. The ramp would remain during early construction of the Preferred Alternative and would then be removed.

- ***North and South Tunnel Projections from West Wall*** (constructed pre-September 11, 2001): Structural modifications would be made to the projections to accommodate the temporary Track 6.

- ***H&M Remnants*** (constructed pre-September 11, 2001): The cast-iron ring tubes in the east slurry wall of the bathtub would be removed for construction of the Preferred Alternative. On the eastern portion of the WTC site, all or portions of the remnants of the former H&M Terminal building and its powerhouse would be removed to construct a north-south concourse for the Preferred Alternative. Other remnants of these tubes (under the Hudson River) would still remain in service.
- ***Other Vehicular Ramps*** (constructed pre-September 11, 2001): Several of these ramps would be removed or sealed off, as they would have no function under the Preferred Alternative. This would also accommodate construction of new pedestrian concourses.
- ***PATH Tracks and Substation*** (reconstructed post-September 11, 2001): The PATH tracks that are part of the temporary WTC PATH station, would remain but would be further modified for permanent operation and to install a switch to the temporary Track 6. The wiring at the existing substation, also installed as part of the temporary PATH facility, would be modified for the permanent operation.
- ***Existing WTC PATH Station Main Entrance and Concourse, Sidewalks, Fencing, Existing PATH Platforms/Mezzanine*** (constructed post-September 11, 2001/temporary): Portions of these elements would be removed for construction of a permanent entry facility, main transit hall, concourses, PATH mezzanine, and platform levels.
- ***Passageway to the NYCT WTC Subway Station (E-Train)*** (constructed pre-September 11): The passageway between the Terminal and the MTA/NYCT E Subway would be designed to incorporate the existing E Subway entrance in its current location. Certain elements and materials of this passageway, which were retained as part of the construction of the temporary station, would be preserved as part of the Preferred Alternative. However, it may be necessary to remove the doors during construction for their protection. They would be stored until they could be returned to the reconstructed passageway.
- ***Steel Beams in Cross Form*** (post-September 11, 2001): The "steel cross" was moved from the area of 6 WTC to its current location in the eastern portion of the WTC site near the intersection of Church and Cortlandt Streets for public viewing. The cross structure would be removed from this location to accommodate the new north-south pedestrian concourse construction at-grade. The steel beam in cross form would remain in the custody of PANYNJ pending its disposition in accordance with the right of its respective owners.
- ***Plaza and Subway Access from Vesey Street*** (constructed pre-September 11, 2001): The structural remnants of this access from Vesey Street are not permanently stable or functional. However, construction of the Preferred Alternative would not directly impact these elements. Furthermore, as described in the Project's Memorandum of Agreement, PANYNJ would prepare a Resource Protection Plan for the WTC site. This plan would include measures to avoid potential indirect effects on this structure during the Terminal's construction.
- ***Cooling Water Pipes*** (constructed pre-September 11, 2001): The Preferred Alternative would have no impact on the cooling water pipes. However, sections of the existing cooling water pipes may be reconstructed and/or rerouted under a separate undertaking.

These effects to the WTC site would constitute a use of a Section 4(f) resource.



1	Location and Reference Number
	Proposed New Street (To be Constructed by Others)
1	No PATH Service to Lower Manhattan (Not Shown)
2	Relocate PATH Projections (Not Shown)
3	Relocate Terminal Off-Site
4A	Church Street Location
4B	Vesey Street Location

Figure 4(f)-3
Avoidance Alternatives

AVOIDANCE ALTERNATIVES

Four alternatives were considered to avoid the potential adverse effect to the use of the WTC site that would result from the construction of the Preferred Alternative, as shown in Figure 4(f)-3 and as described below:

- Avoidance Alternative 1, No PATH Service to Lower Manhattan;
- Avoidance Alternative 2, Relocate PATH Projections;
- Avoidance Alternative 3, Relocate Terminal Off-site; and
- Avoidance Alternative 4, Relocate Terminal On-site.

As described below, two alternatives that would fully avoid the resource would be feasible but not prudent. The other alternatives may reduce the potential adverse effect to certain contributing elements of the resource, but they would not wholly avoid the use of the Section 4(f) resource. No feasible and prudent alternative could avoid the use of the Section 4(f) resource. Thus, measures to minimize harm were considered.

Avoidance Alternative 1, No PATH Service to Lower Manhattan

The suspension of PATH service to Lower Manhattan would avoid the use of the Section 4(f) property. Under this alternative, PATH would no longer operate between New Jersey and Lower Manhattan but all associated PATH infrastructure would be retained in its current state and service on PATH's Uptown line would be maintained. It is assumed that PATH would operate similar to the six months before the opening of the temporary WTC PATH station with service to Exchange Place. Materials remaining on the WTC site would not be physically altered or removed as a direct result of this alternative.

As was described for the No Action Alternative in this EIS, the full suspension of PATH service to Lower Manhattan would not meet the goals and objectives of this Project as follows:

- *Effectively restore long-term PATH service between New Jersey and Lower Manhattan:* This goal would not be achieved under this avoidance alternative. This alternative would not enhance Lower Manhattan's transportation infrastructure nor would it benefit PATH operations.
- *Establish an intermodal transportation facility in Lower Manhattan:* Because this alternative would not result in construction of a Permanent Terminal for PATH, intermodal connections in Lower Manhattan would not be enhanced as part of this Project. Therefore, this avoidance alternative fails to meet this goal and its objectives.
- *Plan and construct a terminal that would support the redevelopment of Lower Manhattan:* Since this avoidance alternative would not result in a Permanent PATH Terminal in Lower Manhattan, this Project would not directly support the redevelopment of Lower Manhattan. Although other independent actions (e.g., WTC Memorial and Redevelopment Plan; Route 9A Project; Fulton Street Transit Center, etc.) may be pursued as planned, the long-term success of these projects may be jeopardized by the absence of PATH and the transit connections that are part of the Terminal Alternatives. Without a convenient, cost effective transit connection between New Jersey and Lower Manhattan, Lower Manhattan's commercial recovery may never be fully realized.
- *Minimize adverse impacts to the environment:* Although this avoidance alternative would not result in short-term, construction period impacts, it would have long-term adverse effects to the environment as follows:

- The elimination of PATH service to Lower Manhattan and the failure to construct a Permanent Terminal is inconsistent with current, publicly-supported plans and policies for redevelopment of the WTC site and Lower Manhattan as a whole.
- The economic recovery of Lower Manhattan is dependent on the provision of reliable, convenient, and cost effective transit service. The absence of PATH service may reduce the desirability and marketability of Lower Manhattan and could result in the relocation of existing businesses. Thus, this avoidance alternative may have a lasting, negative effect on the economy of Lower Manhattan.
- Assuming that the economic recovery of Lower Manhattan is achieved as planned, the absence of PATH service would result in substantial increases in vehicular traffic and diversions to other modes of transit. As described in Chapter 8, "Transportation," full disruption of PATH service to Lower Manhattan would generate: approximately 1,200 new vehicles (autos, buses, and commuter vans); 6,200 new bus passengers; 8,400 new ferry passengers; 3,600 new passengers on Uptown PATH service; and 9,350 new subway passengers in the AM peak hour. The diversion of passengers from PATH to these other modes would constrain the major roadways and vehicular access points to, from, and within Lower Manhattan and would increase peak hour congestion on commuter buses, commuter rail, uptown PATH service, and city subways.
- The new vehicle trips that would be generated by this alternative would also adversely affect air quality in the New York and New Jersey metropolitan area. In 2025, this avoidance alternative would generate an estimated additional 15.7, 18.0, 1.5, and 236.0 tons per year of volatile organic compounds (VOC), nitrous oxides (NO_x), fine particulates ($PM_{2.5}$), and carbon monoxide (CO), respectively.

Although this alternative is feasible and would avoid the Section 4(f) resources, it is not prudent because it would fail to meet any of goals of this Project.

Avoidance Alternative 2, Relocate PATH Projections

New tunnel projections at a location south of Liberty Street or north of Vesey Street would allow for the construction of PATH tracks and a terminal that would avoid the use of the Section 4(f) resource. To achieve this alternative, new structures would be constructed within the Hudson River between New Jersey and New York. Within New Jersey, new track and tunnels would be necessary to link the new Hudson River tunnels with the remainder of the PATH system. It is assumed that the PATH infrastructure on the WTC site would be retained in its current state and that the other remaining materials would not be physically altered or removed.

The construction of new tunnels under the Hudson River and upland infrastructure in both New York and New Jersey would be very costly (approximately $3 billion) and would take three to four years longer to plan and construct than any of the Terminal Alternatives. Furthermore, this avoidance alternative would not meet some of the goals of this Project as described below:

- *Effectively restore long-term PATH service between New Jersey and Lower Manhattan:* Generally, this goal may be achieved by this avoidance alternative. However, depending upon the selected location for new tunnels and the infrastructure needed to support new track connections, not all of its objectives may be met. Waterfront sites in Lower Manhattan and New Jersey are mostly developed, which limits the location and construction of new PATH infrastructure. Furthermore, since new track connections would be required within New

Jersey, it is assumed that temporary PATH service would have to be disrupted for a period during construction.

- *Establish an intermodal transportation facility in Lower Manhattan:* Although extensive planning would be needed to locate new tracks and a terminal within Lower Manhattan, it may be possible to provide for some intermodal connections. However, it is expected that this alternative would not achieve all of the connections that are proposed as part of the Preferred Alternative.
- *Plan and construct a terminal that would support the redevelopment of Lower Manhattan:* This alternative would allow for the redevelopment of the WTC site, but it may not provide for direct connections to future uses on the site. Furthermore, because Lower Manhattan is fully developed, construction activities outside the WTC site may impact existing structures or may inhibit plans for other sites. Thus, this avoidance alternative may not allow for the redevelopment of Lower Manhattan as currently planned.
- *Minimize adverse impacts to the environment:* This avoidance alternative would result in both short- and long-term adverse impacts to the environment. Depending on the location of the new tunnels and new PATH infrastructure in New Jersey and Lower Manhattan, this alternative has the potential environmental impacts:
  - As described above, the waterfront areas of Jersey City and most of Lower Manhattan are fully developed. Therefore, construction of new Hudson River tunnels and upland connections, including a Terminal building, would temporary disrupt or permanently alter existing land uses.
  - New right-of-way would be required to construct and operate new Hudson River tunnels and their supporting upland infrastructure. This may require the displacement of existing businesses and residents. Furthermore, new tunnels would take much longer to construct than the Preferred Alternative. Thus, this avoidance alternative has a greater likelihood for short-term disruption to businesses in Lower Manhattan as well as Jersey City during the construction period.
  - The construction of PATH infrastructure on new right-of-way has the potential to disturb known or potential historic and archaeological resources in both Lower Manhattan and New Jersey.
  - Because this alternative would physically alter the alignment of PATH, it has the potential to constrain operations both during construction and over the long-term.
  - A new alignment for PATH also has the potential to result in noise and vibration impacts from long-term train operations.
  - The construction of new tunnels within the Hudson River would disturb aquatic species in the Hudson River estuary and has the potential to adversely affect water quality.
  - The excavation of new tunnels for PATH may disturb contaminated soils present in both Jersey City and Lower Manhattan.

Although this alternative is feasible and would avoid the Section 4(f) resource, it is not considered prudent since it would have costs and other impacts of extraordinary magnitude such as a lengthy period of construction, and many adverse effects to the environment.

Avoidance Alternative 3, Relocate Terminal Off-site

Construction of a terminal within Lower Manhattan but outside the limits of the WTC site would reduce the amount of PATH infrastructure on the WTC site, but it would not avoid the use of the Section 4(f) resource. As described in Chapter 2, "Project Alternatives," the Port Authority of New York and New Jersey (PANYNJ) previously explored a terminal location near the intersection of Broadway, Dey Street, and John Street. Under this alternative, PATH tracks and certain supporting infrastructure would be constructed within the WTC site to allow trains to travel between the existing Hudson River tunnel projections and the terminal at Broadway. Given the land and infrastructure constraints east of Church Street, this off-site alternative would require that a stub-end terminal be constructed.

Although this alternative could reduce or eliminate the use of certain portions of the WTC site, it would not wholly avoid the Section 4(f) resource. Furthermore, it would not meet some of the goals of this Project as follows:

- *Effectively restore long-term PATH service between New Jersey and Lower Manhattan:* The stub-end configuration of this terminal would allow for a maximum operating capacity of 20 trains per hour, which would reduce the maximum throughput of the PATH system. Because the tracks leading to the terminal would cross those of the temporary station, the temporary tracks would need to be removed, resulting in the full disruption of PATH service for several months. Thus, this avoidance alternative would result in both short-term and long-term operational constraints for the PATH system.
- *Establish an intermodal transportation facility in Lower Manhattan:* Because this avoidance alternative could result in a new terminal in close proximity to the proposed Fulton Street Transit Center, it would provide for certain intermodal connections in Lower Manhattan. However, since it would be further from the WTC site, the World Financial Center, and trans-Hudson ferry terminals than the Terminal Alternatives, it would not provide for all of the proposed intermodal connections.
- *Plan and construct a terminal that would support the redevelopment of Lower Manhattan:* This alternative would allow for the redevelopment of the WTC site, but it may not provide for direct connections to future uses on the site. Furthermore, because Lower Manhattan is fully developed except at the WTC site, construction activities outside the WTC site may impact existing structures or may inhibit plans for other sites. Thus, this avoidance alternative may not allow for the redevelopment of Lower Manhattan as currently planned.
- *Minimize adverse impacts to the environment:* This avoidance alternative would result in both short- and long-term adverse impacts to the environment as follows:
  - The construction of an above-grade terminal building and below-grade infrastructure for this avoidance alternative would likely require building demolition. Thus, there may be adverse impacts to existing and proposed land uses.
  - PANYNJ would need to acquire new right-of-way and property to construct and operate this alternative. This would likely require the displacement of existing business and possibly residents in order to provide permanent structures for the terminal. Furthermore, temporary displacement and or disruption of businesses would likely be necessary during construction to support staging and other activities.
  - Several historic structures such as the former East River Savings Bank Building, the former American Telephone & Telegraph (AT&T) Building, and the Corbin Building

are located east of the WTC site in the vicinity of the proposed location of this avoidance alternative. Furthermore, the area east of Broadway along John Street is part of the John Street-Maiden Lane Historic District. It is possible that one or more of these structures may be physically altered by construction of a PATH terminal under this alternative. Thus, although this alternative may reduce the effects to the WTC site, it may have impacts on other Section 4(f) resources.

- Construction activities and staging would require temporary street, sidewalk, and lane closures in the vicinity of Dey Street, John Street, and Broadway. This would disrupt vehicular and pedestrian access to businesses and existing transit services and may result in increased congestion at other nearby locations.
- The construction of a terminal in the vicinity of Dey Street and Broadway has the potential to disrupt New York City Transit subway service on the R and W; 4 and 5; J, M and Z; and possibly the 2 and 3 lines when underpinning of subway structures is required. Although this work would be carried out according to New York City Transit guidelines, it may cause off-peak and weekend service disruptions throughout the construction process.
- Because the terminal would be located in any area having many older buildings, there is potential for both short- and long-term adverse noise and vibration impacts. These impacts may result both from the terminal's construction and from train operations.

Thus, while this alternative is considered feasible, it is not prudent. Not only would this alternative not avoid the use of the Section 4(f) resources, but it would also not meet the goals of this Project.

The selection of an off-site location to the north or south of the WTC site would have similar environmental impacts and operational constraints as the Broadway location. Furthermore, because any off-site alternative would require some PATH infrastructure within the WTC site, it would not avoid the use of Section 4(f) resource.

Avoidance Alternative 4, Relocate Terminal On-site

Construction of a terminal at an alternative location on the WTC site would not avoid the use of the Section 4(f) resource. As described in Chapter 2, "Project Alternatives," PANYNJ previously explored two alternative terminal locations within the WTC site—Church Street and Vesey Street.

Avoidance Alternative 4A, Church Street Location

The Church Street location would result in a new terminal on the eastern portion of the WTC site in the approximate location of the former H&M Terminal. The terminal itself would occupy much of the sub-grade levels between Church, Fulton, and Cortlandt Streets, and the 1 and 9 subway line, which are currently programmed for elements of the WTC Memorial and Redevelopment Plan. The track connections between the terminal and the Hudson River tunnels as well as certain ancillary facilities would be located on the western portion of the WTC site.

Not only would this alternative fail to avoid the use of the Section 4(f) resource, it would not meet some of the goals of this Project as follows:

- *Effectively restore long-term PATH service between New Jersey and Lower Manhattan:* This alternative would meet the long-term operational goals of PATH and would allow for temporary service during construction.

- *Establish an intermodal transportation facility in Lower Manhattan:* This avoidance alternative would provide for the intermodal connections to NYCT subways and the Fulton Street Transit Center in the same manner as the Preferred Alternative. However, it would locate PATH further from the World Financial Center and trans-Hudson ferries than would the Preferred Alternative. Furthermore, the vertical circulation within the Church Street option would require a less convenient ascent to street level than the Preferred Alternative since passengers would need to double back several times. Thus, the Church Street option may increase the travel time and level of congestion within the Terminal as compared to the Preferred Alternative.

- *Plan and construct a terminal that would support the redevelopment of Lower Manhattan:* The Church Street location would require the use of sub-grade spaces that are programmed for elements of the WTC Memorial and Redevelopment Plan. As was described in Chapter 2, "Project Alternatives," the use of these spaces may not only reduce the quantity of offices and retail that could be developed on the WTC site, but it would also locate certain building functions such as security and loading at street level. This would be inconsistent with the planning goals for the redevelopment of the site, which seek to centralize building services and security in order to reduce the potential for future incidents on the WTC site. Furthermore, the location of truck docks and other building services at street level would increase noise at the memorial site.

- *Minimize adverse impacts to the environment:* This avoidance alternative would result in nearly the same environmental impacts as the Preferred Alternative.

Although this alternative is considered feasible, it is not prudent. This alternative would not avoid the use of the Section 4(f) resource. Furthermore, it would constrain future development of the WTC site, would have adverse noise and visual impacts on the planned WTC Memorial, and it would degrade the level of customer convenience as compared to the Preferred Alternative. Therefore, this alternative is inconsistent with the goals of this Project.

Avoidance Alternative 4B, Vesey Street Location

The Vesey Street location would result in a new terminal along the north periphery of the WTC site. The terminal itself would extend east-west beneath the 1 and 9 subway line and would occupy much of the sub-grade levels in the northern portion of the site between Vesey and Fulton Streets. The tracks connections to the Hudson River tunnels, certain ancillary facilities, and portions of the terminal would be within the bathtub. The remaining portions of the terminal and its tracks would be located east of the 1 and 9 subway line.

Similar to the Church Street location, this alternative would fail to avoid the use of the Section 4(f) resource. It would also not meet some of the goals of this Project as follows:

- *Effectively restore long-term PATH service between New Jersey and Lower Manhattan:* This alternative would meet the long-term operational goals of PATH, but it would require the full disruption of temporary service during construction. As a result, those commuting between New Jersey and Lower Manhattan would need to pursue alternative modes of travel for several months.

- *Establish an intermodal transportation facility in Lower Manhattan:* This avoidance alternative would provide for the intermodal connections to NYCT subways, the Fulton Street Transit Center, the World Financial Center, and trans-Hudson ferries in a similar manner as the Preferred Alternative.

- *Plan and construct a terminal that would support the redevelopment of Lower Manhattan:* The Vesey Street location would require the use of sub-grade spaces that are programmed for elements of the WTC Memorial and Redevelopment Plan. This may result in the location of building serving and security to street level. Similar to the Church Street location, the location of truck docks and other building services at street level would increase noise at the memorial site and would have adverse visual impacts.
- *Minimize adverse impacts to the environment:* This avoidance alternative would result in nearly the same environmental impacts as the Preferred Alternative.

Although this alternative is considered feasible, it is not prudent. This alternative would not avoid the use of the Section 4(f) resource. Furthermore, it would fully suspend temporary PATH service during construction and would have long-term adverse noise and visual impacts on the planned WTC Memorial. Therefore, this alternative is inconsistent with the goals of this Project.

MEASURES TO MINIMIZE HARM

Absent an avoidance alternative, FTA and PANYNJ would implement measures to minimize harm to this Section 4(f) resource.

Subsequent to the publication of the DEIS, FTA, PANYNJ, SHPO, the Advisory Council on Historic Preservation (ACHP), and the Project's Section 106 consulting parties consulted to develop the Project's Memorandum of Agreement (MOA), which provides for specific commitments to minimize harm to remaining remnants and structures on the WTC site.

The MOA also details the process for documenting all remaining features on the WTC site as well as any artifacts that would be moved from the site during construction of the Permanent WTC PATH Terminal.

Concurrent with the development of the MOA, FTA and PANYNJ have considered alternatives and design modifications for the Preferred Alternative's track and platform level. The intent of this process was to reduce the physical area of the WTC tower footprints that would be obscured by the Preferred Alternative. FTA and PANYNJ have concluded that 5 tracks and 4 platforms are needed within the Terminal to meet the project's goals and objectives, but that a portion of one of the 4 platforms (Platform D) could be narrowed.

The following describes these measures to minimize harm to the Section 4(f) property. The full text of the executed MOA and other supporting materials appear in Appendix B of the FEIS. The process for developing these measures and the MOA itself is described in Section C, "Coordination," of this Final Section 4(f) Evaluation.

WTC Site Documentation

As stated in the MOA, PANYNJ would document the WTC site and its historic features to Level II standards of the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) prior to the removal or alteration of any historic features from the WTC site in connection with the undertaking of the Permanent WTC PATH Terminal. This documentation would consist of large-format, black-and-white photography of the site and its historic features as they currently exist; large-format photographic reproduction of selected existing drawings of current conditions and of pre-September 11, 2001 conditions; and a written history and description of the site and its historic features using information previously generated for the

Coordinated DOE for the WTC site as well as the Permanent WTC PATH Terminal's DEIS and FEIS.

PANYNJ would consult with SHPO and HABS/HAER to determine whether particular features warrant measured drawings, and any such drawings would be prepared by an individual with demonstrated experience in the preparation of measured drawings to HABS/HAER standards.

The completed documentation would be submitted to SHPO and HABS/HAER for consideration. The large-format photographs prepared to HABS/HAER standards would consist of the views itemized in Exhibit H, "Schedule of Photographs" of the Project's MOA (see Appendix B of the FEIS).

Tower Perimeter Column Base Remnants

Up to a total of 5 column bases in the North Tower and up to a total of 3 column bases in the South Tower may be temporarily or permanently removed to construct PATH Platform D. Where Platform D would intersect the northeast corner of the North Tower footprint, the platform would be clear of vertical obstructions and architectural treatments would be used to symbolically represent the location of the footprint. A minimum of 5 to a maximum of 7 column bases of the east column line of the North Tower would be visible from Platform D. The viewing area would consist of a glass wall tilted inward from the platform combined with a mirrored wall to the west to provide a view of the column bases from this area of the platform. Appropriate signage, graphics, and lighting would complete the viewing area.

The locations of column remnants of the South Tower that may be permanently obscured by PATH platforms would be symbolically represented on these platforms through architectural treatments that define and differentiate the portions of the infrastructure that are within the Tower footprint areas. These treatments may include color differentiation, texture differentiation, symbolic representation of Tower perimeter column remnants, and/or an emblematic marker designating the location of the historic resource.

In addition to the column bases described above, up to 4 column bases in the North Tower could be temporarily removed by work to install other Project structures and infrastructure. Of the 4 column bases that could be affected by the Project foundation, those column bases that remain in situ undisturbed or are temporarily removed and returned to their original locations would be accessible following the completion of these foundations.

Removing column bases, on either a temporary or permanent basis, would be considered only after practical engineering design options pursuant to Stipulations I.B., 2a, and 2b, to preserve column bases in place have been exhausted. Column bases that are removed would be returned to their original locations if practical engineering design permits. Permanent removal of column bases would only take place as a last resort, and these column bases would be removed and stored in accordance with the stipulations of the MOA.

The east-west pedestrian concourse to the World Financial Center would be designed and built in a manner that avoids the column remnants projecting above the concrete slab that outline the north perimeter of the North Tower and places this corridor at least five (5) feet outside the North Tower footprint as measured from the center line of each projecting column base to the face of the nearest structural support wall.

The temporary PATH track (in addition to the existing 5 tracks) and associated ballast that would be installed on a temporary basis during construction of the Project tracks and platforms and would be removed upon completion of the permanent tracks and platforms to re-expose the

North and South Tower perimeter column remnants and portions of the North and South Tower footprints that may be covered by the temporary track and ballast.

The construction fill currently on the footprints has been temporarily removed for the purposes of documentation of the footprints pursuant to Stipulation I.A. of the MOA, and would be replaced with clean rounded gravel as required after the documentation in order to protect the footprints and column remnants from ongoing construction. Further treatments may be specified in the Project's Resource Protection Plan.

Passageway to the NYCT Subway Station (E Train)

The new pedestrian connection between the Permanent WTC PATH Terminal and the MTA/NYCT WTC E Subway Station would incorporate the existing E subway entrance, in its current location, in a manner that retains existing materials and features of this entrance, including, but not limited to, the handrails, the travertine flooring, the steps and doors separating the E train from the pedestrian connection, and overhead signage, to the extent possible and in accordance with current building codes and Americans with Disabilities Act requirements. The design would include, at a minimum, a plaque identifying the historic features of the E subway entrance. During construction of the new pedestrian connection between the Permanent WTC PATH Terminal and the E Subway Entrance, doors may need to be carefully removed and stored until they can be reinstalled within the new connection.

East and West Slurry Walls

The design for the Project would provide visibility from within the Terminal to a portion of the east or west slurry wall if the following criteria are met: the condition of the slurry wall evokes the image now understood to represent the historic nature of the wall (e.g. tiebacks are part of the area to be exposed, tiebacks project beyond the re-stabilized slurry wall); the exposure which is provided would enable a view of the slurry wall which is clear, recognizable, and respectful of the slurry wall; and the exposure would not pose a safety hazard to the public from exposed finishes of the wall or its components. The design for the east-west pedestrian concourse shall include a location from which the members of the public may view a plaque and photograph of the west slurry wall.

Steel Beams in Cross Form

PANYNJ would relocate the steel column and crossbeam mounted on a concrete pedestal and currently situated within the WTC site near Church Street in accordance with Stipulation VI of the MOA (see Appendix B). The object would remain in the custody and control of PANYNJ, pending final disposition of these artifacts in accordance with the rights of the respective owners.

Resource Protection Plan for the WTC Site

PANYNJ, in consultation with SHPO and in coordination with LMDC and MTA/NYCT, as appropriate, shall develop a WTC Resource Protection Plan for the Permanent WTC PATH Terminal. The plan would be prepared to protect elements of the WTC site that are to remain in situ from inadvertent damage during the Terminal's construction. It would detail the Project's construction procedures and other construction plans for the site. It would provide for an inspection and reporting of the existing condition of elements, establish protection procedures, establish a monitoring program, and establish methods and materials to be used for any repairs. A historic architect who meets the Secretary of the Interior's professional qualifications standards (48 FR 44716) in historic preservation would be part of the design/construction team

and would have the opportunity to review design drawings and specifications prior to construction. The plan would empower the Project's historic architect in consultation with the Chief Engineer of PANYNJ to issue "stop work" orders to prevent any unanticipated damage to historic properties. Recommencement of work would only be permitted once the Chief Engineer of PANYNJ and the historic architect are assured that appropriate modifications have been made to construction techniques to assure that no further damage would occur.

PANYNJ will furnish copies of the Plan to SHPO, ACHP, the National Park Service, and the Section 106 consulting parties for review and comment prior to its implementation.

HUDSON RIVER BULKHEAD

DESCRIPTION OF THE SECTION 4(f) PROPERTY

There is one known archaeological resource in the area where the Preferred Alternative's pedestrian concourse to the World Financial Center would be located—the Hudson River Bulkhead (S/NR-eligible). The bulkhead and its associated structural systems were built between 1871 and 1936 by the New York City Department of Docks. The majority of the construction consisted of masonry walls on a variety of foundation systems, with quarry-faced ashlar granite block forming the visible face along most of the armored frontage. Design of the bulkhead was the responsibility of George B. McClellan, a Civil War general, who became the first Engineer-in-Chief of the Department of Docks. McClellan's plans contemplated the creation of a 250-foot-wide marginal street, from which 60- to 100-foot-wide piers with cargo sheds would project 400 to 500 feet around 150- to 200-foot-wide slips. Initiated to respond to the deteriorated, congested, and silt-filled condition of the waterfront, the carefully built granite walls created a consistent monumental surface to the waterfront that reinforced an image of New York City's commercial prominence. As property was acquired and as commerce warranted, the city built the bulkheads, built or rebuilt pier substructures, and leased redeveloped areas to private companies, which were usually responsible for piershed and headhouse construction. The bulkhead runs from the Battery to West 59th Street. The portion of the bulkhead located within the study area is below-grade along the western edge of Route 9A (see Figure 4(f)-1).

PROBABLE USE OF THE SECTION 4(f) PROPERTY

No Action Alternative

The No Action Alternative may involve minor construction activities to extend the service life of the temporary WTC PATH station, to the extent possible. Most of these activities would be undertaken within the limits of the WTC site and there would be no disturbance to the Hudson River Bulkhead.

Preferred Alternative

Tunneling for a pedestrian concourse under Route 9A would require piercing the Hudson River Bulkhead, which is buried below ground along the western edge of Route 9A. This would constitute a use of this Section 4(f) resource.

AVOIDANCE ALTERNATIVES

Since a pedestrian concourse below Route 9A would not avoid adverse effects to the Hudson River Bulkhead, alternatives were considered to eliminate this potential adverse impact.

Avoidance Alternative 1: At-grade Crossing

Since subsurface construction would not be required for an at-grade crossing, this alternative would not result in adverse impacts to the Hudson River Bulkhead. However, an at-grade crossing would not meet the goals of this Project as follows:

- *Effectively restore long-term PATH service between New Jersey and Lower Manhattan:* The absence of a grade separated crossing at Route 9A would not restore the facilities that existed prior to September 11, 2001. Previously, two pedestrian bridges crossed Route 9A, providing access between the World Financial Center, the World Trade Center, and PATH. Thus, the at-grade crossing would be inconsistent with this goal for the Project.
- *Establish an intermodal transportation facility in Lower Manhattan:* Because the at-grade crossing would not provide for a convenient connection between the World Financial Center and its ferry terminal, which is west of Route 9A, and the multiple transit facilities, including PATH that would be east of Route 9A. This alternative would not be consistent with this goal for the Project.
- *Plan and construct a terminal that would support the redevelopment of Lower Manhattan:* This alternative would allow for the redevelopment of the WTC site, but it may not provide for a convenient connection between the WTC site and PATH and the World Financial Center and Battery Park City. Although the at-grade alternative is not fully inconsistent with this goal, it does not provide for the enhanced pedestrian connections that would be achieved with a pedestrian concourse under or bridge over Route 9A.
- *Minimize adverse impacts to the environment:* This avoidance alternative would result in long-term adverse impacts to the environment as follows:
  - Since all pedestrians traveling between the WTC site and the World Financial Center would cross at grade, this alternative would likely result in adverse impacts to vehicle traffic on Route 9A as well as to pedestrian levels-of-service. Furthermore, the substantial number of trips that would cross at grade would increase the potential for vehicle/pedestrian conflicts, which would degrade the safety of both vehicular and pedestrian travel in Lower Manhattan.

Thus, while this alternative is considered feasible, it is not prudent. Although an at-grade crossing would avoid the use of the Section 4(f) resources, it would not meet the goals of this Project.

Avoidance Alternative 2: Pedestrian Bridge

The DEIS identified a design option that would result in a pedestrian bridge over Route 9A rather than a sub-grade concourse. Subsequent to publication of the DEIS, the pedestrian bridge was removed as a design option for the Preferred Alternative, but it is considered as part of this Final Section 4(f) Evaluation to avoid the use of the Section 4(f) property.

Subsequent to publication of the DEIS, it was determined that a pedestrian bridge would fail to meet some of the project's goals and objectives as follows:

- *Effectively restore long-term PATH service between New Jersey and Lower Manhattan:* This alternative would provide for the same type of connection that was provided between the WTC site and the World Financial Center as existed prior to September 11, 2001. However, a pedestrian bridge does not provide for the same level of service or convenience as a sub-grade concourse. Under the bridge option, pedestrians wishing to travel between the

Permanent WTC PATH Terminal and Battery Park City would need to ascend from the track/platform level to the second level of Freedom Tower, then cross Route 9A via the bridge and descend to street level through the World Financial Center. This results in two additional sets of stairs/escalators as compared to the subgrade concourse, which increases travel time. Furthermore, the bridge necessitates security measures within the Freedom Tower and the Winter Garden that would not be needed for a subgrade concourse since the bridge diverts greater volumes of pedestrian traffic through these facilities than would the subgrade concourse.

- *Establish an intermodal transportation facility in Lower Manhattan:* Although it may be less convenient for some customers than would be a sub-grade concourse, the pedestrian bridge would provide for connections between the World Financial Center and its ferry terminal, which is west of Route 9A, and the multiple transit facilities, including PATH that would be east of Route 9A. Thus, this alternative would be consistent with this goal for the Project.
- *Plan and construct a terminal that would support the redevelopment of Lower Manhattan:* This alternative would allow for the redevelopment of the WTC site, but it may provide a less convenient connection between the WTC site and PATH and the World Financial Center and Battery Park City than would a sub-grade concourse. Although the pedestrian bridge is not fully inconsistent with this goal, it does not provide for the enhanced pedestrian connections that would be achieved with a pedestrian concourse under Route 9A.
- *Minimize adverse impacts to the environment:* This avoidance alternative would result in long-term adverse impacts to the environment as follows:
  - The construction of the bridge's foundations could result in the disturbance or removal of portions of the Hudson River Bulkhead. The bridge's construction could also affect historic resources located within 90 feet of construction limits, which may result in adverse impacts to other structures within the APE for the Permanent WTC PATH Terminal.

Thus, while this alternative is considered feasible, it is not prudent since it results in reduced levels of service for pedestrians and may necessitate additional security measures for Freedom Tower and the Winter Garden.

MEASURES TO MINIMIZE HARM

Absent an avoidance alternative, FTA and PANYNJ would implement measures to minimize harm to this Section 4(f) resource. The project's executed MOA (see Appendix B) details a process to follow to identify and mitigate any adverse impacts on the Hudson River Bulkhead. Because the Hudson River Bulkhead is also located within the APE for the Route 9A Project, PANYNJ would coordinate its treatment plan with NYSDOT. In consultation with SHPO, and as appropriate, NYSDOT, PANYNJ would develop and implement a plan to locate and identify intact portions of the Hudson River Bulkhead that would be affected by construction of the Permanent WTC PATH Terminal's east-west pedestrian connection. In the event that the intact portions of the Hudson River Bulkhead are identified, PANYNJ would, in consultation with the SHPO and NYSDOT, prepare a treatment plan for those portions of the Hudson River Bulkhead to be affected by the Project. The plan would be submitted to SHPO and Section 106 consulting parties for their review and comment prior to implementation.

WTC SITE ARCHAEOLOGY

A Phase IA Archaeological Assessment and a subsequent Topic Intensive Study for the WTC site found former Block 85 (Lots 8-17) at the northeast corner of the site and former Block 60 (Lots 5, 6, and 10) near the southeast corner of the site to be sensitive and to warrant further consideration (see Figure 4[f]-4.) These areas are located outside the former WTC construction footprint and have the potential to contain shaft features (such as privies, cisterns, wells, and cesspools) predating the 1850s that may have survived under former basements. Lots with basements 20 feet or more below grade have a lesser likelihood of shaft feature preservation.

PROBABLE USE OF THE SECTION 4(f) PROPERTY

No Action Alternative

The No Action Alternative may involve minor construction activities to extend the service life of the temporary WTC PATH station, to the extent possible. Most of these activities would be undertaken within the limits of the temporary WTC PATH station. Therefore, this alternative would not disturb or alter the potential archaeological resources within the northeast and southeast portion of the WTC site.

Preferred Alternative

Construction of the Preferred Alternative would impact portions of the WTC site, which has been identified as potentially sensitive for archaeological resources. If National Register-eligible archaeological resources were found to exist, activities that damaged or destroyed those resources would constitute a use of this historic resource.

The regulations specify that Section 4(f) is not applicable for archaeological resources if it is determined that such resources are important because of what can be learned through data recovery rather than through preservation in place. However, the project's MOA provides for stipulations to address potential impacts to these archaeologically sensitive areas pursuant to the project's compliance with Section 106 of the NHPA.

Prior to any Project-related subsurface disturbance at any of the locations that have been determined to be sensitive for historic archaeological resources, PANYNJ will, in consultation with the SHPO, and LMDC as appropriate identify and evaluate the National Register eligibility of any archaeological resources at these locations in accordance with 36 CFR 800.4.

In the event that FTA, in consultation with SHPO, determines that National Register-eligible archaeological resources will be adversely affected by construction of the Preferred Alternative, PANYNJ would, in consultation with FTA, SHPO, and LMDC as appropriate, and the Section 106 consulting parties, develop and implement an Archaeological Resource Treatment Plan for the Project. The Archaeological Resources Treatment Plan and documentation will adhere to the standards established by the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716), including the standards therein for professional qualifications The plan will be submitted to SHPO and Section 106 consulting parties for their review and comment prior to implementation.

At this time, it is not anticipated that the archaeological resources that could be disturbed with the construction of the Preferred Alternative are important for preservation in place. Therefore, Section 4(f) would not apply to these archaeological resources. However, should it be

determined that these resources should be retained in place, PANYNJ and FTA would prepare a separate Section 4(f) evaluation.

OFF-SITE HISTORIC STRUCTURES

DESCRIPTION OF THE SECTION 4(F) PROPERTIES

An area of Potential Effect (APE) for the Permanent WTC PATH Terminal was established to consider the potential short- and long-term impacts to historic structures. This APE was approved by SHPO in March 2004, and includes 21 known historic or archaeological resources as shown in Table 4(f)-1 and Figure 4(f)-1.

The potential effects of the Preferred Alternative on the WTC site and the Hudson River Bulkhead were described above. This section focuses on the other structures within the Permanent WTC PATH Terminal's APE.

PROBABLE USE OF THE SECTION 4(f) PROPERTIES

No Action Alternative

The No Action Alternative is not expected to result in a direct or constructive use of off-site historic resources.

Preferred Alternative

The long-term operation of the Preferred Alternative is not anticipated to result in any use of off-site historic structures. However, the Terminal's construction may result in vibrations that may impact historic structures in close proximity to construction activities.

Per the guidance of the New York City Department of Buildings, historic structures within 90 feet of the Permanent WTC PATH Terminal's project limits were considered to be potentially impacted by construction activities. Based on these guidelines, the Terminal's construction has the potential to adversely impact 5 Section 4(f) properties within its APE as follows:

- Former East River Savings Bank, 26 Cortlandt Street;
- Barcley-Vesey Building, 140 West Street;
- Beard Building, 125 Cedar Street;
- 114-118 Liberty Street; and
- St. Paul's Chapel and Cemetery.

The other off-site structures listed in Table 4(f)-1 are beyond the 90-foot threshold for construction impacts and would not be subject to use of any sort under Section 4(f).

The executed MOA for the Permanent WTC PATH Terminal provides the following stipulations pursuant to potential impacts to the Barclay-Vesey Building, Former East River Savings Bank, Beard Building, St. Paul's Chapel and Graveyard, and 114-118 Liberty Street.

PANYNJ, in consultation with SHPO and Section 106 consulting parties, and in coordination with LMDC and MTA/NYCT, where appropriate, shall develop a Construction Protection Plan (CPP) for the Project. The CPP would set forth measures for the protection and avoidance of structural and architectural damage to these historic properties that may result from construction vibration. The CPP would be based on requirements in the "New York City Department of

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Figure 4(f)-4

Areas of Potential Archaeological Sensitivity

Table 4(f)-1
Known Historic and Archaeological Resources in the Area of Potential Effect

Ref. No.	Name	Address	NHL	S/NR	S/NR-eligible	NYCL	NYCL-eligible
1	Hudson River Bulkhead	Battery to West 59th Street			X		
2	WTC Site	Bounded by Vesey, Church and Liberty Streets, and Route 9A			X		
3	Barclay-Vesey Building	140 West Street			X	X	
4	Federal Office Building/ U.S. Post Office	90 Church Street		X			
5	St. Peter's Roman Catholic Church	22 Barclay Street		X		X	
6	Former St. Peter's School	16 Barclay Street			X		
7	30 Vesey Street	30 Vesey Street			X		
8	Old New York Evening Post Building	20 Vesey Street		X		X	
9	New York County Lawyer's Association	14 Vesey Street		X		X	
10	Astor Building	217 Broadway			X		
11	Transportation Building	225 Broadway			X		
12	African Burial Ground and the Commons Historic District	Bounded by Duane Street, Park Row, Broadway and Centre Street	X	X		X	
13	St. Paul's Chapel and Graveyard	Broadway and Fulton Street	X	X		X	
14	Former American Telephone & Telegraph (AT&T) Company Building	195 Broadway			X		X
15	Fulton Street IRT Station	Fulton Street and Broadway			X	X	
16	Former East River Savings Bank	26 Cortlandt Street			X		X
17	United States Realty Building*	115 Broadway		X	X	X	
18	Beard Building	125 Cedar Street			X		X
19	114-118 Liberty Street	114-118 Liberty Street			X		
20	21-23 Thames Street	21-23 Thames Street			X		
21	90 West Street	90 West Street			X	X	

Notes: Corresponds to Figure 4(f)-1.
NHL: National Historic Landmark.
SR: New York State Register of Historic Places.
NR: National Register of Historic Places.
S/NR-eligible: Site has been found eligible for listing on the New York State and National Registers of Historic Places.
NYCL: New York City Landmark.
NYCL-eligible: LPC has determined that the site appears eligible for NYCL designation.
* The United States Realty Building is listed on the SR only. It is eligible for listing on the NR.

Buildings Technical Policy and Procedure Notice (PPN) #10/88" regarding procedures for the avoidance of damage to historic structures resulting from adjacent construction. The PPN defines adjacent historic structures as being contiguous or within a lateral disturbance of 90 feet from a lot under development or alteration.

The CPP would describe in detail the construction procedures of the Project, as well as the construction procedures associated with other projects under construction in the vicinity of each of these historic properties. It would also provide for the inspecting and reporting of existing conditions at these properties, establish protection procedures, establish a monitoring program to measure vertical and lateral movement and vibration, establish and monitor construction methods to limit vibration; and establish methods and materials to be used for any repairs. The plan shall also specify the implementation of special vibration protection measures to protect

these historic properties from increased vibration levels associated with construction activities. The CPP would provide for a historical architect meeting the Secretary of Interior Standards to supervise implementation of the CPP.

The CPP would empower the historical architect, in consultation with the Chief Engineer of PANYNJ ("The Engineer") to issue "stop work" orders to prevent any damage to historic properties, and any recommencement of work shall only be permitted at such time that the Chief Engineer and historical architect have assurance that the appropriate modifications have been made to the construction technique to assure that no damage would occur to historic properties.

Since measures to avoid substantial impairment of the historic quality of off-site structures protected by Section 4(f) have been incorporated into the Project, this alternative would not require either a direct or constructive use of these structures. The potential impacts to these off-site historic structures under this alternative would be temporary, minor, and repairable.

C. COORDINATION

The FTA is serving as the federal lead agency for this Project under the National Environmental Policy Act (NEPA). PANYNJ a municipal corporate instrumentality and political subdivision of the States of New York and New Jersey, is acting as the Project sponsor.

The NHPA Section 106 review process for the Permanent WTC PATH Terminal began concurrent with its public scoping under NEPA in September 2003. In order to streamline the process for three of the Lower Manhattan Recovery Projects, FTA entered into a coordinated Section 106 review process with the USDOT, Federal Highway Administration (FHWA), lead agency for the Route 9A Project, and the Lower Manhattan Development Corporation (LMDC), lead agency under the U.S. Department of Housing and Urban Development for WTC Memorial and Redevelopment Plan, in December 2003. The three lead agencies jointly notified the SHPO and Advisory Council on Historic Preservation (ACHP) concerning these three Lower Manhattan undertakings and identified potential consulting parties to the Section 106 process. In January and February 2004, FTA, FHWA and LMDC hosted two meetings with consulting parties to discuss the projects and in particular the evaluation of the WTC site for eligibility for inclusion in the National Register of Historic Places. Consulting parties were also offered opportunities to comment on draft versions of the Coordinated DOE for the WTC site, which was issued in final form on March 31, 2004. Upon completion of the Coordinated Determination of Eligibility, the agencies proceeded with their respective projects' Section 106 responsibilities separately.

Subsequently, the FTA determined that the Permanent WTC PATH Terminal would have an adverse effect on the National Register-eligible WTC site and the National and State Register-eligible Hudson River Bulkhead. The FTA also determined that the Permanent WTC PATH Terminal may have adverse effects to off-site historic resources during its construction. As such, PANYNJ and FTA prepared a draft Permanent WTC PATH Terminal Finding of Effects pursuant to Section 106 of the National Historic Preservation Act, which was published as part of the Permanent WTC PATH Terminal's DEIS.

Consulting parties and the general public had the opportunity to comment on this draft Finding of Effects concurrent with the public comment period for this DEIS. FTA and PANYNJ hosted two Section 106 consulting parties meetings, one on June 14, 2004, and one on July 20, 2004. FTA and PANYNJ provided information at these meetings to further clarify the project's effects

on historic resources. The consulting parties commented on the Finding of Effects and provided discussion on measures to avoid, minimize or mitigate these effects.

Following the close of the public comment period on the DEIS, FTA and PANYNJ continued coordination with the Advisory Council on Historic Preservation (ACHP), SHPO, and the other Section 106 consulting parties to develop measures to avoid, minimize, or mitigate adverse effects on the resources identified in the Finding of Effects. One consulting party meeting was held on August 19, 2004, one on November 4, 2004, and one on November 15, 2004 to solicit comments on the draft Memorandum of Agreement (MOA). Another draft version of the MOA was distributed to the consulting parties on December 16, 2004, and the consulting parties were invited to comment in writing.

The consulting parties provided input on the Draft MOA both at the meetings and in writing. The full transcripts of the meetings and the written comment letters appear in Appendix H of the FEIS. The following is a summary of the major issues raised by the consulting parties and how they are addressed in the executed MOA.

- ***Perimeter Column Remnants Outlining North Tower and South Tower Footprints and the Tower Footprint Areas:*** The treatment and accessibility of the perimeter column remnants and footprint areas in the context of the Permanent WTC PATH Terminal was raised at each of the meetings. In response, the MOA contains a set of stipulations regarding FTA and PANYNJ's commitment that, to the maximum extent feasible given project implementation requirements, the design of the Terminal will preserve in place 84 column base remnants in the North Tower and 39 column base remnants in the South Tower at the existing floor at elevation 242 (58' below Sea Level) that outline the footprints of the former Twin Towers at the WTC site and are not located in the PATH right-of-way. The MOA also sets forth the total, not-to-exceed, extent of each of the tower footprints that will be permanently occupied by any portion of the project, and specifies that the east-west pedestrian corridor will be constructed outside the North Tower footprint. The tower perimeter column bases that would remain in place but may be covered by the platform will have symbolic representation, through architectural treatments, of column remnants that may be obscured or permanently removed by the Terminal's platforms.

- ***Cumulative Effects:*** Consulting parties expressed concern about the cumulative effects of multiple undertakings in this area of Lower Manhattan on the WTC site and on other historic properties in the vicinity. Initial drafts of the MOA, as well as the DEIS and FEIS, specified that Construction Protection Plans (CPPs) would be prepared in advance of construction to ensure that buildings adjacent to areas of construction for the Permanent WTC PATH Terminal would not be inadvertently harmed by a variety of factors, including ground-borne vibration. The final MOA takes into account the need to coordinate development and implementation of the CPPs with LMDC, MTA/NYCT and NYSDOT. It also specifically provides for development and implementation of a plan for protection of historic elements of the WTC site during construction activities within the Site, including construction associated with the WTC Memorial and Redevelopment Plan and, as necessary, with the Fulton Street Transit Center and Route 9A. The MOA also sets forth a detailed process for PANYNJ to address cumulative effects on the WTC site during design, and through the first six months of the Terminal's operation.

- ***WTC Site Artifacts:*** A number of consulting parties were concerned about "off-site" artifacts from the WTC site, many of which are in the interim care and custody of PANYNJ at Hangar 17 at JFK International Airport. The inventory and treatment of these off-site

artifacts is not a part of the Permanent WTC PATH station, and their possible use in the WTC Memorial will be coordinated by LMDC. However, the MOA for the WTC PATH station provides a process to be followed in the event that elements now on the WTC site must be removed during construction of the Permanent WTC PATH Terminal.

- ***E-Train Subway Entrance:*** Responding to a number of comments regarding the E-train subway entrance, the MOA specifies that the remains of the pre-September 11, 2001 entrance to the E subway line from the WTC site will be incorporated, to the greatest extent possible consistent with current building codes and Americans with Disabilities Act requirements, into the new pedestrian connection between the Terminal and the subway.
- ***Recordation of the WTC site:*** Consulting parties were very interested in a comprehensive documentation of current conditions on the WTC site prior to construction, As such, recordation of the WTC site is a stipulation of the Permanent WTC PATH Terminal MOA.
- ***Continued Participation of Consulting Parties:*** Consulting parties raised concerns regarding their continued involvement following the execution of the MOA. Consistent with the regulations implementing Section 106 of NHPA, the MOA explicitly provides for continued participation of consulting parties throughout the design process and treatment plans development following the execution of the MOA.

The MOA among the FTA, ACHP, SHPO, PANYNJ, and concurring consulting parties was executed in April 2005.

FTA solicited U.S. Department of the Interior (DOI) review of the Draft Section 4(f) Evaluation, which was published concurrent with the DEIS. In a letter dated, July 30, 2004, DOI agreed with the findings that there are no feasible and prudent alternatives to the proposed project, if project objectives are to be met (see Appendix H). However, DOI could not agree that all planning for measures to minimize harm had been undertaken. DOI recognized that the Project's Section 106 review process was ongoing and that a MOA would be executed prior to publication of the FEIS. DOI has and will continue to have involvement in the Project's Section 106 review process, including the measures developed pursuant to the MOA in order to minimize harm to the Section 4(f) resources.

The executed MOA provides for ongoing coordination with ACHP, SHPO, and the Project's Section 106 Consulting Parties during the design and construction of the Preferred Alternative. This includes review of a Resource Protection Plan, Construction Protection Plans, and HABS/HAER documentation. Design review for the treatment of the Terminal's platforms, the E subway entrance, and the east and west slurry walls will involve SHPO, ACHP, and the Project's Section 106 Consulting Parties. Furthermore, the MOA provides for a process to communicate project information with the Section 106 Consulting Parties as the design moves forward. ✳

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B. LAWS, RULES, AND REGULATIONS

FEDERAL

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This Final Environmental Impact Statement (FEIS) has been widely distributed and is available for review at libraries, community boards, and other locations. Compact disc and/or bound hard copies of the document were distributed to the federal agencies, New York and New Jersey state agencies, New York City agencies, elected officials, and Section 106 consulting parties listed below. A notice of the document's availability was mailed to the major institutions, community groups, interest groups, local businesses, property owners, property managers, and utility companies listed below.

A. LIST OF NOTIFIED PARTIES

FEDERAL AGENCIES

Advisory Council on Historic Preservation (ACHP)*
U.S. Army Corps of Engineers (ACE)
U.S. Department of Commerce, National Marine Fisheries Service (NMFS)
U.S. Department of Homeland Security, Coast Guard (USCG)
U.S. Department of Housing and Urban Development (HUD)**
U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA)
U.S. Department of the Interior
U.S. Department of Transportation, Federal Railroad Administration (FRA)
U.S. Department of Transportation, Federal Highway Administration (FHWA)**
U.S. Environmental Protection Agency (EPA)
U.S. General Services Administration, Northeast Division (GSA)**

NATIVE AMERICAN TRIBES

Cayuga Nation
Delaware Nation
Oneida Indian Nation
Onondaga Indian Nation
Poospatuck Nation Tribal Council
Shinnecock Nation Cultural Center and Museum**
Stockbridge-Munsee Band of Mohicans
St. Regis Band of Mohawk Indians
Tonawanda band of Seneca
Tuscarora Nation

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* Indicates a signatory party for the Memorandum of Agreement.

** Identifies a Section 106 consulting party.