jurisdictional waters. It is assumed that, at a minimum, a USACE Section 404 Nationwide Permit would be necessary to construct these features.

The impacts of the fill into the floodplain cannot be fully assessed at this LEA/PE phase. A detailed hydraulic analysis will be conducted during final design. At that time, a full assessment of impacts would be determined and any mitigation treatments or further potential design modifications would be coordinated with the cities of Garland and Rowlett.

3.8.3 USACE/Section 404 Coordination

As previously discussed, coordination with the USACE has been initiated and will continue through final design. This effort will include any needed coordination with the USACE on the issue of fill in the floodplains and impacts to jurisdictional waters, including wetlands, as a result of the proposed project. It will also be necessary to coordinate with the cities of Garland and Rowlett Public Works Departments in accordance with their floodplain regulations, permits and development conditions.

3.9 Noise and Vibration

3.9.1 Noise

Impact Assessment

The results of the noise analysis indicate that the existing noise environment at locations near the proposed DART Rail to Rowlett alignment is dominated by noise from railroad operations and general community activities. Based on FTA criteria, it is predicted that without mitigation, the proposed LRT operations would cause noise impacts at 20 locations as shown in **Table 3-9**. None of these impacts are in the severe category. Detailed information regarding the impacts can be found in **Appendix C**. A number of noise mitigation treatments can be considered for the impacts listed in **Table 3-9.** The two most likely methods of noise mitigation are noise barriers and sound insulation.

Sound insulation treatments are typically applied to buildings in areas where barriers would not be effective. These areas are primarily located near grade crossings, where additional noise impact is caused by train horns and grade-crossing bells. Relocation of crossovers away from noise-sensitive receptors would also reduce the noise impact. The selection of mitigation would depend on more detailed analysis during final design, including input from abutting neighbors.

Table 3-9: Summary of Noise Impacts

Location	Side of Track	Number of Noise Impacts	
		Moderate	Severe
Parker Circle	S	13	0
Davidson Street	S	0	0
Palomino Drive	S	0	0
Vicinity of Main Street	N	1	0
Rowlett North of Main Street	N	1	0
Rowlett South of Main Street	S	4	0
Totals		**19**	**0**

Source: HMMH, 2006

Potential mitigation treatments for reducing projected noise impacts resulting from the proposed DART Rail to Rowlett are described below.

- **Noise Barriers.** This is a common approach to reducing noise impacts from surface transportation sources. The primary requirements for an effective noise barrier are that (1) the barrier must be high enough and long enough to break the line-of-sight between the sound source and the receiver, (2) the barrier must be of an impervious material with a minimum surface density of 4 pounds per square feet and (3) the barrier must not have any gaps or holes between the panels or at the bottom. Because numerous materials meet these requirements, the selection of materials for noise barriers is usually dictated by aesthetics, durability, cost and maintenance considerations. Depending on the proximity of the barrier to the tracks and on the track elevation, transit system noise barriers typically range in height from between four and eight feet.

- **Relocation of Crossovers or Special Trackwork at Crossovers.** Because the impacts of wheels over rail gaps at track crossover locations, or turn-outs for passing tracks, increases vibration by about 6 dBA, crossovers are a major source of vibration noise impact when they are located in sensitive areas. If crossovers cannot be relocated away from residential areas, spring-rail or moveable point frogs in place of standard rigid frogs at turnouts allow the flangeway gap to remain closed in the main traffic direction for revenue service trains.

- **Building Sound Insulation.** Sound insulation to improve the outdoor-to-indoor noise reduction has been widely applied around airports and has seen limited application for transit projects. Although this approach has no effect on noise in exterior areas, it may be the best choice for sites where noise barriers are not feasible or desirable, and for buildings where indoor sensitivity is of most concern. Substantial improvements in building sound insulation (on the order of 5 to 10 dBA) can often be achieved by adding an extra layer of glazing to the windows, by sealing any holes in exterior surfaces that act as sound leaks, and by providing forced ventilation and air-conditioning so that windows do not need to be opened.

- **Grade Separation, Quiet Zones or Closure of Grade Crossings.** Because the sounding of horns is the dominant noise source for trains near grade crossings, the reduction or elimination of horn use can be an extremely effective noise mitigation measure. Grade crossing noise can be eliminated by grade separations, by closure of grade crossings or by implementation of Federal Railroad Administration (FRA) approved quiet zones. The FRA has published an Interim Final Rule on the *Use of Locomotive Horns at Highway-Rail Grade Crossings* that may allow this under certain conditions. The rule, described in 49 CFR Parts 222 and 229 (December 18, 2003), would permit local public authorities to establish "quiet zones" in which train horns may not be routinely sounded, provided that adequate supplementary safety measures (i.e., four quadrant gates and channelization arrangements) are applied at the crossings to compensate for the absence of the train horn. The rule also authorizes the use of automated wayside horns at crossings with flashing lights and gates as a substitute for the train horn. While activated by the approach of trains, these devices are mounted at the grade crossings, thereby limiting the horn noise exposure area to the immediate vicinity. Although the establishment of quiet zones or the use of wayside horns would be very effective noise mitigation treatments, considerable design analysis and coordination efforts with the railroad and local communities along the corridor would be required to determine if these measures are feasible. In addition to reducing the noise generated by the LRT operations, a quiet zone would also eliminate current horn noise from freight trains, providing an additional benefit to the surrounding community.

FTA requires that severe impacts be mitigated unless there are no practical means to do so. While mitigation is encouraged at the moderate impact level, the implementation of such mitigation would depend on other project-specific factors. These other factors can include the projected increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-to-indoor sound insulation and the cost-effectiveness of mitigating noise to more acceptable levels. Consistent with DART policy on prior FTA-funded rail extensions, noise mitigation is only considered at locations where a noise exposure increase of three dB or more is projected.

Based on the results of the noise assessment, mitigation treatments have been identified for the moderate impacts where there is a projected three dB increase in the noise level. The primary mitigation measure would be the construction of sound barrier walls to shield areas where impact is projected. **Table 3-10** indicates the approximate noise barrier locations, lengths, and side of tracks as well as the number of impacts that would be reduced. Typical barrier height is about eight feet, and can be somewhat less on elevated structures. Exact height and configuration depend on specific conditions, and will be determined during final design.

Table 3-10: Noise Mitigation Locations

Location	Side of Track	Civil Station	Height (ft)	Length (ft)	Impacts[1]	
					Without Mitigation	With Mitigation
Residence on Main Street N	N	1162-1167	4	500	1	0
Residences North of Main Street (Rowlett)	N	1181-1185	8	400	1	0
Residences South of Main Street (Rowlett)	S	1175-1182	4/8[2]	700	4	0
Total					**6**	**0**

Source: HMMH, 2006
Notes: [1] Impacts that are required to be mitigated in accordance with the DART noise mitigation policy.
[2] The barrier should be 4 feet high on the elevated structure, with a transition to 8 feet high at grade.

Mitigation Treatments

After the noise analysis was completed, coordination with City of Rowlett revealed that the properties identified above are a part of the Downtown Rowlett Main Street Project. Each property will be incorporated into the TOD associated with this project, and therefore no mitigation would be required.

In addition, environmental justice and community concerns, as well as the concerns of the City of Garland, necessitate a noise wall for the entire length of the corridor abutting the Rainbow Estates neighborhood. This wall will be approximately 2,270 feet in length.

3.9.2 Ground-borne Vibration

Impact Assessment

Other than very occasional low-speed freight train movements, there is not a significant source of existing vibration along the alignment. Based on FTA criteria, it is predicted that without mitigation, the LRT operations would cause vibration impacts at 13 locations as shown in **Table 3-11**. All of these impacts are related to annoyance effects and not to building damage effects. There are a number of options available for the mitigation of vibration impacts. The most common method is ballast mats. Ballast mats consist of pads made of rubber-like material placed on an asphalt or concrete base with the normal ballast, ties and rail on top. Because the vibration reduction provided by ballast mats is limited at lower frequencies, their effectiveness is dependent on the frequency content of vibration. Relocation of crossovers away from vibration-sensitive receptors would also reduce the vibration impact. Mitigation options would be evaluated in more detail during final design, and the most appropriate measures would be selected based on feasibility, cost effectiveness, and community input.

Table 3-11: Summary of Vibration Impacts

Location	Side of Track	Impact
Parker Circle	S	13
Davidson Street	S	0
Palomino Drive	S	0
Vicinity of MAIN STREET	N	0
Rowlett North of Main Street	N	0
Rowlett South of Main Street	S	0
Total		**13**

Source: HMMH, 2006

The assessment assumes that the vehicle wheels and track are maintained in good condition with regular wheel truing and rail grinding. There are several approaches to reduce ground-borne vibration from LRT operations listed below.

- **Ballast Mats.** A ballast mat consists of a pad made of rubber or rubber-like material placed on an asphalt or concrete base with the normal ballast, ties and rail on top. The reduction in ground-borne vibration provided by a ballast mat is strongly dependent on the frequency content of the vibration and design and support of the mat.

- **Tire Derived Aggregate (TDA).** TDA or shredded tires consists of installing a layer of tire shreds, typically about one foot thick and encased in geo-textile material, in a trench and covering it with a one-foot thick layer of sub-ballast and a one-foot thick layer of ballast to support the track. Preliminary tests suggest that the vibration attenuation properties of the tire shreds are midway between that of ballast mats and that of floating slab track beds. Thus far, this treatment has only recently been installed on two U.S. LRT systems, in San Jose and in Denver. Although this is a low-cost option, the effectiveness of these shredded tire installations has not yet been tested under train operating conditions and the long-term endurance and vibration isolation performance of this treatment is unknown.

- **Resilient Rail Fasteners.** Resilient fasteners can be used to provide vibration isolation between rails and concrete slabs for direct fixation track on aerial structures or in tunnels. These fasteners include a soft, resilient element to provide greater vibration isolation than standard rail fasteners in the vertical direction.

- **Relocation of Crossovers or Special Trackwork.** Because the impacts of wheels over rail gaps at track crossover locations, or turn-outs for passing tracks, increases vibration by about 10 dBA, crossovers are a major source of vibration impact when they are located in sensitive areas. If crossovers cannot be relocated away from residential areas, another approach is to use spring-rail or moveable point frogs in place of standard rigid frogs at turnouts. These devices allow the flangeway gap to remain closed in the main traffic direction for revenue service trains.

- **Floating Slabs.** Floating slabs consist of thick concrete slabs supported by resilient pads on a concrete foundation; the tracks are mounted on top of the floating slab. Most successful floating slab installations are in subways, and their use for at-grade track is rare. Although floating slabs are designed to provide vibration reduction at lower frequencies than ballast mats, they are extremely expensive.

- **Property Acquisitions or Easements.** Additional options for avoiding noise and vibration impacts are for the transit agency to purchase residences likely to be impacted by train operations or to acquire easements for such residences by paying the homeowners to accept the future train vibration conditions. These approaches are usually taken only in isolated cases where other mitigation options are infeasible, impractical, or too costly.

Vibration impacts that exceed FTA criteria are considered to be significant and to warrant mitigation, if reasonable and feasible. **Table 3-12** indicates the locations along the proposed DART Rail to Rowlett Corridor where mitigation has been recommended to reduce the vibration levels. At a minimum, mitigation would require the installation of ballast mats or TDA. However, more extensive mitigation may be required to adequately reduce the vibration levels to below the FTA vibration impact criterion. Vibration mitigation will be addressed in more detail during final design. The vibration mitigation locations in **Table 3-11** are preliminary only, and will be refined based on a more complete vibration analysis with more detailed engineering information.

Table 3-12: Vibration Mitigation Locations

Location	Impacts	Civil Station	Length (ft)
Parker Circle	13	994-1004	1,000
Total			**1,000**

Source: HMMH, 2006

<u>Mitigation Treatments</u>

Vibration Impacts would be mitigated between Civil Station 994 and 1004 to include 1,000 ft. of treatments to be developed during final design.

3.10 Air Quality

This section describes the air quality assessment for the proposed DART Rail to Rowlett. The purpose of this assessment is to identify potential air quality impacts for the proposed DART Rail to Rowlett as compared to the No-Build Alternative and to identify any mitigation treatments that may be required to reduce impacts to a level less than significant.

3.10.1 Air Quality

<u>Impact Assessment</u>

The potential for air quality impacts was evaluated by using an existing regional air quality emissions analysis, dispersion modeling, and evaluating any mitigation treatments determined