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3.19 STREAM IMPACTS

3.19.1 Introduction

Indiana's rivers and streams provide water supplies for communities, irrigation for agriculture, recreational opportunities and habitat for wildlife. Streams evaluated for impacts in this section include perennial, intermittent and ephemeral streams, as well as ditches and unclassified drainages (**Figure 3.19-1**). Perennial streams are those that maintain a base flow year-round while intermittent streams are those with a base flow through a majority of the year but will cease to flow during the dry season. Both perennial and intermittent streams are connected to groundwater which provides a component of their flow. Ephemeral streams exist higher in the watershed and are not connected to groundwater, and as such, only flow in response to storm events. Ditches and unclassified drainages are features in the dataset that do not have a verified flow regime. These are almost exclusively in the category of ephemeral but may include some intermittent features.

Impacts to streams affect not only surface water quality, but also groundwater resources, especially those in karst topography and other areas where recharge rates are high and sinking or disappearing streams are present. Indiana streams and rivers were historically home to 80 species of freshwater mussels, nearly half of which are now extirpated or endangered. Mussels are natural filters that are an important source of food for wildlife. They stabilize the stream bottom and are good indicators of water quality. Physical changes to waterways, hydrology changes, invasive species, and pollution threaten native mussels. A number of federally- and state-listed mussels have been recorded in or near the project area. More detailed discussion on mussels can be found in **Section 3.16 Threatened and Endangered Species**.

Impacts to water quality from the transportation corridor can be broken into three primary categories: construction, operation and maintenance.

- **Construction**. Creating or expanding roadways involves earthmoving (such as clearing/grubbing, grading, filling and excavation) that temporarily removes vegetative cover, exposing soils which can cause sediment to enter the waterways during storm events. The new infrastructure can change localized runoff patterns and concentrate more stormwater runoff from increased impervious surface area. Areas where construction occurred may have compaction of soils from the heavy equipment. This can also result in less stormwater infiltration and increase stormwater runoff to streams and rivers.
- **Operation**. Impacts to streams and rivers from the operation of the transportation corridor can occur when pollutants enter the waterway from runoff or become air-borne and then deposited upon fall out. Primary constituents of highway runoff associated with typical operations include total suspended solids (TSS) from pavement wear, atmospheric deposition, and dirt; lead from tire wear; zinc from tire wear, motor oil and grease; copper from moving engine parts and brake lining wear and petroleum from spills, leaks, gasoline, antifreeze and hydraulic fluids.
- **Maintenance**. Implementation of deicing practices during the winter months and herbicide spraying for invasive/noxious vegetative species within the right-of-way during the growing season are examples of maintenance practices which can impact water quality. Deicing salt helps to maintain safe roadways in the winter, but surface runoff from the roadway leads to elevated levels of chloride within streams as a result of these road salt applications. The amount of salt entering the environment depends on the pavement area, number of snowstorms per season requiring application and the application rate of deicing agents. These impacts may result in short-term acute loadings during and immediately following significant storm events or produce a long-term chronic issue from accumulation within the soils.

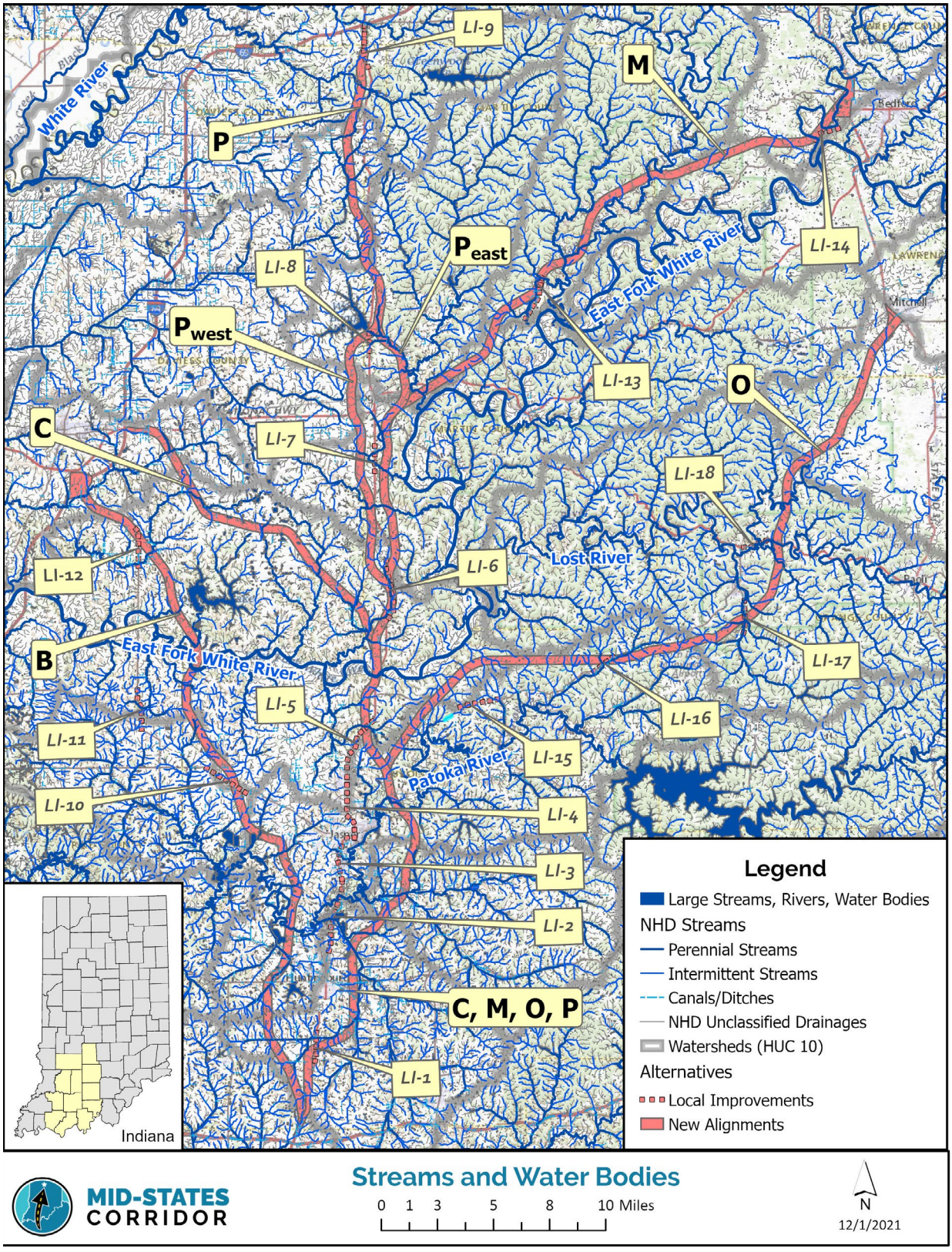

Figure 3.19-1: Streams and Drainages in the Mid-States Corridor

Section 305(b) and 303(d) of the Clean Water Act requires each state to provide regular reporting on the quality of their surface water to the U.S. Environmental Protection Agency (USEPA). Reports must specify how the state defines "designated" or "beneficial" uses for their waters and what criteria is used to determine the waterbodies meet each use. For the State of Indiana, water quality standards for rivers and streams are established under Title 327 Indiana Administrative Code (IAC), Article 2, Rule 1. The Indiana Department of Environmental Management (IDEM) is responsible for preparing the Integrated Water Monitoring and Assessment Report every two years for submittal to the USEPA. Those waterbodies which do not fully support their beneficial uses are considered impaired and must be reported. Title 327 is designed to ensure all waters of the state, unless specifically exempted, are safe for full body contact recreation and are protective of aquatic life, wildlife and human health. The primary categories of beneficial uses include:

- Aquatic Life Use
- Recreational Use
- Fish Consumption Use
- Public Water Supply Use

IDEM is required to place streams which do not fully support their beneficial uses on Indiana's 303(d) List of Impaired Waters. Where impairments are identified, the state will seek to develop Total Maximum Daily Load (TMDL) reports for the watershed it is within. A TMDL analyzes the source of pollutants and develops strategies to improve water quality within the TMDL watershed to support the restoration of the beneficial uses of the impaired waters. Due to the number of impaired waters, not all are located within approved TMDL watersheds.

3.19.2 Methodology

The project Geographic Information System (GIS) was used to identify and quantify stream impacts. **See Section 3.1 - Overview and Methodology** and **Appendix X - Geographic Information System Technical Documentation** for more information about use of project GIS for impact calculations.

Spatial data for Indiana streams, rivers and drainages were obtained from the Local-Resolution National Hydrography Dataset (1:2,400), created by the United States Geological Survey (USGS) and USEPA dated April 26, 2019. Data included two stream layers. One layer was for classified streams that are streams for which a stream type of perennial or intermittent has been determined. Another layer was for unclassified streams that don't have a type assigned. Impaired streams spatial data was obtained from the spatial data layer of the 2018 303(d) List of Impaired Waters created by IDEM. IDEM's 2020 303(d) list as of this writing is still under review by USEPA and not final for public use.

Spatial analysis tools were used to calculate the linear feet of streams that intersected the alternative working ROWs. Results were summarized by alternative and presented as differing stream types. Stream types summarized included perennial, intermittent, canals/ditches, and unclassified drainageways. River centerlines were added with the perennial stream type. Line data not representing natural streams was queried out of the analysis, including connector lines for modeling, underground conduits, underground pipelines and artificial streams for modeling. Similarly, spatial analysis tools were used to calculate the linear feet of impaired streams intersecting the alternative working ROWs.

3.19.3 Analysis

3.19.3.1 Stream Impacts

Table 3.19-1 shows the range of estimated impacts on streams and drainages for each alternative. Impacts for each specific alternative variation are explained in greater detail in **Appendix L - Stream Impact Analysis**. Unclassified drainages comprise 53 – 60 percent of stream impacts for all alternatives. These unclassified streams/drainages will be further described and quantified as it is reasonable and appropriate in Tier 2 field studies.

Stream Impacts (Linear Feet)*						
Alternative**	Canals/Ditches	Intermittent	Perennial	Subtotal of Stream Types	Unclassified Drainage	Total Impact
B	28,300 - 33,000	26,200 - 30,700	11,600 - 13,200	66,100 - 76,900	78,900 - 92,000	145,000 - 168,900
C	22,700 - 27,400	20,800 - 26,900	8,600 - 10,500	52,100 - 64,800	68,200 - 87,300	120,300 - 152,100
M	34,200 - 37,600	33,800 - 41, 900	29,400 - 32,600	97,400 - 112,200	140,900 - 167,400	238,300 - 279,600
O	26,900 - 31,300	45,700 - 52,100	13,500 - 14,800	86,100 - 98,200	95,900 - 111,500	182,000 - 209,700
P	22,900 - 27,300	27,600 - 36,600	16,500 - 24,000	66,900 - 87,900	91,600 - 120,000	158,488 - 207,875

* Tier 1 impacts are reported in ranges including all the alternative bypass and facility type options.

**Facility type 1, freeways, has been removed from consideration. Therefore, no modifications to existing US 231 in Section 1 and existing SR 37 in Section 3 are anticipated. No impacts are anticipated on either of these facilities.

Table 3.19-1: Range of Stream Impacts by Type and Alternative

The Northeast Family Alternatives M and O and Alternative P expressway have the greatest impacts to streams. Alternative M has the most stream impacts with eight to eleven miles more classified stream impacts than the Northwest Family Alternatives B and C or the Super-2 variation of Alternative P. Alternative M has 20 – 30 more miles of total impacts including unclassified drainages. Alternative O and the expressway variations of Alternative P have the second highest stream impacts. Alternative M has roughly 13-18 more miles of stream impacts, including unclassified drainages, than Alternative O. Excluding unclassified drainages, Alternative M has three to five miles more stream impacts than Alternative O. Alternative C has the lowest impacts to streams in all classifications. Alternative P has the widest range of overall stream impacts, 21,000 linear feet or four miles, due to the bypass variations around Loogootee.

Perennial stream impacts ordered from greatest to least by alternative are as follows: M, P, O, B and C. Perennial streams have notably more impacts in Alternative M with three to four times more impacts compared to Alternative C. Alternative M runs parallel to the East Fork of the White River and crosses many connected creeks and tributaries. Alternative P has the second highest impacts to perennial streams. Despite comparable length, Alternative O has substantially lower perennial stream impacts compared to Alternative M. This likely reflects its location and karst geology. Alternative C has the lowest perennial stream impacts with approximately 19,000 feet less impact than Alternative M and approximately 6,000 feet less impact than the lowest impact variation of Alterative P.

Intermittent stream impacts ordered from greatest to least by alternative are as follows: O, M, P, B and C. Alternative O has the highest impacts to intermittent streams, again, likely attributable to its topography and geology. It has roughly 4,000 feet more impacts to intermittent streams than Alternative M and 9,000 more than the expressway variation of Alternative P. Alternative C has the lowest impacts on intermittent streams with 3,000 feet less impact than the next smallest, Alternative B, and 31,000 feet, or 5.8 miles, less impact than the largest, Alternative O.

Ditch and canal impacts ordered from greatest to least by alternative are as follows: M, B, O, P and C; with Alternatives C and P being very similar. Impacts to ditches and canals are concentrated in local improvement areas.

This results from the existing facilities having established ditches and canals for drainage. Impacts to canals and ditches are highest in Alternative M, which also has the highest ROW area and one of the longest lengths. Alternative B is half the length of O and roughly 1,000 acres less ROW but has more canal and ditch impacts. Alternative B is located in an agricultural area with level topography where drainage using canals and ditches is more frequent. Alternative C has the lowest impacts for all stream types and totals, including ditches and canals, and it is similar to the impacts in Alternative P.

Unclassified drainages account for 53 - 60 percent of the total stream impacts for all alternatives. Unclassified streams mostly consist of small ephemeral drainages, but may occasionally have more substantial channels that have not been evaluated. These drainageways may or may not have water present outside of a rain event and may or may not exhibit well developed channels associated with streams. These drainages will be evaluated in detail with Tier 2 field work to determine flow type and jurisdictional status. Impacts to unclassified drainages follow the same general trend as stream impacts overall, with Alternative M having the most impacts followed by O, P, B and the lowest being Alternative C.

The No-Build Alternative would not produce additional impacts beyond its current operational use and maintenance activities.

3.19.3.2 Impaired Stream Impacts

Table 3.19-2 shows the range of estimated impacts on impaired streams for each alternative. Impacts for each specific alternative variation is explained in greater detail in **Appendix L** and **Appendix R, Section 303(d) List**.

Impaired Streams Impacts (linear feet)*				
Alternative**	**Liner Feet Crossed**	**Number of Crossings**	**Number of Unique Streams impacted**	**Number TMDL Watersheds**
B	**22,800 - 26,700**	**40**	**15**	**1**
C	**13,900 - 16,900**	**31**	**13**	**1**
M	**25,000 - 28,500**	**38 - 39**	**12**	**2**
O	**25,000 - 28,100**	**47 - 48**	**15**	**1**
P	**12,600 - 15,100**	**27**	**9**	**3**

*Tier 1 impacts are reported in ranges including all the alternative bypass and facility type options. Impaired streams include streams with 5A/5B impairments included on the 2018 303(d) listing.

**Facility type 1, freeways, has been removed from consideration. Therefore, no modifications to existing US 231 in Section 1 and existing SR 37 in Section 3 are anticipated. No impacts are anticipated on either of these facilities.

Table 3.19-2: Range of Impacts to Impaired Streams

A total of four approved TMDL watersheds were identified in the study area: First Creek watershed (0512020205), Prairie Creek watershed (0512020207), Salt Creek watershed (0512020808) and East Fork White River watershed (0512020815) (**Figure 3.19-2**). Listed 303(d) streams in the East Fork White River TMDL area, which all alternatives are within, have impaired recreational use due to E. coli and impaired aquatic life use due to dissolved oxygen levels. The East Fork White River is also impaired for fish consumption due to levels of PCBs. Listed 303(d) streams in the Prairie Creek TMDL area, which includes Alternative P, are impaired for recreational use due to E. coli and aquatic life use due to an impaired biotic community from excess nutrients, low dissolved oxygen and pH. Listed 303(d) streams in the First Creek TMDL area, which includes Alternative P, are impaired for recreational use due to E. coli and aquatic life use from an impaired biotic community. Fish consumption is impaired in the White River from the levels of PCBs found in fish tissue. Listed 303(d) streams in the Salt Creek TMDL area, which includes Alternative M, are impaired for recreational use due to E. coli and aquatic life use due to an impaired biotic community from excess nutrients and

low dissolved oxygen. Salt Creek, Clear Creek and Pleasant Run also have impairments to fish consumption due to levels of PCBs and Salt Creek impairments include mercury. Further information for the impaired streams and TMDL areas are available in **Appendix R**.

Direct impacts to impaired streams are greatest for Alternative M and Alternative O, but Alternative O has a notably higher number of crossings. Alternative B has the median amount of impaired stream impacts, but is similar in the number of crossings as Alternative M. Alternative C has an average of 1,500 feet more impaired stream impacts than Alternative P, and has more crossings of more unique streams. Alternative P has the least impacts to impaired streams with 27 crossings of nine streams; however, Alternative P crosses the largest number of watersheds which have an approved TMDL. As noted in the introduction section, impacts to water quality can be categorizes into three activities for transportation projects: construction, operation, and maintenance. The number of crossings and linear feet of impact is used to reflect the impacts during the construction period. These disturbances would be permitted activities and the construction impacts would not be anticipated to cause further impairment of these waterbodies. The existing impairments of each of these waterbodies are primarily associated with agricultural non-point pollution. The impairment sources were not affiliated with transportation facilities and none of the alternatives would be anticipated to cause further impairment to these 303(d) waterbodies as result of operation or maintenance.

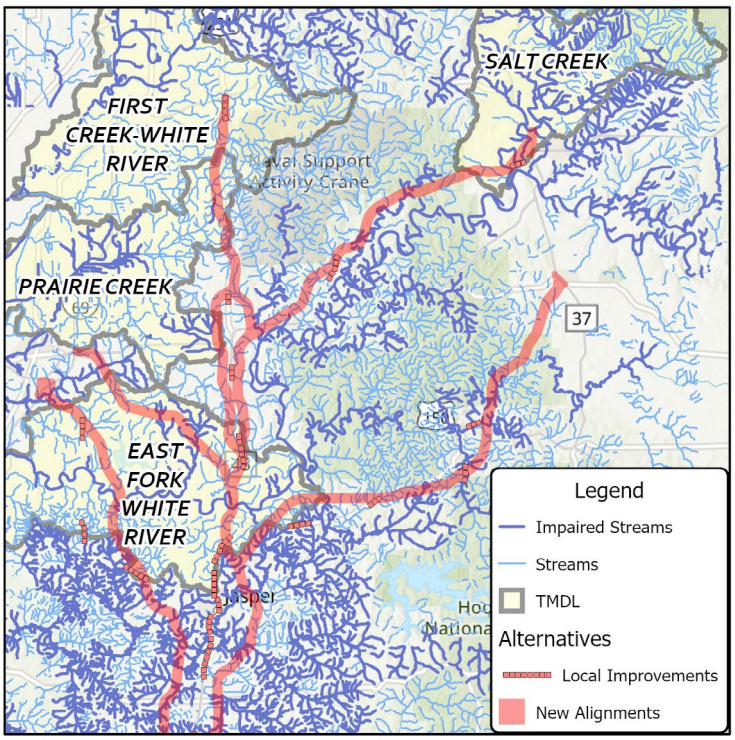

Figure 3.19-2: Watersheds with Approved TMDLs in the Study Area

3.19.4 Mitigation

State and federal permits for impacts to streams require documentation of avoidance and minimization of impacts. Tier 2 design will minimize stream impacts to the greatest extent practicable. Where impacts are unavoidable, a detailed compensatory mitigation plan for impacted streams will developed as part of the Clean Water Act Section 404/401 permitting process. INDOT and FHWA will continue consultation with appropriate resource agencies in Tier 2 regarding mitigation strategies. Mitigation plans may include the mitigation banks, state in-lieu fee programs or on-site plans for stream relocations or enhancements. Stream mitigation and monitoring plans will be developed as appropriate. A Stormwater Pollution Prevention Plan (SWPPP) will be developed and approved by INDOT and IDEM prior to construction. A SWPPP will include Best Management Practices (BMPs) to be used during construction of the project to prevent sediment from entering waterways. The primary water quality impairments in the study area are affiliated with agricultural non-point pollution (*excess nutrients and E. coli.*). The construction activities would not be anticipated to contribute towards these types of impairments. The BMPs deployed would be targeted to prevent sediment or chemicals from leaving the construction areas where their introduction into the waterbodies could create new types of water quality impairment. Increased measures may be necessary to protect groundwater in sensitive areas such as those with karst geology or designated protection areas for water supply. The use of potential mitigation measures will be intended to protect and improve identified impaired streams and newly impacted streams.

For a consolidated listing of proposed mitigation measures, see **Chapter 6 Mitigation and Commitments**. INDOT and FHWA will continue consultation with appropriate resource agencies in Tier 2 regarding mitigation. Detailed mitigation plans will be determined at that stage.

3.19.5 Summary

Alternative M has the greatest impacts to streams and impaired streams, and Alternative C has the least impacts. Alternative M has substantially higher impacts to perennial streams while Alternative O has higher impacts to intermittent streams when compared with other types. Impacts to canals and ditches come from both new alignments and local improvements in similar amounts, likely due to the fact that local improvements involve existing facilities with associated drainage. Unclassified drainages comprise approximately 50 percent to 60 percent of stream impacts for all alternatives. These unclassified streams/drainages will be further described and quantified as it is reasonable and appropriate in Tier 2 field studies. Proposed alternatives impact a total of four watersheds with approved TMDL reports for water quality protection. The impaired East Fork of the White River watershed is crossed by all alternatives. Alternative P, the preferred, has a median number of impacts to streams compared to other alternatives both for grand totals and streams analyzed by type. One exception is for canals and ditches, where Alternative P is comparable to Alterative C for the least impacts. Alternative P has the least impacts and crossings of impaired streams but traverses the most TMDL watersheds. The total linear feet of potential disturbance associated with crossings and realignment is used as the key measurement for comparison. None of the existing stream impairments are associated with transportation sources, and none of the alternatives would be anticipated to cause new or further impairment of the water quality in receiving streams. The use of linear feet of potential direct impact provides a level comparison criterion for the U.S. Army Corps of Engineers (USACE) to use in determining a Least Environmentally Damaging Practicable Alternative (LEDPA).