Geologic Features

What are the typical geological features of the Osage, Maries and Phelps County region?

Topography along Route 63 through Osage, Maries and Phelps Counties is one of long tapering ridges, separated by moderately steep, well-entrenched valleys. The overall geologic conditions are characterized by layered, carbonate sedimentary bedrock. Under certain conditions, and infrequently, the rock can be disturbed or crushed and broken through faulting. Rock may be rotated at higher angles caused by tectonic activity and deep underground water solutioning activity. Since the rock is solutional, containing water-dissolving properties, shallow and deep features such as caves, voids and clay filling may be present. Caves or rock that have been voided and collapsed under pressure can be seen in the rock masses.

Existing rock cut along Route 63 at the Gasconade River Bridge shows solutioning activity, voids and clay filling.

All the soils, except for that which is alluvial (soil deposited by flowing water) and colluvial (soils transported downhill by gravity and water), are derived from the in-place chemical and mechanical weathering of the underlying original rock mass. The depth to bedrock can be highly variable, but can be predicted based on the particular location it is in. The soil layer, or mantle, is typically thin, 10 feet or less on the ridges underlain by the Jefferson City Formation. Rock is exposed in places along bluffs and some hillsides, and in road cuts. Depth to bedrock can be deeper, 10 to 50 feet, in the uplands and on ridge tops, with the underlying rock belonging to the Roubidoux Formation. Soil found above the layer of the Roubidoux Formation may contain a large amount of residual chert fragments. Pennsylvanian age shales, sandstones and claystones may be encountered in cuts from north of Vichy to just south of the Maries/Osage County line and just north of Rolla. These materials may require special handling. Only a few flat alluvial valleys exist throughout the study area. A mantle of 10 to 25 feet of mostly sand and gravel overlying bedrock may characterize these valleys. Colluvial soils can be found at the base of some slopes and may be up to 15 feet deep.

How does this geological data relate to the design of the roadway?
After horizontal and vertical alignments have been established, a geotechnical investigation is performed consisting of drilling, sampling and testing. During the design process, it is assumed there may be deep rock cuts and fills to achieve the desired grades. An economical design consists of balanced earthwork where the volumes of cut are sufficient to provide material for sections requiring fill and where hauling material from cut to fill sections is minimal. General locations of rock and soil layers are helpful for quantifying the different classes of excavation for construction bidding purposes. The type of material also affects the slopes used on the roadsides. Unstable soils require a more gradual slope to prevent slides, whereas some rock can be cut with a near vertical face. The types of cut and fill slopes also affects the amount of land required for the project.

What methods are used for drilling, sampling and testing along the proposed highway?
MoDOT geotechnical teams usually probe the cut area for rock at 100-foot intervals along the centerline of the roadway, to the left at the ditch line and to the right at the ditch line of the proposed alignment. The borings at the centerline locations are usually drilled to refusal and in the ditch lines to 10 feet below proposed grade or to the top of rock, whichever is less.

Wild and Scenic Rivers

The National Wild and Scenic Rivers Act of 1968 established a national system of rivers to be preserved in free-flowing condition, with their immediate environments protected. Congress selected certain rivers that possess outstandingly remarkable outdoor values. They established an initial system of eight rivers, and set up methods and procedures for adding new rivers to the system.

The Nationwide Rivers Inventory (NRI) is a register of rivers that may be eligible for inclusion in the National Wild and Scenic Rivers System. Rivers are placed on the NRI based upon the degree to which they are free flowing, the degree to which the rivers and their corridors are undeveloped, and the outstanding natural and cultural characteristics of the rivers and their immediate environments. There are three classifications of rivers in the system: wild, scenic, or recreational depending on the level of development near the stretch of river. There are no designated wild, scenic, or recreational rivers in the study area.

Air Quality

What impacts would the project have on air quality?
The Clean Air Act (CAA) requires the adoption of air quality standards, quality control regions, and state implementation plans. The federal government established the National Ambient Air Quality Standards (NAAQS), to protect public health, safety and welfare from known or anticipated effects of sulfur dioxide, particulate matter, carbon monoxide, nitrogen dioxide, ozone, and lead. In addition to these pollutants, the State of Missouri established additional criteria for hydrogen sulfide and sulfuric acid.

Transportation can contribute to four of the six NAAQS pollutants: ozone, carbon monoxide, particulate matter, and nitrogen dioxide. Transportation conformity with the NAAQS, as required by the CAA, ensures that federally funded or approved transportation plans, programs, and projects conform to the air quality objectives established in State Implementation Plans. MoDOT is responsible for implementing the conformity regulation in nonattainment and maintenance areas. However, the Route 63 study area is located in a non-classified area as defined by the EPA through the CAA. Therefore, the transportation conformity requirements do not apply to this project. All of the alternatives, including the No-Build Alternative, would generate only minimal air quality impacts and are not subject to any other air quality analysis.

Floodplain Impacts

What is the 100-year (one-percent) floodplain and regulatory floodway?
Executive Order 11988, Floodplain Management, and subsequent federal floodplain management guidelines mandate an evaluation of floodplain impacts. When available, flood hazard boundary maps (National Flood Insurance Program) and flood insurance studies are used to determine the limits of the base (100-year) floodplain and the extent of encroachment.


Maries River Floodplain

The Federal Emergency Management Agency (FEMA) and FHWA regulation 23 CFR 650 have identified the base (100-year) flood as the flood having a one-percent probability of being equaled or exceeded in any given year. The base floodplain is the area of 100-year flood hazard within a county or community.

The regulatory floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood discharge can be conveyed without increasing the base flood elevation more than a specified amount.

FEMA has mandated that projects can cause no rise in the regulatory floodway, and a one-foot cumulative rise for all projects in the base (100-year) floodplain. For projects that involve the state of Missouri, the State Emergency Management Agency (SEMA) issues floodplain development permits. In the case of projects proposed within regulatory floodways, a "no-rise" certificate, if applicable, should be obtained prior to issuance of a permit.

How are floodplains beneficial?
Floodplains provide a number of important functions in the natural environment, including creating wildlife habitat, providing temporary storage of flood water, preventing heavy erosion caused by fast moving water, recharging and protecting groundwater, providing a vegetative buffer to filter contaminants, and accommodating the natural movement of streams. Engineering analyses of floodplain impacts will be conducted to avoid and reduce impacts by bridging wherever possible. A determination will be made as to whether or not floodplain encroachment is significant. It is not possible to avoid floodplains completely; however, encroachments will be longitudinal whenever possible, so as to minimize floodplain impacts.

The use of bridges serves a dual function by reducing wetland disturbance while minimizing construction impact in the floodplain. Where feasible, the proposed crossings are located adjacent to existing road crossings where the additional impact would be minimized.

Flood Hazard Boundary Maps are available for Osage, Maries, and Phelps Counties. Special Flood Hazard Areas (SFHAs), classified as Zone A base (100-year) floodplain, occur intermittently throughout the area of the proposed project. Detailed hydraulic analyses are not performed by FEMA for Zone A areas, so no base flood elevations or depths have been determined.

The proposed project crosses base (100-year) floodplain at the Maries River, just south of Westphalia in Osage County, the Gasconade River and Spring Creek in Maries County, and Spring Creek in Phelps County (Appendix H, Plates 1-9). The Preferred Alternative and Alternative 2 would require a total of 45.1 acres of floodplain. Alternative 1 would need 76.1 acres, the connectors would require 4.8 acres, and improvements on existing right of way would need 97.6 acres. A floodplain development permit would be necessary.

Are there any FEMA buyout properties?
The Flood Disaster Protection Act of 1973, as amended by the Disaster Relief and Emergency Assistance Act of 1988, the Stafford Act, identified the use of disaster relief funds under Section 404 for the Hazard Mitigation Grant Program (HMGP), including the acquisition and relocation of flood damaged property. The Volkmer Bill further expanded the use of HMGP funds under Section 404 to "buyout" flood damaged property that had been affected by the Great Flood of 1993.

There are numerous restrictions on these FEMA buyout properties. No structures or improvements may be erected on these properties unless they are open on all sides. The site shall be used only for open space purposes and stay in public ownership.

These conditions and restrictions, along with the right to enforce same, are deemed to be covenants running with the land in perpetuity and are binding on subsequent successors, grantees, or assigns. Any decision involving these properties should take into consideration that two to three years is necessary to process an exemption from FEMA to utilize this parcel. This exemption would likely be a permanent easement rather than a transfer of property. According to available references, there are no FEMA buyout properties in the study area.

Water Quality

What is water quality?
Water quality is the physical, chemical, and biological characteristics of water in relationship to a set of standards. Water quality standards are created for different types of water bodies and water body locations per their desired use. The primary uses considered for such characterization are parameters, which relate to drinking water, safety of human contact, and for the health of ecosystems.

There are several public water supply wells located within the study area. These wells are located in the vicinity of Westphalia, Freeburg, Vienna, and Vichy and serve the adjacent communities or are owned by the county water supply districts serving rural customers. All of these public wells draw from the Gasconade and Potosi Dolomite Geological Formations, both of which are formations of the Ozark aquifer having moderate yields of groundwater production ranging from 70 to over 125 gallons per minute.

The Preferred Alternative and Alternative 2 may impact two public water supply wells, owned by Osage County Public Water District #2, northeast of Westphalia. No wellhead protection areas are known to exist within the study area, although MDNR has established preliminary source water areas for public water supply wells in the region. If a public water supply well is compromised by construction, the well would be properly closed and the public water supply district would be provided a new supply source at a different location. No surface water sources of public water supply are found within the study area.

Several streams within the study area have beneficial uses as designated in the water quality standards established by the Missouri Clean Water Commission. The Gasconade River has several designated uses: Livestock and Wildlife Watering, Protection of Warm Water Aquatic Life and Human Health – Fish Consumption, Cool Water Fishery, Whole Body Contact Recreation, and Boating and Canoeing. The Maries River also has beneficial uses designated by the Missouri Clean Water Commission. These are: Livestock and Wildlife Watering, Protection of Warm Water Aquatic Life and Human Health- Fish Consumption, and Whole Body Contact Recreation. While none of the alternatives directly impacts the Gasconade, all alternatives would impact the Lower Maries River near the community of Westphalia.

For all alternatives, water quality impacts to surface water systems would outweigh impacts to groundwater systems. In general, longer alternatives would lead to more land disturbance and erosion potential than shorter ones. As a result, potential water quality impacts for each alternative can be represented as a function of both the number of streams crossed and the length of each proposed alternative.

The project crosses the Gasconade River at existing crossing on Route 63, while the crossing of the Maries River at Westphalia includes all of the alternatives. The U.S. Coast Guard does not consider the Gasconade or the Maries Rivers to be navigable rivers. For all of the alternatives, there may be unmapped streams that could qualify as waters of the U.S. and thus fall under the jurisdiction of the Army Corps of Engineers. All of the alternatives are comparable in size and would involve approximately the same amount of land disturbance activities.

It is possible that project components could prove to benefit the water quality of the Maries River. The current state of disrepair of both the existing roadway and bridge allow runoff directly into the Maries River. A new facility and structure could function to prevent the direct discharge of highway runoff into the river by creating detention basins to capture and temporarily store this runoff. The temporary storage should allow the water to slowly percolate through the ground, thus filtering contaminants and minimizing the probability of water pollution.

In addition, the new bridge would have solid walls that would prevent spray from tires from going directly into the river. To prevent contamination of streams, lakes, ponds, or other water impoundments adjacent to the project area, job specifications would require temporary or permanent pollution control measures as outlined in MoDOT's Sediment and Erosion Control Program first approved by the Missouri Department of Natural Resources on October 8, 1991, and subsequently approved June 15, 2007.

Water Resources

Why are water resources important?

Water Resource: ponds, wetlands, streams and springs.

Water resources are important because they provide essential biological functions in the environment. Wetlands provide water storage and energy dissipation during storm events, promote cycling of nutrients including removal and retention of some elements. Streams support animal and plant community types and are an integral part of the hydrologic cyle. In addition to these functions, public water resources provide aesthetic benefits, as well as recreational opportunities including fishing, canoeing, etc.

The Clean Water Act of 1972 (CWA) requires an evaluation of every project to determine whether the project could have a negative impact on any waters of the U.S. including wetlands, streams, ponds and special aquatic sites.

Section 404 of the CWA requires that all federal, state, and public entities obtain a permit from the U.S. Army Corps of Engineers (USACE) before placing dredged or fill materials into waters of the U.S. Section 401 (CWA) requires that water quality certifications be obtained for any activity that results in discharges into streams or jurisdictional wetlands. The MDNR manages this program.

MoDOT project concerns relating to waters of the U.S. include potential stream impacts at bridges and culverts, filling of jurisdictional wetlands, stream channelization, filling of ponds and filling of designated special aquatic sites. All regulated stream impacts are those that take place below the designated ordinary high water mark (OHWM), where the vegetation line is on the stream bank (Figure 27).

Figure 27. Ordinary High Water Mark

What are the key points affecting water resources?
The Route 63 study corridor would impact a variety of water resources including wetlands, streams, and ponds (Appendix H, Plates 1-9). Of the three alternatives, the Preferred Alternative has a greater mitigation cost, hence greater number of stream credits required, greater linear feet of streams impacted, but less actual streams crossed. Overall, impacts regarding ponds and wetlands were fairly equal for all alternatives. The northern portion of the corridor falls within a designated Conservation Opportunity Area (COA), which are MDC focus areas to target mitigation efforts where sensitive species and higher quality water resources exist.

How were the water resources evaluated and quantified for the study?
Streams, wetlands and ponds were initially identified using USFWS National Wetland Inventory (NWI) maps, FEMA Flood Insurance Rate Maps (FIRMs), U.S. Geological Survey (USGS) 7.5 minute topographic quadrangle maps and 2007 aerial photography. A minimal amount of field reconnaissance was conducted to confirm mapped resources and identify any additional unmapped resources. A final jurisdictional determination (JD) for all streams and wetlands within the preferred alternative will be made prior to the Final EIS. The final JD will involve field reconnaissance in order to fill out Routine Wetland Delineation Data Forms, Stream Data Forms, and GPS to define the boundaries of the resources.

Wetland impacts were based on the entire wetland size of the mapped feature regardless of whether a portion fell outside of the corridor limits. Wetlands are classified in accordance with the USACE 1987 Wetland Delineation Manual. Potential wetland areas are considered jurisdictional wetlands if they meet all three wetland criteria (USACE, 1987):

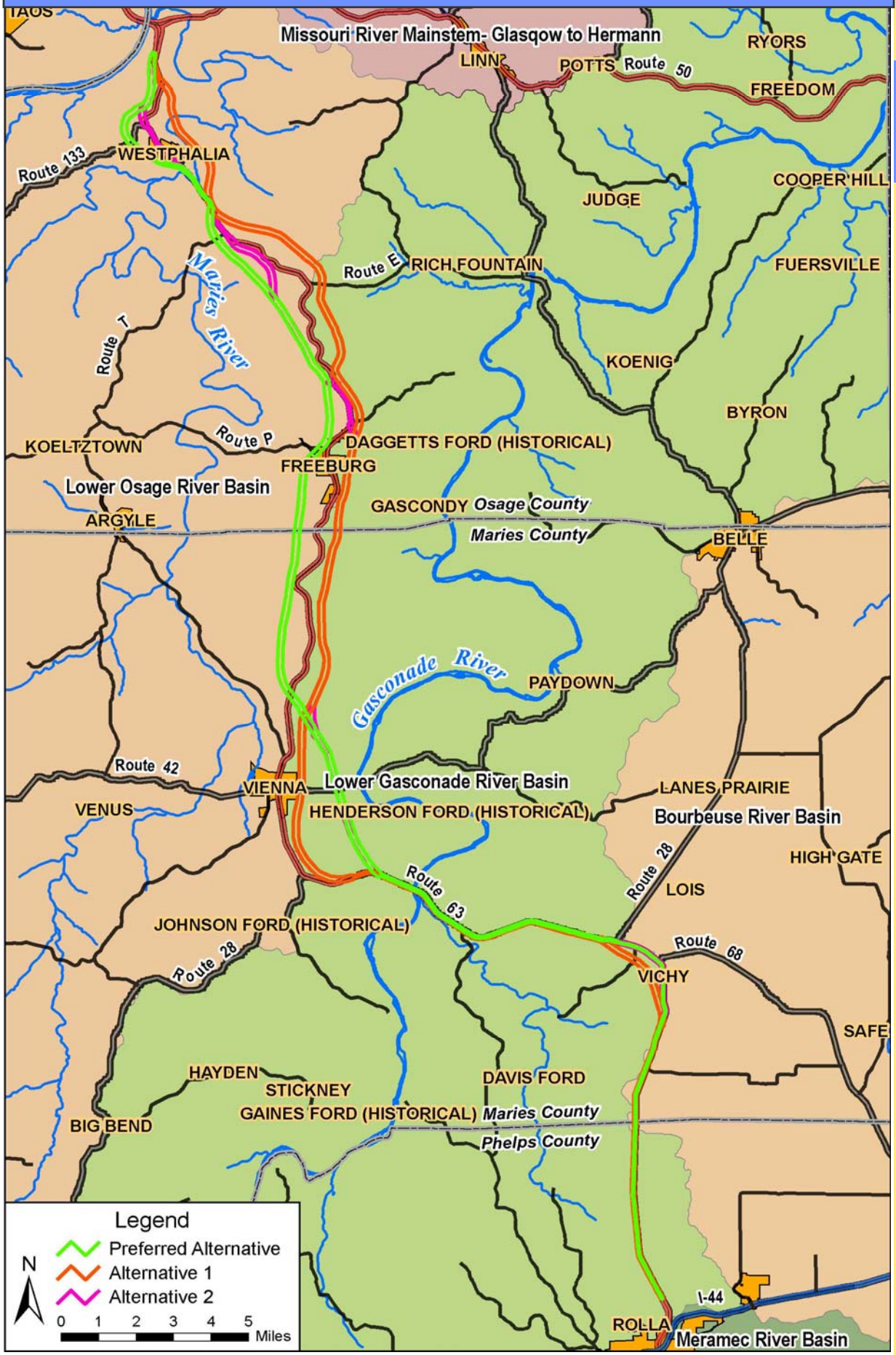
- **Vegetation** - The prevalent vegetation consists of species that are typically adapted to inundated or saturated soil conditions.
- **Soil -** Soils have been classified as hydric, or that they possess visual characteristics that are associated with reduced soil conditions.
- **Hydrology -** The area is either inundated or saturated to the surface continuously for at least five percent of the growing season in most years (50 percent probability of recurrence).

What water resources are found in the study area?

The existing Route 63 follows a ridge-top between three 8-digit hydrologic unit codes (HUC) watersheds, the Lower Osage River Watershed, the Lower Gasconade River Watershed, and the Bourbeuse River Watershed (Figure 28).

What is a Watershed?
A watershed is the entire geographical area drained by a river and its tributaries.

Figure 28. Watershed Map



North of Route E water resources drain into the Maries River, Lower Osage River Watershed. South of Route E resources are split. Water resources to the west of the existing Route 63 drain into the Maries, and to the east drain into the Gasconade River.


Maries River

At Route 28, water resources drain into the Gasconade on both the west and east, until you arrive at Highway 68. At that point, water resources are split until you get to the county line, with water resources on the west draining into the Gasconade River and on the east into the Bourbeuse River (Figure 28).


Gasconade River

After crossing the county line, water resources are entirely located within the Gasconade River drainage. The largest water resources in the study area are the Maries River and the Gasconade River.

Wetlands are not widespread throughout the study area. The majority of the wetlands were identified in the Westphalia area, in association with Alternative 1 as it crosses through the Maries River floodplain. The other area of higher density wetland occurrence is in the Gasconade River floodplain crossing in association with widening on the existing alignment. There are numerous ponds in the project area. Most of the ponds are true farm ponds used for livestock watering. The average size of the ponds in the study area is 0.23 acres. There are no springs in the Preferred Alternative corridor.

How do wetland impacts compare in each alternative?

Overall, there was not a great difference in the amount of wetland impacts between alternatives. There were slightly more wetland impacts in Alternative 1, 23.73 acres; than in Alternative 2, 20.06 acres; or the Preferred Alternative, 20.24 acres (Table 17). The largest wetland complex is located within the Gasconade River floodplain, 16.35 acres, and is impacted in all alternatives. Depending on the placement, width, and design of the new lanes, it may be avoided altogether. A majority of this wetland complex is outside the study corridor; however, it is contiguous with what lies within the corridor.

Forested Wetland

Throughout each alternative, the majority of the impacts are classified as forested wetland. The second largest impacts are classified as ponds, and the third largest with emergent wetlands. There were no impacts associated with farmed wetlands or scrub-shrub wetlands across the alternatives. Compared to the other two alternatives, the Preferred Alternative has equal to or less forested wetland impacts; greater pond impacts, and is second in emergent wetland impacts. The pond resources generally represent ponds constructed for livestock watering and are of significant value to the farming community. However, they are considered a less significant ecological resource since they are easily reproduced.

Emergent Wetland

How do the stream impacts compare in each alternative?
Stream impacts (linear feet) are greater in the Preferred Alternative, 63,639 linear feet, as compared to 54,581 linear feet in Alternative 1 and 45,626 linear feet in Alternative 2. The actual number of streams impacted in the Preferred Alternative is 69, as compared to 79 for Alternative 1 and 55 for Alternative 2 (Table 17).

Each alternative has a footprint encompassing more area than necessary, sometimes twice as much, to construct the new alignment and thereby allow room for adjustments. This additional width affords some flexibility for determining the final location of the selected alternative within the broader alternative boundaries and therefore enables efforts to minimize project effects to water resources.

Table 17. A Comparison of Water Resource Impacts for Each Alternative.

	Preferred	Alternative 1	Alternative 2
Estimated Impact (linear feet)	63,639	54,581	45,626
Number of streams	69	79	55
Wetlands (acres)	20.24	23.73	20.06
Ponds (acres)	10.03	10.24	7.37

Two large order streams would be crossed. The Maries River and Gasconade River would be crossed adjacent to the existing alignment for the Preferred Alternative. This minimizes aquatic impacts by spatially co-locating bridges rather than placing another bridge farther upstream or downstream from the existing structure, as would be the case in Alternative 1.

How do the pond impacts compare in each alternative?
The difference in the amount of pond impacts in the Preferred Alternative when compared to either Alternative 1 or Alternative 2 is minimal. Field verification prior to the final EIS will enable us to determine whether each resource is considered jurisdictional by the USACE and whether or not mitigation will be required. Overall, across the corridor, ponds are small and generally occur in the headwaters of streams high on the landscape.

Table 18. Wetland Impacts by Type in Each Alternative

Type	Preferred (acres)	Alternative 1 (acres)	Alternative 2 (acres)
Farmed	0	0	0
Ponds	10.03	10.24	7.37
Emergent	0.63	0.72	0.45
Scrub Shrub	0	0	0
Forested	19.61	22.61	19.61
Riverine	0	0.4	0
Total	**32.57**	**33.97**	**29.73**

How does the alternative analysis comply with Section 404(b)(1) guidelines?

There was no alternative that stands out as clearly being the best for most of the environmental impacts. In the case of the proposed alternatives for Route 63, the Preferred Alternative impacts were not always the least, including impacts to length of streams and ponds, nor did it have greatest number of negative impacts, including impacts to number of streams and wetland acres, when compared to than the other two build alternatives. To get a clearer picture of which alternative would be picked as the preferred, the study team compared the alternatives by looking at how many of the considerations had the least and most negative impacts and how well the alternatives met the purpose and need of the project.

Alternative 2 fails in meeting the need to improve safety as well as the Preferred Alternative or Alternative 1 because it uses the existing highway through Westphalia, which has an abundance of access points leading to increased crashes and therefore was deemed not practicable. So even though Alternative 2 has the least negative impacts for the most categories, including stream length, number of streams, wetlands and ponds, it has a higher number of negative impacts for other categories and does not meet the need for improved safety as well as the Preferred Alternative.

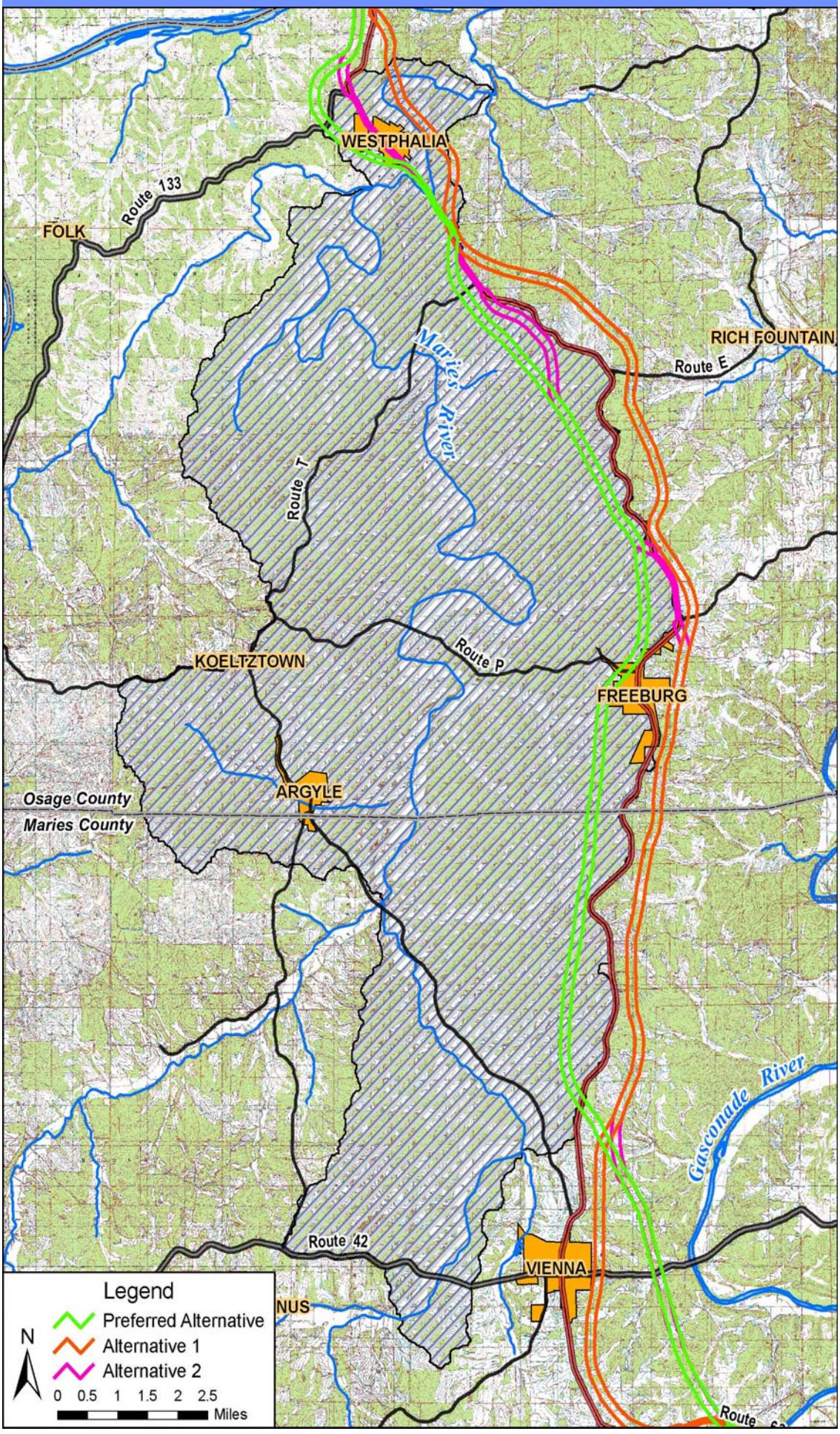
Alternative 1 also had a higher number of negative impacts than the Preferred Alternative, including the number of streams crossed and acres of forested wetlands impacted, which are the most expensive impacts ($221 million compared to $176 million for Alternative 2 and $179 million for the Preferred) and therefore was deemed more environmentally damaging. Because of the factors of negative impacts for Alternatives 1 and 2 and it ability to best meet the project's purpose and need, the Preferred Alternative became the recommended alternative.

What types of compensatory mitigation would be expected?
Mitigation is required after avoidance and minimization have been accomplished for impacts to streams, wetlands and some ponds in the project area. Mitigation for wetlands and ponds is calculated using a ratio system. For instance, wetlands classified as emergent are generally required to be mitigated in the range of 1 to 3 times the impacted area, depending on the quality of the wetland. Ratios are subject to the USACE and MDNR discretion. More mitigation is typically required for higher quality wetlands and unique wetland types.

The amount of mitigation for stream impacts is determined using the State of Missouri Stream Mitigation Method (MSMM). The MSMM determines the amount of credits necessary to compensate for the stream impacts. More stream mitigation is required when impacts fall within certain priority areas or higher order, larger, streams. Examples of these are when impacts are on streams with spawning restrictions or involve those providing habitat for federally listed threatened and endangered species.

One such area is located within the study corridor. The Missouri Department of Conservation has designated part of the Maries River as a Conservation Opportunity Area (COA) (Figure 29). Impacts within this area would be required to have more mitigation than impacts outside of this area. The Preferred Alternative is within this area.

Figure 29. Conservation Opportunity Area Map



How were compensatory stream mitigation costs calculated for the project?
Compensatory stream mitigation costs were calculated based on the cost to participate in the Missouri Conservation Heritage Foundation's Stream Stewardship Trust Fund (SSTF). This cost is estimated at $35.00 per credit. Credits were calculated using the MSMM, Adverse Impact Worksheet. Certain assumptions were made in advance of knowing specific impacts to streams in order to complete the worksheet.

For example, all impacted streams are assumed to be fully functional streams (existing condition), involve *permanent* fill (duration), and a fill (activity). Based on these criteria, the number of credits needed for each alternative could be estimated. More credits are needed for the Preferred Alternative than either Alternative 1 or Alternative 2. Likewise, the cost of mitigation, if MoDOT were to participate in the SSTF, is more for the preferred ($12.6 million) than for Alternative 1 ($9.8 million) or Alternative 2 ($8.5 million). Worksheets can be referenced in the Appendix F.

Overall, what are the water resource impacts and how would the project compensate for unavoidable impacts?

Overall, water resource impacts were not significantly different between the alternatives. The greatest difference is that there are more linear feet of stream impacts in the Preferred Alternative, which then reflects the higher number of credits required, and subsequently the higher cost to mitigate. Overall, impacts to wetlands and ponds showed little variation between any of the alternatives.

Under the obligation of the Clean Water Act (CWA), Section 404 and 401, a permit is necessary for any dredge and fill activities within waters of the United States. A Section 404, USACE permit, and a Section 401, Missouri Department of Natural Resources (MDNR) certification would be needed prior to construction. Impacts to construct the entire Preferred Alternative would require Individual Permit authorization. Final impacts and a mitigation proposal would be required for permit submittal to the USACE and MDNR. Permit application submittal is typically completed during the design phase.