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3.22 MINERAL RESOURCE IMPACTS

3.22.1 Introduction

The following substantive changes have been made to this section since the Draft Environmental Impact Statement (DEIS) was published:

- Impacts for Alternatives R and Refined preferred Alternative P (RPA P) have been added.

Mineral resources are important to the economy of Southern Indiana. They include oil, gas, gas storage, coal, clay, sand and gravel, limestone, and gypsum. These minerals provide electricity, transportation fuel, heating and cooling, building products, and aggregates. Many mineral commodities are processed near mine sites for local use and export. Products are carried by heavy trucks or railcars to end users and consumers.

The sections below describe where mineral resources occur at or near the proposed Mid-States alternatives. Any impacts are compared and discussed. The figures in this chapter illustrate typical surface and underground facilities associated with the mineral extraction sites in Southern Indiana. Additional details about the analysis of mineral resources are provided in **Appendix LL – Mineral Resources**.

3.22.2 Methodology

Mineral resources were reviewed in this study using the project Geographic Information System (GIS). For each alternative, the working alignment was juxtaposed with available spatial layers of mineral resources. **Appendix X – Geographic Information System Technical Documentation** provides details about the project GIS and technical methodology. A geologist used published maps dating back to 1964 to analyze impacts to coal and gypsum resources. Petroleum-well points were intersected with alignment footprints and counted. Acres of mineral resources potential within each alternative were calculated for petroleum fields, coal, sand/gravel, and clay.

Gypsum and limestone resources are found throughout the region. General maps created from regional geology characteristics and literature survey indicate areas where these resources could be present (**Appendix LL**). However, these maps cannot provide any reliable calculation of acres of accessible resources that may be impacted due to the broad generalizations used to create the areas. No mapping is known that displays the presence of gypsum and limestone in mineable quantities and settings without additional core testing and chemical analyses. Currently, one of the best indicators of accessible resources is the presence of past and existing mining operations.

3.22.3 Analysis

3.22.3.1 Coal

Coal is a subsurface resource. Potential coal resources were identified and evaluated using maps of past surface and underground mining activities (**Appendix LL, Figure 2**), maps of current IDNR mine permits (**Appendix LL, Figure 1**), maps of known coal beds, and compiled coal data from the Indiana Geological and Water Survey. While extensive contiguous coal beds under current production are limited to the western portion of the Mid-States Corridor 12-County Study Area, more limited thin coal beds extend into the central portion of the study area in Martin County but are essentially non-existent in the eastern portion of the study area in Orange and Lawrence counties. Due to the extent of minor coal beds and limited marketable production potential, coal impacts are focused on mining activities which account for marketability factors.

Coal Mine Impacts (Acres)			
Alternative	Surface Mines (1880s - 2016)	Underground Mines (1880s - 2016)	Active mine permits*
B	140 - 167	14-17	0
C	225 - 272	<1	204 - 251
M	4	1	0
O	0	<1	0
P	4 - 5	1	0
RPA P	4 - 5	1	0
R	4	1	0

* Only mines with completed extraction had direct impacts.

**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 3.22-1: Impacts to Coal Mine Areas (Past and Present)

Figure 3.22-1: Coal Preparation Plant at an Underground Mine in Gibson County

Coal mine area acreages within the alternatives are presented in **Table 3.22-1**. Impacts reported by alternative variation and section are presented in **Appendix LL, Table 2**. Surface mineable coal deposits are most impacted by Alternatives B and C, minimally impacted by Alternatives M, P, RPA P, and R, and not impacted by Alternative O. Alternative C north of the White River, intersects the most past surface mined areas at 225 to 272 acres, followed by Alternative B south of the White River at 140 to 167 acres. All areas of previous mining, including active permit areas, crossed by the alternatives have been reclaimed. No abandoned mine lands are impacted by the alternatives.

Appendix LL, Table 1 lists the current coal mine permits near the alternatives. Alternative C is the only alternative which impacts a permitted surface mine. It intersects both mine permits S298 and S308 (**Appendix LL, Figure 1**). Coordination with the Indiana Department of Natural Resources Mine Reclamation Office (November 3, 2021) indicated that Permit S308 has finished reclamation and is awaiting release of the bond. Permit S298 is in reclamation, but the operator is now in bankruptcy. IDNR will continue monthly field monitoring until the present permit term ends. While this situation could affect the timing of complete reclamation for the entire permit area, the area crossed by Alternative C has been mined out under these permits and has been reclaimed. The closest active work areas under permit S298 are over a half mile to the northeast of Alternative C. Alternative B is adjacent to a large surface mine permit S340 (**Appendix LL, Figure 1**). Based upon the current permit boundary, no impacts are expected. Reassessment is required if the boundary is changed, or additional permits are added in the future. Additional evaluation will be conducted during Tier 2. Coal may be processed near mine sites for local use and export. (**Figure 3.22-1**).

Alternative B crosses multiple underground coal deposits but there is no impact to active underground mines. Other alternatives have very few associated acres of underground coal mines. Alternative B south of the White River intersects 14 to 17 acres of past underground mine areas near the Patoka River and Dick Creek.

Based on the status of recent and active mining in the vicinity of the alternatives, there is very limited impact to mine activities. However, the previously mined areas do have a potential effect on the development of the alternatives due to settlement issues associated with previously mined areas. This is a substantial issue for Alternatives B and C. Where previously mined areas are crossed by alternatives, additional costs have been included in estimates to account for special subgrade treatment to address mine settlement issues.

Oil and Gas Impacts*^						
Alternative	Abandoned Gas Wells (count)	Gas Wells (count)	Gas Storage Wells (count)	Oil Wells (count)	Other Petroleum Test Wells** (count)	Petroleum Fields*** (acres)
B	1	3	3 - 4	3	11 - 12	693-826
C	0	0	0	0	8 - 11	254-356
M	0	0	0	0	9 - 11	237-333
O	0	0	0	0	9 - 11	558-666
P	0 - 1	0	0	0	8 - 17	415-768
RPA P	0	0	0	0	11-18	461-768
R	0	0	0	0	0	208

^Oil and Gas wells and fields were mapped by the Indiana Geological Survey in 2015 from its Petroleum Database Management System (PDMS)

* Tier 1 Alternative impacts are reported in ranges including all the local improvements, facility types and variations. Facility type 1, freeways, has been removed from consideration.

** The "Other Test Wells" category includes **dry holes, abandoned injection wells, borings, structure tests and abandoned oil well**s. Impacts to these wells will not impact the resource, but may require more detailed hazardous materials investigation before construction.

*** Petroleum fields can be accessed deep in the ground, even if some working alignments overlay their location. No resource impacts are expected.

Table 3.22-2: Impacts to Oil and Gas Wells and Fields

Future coal mining activities are more likely in the vicinity of US 50 near Washington in the Alternative C area, where there are multiple active permits. Future coal production in the Mid-States Study Area is expected to use smaller open-pit surface mines. New large underground mines are not economically competitive.

3.22.3.2 Oil and Gas

Oil and gas wells and fields were mapped in 2015 by the Indiana Geological Survey (IGS - now the Indiana Geological and Water Survey (IGWS)) from its Petroleum Database Management System (PDMS) (**Appendix LL, Figure 3**). This data was used to quantify potential impacts. Large areas of Southwest Indiana contain known petroleum reserves. **Table 3.22-2** shows ranges of the number of petroleum wells and the acreage of generalized petroleum fields impacted by each alternative. Impacts reported by alternative variation and section are presented in **Appendix LL, Table 3**.

All alternatives cross petroleum fields that may contain deposits of natural gas and oil, as well as gas storage fields. Alternative B has the largest area within petroleum fields (693 to 826 acres), followed by Alternative O at 558 to 666 acres. Alternatives C, M**,** and R have the least areas within petroleum fields at 208 to 356 acres. Alternative P and RPA P have the widest ranges of acreage within petroleum fields at 415 to 768 and 461 to 768 acres respectively, due to the variations around Loogootee for these alternatives. It ranks in the middle of all alternatives for impacts. Given current technology and extraction processes, the construction of any alternative should not impact access to these petroleum resources. Based on this, impacts to active or potential petroleum fields are not expected. Active petroleum leases near the proposed action will be investigated in Tier 2 studies. Surface well and tank battery fixtures installed in the future will avoid roadways. Impacts reported by alternative variation and section are presented in **Appendix LL, Table 3**. Impacts for alternative local improvements are presented in **Appendix LL, Table 4.**

Figure 3.22-2: Typical Oil Well and Pumping Unit in Posey County

Figure 3.22-3: Clay Mining Operation in Dubois County Northwest of Jasper

Well locations in the source 2015 PDMS data are categorized into five general types: abandoned gas, gas storage, gas, oil, and other petroleum tests (OPT). GIS was used to identify and count all petroleum well locations that intersected working alignment footprints. Impacts reported by alternative variation and section are presented in **Appendix LL, Table 5**.

The OPT category includes types such as dry holes, core and structure tests, abandoned water or salt injection wells, and abandoned oil wells. Almost all alternatives have comparable impacts to OPT wells, ranging from 8 to 18 OPT wells. Alternative R impacts no OPT wells. Impacts to OPT wells will not affect petroleum resource access or development but will require hazardous materials evaluation before construction.

Active wells and exploration/development wells (OPT - some plugged for decades), may contain contaminants including oil, salt water, sulfur water, drilling chemicals, bentonite clay, lignite, and/or industrial surfactants. Contaminants may be capped off underground and are often under pressure. Records research and efforts to locate recorded wells of all types in the right-of-way should be undertaken before any cut or fill activities in the construction limits. Any wells located should be evaluated for existing leaks, artesian water flow, structural stability, and contaminated soil plumes. Cut and fill activities have the potential to change the pressure in the well from the addition/removal of the substrate, which could cause a leak to develop if not properly addressed.

Impacts to existing gas, oil, gas storage, and abandoned gas storage wells, and related production surface fixtures (**Figure 3.22-2**) potentially affect the petroleum operator's costs and potential loss of production for wells within the final right-of-way. Alternative B is the only alternative with notable producing petroleum well impacts, with nine to ten possible well locations and one abandoned gas storage well recorded. The western variation of Alternative P at Loogootee impacts one abandoned gas well. Other alternatives have no known direct impact to existing petroleum wells.

3.22.3.3 Clay Minerals

Clay is extracted for use in ceramics, bricks, drilling, metal casting, environmental construction and remediation, and hazardous waste treatment (**Figure 3.22-3**). The distribution of clay in Indiana was mapped by the IGS (2000) using well drilling log point data (**Appendix LL, Figure 4**). **Table 3.22-3** reports the range of clay minerals occurring within each alternative in acres and as a percentage of the total alternative right-of-way footprints for new alignments

and local improvements. Impacts to clay deposits by the Local Improvements reported by thickness and section are presented in **Appendix LL, Table 6**. The acreage and percentage of the area of each alternative which may impact clay deposits is presented by thickness and section in **Appendix LL, Tables 7 and 8**. Impacts for alternative local improvements are presented in **Appendix LL, Table 8.**

Clay Minerals Impacts*^					
Alternative	**10-20 ft Thick (acres)**	**20-50 ft Thick (acres)**	**>50 ft Thick (acres)**	**Total Clay** (acres)**	**Total Clay (% in ROW)**
B	443-512	1017-1077	40	1500-1629	65% - 68%
C	482-609	512-648	233-275	1227-1532	64% - 65%
M	1456-1686	1045-1232	151-185	2652-3103	63%-64%
O	1497-1729	263-375	74-77	1834-2181	58%
P	762-982	672-853	109-160	1543-1997	61%-62%
RPA P	679-982	640-892	109-123	1431-1989	60%-62%
R	308	333	86	727	61%

^The distribution of clay in Indiana was mapped by the Indiana Geological Survey using the iLITH Database of water well drilling log data in the state through the year 2000.

* Tier 1 Alternative impacts are reported in ranges including all the local improvements, facility types and variations. Facility type 1, freeways, has been removed from consideration.

** Total Clay is the combined acreage of clay deposits in the 10-20 ft thick, 20-50 ft thick, and >50 ft thick ranges.

Table 3.22-3: Impacts to Clay Mineral Resources

All alternatives have areas with moderate to high potential for clay deposits, ranging from 58 to 68 percent of each right-of-way footprint. The relative rank of the alternatives from greatest to least impacts to clay mineral areas is Alternatives M, O, RPA P, P, B, C, and R. Alternative R has the smallest acreage of clay impacts. Alternative B has the narrowest range of impacts among new terrain alternatives.

Although it contains the most clay resource acreage, Alternative M has a similar percentage of footprint area with potential impacts at 63 to 64 percent as other alternatives. The majority of clay in Alternative B, 68 percent of the total clay area, is in thicker, 20 to 50 feet, deposits. The majority of clay in Alternative O, 80 percent of the total clay area, is in 10-to-20-feet-thick deposits. Alternatives M and P are similar with an estimated 52 percent of the total clay resource in the footprints occurring in 10 to 20 feet thick deposits, and 41 percent of the total clay in the footprints in 20 to 50 feet thick deposits. RPA P has approximately 48 percent of total clay in the footprint in the 10-to-20-feet-thick deposits, and 45 percent in the 20-to-50-foot range. Alternative R has approximately 42 percent of total clay in the footprint in 10-to-20-feet-thick deposits and 46 percent of clay in 20-to-50-foot-thick deposits. Alternative C has 40 percent of total clay in 10-to-20-feet-thick deposits and 42 percent of total clay in 20 to 50 feet thick deposits. Alternative C has the highest percentage of over 50-feet-thick deposits at 18 percent of total clay of any alternative. It is unknown if it would be cost effective to extract these thick layer clay minerals, due to their depth below ground and lack of continuity.

Figure 3.22-4: Sand and Gravel Operation in Southern Indiana

3.22.3.4 Sand and Gravel

Large sand and gravel deposits occur adjacent to and along major river areas in Southwest Indiana. These deposits washed out of melting glaciers upstream. Sand and gravel are used for road construction, railroad ballast, mixing with asphalt, construction fill and production of concrete blocks, bricks, and pipes (**Figure 3.22-4**). Industrial sand and gravel are used to make glass, as foundry sand and as abrasive sand. Sand and gravel material within the right-of-way may be used by contractors during construction.

In 2003, the IGS mapped potential economic concentrations of sand and gravel resources (**Appendix LL, Figure 5**).

Sand and Gravel Potential Resources Impacts^^						
Alternative*	Potential** (acres)	Potential (% in ROW)	Low Potential** (acres)	Low Potential (% in ROW)	Total Resource (acres)	Total (% in ROW)
B	106 - 125	5% - 6%	857-988	39% - 45%	962-1113	43% - 44%
C	66-93	5% - 7%	500-612	41% - 52%	566-705	29% - 30%
M	66-93	3%	751-892	20% - 24%	817-985	20%
O	23	3% - 4%	518-607	26% - 31%	541-630	17%
P	131-167	4% - 5%	622-798	31% - 40%	753-965	29% - 31%
RPA P	131-167	5%	576-805	23%-26%	707-972	28%-31%
R	66	6%	229	19%	294	25%

^^Indiana Geological Survey created the sand and gravel resource potential data in 2003 by assigning qualitative permissive tract assessments to each outcrop area in Gray, H. H., 1989, Quaternary geologic map of Indiana: Indiana Geological Survey Miscellaneous Map 49. The attribute table data was derived from Gray, H. H., 1973, Properties and uses of geologic materials in Indiana: Indiana Geological Survey Regional Geologic Map Supplementary Chart 1 and Carr, D. D., and Webb, W. M., 1970, Sand and gravel resources of Indiana: Indiana Geological Survey Bulletin 42-D, 31 p.

* Tier 1 Alternative impacts are reported in ranges including all the local improvements, facility types and variations. Facility type 1, freeways, has been removed from consideration.

**"Potential resource" indicates that the surficial unconsolidated deposits are likely to contain economic concentrations of sand and gravel. "Low potential" indicates that the surficial unconsolidated deposits may contain economic concentrations of sand and gravel.

Table 3.22-4: Impacts to Potential Economic Concentrations of Sand and Gravel

The data set identified areas likely to contain economic concentrations of the resource as “potential” and areas that may contain economic concentrations of the resource as “low potential.” Using these data, **Table 3.22-4** shows the range of impacts to areas of potential and low potential economic concentrations of sand and gravel for each alternative in acres and as a percentage of the total right-of-way. Impacts of the Local Improvements to potential sand and gravel deposits reported by section are presented in **Appendix LL, Table 9**. The acreage and percentage of the area of each alignment which may impact sand and gravel deposits are presented by alternative and section in **Appendix LL, Tables 10 and 11**, respectively.

All alternatives cross sand and gravel deposits. When ordered by the total acres of the potential and low potential sand and gravel resources, the alternatives rank for impacts from greatest to least as Alternatives B, M, P, RPA P, C, O, and R. The majority of resource impacts in all alternatives are categorized as low potential. While Alternative B has the largest total resource impacts, Alternative P and RPA P have the largest impacts to “potential” resources. Alternative P and RPA P have the widest range of “potential” impacts. Both Alternatives C and M range from 66 to 93 acres of “potential” resource, with Alternative M impacting a greater “low potential” resource. Alternative M’s acreage impact is larger than Alternative C’s. However, its longer length and greater right-of-way means it has a lower percentage of impacts in its total ROW at 20 percent than Alternative C at 29 to 30 percent. Alternative R impacts the least amount of “potential” and “low potential” sand and gravel resource but has a similar total percentage impact. The Alternative R alignment has the smallest overall acreage impact.

While sand and gravel resources exist within all alternatives, there are no active sand and gravel quarry operations within or adjacent to any of the alternatives and no open pits associated with previous operations that would be affected.

3.22.3.5 Limestone

Spatial data of regional bedrock geology includes information on dominant lithology. Geologic groups with a dominant limestone lithology are mapped in **Appendix LL, Figure 6**. No impacts to limestone resources are expected from any alternative. There are no impacts to existing quarries (**Figure 3.24-5**). Expanding existing

active limestone quarries is more economical and much more likely than starting new quarries. Alternatives M and O impact areas containing modest amounts of limestone suitable for aggregates. The thick Blue River Group limestone sequence is generally continuous below Alternatives M and O except where it has been removed by erosion (**Appendix LL, Figure 6)**. Surface or underground limestone resources in the Northeastern Family alternatives (Alternative O and Alternative M) are pervasive, but no definitive thickness or quality mapping is available to indicate where resources are potentially mineable relative to the alternatives. For Alternative M, seven past/present mineral industrial sites are near its connection to SR 37. One concrete industrial site associated with Alternative M was verified via aerial photography. No limestone resources occur near Alternatives B, C, P, RPA P, or R.

Figure 3.24-5: Limestone Quarry Operation at the Village of Georgia on SR 60

3.22.3.6 Gypsum

Gypsum is a mineral that is processed to make building materials, especially wallboard. IGS Bulletin 42-A, "Gypsum Resources of Indiana," (1969) gives a general overview of the resources in Southwestern Indiana and where they may occur (**Appendix LL, Figure 7**). No impacts to gypsum resources are expected from any alternative. Alternative M is located 4.3 miles north/northwest of the U.S Gypsum Company mine located along US 50 east of Shoals in Martin County (**Figure 3.24-6, Appendix LL, Figure 7**). It has produced gypsum from underground mines for approximately five decades. Recently gypsum extraction in the area has been declining due to market trends and alternative sources of gypsum. Gypsum resources extend outward from these mines, but no spatial data are available to determine whether potentially mineable areas of gypsum may exist along the alternatives.

Figure 3.24-6: Gypsum Processing Plant and Mine East of Shoals, Martin County, north of US 50.

3.22.4 Mitigation

According to the INDOT *Real Estate Division Manual* (March 2020) appraisal procedures, "consideration should be determined to what extent the value of the land is increased due to the presence of mineral(s) and an estimation of how much more would a buyer pay for the land if it contains coal. These estimates should be supported by comparable properties containing the contributing item(s)." Thorough review of the caption deed is critical to discovery of this interest. Buying procedures direct that mineral interest owners are to be made party to any offer. When property is acquired by INDOT, mineral rights owners must release the rights via deed, or add a "release of surface rights only" to the deed allowing the continuation of exploration/mining activities that do not penetrate the ground surface within the right-of-way. Deeded mineral interests unused for 20 years or more will be extinguished (IC 32-23-10).

Impacts to commercially owned resources would be compensated as provided by the Uniform Relocation Act. Existing commercial operations also would be eligible for payment of damages for harm to their existing business operations outside of the land taken for right-of-way. All such compensation is determined during right-of-way acquisition.

IDNR Division of Oil & Gas well files should be examined for individual well plugging affidavits of any recorded wells in the right-of-way. Recorded petroleum wells should be located if possible and marked on plans. These should be evaluated for existing leaks, artesian water flow, structural stability, and contaminated soil plumes. Wells in fill areas should be inspected and mitigated as necessary for structural integrity and existing leaks before the area is filled. Wells in a cut area should have their current cap evaluated and any pipe disturbance recapped as necessary.

3.22.5 Summary

- RPA P contains median impact values of the seven alternatives for mineral resource impacts. It has no impact on marketable coal reserves. RPA P has the median impacts of the seven alternatives to clay of all thicknesses, and low potential sand and gravel resource areas. RPA P has the second greatest impacts of the seven alternatives for crossing petroleum fields. RPA P has the most impacts, at 131 to 167 acres, to areas with high potential for sand and gravel resources. No producing petroleum wells were mapped in RPA P, but there are 11 to 18 other well records that will require evaluation before construction, more than any other alternative. No substantial impacts to oil, gas, or mineral production are expected.
- Impacts to active surface coal mine permit areas occur exclusively within Alternative B. No impacts to active extraction operations are expected. There may be future mining using surface small open pits near the Washington/US 50 area near the terminus of Alternative C.
- No impacts to petroleum fields are expected because of the ability to access the resource at depth underground. Any active petroleum leases within the preferred alternative would be further investigated in Tier 2. All impacts to active petroleum wells are within Alternative B, except for one abandoned gas well in Alternative P. All alternatives have comparable amounts of “other” petroleum wells that do not impact the resource but will require hazardous material investigation before disturbance. All impacted wells should be evaluated for leaks, structural integrity, and contaminants and mitigated as necessary to prevent future leaks and to address any existing leaks.
- When ordered by the acres of potential impacts to clay minerals, the alternatives from greatest to least are Alternatives M, O, P, RPA P, B, C, and R. Alternative R has the smallest acreage of impacts. All alternatives have a similar percentage of the working alignment area that occurs within possible clay resources. Alternative C is the only alternative with notable occurrence of clay resources thicker than 50 feet, although its mining potential is unknown.
- When ordered by the average acres of the total of potential and low potential sand and gravel resources, the alternatives from greatest to least are Alternatives B, M, P, RPA P, C, O, and R. Alternatives O and R have the lowest total impacts. Alternative O has the smallest impact to potential resources at 23 acres. Alternative B has the highest total resource impacts, while Alternative RPA P and P have the highest potential resource impacts. The connection of Alternative M with SR 37 may impact some mineral industrial sites.
- Alternatives M and O occur in bedrock geology with a dominant limestone lithology. However, no impacts are expected for limestone resources in any of the alternative variations. Future limestone extraction in the area likely will be from the expansion of existing operations.
- Alternative M is near existing gypsum mines and resources. However, no impacts are expected for gypsum resources in any of the alternatives.

- Alternative R is an upgrade to the existing alignment of US 231; therefore, it has the smallest footprint and the smallest impact to mineral resources.
- Due to the geographically widespread nature of mineral resources in the area, the lack of known potential impact to existing production facilities, none of the alternatives have a significant negative impact on current or future exploitation of mineral resources. Therefore, comparison of potential mineral resource impacts does not strongly favor one alternative over the others.