



# TABLE OF CONTENTS

3.22 Mineral Resource Impacts ..... 2

    3.22.1 Introduction ..... 2

    3.22.2 Methodology..... 2

    3.22.3 Analysis ..... 2

        3.22.3.1 Coal ..... 2

        3.22.3.2 Oil and Gas ..... 4

        3.22.3.3 Clay Minerals..... 5

        3.22.3.4 Sand and Gravel ..... 6

        3.22.3.5 Limestone ..... 7

        3.22.3.6 Gypsum ..... 8

    3.22.4 Mitigation..... 8

    3.22.5 Summary ..... 9

## FIGURES

Figure 3.22-1: Coal Preparation Plant at an Underground Mine in Gibson County..... 3

Figure 3.22-2: Typical Oil Well and Pumping Unit in Posey County..... 5

Figure 3.22-3: Clay Mining Operation in Dubois County Northwest of Jasper ..... 5

Figure 3.22-4: Sand and Gravel Operation in Southern Indiana ..... 6

Figure 3.24-5 Limestone Quarry Operation at the Village of Georgia on SR 60 ..... 7

Figure 3.24-6 Gypsum Processing Plant and Mine East of Shoals, Martin County, north of US 50. .... 8

## TABLES

Table 3.22-1: Impacts to Coal Mine Areas (Past and Present)..... 3

Table 3.22-2: Impacts to Oil and Gas Wells and Fields ..... 4

Table 3.22-3: Impacts to Clay Mineral Resources..... 6

Table 3.22-4: Impacts to Potential Economic Concentrations of Sand and Gravel ..... 7



## 3.22 MINERAL RESOURCE IMPACTS

### 3.22.1 Introduction

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 resource 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 very limited marketable production potential, coal impacts are focused on mining activities which account for marketability factors.

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 and P and not impacted by Alternative O. Alternative C, north of the White River, intersects the most past surface mined areas at 225 – 272 acres, followed by Alternative B



Coal Mine Impacts (Acres)			
Routes	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

\* 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**

south of the White River at 140 – 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 alternatives. Alternative C is the only alternative which impacts a permitted surface mine. It intersects both mine permit S298 and permit 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 are no impacts to active underground mines. Other alternatives have very few or no associated underground coal mines. Alternative B south of the White River intersects 14 – 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 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.

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.



Oil and Gas Impacts						
Alternatives	Abandoned Gas Storage 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

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

<sup>\*</sup> Tier 1 Alternative impacts are reported in ranges including all the local improvements, facility types, and bypass variations. Facility type 1, freeways, has been removed from consideration. Therefore, no modifications to existing US 231 in Section 1 are anticipated.

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

<sup>\*\*\*</sup> 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**

### 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 – 826 acres), followed by Alternative O at 558 – 666 acres. Alternatives C and M have the least areas within petroleum fields at 237 – 356 acres. Alternative P has the widest range of acreage within petroleum fields at 415 – 768 acres, due to the Loogootee bypass variations for this alternative. 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**.

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



**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**

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 – 17 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 effort 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 wells, oil wells, gas storage wells, 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 10 possible well locations and one abandoned gas storage well recorded. The western bypass variation of Alternative P at Loogootee impacts one abandoned gas storage well. Other alternatives have no known direct impacts 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 mineral 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**.



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

Although it contains the most clay resource acreage, Alternative M has a similar percentage of footprint area with potential impacts at 63 percent as other alternatives. The majority of clay in Alternative B, 68 percent of the total clay area, is in thicker, 20 – 50 feet, deposits. The majority of clay in Alternative O, 80 percent of the total clay area, is in 10 – 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 10-20 feet thick deposits, and 41 percent of the total clay in the footprints in 20-50 feet thick deposits. Alternative C has similar amounts of resource in 10-20 foot thick deposits at 40 percent of total clay, and the 20-50 feet thick deposits at 42 percent of total clay. It has the highest percentage of over 50-foot 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.

Clay Minerals Impacts <sup>^</sup>					
Routes	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	1226-1532	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	1556-1957	61%-62%

<sup>^</sup>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 bypass variations. Facility type 1, freeways, has been removed from consideration. Therefore, no modifications to existing US 231 in Section 1 are anticipated.

**Table 3.22-3: Impacts to Clay Mineral Resources**

### 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**). 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** reports 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**.



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



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

^^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 bypass variations. Facility type 1, freeways, has been removed from consideration. Therefore, no modifications to existing US 231 in Section 1 are anticipated.

\*\*"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**

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 at B, M, P, C and O. The majority of resource impacts in all alternatives are categorized as low potential. While Alternative B has the largest total resource impacts, Alternative P has the largest impacts to “potential” resources. Alternative P has the widest range of “potential” impacts. Both Alternatives C and M range from 66 - 93 acres of “potential” resource, with 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 29-30 percent.

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



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



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 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 or P.

### 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 Assistance program. 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 post-NEPA 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

- Preferred Alternative P contains the median impacts values of the five alternatives for mineral resource impacts. It has no impacts to marketable coal reserves. Alternative P has the median impacts of the five alternatives for crossing of petroleum fields, clay of all thicknesses, and low potential sand and gravel resource areas. Alternative P has the most impacts, at 131 – 167 acres, to areas with high potential for sand and gravel resources. Potential impacts to wells and crossings of petroleum fields are higher in the west bypass than the east. No producing petroleum wells were mapped in Alternative P, but there is 8-17 other well records that will require evaluation before construction, similar to other routes. There is one abandoned gas storage well mapped in the western bypass variation. No substantial impacts to oil, gas, or mineral production is expected.
- Impacts to active surface coal mine permit areas occur exclusively within Alternatives B and C. 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 should be further investigated in Tier 2. All impacts to active petroleum wells are within Alternative B, with the exception of one abandoned gas storage 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, B and C. While Alternative C has the smallest acres of impacts, Alternative B has the narrowest range 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, C and O. Alternatives C and O have the lowest total resource impacts. Alternative O has the smallest impacts to likely potential resources at 23 acres. Alternative B has the highest total resource impacts, while Alternative P has 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 expanding existing operations.
- Alternative M is near existing gypsum mines and resources. However, no impacts are expected for gypsum resources in any of the alternatives.

