San Juan County Four Corners Freight Rail Project

Project Development Report (Task 4)

Feasibility Study

San Juan County, New Mexico

February 9, 2025

CONTENTS

TABLES

Exhibits

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I. OVERVIEW

Task 4 consisted of project development activities ranging from project planning and engineering analysis and design. This Project Development Report summarizes the findings of Subtasks 4.1 through 4.6. At a high level, these subtasks found that a rail line connecting the Four Corners region to the national freight rail network along the BNSF Railway (BNSF) corridor (in the general vicinity of Gallup, New Mexico), is feasible. Five potential rail routes were studied that could connect these two endpoints. The various subtasks under Task 4 included developing operating plans, conceptual engineering, and costs (capital costs as well as operations and maintenance costs) for the route options.

The naming convention for the options continued to be based on their connection point with the national freight rail network and a main feature (such as a parallel highway), if existing, along the route. The five design options carried forward in this analysis are named as follows, starting with the westernmost of the routes and ending with the easternmost of the routes.:

1. Defiance via Highway 491
2. Defiance via Indian Creek
3. Defiance via Highway 371
4. El Segundo
5. Star Lake

A map of conceptual route options is in **Exhibit 1**.

The proposed rail line could potentially serve multiple users, including mining, agricultural, and general freight customers, with most shipments originating located either at the Navajo Mine or near the existing Navajo Agricultural Products Industry (NAPI) facility near Farmington, New Mexico.

The subtasks used as the basis for this document are:

- Subtask 4.1, Detailed Operational Requirements and Data Collection Methodology
- Subtask 4.2, Operations Analysis
- Subtask 4.3, Support Facility and Access Analysis
- Subtask 4.4, Conceptual and Early Preliminary Engineering
- Subtask 4.5, Capital Cost Estimation Methodology and Estimation of Probable Cost
- Subtask 4.6, Operations and Maintenance Cost Estimate

The following sections summarize each of the six Subtasks.

II. Summary: Subtask 4.1, Operational Requirements

Subtask 4.1, the Detailed Operational Requirements and Data Collection Methodology, identified data sources to be used throughout Task 4 (such as the previous work of Task 2 and Task 3), and for each of the five route options outlined the basic operational parameters of the rail line, such as traffic volumes and resulting average daily train counts (both derived from Task 2), locomotive and rail car characteristics, and the method for developing conceptual timetables, as well as the conceptual timetables themselves.

Of this information, the conceptual traffic volumes and train counts was the most relevant and has been reproduced in **Table 1**.

Table 1: Freight Forecast Summary, 2023 through 2070

Forecast Year:	**2030**	**2070**
All Commodities, Net Tons		
Total Volume "High" Forecast	9,966,000	6,550,000
Manifest Commodities (Assumed Inbound), Net Tons		
Total Volume "High" Forecast	1,720,000	3,872,000
"High" Forecast Number of Manifest Loaded Trains per Day	**0.50**	**1.13**
Rounded "High" Forecast Number of Manifest Loaded Trains per Day	**1**	**2**
Bulk Commodities (Assumed Outbound), Net Tons		
Total Volume "High" Forecast	8,246,000	2,678,000
"High" Forecast Number of Bulk Loaded Trains per Day	**1.64**	**0.53**
Rounded "High" Forecast Number of Bulk Loaded Trains per Day	**2**	**1**
Rounded "High" Forecast Number Outbound Trains per Day	**3**	**3**
Rounded "High" Forecast Number Inbound Trains per Day	**3**	**3**

Note 1: All volumes in net tons
Note 2: Manifest trains per day assumes 85 cars per train, 115 net tons per car
Note 3: Bulk trains per day assumes 125 cars per train, 115 net tons per car

Since the train counts in **Table 1** are comparatively low (i.e., even in the highest volume scenario, averaging only six trains per day), a single-track railroad would be easily capable of handling these volumes, assuming a few sidings were included.

As a reference point, heavily used single-track mountain railroads, such as the BNSF route over the Cascade Mountains or the Canadian Pacific Kansas City (CPKC) route over the Selkirk Mountains, frequently accommodate twenty or more trains per day. While these single-track railroads generally have closely spaced sidings and comparatively complex signaling systems, these examples demonstrate that a single-track rail line between the Four Corners region and the BNSF connection would be adequate for the anticipated six trains per day and could accommodate additional trains in the event that volumes grew significantly in the future.

The remainder of Subtask 4.1 documented the basic operating characteristics of the proposed railroad, which are consistent with those of other heavy haul railroads in North America. One of the key items was a description of the preliminary operating speeds over the various route options. For all route options, the range of maximum authorized speeds (MAS) was from 25 miles per hour (MPH) to 45 MPH, with the lower MAS limits (e.g., 25 MPH) resulting from curvature. Operations at the NAPI terminal and at the BNSF connection would occur under Yard Limits (YL) rules, requiring operation at Restricted Speed (i.e., not exceeding 20 MPH, in addition to other caveats).

III. Summary: Subtask 4.2, Operations Analysis

Subtask 4.2 included an operational analysis of three of the five route options utilizing the train volumes and train lengths identified in Subtask 4.1. The analysis included operation simulations via Rail Traffic Controller® (RTC) software on each of the routes based on the conceptual alignments and profiles prepared in Task 3 as a basis for the analysis:

- Defiance via Highway 371
- El Segundo
- Star Lake

With Federal Railroad Administration (FRA) concurrence, it was assumed that the three *“Defiance via…”* routes (i.e., Defiance via Highway 491, Defiance via Indian Creek, and Defiance via Highway 371) were sufficiently similar from an infrastructure and operations perspective that the operating characteristics of all three *“Defiance via…”* route options could be represented by operational simulations performed for the *Defiance via Highway 371* route option.

The operations simulation on each of the three route options (i.e., Defiance via Highway 371, El Segundo, and Star Lake) was conducted for four train types: loaded manifest, empty manifest, loaded unit, and empty unit trains. The output from the operations simulation included train performance calculator (TPC) results such as approximate train speeds and fuel consumption, as well as time-distance charts (known as stringlines), which illustrated the way that trains progressed along the route and helped to confirm the locations of proposed sidings used for meeting opposing trains.

The results of the train performance calculator simulation are summarized in **Table 2**.

Table 2: TPC Outputs, Approximated

Route Option	Minimum Operating Speed, mph	Fuel Consumption, gallons (rounded)	Run Time, hh:mm	Length, miles
Defiance via Highway 371				
Manifest – Empty, 85 rail cars	20 mph	500 gallons	03:56	117 miles
Manifest – Loaded, 85 rail cars	13 mph	2,000 gallons	04:24	117 miles
Unit – Empty, 125 rail cars	20 mph	600 gallons	03:59	117 miles
Unit – Loaded, 125 rail cars	11 mph	3,600 gallons	04:31	117 miles
El Segundo				
Manifest – Empty, 85 rail cars	20 mph	500 gallons	03:02	98 miles
Manifest – Loaded, 85 rail cars	13 mph	1,400 gallons	03:24	98 miles
Unit – Empty, 125 rail cars	20 mph	400 gallons	03:03	98 miles
Unit – Loaded, 125 rail cars	12 mph	3,800 gallons	03:41	98 miles
Star Lake				

Route Option	Minimum Operating Speed, mph	Fuel Consumption, gallons (rounded)	Run Time, hh:mm	Length, miles
Manifest – Empty, 85 rail cars	20 mph	500 gallons	03:55	93 miles
Manifest – Loaded, 85 rail cars	10 mph	1,700 gallons	04:12	93 miles
Unit – Empty, 125 rail cars	20 mph	500 gallons	03:55	93 miles
Unit – Loaded, 125 rail cars	12 mph	3,900 gallons	04:33	93 miles

The stringlines, which showed the progression of trains along the route, confirmed the potential location of passing sidings and approximate running times, accounting for train meets. Stringlines were based on a high-volume scenario (from Subtask 4.1), with three trains operating each direction, each day (totaling six one-way trips each day) to identify a worst-case situation with respect to rail capacity. For each route option, it was assumed that passing sidings would be located at approximately the quarter points along the route. Thus, each route would have three proposed sidings, with each siding approximately 13,000 feet long and spaced at approximately 25-mile intervals. The proposed sidings would be several thousand feet longer than the longest anticipated train (approximately 7,500 feet long) in order to allow for adequate stopping distance and potential train length growth. The stringline showed that this siding spacing and placement would be sufficient to accommodate the six train per day schedule on each of the route options.

A preliminary train dynamic analysis was also conducted to assess the number of locomotives needed for each train to operate over the proposed railroad, in conjunction with a review of the TPCs, in order to make a preliminary assessment of undulation characteristics of the route options.

The train dynamic analysis was performed using the Davis Equation, as refined by Canadian National Railway (CN) and as outlined in the American Railway Engineering and Maintenance-of-Way Association's (AREMA) Manual for Railway Engineering (MRE) Chapter 16. Based on worst-case conditions (e.g., wet or frosty rail), and the steepest section of grade faced by the heaviest loaded trains (e.g., loaded bulk unit trains), up to seven locomotives might be required to operate a loaded bulk unit train over the proposed railroad. This assumption was used as an input to the RTC software, which showed that such a train would slow to as little as 12-13 MPH on the steepest sections of route. Improved adhesion conditions (e.g., dry rail) or rail lubrication (to reduce friction between the rail-to-wheel interface of the rail cars) could ultimately result in a need for fewer locomotives per train.

Similarly, the operations analysis showed that the loaded manifest trains (assuming northbound manifest trains consisted entirely of loaded cars) would require up to five locomotives.

Consistent with typical railroad practice, it was assumed that run-through motive power from BNSF would be used for the unit bulk trains, while the proposed railroad would supply motive power for the manifest trains, which would originate at the BNSF interchange. Based on the requirement for five locomotives, it was assumed that the proposed railroad would need to own at least seven locomotives in order to provide sufficient spares for both planned and unplanned maintenance.

The operations analysis also developed an initial staffing plan for the proposed railroad for the high-volume scenario (using the high-volume scenario provided a worst-case condition). The staffing plan showed a need for up to 18 train, engine, and yard (TE&Y) employees, 10 maintenance-of-way (MOW) employees, 5 mechanical employees, and 5 supervisory employees.

IV. Summary: Subtask 4.3, Support Facility and Access Analysis

Subtask 4.3, Support Facility and Access Analysis, evaluated ancillary facilities that would be part of the proposed railroad, as well as the accessibility of the railroad.

Most of the facilities along the railroad would be located at the northern terminal, at the site of the headquarters of the Navajo Agricultural Products Industry (NAPI). The facilities located at NAPI would include the

- Freight marshalling yard
- Locomotive and rail car maintenance facility
- Transload facilities
- Unit train loop track
- MOW facility

The marshalling yard and unit train loop track would be configured to accommodate the longest anticipated trains, along with some additional spare capacity for switching and potential future growth in train length. The yard would have five double-ended through tracks to allow for arrival, departure, and storage of trains up to 12,000 feet long. There would be three additional tracks, each 3,000 feet long for storage of manifest cars.

The concept for the locomotive and rail car maintenance facility assumes a two-track shop building, with interior space to store or maintain up to four locomotives or rail cars. The facility would be configured to perform inspection and light and medium repairs on locomotives. It includes an inspection pit, overhead crane, workspace, and space for indoor storage of parts, such as spare wheelset-traction motor combinations. The building also includes an indoor work area for maintenance of other equipment — for example, the backhoe that would likely be used by the MOW crews. Additional exterior track space would be available for rail car maintenance and for storage of rail cars awaiting repair. Locomotive fueling would be performed on a separate track, equipped with a fueling pad and spill containment system for direct-to-locomotive (DTL) fueling.

Transload facilities would also be constructed at the NAPI site, allowing for the truck-to-rail transload of smaller quantities of materials. The two transload tracks would be approximately 1,000 feet long each, spaced to allow for truck and loading equipment operation around each track atop a road rock surface. An access road and commercial driveway would be included to connect the transload facility with the nearest public road.

The unit train loop track would allow for loading or unloading of a unit train of bulk materials, such as outbound corn produced by NAPI, or inbound fertilizer used by NAPI, while keeping the train intact. The concept includes only the lop track; the type of loading or unloading facilities (e.g., conveyor, pit, and loading or unloading speed, type of storage area (e.g., silos, bins, or flat storage) would be left to the customer.

The MOW facility would include up to two spur tracks for storage of rail-mounted MOW equipment, such as a tamper and ballast regulator, as well as any rail cars used for MOW, such as ballast hoppers or flatcars.

In addition to the facilities at NAPI, there would be additional interchange facilities at the connection to the BNSF. These facilities would include three interchange tracks, parallel to the main track, on which to store up to three interchange trains. These three tracks could thus accommodate one day's worth of inbound trains from the BNSF (assuming the high-volume scenario with up to three daily trains operating in each direction). The interchange may have a small shed for storing miscellaneous materials for light rail car repair, such as brake hoses, brake shoes, etc.

Access to the railroad would be relatively easy for most of its length. At NAPI and the BNSF interchange, access roads would be provided. Access along the remainder of the railroad would be overland. There are few wetlands or other obstacles to driving overland most of the year. Additional access roads to siding or bridge locations may be evaluated during final design.

V. Summary: Subtask 4.4, Conceptual and Early Preliminary Engineering

Route Options

Subtask 4.4 refined the plans for the five routes options. The same aerial imagery and topographic information obtained from the United State Geological Service (USGS) for Task 3 was used as a basis for Task 4; while the resolution is somewhat coarse, USGS information is often used for conceptual-level efforts. As with previous efforts in Task 4, the five route options were the *Defiance via Highway 491, Defiance via Indian Creek, Defiance via Highway 371, El Segundo, and Star Lake*. The route options underwent some geometric refinement (compared to their configuration in Task 3), but the endpoints and corridors remained generally the same. Sidings were shown at approximately 25-mile spacing (with exact locations based on topography and track geometry), thus providing sidings at approximately the quarter points of each route option, for a total of three sidings per option. Short (approximately 1,500 foot long) setout tracks for bad-order rail cars or MOW equipment were shown in the space between sidings.

The five route options considered are illustrated in **Exhibit 1**.

Investment Options

Additionally, several investment options were identified for consideration in this Subtask, including:

- The Farmington Connection extended each of the 5 routes into the San Juan River valley to provide closer access to Farmington.
- The Navajo Mine Connection provided a connection to the Navajo Mine operated by Navajo Transitional Energy Company (NTEC), which has an isolated mine railroad. This connection would provide NTEC access to the greater North American freight rail network for shipment of product and maintain the mine as an employment source for the Navajo Nation.
- The northern terminal at the Navajo Agricultural Products Industry (NAPI), which would be the location of the maintenance facility and transload facility serving Farmington.
- Sidings for trains traversing opposite directions to meet and set-out tracks (short sidings for use by maintenance equipment or crews or for temporary storage of railcars that are determined to need repair while enroute), and road /rail grade separations, are included in the drawings for each route option.

Of these investment options, the NAPI location was favored for a terminal and transload facility because there is sufficient space at this location and because initial discussions with NAPI indicate that NAPI is willing to host such a terminal.

The Navajo Mine Connection was advanced in order to provide a connection to a potential high-volume customer. As noted in Subtask 4.1, the Navajo Mine has the potential to generate tens of thousands of carloads per year.

Conversely, the Farmington Connection was assessed as adding little value, since it would not eliminate transloading, and it would not significantly reduce the length of truck trip between Farmington and the transload location. But it would require significant amounts of earthwork, with cuts or fills on the order of 80 feet – 100 feet deep as well as steep grades in order to descend the bluff from the NAPI site to the Farmington valley. For these reasons, the Farmington Connection was eliminated from further consideration.

The route options identified in Subtask 4.4 were used as the basis for Task 5, the environmental analysis. While the exact alignments may change somewhat, the overall routes are sufficiently refined to use as a basis for the environmental analysis.

A map of the conceptual route options (including investment options) is attached as **Exhibit 1**. The route options include large buffers around each conceptual alignment to reflect the potential variability in final alignments as final design progresses; at any given locations, the buffer area may or may not be needed.

Right-of-Way

A key consideration identified during the refinement of the route options was the nature of the land title. Much of the land east of the Navajo Reservation and Tribal Land (and specifically between the BNSF connection and the Four Corners region) is known as allotment land, with sections of land in which multiple family members have an interest and who must all mutually agree before any action can be taken. Due to the fractionated nature of the control, it may be extremely difficult to obtain a right-of-way (ROW) across allotment lands. As such, the route options have attempted to avoid this type of land.

All three *"Defiance via…"* route options traverse one section of allotment land near the BNSF interchange. The Navajo families who control this section have not been contacted, and it is not known how many individuals control this section. Due to the checkerboard nature of the allotment lands, if this one allotment were to be avoided, the route options instead would pass through two other allotment areas. The *Defiance via Highway 371* route option crosses a total of three allotment areas, with the two additional allotments in an area where Highway 371 already crosses the allotments. Note that the presence of the highway on these allotments offers no assurance that the families that control these allotments (the allotees) are the same as those who granted authorization for the highway, or that they would be amenable to granting ROW access to a railroad. The remainder of the three *"Defiance via…"* route options chiefly traverses Navajo Tribal land; while the Navajo Nation has been engaged with these early studies, no agreements have been reached with the Navajo Nation to secure ROW access across tribal lands.

The *El Segundo* route option traverses five allotments, while the *Star Lake* route option traverses none. Both routes would connect to the (compass) north end of the BNSF Lee Ranch Subdivision and would require significant amounts of privately-owned property.

The north end of all route options would traverse lands of the Navajo Nation and would use NAPI lands at the northern terminal. While no agreements for use of Navajo Nation land have been discussed, the Navajo Nation has been engaged in this study based on a memorandum of understanding between San Juan County and the Navajo Nation. **Table 3** summarizes the characteristics of each route option.

Table 3: Summary of Route Options

Route	Defiance via Hwy 491	Defiance via Indian Creek	Defiance via Hwy 371	El Segundo	Star Lake	Farmington Connection	Navajo Mine Connection
Geometry & Operations: *Grade (uncompensated)*	2.0% NB 2.0% SB	1.9% NB 2.0% SB	2.0% NB 2.0% SB	1.8% NB 1.9% SB	2.0% NB 1.9% SB	0.2% NB 2.0% SB	1.5% NB 1.5% SB
Geometry & Operations: *Max. Curvature*	5.0° (typical) 7.5° (max, 1 location)	5.0° (typical) 7.5° (max, 1 location)	5.0° (typical) 7.5° (max, 1 location)	4.0°	5.0° (typical) 7.5° (max, 2 locations)	6.0°	3.0°
Geometry & Operations: *Undulation*	Minimal undulation	Minimal undulation	Minimal undulation	Minimal undulation	Relatively significant undulation	Minimal undulation, but long, steep continuous 2% grade	Minimal undulation
Geometry and Operations: *Meets Objectives*	Yes, Route meets Task 4.4 objectives	Yes, Route meets Task 4.4 objectives	Yes, Route meets Task 4.4 objectives	Yes, Route meets Task 4.4 objectives	Yes, Route meets Task 4.4 objectives	Yes, Investment Option meets Task 4.4 objectives	Yes, Investment Option meets Task 4.4 objectives
Feasibility and Constructability: *Potentially High-Cost Constraints*	~1 mile private ROW	~1 mile private ROW	~1 mile private ROW	16 miles private ROW	18 miles private ROW, ~1 mile tunnel, undulation	~0.5 mile private ROW	Primarily on reservation and tribal controlled lands.
Feasibility and Constructability: *Conflicts with Existing Infrastructure*	Parallels water line; Hwy 264, 491, 371 crossings	Parallels water line and gas lines; Hwy 264, 491, 371 crossings	Parallels water line; Hwy 264, 491, 371 crossings	Hwy 57, 371 (2) crossings	No identified conflicts with major infrastructure	No identified conflicts with major infrastructure	No identified conflicts with major infrastructure
Feasibility and Constructability: *Allotments Traversed (based on conceptual design)*	1	1	3 (two allotments are already traversed by Highway 371)	5	None	None	None
Feasibility and Constructability: *Meets Objectives*	Yes, Route meets Task 4.4 objectives	Yes, Route meets Task 4.4 objectives	Yes, Route meets Task 4.4 objectives	Yes, Route meets Task 4.4 objectives	Yes, Route meets Task 4.4 objectives	No, the Farmington Connection Investment Option has been deemed	Yes, Investment Option meets Task 4.4 objectives

Route	Defiance via Hwy 491	Defiance via Indian Creek	Defiance via Hwy 371	El Segundo	Star Lake	Farmington Connection	Navajo Mine Connection
						to not provide enough benefit to study further at this time.	
Environmental Constraints *(As they are known based on preliminary information from Task 5)*	To Be Determined (TBD) in Task 5 (Near existing Hwy 491 and water line corridor, already cleared; ~1 mile or less from Twin Lakes, Naschitti, and Sheep Springs, and homesites near Hwy 264; near grazing permit areas)	TBD in Task 5 (~1 miles to Twin Lakes and homesites near Hwy 264; near grazing permit areas)	TBD in Task 5 (Close to several homesites near Hwy 264 and ~1 mile from Twin Lakes, Standing Rock and White Rock; avoids Chaco Canyon by ~3.5 miles; near grazing permit areas)	TBD in Task 5 (avoids Chaco Canyon by ~3 miles; near grazing permit areas)	TBD in Task 5 (near grazing permit areas)	North end of Farmington Connection would be in or near a floodplain. Recommend that this option not be pursued.	TBD in Task 5

VI. Summary: Subtask 4.5, Capital Cost Estimation Methodology and Estimate of Probable Cost

Subtask 4.5 developed conceptual capital cost estimates for each of the five aforementioned route options, as well as the investment options carried forward from Subtask 4.4. The subtask also identified key risks and uncertainties. For example, the design is at a relatively low level of development, the complexity of environmental avoidance and mitigation measures is not yet known, and there has recently been significant construction cost escalation.

The conceptual cost estimates were based on quantities derived from the concept plans (from Subtask 4.4), with major cost elements being the quantity of earthwork, the amount of railroad track, and the number of structures (i.e., bridges, or in the case of the Star Lake route, also a tunnel). Each of the items in these few categories exceeded $250 million for each of the options (exact costs varying depending upon option, with some cost categories significantly higher for certain options). Unit costs for railroad-specific construction activities (such as construction of railroad track) were determined from recent bid prices. Track construction was estimated at $350 per track foot in anticipation of the very large quantity of track construction being conducive to use of a track laying machine, which is assumed to create efficiencies in construction; track construction represents approximately $200 million of the total cost, varying slightly depending upon route option. Costs for earthwork (e.g., excavation and embankment) were based on recent New Mexico Department of Transportation (DOT) bid results for these activities. Note that the very large quantities of earthwork, for example, approximately 15 million cubic yards (or more, depending upon option) of excavation, may offer economies of scale not found on typical New Mexico DOT projects. The respective unit cost categories were mapped to the standard cost categories identified in the FRA's Standard Cost Categories (SCC) Worksheet.

Table 4 summarizes the conceptual-level estimated capital costs for each option, including both the main route option, relevant investment options, but before contingency. These costs were developed late in the year (November) 2024 using unit costs from that timeframe and thus, with little time for inflation to occur in the remaining month of 2024, were also assumed to be representative of 2025 conceptual-level costs.

Table 4: Summary of Estimated Construction Costs, *Excluding* Contingencies

Summary of Estimated Construction Costs per Route Option	
Route Option	**Conceptual-Level Cost *Before* Contingency (Billions of 2025 dollars)**
Defiance via Highway 491	$1.4
Defiance via Indian Creek	$2.0
Defiance via Highway 371	$1.5
El Segundo	$1.3
Star Lake	$1.7

As noted above, the very large quantities of construction material may offer the opportunity for further cost savings resulting from economies of scale during construction. Similarly, more advanced design and geotechnical analysis at a subsequent time may be able to identify economies in the earthwork, such as reductions in total quantity, or revised balancing of cuts and fills that might be accomplished by adjustments in the alignment or track profile.

VII. Summary: Subtask 4.6, Operations and Maintenance Cost Estimate

Subtask 4.6 developed conceptual estimates for the annual costs to operate and maintain the proposed railroad. It was assumed that the proposed railroad would be operated as a stand-alone entity, with its own organizational structure. The conceptual Operations and Maintenance (O&M) costs were prepared for one route option only—the *Defiance via Highway 371* route option. Nearly all estimated costs depend upon the length of the route; for example, crew on-duty time, locomotive fuel consumption, vegetation control, and rail grinding, are all related to mileage. Thus, it was assumed that costs for other route options would be approximately proportional, based on the relative length of the selected option to the *Defiance via Highway 371* route option.

The major components driving the proposed railroad's O&M program train crew costs, infrastructure inspection and maintenance costs, locomotive fuel and other consumables, and materials and services, such as rail grinding or replacement.

Many of these costs are functions of the number of trains operated or the gross tonnage of traffic over the line. For example, the more gross tons operated over the railroad, the higher the rail wear. Similarly, as more trains are operated in any given day, more operating crews would be necessary.

There are several exceptions to this general rule. Consistent with the Subtask 4.2 Operations Analysis, it was assumed that while bulk commodity unit trains operate on the proposed railroad, the locomotives and their fuel would be provided by BNSF. This is typical of many bulk commodity operations, where the main line railroad's locomotives remain with the trains over originating or terminating short line railroads (in this case, analogous to the proposed railroad). In these situations, the cost for use of the main line railroad's locomotives and the incremental fuel consumed while operating over the short line railroad is included in the commercial arrangements between the short line and connecting main line railroad (in this case, BNSF), but does not appear as a line-item in the short line railroad's operating and maintenance cost.

Conversely, for the manifest traffic, the cost of locomotives and fuel is assumed to be borne by the proposed railroad. Consistent with the Subtask 4.2 Operations Analysis, the manifest traffic is assumed to be interchanged with BNSF at the connection point, which would necessitate that the proposed railroad provides locomotives and fuel for the manifest traffic. Fuel consumption was estimated via the RTC model developed in Subtask 4.2, Operations Analysis.

The Subtask 4.6 O&M analysis considered two scenarios matching the traffic levels considered in the Subtask 2.2 Freight Demand Forecast. The total net ton volumes for the year 2030 and at the end of the analysis period in 2070 are presented in **Table 5**:

Table 5: Estimated Annual Net Tonnage for Conceptual O&M Cost

Estimated Annual Net Tonnage from Subtask 2.2		
Scenario:	**Total Net Tonnage (2030):**	**Total Net Tonnage (2070):**
Low Volume	830,000	748,000
High Volume	9,966,000	6,550,000

The O&M analysis estimated different plans for each scenario, including plans for operating staff (e.g., train crews), maintenance staff (e.g., track and ROW maintenance and equipment maintenance), administrative and management staff. The O&M analysis also estimated annual costs for fuel for locomotives and maintenance equipment, costs for maintenance of equipment, materials (e.g., ballast for track maintenance, replacement gate arms at grade crossings), and capital replacements (e.g., replacement of turnouts or, in the high-volume scenario, curve-worn rail). The analysis also considered contracted services (e.g. allowances for outside contractors for rail inspection, vegetation control, contracted third-party dispatching services, and occasional heavy repairs requiring unique skills or equipment). Note that rail replacement and mid-life overhaul of locomotives would likely be capitalized on a railroad's balance sheet, but for the purposes of this analysis, have been included in this O&M analysis.

Based on a total of approximately 500 million gross tons over 40 years for the high-volume scenario, it was assumed that the concrete ties would not require replacement (there are existing concrete tie railroads that exceed 100 million gross tons per year on a double-track railroad, such as portions of BNSF main line across New Mexico, where concrete ties are believed to have lasted 10 or more years).

Note that annual maintenance costs in certain years increased somewhat due to infrequent activities, such as rail grinding (which could add several million dollars in a few selected years when large quantities of rail grinding were required), locomotive mid-life overhauls, etc. As a result of these costs, which would likely be capitalized, the maximum O&M cost for the high-volume scenario would occur halfway through the analysis period, in 2050, when an additional $10 million was assumed for mid-life locomotive overhauls, increasing the O&M cost that one year by $10 million. Conversely, for the low-volume scenario, costs are generally similar from one year to the next, since there is only infrequent rail grinding and no rail replacement, though for the low-volume scenario there is also an assumed mid-life locomotive overhaul.

The estimated O&M cost was developed based on estimated 2024 costs. Hourly rates were assumed to be slightly below the rates found on the "Careers" potion of several Class I railroad websites, on the assumption that pay scales would need to be nearly comparable to Class I rates in order to attract employees. At this conceptual stage, fully burdened staff costs, accounting for benefits, taxes, and overhead costs associated with employment, were assumed to be twice the direct hourly rate (e.g., a position with a direct pay rate to the employee of $30/hour would actually cost the proposed railroad $60/hour).

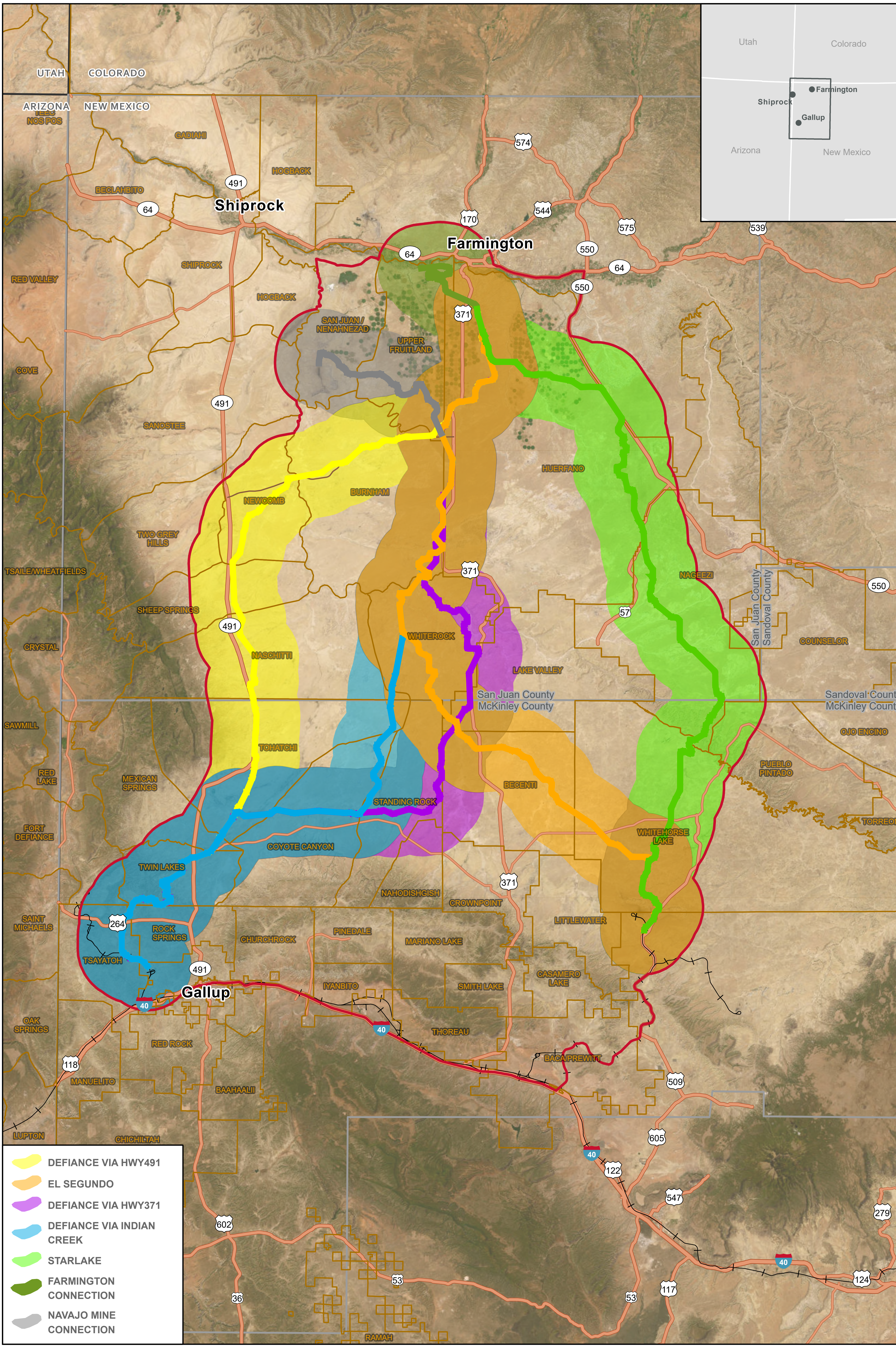
The resulting estimated O&M costs before contingencies, discounting, and inflation, for year 2030 and year 2070 (a slightly different presentation of the same cost structure shown in the Conceptual O&M Cost memorandum) , for the *Defiance via Highway 371* route option are illustrated in **Table 6**:

Table 6: Estimated Annual O&M Costs

Estimated Annual Operations and Maintenance Costs		
Scenario:	**2030 Cost ($ millions)**	**2070 Cost ($ millions)**
Low-Volume	$ 4.3	$ 4.3
High-Volume	$ 9.9	$ 11.8

Note that the annual O&M costs for the high-volume scenario increase from 2030 to 2070. This is because, over time, the traffic mix shifts to include more manifest trains and fewer bulk commodity unit trains. As noted above, it has been assumed that the unit trains make use of fuel already present in the locomotives received from BNSF, while the manifest trains use fuel supplied by the proposed railroad. Thus, the relative increase in manifest trains over time necessitates more mileage from the proposed railroad's locomotives and an increase in fuel costs.

EXHIBIT 1 - CONCEPTUAL ROUTE OPTIONS



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NAVAJO NATION CHAPTER BOUNDARY

SERVICE ROUTE 5

RAILROAD

COUNTY BOUNDARY

STATE BOUNDARY

CONCEPTUAL ROUTE OPTIONS