Seven County Infrastructure Coalition - Uinta Basin Railway:
Evaluation of Potential Route Alternatives

March 13, 2019

The Seven County Infrastructure Coalition ("Coalition") proposes to construct a new rail line connecting termini in Myton and Leland Bench, Utah to the national rail network. The Coalition engaged HDR Engineering, Inc. ("HDR") to identify potential route options for such a rail line and to provide an evaluation of these alternatives. A summary of that process is provided below.

I. Route Objectives

To guide its evaluation of potential alternatives, the Coalition and HDR identified certain objectives that a railway route would have to meet to be considered feasible. These objectives include:

- **Operational Feasibility**: An operationally feasible route must have grades, curvature, and other design characteristics that do not exceed the criteria established in the Operational Basis of Design. The Operational Basis of Design is a document prepared for the Coalition that establishes parameters for the operations of trains on the railway.

- **Economical**: In order to meet the purpose of the project, the route selected must allow the Coalition to economically attract shippers. The ability to do this is directly tied to the cost of constructing and operating the railway. Generally, an economic route will (1) be shorter in length; (2) follow flatter/less rough terrain; and (3) minimize the length of tunnels.

- **Avoid Urban and Residential Areas**: Generally, a route that avoids urban and residential land uses is preferable.

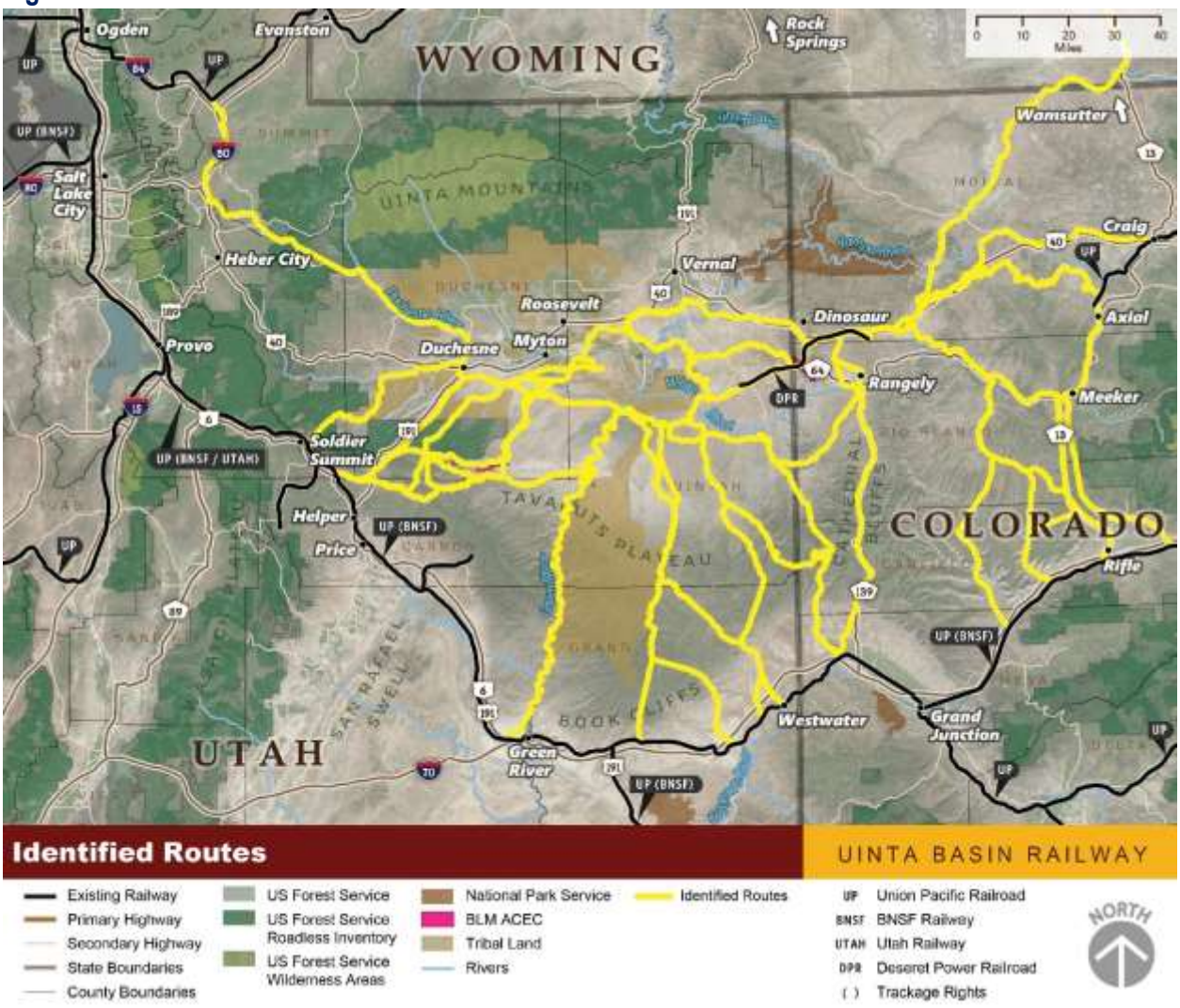
- **Minimize Environmental Impacts**: Generally, a route that results in fewer impacts to environmental and cultural resources is preferable, and a route that utilizes to the greatest extent possible already disturbed areas is preferable.

II. Evaluation of Potential Routes

The Uinta Basin is bounded on all sides by high mountains or plateaus. This difficult terrain severely limits the number of possible routes that can connect the Uinta Basin to the national railway network. Generally, potential routes must either travel east or south to get out of the Basin.

HDR started its evaluation with 29 potential route alternatives as depicted in Figure 1 below. Twenty-six of these routes were drawn from a study conducted by the Utah Department of Transportation in 2014. Three additional routes were identified by Jones and DeMille Engineering ("JDE") and HDR.

Figure 1: Identified Routes



After identification of these 29 routes, HDR began the initial screening process. Based on the screening criteria developed for the project, 21 routes were removed from further consideration as they (1) did not meet the operating parameters established in the Operating Basis of Design; (2) had a significantly higher cost of construction, compared to the other routes; (3) ran through significantly more areas of urban and residential land use, compared to the other routes; and/or (4) ran through significantly more areas that are environmentally sensitive or have substantial cultural resources, compared to the other routes.

HDR then developed conceptual engineering for each of the eight remaining routes. This was done so that each route would have the same common termini in the Uinta Basin of Myton and Leland Bench. For those routes that were previously identified in the 2014 UDOT studies, HDR refined the conceptual engineering to reduce length of tunnels, earthwork, and length and number of railway bridges, and to align them to the Operating Basis of Design developed for the Coalition. In addition, each route's horizontal and vertical alignment was refined to reflect the parameters of the Operating Basis of Design, in order to reduce construction cost and operating and maintenance cost. Track mileage was reduced where practical to reduce construction costs. The refinement also sought to reduce the environmental impact of each route, based on preliminary environmental data (discussed below) for each route.

The eight routes carried forward for further evaluation are depicted in Figure 2 and described in in Table 1 below.

Figure 2: Routes Carried Forward for Further Evaluation

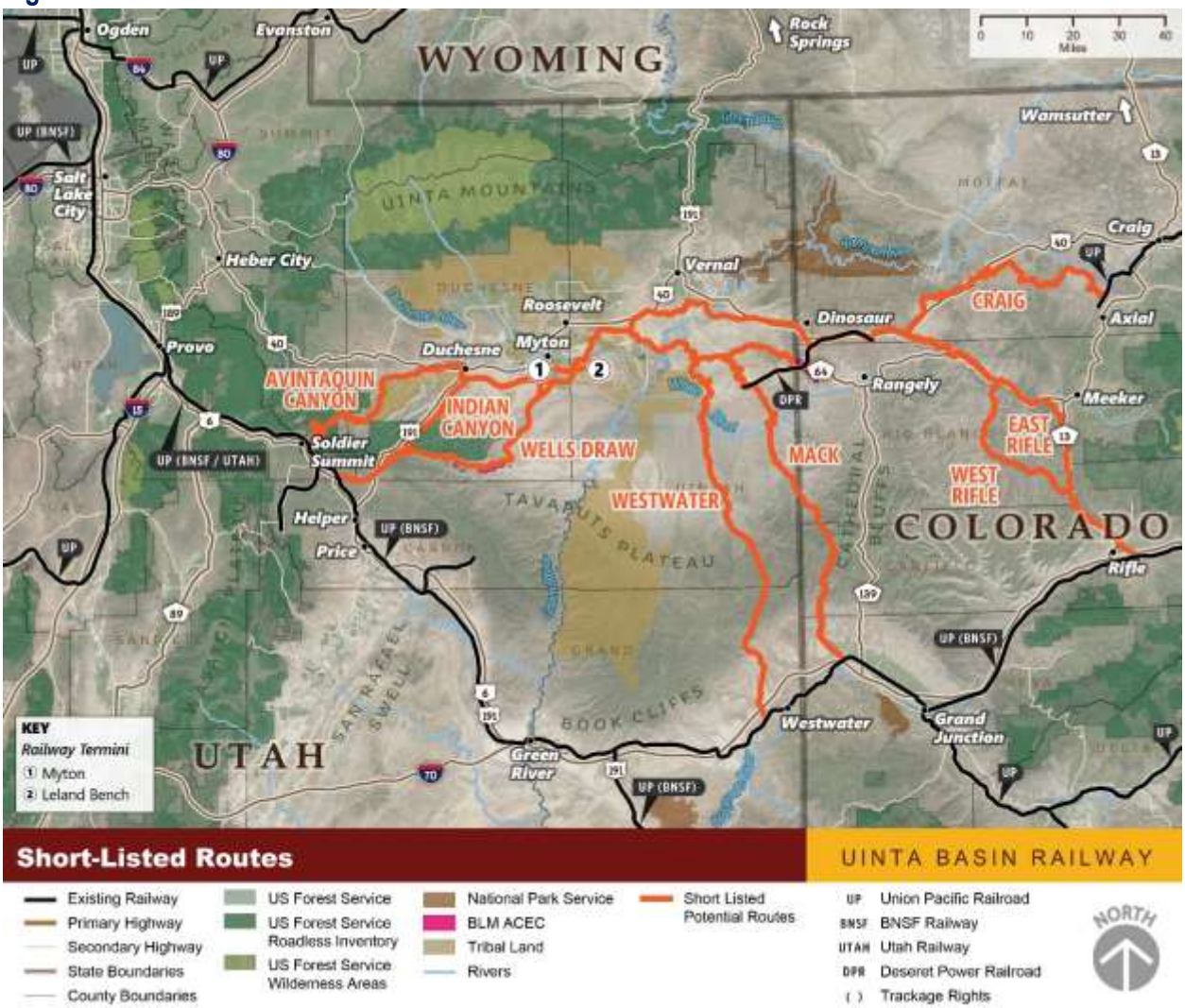


Table 1: Description of Potential Routes Carried Forward for Further Evaluation

Route Name	Description
Avintaquin Canyon	Starting at the UP Provo Subdivision main line near Soldier Summit, Utah, this route heads north-easterly and climbs the Roan Cliffs to a summit tunnel through the West Tavaputs Plateau. It then descends northward in Avintaquin Canyon to reach the Uinta Basin in the Strawberry River drainage. Before reaching the mouth of Avintaquin Canyon, the route turns east and ascends onto benchlands south of the Strawberry and Duchesne rivers to reach the proposed termini in the Uinta Basin. The basis of this route was identified by reviewing a historic Denver & Rio Grande Western Railroad survey. The route was adapted to terrain mapping and to skirt Starvation Reservoir. This route crosses Tribal Lands.
Indian Canyon	Starting at the UP Provo Subdivision main line near Kyune, Utah, this route heads easterly through Emma Park parallel to the Roan Cliffs. It then climbs the Roan Cliffs to a summit tunnel through the West Tavaputs Plateau near Indian Creek Pass on U.S. Highway 191. The summit tunnel emerges near the headwaters of Indian Creek. The route then descends northward in Indian Canyon to a location approximately two miles south of Duchesne. The route turns eastward and ascends onto benchlands to the south of the Duchesne River to reach the proposed termini in the Uinta Basin. The route's crossing of the West Tavaputs Plateau and its location in Indian Canyon were substantially modified compared to the location selected by UDOT to reduce construction costs. Portions of this route were identified and selected as the preferred alternative in the 2014 UDOT Uinta Basin Railroad Environmental Study. This route crosses Tribal Lands.
Wells Draw	Starting at the UP Provo Subdivision main line near Kyune, Utah, this route heads easterly through Emma Park parallel to the Roan Cliffs. It then climbs the Roan Cliffs to a summit tunnel through the West Tavaputs Plateau. The location of the Wells Draw summit tunnel's west portal is similar to the Indian Canyon summit tunnel west portal, but its east portal is located in the upper reaches of Argyle Canyon instead of the upper reaches of Indian Canyon. After entering Argyle Canyon, the Wells Draw Route gradually climbs the north slope of Argyle Canyon, running in an eastward direction, reaching the canyon rim near the headwaters of Wells Draw. The route then turns north and descends in the Wells Draw drainage to reach the proposed termini in the Uinta Basin. This route does not cross Tribal Lands.
Westwater	Starting at the UP Green River Subdivision main line near Agate, Utah, this route heads northerly across the Green River Desert to the base of the Book Cliffs. It enters the Book Cliffs and follows Westwater Wash, and then East Westwater Canyon to the canyon's end. A summit tunnel passes through the East Tavaputs Plateau. Then route then follows Sweetwater and Bitter Creek canyons northerly to the White River. After crossing the White River, the route turns westward and northward to reach the proposed termini in the Uinta Basin. Portions of this route were identified in the 2014 UDOT Uinta Basin Railroad Environmental Study. This route does not cross Tribal Lands.
Mack	Starting at the UP Green River Subdivision main line near Mack, Colorado, this route heads northerly across the Grand Valley to the base of the Book Cliffs. It enters the Book Cliffs and follows Atchee Wash to reach a summit tunnel through the East Tavaputs Plateau in the vicinity of Baxter Pass. Beyond the summit tunnel, the route heads westerly following Bitter Creek Canyon, then turns westward to reach the proposed termini in the Uinta Basin. Portions of this route were identified in the 2014 UDOT Uinta Basin Railroad Environmental Study. This route does not cross Tribal Lands.
West Rifle	Starting at the UP Glenwood Springs Subdivision main line near Rifle, Colorado, the West Rifle Route heads northerly toward Rifle Gap, then turns northward and connects to the Deseret Power Railroad ("DPR") approximately two miles west of the Deserado Mine. After following the DPR for 12.7 miles, the Craig Route departs the DPR and proceeds northwestward, crossing the Green River approximately five miles south of Jensen, Utah. It then proceeds westward to reach the proposed termini in the Uinta Basin. Portions of this route were identified in the 2014 UDOT Uinta Basin Railroad Environmental Study. This route does not cross Tribal Lands.

Route Name	Description
East Rifle	Starting at the UP Glenwood Springs Subdivision main line near Rifle, Colorado, the East Rifle Route heads northerly toward Rifle Gap, continues to a point west of Meeker, Colorado, then turns northward and connects to the DPR approximately two miles west of the Deserado Mine. After following the DPR for 12.7 miles, the Craig Route departs the DPR and proceeds northwestward, crossing the Green River approximately five miles south of Jensen, Utah. It then proceeds westward to reach the proposed termini in the Uinta Basin. Portions of this route were identified in the 2014 UDOT Uinta Basin Railroad Environmental Study. This route does not cross Tribal Lands.
Craig	Starting at the UP Craig Subdivision main line near Axial, Colorado, this route heads westerly across open terrain and connects to the DPR approximately two miles west of the Deserado Mine. After following the DPR for 12.7 miles, the Craig Route departs the DPR and proceeds northwestward, crossing the Green River approximately five miles south of Jensen, Utah. It then proceeds westward to reach the proposed termini in the Uinta Basin. Portions of this route were identified in the 2014 UDOT Uinta Basin Railroad Environmental Study. This route does not cross Tribal Lands.

For each of these eight routes, HDR developed an estimated construction cost. The cost of all eight routes was estimated by approximating the mileage of each route, in three terrain categories:

- **Open Terrain:** Relatively flat, agricultural, or grazing lands, such as those found in the populated and farmed areas of the Uinta Basin, in the grazing lands between Vernal and Craig, and in Emma Park. Construction in Open Terrain does not require large cuts and fills or numerous bridges, but occasional large bridges may be present. No tunnels are required.

- **Moderately Rugged Terrain:** Foothills and incised river valleys, such as those found in the vicinity of the Green River Crossing south of Vernal on the Craig Route, and in the upper reaches of Wells Draw. Construction in Moderately Rugged Terrain requires some large cuts and fills, occasional large bridges, but not numerous bridges. No tunnels are required.

- **Rugged Terrain:** Deep canyons and mountainous terrain, such as those found in the Tavaputs Plateau, Argyle Canyon, and Indian Canyon. Construction in Rugged Terrain requires many large cuts and fills, some retaining walls, and numerous bridges and large bridges. Tunnels are often required in lieu of overly deep cuts or to pass through mountains that are not practical to cross in the open.

Table 2 below shows the length in miles of open terrain, moderately rugged terrain, rugged terrain, and tunneling for each route.

Table 2: Types of Terrain in Miles for Potential Routes

Route	Total Mileage	Open Terrain Miles	Moderate Terrain Miles	Difficult Terrain Miles	Tunnel Miles
Indian Canyon	80.5	60.3	0.0	17.0	3.2
Craig	185.3	155.3	30.0	0.0	0.0
Wells Draw	111.0	33.9	41.0	30.5	5.6
Avintaquin Canyon	97.3	34.4	0.0	59.0	3.9
East Rifle	196.8	132.1	0.0	63.5	1.2
West Rifle	201.6	136.9	0.0	63.5	1.2
Mack	155.0	90.4	0.0	59.5	5.1
Westwater	159.7	94.9	0.0	59.5	5.3

HDR then developed an estimated conceptual cost per mile for each of these terrain types. Generally, open terrain is the least costly per mile, while rugged terrain is the most costly per mile. An estimated conceptual cost for tunneling was also developed for each route. This cost was based on prior tunneling projects in the Uinta Basin and Wasatch Plateau regions and high-level desktop geological and geotechnical analysis of the area. The estimated cost to construct each route did not include signaling, sidings, shipper facilities, improvements to the Union Pacific Railroad (UP), improvements to the Deseret Power Railroad (DPR), environmental mitigation, and right-of-way acquisition.

Based on HDR's estimated conceptual cost of construction, the eight routes were categorized as follows:

Lower Cost	**Middle Cost**	**Higher Cost**
Indian Canyon	Wells Draw	East Rifle
Craig	Avintaquin Canyon	West Rifle
		Mack
		Westwater

The four most costly routes—East Rifle, West Rifle, Mack, and Westwater—correspond with those having a high number of rugged terrain miles. This is because routing through such terrain results in more high degree curves, an increase in grades and lengths of grades, an increase in the number and length of tunnels, and higher fills and deeper cuts causing wider areas of impacts. In addition to increasing the cost of such routes, these factors also make these routes less feasible from an engineering and design perspective. While Avintaquin Canyon also has a high number of rugged terrain miles, that route fell within the Middle Cost category because the length of the entire route is significantly shorter.

In addition to estimated conceptual construction costs, HDR also collected and analyzed currently existing environmental, land ownership, and land use data for each of

the eight routes. Specifically, environmental and land use geospatial information systems (GIS) database information was obtained from existing public sources. This information included land ownership, parks, refuges, recreational areas, waterbodies, wetlands and wetland banks, historic properties, and limiting soils. The GIS data were then overlaid on each route to allow an equal comparison of the routes for the identified constraints. A corridor was developed for each route so that it included 1,000 feet of land on both sides of a particular route's centerline, for a total route corridor width of 2,000 feet. While actual project impacts will be based on further engineering refinement and field verification of the GIS data, this evaluation allowed for a preliminary high-level comparison of environmental and land use impacts among each of the eight routes. Based on this preliminary comparison, no route was identified as having significant advantages over any of the other routes from an environmental perspective.

Taking into account all of these screening factors, HDR conducted the next step in the process of screening to winnow down the 8 routes. The following findings were made resulting in the selection of 3 routes to carry forward:

1. Indian Canyon and Craig were determined to be the most feasible from an engineering and design perspective and are the most economical routes.

2. East Rifle, West Rifle, Mack, and Westwater were eliminated from further consideration because they are less feasible from an engineering and design perspective (*i.e.*, go through substantially more rugged terrain) than the other routes, cost substantially more to construct than Indian Canyon and Craig, and do not any provide any significant environmental benefits or advantages.

3. Avintaquin Canyon was eliminated from further consideration because it is less feasible from an engineering and design perspective (*i.e.*, goes through substantially more rugged terrain) than the other routes, costs substantially more to construct than Indian Canyon and Craig, and does not provide any significant environmental benefits or advantages. Wells Draw, while more costly to construct than Indian Canyon and Craig, does not cross tribal land and avoids U.S. Forest Lands. For this reason, the Coalition elected to move Wells Draw forward for further consideration as well.

4. At this time, based on the information it has collected to date, the Coalition has selected Indian Canyon as its preferred route.