

# **Appendix F**

## Transportation Assessment

# Technical Memorandum

November 30, 2023

Project# 29540

To: Ryan Rudnick, PE, and Dwight Miller, PE

From: Matt Kittelson, PE, and Cameron Thompson

RE: Deschutes County Landfill Siting - Moon Pit Site Traffic Report &amp; Transportation Infrastructure Assessment

The Deschutes County Solid Waste Department is evaluating two potential sites to identify the preferred location for a new municipal solid waste landfill ("landfill") within the County. These sites are the Moon Pit and the Roth East sites. The enclosed memo provides transportation-related considerations for the Moon Pit site, including:

- An estimate of the number of vehicles/trucks that could access the landfill on a typical day and where they may be coming from/going to;
- A general assessment of the ability of the adjacent County roadway system to provide the capacity needed to serve the new landfill traffic;
- Considerations related to the sight distance and possible location of the accesses into the landfill;
- Review of the documented crash history on the roadways near the landfill; and,
- Overall transportation siting considerations and conclusions related to the potential for the Moon Pit site as the preferred location for the new landfill.

In addition, this memo has also been prepared to address the Site Traffic Report (STR) guidelines outlined in Deschutes County Development Code 18.116.310 if this site is chosen as the preferred landfill site.

## Moon Pit Location

The Moon Pit site is located between Bend and Millican and is currently an active surface mine. Access to the existing mine is provided opposite the US 20/Horse Ridge Frontage Road southern intersection. All of the existing Deschutes County landfills and transfer stations are located to the northwest of this site so all truck traffic would occur via US 20. Figure 1 shows the location of the site and the rural uses surrounding it.

**Figure 1. Site Location**



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## Trip Generation Estimate for Trucks and Employees

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To understand the potential number of cars and trucks associated with a landfill at this site, the Solid Waste Department provided the following information:

- The landfill would not be open to public use so all traffic generated by the site is associated with employees and the transfer of materials via truck;
- Seven employees would be on-site per day for operations and maintenance;
- Approximately 35 trucks would transfer materials to the site per day, seven days per week.

Based on these estimates, the Moon Pit site would generate a total of 84 vehicle trips on a typical day (i.e., 7 employee trips in/7 out and 35 truck trips in and 35 truck trips out) over the course of the day. Assuming all seven employees were to leave during the PM peak hour and up to three trucks exit during the same period, no more than 10 weekday PM peak hour trips would be generated. Based on these estimates, a Site Traffic Report (STR) is needed per DCC 18.116.310 given that the estimated daily trip generation is between 50 and 200 daily trips and the weekday PM peak hour is estimated to be less than 20 trips.

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## Trip Distribution and Assignment

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As noted above, all of the existing County landfill and transfer sites are located to the northwest of the Moon Pit site and no access to the general public will be provided. As such, we estimate that all of the truck trips will travel to/from the northwest on US 20 using the existing Access Road to access the site. The employees that could work onsite would most likely live to the northwest of the site but it is conceivable that one or two could live to the southeast. For the purposes of the analyses, we assumed all would travel to/from the northwest via US 20 would result in 10 weekday PM Peak hour trips.

We note that the Deschutes County Transportation System Plan (TSP) has not identified any capacity deficiencies on US 20 near the Moon Pit site and that the addition of 10 peak hour trips would not require any capacity-based mitigation if the landfill were sited at this location.

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## Sight Distance Evaluation

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As noted above, the Moon Pit site would access US 20 via the existing southern Horse Ridge Frontage Road intersection. This access is being used today by the surface mining operations on the site.

We measured the sight distance at this intersection in August 2023 using the guidance provided in the *American Association of State Highway and Transportation Officials (AASHTO) Green Book, 2018*. Based on the posted speed limit of 65 miles per hour speed limit on US 20 at this location, AASHTO recommends 720 feet of sight distance for outbound left-turning passenger vehicles (1,110 feet for combination trucks) and 625 feet of sight distance for outbound right-turning passenger vehicles (1,010 for combination trucks).

Photos illustrating the available sight distance are shown in Figures 2 and 3. As shown, there is several hundred feet of available sight distance in both directions and the field measurements confirmed that the AASHTO sight distance for right-turning and left-turning vehicles from the stop-controlled approach is met.

If the Moon Pit site is selected as the preferred landfill locations, we recommend that any signage, utilities, vegetation or above ground objects placed at the access be located so as to maintain minimum sight lines for exiting vehicles.



Figure 2. Access Road Facing Southeast



Figure 3. Access Road Facing Northwest

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## Crash Record Review

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Crash records within the ODOT crash database were reviewed from the most recent five-year period spanning from January 1, 2017, to December 31, 2021. The crash database contains all reported crashes as compiled by the State. Crashes requiring reporting are those that result in some level of injury and/or more than \$1,500 in property damage. Review of the crash database showed there were no reported crashes at the Access Road/US 20/Horse Ridge Frontage Road intersection.

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## Existing Transportation System Characteristics

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The existing surface mine is accessed via a 28-foot-wide paved road that extends approximately one mile from US 20 to the mine. The right-of-way along the road between the Moon Pit site and US 20 is approximately 30-feet wide and is bound on both sides by Bureau of Land Management (BLM) property. This road also provides access to a gravel parking lot for the Badlands Trailhead at a distance of approximately 850 feet from US 20. The condition of the access road at the parking lot is shown in Figure 4. If the Moon Pit site is chosen as the preferred location, the County may consider adding signage on the access road to alert truck drivers to the location of the parking lot.

As shown in Figure 4, the pavement conditions of the access road vary in places. This road is being used by trucks transporting materials to/from the surface mine today but the County may consider some potential pavement repairs if the site is selected.



Figure 4. Existing Access Road and Badlands Trailhead Parking Lot

## Transportation Infrastructure Evaluation

As part of the evaluation of the Moon Pit site compared to other landfill siting locations, the County will need to understand opportunities and challenges associated with each location and site. The table below provides information pertaining to the opportunities and challenges specific to the Moon Pit site.

Opportunities	Challenges
There is an existing roadway to the Moon Pit site, alleviating the need to plan for and construct access to the site from US 20. This would reduce upfront capital costs.	The access to the site is shared with to the Badlands Wilderness area – a popular walking and recreational trail system. Large trucks would share the roadway with passenger vehicles and people accessing the Wilderness area.
Large trucks and equipment already access the site via the existing roadway.	The roadway cross section cannot exceed the current width (28-feet). The right-of-way process for BLM is extensive and could require 2-3 years for approval.
	The access is located on a grade that is uphill to the west on US 20. There is currently extra pavement on the outside of the westbound lane acting as a de facto acceleration lane. Additional analysis and design may be required to evaluate the need for an acceleration lane that meets ODOT design standards for exiting trucks.

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## Conclusions

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Based on our review, we conclude that the transportation system can support the Moon Pit landfill site if chosen as the preferred site by the Deschutes County Solid Waste Department. If this site is the preferred location for a new landfill, County could consider the following:

- Adding signage on the access road to alert truck drivers to the location of Badlands Trailhead parking lot;
- Incorporating potential pavement repair on the Access Road at various locations;
- Considering a permanent acceleration lane for trucks existing the site to the west; and/or,
- Placing any signage, vegetation, utilities or above ground objects at the Access Road/US 20 intersection in a manner that maintains minimum sight lines.

Please let us know if you have any questions regarding our review.

# Technical Memorandum

February 1, 2024

Project# 29540

To: Ryan Rudnick, PE, and Dwight Miller, PE

From: Matt Kittelson, PE, and Cameron Thompson

RE: Deschutes County Landfill Siting - Roth East Site Traffic Report &amp; Transportation Infrastructure Assessment

The Deschutes County Solid Waste Department is evaluating two potential sites to identify the preferred location for a new municipal solid waste landfill ("landfill") within the County. These sites are the Moon Pit and the Roth East sites. The enclosed memo provides transportation-related considerations for the Roth East site, including:

- An estimate of the number of vehicles/trucks that could access the landfill on a typical day and where they may be coming from/going to;
- A general assessment of the ability of the adjacent County roadway system to provide the capacity needed to serve the new landfill traffic;
- Considerations related to the sight distance and possible location of the accesses into the landfill;
- Review of the documented crash history on the roadways near the landfill; and,
- Overall siting considerations and conclusions related to the potential for the Roth East site as the preferred location for the new landfill.

In addition, this memo has also been prepared to address the Site Traffic Report (STR) guidelines outlined in Deschutes County Development Code 18.116.310 if this site is chosen as the preferred landfill site.

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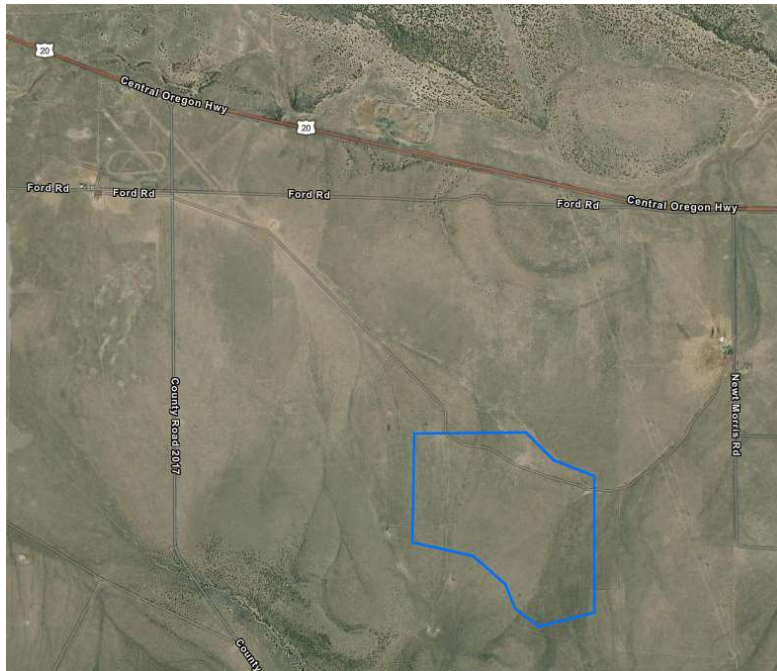
## Roth East Location

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The Roth East site is located to the southwest of the Newt Morris Road/US 20 intersection, southeast of Bend and Millican. There is an existing dirt road to the property that connects to Pine Mountain Road. Access to a landfill at Roth East could occur via the existing Pine Mountain Road/US 20 intersection or via construction of a new access between Pine Mountain Road and Newt Morris Road that would connect to US 20. If the existing dirt roadway connecting to Pine Mountain Road is used for access, this road would need to be reconstructed to provide for both employee and truck traffic.

All of the existing Deschutes County landfills and transfer stations are located to the northwest of this site so travel between the Roth East site and the existing sites would occur via US 20. Figure 1 shows the location of the site and the rural uses surrounding it.

Figure 1. Site Location



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## Trip Generation Estimate for Trucks and Employees

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To understand the potential number of cars and trucks associated with a landfill at this site, the Solid Waste Department provided the following information:

- The landfill would not be open to public use so all traffic generated by the site is associated with employees and the transfer of materials via truck;
- Seven employees would be on-site per day for operations and maintenance;
- Approximately 35 trucks would transfer materials to the site per day, seven days per week.

Based on these estimates, the Roth East site would generate a total of 84 vehicle trips on a typical day (i.e., 7 employee trips in/7 trips out and 35 truck trips in and 35 truck trips out) over the course of the day. Assuming all seven employees were to leave during the PM peak hour and up to three trucks exit during the same period, no more than 10 weekday PM peak hour trips would be generated. Based on these estimates, a Site Traffic Report (STR) is needed per DCC 18.116.310 given that the estimated daily trip generation is between 50 and 200 daily trips and the weekday PM peak hour is estimated to be less than 20 trips.

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## Trip Distribution and Assignment

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As noted above, all of the existing County landfill and transfer sites are located to the northwest of the Roth East site and no access to the general public will be provided. As such, we estimate that all of the truck trips will travel to/from the northwest on US 20 via either a connection to Pine Mountain Road or via a new access roadway that would intersect US 20 between Pine Mountain Road and Newt Morris Road. The employees that could work onsite would most likely live to the northwest of the site but it is conceivable that one or two could live to the southeast. For the purposes of the analyses, we assumed all would travel to/from the northwest via US 20 would result in 10 weekday PM peak hour trips.



We note that the Deschutes County Transportation System Plan (TSP) has not identified any capacity deficiencies on US 20 near the Roth East site and that the addition of 10 peak hour trips would not require any capacity-based mitigation if the landfill were sited at this location.

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## Sight Distance Evaluation

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As noted above, the Roth East site would access US 20 via either a new roadway that would intersect US 20 between Newt Morris Road and Pine Mountain Road or via the Pine Mountain Road/US 20 intersection, depending on the ultimate site design and access roadway construction.

We measured the sight distance along US 20 between Pine Mountain Road and Newt Morris Road as well as at the Pine Mountain Road/US 20 intersection in August 2023 using the guidance provided in the *American Association of State Highway and Transportation Officials (AASHTO) Green Book, 2018*. Based on the posted speed limit of 65 miles per hour speed limit on US 20 at this location, AASHTO recommends 720 feet of sight distance for outbound left-turning passenger vehicles (1,110 feet for combination trucks) and 625 feet of sight distance for outbound right-turning passenger vehicles (1,010 for combination trucks).

Photos illustrating the available sight distance at the Pine Mountain Road/US 20 intersection are shown in Figures 2 and 3. As shown, there is several hundred feet of available sight distance in both directions and the field measurements confirmed that the AASHTO sight distance for right-turning and left-turning vehicles from the stop-controlled approach is met.

If an alternate access point with US 20 is selected to the east between Pine Mountain Road and Newt Morris Road, the design team should consider vertical curvature along US 20 that could affect available sight distance and verify that required sight distance can be achieved.

If the Roth East site is selected as the preferred landfill locations, we recommend that any signage, utilities, vegetation or above ground objects placed at the connection point to US 20 (whether at the existing Pine Mountain Road intersection or a new connection point to the east) is provided so as to provide minimum sight lines for exiting vehicles.



Figure 2. Pine Mountain Road Facing West



Figure 3. Pine Mountain Road Facing East

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## Crash Record Review

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Crash records within the ODOT crash database were reviewed from the most recent five-year period spanning from January 1, 2017, to December 31, 2021. The crash database contains all reported crashes as compiled by the State. Crashes requiring reporting are those that result in some level of injury and/or more than \$1,500 in property damage.

Review of the crash database showed there were ten reported crashes along US 20 between Pine Mountain Road and Newt Morris Road during this five-year period. Seven of the ten crashes were animal-related crashes. Two of the non-animal crashes were single vehicle crashes, that were caused by driving too fast for the conditions of ice or wet pavement. There was one turning crash at the intersection of Newt Morris Road and US 20. Seven of the ten crashes resulted in property damage only, three resulted in an injury, and none resulted in a fatality.

Per the draft Deschutes County Transportation System Plan (TSP), Policy 2.8 states that the County will coordinate with the Oregon Department of Transportation (ODOT) to plan for grade-separated wildlife crossings of state highways using "relevant wildlife migration information, crash data, and best management practices." Regardless of whether the Roth East site is selected, we would recommend that the County and ODOT consider reviewing the animal-related crashes in this approximately 2.5 mile segment of US 20 per Policy 2.8.

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## Existing Transportation System Characteristics

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There is no direct access to the Roth East site via a paved road today, though several access alternatives are under consideration. These are discussed further in the following section.

Pine Mountain Road, which is to the west of the Roth East site, could be used as part of an access route between US 20 and the future landfill site. Pine Mountain Road intersects US 20 at two locations that are approximately 200 – 225 feet apart.

As shown in Figure 4, Pine Mountain Road diverges approximately 250 feet south of US 20. Both roadways provide for both northbound and southbound traffic so each orientates vehicles toward the direction they intend to travel on US 20. This atypical configuration could cause confusion for unfamiliar drivers in this area.

During the August 2023 site visit, it was noted that the street name sign at the point of the “V” was on the ground during a site visit, possibly having been knocked down by a driver.

If the Roth East site were selected and the existing Pine Mountain Road/US 20 intersection were the preferred access to the landfill, we would recommend that the County consider improving the intersection to a traditional intersection design (“T” intersection) and adding wayfinding signage at both the US 20 intersection and along the preferred site access route.



Figure 4. Intersection of Pine Mountain Road and US 20

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## Transportation Infrastructure Evaluation

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For the purpose of evaluating access options to the Roth East site, four route alignments were developed to assess various trade-offs between the access options, including overall route length, implementation costs, right-of-way impacts, grade, and connection points with US 20.

The following are key considerations in the vicinity of the site for all routes:

- **Established versus new access with US 20:** As noted previously, an existing access point with US 20 via Pine Mountain Route could be utilized to access the site, though this access point may need to

be reconfigured to a more traditional “t” intersection at US 20 to avoid driver confusion. New access points with US 20 could also be considered to the west, though adequate sight distance would need to be confirmed at the preferred location.

- **Existing right-of-way:** Several route options could utilize existing right-of-way, such as along Pine Mountain Road or Ford Road, which would reduce impacts to private property.
- **Deschutes County Property:** The County owns property between Ford Road and US 20 that could be utilized to avoid impacts to private property or BLM managed lands.
- **BLM Lands** exist east and south of the Deschutes County Property. For all routes, these lands should be avoided due to the time intensive and expensive process that would be likely to utilize these lands.
- **Steep Grade** exists north of the Roth East site. Routes that utilize Ford Road or connect to US 20 north of this grade may be required to climb this grade to avoid impacts to the BLM property. Such a roadway would likely need to be cut into the side of the grade, requiring a longer and more challenging road to construct.

Figure 5 shows the four conceptual access routes evaluated for the Roth East site. Table 1 provides information pertaining to the opportunities and challenges with each of the routes.

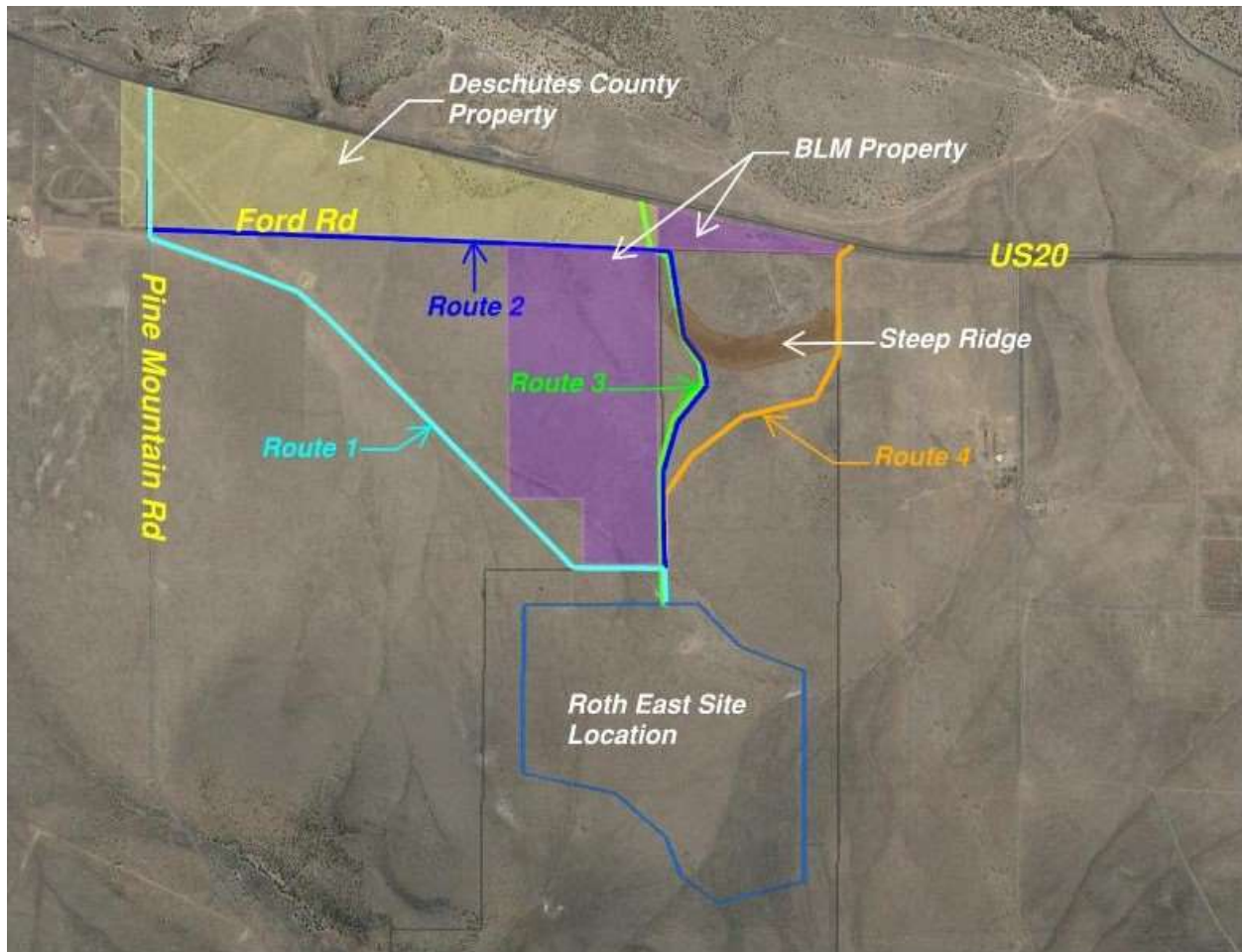


Figure 5. Intersection of Pine Mountain Road and US 20

**Table 1. Roth East Site Access Route Option Evaluation**

Route	Opportunities	Challenges
<p><b>Route 1</b> – Pine Mountain Road</p> <p>Planning level cost estimate: ~\$2.3 million.</p>	<ul style="list-style-type: none"> <li>■ Makes use of existing Pine Mountain Road infrastructure and roadway alignment.</li> <li>■ Pine Mountain Road has existing access with US 20</li> <li>■ Grade along the route is more flat than other routes considered</li> </ul>	<ul style="list-style-type: none"> <li>■ Pine Mountain Road would be shared with the Pine Mountain Observatory, requiring that large trucks share the roadway with passenger vehicles.</li> <li>■ The existing access at US 20/Pine Mountain Road would need to be modified to a traditional “T” intersection to reduce the roadways skew angle and possible driver confusion with existing geometry.</li> <li>■ While a built roadway exists along a portion of the Pine Mountain Road alignment, it would likely need to be upgraded to accommodate heavy vehicles.</li> </ul>
<p><b>Route 2</b> – Ford Road</p> <p>Planning level cost estimate: ~\$2.9 million.</p>	<ul style="list-style-type: none"> <li>■ Makes use of existing Pine Mountain Road and Ford Road infrastructure and roadway alignment.</li> <li>■ Pine Mountain Road has existing access with US 20</li> <li>■ Uses County right-of-way instead of right-of-way owned by private parties for large portion of route.</li> </ul>	<ul style="list-style-type: none"> <li>■ Longest route (approximately 2.9 miles)</li> <li>■ This route alignment would need to travel east to avoid BLM lands to the south which would require navigating a steep hill. Prior to implementation, this route would need to be further evaluated to determine the road alignment and design that would limit grades to 6 percent or less while climbing the hill. This may require a longer route that cuts into the slope of the hill at a less steep grade.</li> <li>■ While a built roadway exists along a portion of the Pine Mountain Road alignments, it would likely need to be upgraded to accommodate heavy vehicles.</li> </ul>
<p><b>Route 3</b> – New North/South Road</p> <p>Planning level cost estimate: ~\$1.2 million</p>	<ul style="list-style-type: none"> <li>■ Most direct route to site (1.2 miles).</li> <li>■ Uses County right-of-way instead of right-of-way owned by private parties for northern section of route.</li> <li>■ Access route would be dedicated for the landfill and not shared with other uses.</li> </ul>	<ul style="list-style-type: none"> <li>■ A steep hill exists immediately south of BLM property. Prior to implementation, this route would need to be further evaluated to determine the road alignment and design that would limit grades to 6 percent or less while climbing the hill. This may require a longer route that cuts into the slope of the hill at a less steep grade.</li> <li>■ The route south from US 20 would need to utilize the Ford Road alignment to avoid impacts to BLM property. The specific alignment of this route would need to be further evaluated to ensure appropriate roadway curvatures could be maintained while avoiding these impacts.</li> <li>■ Would require construction of a new intersection on US 20 and coordination with ODOT. Sight distance would need to be verified at the new access location.</li> </ul>

Route	Opportunities	Challenges
<b>Route 4 – New Eastern Road</b>  Planning level cost estimate: ~\$1.3 million.	<ul style="list-style-type: none"> <li>■ Could be aligned to avoid large hill immediately south of the BLM property.</li> <li>■ Second shortest route (1.3 miles) with flatter grades than Route 2 and Route 3.</li> <li>■ Access route would be dedicated for the landfill and not shared with other uses.</li> </ul>	<ul style="list-style-type: none"> <li>■ Route alignment south of US 20 could require right-of-way acquisition from Guzman Property to the east to avoid impacts to BLM property to the west.</li> <li>■ Would require construction of a new intersection on US 20 and coordination with ODOT. Sight distance would need to be verified at the new access location.</li> </ul>

Note: Cost estimates based on County estimate of \$1 million/mile to construct access road

## Conclusions

Based on our review, we conclude that the transportation system can support the Roth East landfill site if this is chosen as the preferred site by the Deschutes County Solid Waste Department. If this is the preferred location for a new landfill, County could consider the following:

- Identifying, designing, and constructing a preferred access location between the site and US 20. This could occur via the existing Pine Mountain Road/US 20 intersection or via a new connection point to the east. Construction of an access route would be a notable capital cost for this site that would need to be incorporated into the initial site development costs.
- If the Pine Mountain Road/US 20 intersection were the preferred access to the landfill, we would recommend that the County consider adding wayfinding signage at both the US 20 intersection and the upgraded dirt road/Pine Mountain Road intersection.
- If a new access point to the east were the preferred access to the landfill, the design team should ensure that adequate sight distance can be provided based on the existing vertical curves along US 20.
- Placing any signage, vegetation, utilities or above ground objects at the appropriate locations on US 20 and/or Pine Mountain Road in a manner that provides and maintains minimum sight lines.

Please let us know if you have any questions regarding our review.