APPENDIX G:

TRANSPORTATION (VEHICULAR) ANALYSIS

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TECHNICAL MEMORANDUM

Project: Port of Longview's Barlow Point Bulk Terminal

Subject: Due Diligence Review – Transportation Analysis

Date: February 25, 2016

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In 2010, the Port of Longview purchased the 282.5-acre property at Barlow Point for future Port industrial development. The property is located downstream of the current developed Port at approximately River Mile 64, which is on the west side of the City of Longview, Washington. In order to better understand the full potential of the Barlow Point site, the Port determined that a comprehensive master planning process should occur. The first step in that process was to perform a due diligence study to assess the development feasibility of Barlow Point as a marine terminal.

As part of the due diligence study, the Port retained Heffron Transportation to assist the overall project team (led by KPFF) with analysis of land-side access requirements. The site is adjacent to and southwest of State Route 432 (SR 432). This memorandum presents the transportation analysis review results and recommendations in support of the overall due-diligence review.

The due diligence review was conducted based on a market analysis and conceptual site planning exercise performed in late 2014 and early 2015 to identify possible types of use and site layouts. Two options were identified based on those processes. The options evaluated for this feasibility review focus on production and export of dry or liquid bulk commodities. Specific industry types were identified from the market analysis to be the basis to evaluate demand and capacity requirements for Barlow Point. The options evaluated in this feasibility review were identified by the project team based on the market forecasts for the River, the types of uses that could feasibly be located on the property, and to understand transportation impacts from high demand commodities. The dry bulk option (Option 1) includes potash (export only), urea (production and export), and wood pellets (export only). The liquid bulk option includes crude oil (export only), methanol (production and export), and biodiesel (production and export).

1. Conceptual Plan Descriptions

Two conceptual plan options were developed for this initial due diligence review. The identified commodities were grouped together based on their operational and site needs. For example, the potash and crude oil commodities for both options would be expected to have high rail transportation demand, while the urea and methanol commodities for both options are production facilities expected to have high employment. The wood pellets component of Option 1 could be expected to have high truck transportation demand; the biodiesel component of Option 2 would not. Both terminal options share a similar rail layout, general tenant configuration, and need for three purpose-built bulk handling piers. For both terminal options, primary vehicular access to the site is expected to be

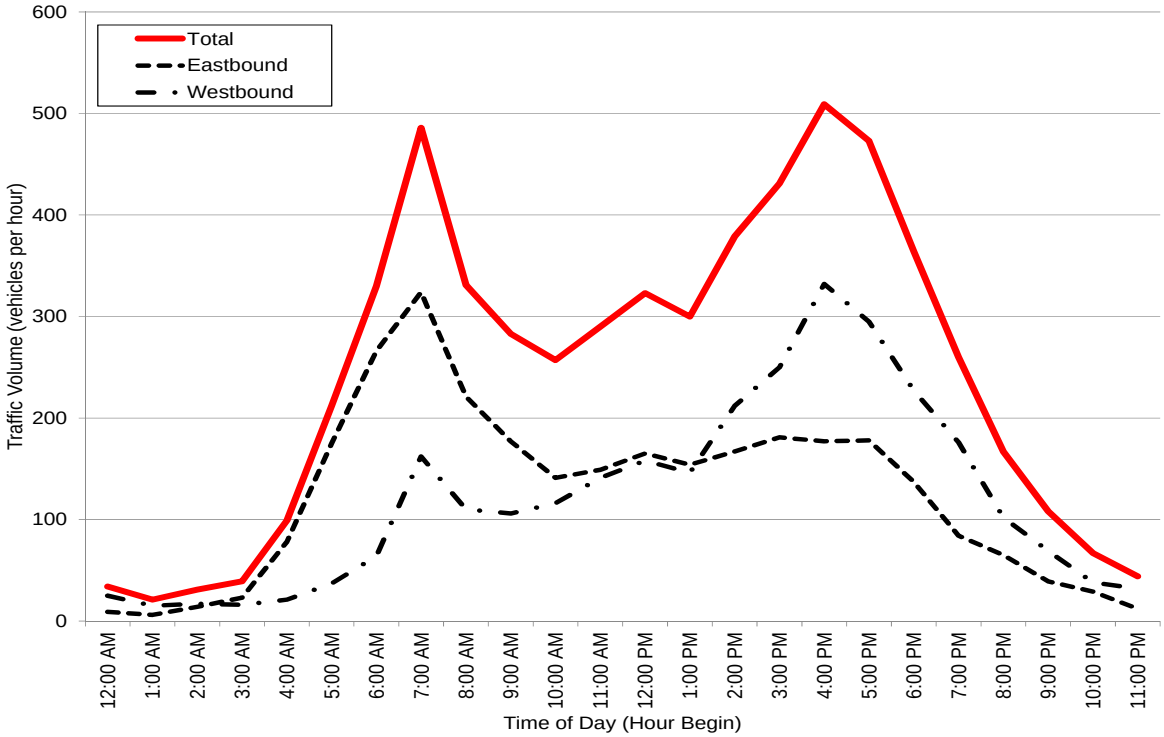
provided from a single entrance roadway on SR 432 located roughly between Memorial Park Drive and Solo View Drive. A possible emergency-only access could be provided at the southwest corner of the site with a short extension of Barlow Point Road to the site and on-site loop road. If provided, this access would be gated and would remain closed except for emergency vehicle access. Barlow Point Road could also serve as a public access point to a public viewing area. If included, it is likely a small parking area would be provided to accommodate the public access.

The project is also expected to require a small rail-crew pull-out from SR 432 located about two-thirds of a mile east of the likely site access roadway. This pull-out would provide a space for rail crews to park a vehicle while they access the engines.

2. Existing and Forecast Vicinity Traffic Volumes

To assess the current and potential future traffic operations at the possible site access location, a new 72-hour machine traffic count was performed on SR 432 about midway between Memorial Park Drive and Solo View Drive. The count effort collected volume, speed, and vehicle classification data from Tuesday, March 31 through Thursday, April 2, 2015. The average weekday volumes by hour are presented in Figure 1. As shown, the volume pattern on SR 432 reflects traditional peaking characteristics with higher eastbound (toward Longview and Interstate 5 (I-5)) volumes in the morning and higher westbound (away from Longview and I-5) volumes in the evening. The morning peak hour volume of about 480 vehicles (330 eastbound, 150 westbound) occurs from 7:15 to 8:15 A.M.; the evening peak hour volume of about 525 vehicles (195 eastbound, 330 westbound) occurs from 4:15 to 5:15 P.M.

Figure 1. Average Weekday Volumes on SR 432 btwn Memorial Park Dr & Solo View Dr



Source: Compiled by Heffron Transportation, Inc., from counts performed by Idax Data Solutions, March 31-April 2, 2015.

The data found that the 85th-percentile speed of vehicles at the count locations was 56 mph for both directions of travel. This is higher than the posted speed limit of 50 mph. The vehicle classification data indicated that trucks (including buses and single-unit two-axle trucks) make up about 7.6% of the total daily traffic on SR 432 at the count location. During the peak hours, trucks represent 9.9% of the average AM peak hour traffic (about 16% of westbound and 7% of eastbound) and 3.4% of the average PM peak hour traffic (about 2 % westbound and 6% eastbound).

Historical traffic volumes on SR 432 near the Barlow Point site were examined to determine a reasonable growth rate to estimate future background traffic. Count data from the Washington State Department of Transportation's (WSDOT) *2014 Annual Traffic Report*[1] indicate that daily volume on SR 432 increased by about 3.9% annually between 2012 and 2015. Based on this data, a compound annual growth rate of 4% was selected and applied to the 2015 traffic volumes to forecast year 2020 background traffic volumes on SR 432 adjacent to the Barlow Point site. With this level of background growth, the 2020 AM peak hour volume on SR 432 is forecast at 585 vehicles (400 eastbound, 185 westbound); the 2020 PM peak hour volume on SR 432 is forecast at 635 vehicles (400 eastbound, 235 westbound).

3. Terminal Vehicular Trip Generation

Traffic generation, including employee vehicle trips and truck trips generated to haul materials to and from the site were estimated to evaluate potential site access requirements and operational impacts. Trip generation estimates were developed using employee and truck volume estimates developed by the project team. The following describes the range of possible traffic generation.

3.1. Employees, Shifts, and Truck Volumes

The numbers of employees anticipated for each of the bulk commodities being considered for the two terminal options were provided by the project team.[2] The employee and truck estimates were inflated by 50% to reflect a reasonable worst case for this due diligence review. The estimates are summarized in Table 1. These estimates indicate that Option 1 (Dry Bulk) is expected to have a higher number of employees. This option was evaluated for up to 385 employees and is also likely to have a higher volume of truck trips due to the wood pellets component, which is expected to transport all (or nearly all) product to the terminal by truck.

Table 1. Barlow Point Terminal Options – Range of Potential Employee and Truck Volumes

Option 1 – Dry Bulk	Employees	Trucks	Option 2 – Liquid Bulk	Employees	Trucks
Potash	80	10	Crude	40	10
Urea	150	10	Methanol	150	10
Wood Pellets	25	45	Biodiesel	50	10
Total	255	65	Total	240	30
1.5 factor increase	382.5	97.5	1.5 factor increase	360	45
Use for Analysis	385	100	Use for Analysis	360	50

Source: KPFF, June 11, 2015

1 WSDOT, 2014.
2 Martin Associates, February & March 2015.

Based on estimates of potential employee shifts for each option provided by the project team and the Port of Longview, it is assumed all components of the terminal would be operational seven days per week and that about 20% of the employees would be office/administrative staff working traditional days and hours (Monday through Friday 7:30 A.M. to 5:00 P.M.). It is assumed 80% of all employees would be shift workers with three shifts per day, seven days per week. The shift employees are assumed to distribute with about two-thirds (66%) on day shift and the remaining third split evenly between swing shift and night shift.

3.2. Trip Generation Estimates

Trip generation estimates for the terminal options were developed using two methods. First, rates published by the Institute of Transportation Engineers [ITE] in its *Trip Generation Manual*[3] for General Heavy Industrial (Land Use 120) were applied based on the total employee estimates. Second, detailed trip estimates were developed based on expected arrival and departure volumes using the employee and shift information presented previously. Truck trip estimates were added separately based on the total daily volume of trucks expected and assumed to occur evenly over the typical eight-hour workday. The resulting trip generation estimates for the morning and evening peak hours (the times when the terminal options are expected to generate the highest volume of traffic) are presented in Table 2. The highest results for employee trip generation using the two methods were selected for analysis. The terminal trip generation evaluated was 286 AM peak hour trips (238 in, 48 out) and 366 PM peak hour trips (83 in, 283 out).

Table 2. Parlow Point Bulk Terminal Options – Trip Generation Estimates

	AM Peak Hour Trips			PM Peak Hour Trips		
Terminal Option / Method	In	Out	Total	In	Out	Total
Dry Option 1						
Based on ITE Rates [1]	170	25	195	70	270	340
Based on Employee Shift Estimates [2]	225	35	260	35	225	260
Truck Trip Estimates [3]	13	13	26	13	13	26
Dry Option 2						
Based on ITE Rates [1]	165	20	185	65	250	315
Based on Employee Shift Estimates [2]	210	35	245	35	210	245
Truck Trip Estimates [4]	6	6	12	6	6	12
Totals Used for Analysis	238	48	286	83	283	366

Source: Heffron Transportation, Inc., June 2015.

1. *Trip estimates based on total employees(385 for Option 1 and 360 for Option 2). ITE rates for General Heavy Industrial (LU 120) were applied.*
2. *Based on total employees, 20% administration (Mon-Fri, 7:30 A.M. to 5:00 P.M.) 80% shift seven days per week, with 66% day shift, 17% swing shift, and 17% night shift.*
3. *Terminal Option 1 assumes 100 truck trips per day evenly distributed over an eight-hour workday, which reflects an assumption that all wood pellets would be delivered to the terminal by truck.*
4. *Terminal Option 2 assumes 50 truck trips per day evenly distributed over an eight-hour workday.*
5. *Totals used for analysis include employee and truck trips.*

[3] ITE, 9th Edition, 2012.

4. Trip Distribution and Assignment

The distribution of terminal trips was estimated based on the travel patterns observed from the count data on SR 432 and the expected arrival and departure patterns for employees and trucks at the terminal. It is estimated that 20% of peak hour trips would arrive at the site from the west on SR 432; the remaining 80% are assumed to arrive from the east. It is also assumed that 25% of trips leaving the site would be destined to the west; 75% destined to the east. These trip patterns were applied to the project traffic estimates presented in Section 3 and added to the background 2020 peak hour traffic forecasts presented in Section 2 to reflect 2020 conditions with the terminal project.

5. Site Access Channelization Requirements

As previously described, primary vehicular access is planned from a single access roadway on SR 4323. The channelization requirements for this terminal site access were determined using the 2020 peak hour traffic volume forecasts described in the previous section and guidance in section 1310.04(2)(a) of WSDOT's *Design Manual* (July 2014). The manual states:

> *At unsignalized intersections, use the following as a guide to determine whether or not to provide one-way left-turn lanes:*
>
> - *A traffic analysis indicates congestion reduction with a left-turn lane. On two-lane highways, use Exhibit 1310-7a, based on total traffic volume (DHV) for both directions and percent left turn traffic, to determine whether further investigation is needed.*
> - *A study indicates crash reduction with a left-turn lane.*
> - *Restrictive geometrics require left-turning vehicles to slow greatly below the speed of the through traffic.*
> - *There is less than decision sight distance for traffic approaching a vehicle stopped at the intersection to make a left turn.*
>
> *A traffic analysis based on the Highway Capacity Manual (HCM) may also be used to determine whether left-turn lanes are needed to maintain the desired level of service.*

Exhibit 1310-7a – Left-Turn Storage Guidelines: Two-Lane, Unsignalized from the WSDOT *Design Manual* was used together with the forecast 2020 AM and PM peak hour traffic volumes on SR 432 as described above. The warrant exhibit provides guidance for roadways with posted speed limits of 50 and 60 mph. The posted speed limit on SR 432 is 50 mph. As shown on the attached warrant evaluation sheet, the forecast-with-project traffic volumes and the resulting left-turn percentages at the terminal access roadway would fall above the warrant curves for both AM and PM peak hour conditions. Therefore, the guidelines indicate left-turn storage is needed to accommodate the left-turning traffic at the site.

Exhibit 1310-8b – Left-Turn Storage Length: Two-Lane, Unsignalized (50 mph) from the WSDOT *Design Manual* was used to determine the recommended storage length for the left-turn lane. As shown on the attached evaluation sheet, the AM peak hour volumes indicate a storage length of 150 feet would be required as a minimum. However, a portion of the left-turning vehicles are expected to be trucks (estimated at 6.7% in the AM peak hour). Based on guidance in *Exhibit 1310-9 – Left-Turn Storage With Trucks (ft)*, and applying the guidelines for 10% trucks, the turn lane storage length would be 175 feet. In addition to the turn-lane storage of 175 feet, widening of SR 432 would also be required to accommodate the minimum 50-foot entry segment and a taper length at a ratio of 50:1 (taper length to width of left-turn lane on departure side of centerline per *Exhibit 1310-10a – Median Channelization:*

Widening from the WSDOT *Design Manual*). Assuming the center left-turn storage lane is 12-feet wide (6 feet on each side of the centerline), the taper length would be 300 feet (50 × 6 = 300). A shadow taper (also assumed to be 300 feet in length) would be required west of the access roadway. Therefore, the total anticipated widening of SR 432 to accommodate the left-turn lane is expected to extend 950 to 1,000 feet (300 feet for the taper east of the access roadway, 50 feet for turn lane entry, 175 feet for turn lane storage, up to 125 feet to accommodate the width of access roadway and turn radii to allow a WB-67 size truck, and 300 feet for the taper west of the access roadway). If the WSDOT requires a center acceleration lane for westbound turns, the length of widening could be extended another 300 to 600 feet west. However, it is not expected this would be required.

For right-turn lanes, the guidelines presented in *Exhibit 1310-11 – Right-Turn Guidelines* from the WSDOT *Design Manual* are based on the approach volume and right-turn volume at the access roadway. Based on the forecast AM and PM peak hour volumes on SR 432 and at the terminal site access roadway, the guidelines indicate a right-turn pocket or taper should be considered. Using *Exhibit 1310-12 – Right-Turn Pocket and Right-Turn Taper* from WSDOT's *Design Manual*, and given the posted speed limit of 50 mph, widening to provide a taper 100 feet in length and 13 feet wide at the access roadway entrance would be recommended. Alternatively, an 11-foot wide right-turn pocket with 60 feet of storage length and a 100-foot taper could be provided. The anticipated site access channelization and lengths are shown on Figure 2 (attached).

The rail-crew pullout described previously is expected to be used relatively infrequently—fewer than ten times per day—and is not expected to require any channelization improvements.

6. Traffic Operations

Based on the traffic volumes forecast for SR 432 and the site access roadway, the intersection would not meet the applicable minimum volume warrants for signalization outlined in the *Manual on Uniform Traffic Control Devices* (MUTCD).[4] WSDOT generally requires intersections to meet the applicable minimum volume warrants prior to the approval or requirement of signalization. Therefore, the site access roadway is not expected to require signalization and was assumed to have stop-sign control on the access roadway approach for this due-diligence review effort.

Level of service (LOS) analyses were performed for a single site access roadway expected to serve the terminal options. Level of service is a qualitative measure used to characterize traffic operating conditions. Six letter designations, "A" through "F," are used to define level of service. LOS A is the best and represents good traffic operations with little or no delay to motorists. LOS F is the worst and indicates poor traffic operations with long delays. City of Longview strives to maintain an overall level of service consistent with the Metropolitan Planning Organization (MPO) area standard of LOS D or better for urban area arterials.

Levels of service for the site access roadway were calculated using Trafficware's *Synchro 8.0* traffic operations analysis software. Input data for this analysis reflected the anticipated channelization outlined in the Section 5 (a westbound left-turn lane and an eastbound right-turn taper). Table 3 summarizes the level of service results for year 2020 with project conditions. As shown, the analyses indicate that all movements at the site access roadway would operate at LOS D or better. The queuing analysis produced as part of the level of service calculations indicate all movements would have 95th-percentile queues of two vehicles or less during both peak hours.

[4] US Department of Transportation, Federal Highway Administration, 2009 Edition.

Table 3. Forecast 2020 Peak Hour Levels of Service – Barlow Point Terminal Access

Intersection / Control Type	AM Peak Hour		PM Peak Hour	
	LOS [1]	Delay [2]	LOS	Delay
SR 432 / Barlow Point Site Access (overall)	A	3.2	A	5.4
Northbound Left-Turn Leaving Site	D	30.5	C	20.6
Northbound Right-Turn Leaving Site	B	12.1	B	12.0
Westbound Left Turn into Site	A	9.3	A	8.1

Source: Heffron Transportation, June 2015. All levels of service determining using the Synchro 8.0 software program and HCM 2010 reporting module.

1. *LOS = Level of service.*
2. *Delay = Average seconds of delay per vehicle.*

7. Access Sight Distance

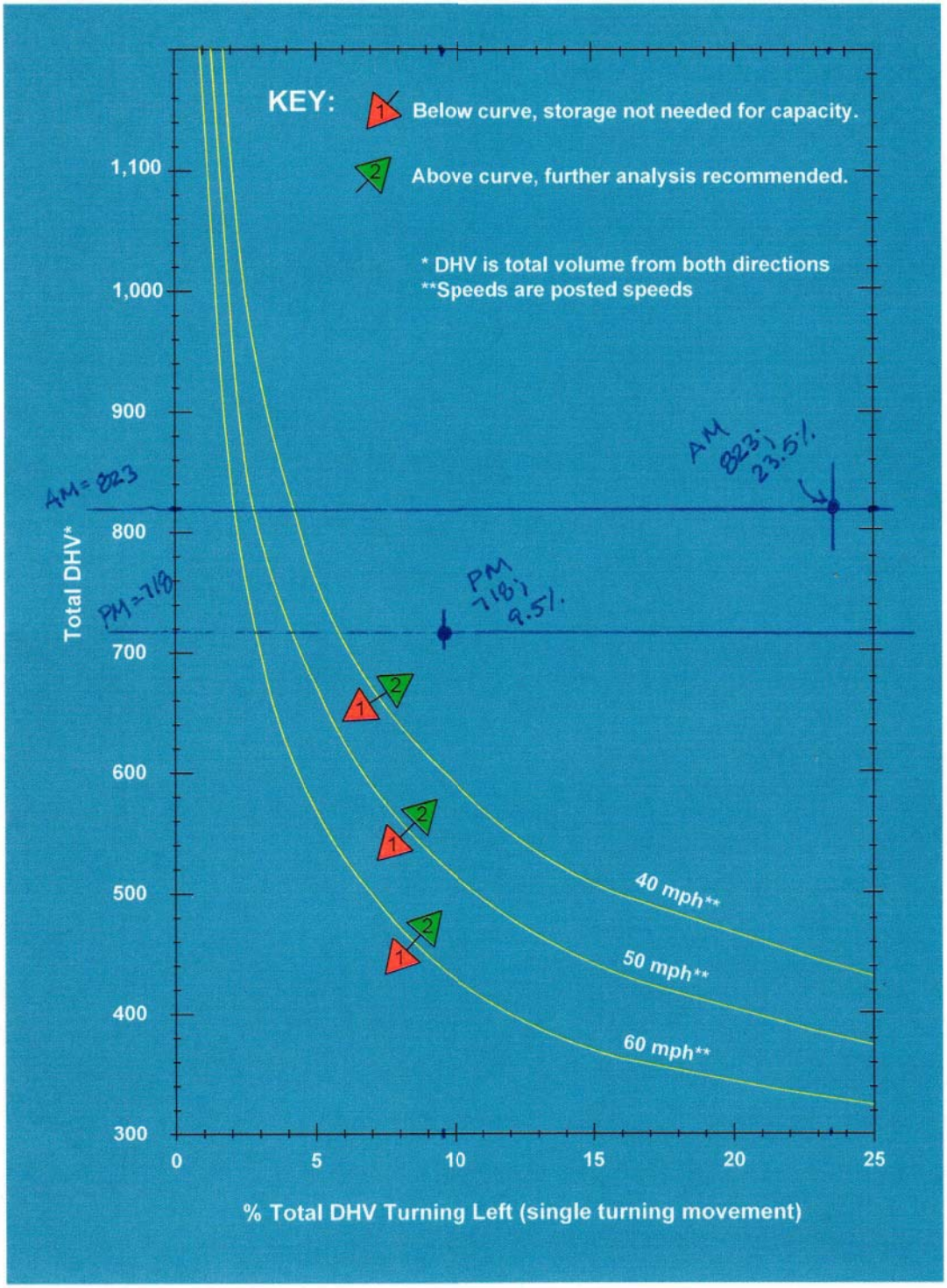
Along the Barlow Point site frontage, SR 432 is generally flat. It is a two-lane roadway with approximately four-foot paved shoulders. Along the site frontage there is a horizontal curve located between Memorial Park Drive Solo View Drive. There is also a horizontal curve and slight vertical rise in the vicinity of Solo View Drive. As described previously, the posted speed limit on SR 432 is 50 mph. Sight distance requirements for the access roadway were determined using *Exhibit 1310-19a – Sight Distance at Intersections* from the WSDOT *Design Manual*. The minimum requirements were determined using the published equation $S = 1.47 \times V \times t$, where S = Intersection sight distance, V = Design speed of through roadway, and t = Time Gap for minor roadway traffic to enter or cross the through roadway. For this site, the design speed of SR 432 is assumed to be 60 mph (10 mph over the posted speed limit) and the time gap for combination trucks (11.5 seconds) was applied to account for truck traffic expected at the terminal access. Based on these assumptions, the site access roadway would require a minimum intersection sight distance of about 1,015 feet in both directions. No adjustment for grade was applied since the access is expected to be located at a point where grades of SR 432 are less than 3%. Based on the preliminary terminal concept layout and expected access location, there is generally only one point that can provide adequate sight distance. The location is at the apex of the horizontal curve about 140 feet west of an existing gravel drive (centerline-to-centerline) on the south side of SR 432 as shown in Figure 3 (attached). Due to the curvature of SR 432, the access roadway intersection may be able to be located further west of the point shown by up to 50 feet (or about 190 feet west of the existing gravel drive). Any access location west of this point would have a sightline obstructed by vertical embankment and vegetation on the north side of SR 432. It may be possible to achieve minimum sight distance with clearing and re-grading the north side of the curve and with on-going maintenance within WSDOT right-of-way; however, this would require approval from WSDOT.

Attachments: Attachment A – WSDOT Design Manual Channelization Warrant Sheets

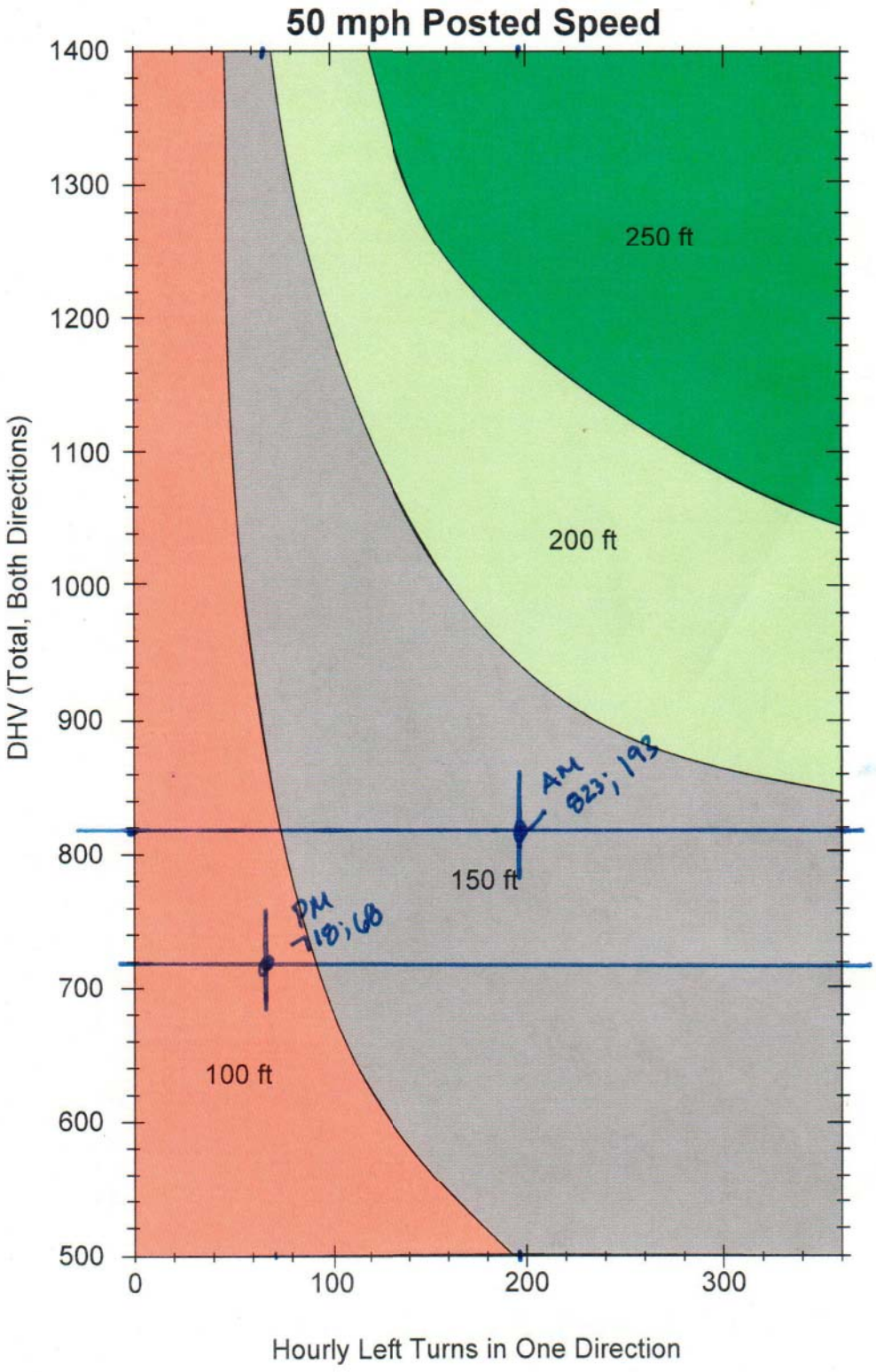
Figure 2. Site Access Roadway Channelization

Figure 3. Recommended Site Access Roadway Location & Sightlines to Meet Minimum Sight Distance Requirements

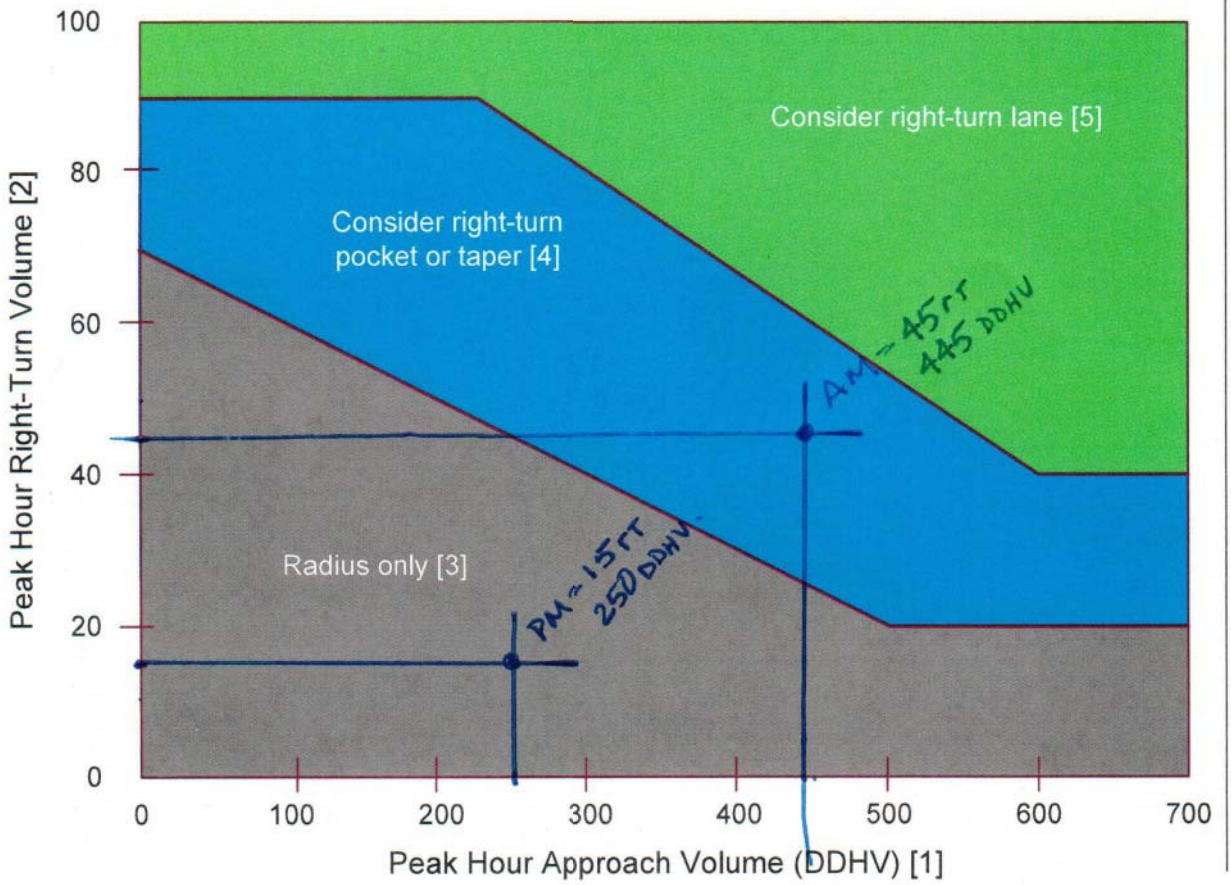
TSM/tsm



Left-Turn Storage Guidelines: Two-Lane, Unsignalized
Exhibit 1310-7a



Left-Turn Storage Length: Two-Lane, Unsignalized (50 mph)
Exhibit 1310-8b



Notes:

[1] For two-lane highways, use the peak hour DDHV (through + right-turn).
For multilane, high-speed highways (posted speed 45 mph or above), use the right-lane peak hour approach volume (through + right-turn).

[2] When all three of the following conditions are met, reduce the right-turn DDHV by 20:

- The posted speed is 45 mph or below
- The right-turn volume is greater than 40 VPH
- The peak hour approach volume (DDHV) is less than 300 VPH

[3] For right-turn corner design, see Exhibit 1310-6.

[4] For right-turn pocket or taper design, see Exhibit 1310-12.

[5] For right-turn lane design, see Exhibit 1310-13.

Right-Turn Lane Guidelines
Exhibit 1310-11

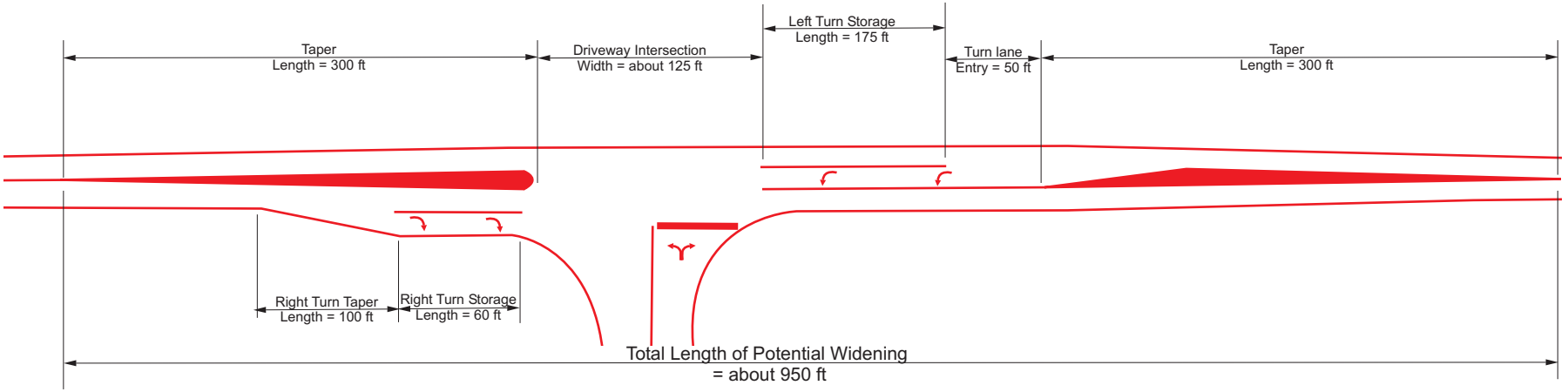


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Figure 2

Site Access Roadway Channelization

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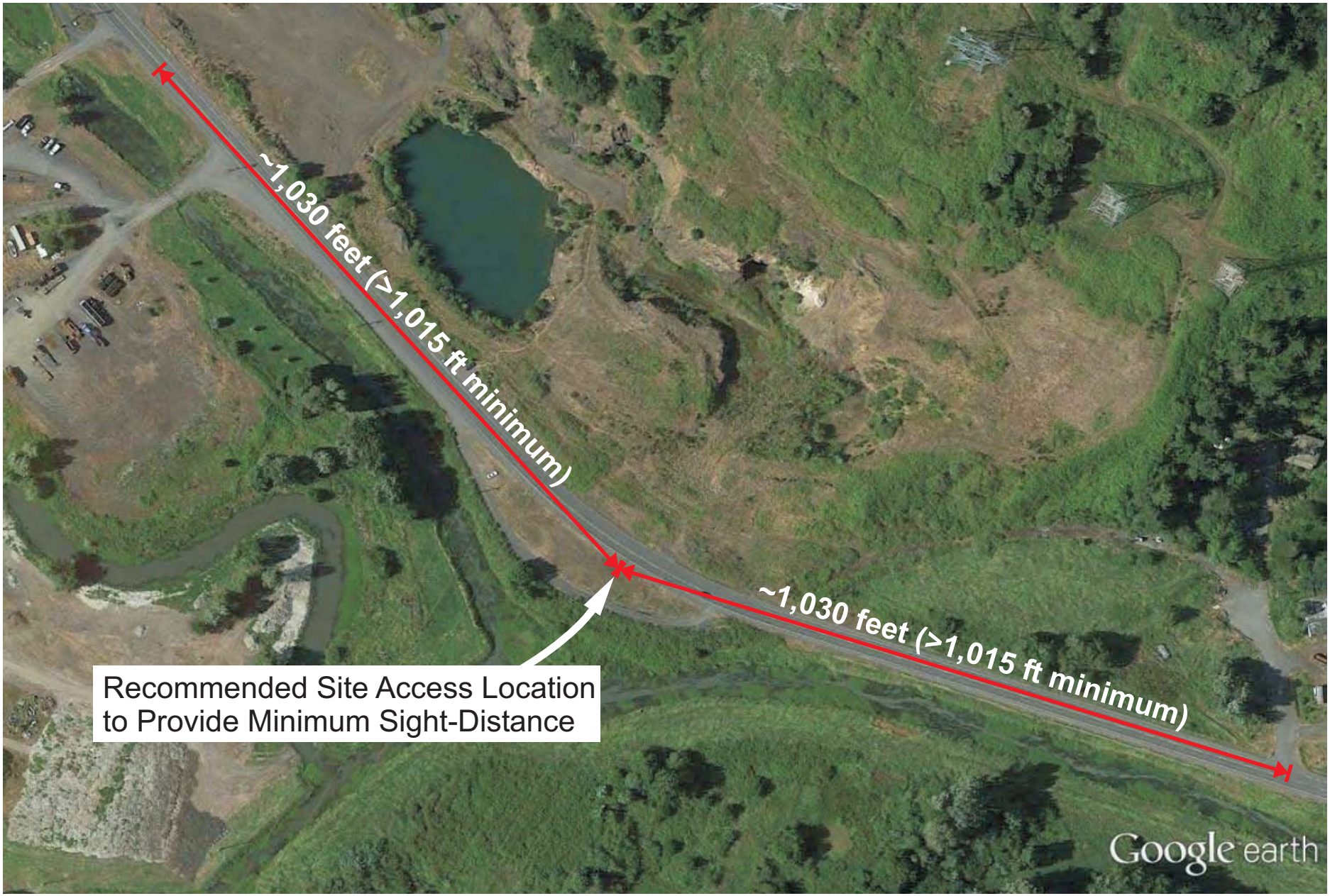

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Figure 3

Recommended Site Access Driveway Location &
Sightlines to Meet Minimum Sight Distance Requirements

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