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DRAFT MEMORANDUM

DATE: August 6, 2019

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FROM: Kevin Chewuk, DKS Associates
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SUBJECT: Oregon City Beaver Creek Analysis

P19082-000

This memorandum summarizes a traffic study for the Oregon City Beaver Creek Road Concept Plan. The study area comprises the adopted 2008 Beaver Creek Road Concept Plan area. The objective of this traffic study is to:

1. Compare future development and infrastructure recommendations in the Beaver Creek Road Concept Plan to that of the 2013 Transportation System Plan (TSP) and Municipal Code
2. Ensure Transportation Planning Rule consistency
3. Provide responses to three questions asked by city staff in response to public comments during the public engagement phase of the Beaver Creek Road Concept Plan Zoning and Code amendments project. The responses contained in this memo address staff's questions from a transportation capacity and design lens. Additional legal, fiscal, construction, or maintenance factors may be part of the larger discussion and are not identified in this report

Staff Questions

1. **Holly Lane Connection.** How important is the Holly Lane connection to the transportation model? What if it does not connect for a very long time, or is removed?
2. **Intersection Control Analysis.** What is the optimal design for intersection control along the Beaver Creek Road Concept Plan boundary- traffic signals or roundabouts?
3. **Road Network Evaluation.** What is the optimal cross section for Beaver Creek Road?

Findings

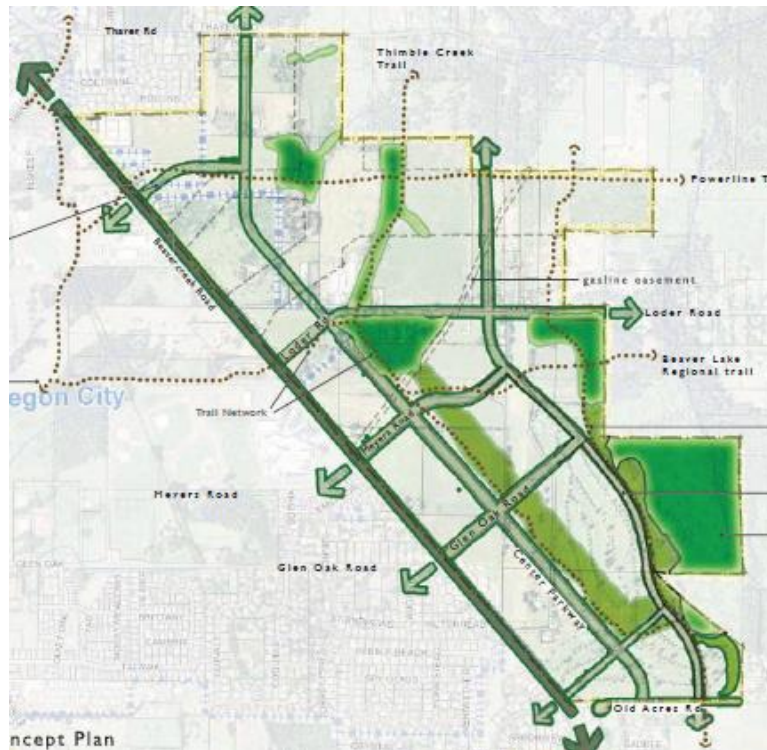
Overall, the current TSP includes adequate transportation system projects for the Beaver Creek Road Concept Plan area to comply with the Transportation Planning Rule (TPR) as adopted (3 lane section with roundabouts). All transportation impacts as a result of the projected 2019 housing units and employees in the Beaver Creek Road Concept Plan (5,700 new jobs and 1,100 new dwelling units) area are addressed by current TSP projects.

Likewise, a revised 5-lane cross-section and replacement of signals for roundabouts as intersection control also meets the TPR requirements. In addition, with the recommended intersection improvements, classifications and cross-sections listed later in this document, no additional provisions are needed beyond current TSP projects to accommodate potential growth in the Beaver Creek Road Concept Plan area without the Holly Lane extension between Maple Lane Road to Thayer Road.

Study Area

The study area (see Figure 1) comprises the adopted 2008 Beaver Creek Road Concept Plan area which established land use designations, design guidelines and future transportation infrastructure needs. The Beaver Creek Road Concept Plan area is roughly bounded by the Urban Growth Boundary to the east, Beaver Creek Road to the west, Old Acres Road to the south and Thayer Road to the north. The following list provides the study intersections with existing and future control, as applicable:

1. Highway 213 / Beaver Creek Road (existing signalized intersection)
2. Beaver Creek Road / Maple Lane Road (existing signalized intersection)
3. Beaver Creek Road / Clairmont Drive (existing signalized intersection)
4. Beaver Creek Road / Loder Road (existing unsignalized intersection; planned future roundabout)
5. Beaver Creek Road / Meyers Road (existing signalized intersection)
6. Beaver Creek Road / Glen Oak Road (existing unsignalized intersection; planned future roundabout)

Figure 1: Study Area

Land Use Assumptions

The Beaver Creek Road Concept Plan area includes about 5,700 new jobs and 1,100 new housing units based on the current analysis prepared by EcoNW and 3J Consulting (2019) as part of current zoning and code amendment project. These numbers are consistent with the initial 2008 Concept Plan projection of 5,000 jobs and 1,023 housing units. Table 1 describes the assumptions that were used.

For the Oregon City TSP, vehicle trips within the Beaver Creek Road Concept Plan area were estimated based on around 1,639 new jobs and 355 new households. The Beaver Creek Road Concept Plan was being litigated by the Oregon Land Use Board of Appeals (LUBA) during the 2013 update to the Oregon City TSP, thus the zoning in the Beaver Creek Road Concept Plan area reflected existing conditions and did not reflect the projected housing and jobs resulting from the plan. Once the Concept Plan was readopted in 2016, the regional transportation model was updated to include 2008 Beaver Creek Road Concept Plan jobs and housing projections (5,000 jobs and 1,023 housing units).

Land Use and Motor Vehicle Trip Generation Assumptions

The impact of the increased vehicle trip generation on the surrounding transportation system, as a result of the Beaver Creek Road Concept Plan, was evaluated through the year 2035 (consistent with the horizon year of the current TSP).

For the current Oregon City TSP, vehicle trips were estimated based on the existing land use assumptions (see Table 1). These trips are included in the 2035 TSP Baseline scenario. For the TPR analysis, the Beavercreek Road Concept Plan utilized the projected 2019 numbers which was estimated to accommodate 750 more housing units and 4,095 more employees than the current TSP.

Vehicle trips that would be generated by the increased housing units and employees were estimated by applying the Metro Regional Travel Forecast model trip generation rates by land use type. This model assumes development and redevelopment within Oregon City as well as throughout the region and thus accounts for consequences of development outside Oregon City. Overall, the Beavercreek Road Concept Plan is expected to generate about 2,584 motor vehicle trips during the p.m. peak hour, or 925 more than what was assumed in the current TSP.

Table 1: Land Use Assumptions

Scenario	New Housing Units	New Employees	Forecasted Weekday PM Peak Hour Vehicle Trip End Growth
TSP Baseline (without Beavercreek Road Concept Plan)	355	1,639	1,659
Beavercreek Road Concept Plan <i>2019 Code and Zoning Amendments Projection</i>	1,105	5,734	2,584
Change (With Beavercreek Road Concept Plan – Without Beavercreek Road Concept Plan)	+750	+4,095	+925

Traffic Forecasting

Future p.m. peak hour traffic forecasts were prepared for two land use scenarios, with and without the Beavercreek Road Concept Plan to provide a baseline for identifying new transportation improvement needs beyond those included in the TSP; these scenarios include:

- **TSP Baseline (without Beavercreek Road Concept Plan)** – This scenario assumes the land use within the Beavercreek Road Concept Plan will be built out consistent with the prior TSP analysis (1,639 new jobs and 355 new households). It includes the improvement projects listed in the “Baseline Transportation System Improvements” section as envisioned in the Beavercreek Road Concept Plan.
- **Beavercreek Road Concept Plan** – This scenario assumes full buildout of Beavercreek Road Concept Plan area (5,700 new jobs and 1,100 new housing units). It includes the improvement projects listed in the “Baseline Transportation System Improvements” section as envisioned in the Beavercreek Road Concept Plan.

With each of these two land use scenarios, a sensitivity option was tested that assumed the planned segment of Holly Lane between Maple Lane Road and Thayer Road would not be completed. The forecast will include 2035 volumes to match the TSP horizon year.

Baseline Transportation System Improvements

The starting point for the future operations analysis relied on a list of street system improvement projects contained in the Oregon City TSP. These projects represent only those that are expected to be reasonably funded, and therefore can be included in the Baseline scenario. Many of the projects in the Beavercreek Road Concept Plan area will be constructed as private development occurs. Others will be constructed as part of public infrastructure improvements or concurrent with adjacent private developments. The improvements assumed include:

- Roundabout installation at the **Beavercreek Road/Glen Oak Road** intersection (TSP Project D39)
- Roundabout installation at the **Beavercreek Road/Loder Road** intersection (TSP Project D44)
- **Meyers Road** extension from OR 213 to High School Avenue (TSP Project D46)
- **Meyers Road** extension from Beavercreek Road to the Meadow Lane Extension (TSP Project D47)
- **Clairmont Drive** extension from Beavercreek Road to the Holly Lane South Extension (TSP Project D54)

- **Glen Oak Road** extension from Beaver Creek Road to the Meadow Lane Extension (TSP Project D55)
- **Timbersky Way** extension from Beaver Creek Road to the Meadow Lane Extension (TSP Project D56)
- **Holly Lane** extension from Thayer Road to the Meadow Lane Extension (TSP Projects D58 and D59)
- **Meadow Lane** extension to the Urban Growth Boundary, north of Loder Road (TSP Projects D60 and D61)
- **Loder Road** extension from Beaver Creek Road to Glen Oak Road (TSP Project D64)
- **Beaver Creek Road** improvements from Clairmont Drive to the Urban Growth Boundary, south of Old Acres Lane (TSP Projects D81 and D82)
- **Loder Road** improvements from Beaver Creek Road to the Urban Growth Boundary (TSP Project D85)
- Construct westbound right-turn merge lane at the **Highway 213 / Beaver Creek Road** intersection (Highway 213 Corridor Alternative Mobility Targets Study)

Estimating Driving Trips

Determining future street network needs requires the ability to forecast traffic volumes resulting from estimates of future population and employment for the Beaver Creek Road Concept Plan area, and the rest of the City and Metro region. The objective of the transportation planning process is to provide the information necessary for making decisions about how and where improvements should be made to create a safe and efficient transportation system that provides travel options.

Metro Regional Travel Demand Model

The travel demand forecasting process generally involves estimating travel patterns for new development based on the decisions and preferences demonstrated by existing residents, employers and institutions around the region. Travel demand models are mathematical tools that help us understand future commuter, school and recreational travel patterns including information about the length, mode and time of day a trip will be made. The latest travel models are suitable for motor vehicle and transit planning purposes, and can produce total volumes for autos, trucks and buses on each street and highway in the system.

Land use data for the entire Metro region is split into geographical areas called transportation analysis zones (TAZs), which represent the sources of vehicle trip generation in the Metro Regional Travel Forecast model. The TAZs extend beyond the current UGB and include land use assumptions

for the entire region and rural communities surrounding Oregon City. The Beavercreek Road Concept Plan area includes one TAZ, which was updated with land use data from Table 1. Vehicle trips that would be generated by the proposed land use was estimated by applying the Metro Regional Travel Forecast model trip generation rates by land use type. Model forecasts are refined by comparing outputs with observed counts and behaviors on the local system. This refinement step is completed before any evaluation of system performance is made. Once the traffic forecasting process is complete, the future volumes are used to determine the areas of the street network that are expected to be congested and that may need future investments to accommodate growth.

The modeling and volume forecasting performed for the previous 2013 TSP was based on the year 2010 (existing) and year 2035 (horizon) Metro models. The current Metro travel demand models are for years 2015 and 2040. These models have updated land uses that assume less growth than the previous 2010-2035 land use growth. In addition, the new Metro models have "peak spreading" built into them, which means the peak period of two hours is modeled, rather than just the single peak hour. When comparing the 2010 and 2015 base years, the 2010 model year shows higher volumes than the 2015 model. This is due to a correction that happened after the 2008 recession. The recent 2019 counts collected for this project more closely match the magnitude of the 2015 volumes. Due to this correction and the lower land use growth assumptions, the Metro 2040 model shows notably lower volumes along the Beavercreek Road corridor and the surrounding region. As a result, the new forecasted 2035 volumes are lower than the 2035 TSP volume set.

2035 Motor Vehicle Operations

Motor vehicle conditions were evaluated for each future scenario during the p.m. peak hour at the study intersections (see Table 2). The future conditions include the improvements summarized in the "Baseline Transportation System Improvements" section.

During the evening peak hour, a few study intersections are expected to exceed standards under each scenario, including the Beavercreek Road / Loder Road and Beavercreek Road / Glen Oak Road intersections. These intersections are currently unsignalized and the side street approach is over capacity given the limited gaps to turn onto Beavercreek Road in the future. Transportation solutions for these intersections are identified later in this report.

The Highway 213 / Beavercreek Road has an adopted alternative mobility target that changes the standard analysis parameters used or the time period to which the targets/standards apply from the

design hour¹ to an average weekday, which better represents traffic volumes experienced throughout the majority of the year. The intersection is expected to meet the alternative mobility target with the Beaver Creek Road Concept Plan.

Holly Lane Extension

The portion of the proposed Holly Lane extension project between Maple Lane Road and Thayer Road (TSP project D57) is blocked by existing development and therefore the proposed alignment must divert outside of the Urban Growth Boundary. To ensure the future roadway network can accommodate potential growth, the future volumes and study intersection operations under the 2035 Beaver Creek Road Concept Plan without this segment of the Holly Lane Extension scenario were reviewed.

As shown in Table 2, the re-routed traffic associated with removing the segment of the proposed Holly Lane extension is expected to have little impact on intersection operations when compared to the scenario with the segment. The greatest impact would be expected at the two existing unsignalized intersections, Loder Road and Glen Oak Road, since more traffic would be utilizing these intersections to enter and exit the Beaver Creek Road Concept Plan area without the segment of the Holly Lane extension. However, this issue is resolved once the recommended traffic signal is assumed at these intersections. Overall, with the recommended intersection improvements, classifications and cross-sections listed later in this document, no additional provisions are needed to accommodate potential growth in the Beaver Creek Road Concept Plan area without the Holly Lane extension between Maple Lane Road to Thayer Road. However, this segment of the Holly Lane extension project is still recommended long-term to provide an alternative route to Highway 213 and option for local motor vehicle, pedestrian and bicycle circulation.

¹ On state highways in Oregon City, the design hour volume generally occurs during the summer season when traffic volumes are higher than typical weekday peaks hours.

Table 2: Future Intersections Operations (2035 PM Peak Hour)

Intersection (traffic control)	Mobility Target	TSP Baseline (without Beaver Creek Road Concept Plan)	Beaver Creek Road Concept Plan (with Holly Lane Extension)	Beaver Creek Road Concept Plan (without Holly Lane Extension)
Highway 213 / Beaver Creek Road (signalized intersection)	1.00 v/c AWD	-	0.99 (AWD)	0.99 (AWD)
Beaver Creek Road / Maple Lane Road (signalized intersection)	0.99 v/c	0.80	0.94	0.95
Beaver Creek Road / Clairmont Drive (signalized intersection)	0.99 v/c	0.99	0.75	0.75
Beaver Creek Road / Loder Road (unsignalized intersection)	0.99 v/c	1.12	>2.00	>2.00
Beaver Creek Road / Meyers Road (signalized intersection)	0.99 v/c	1.05	0.80	0.82
Beaver Creek Road / Glen Oak Road (unsignalized intersection)	0.99 v/c	0.82	1.50	1.70
Bolded red values indicate intersection exceeding the mobility target				

Intersection Control Analysis

The traffic control at the Beaver Creek Road / Loder Road and Beaver Creek Road / Glen Oak Road intersections was assessed with a traffic signal and a roundabout. A signal warrant analysis was performed for these study intersections to determine if side-street volumes are high enough to justify (i.e. warrant) the construction of a traffic signal. For this analysis, ODOT's preliminary traffic signal warrants form² was utilized. This warrant is based on the MUTCD Signal Warrant 1, Case A and Case B, which deals primarily with high volumes on the intersecting minor roadway and high volumes on the major roadway. The result of the analysis found that a traffic signal would be warranted at both intersections by 2035.

These intersections are expected to meet mobility targets through 2035 with either a traffic signal or roundabout. Although both options would work, signals are recommended at these intersections. Existing intersections along the corridor surrounding Loder Road and Glen Oak Road are signalized,

² Analysis Procedures Manual, ODOT TPAU

including Clairmont Drive and Meyers Road. Installation of traffic signals at these two intersections would create for consistency along the corridor. The traffic signals could also be interconnected and timed to allow for traffic to flow smoothly along the corridor with minimal delay. Installation of a roundabout at one or both intersections would break up the flow of traffic and cause random arrivals of vehicles and more delay at the existing signalized intersections along the corridor.

If the cross-section of Beavercreek Road was expanded to incorporate a 5-lane section the design of future intersections is easier with signals over roundabouts. Existing and future signalized intersections along a corridor could be designed to accommodate a 5-lane section without requiring the full roadway width to be constructed. A roadway can be built with a 3-lane section and widened later to a 5-lane section with only minor changes needed at the intersections. Conversely, a roundabout must be designed and constructed to the expected future width of the roadway to avoid having to rebuild the intersection. For example, if you build the roundabout to only accommodate 3-lanes and ultimately need 5-lanes in the future, the roundabout would have to be rebuilt. This is further complicated by portions of the west side of Beavercreek Road near Glen Oak Road that are built out or not likely to be redeveloped any time soon.

A traffic signal also allows for flexibility in improving the intersection over time as adjacent parcels are developed. Each individual approach can be improved incrementally over time without any modifications to the other approaches to the intersection. The flexibility is lost when constructing a roundabout as the entire intersection must be built at once.

With the through volume of traffic forecasted to be over 1,500 vehicles during the peak hour, and with travel speeds up to 40 miles per hour along this segment of Beavercreek Road, a traffic signal would provide a controlled pedestrian crossing opportunity for pedestrians and cyclists. A center median could provide refuge between the vehicle traffic lanes for those crossing with either a 3-lane or 5-lane section.

Pedestrians and cyclists must use an unsignalized crossing in a roundabout, however, they are designed for vehicles to travel at a slower rate of speed when compared to a signalized intersection. In a roundabout, crosswalks are set further back from vehicle traffic, allowing drivers more time to react to people in the roadway before merging into or out of the roundabout. Triangular islands between lanes of vehicle traffic give people moving through the roundabout a safe place to wait if they choose to cross only one direction of traffic at a time. People on bikes can choose to ride through the roundabout with traffic or walk their bicycles through the pedestrian crosswalks.

Roadway Network Evaluation

Streets in the plan area were sized based on future capacity needs with full buildout of the Beaver Creek Road Concept Plan. Forecasted volumes along Beaver Creek Road can be accommodated with a 3-lane or 5-lane section within the adopted 90-foot road right-of-way.

A 5-lane section provides more capacity but could draw more traffic to Beaver Creek Road from Highway 213 and reduce the benefit of the added capacity. This is referred to by the term induced demand. Whereby additional lane capacity is filled by drivers who previously chose to travel on different routes or at different times but changed their behavior upon the creation of new capacity on a specific road segment.

A 5-lane section would be supportive of more population growth beyond the planning horizon when compared to a 3-lane section. However, the timing of growth is uncertain. Alternatively, a 3-lane section is built to meet the needs of the adjacent development, provides less capacity for through traffic and helps keep more traffic with destinations outside of Oregon City on Highway 213.

A 3-lane section would encourage slower travel speeds, would be more inviting to pedestrians and cyclists and would reduce the crossing distance of Beaver Creek Road, especially for students traveling between the neighborhoods on the east side and the school on the west side. A 3-lane section could also allow for a larger buffer between the roadway and sidewalk and allow for wider travel lanes to better facilitate the large trucks expected at the northern end of the Concept Plan area.

Given the City's standards, the projection of traffic volumes on area streets, and overall circulation needs, the recommended TSP classifications and cross-sections are to be maintained, as follows:

- Maintain classification of Beaver Creek Road as a major arterial, provide three-lane cross-section with 90-feet of right-of-way
- Maintain classification of the Meyers Road extension as a minor arterial, provide three-lane cross-section
- Maintain classification of the Clairmont Drive extension as a collector, provide a three-lane cross-section
- Maintain classification of the Glen Oak Road extension as a collector, provide two-lane cross-section
- Maintain classification of the Timbersky Way extension as a collector, provide two-lane cross-section
- Maintain classification of the Holly Lane extension as a collector, provide three-lane cross-section

- Maintain classification of the Meadow Lane extension as a collector, provide two-lane cross-section
- Maintain classification of Loder Road as a collector, provide three-lane cross-section
- Classify all remaining streets in the Beaver Creek Road Concept Plan area as local streets

Recommended Improvements

The recommended improvements for the intersections that are expected to exceed mobility targets in the 2035 Beaver Creek Road Concept Plan scenarios can be seen in Table 3. Overall, the current TSP includes adequate transportation system projects for the Beaver Creek Road Concept Plan area to comply with the Transportation Planning Rule (TPR). All transportation impacts as a result of the additional housing units and employees in the Beaver Creek Road Concept Plan area are addressed by current TSP projects. This includes the widening of Beaver Creek Road through the project area to a 3-lane cross-section and intersection control improvements to the Loder Road and Glen Oak Road intersections with Beaver Creek Road.

If a 5-lane section is desired along a portion of Beaver Creek Road adjacent to the Concept Plan boundary, a logical transition point back to a 3-lane section could be the Loder Road intersection. This location will serve as a primary access point to the industrial employment and the associated heavy vehicle traffic at the northern end of the Beaver Creek Road Concept Plan area. South of this intersection, the land use transitions to a mixed use neighborhood. In any case, the City should design intersections and obtain right-of-way to accommodate the ultimate cross-section in the future.

Table 3: Operations with Beaver Creek Road Concept Plan and Recommended Improvements (2035 PM Peak Hour)

Intersection (traffic control)	Mobility Target	Beaver Creek Road Concept Plan (with Holly Lane Extension)	Beaver Creek Road Concept Plan (without Holly Lane Extension)	Recommended Improvements
Beaver Creek Road / Loder Road (unsignalized intersection)	0.99 v/c	0.89	0.89	Install a traffic signal
Beaver Creek Road / Glen Oak Road (unsignalized intersection)	0.99 v/c	0.71	0.72	Install a traffic signal
Bolded red values indicate intersection exceeds the mobility target				