Traffic Impact Analysis

North Star
Residential Estates
Salem, Oregon

Recommends
- Boundary Street improvements
- Possible revisions of Portland Rd & Lancaster and Hyacinth Rd & Portland.

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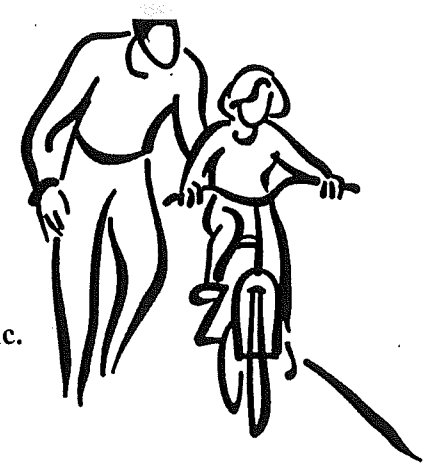

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Table of Contents

Appendices

Appendix A - Figures

Traffic Impact Analysis

North Star Residential Estates

Salem, Oregon

Introduction

Purpose of this Study - This document provides the assumptions and the conclusions of engineering analysis used for this Traffic Impact Analysis (TIA) for the North Star Residential Estates. The property is south of Hazelgreen Road, north of Kale Street between Countryside Avenue and Bayne Street in Salem, Oregon. The 150 acre site is zoned RM and RS in the City of Salem and includes tax lots 701 and 1100 in tax map 6S 2W 32D and tax lots 200, 800, 900 and 1000 in tax map 6S 2W 32C. This site is intended to be developed for residential uses when complete. The site is presently served by Hazelgreen Road, Lake Labish Road, Kale Road, Countryside Avenue, Bayne Street and 49th Avenue. The site will be developed in 6 phases and this analysis will recommend benchmark improvements at specific stages of the development. Phase 1 will create sites for 100 homes, 164 apartments, 16 town homes and 72 duplexes. Phase 2 will create an additional 142 home lots, Phase 3 will create 128 home lots, Phase 4 will create 81 home lots, Phase 5 will create 117 home lots and Phase 6 will create 100 home lots. There will be a total of 920 living units when North Star Residential Estates is complete.

This study responds to the City of Salem scope of work developed with Marion County for this TIA. The property is entirely in the City of Salem and is zoned for the planned residential uses. Cordon Road and several other roads are under the jurisdiction of Marion County and Ms. Karen Odenthal, with the County, has taken leadership in representing Marion County. The other roads in the study are under the jurisdiction of ODOT or the City of Salem and Mr. Eric Destival, PE has provided leadership for those agencies. The TIA examines current traffic conditions and conditions in 2008 at development of Phase 1, at the end of each building phase and in 20 years (2028) after the development of homes is complete. Residents of North Star Residential Estates

will use several different routes to travel to a variety of destinations. The Mid Willamette Valley Council of Government's SKATS model is being revised and trip distribution assumptions were made for this analysis based on traffic patterns. The intent of this analysis is to determine the impacts of traffic from planned uses for the City of Salem, Marion County and other agencies.

Study Approach – The scope of work developed for this project suggests the methodology for this analysis. Turning movement counts were conducted in January 2007 and used as a basis for analyzing the level of service consistent with current professional traffic engineering methodologies. The City of Salem assumes that a signalized intersection can handle 1800 pcplph (passenger cars per lane per hour). Traffic volumes were adjusted up 9.1% to account for and adjust to the peak traffic volume that was counted in January up to the summertime traffic volumes. The adjustment is found by using the ODOT urbanized interstate seasonal adjustment factors and their methodology.

ODOT has jurisdiction of Highway 99E west of this site. There is no direct access to ODOT roadways from the site. The City of Salem Transportation System Plan used the SKATS study to estimate increases in traffic volumes on its roadways. That document estimates traffic will increase 25% in the 20 years from 1995 to 2015. This results in a growth of 1.12% per year over the 20 year period. This study will also assume traffic volumes increase 1.12% per year.

Existing Conditions

Roadways and Intersections – There are numerous roadways that will serve this site, Hazelgreen Road along the north is a parkway in the City's TSP, Kale Street is a minor arterial along the south boundary and 49th Avenue is a collector and will extend into the site. This analysis will consider the existing level of service at the intersections listed below. Figure 1 is a vicinity map of the analysis area and Figure 2 is a site map of the proposed site improvements. All figures for this analysis are included in the appendix.

Hazelgreen Road – This roadway is a Parkway in the City of Salem TSP. This two lane roadway is under the jurisdiction of Marion County. This roadway is a connection for residents of North Star Residential Estates to I-5. The posted speed on this roadway is 50 mph. It extends east from Highway 99E toward Silverton. Hazelgreen Road extends along the northern boundary of the project site for approximately 600'.

Kale Road – Kale Road is a two lane minor arterial in the City of Salem TSP. This roadway extends approximately 4400' (0.8 mi) along the southern boundary of the site. At build out, this roadway will be 46' wide in a 72' wide right-of-way with three lanes and bike lanes. The connections to Kale Road from the site should be limited to the three existing roadways connecting to Kale Road, (Countryside Avenue, 49th Avenue and Bayne Street) and one or two new connections with appropriate spacing and connectivity.

49th Avenue – 49th Avenue is a collector street in the City of Salem TSP. The southern end of this section of 49th ends in the middle school at Hayesville Road

Countryside Avenue –Countryside Drive is a local street in the City of Salem TSP.

Bayne Street – Bayne Street is a local street in the City of Salem TSP.

Lake Labish Road – Lake Labish Road is a two lane rural county road

Chemawa Road – Chemawa Road is a parkway in the City of Salem TSP from Highway 99E (Portland Road) to I-5. It is a major connection for the north side of Salem to I-5 and to the City of Keizer. It is the extension of Hazelgreen Road west of Highway 99E.

Highway 99E (Portland Road) – Highway 99E is a major arterial in the City of Salem TSP. Highway 99E (Portland Road) is a Regional Highway in the State of Oregon Highway Plan. This roadway does not abut the site, but will provide a significant connection for residents of the project. This roadway has been improved within the last few years.

Cordon Road – Cordon Road is designated as a parkway in the City's TSP. Currently it is a two lane, two-way roadway without left turn lanes at intersections with Kale, Hayesville or Hazelgreen. It is in the jurisdiction of Marion County and does not abut the site. Cordon Road conveys a significant amount of traffic around the east side of Salem. The ultimate right of way will be 120' wide with a roadway that is 80' wide.

Hyacinth Street – Hyacinth Street is a major arterial in the TSP. In the vicinity of Hwy 99E (Portland Road), this north-south roadway has been improved to current City of Salem standards.

Lake Labish at Hazelgreen Road - This tee intersection finds a county road (Lake Labish) stop controlled at Hazelgreen Road (a Parkway) in Salem's TSP. It is anticipated that Lake Labish will be extended into the site to serve traffic traveling to and from the north of the site. Each existing approach leg is a single lane. As Hazelgreen Road is developed as a parkway with 4 travel lanes, bike paths and a median strip, it is anticipated the intersection may eventually become signalized. However, traffic volumes on Lake Labish are relatively low.

Portland Road at Hazelgreen Road – This four-legged signal controlled intersection finds a Parkway (Hazelgreen Road) and a major arterial intersecting. Portland Road is an ODOT roadway and Hazelgreen is a Marion County roadway.

55th Street at Hazelgreen Road – This four way stop controlled intersection is at a skew. Each approach leg has a single lane. The intersection is in the jurisdiction of Marion County. The northbound and the eastbound approaches are designated parkway in the City of Salem TSP.

Kale Road at Portland Road – This signalized intersection has three legs with Portland Road having the through movement.

Kale Road at Countryside Drive – This TWSC intersection has one lane on each of the three approaches.

Kale Road at 49th Street - This TWSC intersection has one lane on each of the three approaches.

Kale Road at Bayne Street - This TWSC intersection has one lane on each of the three existing approaches. Bayne Street is the minor roadway at this intersection.

Kale Road at Cordon Road - This TWSC intersection has one lane on each of the three approaches. Kale Road is a minor arterial in the City of Salem TSP and is stop controlled. Cordon Road is a parkway in the TSP and currently under Marion County jurisdiction.

Hayesville Road at Cordon Road - This TWSC intersection has one lane on each of the three approaches. Hayesville Road is a collector in the City of Salem TSP and is stop controlled. Cordon Road is a parkway in the TSP and currently under Marion County jurisdiction.

Hayesville Road at 49th Street – This TWSC intersection has stop control on the 49th Street approaches. The northbound approach serves as the driveway into a middle school.

Hayesville Road at Lancaster Drive – Hayesville Road is a two lane City street, classified as a Collector in the TSP. Lancaster Drive is a 5 lane roadway and is classified as a major arterial in the TSP. This intersection is signal controlled.

Hayesville Road at Portland Road – This three legged signalized intersection is the intersection of a major arterial with a collector street. Lancaster is a 5-lane roadway and Hayesville Road is a two lane approach.

Portland Road at Lancaster – The four legged TWSC intersection finds two major arterials in the City intersecting. Left turns at this intersection are experiencing long delays.

Portland Road at I-5 NB Off Ramp – This is a three-legged signalized intersection. Portland Road is 6 lanes in this section and the off-ramp has 3 lanes.

Portland Road at I-5 SB Off Ramp - This is a three-legged signalized intersection. Portland Road is 6 lanes in this section and the off-ramp has 3 lanes.

Portland Road at Hyacinth – This is a four-legged, signalized intersection. Portland road has 5 lanes in this section, the eastbound approach of Hyacinth has 3 lanes and the westbound approach of Hyacinth has 2 lanes. There are a significant number of accidents in this area.

Chemawa Road at Northbound I-5 Ramps – This recently rebuilt signalized intersection provides a connection between a parkway in the City and the Interstate Highway.

Chemawa Road at Southbound I-5 Ramps – This signalized intersection is recently rebuilt and provides a connection between a parkway in the City and the Interstate Highway.

Existing Traffic Volumes – Weekday AM and PM Peak hour turning movement counts were conducted by TrafStats at the studied intersections in January 2007. These turning movement volumes were used as the independent variables in Traffix (a software program used to model traffic volumes and levels of service at intersections). The computer printouts are included in the appendix of this analysis and the results are summarized throughout this report. Salem is a major Oregon city with significant growth in the last few years. It is anticipating continued growth in the future. The turning movement counts have been adjusted using the peak hour factor and the counts have been adjusted for the 1.12% annual growth projected in the TSP. Volumes were also adjusted for the highest anticipated month of volume of traffic (approximately 9%). Adjusted existing traffic volumes are shown in Figures 3 and 4 in the appendix of this analysis.

Existing Level of Service Findings at Studied Intersections – Traffix software was used to model the level of service of each intersection in this study. "Level of Service (LOS) is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions and comfort and convenience. Six LOS are defined for each type of facility that has analysis procedures available. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions and the driver's perception of those conditions. Safety is not included in the measures that establish service levels." (Highway Capacity Manual, 2000, The Transportation Research Board)

Vehicle capacity is the maximum number of vehicles that can pass a given point during a specified period under prevailing roadway, traffic and control conditions. This assumes that there is no influence from downstream traffic operation, such as the backing up of traffic into the analysis point." (Highway Capacity Manual, 2000, the Transportation Research Board) The City of Salem assumes that a signalized intersection can transport 1800 pcplph (passenger cars per hour per lane) and uses the v/c ratio to measure performance of its roadways and intersections.

Table 1 summarizes the findings of this analysis. It is assumed that ODOT has established v/c = 0.85 as the maximum acceptable volume to capacity ratio that is acceptable on urban Regional Highways like Highway 99E (Portland Road) in Salem.

Table 1 – Existing Level of Service at Studied Intersections						
Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	C	16.5	0.30	B	14.8	0.17
Hayesville Road at 49th Street	F	143.5	1.23	B	14.2	0.07
Hayesville Road at Lancaster Drive	C	28.1	0.496	C	32.5	0.673
Hayesville Road at Portland Road	C	23.1	0.737	B	18.9	0.779
Portland Road at Lancaster Drive	B	11.6	0.21	F	74.1	0.58
Portland Road at I-5 NB Ramps	B	14.6	0.614	B	16.3	0.798
Portland Road at I-5 SB Ramps	B	12.4	0.712	B	12.3	0.597
Portland Road at Hyacinth Street	E	60.0	1.056	F	150.1	1.385
Lake Labish Road at Hazelgreen Road	B	10.5	0.01	B	12.5	0.01
Chemawa Road at Northbound I-5 Ramps	C	28.9	0.402	C	31.0	0.675
Chemawa Road at Southbound I-5 Ramps	B	17.5	0.542	C	21.4	0.610
Portland Road at Hazelgreen Road	C	31.6	0.570	C	34.8	0.751
55th Street at Hazelgreen Road	B	11.9	0.491	B	12.2	0.563
Kale Road at Portland Road	B	15.8	0.453	B	13.2	0.629
Kale Road at Countryside Drive	B	10.8	0.11	B	10.2	0.03
Kale Road at 49th Street	B	10.2	0.08	A	10.0	0.05
Kale Road at Bayne Street	B	10.2	0.14	A	9.4	0.04
Kale Road at Cordon Road	B	10.2	0.06	B	11.3	0.10

The City of Salem TSP estimates the ADT volume on Portland Road south of Hazelgreen Road will be 24,500 in 2015. Lancaster Drive is estimated to carry 31,800 ADT in 2015. Traffic volumes are anticipated to increase 1.12% per year from 1995 to 2015.

A rule of thumb traffic engineers use is that 10% of the ADT will travel in the pm peak hour period. An assumption the City of Salem makes is that the saturation flow rate is 1800 vehicles per lane per hour at signalized intersections. There are three intersections that are not meeting level of service standards with existing levels of traffic. There are a significant number of vehicles turning left from 49th Street onto Hayesville Road in the morning and the level of service does not meet the City of Salem standard. Preliminary signal warrants are not met at this time or

at build out of North Star Residential Estates. When modeled with a roundabout, the intersection works very well and is the recommended mitigation for this existing intersection.

The intersection of Portland Road at Lancaster Drive is a TWSC intersection. The WBLT in the PM peak hour turning movements are queuing. The eastbound approach had 9 vehicles during the PM peak. Mitigating this intersection will involve closing the eastbound approach and eventually signalizing the intersection. The v/c ratio is reasonable, but the delays for minor approach traffic are not.

The intersection of Portland Road at Hyacinth has a v/c ratio of 0.957 in the PM Peak and is outside acceptable standards. The accident rate in this section of Portland Road is very high. Mitigating this intersection will involve adding a lane to each approach and extending the cycle length to 130 sec. Adding a through lane to the Portland Road approaches and to the westbound approach and adding a left turn lane to the eastbound approach will bring the level of service standards back into acceptable levels.

Transit Service – The City of Salem is served by an extensive bus transit system. There are bus stops along Portland Road, Hayesville Road and Kale Road. Buses run every 15 minutes during the morning and afternoon commute periods. The bus is operated as part of the Cheriotts Salem Keizer Transit system.

ODOT Crash Data – The Oregon Department of Transportation (ODOT) has provided information about the 220 reported crashes that have occurred on Highway 99E between mileposts 44.00 and 46.78 for the 5 years 2001 through 2005. ODOT also reported on the 21 crashes on Hazel Green (Hwy 99E to 55th St), 18 on Cordon Road (Hayesville Rd to Hazel Green Rd) and 2 on Kale Rod (Hwy 99E to 55th St). The data is summarized in Table 2.

Table 2 – ODOT Crash Data for Selected Roads (2001-2005)

Roadway Section	Fatal Accidents	Injury Accidents	Property Damage	Total Accidents
Hwy 99E (MP 44 to MP 46.78)	2	111	107	220
Hazel Green (Hwy 99E to 55th St)	0	14	7	21
Cordon Road (Hayesville Rd to Hazel Green Rd)	0	11	7	18

Kale Rod (Hwy 99E to 55th St)	0	1	1	2

It is apparent the 79 accidents per mile on the Highway 99E is much higher than one would like. Table 3 summarizes the accidents on Portland Road between mile post 44.00 and 46.78 in ½ mile segments. There are many accidents on Portland Road between Hyacinth and the northbound I-5 ramps.

Table 3 – Detail of accidents between Milepost 44.0 - 46.78 on Portland Road in Salem, OR

	Fatal Accidents	Injury Accidents	Property Damage Only	Total Accidents
MP 44.0 to 44.49	0	17	21	38
MP 44.5 to 44.99	0	9	9	18
MP 45.0 to 45.49	0	17	13	30
MP 45.5 to 45.99	2	20	27	49
MP 46.0 to 46.49	0	47	38	85
MP 46.5 to 46.78	0	0	0	0

Future Traffic Conditions

This TIA examines the traffic conditions at the studied intersections at 8 different times in the future. The first are the conditions that can be expected if the North Star Residential Estates is not developed and traffic volumes continue to increase at an assumed rate of 1.12% per year for 1 year or in other words what will traffic be like in the year 2008 adjusted for the peak traffic hour. These values provide a basis for comparison for alternative scenarios. The second through seventh scenarios are the traffic conditions that can be expected at the studied intersections at the end of each phase if the North Star Residential Estates is developed in 6 phases and fully occupied. This will facilitate comparing the level of service of the intersections and roadways if additional homes are built in the development and if the improvements proposed as part of this project are made to the transportation system. The last scenario examines the levels of service that can be expected at the studied intersections in the year 2028 if North Star Residential Estates is completed and occupied. This scenario assumes that the existing traffic volumes continue to increase at 1.12% per year and the traffic from the developed North Star Residential Estates is added to the anticipated increased traffic on the roadway. This is a 26.4% increase during the 21

years (1.0112 ^ 21) between 2007 and 2028. The volumes are also adjusted for peak periods. The study has applied a Growth Adjustment in the model to factor for these increases.

Scenario 1 – Traffic Conditions in 2008 without the North Star Residential Estates – This scenario assumes that the traffic volume through the studied intersections continues to increase at a 1.12% per year rate. With this additional volume of traffic a baseline for future levels of service is established. Table 4 summarizes the levels of service in 1 year assuming that the North Star Residential Estates site is not developed.

Table 4 – Levels of Service in 2008 without the North Star Residential Estates

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	C	16.8	0.19	C	15.0	0.17
Hayesville Road at 49th Street	F	163.0	0.33	B	14.3	0.07
Hayesville Road at Lancaster Drive	C	23.6	0.422	C	32.7	0.681
Hayesville Road at Portland Road	C	23.3	0.745	B	19.2	0.788
Portland Road at Lancaster Drive	B	11.7	0.30	F	78.5	0.59
Portland Road at I-5 NB Ramps	B	14.6	0.621	B	16.5	0.807
Portland Road at I-5 SB Ramps	B	12.5	0.720	B	12.4	0.603
Portland Road at Hyacinth Street	E	62.6	1.068	F	155.1	1.401
Lake Labish Road at Hazelgreen Road	B	10.5	0.01	B	12.6	0.01
Chemawa Road at Northbound I-5 Ramps	C	28.9	0.406	C	31.1	0.683
Chemawa Road at Southbound I-5 Ramps	B	17.6	0.548	C	21.5	0.617
Portland Road at Hazelgreen Road	C	31.7	0.576	D	35.0	0.759
55th Street at Hazelgreen Road	B	12.0	0.499	B	12.4	0.571
Kale Road at Portland Road	B	15.8	0.458	B	13.3	0.636
Kale Road at Countryside Drive	B	10.9	0.11	B	10.3	0.03
Kale Road at 49th Street	B	10.2	0.08	B	10.0	0.06
Kale Road at Bayne Street	B	10.2	0.14	A	9.4	0.04
Kale Road at Cordon Road	B	10.2	0.06	B	11.3	0.10

North Star Residential Estates Site

It is proposed to develop the North Star Residential Estates with a Single Family Homes (ITE #210), apartments (ITE #220), townhouses (ITE #230) and duplexes (ITE #221). Development will occur in 6 phases. Phasing of the development of the Estates is studied to determine benchmarks for major roadway improvements.

Table 5 - Trip Generation Assumptions by Phase – North Star Residential Estates

	Number of Units	AM Peak Hr Trips	PM Peak Hour Trips
Phase 1 Homes	100	80	108
Phase 1 Apartments	164	84	108
Phase 1 Townhouses	16	12	13
Phase 1 Duplexes	72	42	105
Phase 2 Homes	142	109	147
Phase 3 Homes	128	99	134
Phase 4 Homes	81	66	89
Phase 5 Homes	117	91	123
Phase 6 Homes	100	80	108
Total	**920**	**663**	**935**

Access to the site is proposed by extending Countryside Avenue, 49th Avenue NE and Bayne Street north into the site to serve the first 5 phases and extending Lake Labish Road south into the site in the 6th Phase. An internal interconnected network of streets will be developed in coordination with the City to provide access to residents and others consistent with the City's connectivity standards.

Trip Generation – For this study it is assumed that North Star Residential Estates will be developed in 6 phases. It is a goal of this analysis to identify the number of housing units that can be built before specific offsite system improvements are needed as the traffic volumes increase as additional phases are completed. When completed it is anticipated there will be about 670 single family homes, 165 apartments, 16 townhouses and 72 duplexes in the "Estates".

Scenario 2 – Traffic Conditions in 2008 through 2013 with the North Star Residential Estates site developed in Phases. – This scenario assumes that the City of Salem approves the project phases planned for the North Star Residential Estates and that it is built and each phase is progressively occupied. This scenario facilitates comparing the existing level of service at the studied intersections and the anticipated level of service as each progressive phase of the North Star Residential Estates is completed. Tables 6 through 11 summarizes the levels of service at the studied intersections when each phase is completed and occupied.

Table 6 – Level of Service in 2008 with Phase 1 of North Star (352 Dwelling Units)

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	C	17.4	0.33	C	15.5	0.19
Hayesville Road at 49th Street	F	167.9	1.33	B	14.6	0.07
Hayesville Road at Lancaster Drive	C	23.7	0.424	C	32.9	0.692
Hayesville Road at Portland Road	C	23.6	0.749	B	19.5	0.801
Portland Road at Lancaster Drive	B	12.0	0.31	F	103.6	0.71
Portland Road at I-5 NB Ramps	B	14.7	0.627	B	16.7	0.819
Portland Road at I-5 SB Ramps	B	12.5	0.727	B	12.5	0.605
Portland Road at Hyacinth Street	E	64.2	1.074	F	158.1	1.410
Lake Labish Road at Hazelgreen Road	B	10.5	0.10	B	12.6	0.01
Chemawa Road at Northbound I-5 Ramps	C	28.8	0.415	C	31.3	0.688
Chemawa Road at Southbound I-5 Ramps	B	17.9	0.553	C	21.6	0.620
Portland Road at Hazelgreen Road	C	32.0	0.611	D	36.8	0.810
55th Street at Hazelgreen Road	B	12.3	0.506	B	12.6	0.579
Kale Road at Portland Road	B	17.7	0.547	B	17.7	0.754
Kale Road at Countryside Drive	C	15.5	0.18	C	15.4	0.11
Kale Road at 49th Street	B	10.6	0.09	B	10.4	0.08
Kale Road at Bayne Street	B	10.4	0.15	A	9.5	0.04
Kale Road at Cordon Road	B	10.8	0.06	B	11.8	0.10

Table 7 – Level of Service in 2009 with Phase 1 & 2 of North Star (494 Dwelling Units)						
Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	C	18.3	0.35	C	16.0	0.20
Hayesville Road at 49th Street	F	204.8	1.47	B	14.9	0.08
Hayesville Road at Lancaster Drive	C	28.5	0.515	C	33.3	0.708
Hayesville Road at Portland Road	C	24.2	0.762	C	20.2	0.820
Portland Road at Lancaster Drive	B	12.3	0.33	F	138.7	0.87
Portland Road at I-5 NB Ramps	B	14.8	0.640	B	17.3	0.839
Portland Road at I-5 SB Ramps	B	12.7	0.742	B	12.7	0.616
Portland Road at Hyacinth Street	E	69.0	1.093	F	167.1	1.437
Lake Labish Road at Hazelgreen Road	B	10.6	0.01	B	12.7	0.01
Chemawa Road at Northbound I-5 Ramps	C	28.9	0.425	C	31.6	0.701
Chemawa Road at Southbound I-5 Ramps	B	18.1	0.564	C	21.9	0.631
Portland Road at Hazelgreen Road	C	32.5	0.641	D	38.9	0.851
55th Street at Hazelgreen Road	B	12.7	0.520	B	13.1	0.597
Kale Road at Portland Road	B	18.8	0.602	C	21.7	0.833
Kale Road at Countryside Drive	C	20.1	0.27	C	21.5	0.17
Kale Road at 49th Street	B	10.8	0.10	B	10.7	0.10
Kale Road at Bayne Street	B	10.6	0.15	A	9.6	0.04
Kale Road at Cordon Road	B	11.1	0.08	B	12.2	0.10

Table 8– Level of Service in 2010 with Phases 1 to 3 of North Star (622 Dwelling Units)						
Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	C	18.9	0.36	C	16.5	0.21
Hayesville Road at 49th Street	F	282.2	1.76	C	16.2	0.11
Hayesville Road at Lancaster Drive	C	28.6	0.521	C	33.9	0.726
Hayesville Road at Portland Road	C	24.5	0.770	C	20.6	0.832
Portland Road at Lancaster Drive	B	12.4	0.33	F	158.2	0.72
Portland Road at I-5 NB Ramps	B	14.9	0.648	B	17.6	0.851
Portland Road at I-5 SB Ramps	B	12.8	0.750	B	12.8	0.622

Portland Road at Hyacinth Street	E	71.7	1.104	F	172.1	1.452
Lake Labish Road at Hazelgreen Road	B	10.6	0.01	B	12.7	0.01
Chemawa Road at Northbound I-5 Ramps	C	28.8	0.432	C	31.8	0.708
Chemawa Road at Southbound I-5 Ramps	B	18.3	0.570	C	22.0	0.637
Portland Road at Hazelgreen Road	C	32.8	0.662	D	41.0	0.882
55th Street at Hazelgreen Road	B	13.0	0.529	B	13.4	0.606
Kale Road at Portland Road	B	19.5	0.631	C	25.8	0.883
Kale Road at Countryside Drive	C	24.8	0.33	D	28.1	0.21
Kale Road at 49th Street	B	11.8	0.12	B	11.8	0.11
Kale Road at Bayne Street	B	10.7	0.15	A	9.7	0.04
Kale Road at Cordon Road	B	11.4	0.09	B	12.5	0.10

Table 9 – Level of Service in 2011 with Phases 1 thru 4 of North Star (703 Dwelling Units)

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	C	19.7	0.37	C	16.9	0.22
Hayesville Road at 49th Street	F	390.2	2.16	C	17.5	0.12
Hayesville Road at Lancaster Drive	C	28.9	0.532	C	34.6	0.747
Hayesville Road at Portland Road	C	25.4	0.790	C	21.9	0.853
Portland Road at Lancaster Drive	B	12.5	0.34	F	181.4	1.05
Portland Road at I-5 NB Ramps	B	15.0	0.657	B	18.1	0.865
Portland Road at I-5 SB Ramps	B	13.0	0.761	B	12.9	0.630
Portland Road at Hyacinth Street	E	15.4	1.118	F	178.7	1.472
Lake Labish Road at Hazelgreen Road	B	10.6	0.01	B	12.8	0.01
Chemawa Road at Northbound I-5 Ramps	C	28.9	0.439	C	32.0	0.718
Chemawa Road at Southbound I-5 Ramps	B	18.4	0.578	C	22.2	0.645
Portland Road at Hazelgreen Road	C	33.2	0.681	D	42.0	0.907
55th Street at Hazelgreen Road	B	13.3	0.540	B	13.7	0.619
Kale Road at Portland Road	B	20.0	0.648	C	29.4	0.913
Kale Road at Countryside Drive	D	27.7	0.35	D	31.6	0.22
Kale Road at 49th Street	B	12.6	0.13	B	12.7	0.13
Kale Road at Bayne Street	B	11.0	0.17	B	10.3	0.05
Kale Road at Cordon Road	B	11.6	0.11	B	12.9	0.09

Table 10 – Level of Service in 2012 with Phase 1 thru 5 of North Star (820 Dwelling Units)						
Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	C	20.6	0.38	C	17.4	0.16
Hayesville Road at 49th Street	F	583.4	2.86	C	19.7	0.13
Hayesville Road at Lancaster Drive	C	29.1	0.551	D	35.5	0.773
Hayesville Road at Portland Road	C	26.5	0.813	C	23.6	0.878
Portland Road at Lancaster Drive	B	12.7	0.34	F	211.8	1.15
Portland Road at I-5 NB Ramps	B	15.1	0.666	B	18.7	0.879
Portland Road at I-5 SB Ramps	B	13.2	0.771	B	13.1	0.637
Portland Road at Hyacinth Street	E	79.3	1.132	F	185.4	1.492
Lake Labish Road at Hazelgreen Road	B	10.6	0.01	B	12.9	0.01
Chemawa Road at Northbound I-5 Ramps	C	18.4	0.423	C	32.3	0.728
Chemawa Road at Southbound I-5 Ramps	B	12.0	0.561	C	22.4	0.653
Portland Road at Hazelgreen Road	C	33.6	0.702	D	46.4	0.941
55th Street at Hazelgreen Road	B	13.6	0.558	B	14.1	0.632
Kale Road at Portland Road	C	20.7	0.670	D	36.1	0.960
Kale Road at Countryside Drive	D	32.9	0.40	E	37.1	0.23
Kale Road at 49th Street	B	13.9	0.15	B	14.0	0.14
Kale Road at Bayne Street	B	11.7	0.18	B	10.9	0.06
Kale Road at Cordon Road	B	11.9	0.12	B	13.3	0.12

Table 11 – Level of Service in 2013 with Phase 1 thru 6 of North Star (920 Dwelling Units)						
Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	C	21.7	0.39	C	180.	0.23
Hayesville Road at 49th Street	F	693	3.25	C	20.2	0.15
Hayesville Road at Lancaster Drive	C	29.3	0.558	D	36.0	0.785
Hayesville Road at Portland Road	C	27.1	0.824	C	24.6	0.894
Portland Road at Lancaster Drive	B	12.9	0.35	F	291.2	1.36

Portland Road at I-5 NB Ramps	B	15.2	0.675	B	19.4	0.894
Portland Road at I-5 SB Ramps	B	13.3	0.782	B	13.2	0.645
Portland Road at Hyacinth Street	F	83.4	1.147	F	192.6	1.513
Lake Labish Road at Hazelgreen Road	C	15.9	0.09	C	17.6	0.06
Chemawa Road at Northbound I-5 Ramps	C	28.9	0.455	C	32.6	0.738
Chemawa Road at Southbound I-5 Ramps	B	18.8	0.595	C	22.5	0.662
Portland Road at Hazelgreen Road	C	34.2	0.709	D	47.7	0.950
55th Street at Hazelgreen Road	B	14.0	0.571	B	14.5	0.649
Kale Road at Portland Road	C	21.4	0.702	D	40.7	0.988
Kale Road at Countryside Drive	E	38.8	0.45	E	44.5	0.27
Kale Road at 49th Street	B	14.2	0.16	B	14.3	0.15
Kale Road at Bayne Street	B	11.8	0.19	B	10.9	0.06
Kale Road at Cordon Road	B	11.9	0.12	B	13.4	0.12

Scenario 3 – Traffic Conditions in the future (2028) with the North Star Residential Estates Subdivision - This scenario assumes that the North Star Residential Estates site is built and occupied and that traffic on the roadways continues to grow at 1.12% / year. Table 12 summarizes the levels of service at the intersections in 20 years after the project is completed and occupied.

Table 12 – Level of Service in 2028 with North Star (920 Dwelling Units) <u>without mitigation</u>

Intersection	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Hayesville Road at Cordon Road	E	43.2	0.48	D	25.7	0.25
Hayesville Road at 49th Street	F	over	1.34	D	25.3	0.17
Hayesville Road at Lancaster Drive	C	31.5	0.655	D	45.6	0.916
Hayesville Road at Portland Road	D	42.2	0.968	D	48.3	1.046
Portland Road at Lancaster Drive	C	15.1	0.43	F	over	over
Portland Road at I-5 NB Ramps	B	17.1	0.795	D	37.5	1.050
Portland Road at I-5 SB Ramps	B	18.6	0.921	B	15.3	0.762
Portland Road at Hyacinth Street	F	144.4	1.353	F	288.8	1.783
Lake Labish Road at Hazelgreen Road	C	18.6	0.11	C	21.1	0.08

Chemawa Road at Northbound I-5 Ramps	C	30.0	0.533	D	38.1	0.870
Chemawa Road at Southbound I-5 Ramps	C	20.3	0.700	C	25.0	0.781
Portland Road at Hazelgreen Road	D	38.8	0.820	E	70.2	1.096
55th Street at Hazelgreen Road	C	19.3	0.724	C	21.8	0.831
Kale Road at Portland Road	C	24.0	0.790	E	66.4	1.111
Kale Road at Countryside Drive	F	55.5	0.61	F	54.6	0.36
Kale Road at 49th Street	C	15.6	0.20	C	15.6	0.18
Kale Road at Bayne Street	B	12.7	0.23	B	11.3	0.07
Kale Road at Cordon Road	B	12.9	0.15	C	15.1	0.15

Mitigation Alternatives

There are several intersections that are currently failing, will fail before completion of North Star Residential Estates or will fail after completion of the 6th phase. This section is intended to describe mitigation measures that could be taken to bring these intersections back to acceptable standards.

Hayesville Road at 49th Street – This intersection is currently failing in the AM Peak Hour. The parents who have dropped their children off at the middle school stack waiting to turn left onto Hayesville Road at the school entrance. A roundabout at this location will restore service to LOS A. Preliminary signal warrants are not met. There appears to be some space available to construct the roundabout on the school property.

Portland Road at Lancaster Drive – This intersection is currently failing in the PM Peak Hour. The left turn volumes at this intersection in the PM Peak Hour are creating long delays as they wait for gaps in the through traffic flows. Preliminary traffic warrants are met for Case A. Mitigation measures could include 1) Closing the eastbound approach and routing this traffic to the west through a recently vacated street. 2) A second SBLT lane could be added. 3) Constructing a signal at this intersection. Implementing these three changes will result in an estimated v/c ratio of 0.683 in 2028

Portland Road at Hyacinth Street – This intersection is currently failing in the PM Peak Hour. This is an important intersection in the City of Salem with an unacceptably high number of accidents. Mitigation measures could include increasing the cycle length to 130 seconds, adding through lanes to the northbound Portland Road approach, a westbound through lane to the

Hawthorne Street approach and a second left turn lane to the eastbound Hyacinth Street approach. The intersection will function at LOS D with v/c 0.746 and a 42.5 second delay with current volumes. In 2028, the level of service will be E / 68.9 / 1.046.

Kale Road at Countryside Drive – This intersection is currently a 3 legged intersection and is functioning well. With the construction of Phase 1 of North Star Residential Estates, the NBLT movement will begin experiencing longer delays. This analysis has modeled this intersection with separate NBLT and SBLT lanes constructed as part of Phase 1. The intersection will function with a v/c ratio of 0.61 in 2027. It is noted that the LOS for the NBLT will be F and the delay for that movement will be 61 seconds in this model without the additional NBLT lane.

Portland Road at Hazelgreen Road – This intersection is currently serving the community reasonably well. With the completion of Phase 2 and the anticipated growth in background traffic, it is expected that the LOS measures will be D / 38.9 / 0.851. Adding a second NBLT lane and changing the NBRT lane to a through right lane can result in LOS measures of D / 47.0 / 0.855 in 2028.

Kale Road at Portland Road – This signalized intersection is currently serving the community well. However as North Star Residential Estates is built out, traffic on this roadway will continue to build. With the completion of Phase 3, it is anticipated that the LOS measures will be C / 25.8 / 0.883. Mitigation measures that could be taken include a timing cycle of 130 seconds and the addition of a second through lane. The 2028 LOS measures are anticipated to be C / 34.5 / 0.796.

Summary & Recommendations

This study examines the intersections in the vicinity of the proposed North Star Residential Estates site and the impact that additional traffic would have on the City of Salem traffic levels of service. The 150 Acre site would be developed with 164 apartments and 668 single family homes, 16 town homes and 72 duplexes.

It is the recommendation of this analysis that the roadways along the frontage of this site be improved to current City of Salem standards with curbs along the south side of the Hazelgreen and along the north side of Kale road in front of the property. Requisite city services, public utilities and storm drainage should also be included in the improvements.

All construction should be completed consistent with applicable, current Oregon Department of Transportation, Marion County and City of Salem construction standards as appropriate. There are 2 intersections functioning below current established standards. Mitigation measures are included with this analysis. It is anticipated that traffic volumes will continue to increase from the larger community and from the anticipated homes in North Star Residential Estates. The intersections include Lancaster Drive at Portland Road and Hyacinth Road at Portland Road. Several other intersections will operate below established standards as time and the development of North Star Residential Estates moves on. These intersections included Hayesville at 49th Street, Kale at Portland Road, Kale at Countryside Road and Portland Road at Hazelgreen Road.

Appendix

North Star Residential Estates

Figures

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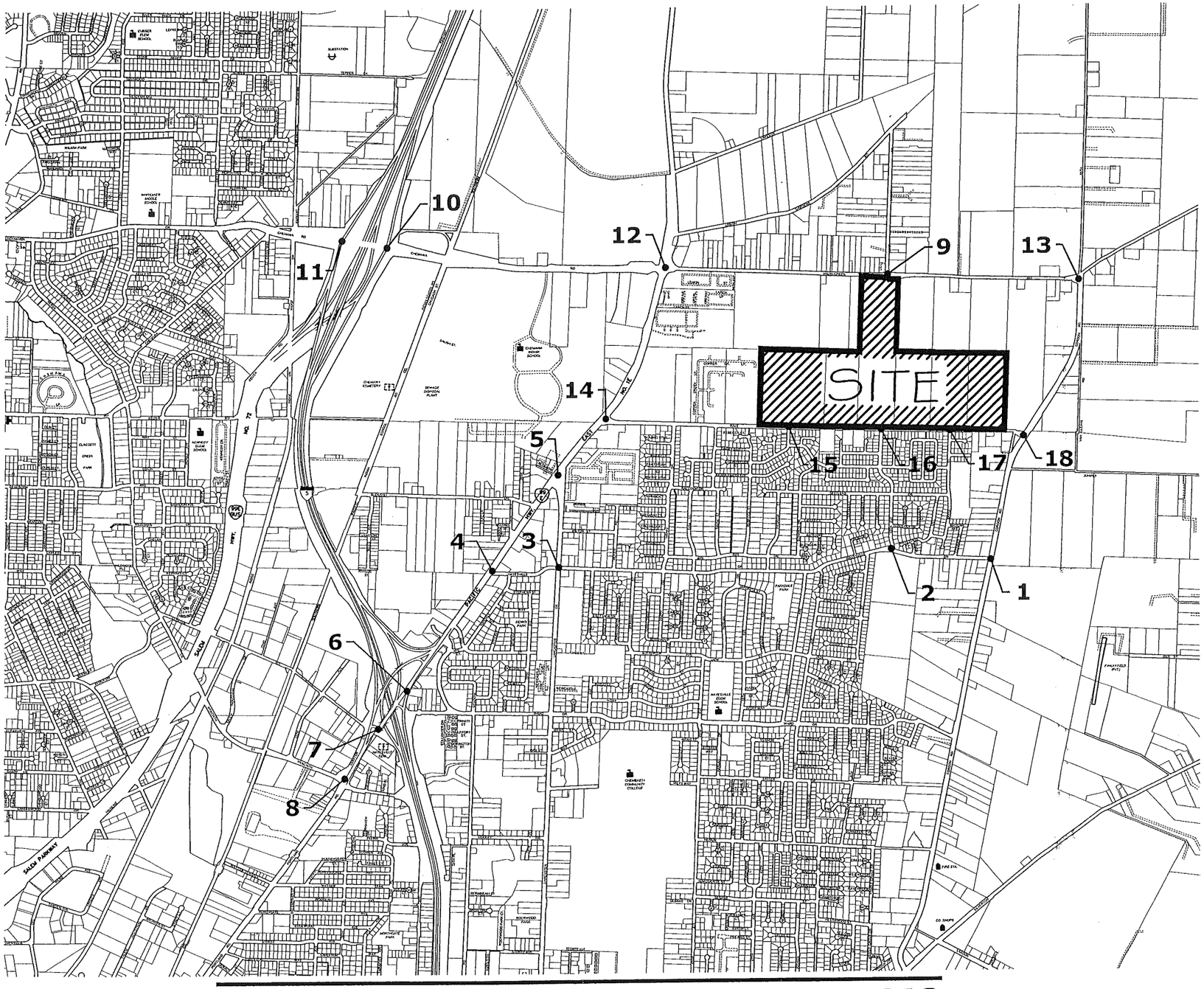


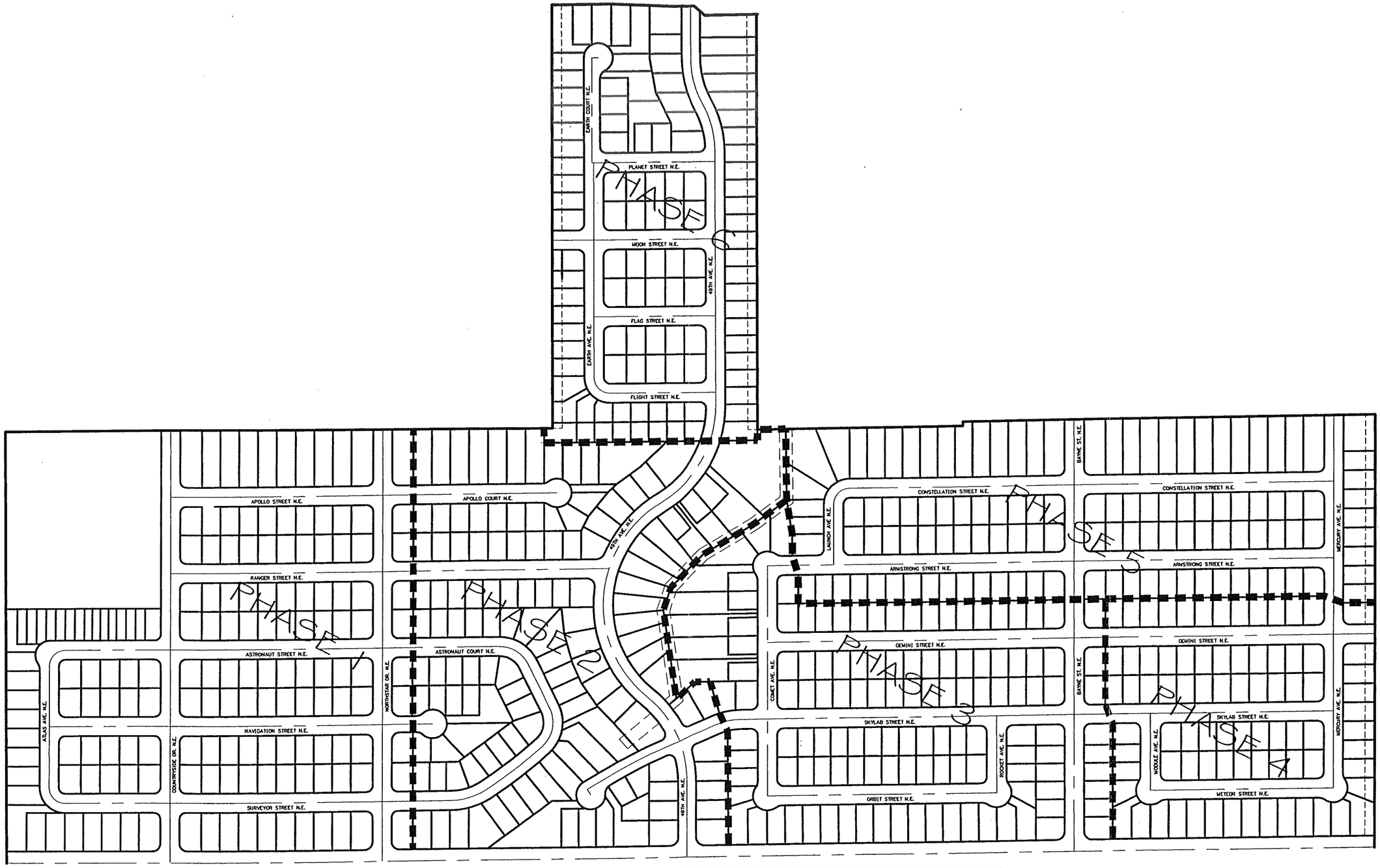
NORTH STAR RESIDENTIAL ESTATES

VICINITY MAP

NORTH

FIGURE 1

ATEP



NORTH STAR RESIDENTIAL ESTATES

PRELIMINARY SITE LAYOUT

NORTH

FIGURE 2

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