**A G E N D A**
**JAMES CITY COUNTY BOARD OF SUPERVISORS**
**REGULAR MEETING**
**County Government Center Board Room**
**101 Mounts Bay Road, Williamsburg, VA 23185**
**January 11, 2022**
**5:00 PM**

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**A. CALL TO ORDER**

**B. ROLL CALL**

**C. MOMENT OF SILENCE**

**D. PLEDGE OF ALLEGIANCE**

**E. PUBLIC COMMENT**

**F. CONSENT CALENDAR**

**G. PUBLIC HEARING(S)**

1. Pre-Budget Public Hearing
2. Ordinance to Amend County Code Sec. 20-86, cigarette tax penalties
3. Cell Tower Lease Amendment - 5301 Longhill Rd.
4. Z-20-0002. 2280 Lake Powell Road Rezoning
5. AFD-21-0002. 9958 Mill Pond Run, Barnes Swamp AFD Addition
6. Z-21-0012 and MP-21-0003. Proffer and Master Plan Amendment for the Continuing Care Retirement Facility at Ford's Colony (Ford's Village)
7. SUP-21-0018. 1403 Jamestown Road Rental of Rooms
8. SUP-21-0020. 528 Neck-O-Land Road Tourist Home

**H. BOARD CONSIDERATION(S)**

1. Appeal of Notice of Violation, 5032 River Drive
2. Authorization for Nine Full-Time Firefighter I-IV Positions
3. Ordinance to amend James City County Code section 20-45 to allow the Commissioner of the Revenue to assess a penalty for late returns (Action deferred at Nov. 9, 2021 Regular Meeting)

**I. BOARD REQUESTS AND DIRECTIVES**

**J. REPORTS OF THE COUNTY ADMINISTRATOR**

**K. CLOSED SESSION**

1. Consideration of a personnel matter, the appointment of individuals to County Boards and/or Commissions pursuant to Section 2.2-3711(A)(1) of the Code of Virginia and pertaining to the Planning Commission

**L. ADJOURNMENT**

1. Adjourn until 1 p.m. on January 25, 2022

**AGENDA ITEM NO. G.1.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Sharon Day, Director of Financial and Management Services

SUBJECT: Pre-Budget Public Hearing

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Opportunity for the public to comment on the upcoming budgets for the two fiscal years ending June 30, 2023 and June 30, 2024

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Board Secretary | Saeed, Teresa | Approved | 1/5/2022 - 9:18 AM |

**AGENDA ITEM NO. G.2.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Jenni Tomes, Treasurer

SUBJECT: Ordinance to Amend County Code Sec. 20-86, cigarette tax penalties

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**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Memo | Cover Memo |
| | Ordinance | Ordinance |
| | Final Ordinance | Ordinance |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Attorney | Kinsman, Adam | Approved | 11/23/2021 - 2:40 PM |
| Publication Management | Pobiak, Amanda | Approved | 11/23/2021 - 3:11 PM |
| Legal Review | Kinsman, Adam | Approved | 11/23/2021 - 3:12 PM |
| Board Secretary | Saeed, Teresa | Approved | 12/6/2021 - 2:57 PM |
| Board Secretary | Rinehimer, Bradley | Approved | 12/7/2021 - 2:21 PM |
| Board Secretary | Saeed, Teresa | Approved | 12/7/2021 - 2:26 PM |

**M E M O R A N D U M**

DATE: January 11, 2022

TO: The Board of Supervisors

FROM: Jennifer D. Tomes, Treasurer

SUBJECT: Ordinance to Amend County Code Section 20-86

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James City County Code Section 20-86 provides for penalties for violations of the new Cigarette Tax Ordinance set forth in James City County Code, Chapter 20, Article XI, Section 20-72, et seq. Section 20-86(a)(1) provides for a monthly penalty of 10% for late payment of the cigarette tax.

In implementing procedures to handle this new tax, the Treasurer realized applying a monthly penalty would cause substantial coding from the vendor; a cost that was not foreseen. Additionally, all other taxes and fees charged and collected by the County incur a one-time payment penalty of 10% when late. Keeping this penalty process the same across all taxes and fees offers continuity for both citizens and employees in both the Treasurer and Commissioner of the Revenue offices.

The Treasurer recommends amending County Code Section 20-86 to provide for a one-time penalty of 10% for late payment of the cigarette tax instead of a monthly 10% penalty.

JDT/md
AmdCCSec20-86-mem

Attachment

ORDINANCE NO._____

AN ORDINANCE TO AMEND AND REORDAIN CHAPTER 20, TAXATION, OF THE CODE OF THE COUNTY OF JAMES CITY, VIRGINIA, BY AMENDING ARTICLE XI, CIGARETTE TAX, SECTION 20-86, VIOLATIONS OF ARTICLE.

BE IT ORDAINED by the Board of Supervisors of the County of James City, Virginia, that Chapter 20, Taxation, is hereby amended and reordained by amending Article XI, Cigarette Tax, Section 20-86, Violations of article.

## Chapter 20. Taxation

## Article XI. Cigarette Tax

**Sec. 20-86. Violations of article.**

(a) Any person violating any of the provisions of this article shall be guilty of a Class 1 misdemeanor and required to pay the following, as applicable:

(1) Penalty of ten percent ~~per month~~ for late payment calculated from the day such tax became due;

(2) Penalty of 50 percent of any tax found to be overdue and unpaid for any act or failure to act constituting fraud or evasion of the payment of any tax imposed by this article; and

(3) Interest not to exceed three-quarters of one percent per month upon any tax found to be overdue and unpaid.

(b) Each violation of, or event of noncompliance with, any of the provisions of this article shall be and constitute a separate offense and shall subject every person convicted thereof to the penalties prescribed. Conviction and payment of a fine or penalties for such violation shall not relieve any person from the payment of any tax imposed by this article.

(c) Any cigarettes, vending machines, counterfeit stamps, or other property found in violation of this article shall be declared contraband goods and may be seized by the commissioner of revenue. In addition to any tax due, the dealer or other person liable for the tax possessing such untaxed cigarettes shall be subject to civil and criminal penalties herein provided.

_____
Chairman, Board of Supervisors

ATTEST:

_____
Teresa J. Fellows
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

AmdCCSec20-86-ord

ORDINANCE NO._____

AN ORDINANCE TO AMEND AND REORDAIN CHAPTER 20, TAXATION, OF THE CODE OF THE COUNTY OF JAMES CITY, VIRGINIA, BY AMENDING ARTICLE XI, CIGARETTE TAX, SECTION 20-86, VIOLATIONS OF ARTICLE.

BE IT ORDAINED by the Board of Supervisors of the County of James City, Virginia, that Chapter 20, Taxation, is hereby amended and reordained by amending Article XI, Cigarette Tax, Section 20-86, Violations of article.

## Chapter 20. Taxation

## Article XI. Cigarette Tax

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(2) Penalty of 50 percent of any tax found to be overdue and unpaid for any act or failure to act constituting fraud or evasion of the payment of any tax imposed by this article; and

(3) Interest not to exceed three-quarters of one percent per month upon any tax found to be overdue and unpaid.

(b) Each violation of, or event of noncompliance with, any of the provisions of this article shall be and constitute a separate offense and shall subject every person convicted thereof to the penalties prescribed. Conviction and payment of a fine or penalties for such violation shall not relieve any person from the payment of any tax imposed by this article.

(c) Any cigarettes, vending machines, counterfeit stamps, or other property found in violation of this article shall be declared contraband goods and may be seized by the commissioner of revenue. In addition to any tax due, the dealer or other person liable for the tax possessing such untaxed cigarettes shall be subject to civil and criminal penalties herein provided.

**AGENDA ITEM NO. G.3.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: John Carnifax, Director of Parks and Recreation

SUBJECT: Cell Tower Lease Amendment - 5301 Longhill Rd.

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**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Memo | Cover Memo |
| | Resolution | Resolution |
| | Location Map | Backup Material |
| | Additional 150 Sq. Ft. | Backup Material |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Attorney | Kinsman, Adam | Approved | 12/28/2021 - 7:36 AM |
| Publication Management | Daniel, Martha | Approved | 12/28/2021 - 8:03 AM |
| Legal Review | Kinsman, Adam | Approved | 1/3/2022 - 9:20 AM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:07 PM |
| Board Secretary | Purse, Jason | Approved | 1/4/2022 - 2:12 PM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:46 PM |

# M E M O R A N D U M

DATE: January 11, 2022

TO: The Board of Supervisors

FROM: John H. Carnifax, Jr., Director of Parks and Recreation
Max Hlavin, Deputy County Attorney

SUBJECT: Lease Amendment - Cell Tower at 5301 Longhill Road

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The County currently leases a portion of the James City County Recreation Center property to SRR Towers, LLC (the "Tenant") for the operation of a communications tower and associated equipment. The tower is located to the east of the soccer fields and also supports field lighting. The Tenant has requested to lease an additional 150 square feet of ground area to install equipment associated with the communications tower for the benefit of its subtenant's cellular upgrades. The additional area is located to the northern side of the existing lease footprint and will not impact the recreation facilities. The lease amendment includes additional rent of $433.50 per month, which will be subject to escalation according to the existing lease.

Attached is a resolution authorizing the amendment of the existing lease to include an additional 150 square feet of ground area.

JHC/MH/md
LeasAmdLghllCTwr-mem

Attachment

# **R E S O L U T I O N**

LEASE OF PROPERTY AT 5301 LONGHILL ROAD

WHEREAS, James City County owns a parcel of property located at 5301 Longhill Road, further identified as James City County Real Estate Tax Map No. 3910100153 (the "Property"); and

WHEREAS, on July 8, 2008, the Board of Supervisors of James City County, Virginia (the "Board") authorized the lease of approximately 900 square feet of the Property for the construction and operation of a communication tower and related structures (the "Tower Site"); and

WHEREAS, by resolution adopted on April 13, 2021, the Board of Supervisors authorized the lease of an additional 136 square feet of the Property as part of the Tower Site; and

WHEREAS, the current lessee of the Tower Site, SRR Towers, LLC, has requested to lease an additional 150 square feet adjacent to the Tower Site for the construction of improvements related to the Tower Site; and

WHEREAS, the additional lease area for the Tower Site will not impact the County's recreation facilities on the Property; and

WHEREAS, a public hearing was advertised and held on the disposition of the additional lease area; and

WHEREAS, the Board is willing to amend the existing lease to include the additional square footage in consideration of additional rent and subject to certain terms.

NOW, THEREFORE, BE IT RESOLVED by the Board of Supervisors of James City County, Virginia, that the County Administrator is authorized and directed to execute those documents necessary to amend the lease for the Tower Site to include an additional 150 square feet of ground area.

_____
??
Chairman, Board of Supervisors

ATTEST:

_____
Teresa J. Saeed
Deputy Clerk to the Board

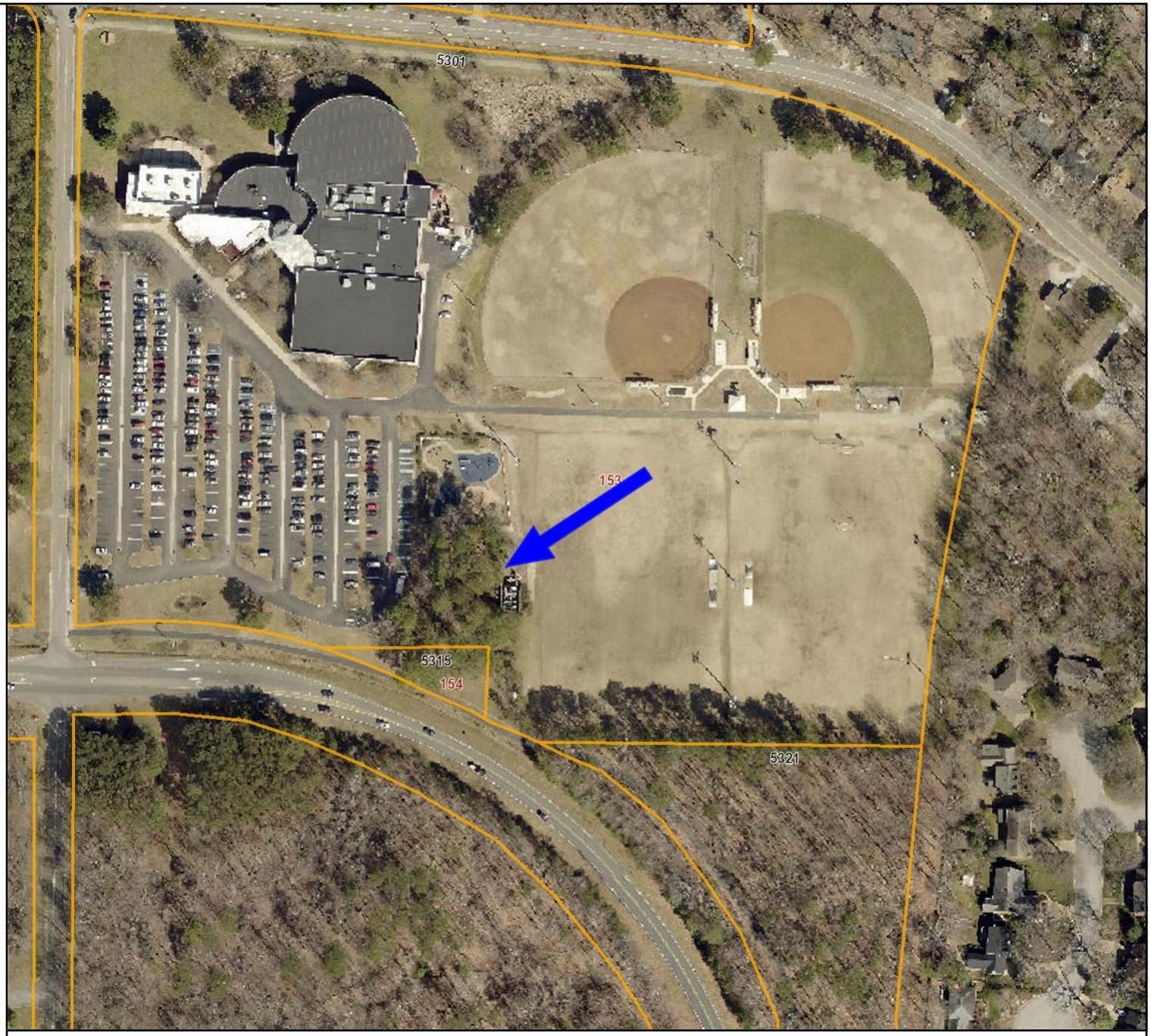
| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

LeasAmdLghllCTwr-res

## Legend

- Parcels




Feet

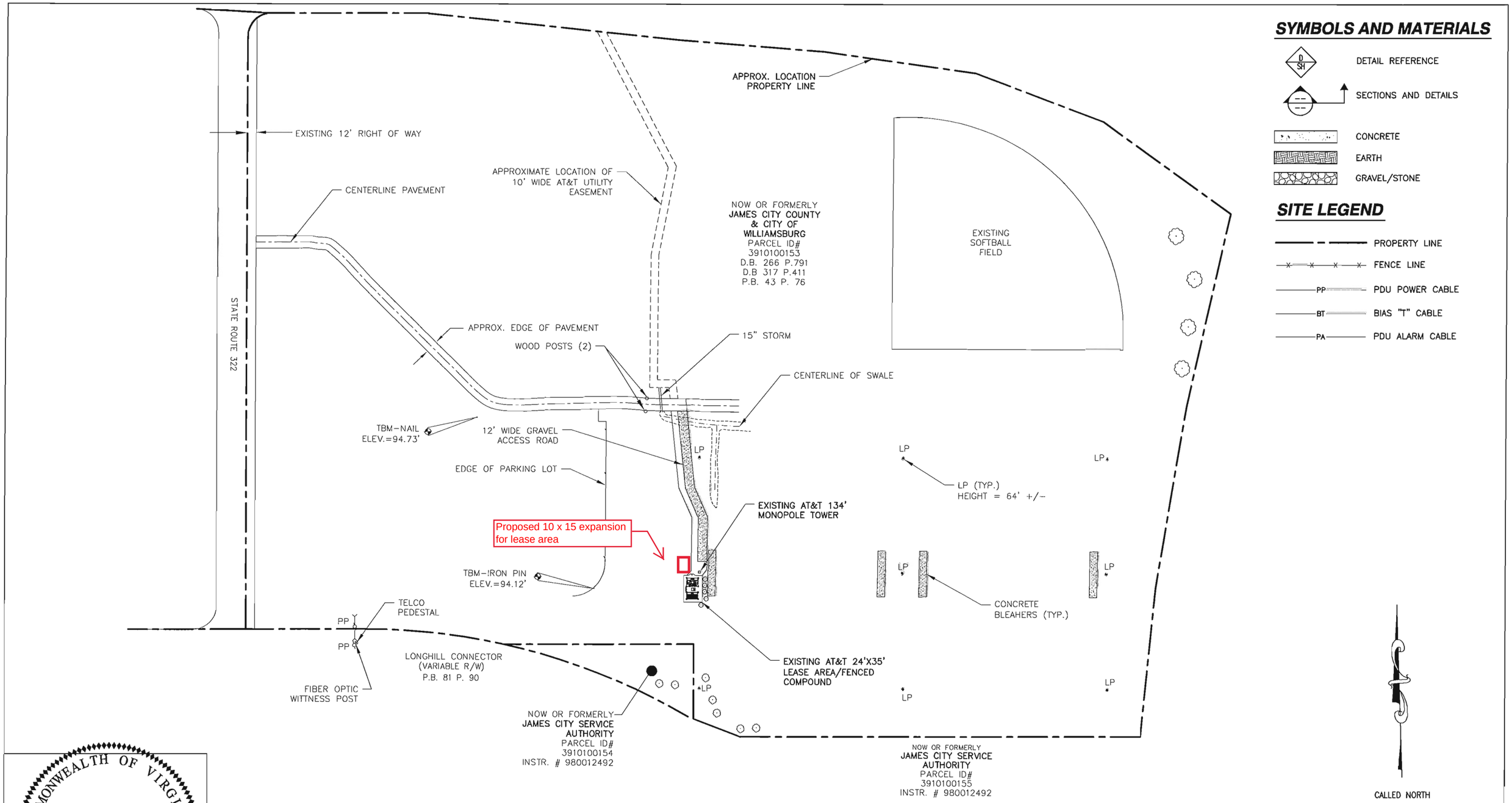
0 50 100 150 200

1:2,257 / 1"=188 Feet

**Title: Location Map**

**Date: 12/17/2021**

*DISCLAIMER:This drawing is neither a legally recorded map nor a survey and is not intended to be used as such. The information displayed is a compilation of records,information, and data obtained from various sources, and James City County is not responsible for its accuracy or how current it may be.*




COMMONWEALTH OF VIRGINIA
WILLIAM PANEK
Lic. No. 034732
PROFESSIONAL ENGINEER
4/15/18

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velocitel, llc
complete wireless solutions
4144 INNSLAKE DRIVE
GLEN ALLEN, VA 23060
(804) 217-7088 (MAIN)
(757) 401-6453 (FAX)

at&t MOBILITY
LIBERTY PLAZA 1
4801 COX ROAD, SUITE 300
GLEN ALLEN, VA 23060

**LTE 3C/4C**
**SITE NO. NF290**
**LONGHILL ROAD**
**FA# 10129359**
5301 LONGHILL ROAD
WILLIAMSBURG, VA 23188

| NO | DATE | REVISIONS | BY | CHK | APP'D |
|---|---|---|---|---|---|
| 1 | 04/05/18 | REVISED PER COMMENTS | YS | MZ | – |
| 0 | 02/12/18 | ISSUED FOR CONSTRUCTION | ED | MZ | – |
| A | 01/15/18 | ISSUED FOR REVIEW | YS | MZ | – |

SCALE: DESIGNED: YS CHECKED: MZ

# SURVEY & SITE PLAN

| FA # | DRAWING NUMBER | REV |
|---|---|---|
| 10129359 | C2 | 1 |

**AGENDA ITEM NO. G.4.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Tori Haynes, Senior Planner

SUBJECT: Z-20-0002. 2280 Lake Powell Road Rezoning

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**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Staff Report | Staff Report |
| | 1. Ordinance | Ordinance |
| | 2. Location Map | Backup Material |
| | 3. Master Plan | Backup Material |
| | 4. Community Impact Statement | Backup Material |
| | 5. Adopted minutes from the October 6, 2021 Planning Commission meeting | Backup Material |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Planning | Holt, Paul | Approved | 12/22/2021 - 3:52 PM |
| Development Management | Holt, Paul | Approved | 12/22/2021 - 3:52 PM |
| Publication Management | Daniel, Martha | Approved | 12/22/2021 - 4:00 PM |
| Legal Review | Kinsman, Adam | Approved | 12/28/2021 - 7:36 AM |
| Board Secretary | Saeed, Teresa | Approved | 12/28/2021 - 8:36 AM |
| Board Secretary | Purse, Jason | Approved | 1/4/2022 - 2:13 PM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:55 PM |

## SUMMARY FACTS

| | |
|---|---|
| Applicant: | Mr. Benming Zhang, Kaufman & Canoles, P.C., on behalf of Mr. Paul Smith, Jr. |
| Land Owner: | Ms. Iris L. Smith |
| Proposal: | Rezoning of approximately 1.985 acres from R-8, Rural Residential to R-2, General Residential for the purpose of a one lot, single-family residential minor subdivision |
| Location: | 2280 Lake Powell Road |
| Tax Map/Parcel No.: | 4830100038 |
| Current Zoning: | R-8, Rural Residential |
| Proposed Zoning: | R-2, General Residential |
| Project Acreage: | ±1.985 acres |
| Comprehensive Plan: | Low Density Residential |
| Primary Service Area: (PSA) | Inside, but must utilize private well/septic systems |
| Staff Contact: | Tori Haynes, Senior Planner |

## PUBLIC HEARING DATES

| | |
|---|---|
| Planning Commission: | October 6, 2021, 6:00 p.m. |
| Board of Supervisors: | January 11, 2022, 5:00 p.m. |

## FACTORS FAVORABLE

1. The maximum subdivision potential would be one residential parcel, and the maximum by-right unit potential would be one single-family unit.
2. Staff finds that the impact of one single-family unit would not adversely impact surrounding development.
3. Staff finds that the proposal passes the Adequate Public Schools Facilities Test.
4. Impacts: See Impact Analysis on Page 3.

## FACTORS UNFAVORABLE

1. Impacts: See Impact Analysis on Page 3.

## SUMMARY STAFF RECOMMENDATION

Staff recommends that the Board of Supervisors approve this application.

## PLANNING COMMISSION RECOMMENDATION

At its October 6, 2021, public hearing, the Planning Commission voted 7-0 to recommend approval of this application to the Board of Supervisors.

## CHANGES SINCE PLANNING COMMISSION MEETING

None.

## PROJECT DESCRIPTION

Mr. Benming Zhang of Kaufman & Canoles, P.C. has applied on behalf of Mr. Paul Smith, Jr. to rezone approximately 1.985 acres of

land located at 2280 Lake Powell Road from R-8, Rural Residential to R-2, General Residential for the purpose of subdividing one single-family residential lot. The owner's intent is to gift the new lot to her daughter. The minimum lot size in the R-8 Zoning District is three acres, even for family subdivisions. The property is located inside the PSA, but the James City Service Authority (JCSA) has confirmed that this location cannot be served by public water/sewer utilities at this time. For a new dwelling unit, the owner would need to install private well and septic systems.

Under the current R-8 zoning, the existing acreage is considered legally nonconforming since it is less than the required minimum lot size of three acres; therefore, the proposed subdivision would not be permitted in R-8.

Should the parcel be rezoned to R-2, the minimum lot size would be 30,000 square feet for parcels served by private well and septic systems. Staff reviewed a preliminary plat (same as the Master Plan; see Attachment No. 3) to confirm that the subdivision would be possible in the R-2 District and found that the proposal can meet Ordinance requirements. The Virginia Department of Health (VDH) has also confirmed that the on-site soils can support well and septic systems.

The gross density is approximately one unit per acre. The density as defined by the R-2 District Ordinance is 1.6 units per acre. Should the parcel be rezoned, the maximum subdivision potential would be one residential lot due to existing site constraints and lot size, and the maximum by-right unit potential would be one single-family unit. Duplexes and multifamily units with a density of more than one unit per acre would require a Special Use Permit (SUP) and could not be permitted administratively.

The proposed subdivision would be considered a minor subdivision. Staff notes that major subdivisions in the R-2 District require an SUP for a density above one unit per acre, but minor subdivisions are not subject to this requirement.

## PLANNING AND ZONING HISTORY

There have been no known Planning or Zoning actions on the property.

## SURROUNDING ZONING AND DEVELOPMENT

The adjacent parcel to the east is split-zoned R-2 (north of Lake Powell Road) and R-8 (south of Lake Powell Road) and designated Rural Lands in the 2045 Comprehensive Plan. This parcel is historically associated with Gospel Spreading Church Farm. Other adjacent parcels south of Lake Powell Road are zoned R-8 and designated Low Density Residential. Adjacent parcels north of Lake Powell Road are zoned R-2 and designated Low Density Residential.

## IMPACT ANALYSIS

See next page.

| Impacts/Potentially Unfavorable Conditions | Status *(No Mitigation Required/Mitigated/Not Fully Mitigated)* | Considerations/Proposed Mitigation of Potentially Unfavorable Conditions |
|---|---|---|
| Public Transportation: Vehicular | No Mitigation Required | - The proposal is anticipated to generate one peak-hour trip, or up to 10 weekday trips.<br>- This segment of Lake Powell Road is classified as a local road, and there is no through-access from Brookwood Drive to Jamestown Road. |
| Public Transportation: Pedestrian/Bicycle | No Mitigation Required | - The proposal does not generate impacts that require mitigation for pedestrian/bicycle accommodations. |
| Public Safety | No Mitigation Required | - The proposal does not generate impacts that require mitigation for emergency services or facilities. |
| Public Schools | No Mitigation Required | - The proposal is anticipated to generate one additional student.<br>- See additional discussion on Page 4. |
| Public Parks and Recreation | No Mitigation Required | - The proposal does not generate impacts that require mitigation for parks and recreation services or facilities. |
| Public Libraries and Cultural Centers | No Mitigation Required | - The proposal does not generate impacts that require mitigation for public libraries or cultural centers. |
| Groundwater and Drinking Water Resources | No Mitigation Required | - The proposal does not generate impacts that require mitigation for ground-water and drinking water resources.<br>- VDH has confirmed that the on-site soils can adequately accommodate private well and septic systems. |
| Watersheds, Streams, and Reservoirs<br>Proposal is located in the Mill Creek Watershed | No Mitigation Required | - The proposal does not generate impacts that require mitigation to watersheds, streams, and reservoirs.<br>- Erosion and sediment control measures and/or stormwater mitigation would be reviewed as part of the building permit for single-family dwellings. |
| Cultural/Historic Resources | No Mitigation Required | - The proposal does not generate impacts that require mitigation for cultural or historic resources. |
| Nearby and Surrounding Properties | No Mitigation Required | - The proposal does not generate impacts that are anticipated to negatively affect adjacent properties. |
| Community Character | No Mitigation Required | - The proposal does not generate impacts that require mitigation for community character. |
| Covenants and Restrictions | No Mitigation Required | - The applicant has verified that he is not aware of any covenants or restrictions on the property that prohibit the proposed use. |

## FINANCIAL IMPACTS OF RESIDENTIAL UNITS

On September 10, 2019, the Board of Supervisors adopted a resolution directing staff to produce a fact sheet that outlines general financial impacts of residential dwellings based on the Adopted Budget, the Capital Improvements Program, the Comprehensive Plan, the Strategic Plan, and any other relevant data. The resolution further directs that the fact sheet should address the immediate and long-range fiscal impacts related to increased use and demand on the following public facilities and resources. The per unit Residential Impacts are based on the Fiscal Year 2022 data provided by the Department of Financial and Management Services and JCSA, as well as the projected number of annual residential unit data through 2034 (the Comprehensive Plan horizon year). The per unit impacts are detailed in the following table:

| Category | Residential Impact | Proffered with Current Application |
|---|---|---|
| Public Transportation | $299.04 | $0 |
| Public Safety | - | $0 |
| Public Schools | $1,417.63 | $0 |
| Public Parks & Recreation | $4,156.19 | $0 |
| Public Libraries and Cultural Centers | $170.88 | $0 |
| Groundwater and Drinking Water Resources | $3,542.69 | $0 |
| Watersheds, Streams, and Reservoirs | $1,954.03 | $0 |

A Fiscal Impact Analysis (FIA) is typically required for re-zonings that include a residential component; however, staff determined that the impacts generated by this proposal would be more comparable to a by-right minor subdivision and would not necessitate a full FIA.

## SCHOOLS

The proposal is anticipated to generate one additional student. As currently districted, the subject parcel is zoned for Laurel Lane Elementary School, Berkeley Middle School, and Lafayette High School. As illustrated in the following table, an increase of one student would not cause enrollment levels to exceed effective capacity.

| School | Effective Capacity | 2020-21 Enrollment | Students Generated by Proposal | Enrollment + Students Generated |
|---|---|---|---|---|
| Laurel Lane Elementary School | 574 | 506 | 1 | 507 |
| Berkeley Middle School | 779 | 599 | 0 | 599 |
| Lafayette High School | 1,314 | 1,123 | 0 | 1,123 |

*Source: FutureThink Enrollment Projections Report (October 2020) and Williamsburg-James City County Schools.*

## COMPREHENSIVE PLAN

The property is designated Low Density Residential in the 2045 Comprehensive Plan. The recommended uses for Low Density Residential include single-family and multifamily units, cluster housing, and recreation areas. Recommended gross density is one unit per acre, up to four units per acre if particular public benefits are provided.

Staff finds that the scope of the proposed rezoning and subdivision is consistent with the intent of the Comprehensive Plan regarding Low Density Residential development.

## STAFF RECOMMENDATION

Staff finds that the proposed rezoning is consistent with the 2045 Comprehensive Plan. Staff also finds that the impact of one single-family unit would not adversely impact surrounding development and would be consistent with by-right minor subdivisions currently permitted in the R-2 District.

Staff recommends that the Board of Supervisors approve this application.

TH/md
RZ20-2_2280LkPwll

Attachments:
1. Ordinance
2. Location Map
3. Master Plan (Preliminary Subdivision Plat)
4. Community Impact Statement
5. Adopted minutes from the October 6, 2021 Planning Commission meeting

ORDINANCE NO. _____

AN ORDINANCE TO AMEND THE ZONING DISTRICT MAPS OF JAMES CITY COUNTY, VIRGINIA, TO REZONE APPROXIMATELY 1.985 ACRES LOCATED AT 2280 LAKE POWELL ROAD (TAX MAP PARCEL NO. 4830100038) FROM R-8, RURAL RESIDENTIAL TO R-2, GENERAL RESIDENTIAL, AS DESCRIBED IN CASE NO. Z-20-0002

WHEREAS, on behalf of Ms. Iris Smith, Mr. Benming Zhang of Kaufman & Canoles, P.C. has applied to rezone a ±1.985-acre parcel located at 2280 Lake Powell Road and further identified as James City County Real Estate Tax Map No. 4830100038 from R-8, Rural Residential to R-2, General Residential; and

WHEREAS, a public hearing was advertised, adjoining property owners notified, and a hearing conducted on Case No. Z-20-0002; and

WHEREAS, the Planning Commission of James City County, following its consideration on October 6, 2021, recommended approval of Case No. Z-20-0002, by a vote of 7-0; and

WHEREAS, the Board of Supervisors of James City County, Virginia, finds Case No. Z-20-0002 to be required by public necessity, convenience, general welfare, and good zoning practice.

NOW, THEREFORE, BE IT ORDAINED by the Board of Supervisors of James City County, Virginia, that Case No. Z-20-0002 is hereby approved as described therein.

_____

Chairman, Board of Supervisors

ATTEST:

_____

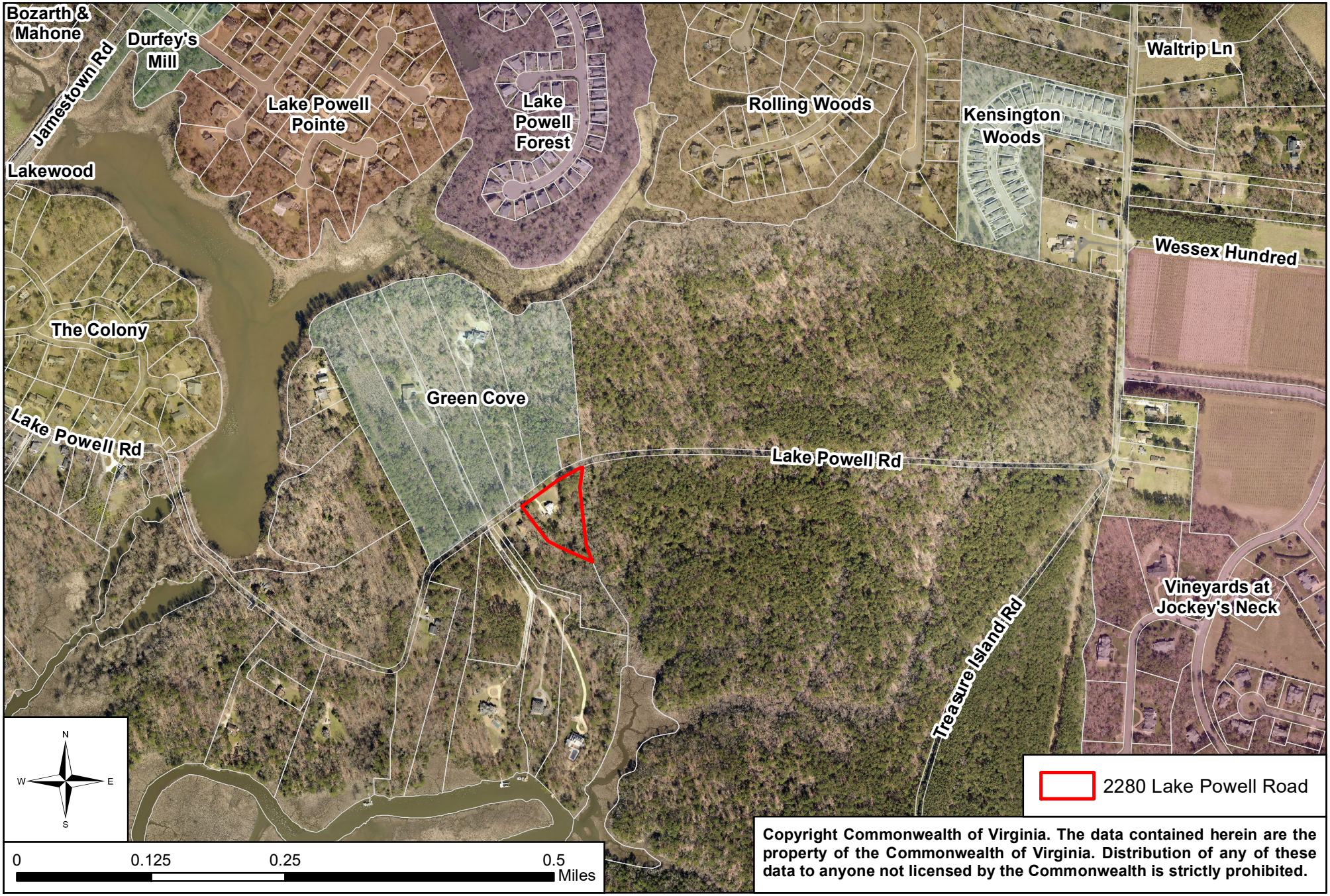
Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

RZ20-2_2280LkPwll-ord

# JCC Z-20-0002
# 2280 Lake Powell Road Rezoning

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# SUBDIVISION OF PARCEL ONE LOUISE G. WALTRIP SUBDIVISION

(PIN: 4830100038)

JAMES CITY COUNTY ROBERTS DISTRICT VIRGINIA

DATE: 05/20/2020 SCALE: 1"=30" JOB # 19-003


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Engineering & Surveying Consultants
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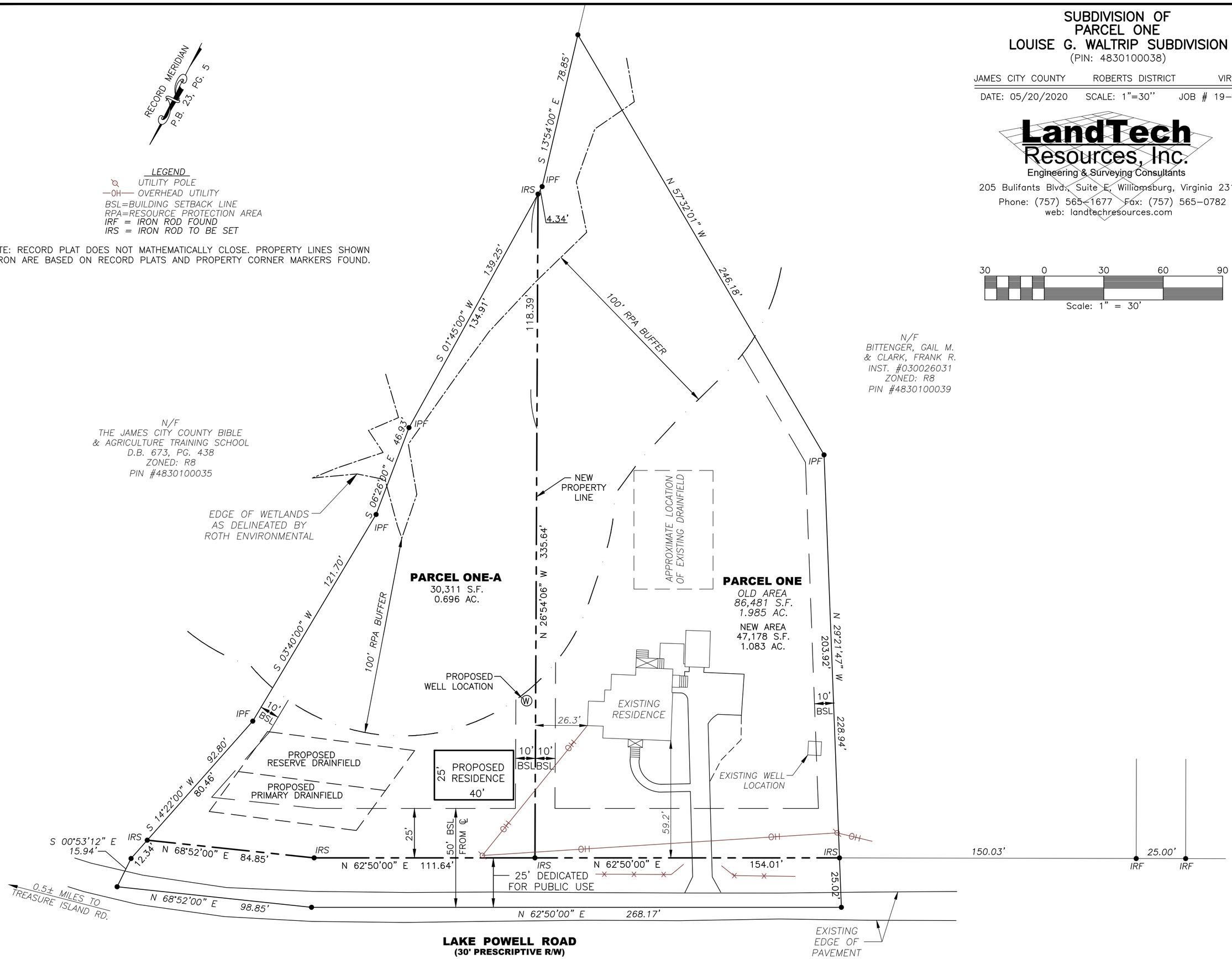


**REZONING APPLICATION NO.**

**2280 LAKE POWELL ROAD**

**COMMUNITY IMPACT STATEMENT**

The subject of this Community Impact Statement is a proposed rezoning of 2280 Lake Powell Road, consisting of approximately 1.985 acres, and located in James City County Virginia (GPIN 4830100038 the "Subject Property") from R-8 to R-2 to permit a minor subdivision of two (2) single-family lots. The Subject Property is currently improved by a single family detached home. It is surrounded by single family detached residential properties to the north (zoned R-2) and west (zoned either R-2 or R-1), and by residential (R-8), agricultural, and wetlands to the east and south.

The Subject Property was first created by the recordation of a subdivision plat titled "Jamestown Dist. James City County, Virginia, Plat Showing Boundary Survey and Partition of Land Standing in the Name of Mrs. Louise G. Waltrip." made by Vincent D. McManus, dated July 28, 1965, and of record in Plat Book 23 at page 5 ("Original Subdivision Plat"). The Original Subdivision Plat was recorded four years prior to the adoption of the first zoning ordinance in James City County. At the time, in 1969, the Subject Property was zoned A-2, Limited Agricultural. The old A-2 district allowed single family homes with lot sizes as small as 20,000 sf (0.46 acres). The Subject Property was downzoned twice since its creation. The first was in 1990 when the A-2 district was replaced with the R-8 zoning district. The initial iteration of the R-8 zoning district allowed, among other things, minor subdivisions to have minimum lot sizes of 40,000 sf (0.92 acres) for lots which were not served by public water and sewer (as applicable with the Subject Property). In 1999, the R-8 zoning district was amended again to delete all of the minor subdivision exceptions, therefore downzoning the Subject Property to a minimum 3 acre lot size and creating the currently existing legal nonconformance.

The owner of the Subject Property wishes to subdivide his lot and gift the new lot to his daughter.

Pursuant to Section 24-254(a) and (b) of the James City County Zoning Ordinance, minor subdivisions with a density in excess of one (1) dwelling unit per acre are permitted in the R-2 District provided that the area requirements set forth in Section 24-255 are met. In partial fulfillment of the rezoning submission requirements, this Community Impact Statement addresses the items listed in Sec. 24-23(a)(1) of the James City County Zoning Ordinance.

*Infrastructure Information*

Traffic — A traffic impact study is required for all projects that are expected to generate 100 or more weekday peak hour trips to and from the site during the peak hour of the operation, based on the application of the Institute of Transportation Engineers (ITE) traffic generation rates. Two (2) single-family detached residential lots (one additional lot in excess of the one existing residence on the Subject Property) will not create sufficient trips during the peak hour to warrant a traffic impact study. Indeed, the trips that would be expected to be generated by this project would be roughly equivalent to the expected daily variation in trips across this segment of Lake Powell Road in the absence of any increase in dwelling units, and are therefore deemed to be insignificant.

Additionally, the requirement for a traffic impact study has been waived by County Staff for this project.

Water and Sewer — This project will use well and septic. The Health Department is evaluating the proposed drainfield location and will provide its results prior to the Planning Commission Public Hearing. Because there is only one new residential structure being proposed, and it will be served by well and septic, a water and sewer impact study should not be required to support the rezoning application for 2280 Lake Powell Road.

Adequate Public Facilities — Pertinent public facilities for this project include schools, police and emergency services. Issues related to water and sewer adequacy have been addressed above. The fiscal impact of the subject rezoning is addressed below; however, the requirement to determine adequate public facilities has been waived by County Staff for this project.

*Schools*

The Williamsburg — James City School division assumes 0.6 children per dwelling unit (CPDU) are generated by the average new home. With one (1) new residential structure proposed in the current rezoning proposal, one would expect 0.6 new school age children to attend public schools. Given the very small nature of this rezoning request, it is assumed that existing schools are adequate to accommodate any additional school age children to be generated by this proposal.

*Police, Fire and Rescue Services*

The James City County Police and Fire Departments should experience no significant additional burden with the creation of a single new residence.

Given the foregoing, public facilities serving the proposed rezoning of 2280 Lake Powell Road are adequate to meet all reasonably anticipated needs.

*Quality of Life Information*

1. Historic and Archaeological Resources — A single residential dwelling involves minimal soil disturbance. This area has been widely developed with standard lots as well as planned community cluster style developments. A Phase 1 Archeological Study is not justified.

2. Environmental Inventory — As above, a single residential unit, particularly one that is being created from an existing lot, will involve little soil disturbance. An environmental inventory is not justified for this project.

3. Fiscal Impact Analysis — It is expected that the new home to be built on the Subject Property will be granted to an immediate family member. Given the very small nature of this rezoning request, it is assumed that this project will not pose a measurable fiscal impact for local government services. Additionally, the requirement for a fiscal impact analysis has been waived by County Staff for this project.

**Minutes of the October 6, 2021**
**Planning Commission Regular Meeting**

## Z-20-0002. 2280 Lake Powell Road Rezoning

Ms. Tori Haynes, Senior Planner, stated Mr. Benny Zhang of Kaufman and Canoles has applied on behalf of the Smith family to rezone 1.985 acres located at 2280 Lake Powell Road from R-8 Rural Residential to R-2 General Residential for the purpose of a single-family residential minor subdivision. Ms. Haynes stated that the property is designated Low Density Residential in both the 2035 and draft 2045 Comprehensive Plans, and is inside the PSA, but per James City Service Authority must use private well and septic systems at this location.

Ms. Haynes stated that under the current R-8 zoning, the minimum lot size is 3 acres, so a subdivision of the parcel would not be possible. Ms. Haynes further stated that should the property be rezoned to R-2, the minimum lot size is 30,000 square feet for lots served by well and septic. Ms. Haynes stated that staff reviewed a preliminary plat and found that the proposal can meet the R-2 district ordinance requirements.

Ms. Haynes stated that the gross density would be about 1 unit per acre. Ms. Haynes stated that the maximum subdivision potential would be one residential lot, and the maximum by-right unit potential would be one single-family unit. Ms. Haynes stated that duplexes or multifamily units would require a Special Use Permit. Ms. Haynes stated that staff estimates an average of one student could be generated, and can be adequately accommodated by the school system.

Ms. Haynes further stated that staff finds that the proposed rezoning is consistent with the 2035 and draft 2045 Comprehensive Plans. Ms. Haynes stated that the impact of one single-family unit would not adversely impact surrounding development and would be consistent with by-right minor subdivisions currently permitted in the R-2 district.

Ms. Haynes stated that staff recommends that the Planning Commission recommend approval of the application to the Board of Supervisors.

Mr. Haldeman called for disclosures from the Commission.

There were no disclosures.

Mr. Haldeman opened the Public Hearing.

As no one wished to speak, Mr. Haldeman closed the Public Hearing.

Mr. Krapf made a motion to recommend approval of the application.

On a roll call vote the Commission voted to recommend approval of Z-20-0002. 2280 Lake Powell Road Rezoning. (6-0)

**AGENDA ITEM NO. G.5.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Tori Haynes, Senior Planner

SUBJECT: AFD-21-0002. 9958 Mill Pond Run, Barnes Swamp AFD Addition

---

**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Staff Report | Staff Report |
| | 1. Ordinance | Ordinance |
| | 2. Location Map | Backup Material |
| | 3. Barnes Swamp AFD 2018 Renewal Ordinance and Staff Report | Backup Material |
| | 4. State Code § 15.2-4305 | Backup Material |
| | 5. CSWCD Conservation Plan | Backup Material |
| | 6. Unapproved minutes from the October 21, 2021 AFD Advisory Committee | Backup Material |
| | 7. Unapproved minutes from the December 1, 2021 Planning Commission meeting | Backup Material |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Planning | Holt, Paul | Approved | 12/22/2021 - 3:51 PM |
| Development Management | Holt, Paul | Approved | 12/22/2021 - 3:51 PM |
| Publication Management | Pobiak, Amanda | Approved | 12/22/2021 - 4:20 PM |
| Legal Review | Kinsman, Adam | Approved | 12/28/2021 - 7:33 AM |
| Board Secretary | Saeed, Teresa | Approved | 12/28/2021 - 8:35 AM |
| Board Secretary | Purse, Jason | Approved | 1/4/2022 - 2:11 PM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:30 PM |

## SUMMARY FACTS

| | |
|---|---|
| Applicant: | Mr. David Hogue |
| Land Owner(s): | Mr. David and Ms. Karen Hogue |
| Proposal: | Addition of a ±60.77-acre parcel to the Barnes Swamp Agricultural and Forestal District (AFD) |
| Location: | 9958 Mill Pond Run |
| Tax Map/Parcel No.: | 0540100001 |
| Project Acreage: | ± 60.77 acres |
| Zoning: | A-1, General Agricultural |
| Comprehensive Plan: | Low Density Residential |
| Primary Service Area: (PSA) | Inside |
| Staff Contact: | Tori Haynes, Senior Planner |

## PUBLIC HEARING DATES

| | |
|---|---|
| AFD Committee: | October 21, 2021, 4:00 p.m. |
| Planning Commission: | December 1, 2021, 6:00 p.m. |
| Board of Supervisors: | January 11, 2022, 5:00 p.m. |

## FACTORS FAVORABLE

1. Staff finds that this addition to the Barnes Swamp AFD would not adversely affect surrounding development and is consistent with the core of the District.

2. Staff finds the proposal consistent with the 2045 Comprehensive Plan Land Use Action 6.1.1.

3. The applicant has coordinated harvesting and resource management plans with the Virginia Department of Forestry (VDOF) and Colonial Soil and Water Conservation District (CSWCD).

4. Impacts: This proposal is not anticipated to generate any impacts that require mitigation.

## FACTORS UNFAVORABLE

As this proposal is not anticipated to generate any impacts that require mitigation, staff finds no unfavorable factors.

## SUMMARY STAFF RECOMMENDATION

Staff recommends that the Planning Commission recommend approval of this application to the Board of Supervisors, subject to the attached conditions, consistent with other properties in the District.

## PLANNING COMMISSION RECOMMENDATION

At its December 1, 2021, public hearing, the Planning Commission voted 7-0 to find that the property is agriculturally and forestally significant and recommended approval of this application to the Board of Supervisors.

## AFD ADVISORY COMMITTEE RECOMMENDATION

At its October 21, 2021, meeting, the AFD Advisory Committee voted 8-0 to find that the property is agriculturally and forestally significant and recommended approval of this application to the Planning Commission and Board of Supervisors.

## PROJECT DESCRIPTION

- Mr. David Hogue has applied to enroll ±60.77 acres of land located at 9958 Mill Pond Run into the Barnes Swamp AFD. The parcel is currently undeveloped. A 50-foot ingress/egress easement was granted in 2004 for access to the parcel from Mill Pond Run.

- The subject parcel is more than one mile away from the core parcels in the Barnes Swamp AFD; therefore, as specified in the Code of Virginia, the governing body must decide if this property contains agriculturally and forestally significant land to be added to the Barnes Swamp AFD (see Attachment No. 4).

- The applicant has been working with the VDOF and CSWCD for harvesting and resource management plans. Approximately five acres of harvested land will be reforested with loblolly pine under VDOF's Reforestation of Timberlands cost-share program, and the remaining harvested acreage will be converted into pasture per a conservation plan administered by CSWCD (see Attachment No. 5). VDOF noted that the soils are well-suited for timber production.

- Per the United States Department of Agriculture's *Soil Survey of James City and York Counties and the City of Williamsburg Virginia*, the parcel consists of the following soils:

| Soil Type | Erosion Hazard | Equipment Limitation | Seedling Mortality | Windthrow Hazard |
|---|---|---|---|---|
| 11C, Craven-Uchee complex, 6-10% slopes | Slight | Moderate | Slight/ Moderate | Slight |
| 14B, Emporia fine sandy loam, 2-6% slopes | Slight | Slight | Slight | Slight |
| 15F, Emporia complex, 25-50% slopes | Moderate | Severe | Slight | Slight |
| 17, Johnston complex | Slight | Severe | Severe | Moderate |
| 18B, Kempsville fine sandy loam, 2-6% slopes | Slight | Slight | Slight | Slight |
| 19B, Kempsville-Emporia fine sandy loams, 2-6% slopes | Slight | Slight | Slight | Slight |
| 34B, Uchee loamy fine sand, 2-6% slopes | Slight | Moderate | Moderate | Slight |

## DISTRICT HISTORY

- The Barnes Swamp AFD was created in 1986 for a term of four years and originally consisted of 29 parcels totaling ±1,905 acres.

- The District was renewed in four-year intervals in 1990, 1994, 1998, 2002, 2006, 2010, 2014, and 2018, with various additions and withdrawals taking place during those periods.

- The District currently consists of ±1,894.78 acres. Should this addition be approved, the District would consist of ±1,955.55 acres.

## SURROUNDING ZONING AND DEVELOPMENT

All surrounding properties are part of the Stonehouse Master Plan, zoned PUD-R, Planned Unit Development-Residential, and designated Low Density Residential in the 2045 Comprehensive Plan. Single-family residential parcels are located to the north and are separated from the subject parcel by a minimum 50-foot vegetated buffer. There are no residential parcels directly adjacent. Parcels to the south are undeveloped and located in conservation easements.

## COMPREHENSIVE PLAN

The subject parcel is designated Low Density Residential in the 2045 Comprehensive Plan. Appropriate uses in Low Density Residential include single-family and multifamily units, accessory units, cluster housing, and recreation areas. While agricultural and forestal uses tend to be located in areas designated Rural Lands outside of the PSA, staff notes that these activities are consistent with the parcel's underlying zoning of A-1, General Agricultural. The proposal is also consistent with the following Goals, Strategies, and Actions:

<u>Land Use</u>

LU Action 6.1.1: Support both the use value assessment and AFD programs to the maximum degree allowed by the Code of Virginia. Explore extending the terms of the County's Districts.

## PUBLIC IMPACTS

This proposal is not anticipated to generate any impacts that require mitigation.

## STAFF RECOMMENDATION

The subject parcel is located more than one mile away from the core parcels of the Barnes Swamp AFD; therefore, as specified in the Code of Virginia, this parcel may be added to the District only upon finding that it contains agriculturally and forestally significant land. At its October 21, 2021, meeting, the AFD Advisory Committee found that the subject parcel is agriculturally and forestally significant and recommended its addition to the Barnes Swamp AFD. At its December 1, 2021, meeting, the Planning Commission concurred and also recommended approval. With these findings and recommendations of approval, staff recommends that the Board of Supervisors approve this application, subject to the proposed conditions, consistent with other properties in the District.

TH/md
AFD21-2_9958MillPdRun

Attachments:
1. Ordinance
2. Location Map
3. Barnes Swamp AFD 2018 Renewal Ordinance and Staff Report
4. State Code § 15.2-4305 regarding AFD application criteria
5. CSWCD Conservation Plan
6. Unapproved minutes from the October 21, 2021 AFD Advisory Committee
7. Unapproved minutes from the December 1, 2021 Planning Commission meeting

ORDINANCE NO._____

AGRICULTURAL AND FORESTAL DISTRICT-21-0002

9958 MILL POND RUN, BARNES SWAMP ADDITION

WHEREAS, a request has been filed with the Board of Supervisors of James City County, Virginia, (the "Board of Supervisors") to add ±60.77 acres of land located at 9958 Mill Pond Run, further identified as James City County Real Estate Tax Map Parcel No. 0540100001, to Agricultural and Forestal District (AFD) No. 05-86, which is generally known as the "Barnes Swamp Agricultural and Forestal District" (the "Application"); and

WHEREAS, at its October 21, 2021, meeting, the AFD Advisory Committee voted 8-0 to recommend approval of the Application; and

WHEREAS, a public hearing was advertised and held by the Planning Commission (the "Commission") at its December 1, 2021, meeting, after which the Commission voted 7-0 to recommend approval of the Application; and

WHEREAS, a public hearing was advertised and held by the Board of Supervisors.

NOW, THEREFORE, BE IT ORDAINED that the Board of Supervisors of James City County, Virginia, hereby adds ±60.77 acres located at 9958 Mill Pond Run and identified as James City County Real Estate Tax Map Parcel No. 0540100001, (the "Property") to AFD-05-86, which is generally known as the "Barnes Swamp Agricultural and Forestal District" (the "District") with the following conditions:

1. The subdivision of land is limited to 25 acres or more, except where the Board of Supervisors authorizes smaller lots to be created for residential use by members of the owner's immediate family, as defined in the James City County Subdivision Ordinance. Parcels of up to five acres, including necessary access roads, may be subdivided for the siting of Wireless Communications Facilities (WCFs), provided: a) the subdivision does not result in the total acreage of the District to drop below 200 acres; and b) the subdivision does not result in a remnant parcel of less than 25 acres.

2. No land outside the Primary Service Area and within the District may be rezoned and no application for such rezoning shall be filed earlier than six months prior to the expiration of the District. Land within the District may be withdrawn from the District in accordance with the Board of Supervisors' Policy Governing the Withdrawal of Properties from Agricultural and Forestal Districts, adopted September 28, 2010.

3. No Special Use Permit (SUP) shall be issued except for agricultural, forestal, or other activities and uses consistent with the Agricultural and Forestal Districts Act (Va. Code § 15.2-4300 et seq.), which are not in conflict with the policies of this District. The Board of Supervisors, at its discretion, may issue SUPs for WCFs on properties in the District that are in accordance with the County's policies and Ordinances regulating such facilities.

_____

Chairman, Board of Supervisors

ATTEST:

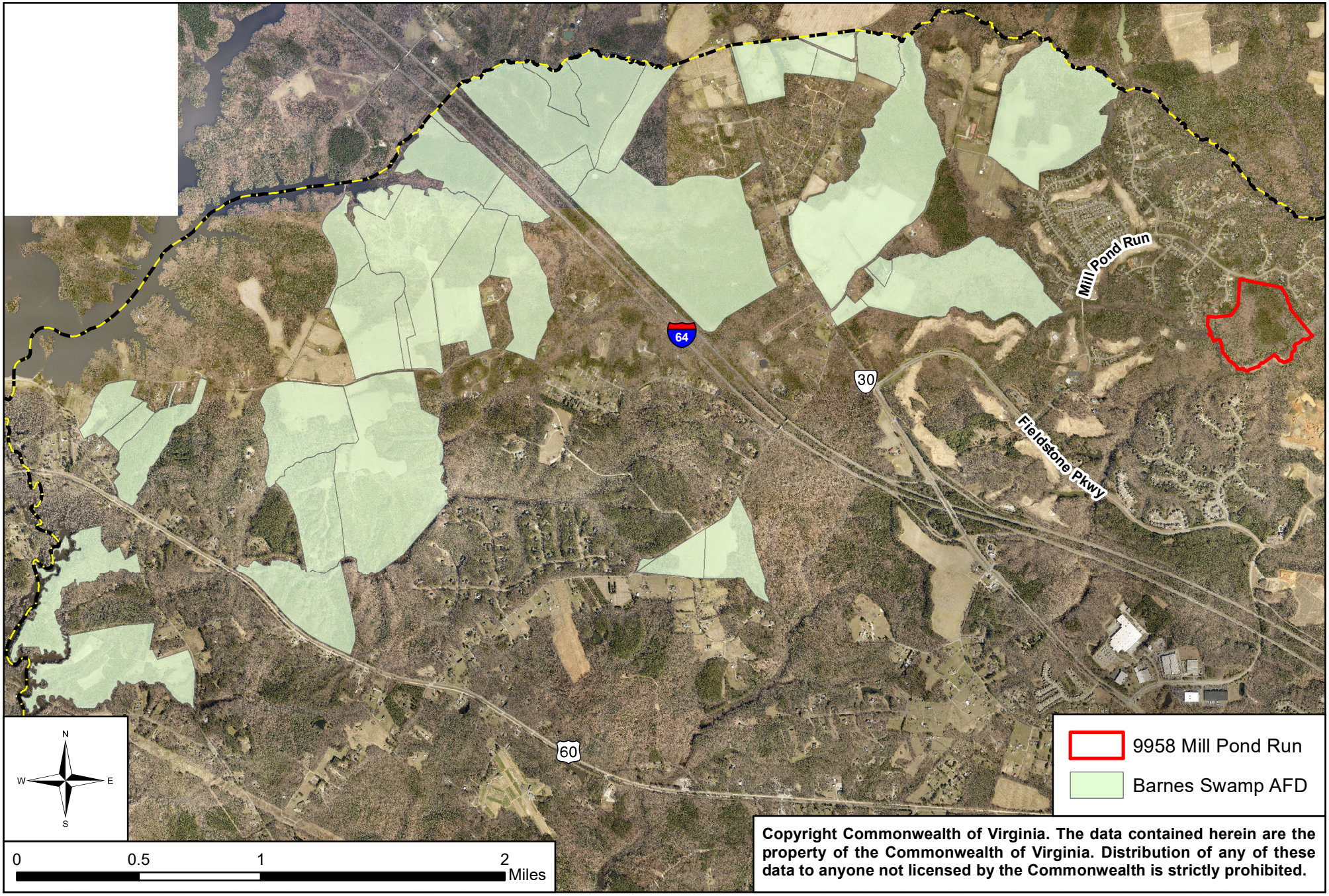
_____
Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

AFD21-2_9958MillPdRun-res

# JCC AFD-21-0002
# 9958 Mill Pond Run, Barnes Swamp AFD Addition

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ADOPTED

SEP 11 2018

Board of Supervisors
James City County, VA

ORDINANCE NO. 167A-14

AGRICULTURAL AND FORESTAL DISTRICT-05-86-1-2018

BARNES SWAMP 2018 RENEWAL

WHEREAS, James City County has completed a review of the Barnes Swamp Agricultural and Forestal District (the "District"); and

WHEREAS, in accordance with Section 15.2-4311 of the Code of Virginia, 1950, as amended (the "Virginia Code"), property owners have been notified, public notices have been filed, public hearings have been advertised, and public hearings have been held on the continuation of the District; and

WHEREAS, the Agricultural and Forestal District (AFD) Advisory Committee at its meeting on June 21, 2018, voted 9-0 to recommend renewal of the District; and

WHEREAS, the Planning Commission following its public hearing on August 1, 2018, concurred with the recommendation of staff and the AFD Advisory Committee and voted 5-0 to recommend renewal of the District with the conditions listed below.

NOW, THEREFORE, BE IT ORDAINED by the Board of Supervisors of James City County, Virginia, that:

1. The Barnes Swamp Agricultural and Forestal District (the "District") is hereby continued to October 31, 2022 in accordance with the provisions of the Virginia Agricultural and Forestal District Act, Virginia Code Section 15.2-4300 et. seq. (the "Act").

2. That the District shall include the following parcels, provided, however, that all land within 25 feet of road right-of-ways is excluded from the District:

| Owner | Parcel No. | Acres |
|---|---|---|
| SD & SKI, LLC | 0310100001 | 108.47 |
| Jane B. Farmer & Betty B. Rady | 0310100002 | 36.00 |
| Katherine Leon Hockaday | 0310100003 | 65.26 |
| Jane Farmer & Betty Rady | 0330100003 | 70.00 |
| Jane Farmer & Betty Rady | 0330100004 | 70.00 |
| Arline H. Bowmer Estate | 0330100006 | 96.75 |
| Arline H. Bowmer Estate | 0240100012 | 62.19 |
| Martha W. McMurran & SWR-Misc, LLC | 1010100001 | 61.61 |
| Elizabeth O. Harwood | 0320100001 | 43.52 |
| Stephen E. & Rebecca Murphy, Trustee | 0320100002 | 13.85 |
| Frederick C. Johnson, Trustee | 0320100002A | 17.20 |
| Betty L. Johnson & Lynne J. Fischer | 0320100003 | 19.07 |

| | | |
|---|---|---|
| Betty L. Johnson & Lynne J. Fischer | 0320100003A | 93.98 |
| Robert Michael Dzula | 0320100004 | 28.07 |
| John Avery Richardson | 0410100005 | 42.00 |
| John Avery Richardson | 0410100006 | 10.00 |
| Niceland Farm, LLC | 0420100008 | 189.74 |
| Cherri U. Spellmeyer | 0420100014 | 134.00 |
| Pamaka, LLC | 0430100015 | 21.99 |
| Pamaka, LLC | 0430100016 | 52.00 |
| Charles & Dianne Hasbrouck | 0920100001 | 97.50 |
| Alex Lamar Penland | 0240100029 | 55.90 |
| Donald A. Hazelwood | 0420100020 | 112.44 |
| Donald A. Hazelwood | 0420100018 | 3.46 |
| Donald A. Hazelwood | 0440100001 | 6.11 |
| John P. and Shelly D. Latoski Trustee | 0310100001B | 10.23 |
| Dennis Wayne Leonituk, Jr. | 0310100001A | 10.00 |
| Pamaka, LLC | 0430100014A | 1.34 |
| Steven M. & Michelle T. Johnson | 0340800003 | 52.63 |
| Steven M. & Michelle T. Johnson | 0340800005 | 68.43 |
| | Total: | 1,653.74 |

3. That pursuant to Sections 15.2-4312 and 15.2-4313 of the Act, the Board of Supervisors requires that no parcel in the District be developed to a more intensive use without prior approval of the Board of Supervisors. Specifically, the following restrictions shall apply:

   a. The subdivision of land is limited to 25 acres or more, except where the Board of Supervisors authorizes smaller lots to be created for residential use by members of the owner's immediate family, as defined in the James City County Subdivision Ordinance. Parcels of up to five acres, including necessary access roads, may be subdivided for the siting of Wireless Communications Facilities (WCFs), provided: a) The subdivision does not result in the total acreage of the District to drop below 200 acres; and b) the subdivision does not result in a remnant parcel of less than 25 acres.

   b. No land outside the Primary Service Area and within the District may be rezoned and no application for such rezoning shall be filed earlier than six months prior to the expiration of the District. Land within the District may be withdrawn from the District in accordance with the Board of Supervisors' Policy Governing the Withdrawal of Properties from Agricultural and Forestal Districts, adopted September 28, 2010.

   c. No Special Use Permit (SUP) shall be issued except for agricultural, forestal, or other activities and uses consistent with the Act, which are not in conflict with the policies of this District. The Board of Supervisors, at its discretion, may issue SUPs for WCFs on properties in the District that are in accordance with the County's policies and Ordinances regulating such facilities.

Ruth M. Larson
Chairman, Board of Supervisors

| | VOTES | | |
|---|---|---|---|
| | AYE | NAY | ABSTAIN |
| MCGLENNON | ✓ | | |
| ICENHOUR | ✓ | | |
| SADLER | ✓ | | |
| HIPPLE | ✓ | | |
| LARSON | ✓ | | |

ATTEST:

Teresa J. Fellows
Deputy Clerk to the Board

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of September, 2018.

AFD-BarnesSwpRnw-res

## SUMMARY FACTS

| LAND OWNERS | PARCEL ID | ACRES(±) |
|---|---|---|
| SD & SKI, LLC | 0310100001 | 108.47 |
| *Jane Farmer & Betty B. Rady* | *0310100002* | *64.00** |
| Katherine L. Hockaday | 0310100003 | 65.26 |
| Jane Farmer & Betty Rady | 0330100003 | 70.00 |
| Jane Farmer & Betty Rady | 0330100004 | 70.00 |
| Arline H. Bowmer Estate | 0330100006 | 96.75 |
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| John A. Richardson | 0410100006 | 10.00 |
| *Niceland Farm, LLC* | *0420100008* | *227.98*** |
| Cherri U. Spellmeyer | 0420100014 | 134.00 |
| Pamaka, LLC | 0430100015 | 21.99 |
| Pamaka, LLC | 0430100016 | 52.00 |
| Charles & Dianne Hasbrouck | 0920100001 | 97.50*** |
| Alex L. Penland | 0240100029 | 55.90 |
| Donald A. Hazelwood | 0420100020 | 112.44 |
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| Dennis W. Leonituk, Jr. | 0310100001A | 10.00 |
| Pamaka, LLC | 0430100014A | 1.34 |
| Steven & Michelle Johnson | 0340800003 | 52.63 |
| Steven & Michelle Johnson | 0340800005 | 68.43 |
| TOTAL ACRES | | 1,719.98 |

**Proposing to withdraw 28 acres, with 36 acres remaining in the Agricultural and Forestal District (AFD).*

***Proposing to withdraw 38.24 acres, with 189.74 acres remaining in the AFD.*

****Acreage has been updated based on boundary surveys that have been recorded for this property.*

Zoning: A-1, General Agricultural

Comprehensive Plan: Rural Lands; Open Space and Recreation

Primary Service Area (PSA): Outside

Staff Contact: Roberta Sulouff, Senior Planner

## PUBLIC HEARING DATES

Planning Commission: August 1, 2018, 6:00 p.m.
Board of Supervisors: September 11, 2018, 5:00 p.m.

## STAFF RECOMMENDATION

Approval, subject to the proposed conditions.

## AFD ADVISORY COMMITTEE RECOMMENDATION

At its June 21, 2018 meeting, the AFD Advisory Committee voted 9-0 to recommend the continuation of the District to the Planning Commission and Board of Supervisors.

## PLANNING COMMISSION RECOMMENDATION

At its August 1, 2018 meeting, the Planning Commission voted 5-0 to recommend the continuation of the District to the Board of Supervisors.

## DISTRICT HISTORY

- The Barnes Swamp AFD was created in 1986 for a term of four years and originally consisted of 29 parcels totaling ±1,905 acres.
- The District was renewed at four-year intervals again in 1990, 1994, 1998, 2002, 2006, 2010 and 2014 with various additions and withdrawals taking place during that period.
- There have been no additions to or withdrawals from the District since its most recent renewal in 2014.

## DISTRICT DESCRIPTION

This District is primarily forested, though records indicate that a significant portion of the land is actively in agricultural use. All the land in this District is zoned A-1, General Agricultural, located outside of the PSA, and designated Rural Lands and Open Space and Recreation by the adopted Comprehensive Plan.

Total acreage includes all the land in the above properties with the exception of all land within 25 feet of right-of-ways. This area has been excluded to allow for possible road and/or drainage improvements.

## ADDITION/WITHDRAWAL REQUESTS

- *Addition Requests:*
    - The owner of the property located at 10039 Old Stage Road (James City County Tax Map ID 0410100010) has applied to add approximately 196 acres to the District. That application will be evaluated under a separate cover and is tentatively scheduled for the Committee's consideration at the October 25, 2018, meeting.
- *Withdrawal Requests:*
    - The owners of the property located at 1245 Stewarts Road (James City County Tax Map ID No. 0310100002) have requested to withdraw 28 acres of their parcel out of the District. Thirty-six acres of the subject parcel would be left in the AFD.
    - The owners of the property located at 9812 Old Stage Road (Tax Map ID No. 0420100008) have requested to withdraw 38.24 acres of their parcel out of the District; 189.74 acres of the subject parcel would be left in the AFD.
    - With these withdrawals, the District would include a total of 1,653.56 acres, and will thus continue to meet minimum area requirements.

## CHANGES TO CONDITIONS

None.

## SURROUNDING ZONING AND DEVELOPMENT

The area surrounding the main body of the District is zoned A-1, General Agricultural and designated Rural Lands by the adopted Comprehensive Plan. Some parcels at the eastern end of the District are adjacent to the Stonehouse development, which is zoned Planned Unit Development and designated Low-Density Residential and Mixed Use by the adopted Comprehensive Plan. The Diascund Reservoir borders the main body of the District to the west and Mill Creek AFD is located directly south of the District.

## COMPREHENSIVE PLAN

The Comprehensive Plan designates these parcels as Rural Lands and Open Space and Recreation. Land Use Action 6.1.1 of the adopted

Comprehensive Plan states the County shall "support both the use value assessment and Agricultural and Forestal (AFD) programs to the maximum degree allowed by the *Code of Virginia*."

## STAFF RECOMMENDATION

Staff finds the Barnes Swamp AFD compatible with surrounding development and consistent with the recommendations of the adopted Comprehensive Plan and Zoning Ordinance. Staff recommends that the Board of Supervisors approve the renewal of this AFD for a period of four years subject to the conditions listed in the District Ordinance (Attachment No. 1).

RS/md
AFD-BarnesSwpRnw

Attachments:
1. Ordinance
2. Location Map
3. Property owner withdrawal request for 1245 Stewarts Road
4. Property owner withdrawal request and plat for 9812 Old Stage Road
5. Adopted conditions for the Barnes Swamp AFD
6. Board of Supervisors staff report for the 2014 renewal of the Barnes Swamp AFD

Code of Virginia
Title 15.2. Counties, Cities and Towns
Subtitle IV. Other Governmental Entities
Chapter 43. Agricultural and Forestal Districts Act

# § 15.2-4305. Application for creation of district in one or more localities; size and location of parcels

On or before November 1 of each year or any other annual date selected by the locality, any owner or owners of land may submit an application to the locality for the creation of a district or addition of land to an existing district within the locality. Each district shall have a core of no less than 200 acres in one parcel or in contiguous parcels. A parcel not part of the core may be included in a district (i) if the nearest boundary of the parcel is within one mile of the boundary of the core, (ii) if it is contiguous to a parcel in the district the nearest boundary of which is within one mile of the boundary of the core, or (iii) if the local governing body finds, in consultation with the advisory committee or planning commission, that the parcel not part of the core or within one mile of the boundary of the core contains agriculturally and forestally significant land. No land shall be included in any district without the signature on the application, or the written approval of all owners thereof. A district may be located in more than one locality, provided that (i) separate application is made to each locality involved, (ii) each local governing body approves the district, and (iii) the district meets the size requirements of this section. In the event that one of the local governing bodies disapproves the creation of a district within its boundaries, the creation of the district within the adjacent localities' boundaries shall not be affected, provided that the district otherwise meets the requirements set out in this chapter. In no event shall the act of creating a single district located in two localities pursuant to this subsection be construed to create two districts.

1977, c. 681, § 15.1-1511; 1979, c. 377; 1981, c. 546; 1984, c. 20; 1985, c. 13; 1987, c. 552; 1993, cc. 745, 761; 1997, c. 587; 1998, c. 833;2011, cc. 344, 355.

The chapters of the acts of assembly referenced in the historical citation at the end of this section(s) may not constitute a comprehensive list of such chapters and may exclude chapters whose provisions have expired.

**Colonial Soil & Water Conservation District**

**Conservation Plan for Chesapeake Bay Preservation Act Compliance**

**James City County, Municipal Code Sec. 23-9 (b) (11).**

**Tax Parcel Pin # 0540100001**

_____

Signature Date

***Chairman of Board of Directors, Colonial SWCD***

_____

Signature Date

***Plan Prepared By***

_____

Signature Date

***Land Owner/Operator***

*By signing this conservation plan coversheet, you the Land Owner/Operator agree to the provisions set forth in this plan as well as the following identified measures. For the purposes of the following provisions, the Colonial Soil & Water Conservation District is referred to as the "District", and James City County is referred to as the "County".*

1.) *District staff or County staff may need access to the property to assess progress of project completion, or for the purpose of verifying any ongoing managements as indicated here in; in such instances District or County staff will always seek to notify you of their intent prior to accessing the property, however by signing this document you are agreeing to offer conditional access for these purposes to the property defined in this conservation plan.*
2.) *By signing this document, the land owner/operator acknowledges that the management provisions in this plan may not ensure compliance with local, state, or federal regulations in adverse or extreme weather and/or climactic conditions (i.e. unforeseen drought, precipitation, flooding, etc.). Further management considerations may need to be undertaken to ensure soil and water resources are protected. District and County staff will assist*
3.) *By signing this document, the land owner/operator acknowledges that this plan may not ensure compliance with any future local, state, or federal laws and ordinances. It is the land owner/operator's*

- *Continued* -

*responsibility to ensure that the agricultural operation outlined in this plan is in compliance with such future ordinances, though the District and the County will assist you to the fullest extent of their ability in understanding future relevant regulations.*

4.) *If this conservation plan includes a Nutrient Management Plan drafted by a Dept. of Conservation and Recreation certified Virginia Nutrient Management Planner, the plan shall be followed and not deviated from, otherwise this plan shall be voided. If changes to the plan are necessary, contact the Nutrient Management Planner responsible and have an updated Nutrient Management Plan drafted, and provide a copy to the District.*

5.) *Should the operation outlined in this plan change in any meaningful way, this plan may be voided or an amendment to the plan be required, and any regulation or program satisfied by the implementation of this plan may no longer be. Such changes can include but are not limited to: the addition of livestock beyond numbers reflected by normal operation in this plan; the change in commodity crop grown, the modification of any forested or perennial grass buffer areas, the modification in any way of Chesapeake Bay Preservation Act area beyond that described in this plan, and other actions negatively impacting natural resources on or abutting this property. If you have a question about which activities may contribute to or cause a negative natural resource impact, please contact the District prior to initiating such activities.*

6.) *If this plan has not been executed or implemented within 5 years of the signature date, or meaningful steps taken towards the implementation of this plan are not readily apparent to County or District staff within that time frame, this plan shall be voided.*

*I (plan recipient) have read, understand, and agree to the provisions as set forth above* _____

Initial

# Plan Narrative
# 9958 Mill Pond Run
# Toano, VA 23168

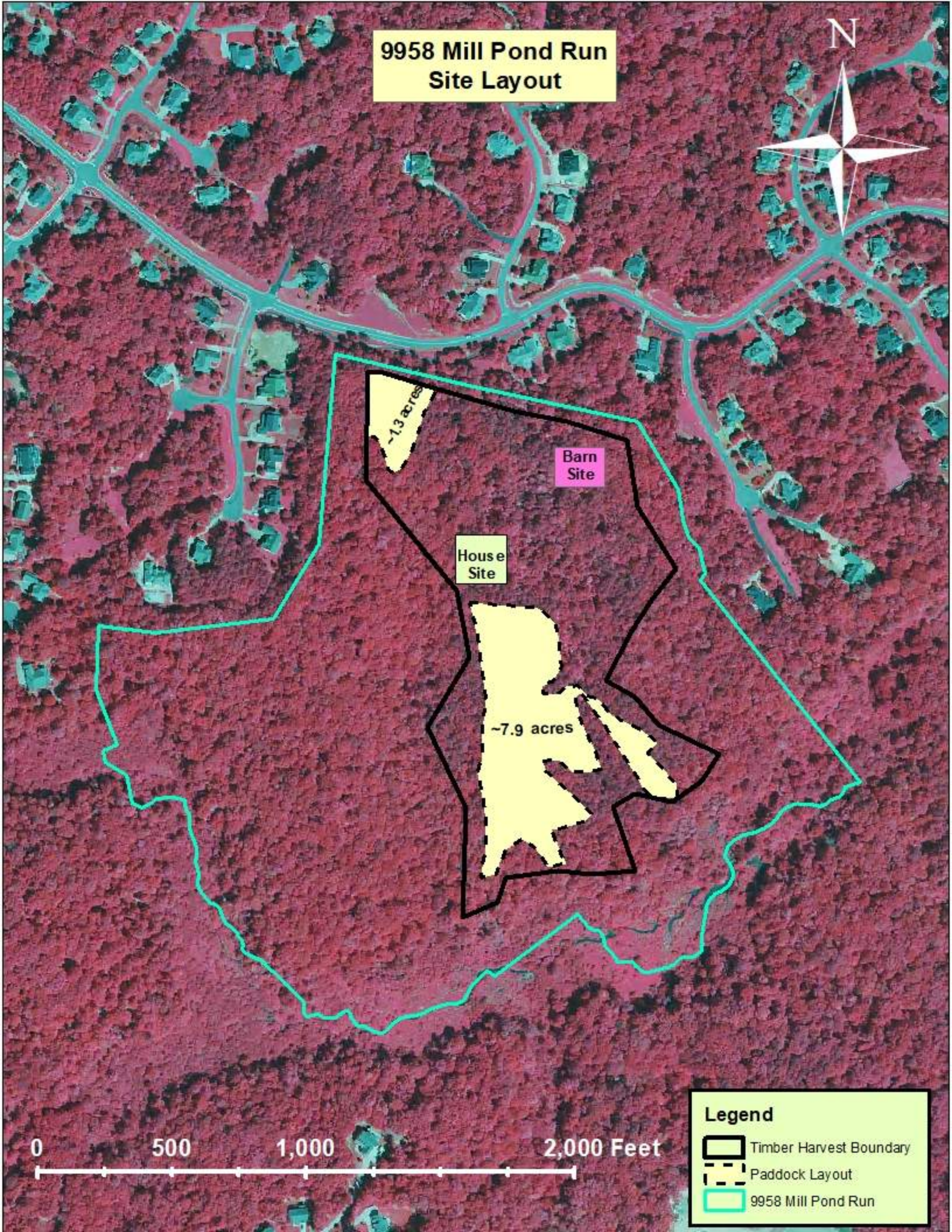
David and Karen Hogue own approximately 60 acres located off Mill Pond Run, adjacent to the Stonehouse subdivision, in James City County (photo right).

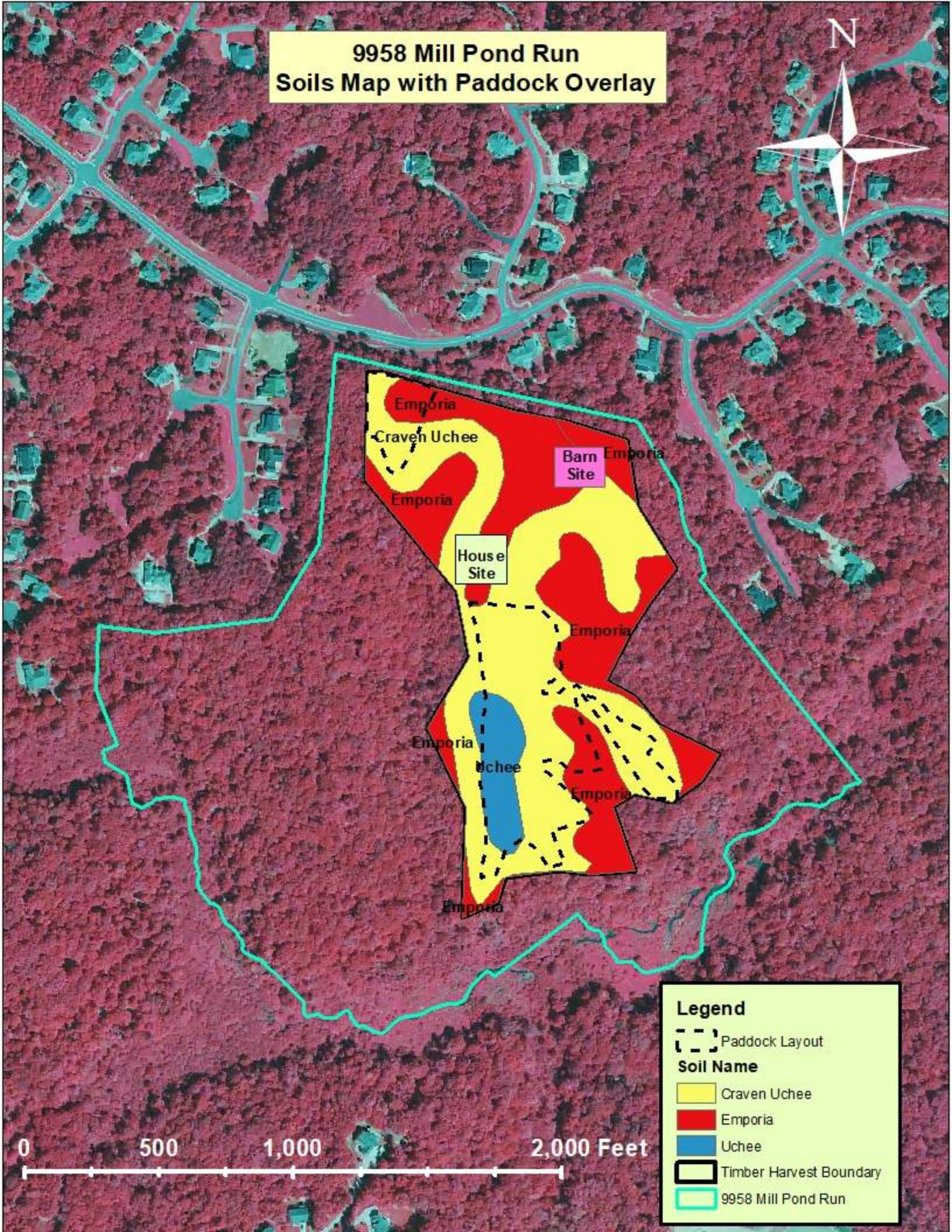
The site is zoned for general agriculture (A1) and can be further identified as James City County Parcel Number (PIN) 0540100001. The current landowners purchased the property in early 2021 with the intent to establish a small working horse farm. To facilitate the establishment of pasture, construct a barn, and install other agricultural infrastructure, approximately 23 acres of trees were harvested during the summer of 2021. The site can be characterized by its large size, relative to the residential sized lots of Stonehouse and its extreme topography, which ranges from nearly flat to very steep. Reviewing the historic aerial photography for 1937 and 1953, provided by USDA, it appears that agricultural activities have not been conducted on this parcel in the last 85 years.

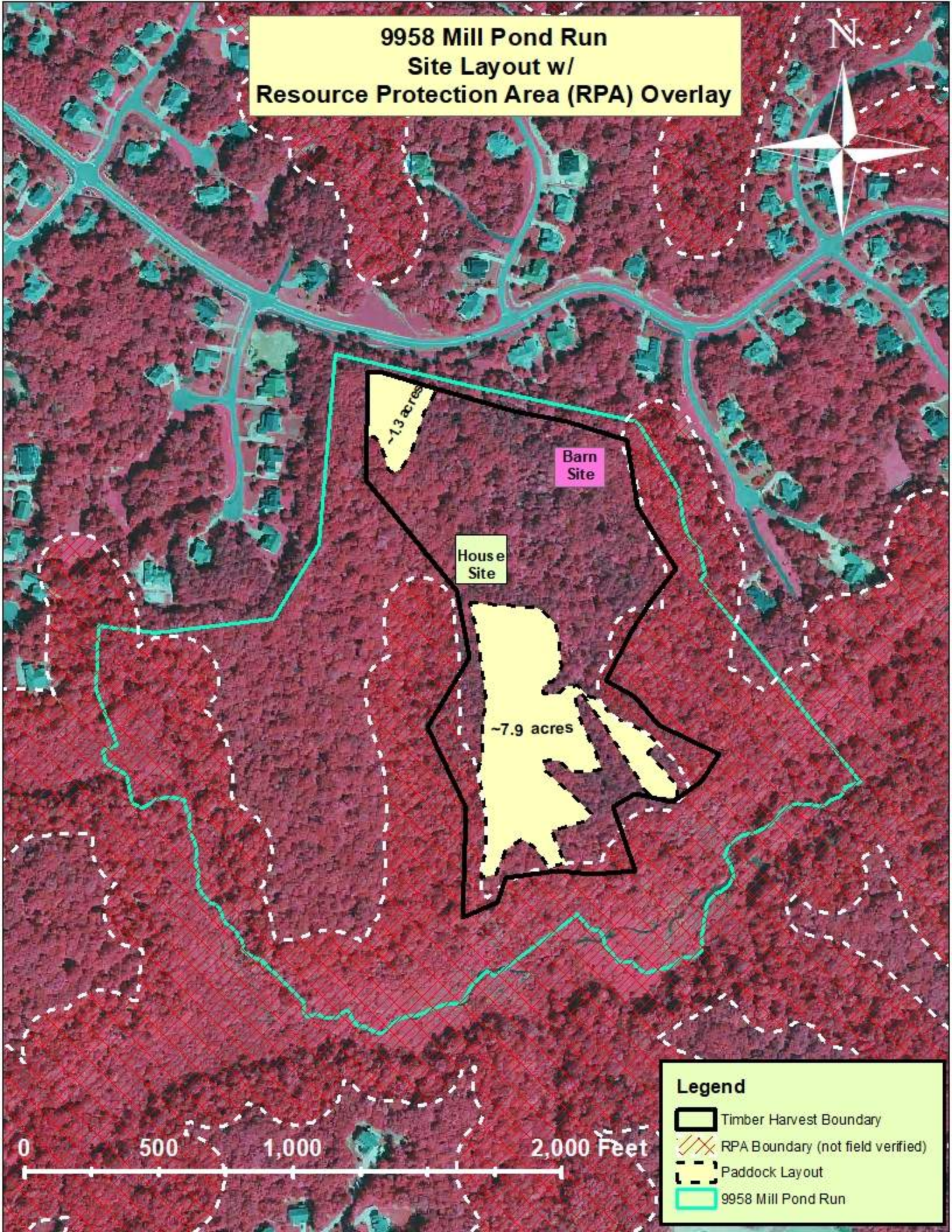
The landowner was referred to the Colonial SWCD by the Department of Forestry at the conclusion of the timber harvest, at which time district staff visited the site and collected soil samples to begin the process of developing a Soil and Water Quality Conservation Plan to comply with the County's Chesapeake Bay Preservation Ordinance. All agricultural land clearing activities in James City require a conservation plan approved by the Colonial SWCD. The following plan will offer recommendations that will help maintain stabilization throughout the process of converting portions of the parcel from a forested land use to an agricultural land use.

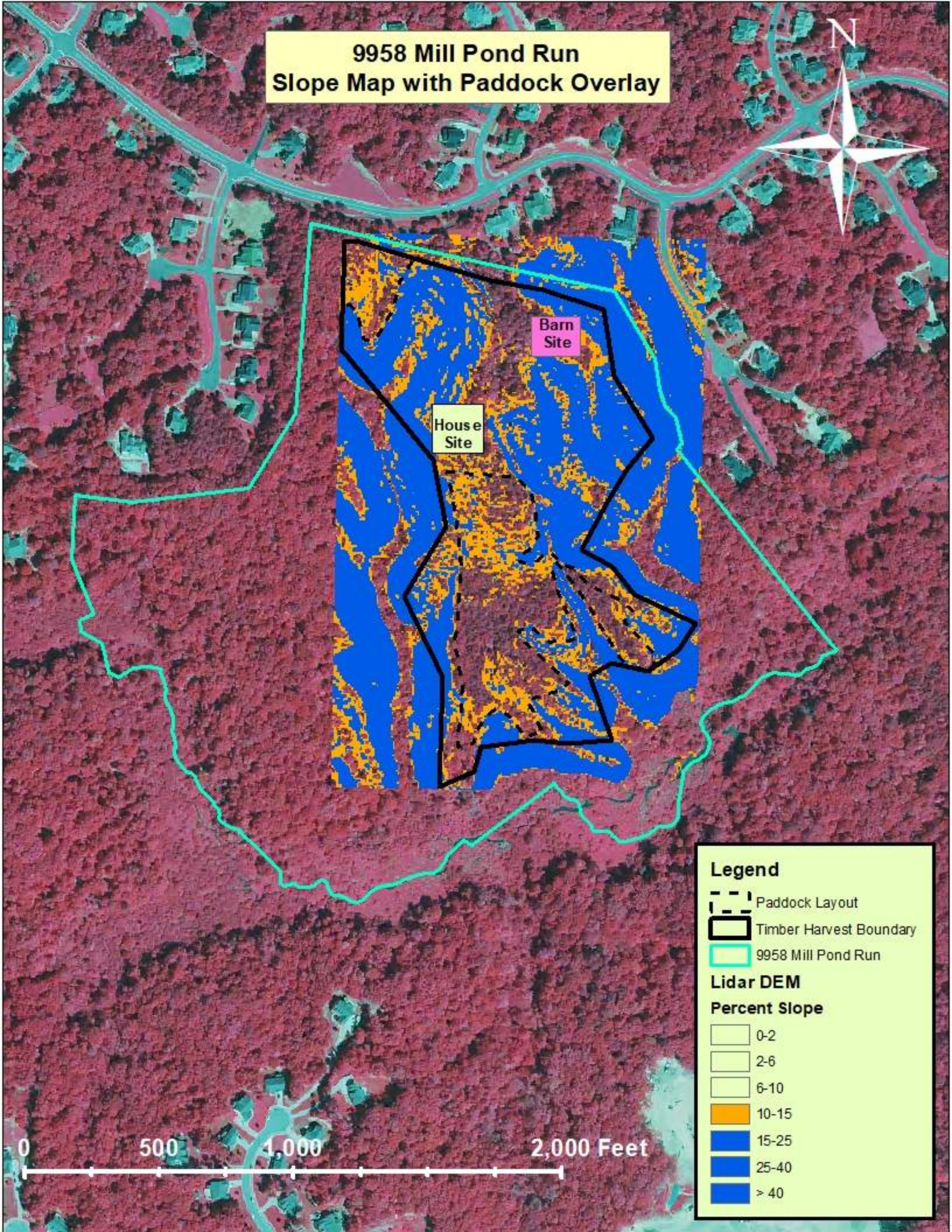
This plan has been developed to satisfy the requirements of James City County and meet the standards of the Colonial SWCD to maintain or improve water quality as it pertains to agricultural operation and management in the Commonwealth of Virginia. The conservation practices and management recommendations addressed in this plan represent treatments to protect the natural resources under the proposed agricultural production system. Material changes to the agricultural system will require updates to the plan.

The following plan has been reviewed by the District's conservation partners and approved by the Colonial SWCD Board of Directors. The County is the governing body with respect to the enforcement of this plan. In the event of an enforcement action, the Colonial SWCD will serve as a technical resource to the County to recommend appropriate management practices and suitable schedules for implementation to achieve environmental goals set forth by the County, state, and federal agencies.


9958 Mill Pond Run
Site Layout
N
~1.3 acres
Barn
Site
House
Site
~7.9 acres
0
500
1,000
2,000 Feet
Legend
Timber Harvest Boundary
Paddock Layout
9958 Mill Pond Run


9958 Mill Pond Run
Soils Map with Paddock Overlay
N
Emporia
Craven Uchee
Barn Site
Emporia
Emporia
House Site
Emporia
Emporia
Uchee
Emporia
Emporia
0
500
1,000
2,000 Feet
Legend
Paddock Layout
Soil Name
Craven Uchee
Emporia
Uchee
Timber Harvest Boundary
9958 Mill Pond Run


9958 Mill Pond Run
Site Layout w/
Resource Protection Area (RPA) Overlay
N
~1.3 acres
Barn Site
House Site
~7.9 acres
0
500
1,000
2,000 Feet
Legend
Timber Harvest Boundary
RPA Boundary (not field verified)
Paddock Layout
9958 Mill Pond Run


9958 Mill Pond Run
Slope Map with Paddock Overlay
N
Barn Site
House Site
Legend
Paddock Layout
Timber Harvest Boundary
9958 Mill Pond Run
Lidar DEM
Percent Slope
0-2
2-6
6-10
10-15
15-25
25-40
> 40
0
500
1,000
2,000 Feet

# James City County PIN 0540100001
# Conservation Plan Summary

## I. Intent

The intent of the following conservation plan is to document proposed agricultural management activities on the referenced parcel for the purpose of complying with the provisions of James City County's Chesapeake Bay Preservation Ordinance. Although this conservation plan has been developed to local and state government requirements for this purpose, it may not meet the requirements of the Virginia Department of Conservation and Recreation or the United States Department of Agriculture for state and federal government program eligibility or participation.

The management practices identified in this plan reflect treatments or considerations aimed to maintain stabilization of the site and protect natural resources during and after the process of converting forested land to an agricultural use. This plan includes recommendations based on the local topography, soils, and resources present on the parcel. Should the proposed agricultural management system change, or if changes to local, state, or federal regulations affect the management of the referenced parcel, an updated plan will be necessary.

## II. Plan

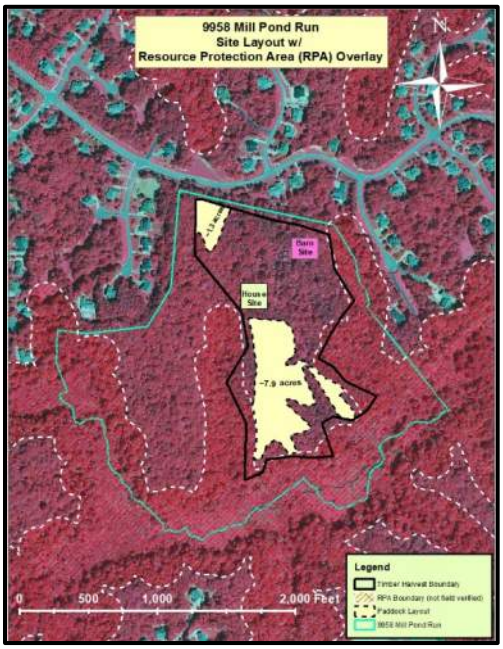
### 1. Proposed Operation Description

The project proposed for 9958 Mill Pond Run, is a land conversion for agricultural purposes. The landowner intends to develop approximately 10 acres of the property for an equine facility, to include multiple grazing paddocks, fence, barn and run-in structures, and watering infrastructure to include a well, pipelines, and watering troughs. Future infrastructure to support endeavor may include a manure storage shed and a barn or shed to provide shelter for livestock and/or farm equipment.

### 2. Chesapeake Bay Preservation Area

All lands in James City County are designated as Chesapeake Bay Preservation Area (CBPA), per county ordinance. CBPA is differentiated as Resource Protection Area (RPA) or Resource Management Area (RMA). RPA is defined by James City County as land adjacent to water bodies with perennial flows that have an intrinsic water quality value due to the ecological and biological process they perform or are sensitive to impacts which may result in significant degradation to the quality of state waters; these later water bodies are explicitly defined as tidal wetlands, nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow, and tidal shores. RPA is designated as being a 100-ft. buffer area, measured horizontally, and located adjacent to the aforementioned features and along both sides of any water body with perennial flow. All land not considered RPA is designated as RMA. Lands of particular sensitivity within RMAs include, but are not limited to, nontidal wetlands not in RPAs, floodplains, highly erodible soils, highly permeable soils, and hydric soils.

# James City County PIN 0540100001
# Conservation Plan Summary




The map, right, shows the County's RPA boundary in relation to the parcel boundary. The Colonial SWCD has not performed an on-site delineation of the RPA, rather has used the County's Geographic Information System (GIS) to make the claim that proposed agricultural activities will be conducted exclusively within the RMA. The RPA map shows that the timber harvest boundary (bold black line) does encroach into the 100' RPA buffer. For silvicultural activities, encroachment into the landward 50' of the RPA buffer is allowed. **No encroachment into the 100' RPA buffer is being requested by the landowner for the planned agricultural operation,** which will result in the need for that portion of the buffer to be restored or allowed to revert to its natural state.

Moving forward and as this conservation plan is implemented, should the site be determined to be out of compliance with James City County's Chesapeake Bay Preservation Ordinance, the County will have complete authority to take corrective action, as needed and authorized by the Commonwealth of Virginia. The Colonial Soil and Water Conservation District will assist the County, as appropriate, in the interest of protecting local soil and water natural resources.

## 3. <u>Site Conversion and Stabilization</u>

Due to the sandy and erodible nature of the soils found on site, combined with very steep topography, proper stabilization is very important. The proposed method or removing tree stumps, roots, and woody debris left over from the timber harvest will be a forest mulcher. It is highly recommended the forest mulching process grind stumps and roots as far below the soil as possible to reduce the amount of stump sprouting, incorporate mulch into the soil to aid with decomposition, and allow for adequate seed to soil contact.

The timeline for completion of this project is fluid and therefore requires alternatives for stabilization dependent upon the time of year in which the trees are cleared and site stabilization is necessary. It is recommended to be prepared to plant seed within a 30-day period after a seedbed is prepared with the forest mulcher. Long term exposure of heavily tilled/denuded soil to the elements can lead to severe erosion problems. When stabilizing slopes greater than 15%, the use of stabilization fabric is recommended along with a temporary seed mixture aimed at quick germination and establishment. Practice specifications for stabilization fabric and temporary seeding can be found at the end of this document. These practices are to be used during times of the year when establishing the primary forage species is not an option.

The table below summarizes actions to be taken based on the time of year:

James City County PIN 0540100001
Conservation Plan Summary

| Time of Year | Stabilization Species | Seeding Rate |
|---|---|---|
| April 15 -September 1 | Millet<br>or<br>Sorghum-Sudan Grass | Millet – 25-40 lbs/ac<br>Sorghum Sudan Grass – 30-40 lbs/ac |
| September 1 – October 15 | Clover, Pea, Radish mix | Clover – 6-8 lbs/ac<br>Pea – 10-12 lbs/ac<br>Radish – 1-2 lbs/ac |
| October 15 – December 1 | Cereal Rye or Annual Ryegrass | Cereal Rye – 75 lbs/ac<br>Ryegrass – 20-30 lbs/ac |
| December 1 – March 1 | Not Recommended | Not Recommended |
| March 1 – April 15 | Cereal Rye or Annual Ryegrass | Cereal Rye – 75 lbs/ac<br>Ryegrass – 20-30 lbs/ac |

In general, spring planted cool season grasses such as fescue will need a grow-in period that may last 12 months before grazing is recommended. During the grow-in period, use the heavy use area to allow horses to loiter when turned out of their stalls rather than boarding the animals in the pastures. If cool season grasses cannot be planted in the window of March 1st and April 15$^{th}$, consider planting a warm season (summer annual) crop to stabilize the soil and provide some supplemental grazing. Species such as Dwarf Pearl Millet or Crabgrass. Summer annuals will die with the frost in fall, and cool season species such as fescue can be direct seeded (no tillage necessary) over top of the summer annual plant residue. This fall window of seeding cool season species runs from September 1$^{st}$ through October 15$^{th}$.

Most agricultural activities are exempt from state Erosion and Sediment Control (E&S) regulations, which require disturbed (i.e. newly cleared) lands to be stabilized with seed, straw, and or other material within 7 days after final grade is achieved. While the clearing at 9958 Mill Pond Run is not required to follow Virginia E&S laws, it is highly recommended that disturbed lands and lands denuded of vegetation be stabilized as soon as possible after a seed bed is prepared, not to exceed 30 days.

Areas that have been timbered and will not be converted to pasture, barn, house, or roadway, must be planted/seeded with stabilizing vegetation, which could be trees, wildflowers, or warm season grasses, depending on the landowners' long-term goals. Information pertaining to establishment of warm season grasses and wildflower meadows are included as an appendix to this document.

**4. <u>Soils/Land Use</u>**

# James City County PIN 0540100001
# Conservation Plan Summary

The soil types as mapped by USDA (Web Soil Survey) on the parcel within the timbered area include the Craven-Uchee Complex (map complex unit symbol 11C), the Emporia fine sandy loam (14B), the Emporia Complex (15F), and the Uchee loamy fine sand (34B). A custom report detailing the soil's characteristics is included at the end of this document. These soils tend to have sandy surfaces and are known to suffer the effects of erosion if not properly vegetated and managed. Slopes greater than 15% are not recommended for agricultural operations and slopes between 10% and 15% may necessitate additional management to combat the potential for erosion, which may include:

- Perimeter Controls - A perimeter control is recommended to prevent sediment enriched stormwater from leaving the site. Typical perimeter controls include staked straw bales and silt fence. An alternative method for perimeter control is to create a brush berm made from the woody debris remaining after the timbering process. The woody material is laid parallel to the slope, and intercepts surface water as the water travels downhill. Over time, as the brush berm decays, the organic material left behind will improve the soil and encourage other vegetative growth. Specifications for straw bale barriers, silt fence, and brush barriers can be found as attachments at the end of this document.
- Temporary Slope Drain – A temporary slope drain is a tube or conduit which extends from the top to the bottom of a slope designed to carry concentrated stormwater down the slope face without causing erosion. A temporary slope drain can be used in conjunction with a temporary diversion at the top of the slope and a plunge pool at the bottom of the slope. Specifications for each of these BMPs can be found at the end of this document.
- Rock Check Dams – Rock check dams are temporary stone dams built perpendicular to the flow path of a swale or ditch. The dams intercept and reduce the velocity and energy of stormwater flows. The practice specification is attached to the end of this document.
- Stabilization Blanket – mentioned previously

**5. <u>Nutrient Management</u>**

Nutrients, especially nitrogen and phosphorus, represent one of agriculture's greatest potential threats to pollute local waterways, while simultaneously are inexorably essential for plant growth. The basis for Virginia's nutrient management program is the balance between agricultural economics, conventional land management practices, and mandates to reduce the level of nutrients reaching local water bodies, and ultimately the greater Chesapeake Bay. Nutrient Management Plans (NMPs) are developed by planners, certified by the Commonwealth of Virginia, and are consistent with standard agronomic principles and modern conservation practices.

A Nutrient Management Plan has been developed for this parcel. Recommendations for soil amendments such as lime and fertilizer have been made based on soil analysis results from the Virginia Tech soil testing lab, following Virginia's Nutrient Management Standards and Criteria. The management of nutrient applications (i.e. timing, application rate, source of nutrients, and placement) is extremely important to the health of the pasture and assists in the protection of local waterways, therefore it is very important that lime and fertilizer applications be made in conjunction with seeding and vegetative growth. The nutrient management plan that accompanies this

# James City County PIN 0540100001
# Conservation Plan Summary

conservation plan is a free-standing document, and also a component of this plan. If the landowner intends to deviate from the nutrient management plan as written, consult the district prior to implementing any changes to discuss revisions to the nutrient management plan. The table below summarizes actions necessary to implement the nutrient management plan.

| Area Name | Land Area | Lime Requirement | Fertilizer Requirement |
|---|---|---|---|
| Pasture #1 | 4.6 acres **or** 200,375 sq. ft. | **4 Tons/ac**<br>• Apply 2.0 tons/acre of lime as soon as the land is prepared by the forest mulcher.<br>• Apply 2.0 tons/ac of lime 6-12 months following the first application. | **Establishment – Year 1**<br>**Target: 40-170-140 (N-P-K)**<br>325 lbs/ac of 11-52-0 fertilizer blend will provide 36-169-0 plant food.<br>235 lbs/ac of 0-0-60 fertilizer blend will provide 0-0-141 plant food.<br>Together, these blends will provide 36-169-141 – close to the target<br>**Maintenance – Years 2 & 3**<br>**Target: 50-50-40 (N-P-K)**<br>350 lbs/ac of 13-13-13 fertilizer blend will provide 46-46-46 plant food – close to the target |
| Pasture #2 | 3.3 acres **or** 143,750 sq. ft. | **4 Tons/ac**<br>• Apply 2.0 tons/acre of lime as soon as the land is prepared by the forest mulcher.<br>• Apply 2.0 tons/ac of lime 6-12 months following the first application. | **Establishment – Year 1**<br>**Target: 40-170-160 (N-P-K)**<br>325 lbs/ac of 11-52-0 fertilizer blend will provide 36-169-0 plant food.<br>265 lbs/ac of 0-0-60 fertilizer blend will provide 0-0-159 plant food.<br>Together, these blends will provide 36-169-159 – close to the target<br>**Maintenance – Years 2 & 3**<br>**Target: 50-50-40 (N-P-K)**<br>350 lbs/ac of 13-13-13 fertilizer blend will provide 46-46-46 plant food – close to the target |

**Notes:**

1. A third pasture, located at the entrance to the property is being considered. The ~1.3 acre paddock contains the same soils and has the same level of fertility as the soil samples taken over the rest of the site. If the landowner chooses to convert the area to pasture, apply the same

nutrients applied to paddocks 1 & 2. Also, apply lime to the third paddock in the same manner as paddocks 1 & 2.

2. Fertilizer recommendations above are based on a "Do-It-Yourself" application, where pre-blended, bagged fertilizer is purchased. A custom fertilizer applicator such as Southern States, Nutrien, Home Field Fertilizer, etc., may be able to blend and apply the fertilizer recommended here. If that option is available, ask for 7.9 acres of 40-170-150.
3. Lime will take some time to chemically change the soil pH. Many factors determine the rate of change, but a soil test in spring of 2022, following the first lime application is recommended to measure the rate of change in soil pH and soil fertility.
4. Fertilizer blends mentioned above are examples of a multitude of fertilizer blends available in the marketplace and do not represent an endorsement of any fertilizer company.
5. Based on the planned acreage to be converted to pasture (7.9 acres), you'll need 16 tons of lime for the first application, then another 16 tons for the 2nd application in several months.
6. Due to the exceptionally low soil pH, consider broadcasting cereal oats and/or rye this fall, as a stabilization measure. In the spring, after the lime has had a chance to chemically react and raise soil pH some, plant your perennial forage grasses. If planting cereal grains, plant 2-3 bushels per acre.

## III. Additional Conservation Considerations

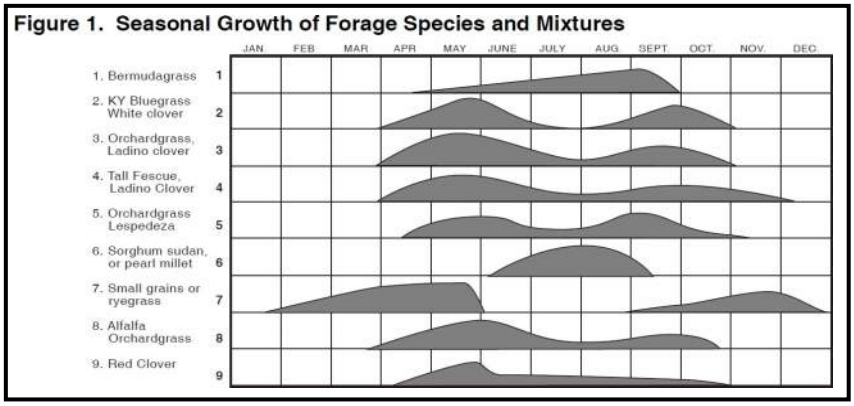
**Pasture Species & Mixes**

Planting pasture species targeted towards your intended livestock and for ease of maintenance is highly recommended. Therefore, use mowing/clipping to control weeds and undesirable species in areas of the pasture not grazed by the animals. If herbicides are used to selectively control weeds, be sure to follow the labeled instructions. Note:pesticide and herbicide labels, guidance, and instructions are informed by federal and state law, and are regularly updated.

It is advised that if in doubt of standards and requirements for use, the manufacturers website, orthe local Virginia Cooperative Extension office be consulted for assistance with use compliance.

Planting and maintaining multiple species can help improve soil health and function, may help alleviate pest and disease pressure, may assist in overall pasture vitality across seasonal shifts, willprovide a greater range of access to macronutrients and micronutrients for livestock, and is generally a good agricultural management consideration.

The landowner is urged to consider warm season forage such as Bermudagrass; It is drought and heat tolerant, responds well to summer nitrogen fertilization, and regenerates with fast growing stolons and rhizomes.



# James City County PIN 0540100001
# Conservation Plan Summary

Bermudagrass can be established by sodding, sprigging, or seeding. Cool season forages are a traditional choice in most pastures.
Fescue, including novel endophyte fescue, bluegrass, clover, etc. are generally planted in the coolseason of spring or fall. Specific recommendations can be found in the table below.

| **Forage Species** | **Establishment Window** | **"Seeding" Rate** | **Fertilize** |
|---|---|---|---|
| Bermudagrass | Seed: March – June<br>Sprigs: April – June<br>Sod: April - August | Seed: 40 lb. seed/acre<br>Sprigs: 40 bu/sprigs/ac<br>Sod: NA | May - August |
| Bluegrass | March 1 – April 15<br>**or**<br>September 1 – October 15 | Should not be seeded alone.<br>4-5 lbs./ac in a mix | March 15 – April 15<br>**or** September 15 – November 1 |
| Fescue | March 1 – April 15<br>**or**<br>September 1 – October 15 | 15 – 25 lbs./ac when seeded alone<br>**or**<br>6-12 lbs./ac in a mix | March 15 – April 15<br>**or**<br>September 15 – November 1 |
| Clover<br>(white, red, orcrimson) | 45 days before last killing frost of the spring **or** 30 days before the first killing frost in the fall | Should not be seeded alone.<br>1-2 lbs./ac in a mix | At time of planting |

For additional information, refer to the Virginia Tech Agronomy Handbook at:
http://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/424/424-100/PDF_part2.pdf

During the initial site visit, the landowner mentioned using a novel endophyte fescue variety. Attached in the appendix is a publication developed by University of Georgia Extension with some valuable information about novel endophyte fescues and how to establish them. In general, novel endophyte is a better choice of forage than endophyte free fescues due to their hardiness and sustainability.

**Fencing**

At a minimum, the perimeter of the pasture will need to be fenced. Interior fencing to create multiple paddocks is recommended. When sizing gates, consider the width of equipment that willaccess the paddocks. This equipment may include tractors, manure spreaders, etc.

**Water**

# James City County PIN 0540100001
# Conservation Plan Summary

Per conversation with the landowner, water to the paddocks will be supplied from a well. When possible, it is recommended that hydrants or animal waterers be placed in row with fence lines or in appropriate common areas; avoid steep slopes, low spots, and poor draining areas for waterers to reduce negative environmental impacts and improve longevity of infrastructure. The standards for laying water line follow general constructionspecifications in Virginia, and lines are recommended to be buried at a minimum depth of 2 ft. below the frost line. Other considerations recommended before install include future water use needs and location of associated hydrants, access to lines for flushing, and heavy use areas for the space directly around water troughs (recommended minimum 64 sq. ft.).

**Stocking Rates**

The Virginia Nutrient Management Standards and Criteria (2014) suggests that the soils on this site are capable of supporting one animal unit (1,000 lbs. of livestock, either singularly or combined) per 2-3 acres. This estimate is based on the livestock deriving 100% of their nutrition from grazing in the paddocks for 8 months out of the year. If supplemental feeding of grain and/or hay will be provided to the horses, then an increase in stocking density is possible. Over stocking of livestock, particularly horses, is a common management problem that often leads to denuded pastures, gully erosion, and poor equine health. Maintain pasture grass height at 3" or more and rotate horses out of pastures when grass height falls below 3". Use heavy use area to turn horses out when pastures have been grazed too short or when the soil is saturated or frozen.

**Manure Management**

The average horse produces approximately 50 lbs. of manure per day, in addition to the estimated15 lbs. of bedding material. These waste materials can build up quickly when multiple horses are boarded. In an effort to protect water resources on and adjacent to this property, we recommend composting these wastes and that any composting facility be either a self-contained unit (ex. drumcomposter) or a static pile with a concrete slab. Further, it is recommended that a heavy use area for machinery be established around and under any composting facility, and adequate protection for roof runoff of the compost structure be installed (ex. maintain or gravel perimeter at the dripline of the structure). It is also recommended that at least 2 manure composting facilities be constructed to accommodate the appropriate amount of time necessary for composting.

Key considerations for the location and construction of a manure composting structure include:

- Manure storage should be designed to limit the chance of leachate entering surface- and groundwater resources. Storage piles should be placed on a hardened surface such as a concrete pad that slope inward.
- Storage piles should not be placed in low-lying or flood-prone areas, and care should be taken to direct water from higher elevations away from the site. **Manure storage may not be located within a 100' RPA buffer area.**
- To comply with James City County ordinances, accessory structures such as a manure composting facility, should be a **minimum of 8 feet from property lines**.

- Prevailing wind direction may influence location of manure stockpiles.

While composting manure depends on several variables (Carbon:Nitrogen ratio of materials, temperature, moisture, particle size, aeration rate, etc.) some standard recommendations canguide the process.

- Compost can be managed in a relatively odorless manner, if odor is persistent consideradding more high-carbon ratio material (straw, wood chips, etc.).
- Pathogens and weed seeds are likely present in animal wastes, seek to reach and maintainthe appropriate temperature to kill off target pests. A blanket suggestion is between 131°Fand 170°F.
- Too high of a temperature within the pile can suppress the microbiota facilitating thedecomposition process. If the temperature reaches 180°F cool the pile down.
- Moisture is essential for effective composting and maintaining pile temperature. Use a moisture meter to check the pile and strive to keep the moisture between 45% and 60%.
- The pile will need to be aerated. Turn the pile every 4-7 days to achieve the fastestbreakdown timeframe.
- Compost piles may take 3 to 6 months to achieve a suitable decomposition level. If a pile isnot given the appropriate amount of time to break down, pathogens and weed seeds may still be present.

Please refer to Virginia Cooperative Extension publication 406-208 for more information onutilization of horse manure. (https://pubs.ext.vt.edu/406/406-208/406-208.html)

**Heavy Use Areas**

At certain times throughout the year pastures may not be suitable for animal traffic. Factors such as heavy rain, snow, herbicide applications, etc., can restrict the use of paddocks. Certain heavy use areas are highly recommended components of any livestock operation because they provide asuitable location for animals when pasture access is limited and protect soils at frequented locations. In all scenarios, it is recommended that heavy use areas are located on flat terrain.

For this operation, it is recommended that any shelters constructed for the horses have a heavy use component to reduce the impacts of animals when confined to a limited area for weather or

other reasons. An acceptable solution can be to utilize wood chips to provide an expendable, andcompostable material that will not impact animal hooves.

Additionally, for water troughs and supplemental feeding locations, heavy use areas are recommended due to the impacts associated with the frequency of use at and directly aroundthese sites.

Heavy use areas are most effective when the footprint is excavated to a depth of 6-10 inches, a woven landscape fabric is "keyed" into to the perimeter ground, and a sturdy, porous medium added to assist with draining. Example: excavation to 10 inches, grading and leveling of excavation,installation of woven landscape fabric, 5 in. depth of sand added, 5 in. depth of gravel on top to bring the heavy use area to level with surrounding landscape.

Regardless of the material, heavy use areas should be maintained. This maintenance can includeexcavating stone when pore spaces become filled in or compacted, replacing, or removing degraded mulch, and monitoring and repairing any damage to the functioning of the drainage ofthe site due to climatic, machinery and/or livestock related impacts.

For more information regarding heavy use areas, read ***Heavy Use Areas: A Guide for Planning & Building Heavy Use Areas for Horses & Livestock*** published by the Spokane County Conservation District. (http://www.sccd.org/wp-content/uploads/2015/07/Heavy-Use-Areas.pdf)

Similar to a heavy use area, it is recommended that a 24-30" strip of gravel, crush and run rock, or some other all-weather surface be placed against the interior of the fence line along the perimeterof the down slope fence. The recommendation is based on observations that horses tend to pace or walk along fences, which creates high traffic patterns that do not support vegetative growth (i.e., grass won't grow). The rock will reduce mud and reduce the volume and velocity of stormwater surface flow moving down the slope.

**Horse Pasture Management**

Refer to Virginia Cooperative Extension publication 418-101 for more information on pasturemanagement (http://pubs.ext.vt.edu/418/418-101/418-101.html)

**Pest Management**

Using pesticides to address on farm pests can be confusing. Virginia Cooperative Extension's 2020 Pest Management Guide helps resolve some of the questions raised farm operators. The 626-pagedocument includes information on agricultural crops and livestock commonly found in Virginia, including horses. Three key principles of proper pest management include:

1. Read and follow the pesticide label for your pest problem explicitly.
2. Store pesticide in their original container, preferably locked away from access to children,pets, and food, seeds, animal feed.
3. Dispose of pesticide containers properly

Virginia Tech Agronomy Handbook at:
http://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/424/424-100/PDF_part2.pdf

**Using Organic Materials**

Regular additions of organic materials (i.e., leaf compost, manures, etc.) is an excellent way to improve soil quality. Organic materials contain nutrients, but the quantity of nutrients varies

greatly depending on the source. If you add organic materials to your agricultural lands, test the materials for nutrient content if an analysis isn't provided for you. The nutrients added with organic amendments should be deducted from the plant nutrient needs recommended by your soil tests.

# Farm Narrative

David Hogue owns a parcel of land in James City County containing approximately 60 acres. In 2021, timer was harvested on approximately 23 of the 60 acres, and Mr. Hogue contacted the Colonial SWCD to write a conservation plan for the conversion of the cutover land to horse pasture. The land can be characterized as containing broad ridges, which transition to adjacent streams and wetlands via slopes which range from 5-40%. Soils on the site can become moderately productive with additions of lime and fertilizer, however, due to their sandy nature and topographic relief, are prone to leaching and erosion.

The conversion of the cutover land to horse pasture is proposed to be executed with a forest mulcher. Generally, forest mulchers do not penetrate far into the mineral soil. As a result, expect for tree stumps to re-sprout, which will require mechanical or chemical treatment to destroy. In addition, expect organic matter levels in the soil to increase as woody debris is mulched and left on the soil surface to decay. Through the decomposition process, microbes will consume nutrients applied as fertilizer, and may causes deficiencies, especially in nitrogen. The following plan allows for additional nitrogen to be applied in the fall of the year to produce more forage as the weather, and soil temperatures cool. The extra +/- 40 lbs. N/ac will be especially helpful in the first two years of pasture establishment. In addition to the nitrogen, phosphorus, and potassium fertilizer, lime will be a key factor in pasture establishment and grass health. Due to the extremely low soil pH, apply two tons of lime per acre when a seed bed is prepared, then apply another 2 tons per acre 6 to 12 months following the first application.

Establishing grass on this site is extremely important. For the landowner, a high-quality forage means lower feed (hay and or grain) bills. However, from an environmental standpoint, a well-established and maintained stand of grass protects the soil from rain drop impact. The roots of a well-established pasture provide structure to the sandy soil, binding it together. Maintaining the grass at no less than 3” in height will allow the grass to photosynthesize (feed itself) and slow stormwater runoff. When considered in concert, the benefits of a well-established and maintained pasture are numerous, which emphasizes how important it is to get it right the first time.

There is considerable cutover land on this tract that is not suitable for horse pasture or other agricultural activities. The Colonial SWCD does not recommend clearing slopes over 15%. The Virginia Nutrient Management Standards and Criteria (2014), the basis of this nutrient management plan, suggests that yield expectations be reduced by 25% for soils with extreme erosion potential, which can be found on this site. In addition, recommended animal stocking rates are reduced by 50% on slopes greater than 15%. Therefore, it is recommended that on areas not being converted to permanent pasture, consider reforestation, or some other permanent ground cover or use that will prevent erosion and absorb stormwater runoff.

# *NUTRIENT MANAGEMENT PLAN IDENTIFICATION*

***Operator***
*David Hogue*
*9958 Mill Pond Run*
*Toano, VA 23168*
*804-398-0424*

***Integrator:****None*

***Farm Coordinates***
*Easting: 0, Northing: 0, zone: 17*

***Watershed Summary***
watershed: YO62
county: James City

***Nutrient Management Planner***
*Jim Wallace*
*205 C Bulifants Blvd.*
*Williamsburg, VA 23188*

*Certification Code: 429*

***Acreage Use Summary***
Total Acreage in this plan: 9.2

| | |
|---|---|
| Cropland: | 0. |
| Hayland: | 0. |
| Pasture: | 9.2 |
| Specialty: | 0. |

***Livestock Summary***

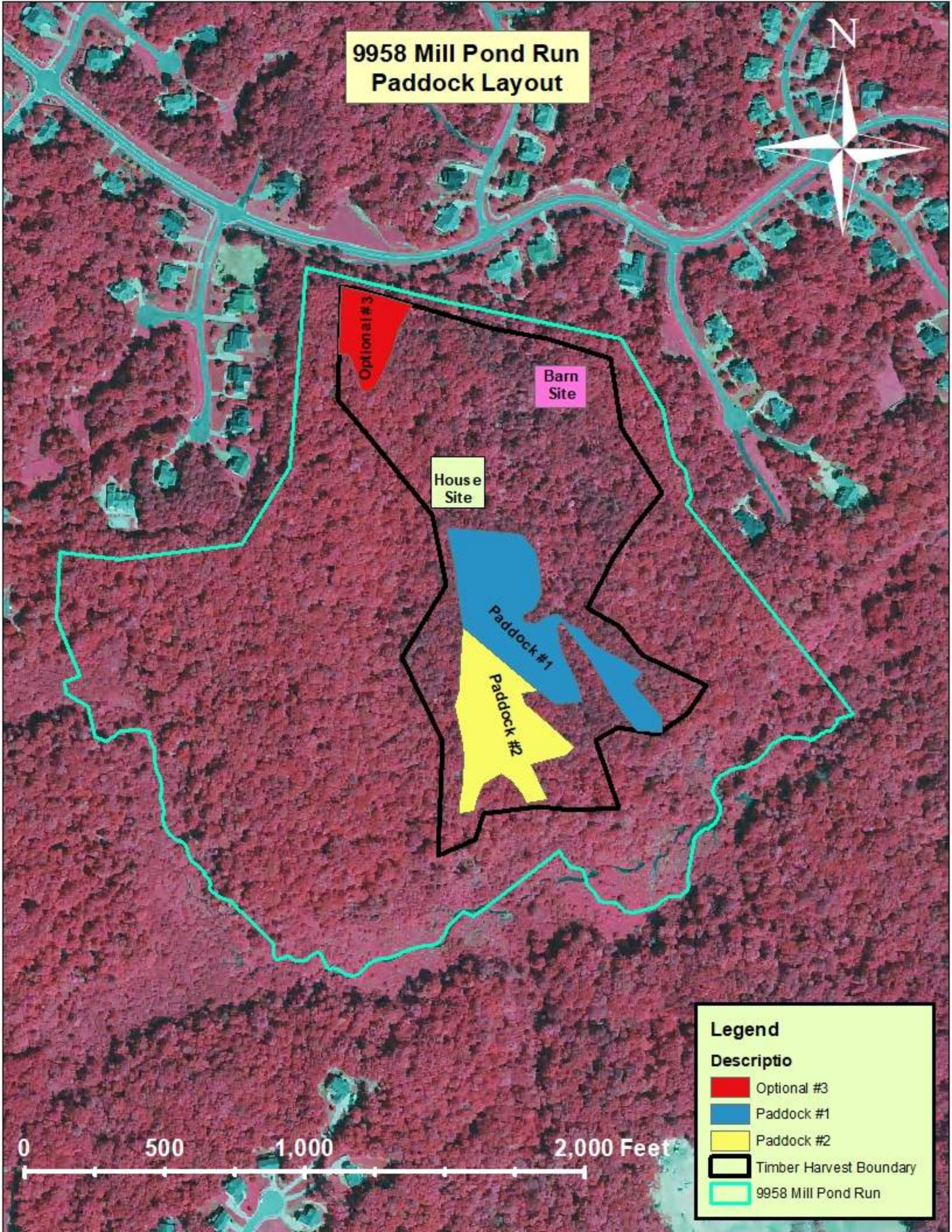
| | |
|---|---|
| Beef Cattle | 0 |
| Dairy Cattle | 0 |
| Poultry | 0 |
| Swine | 0 |
| Other | 0 |

***Manure Production Balance***

| | Imported | Produced | Exported | Used | Net |
|---|---|---|---|---|---|
| **kgals** | 0. | 0. | 0. | 0. | 0. |
| **tons** | 0. | 0. | 0. | 0. | 0. |

*Plan written 9/28/2021*
*Valid until 9/28/2024*

**Signature:** _____ 9/28/2021
**Planner** **date**


9958 Mill Pond Run
Paddock Layout
N
Optional #3
Barn Site
House Site
Paddock #1
Paddock #2
0
500
1,000
2,000 Feet
Legend
Descriptio
Optional #3
Paddock #1
Paddock #2
Timber Harvest Boundary
9958 Mill Pond Run

## *Field Productivities for Major Crops*

| Tract Name | Tract/ Field | Field Name | Acres | Predominant Soil Series | Corn | Small Grain | Alfalfa | Grass Hay | Environmental Warnings |
|---|---|---|---|---|---|---|---|---|---|
| Home | 0/0 | Optional Pas | 1 | Craven | IVa | III | Not Suited | III | |
| | 0/0 | Pasture #1* | 5 | Craven | IVb | III | Not Suited | III | High Leaching, High Slope |
| | 0/0 | Pasture #2* | 3 | Uchee | IVb | II | Not Suited | III | High Leaching, High Slope |

* Do not apply manure or biosolids more than 30 days prior to planting. Apply commercial fertilizer nitrogen to row crops in split spring applicaions.

## *Yield Range*

| Field Productivity Group | Corn Grain Bu/Acre | Barley/Intensive Wheat Bu/Acre | Std. Wheat Bu/Acre | Alfalfa Tons/Acre | Grass/Hay Tons/Acre |
|---|---|---|---|---|---|
| I | >170 | >80 | >64 | >6 | >4.0 |
| II | 150-170 | 70-80 | 56-64 | 4-6 | 3.5-4.0 |
| III | 130-150 | 60-70 | 48-56 | <4 | 3.0-3.5 |
| IV | 100-130 | 50-60 | 40-48 | NA | <3.0 |
| V | <100 | <50 | <40 | NA | NA |

# *Nutrient Management Plan Balance Sheet*
## *(Fall, 2021-Fall, 2024)*
## *Mill Pond Run*
## *Planner: Jim Wallace (cert. No. 429)*

**Tract: Home** **Location: James City**
**(N = N based, 1P = P based, 1.5P = P based at 1.5 removal, 0P = No P allowed)**

| Field CFSA No. /Name | Size (ac) Total/ Used | Yr. | Crop | Needs N-P-K (lbs/ac) | Leg /Man Resid | Manure/Biosld Rate & Type (season) | IT (d) | Man/Bios N-P-K (lbs/ac) | Net = Needs - appld N-P-K (lbs/ac) | Sum P rem cred | Commercial N-P-K (lbs/ac) | Notes | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0/Optional Pasture #3(N) | 1/1 | 2021 | Grass Pasture estb | 40-140-140 | 0/0 | | | | 40-140-140 | N/A | 40-140-140(br) | | |
| | | 2022 | Grass Pasture | 50-30-50 | 0/0 | | | | 50-30-50 | N/A | 50-30-50(br) | | |
| | | | | | | | | | | | 40-0-0(br) | 1 | |
| | | 2023 | ... ... ... | 50-30-50 | 0/0 | | | | 50-30-50 | N/A | 50-30-50(br) | | |
| | | | | | | | | | | | 40-0-0(br) | 1 | |
| | | 2024 | ... ... ... | 50-30-50 | 0/0 | | | | 50-30-50 | N/A | 50-30-50(br) | 2 | |
| 0/Pasture #1(N) | 5/5 | 2021 | Grass Pasture estb | 40-170-140 | 0/0 | | | | 40-170-140 | N/A | 40-170-140(br) | | |
| | | 2022 | Grass Pasture | 50-60-60 | 0/0 | | | | 50-60-60 | N/A | 50-60-60(br) | | |
| | | | | | | | | | | | 40-0-0(br) | 1 | |
| | | 2023 | ... ... ... | 50-60-60 | 0/0 | | | | 50-60-60 | N/A | 50-60-60(br) | | |
| | | | | | | | | | | | 40-0-0(br) | 1 | |
| | | 2024 | ... ... ... | 50-60-60 | 0/0 | | | | 50-60-60 | N/A | 50-60-60(br) | 2 | |
| 0/Pasture #2(N) | 3/3 | 2021 | Grass Pasture estb | 40-170-160 | 0/0 | | | | 40-170-160 | N/A | 40-170-160(br) | | |
| | | 2022 | Grass Pasture | 50-60-60 | 0/0 | | | | 50-60-60 | N/A | 50-60-60(br) | | |
| | | | | | | | | | | | 40-0-0(br) | 1 | |
| | | 2023 | ... ... ... | 50-60-60 | 0/0 | | | | 50-60-60 | N/A | 50-60-60(br) | | |
| | | | | | | | | | | | 40-0-0(br) | 1 | |
| | | 2024 | ... ... ... | 50-60-60 | 0/0 | | | | 50-60-60 | N/A | 50-60-60(br) | 2 | |

**Commercial Application Methods:**
**br - Broadcast ba - Banded sd - Sidedress**

***Notes:***
1 If additional production is needed later in the growing season, apply 40-60 lbs./ac N in late summer.
2 New soil tests are recommended before this nutrient application. New soil tests will gage the effectiveness of previous lime and fertilizer applications.

# Virginia Cooperative Extension
## Soil Test Report

*Questions? Contact:*
James City County Office
3127 Forge Road
P.O. Box 69
Toano, VA 23168-0069
757-564-2170

Virginia Tech Soil Testing Laboratory
145 Smyth Hall (0465)
185 Ag Quad Ln
Blacksburg, VA 24061
www.soiltest.vt.edu

SEE NOTES:
1 3
at www.soiltest.vt.edu under Report Notes

OWNER
HOGUE DAVID
9958 MILL POND RUN

TOANO, VA 23168

COPY FOR
JIM WALLACE

SAMPLE HISTORY

| Sample ID | Field ID | LAST CROP | | LAST LIME APPLICATION | | SOIL INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Yield | Months Prev. | Tons/Acre | SMU-1 % | SMU-2 % | SMU-3 % | Yield Estimate | Productivity Group |
| PAST1 | | | | --- | | 18B 50 | 11C 50 | | | |

LAB TEST RESULTS (see Note 1)

| Analysis | P (lb/A) | K (lb/A) | Ca (lb/A) | Mg (lb/A) | Zn (ppm) | Mn (ppm) | Cu (ppm) | Fe (ppm) | B (ppm) | S.Salts (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|
| Result | 3 | 76 | 193 | 49 | 0.9 | 5.6 | 0.2 | 70.1 | 0.1 | |
| Rating | L- | M- | L- | L+ | SUFF | SUFF | SUFF | SUFF | SUFF | |

| Analysis | Soil pH | Buffer Index | Est.-CEC (meq/100g) | Acidity (%) | Base Sat. (%) | Ca Sat. (%) | Mg Sat. (%) | K Sat. (%) | Organic Matter (%) |
|---|---|---|---|---|---|---|---|---|---|
| Result | 4.5 | 5.68 | 5.1 | 84.5 | 15.5 | 9.5 | 4.0 | 1.9 | |

FERTILIZER AND LIMESTONE RECOMMENDATIONS

**Crop:** Orchardgrass/Fescue-Clover Establishment (31)

| Lime, Tons/Acre | |
|---|---|
| Amount | Type |
| 4.75 | AG |

| Fertilizer, lb/A | | |
|---|---|---|
| N | P205 | K20 |
| 40 | 170 | 140 |

**620. For best results, the lime should be applied six months to one year ahead of time.**

**121. P2O5 and K2O recommendations will supply the needed nutrients for establishment and one harvest year's growth.**

**823. Apply the nitrogen at the time the grass is seeded in late summer, early fall or early spring. Overseed the grass with clover the following February.**

**991. "Explanation of Soil Tests, Note 1" and other referenced notes are viewable at www.soiltest.vt.edu under Report Notes.**

# *Virginia Cooperative Extension*
## Soil Test Report

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**3127 Forge Road**
**P.O. Box 69**
**Toano, VA 23168-0069**
**757-564-2170**

**Virginia Tech Soil Testing Laboratory**
**145 Smyth Hall (0465)**
**185 Ag Quad Ln**
**Blacksburg, VA 24061**
**www.soiltest.vt.edu**

**SEE NOTES:**
1 3
**at www.soiltest.vt.edu under Report Notes**

OWNER
HOGUE DAVID
9958 MILL POND RUN

TOANO, VA 23168

COPY FOR
JIM WALLACE

**SAMPLE HISTORY**

| Sample ID | Field ID | LAST CROP | | LAST LIME APPLICATION | | SOIL INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Yield | Months Prev. | Tons/Acre | SMU-1 % | SMU-2 % | SMU-3 % | Yield Estimate | Productivity Group |
| PAST2 | | | | --- | | 34B 50 | 11C 50 | | | |

**LAB TEST RESULTS (see Note 1)**

| Analysis | P (lb/A) | K (lb/A) | Ca (lb/A) | Mg (lb/A) | Zn (ppm) | Mn (ppm) | Cu (ppm) | Fe (ppm) | B (ppm) | S.Salts (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|
| Result | 3 | 54 | 113 | 30 | 0.6 | 2.6 | 0.1 | 54.5 | 0.1 | |
| Rating | L- | L | L- | L | SUFF | SUFF | SUFF | SUFF | SUFF | |

| Analysis | Soil pH | Buffer Index | Est.-CEC (meq/100g) | Acidity (%) | Base Sat. (%) | Ca Sat. (%) | Mg Sat. (%) | K Sat. (%) | Organic Matter (%) |
|---|---|---|---|---|---|---|---|---|---|
| Result | 4.4 | 5.79 | 4.1 | 88.4 | 11.6 | 6.9 | 3.0 | 1.7 | |

**FERTILIZER AND LIMESTONE RECOMMENDATIONS**

**Crop:** Orchardgrass/Fescue-Clover Establishment (31)

| Lime, Tons/Acre | | Fertilizer, lb/A | | |
|---|---|---|---|---|
| Amount | Type | N | P205 | K20 |
| 4 | Dolomitic | 40 | 170 | 160 |

**620. For best results, the lime should be applied six months to one year ahead of time.**

**121. P2O5 and K2O recommendations will supply the needed nutrients for establishment and one harvest year's growth.**

**823. Apply the nitrogen at the time the grass is seeded in late summer, early fall or early spring. Overseed the grass with clover the following February.**

**991. "Explanation of Soil Tests, Note 1" and other referenced notes are viewable at www.soiltest.vt.edu under Report Notes.**

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SEE NOTES:
1 12
at www.soiltest.vt.edu under Report Notes

OWNER
HOGUE DAVID
9958 MILL POND RUN

TOANO, VA 23168

COPY FOR
JIM WALLACE

SAMPLE HISTORY

| Sample ID | Field ID | LAST CROP | | LAST LIME APPLICATION | | SOIL INFORMATION | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Yield | Months Prev. | Tons/Acre | SMU-1 % | SMU-2 % | SMU-3 % | Yield Estimate | Productivity Group |
| Option | | | | --- | | 15F 100 | | | | |

LAB TEST RESULTS (see Note 1)

| Analysis | P (lb/A) | K (lb/A) | Ca (lb/A) | Mg (lb/A) | Zn (ppm) | Mn (ppm) | Cu (ppm) | Fe (ppm) | B (ppm) | S.Salts (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|
| Result | 15 | 97 | 241 | 56 | 1.5 | 5.3 | 0.3 | 89.3 | 0.1 | |
| Rating | M- | M- | L | L+ | SUFF | SUFF | SUFF | SUFF | SUFF | |

| Analysis | Soil pH | Buffer Index | Est.-CEC (meq/100g) | Acidity (%) | Base Sat. (%) | Ca Sat. (%) | Mg Sat. (%) | K Sat. (%) | Organic Matter (%) |
|---|---|---|---|---|---|---|---|---|---|
| Result | 4.4 | 5.54 | 6.1 | 84.2 | 15.8 | 9.9 | 3.8 | 2.0 | |

FERTILIZER AND LIMESTONE RECOMMENDATIONS

Crop: PINE ESTABLISHMENT (109)

| Lime, Tons/Acre | |
|---|---|
| Amount | Type |
| 3.75 | AG |

| Fertilizer, lb/A | | |
|---|---|---|
| N | P205 | K20 |
| 0 | 50 | 40 |

186. See Note 12 for further information on fertilization and liming.

991. "Explanation of Soil Tests, Note 1" and other referenced notes are viewable at www.soiltest.vt.edu under Report Notes.

Virginia Cooperative Extension
Virginia Tech • Virginia State University
Publication 442-305

# Nutrient Management for Small Farms

*Jactone Arogo Ogejo, Extension Specialist, Biological Systems Engineering, Virginia Tech*
*Rory Maguire, Extension Specialist, School of Plant and Environmental Sciences, Virginia Tech*

## Introduction

The basic principles of nutrient management on small farms are similar to those of large farms. However, small farms may have a greater challenge with managing manure nutrients because of (1) the different characteristics of manure from the multiple animal species they keep, (2) the limited land area available to apply manure, and/or (3) a lack of equipment for manure management and spreading. The purpose of this publication is to outline how to quantify and determine use of manure nutrients in small farms as a crop fertilizer in order to prevent environmental damage that may be caused by nutrient losses.

## What Is a Small Farm?

Small farms are diverse, ranging from retirement and residential farms with few off-farm sales to commercially oriented farms with annual sales approaching $250,000.

## What Is Nutrient Management?

Nutrient management is the process used to handle the application of nutrients to crops, including their quantity, form, placement, and timing. On most farms, the nutrients predominantly come from manure and commercial fertilizer, but other sources, such as compost, can also be important. The purpose of nutrient management is to supply sufficient plant nutrients for optimum forage and crop yields, and thus prevent excess applications that can contaminate water quality. A nutrient management plan (NMP) documents the source, rate, method, and timing of nutrient applications.

## Movement of Nutrients on a Farm

To manage manure effectively, it is important to consider the entire farm's nutrient balance. Figure 1 provides an overview of nutrient cycling on a farm. Usually, there is a tendency to focus on manure management alone, which may only account for a small part of the total nutrients. Nutrient dynamics include inputs, outputs, what is lost, and what is stored on the farm. It is necessary to consider the big picture in order to understand and identify the sources of nutrients potentially associated with environmental issues and how to develop solutions to deal with the problems they create.

**Farm nutrient inputs** include purchased animals, feed, fertilizer, legume nitrogen, and bedding. **Farm nutrient outputs** are products that are moved out of the farm through sales or given away, including animals, milk, meat, eggs, manure, and crops. Recycling of nutrients occurs on the farm when manures from livestock are used for crop fertilizer, and then the crops are harvested and fed to the livestock. The optimal goal is to have a situation whereby the farm can balance the inputs with crop and animal needs to minimize risk of environmental damage.

The major nutrients of interest are nitrogen (N) and phosphorus (P). Losses of N occur via leaching of nitrates to groundwater, volatilization of ammonia to the atmosphere, and phosphorus (P) runoff into the surface water. Phosphorus may also accumulate in the soil to levels greater than crop needs and cause excessive losses in runoff. Nutrients may leave the farm when manure is used for off-site energy generation (thermal and biological processes) and composting.

## Estimating Manure Quantity and Nutrients on a Farm

In general, the quantity and nutrient content of manure depend on the species, breed, and age of the animal and the composition of feed in their diet. Table 1 presents quantity and nutrient content of freshly excreted manure from different animal species, usually referred to "as excreted."

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Produced by Virginia Cooperative Extension, Virginia Tech, 2018

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VT/1218/442-305(BSE-241P)

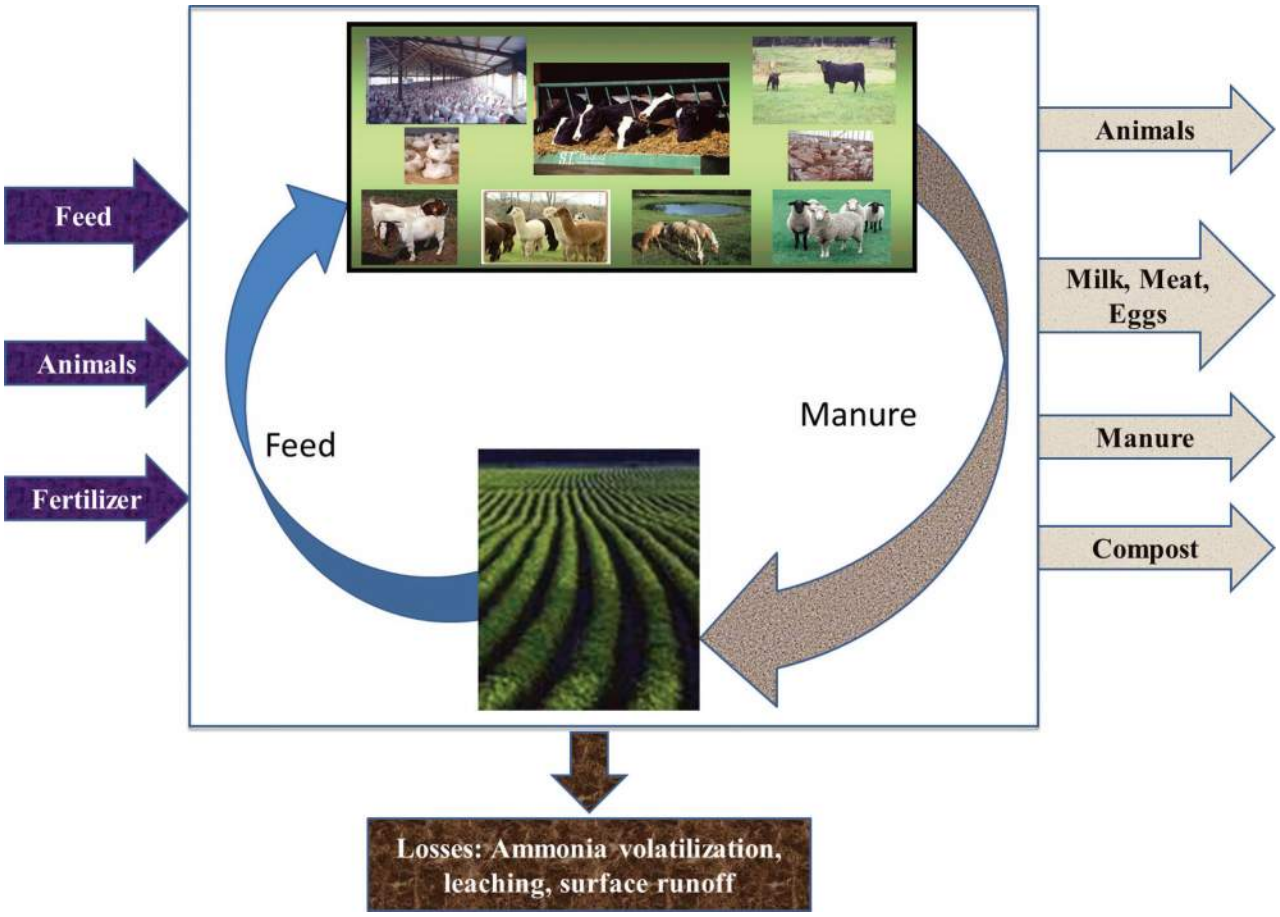


Figure 1. Nutrient cycling on a farm operation

The composition of manure applied to cropland is usually different from that of freshly excreted manure because of decomposition and losses during storage. The amount of loss depends on the climate, transformation of nutrients, storage period, and type of manure handling system used. Major losses are from N volatilization and leaching of soluble nutrients. Some studies have indicated that as much as 50 to 70 percent of N may be lost from manure (depending on how it is stored), due to ammonia volatilization and denitrification to dinitrogen gas ($N_2$). Phosphorus and potassium (K) losses are less likely except for manure not contained properly. Tables 2 and 3 present the nutrient content of stored manure for the common animal species in Virginia.

Manure quantities in table 1 are suitable for planning short-term storage and nutrient application where there is no manure storage on the farm. Tables 2 and 3 are useful in estimating the amount of nutrients that will be available for application to cropland after storage. The data in tables 2 and 3 also include standard deviations, which show how the nutrients in manure vary and how close individual manure samples are to the average value. These values should be used as a guide and only when manure analyses for your farm are not available.

Manure composition can vary widely, so testing is the most accurate way to determine nutrient content. Taking a representative sample from your manure is important because manure composition is not consistent. For example, manure on the surface of a pile will contain less N because of ammonia loss than that deeper in the pile. To learn how to take a representative sample, see the publication by Maguire, Hodges, and Crouse (2009).

Also, all phosphorus in manure is considered plant-available. This is not the case for N because it is so mobile and exists in many forms. The total N and ammonium-N in manure are used to calculate the plant-available component, as described in *Soil Test Note No. 5: Fertilizing with Manures*, Virginia Cooperative Extension (VCE) publication 452-705 *(https://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/452/452-705/452-705_pdf.pdf)*. The example below shows how to estimate the nutrients on a farm with several animal species.

**Table 1. Quantity of manure produced daily and nutrient concentrations as excreted by different animals.**

| Animal type | Weight (lb) | Quantity produced per day: Weight (lb) | Quantity produced per day: Volume (gal) | Moisture content (%) | Nutrients (lb/day per animal): Total N | Nutrients (lb/day per animal): Total P ($P_2O_5$) | Potassium ($K_2O$) |
|---|---|---|---|---|---|---|---|
| **Dairy** | | | | | | | |
| Lactating | Mature | 150 | 18.00 | 87 | 0.99 | 0.39 | 0.28 |
| Dry | Mature | 83 | 9.72 | 87 | 0.50 | 0.15 | 0.40 |
| Heifer | 970 | 48 | 5.83 | 83 | 0.26 | 0.10 | 0.33 |
| Calf | 250 | 22 | 2.60 | 87 | 0.11 | 0.04 | 0.09 |
| **Beef** | | | | | | | |
| Finishing | 975 | 58 | 6.9 | 88 | 0.36 | 0.11 | 0.30 |
| Cow (confined) | Mature | 64 | 7.80 | 88 | 0.42 | 0.22 | 0.36 |
| Calf (confined) | 500 | 29 | 3.5 | 88 | 0.29 | 0.13 | 0.23 |
| **Horses** | 1,100 | 57 | 6.80 | 85 | 0.34 | 0.17 | 0.25 |
| **Poultry** | | | | | | | |
| Broilers | 2.5 | 0.2290 | 0.0265 | 74 | 0.0025 | 0.0017 | 0.0017 |
| Layers | 2.5 | 0.1900 | 0.0232 | 75 | 0.0035 | 0.0025 | 0.0016 |
| **Turkey** | | | | | | | |
| Male (toms) | 17 | 0.5850 | 0.0730 | 74 | 0.0090 | 0.0062 | 0.0051 |
| Female (hens) | 10 | 0.3620 | 0.0430 | 74 | 0.0054 | 0.0034 | 0.0029 |
| Sheep | 63 | 3.1800 | 0.4190 | 70 | 0.0319 | 0.0089 | 0.0316 |
| Goats | 64 | 3.4200 | 0.3800 | 64.5 | 0.0412 | 0.0092 | 0.0367 |

Source: ASABE 2005; MWPS 1993; Barker, Zublena, and Walls 2001.

**Table 2. Average nutrient content (± standard deviation) of liquid manure for different animal species at the time of application in Virginia.**

| Animal | Samples (#) | Moisture content (%) | Nutrient (lb/1,000 gal): Total N | Nutrient (lb/1,000 gal): Ammonium-N | Nutrient (lb/1,000 gal): Total P ($P_2O_5$) | Nutrient (lb/1,000 gal): Potassium ($K_2O$) |
|---|---|---|---|---|---|---|
| Beef | 59 | 93.1 (±2.3) | 22.11 (±3.30) | 9.51 (±1.52) | 12.50 (±3.51) | 19.61 (±3.42) |
| Dairy | 1,181 | 94.0 (±1.3) | 21.19 (±3.94) | 9.18 (±0.52) | 9.18 (±1.11) | 21.25 (±9.79) |
| Swine | 617 | 98.9 (±0.5) | 9.06 (±0.93) | 6.61 (±0.73) | 4.20 (±1.32) | 12.28 (±0.98) |

Source: Virginia Department of Conservation and Recreation.

**Table 3. Average nutrient content (± standard deviation) of solid manure for different animal species at the time of application in Virginia.**

| Animal | Samples (#) | Moisture content (%) | Nutrient concentration (lb/ton): Total N | Nutrient concentration (lb/ton): Ammonium-N ($NH_4$-N) | Nutrient concentration (lb/ton): Total P ($P_2O_5$) | Nutrient concentration (lb/ton): Potassium ($K_2O$) |
|---|---|---|---|---|---|---|
| Dairy | 384 | 65.8 (±2.6) | 19.78 (±10.94) | 2.99 (±0.72) | 7.93 (±1.58) | 17.98 (±9.87) |
| Beef | 142 | 59.6 (±4.8) | 23.81 (±10.98) | 2.34 (±0.43) | 12.71 (±2.50) | 26.08 (±11.69) |
| Swine | 6 | 46.1 (±27.1) | 29.45 (±13.04) | 7.80 (±1.98) | 24.35 (±18.34) | 10.75 (±5.93) |
| Broiler | 2,025 | 27.8 (±0.6) | 66.58 (±3.49) | 11.05 (±0.61) | 48.09 (±8.50) | 54.25 (±2.26) |
| Layer (breeders) | 436 | 30.7 (±2.0) | 48.68 (±3.98) | 8.45 (±0.54) | 57.85 (±8.92) | 44.77 (±2.72) |
| Turkey | 1,017 | 29.5 (±1.0) | 66.54 (±6.44) | 13.5 (±0.41) | 49.74 (±7.42) | 41.73 (±5.31) |
| Turkey (breeders) | 107 | 24.4 (±2.6) | 59.18 (±5.60) | 11.91 (±1.76) | 57.45 (±9.72) | 38.02 (±6.12) |

Source: Virginia Department of Conservation and Recreation.

## Example: Estimating Quantity and Nutrients in Manure

A farm has 50 lactating cows, five dry cows, 45 heifers, 40 goats (1-year-olds), 1,000 broilers, and five horses. Estimate (1) the amount of manure generated per year; (2) the nutrient content (nitrogen, phosphorus, and potassium) in manure excreted by each of the animals; and (3) the total nitrogen, phosphorus, and potassium produced on the farm annually.

The answers to this example can be obtained by using table 1.

1. Estimate the amount of manure generated in a year.For each animal species, estimate by multiplying "volume of manure produced per day" by the number of animals on the farm and the number of days in a year.

   Lactating cows:
   18 gal/animal-day × 50 animals × 365 days/year = 328,500 gal

   Dry cows:
   9.72 gal/animal-day × 5 animals × 365 days/year = 17,739 gal

   Heifers:
   5.83 gal/animal-day × 45 animals × 365 days/year = 95,758 gal

   Goats:
   0.38 gal/animal-day × 40 animals × 365 days/year = 5,548 gal

   Broilers:
   0.00265 gal/bird-day ×1,000 birds × 365 days/year = 9,673 gal

   Horses:
   6.8 gal/animal-day × 5 animals × 365 days/year = 12,410 gal

2. Estimate the amount of nutrients in the manure that are generated in a year.

   For each animal species, estimate each nutrient — nitrogen, phosphorus, and potassium — by multiplying pounds of the nutrient in manure produced per day by the number of animals on the farm and the number of days in a year. The calculations for nitrogen values are presented below. You can estimate phosphorus and potassium using the same method and compare with the answers given in table 4.

   Lactating cows:
   0.99 lb N/animal-day × 50 animals × 365 days/year = 18,608 lb N

   Dry cows:
   0.5 lb N/animal-day × 5 animals × 365 days/year = 913 lb N

   Heifers:
   0.26 lb N/animal-day × 45 animals × 365 days/year = 4,271 lb N

   Goats:
   0.0412 lb N/animal-day × 40 animals × 365 days/year = 602 lb N

   Broilers:
   0.0025 lb N/bird-day ×1,000 birds × 365 days/year = 913 lb N

   Horses:
   0.34 lb N/animal-day × 5 animals × 365 days/year = 621 lb N

3. Estimate the total amount of manure and nutrients in the manure generated in a year.The total amount of manure and nutrients generated on the farm in a year is the sum of all the manure produced by each species, as shown in table 4.

**Table 4: Total manure and nutrient production in a year.**

| Animal | Manure (gal) | N (lb) | $P_2O_5$ (lb) | $K_2O$ (lb) |
|---|---|---|---|---|
| Dairy: lactating | 328,500 | 18,608 | 7,118 | 5,293 |
| Dairy: dry | 17,739 | 913 | 274 | 730 |
| Dairy: heifers | 95,758 | 4,271 | 1,643 | 5,417 |
| Goats | 5,548 | 602 | 134 | 536 |
| Broilers | 9,673 | 913 | 621 | 621 |
| Horses | 12,410 | 621 | 310 | 456 |
| Total | 469,628 | 25,385 | 10,009 | 10,052 |

## How To Decide Location and Nutrient Application Rates

Conduct a farm risk assessment using a farm map to determine appropriate areas for spreading. Consider slope, distance to water sources, erosion potential of the land where manure might be applied, and soil nutrient tests. Soil testing is the basis of good nutrient management, and soil samples should be taken regularly. Details regarding sampling procedures and laboratory methods are available at *www.soiltest.vt.edu*.

A soil sample should be taken every three to five years. From the soil test data, knowledge of the soil type, and the crop to be grown, nutrient and lime application rates can be determined for optimum crop growth. A three-year sampling interval is recommended for row crops and hay systems where nutrients are removed in harvested crops; a five-year sampling interval is acceptable for forage systems where grazing animals return nutrients to the soil through their manure. Soil pH must be kept within a specific range for each crop, and your soil test report will include the lime requirement (if any) along with nutrient recommendations. Lime supplies calcium, but the main benefit is to increase the pH of the predominantly acidic soils we have in Virginia.

# Source of Nutrients

Once your soil test tells you the quantity of nutrients required in each field, the next step is to decide what source of nutrients to use. If you have manure on the farm, it is normally cheapest to use this before purchasing any commercial fertilizer. The problem with manure is that its ratio of nitrogen to phosphorus is low compared to crop requirements, so applying manure to meet crop nitrogen needs overapplies phosphorus (unless soil test phosphorus is low) and applying to meet crop phosphorus needs underapplies nitrogen. The solution to this is either (1) apply manure according to crop phosphorus needs or supplement with commercial nitrogen fertilizer; or (2) apply according to crop nitrogen needs once every three years, track soil test phosphorus, and use no phosphorus fertilizer or manure in the intervening two years.

Once you have decided where to use your manure, the remaining nutrient needs can be made up through commercial fertilizers. There are various fertilizers available that can be mixed to provide the correct quantities of the primary nitrogen, phosphorus, potassium, and other secondary and micronutrients. Common commercial fertilizers and how to calculate application rates are covered in *Fertilizer Types and Calculating Application Rates*, VCE publication 424-035 (*https://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/424/424-035/424-035_pdf.pdf*).

## Summary

**Step 1:** Estimate the total nutrients on your farm. Use manure analysis data for your farm if available. Otherwise, use local book values or general book values provided by professional organizations whose work involves manure.

**Step 2:** Test soils in the fields where manure is to be applied. This test will tell you the amount of nutrients needed for the planned crops for that field.

**Step 3:** Determine how much of the nutrients required by the crops in step No. 2 will come from manure. Plan use of manure based on the nutrient (phosphorus or nitrogen) that limits manure application.

**Step 4:** Determine how much supplemental commercial fertilizer is needed to meet crop nutrient needs for optimum production.

## When and How to Apply

Lime takes time to react in the soil, so it should be applied several months in advance of planting or at the start of the growing season for perennials, if possible. Nutrients — especially nitrogen, which is very mobile in soil — should be applied as close to planting as possible or at the start of the growing season for perennials. This will maximize nutrient use by the crop and minimize unwanted losses through runoff and leaching that can be economically and environmentally damaging.

When deciding how to apply the nutrients, there are several factors to take into consideration, including manure and equipment availability and cropping system. Losses of nutrients in runoff are generally less if they can be placed under the soil surface, either through injection or incorporation. However, special equipment is needed for injection, while incorporation through tillage conflicts with forage and no-till systems and can increase soil erosion. Therefore, surface applications of manure or fertilizer are most common.

# Record Keeping

Keeping good nutrient management plan records is critical for demonstration of good environmental stew-

ardship. Records should include the necessary items to help with proper development/improvement and implementation of the nutrient management plan. The records may be kept in various ways, ranging from a simple handwritten logbook to a detailed, computer-based spreadsheet. Records should document the quantity and location of nutrients on the farm.

The basic components of a record book consist of:
- Number and type of animals.
- Manure generated and inventory.
- Manure applied to land or used on the farm.
- Any manure (excess or otherwise) moved off the farm through sales or given away.
- Any other change that affects quantity of manure produced on the property that is not listed above.

Records should be maintained for a period of five years for other beneficial uses, which include making important business decisions that affect farm income; improving efficiency of production by evaluating the yields, soil tests, manure nutrients, and usage as a fertilizer; and using other commercial fertilizers. Although not a desirable situation, records provide the potential to reduce liability for producers should they be accused of environmental mismanagement. The records will help document responsibility and show the practices in place on the farm to manage nutrients.

## Manure Records

Where animals are housed or confined, manure accumulation will occur, making manure collection and storage necessary. It is important to know the quantity and nutrient content of the manure to plan for its use. It is a good practice to collect and send manure samples for analysis.

Manure records should include:
- Sampling date.
- Sampling protocol.
- Name of the person who took the samples.
- Name of the analytical laboratory.
- Analytical results.

If manure is to be moved off the property, the records to keep include:
- Amount (volume or weight) of manure produced or handled.
- Date of manure transfer.
- Volume or weight of manure transferred.
- Name and address of person to whom manure is given or sold.

## Storage

The two critical issues or questions one should consider about storage structures are their capacity and maintenance. Manure storage structures should have enough capacity to allow for the environmentally safe utilization of the manure and wastewater generated by an operation. "Environmentally safe utilization" means that manure and wastewater are not land-applied at times or under conditions that increase the likelihood of nutrients to enter surface water.

These conditions or periods include:
- High precipitation.
- Frozen or snow-covered ground.
- Saturated soil (with water and nutrients).
- Floods.
- Near the end of or after the growing season, when crops cannot take up applied nutrients.

Adequate capacity will provide the operator with the flexibility to make changes to the NMP, especially if manure storage for a longer time is required. Details on how to site, size, and maintain a storage structure can be found in *Selection and Location of Poultry and Livestock Manure Storage*, VCE publication 442-307*(https://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/442/442-307/442-307_pdf.pdf)*; and *Poultry and Livestock Manure Storage: Management and Safety*, VCE publication 442-308 (http://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/442/442-308/442-308_pdf.pdf).

Specific records to keep for manure storage are:
- Animal numbers (monthly or weekly).
- Storage capacity.
- Storage volumes or levels recorded weekly.
- Any changes to the storage structure.
- Dates and quantities of any discharges from storage and corrective measures taken to manage the discharges.
- Notes on weekly or regular inspections of the storage structure's integrity, including the liquid depth marker.
- Other information.

## Land Application

Records concerning land application activities that the farmer is to maintain should be specified in the plan. Land application records are critical because they enable farmers to demonstrate that they are applying manure and wastewater in accordance with a site-specific NMP. Land application records will demonstrate that the manure and wastewater are being applied in

accordance with the requirements of the NMP.

Specific records for land application include:

- Location and description of land where manure is applied.
- Area of land where manure is applied.
- Date the manure is applied.
- Volume or weight of manure applied.
- Application rates of manure nutrients and fertilizer by field and year.
- Manure incorporation methods.
- Weather conditions at the time of application and 24 hours before and after application.
- Explanation of the basis for determining manure application rates.
- Calculations showing the total nitrogen and phosphorus to be applied to each field, including sources other than manure, litter, or process water.
- Total amount of nitrogen and phosphorus actually applied to each field, including documentation of calculations for the total amount applied.
- Methods used to apply the manure, litter, or process water.
- Dates of manure application equipment inspection.
- Expected crop yields.
- Soil test results.
- Conservation practices to reduce nutrient losses.

## Other Records

- Mortality management.
- Manure and wastewater analysis.
- Soil tests.
- Crop yields.
- Equipment inspections and calibrations.
- Handling, use, and management of chemicals on the farm.

# Resources


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UNIVERSITY OF GEORGIA
EXTENSION

# Novel Endophyte-Infected Tall Fescue

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Tall fescue (*Schedonorus phoenix* (Scop.) Holub) is a cool season perennial grass that fills a critical forage produc-tion gap in the Southeast and is the predominant forage crop in much of the U.S. In fact, this species is the most widely used grass in improved U.S. pastures, occupying more than 36 million acres. Its popularity is related to establishment ease, drought tolerance, excellent grazing persistence, and a long grazing season.

Some of these desirable attributes are due to the presence of a fungus (*Neotyphodium coenophialum*) that lives inside the plant (endophyte). This fungus is transmitted from one generation to the next in the seed. It is not transmitted through pollen or from plant to plant.

Unfortunately, this endophyte produces toxic alkaloids that greatly decrease animal gains and reproductive perfor-mance, which, conservatively estimated, costs the U.S. beef industry from $600 million to more than $1 billion annually. Removing the toxin-producing endophyte alleviates animal symptoms and improves animal performance but reduces the longevity, vigor, and drought tolerance of the tall fescue stand.

Recently, endophyte strains that do not produce toxic ergot alkaloids have been identified and inserted into tall fescue varieties. Replacing toxic tall fescue stands with these "novel" endophyte-infected varieties will benefit producers if new stands (1) persist as well as toxic tall fescue under grazing and (2) provide animal performance at levels comparable to endophyte-free tall fescue. This publication outlines plant persistence and animal performance characteristics of novel endophyte-infected tall fescue and provides recommended pasture renovation practices.

## Development of Novel Endophyte-Infected Tall Fescue Products

Many pasture and hay acres have been planted to novel endophyte tall fescues since their release in 2000. For the first several years, only one product containing a novel endophyte was available in Georgia: MaxQ™.

MaxQ™ tall fescue was jointly developed by Dr. Joe Bouton at the University of Georgia and Dr. Gary Latch at Ag-Research Limited of New Zealand. Many naturally-occurring endophyte strains had been discovered in tall fescue in the 1980s and 90s – some of which did not produce toxic ergot alkaloids. Drs. Bouton and Latch inserted these novel endophytes into "Jesup" and "GA 5," tall fescue cultivars that were developed in Georgia (Figure 1). This resulted in two novel endophyte-containing tall fescue varieties that produced no toxic alkaloids but retained all of the positive agronomic features (excellent persistence, improved vigor, drought tolerance, etc.) of tall fescue varieties infected with the wild-type endophyte.

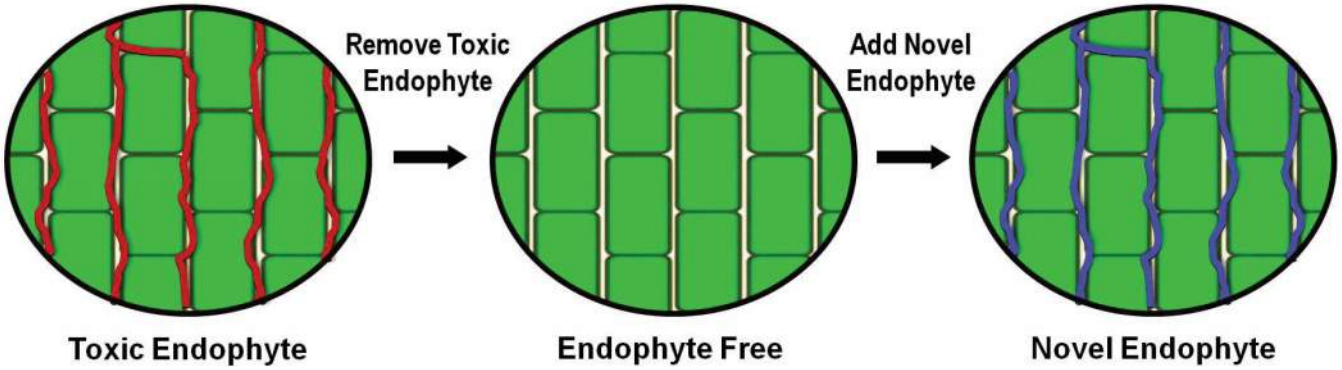


**Figure 1.** Hyphae of the fungal endophyte grow between the cells (green) of the tall fescue plant. When building a novel endophyte-infected tall fescue, the toxic endophyte (red lines) is removed from the tall fescue plant to create an endophyte-free plant. Then, the novel endophyte (blue lines) is introduced into the plant.

These novel endophyte tall fescue varieties were tested extensively in Georgia, both on experiment stations and producer farms. The success of these yield, persistence, and animal performance trials led to the eventual release of both "Jesup MaxQ™" and "GA 5 MaxQ™." Pennington Seed, Inc. (Madison, Ga.) obtained the rights to sell these novel endophyte varieties in North America. Although both were sold initially, Pennington Seed eventually simplified the production and marketing of the novel endophyte varieties and sold only "Jesup MaxQ™."

Additional novel endophyte tall fescues are being developed by Ag-Research, UGA, and other public and private plant breeders. These newer novel endophyte tall fescue products will be different from "Jesup." They will allow producers to select a novel endophyte tall fescue variety that better matches their climate or production goals. More information on novel endophyte tall fescue varieties that are currently recommended for use in Georgia may be found on the "Forage Species and Varieties Recommended for Use in Georgia" Web site (http://www.caes.uga.edu/commodities/fieldcrops/ forages/species.html).

## Will Novel Endophyte-Infected Tall Fescue Persist?

Soon after researchers discovered the wild-type toxic endophyte in the 1980s, they noted that it could be removed from the tall fescue seed and that endophyte-free stands could be established. Gains and reproductive performance of animals grazing endophyte-free tall fescue showed much higher animal performance than toxic tall fescue. However, the stands in endophyte-free tall fescue pastures frequently failed to persist. Researchers found that the endophyte causes the tall fescue plant to be more vigorous and tolerant of heavy grazing and other stress. Without this added tolerance, endophyte-free tall fescue stands do not survive long, particularly under grazing.

Because of the potential for stand losses, many producers choose to plant more "dependable" toxic tall fescue and tolerate economic losses associated with the toxins. Novel endophyte tall fescue must persist substantially better than endophyte-free tall fescue to justify the higher costs of seed and renovating existing tall fescue stands.

Before the release of the MaxQ™ tall fescue products, tests of novel endophyte tall fescue persistence were performed near Eatonton and Calhoun, Ga. One test compared the stand persistence of novel endophyte ("Jesup MaxQ™"), endophyte-free, and toxic tall fescue planted into a bermudagrass sod near Eatonton, Ga., and subjected to severe grazing conditions (Figure 2). These plots were established on droughty soils and grazed closely (under continuous stocking) during two successive summers to accelerate stand decline and evaluate endophyte effects on plant persistence.

Because of the grazing pressure severity and the bermudagrass competition present in these pastures, the stand ratings for all of the entries, including toxic tall fescue, declined. Nevertheless, the novel endophyte tall fescue persisted as well as its toxic endophyte-infected cohort and both were more persistent than the endophyte-free plantings. The novel endophyte tall fescue maintained stands equal to toxic tall fescue over a four-year period. Similar results were also obtained in grazing trials near Calhoun, Ga.

Pure stands of novel endophyte tall fescue have also been evaluated for grazing persistence at several State Experiment Stations throughout the country, including the Southeast (except Florida). In addition to these trials, novel endophyte tall fescue has been successfully maintained in pastures throughout the South. In each case, novel endophyte tall fescue persistence has been similar to toxic tall fescues. In pure stands and under normal grazing conditions, it is reasonable to expect that novel endophyte tall fescue will survive as well as toxic tall fescue and will persist much better than endophyte-free tall fescue.

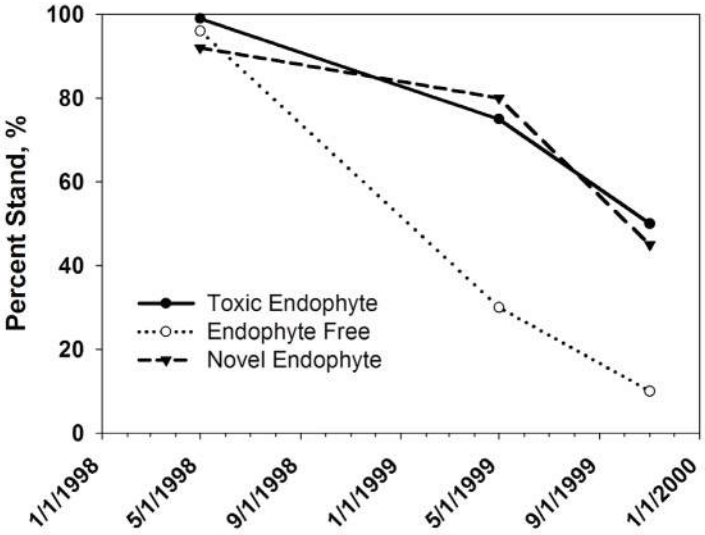


**Figure 2.** Stand persistence of novel endophyte-infected ("Jesup MaxQ™"), toxic endophyte-infected, and endophyte-free tall fescue in bermudagrass sod after two years of close grazing near Eatonton, Ga. (Bouton et al., 2000).

# How do Animals Perform on Novel Endophyte-Infected Tall Fescue?

**Cow-Calf Performance**

Most cattle operations in the Southeast are cow-calf producers. To justify higher seed costs and the cost of renovating existing tall fescue stands, the novel endophyte tall fescue must substantially increase the weaning weight of calves and/or the pregnancy/calving rate of the cows. Cow-calf performance data on novel tall fescue remains limited; however, initial results appear promising.

In a study conducted in northwest Georgia, cows grazing novel endophyte infected tall fescue tended to have higher body condition scores and weights than cows that grazed toxic tall fescue. Steer and heifer calves grazing novel endophyte tall fescue also had approximately 50 and 60 pounds greater weaning weights, respectively, than their cohorts grazing toxic tall fescue (Figure 3). Unfortunately, cattle numbers were too small in this study to determine if reproductive characteristics were positively affected by the use of novel endophyte tall fescue.

A larger study was performed at the University of Arkansas where 136 pregnant cows (1078 ± 14 lbs) were split between novel endophyte and toxic tall fescue pastures. The performance of these cows and their calves has been tracked for the past two years (Table 1). From this study on cow-calf performance, it appears that novel endophyte tall fescue substantially improves both the calf weaning weight and the cow pregnancy rate. Furthermore, these data suggest that replacement heifer performance is also improved when these animals graze novel endophyte tall fescue.

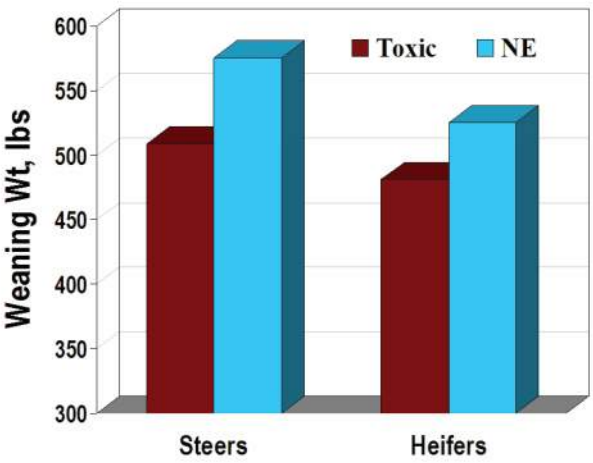


**Figure 3.** Calf weaning weights of cattle grazing toxic or novel endophyte (NE; "Jesup MaxQTM") tall fescue stands. Values are averages of two years' data collected near Calhoun, Ga. (Bouton et al., 2000, and Watson et al., 2001).

**Table 1.** Cow-calf performance on toxic or novel endophyte (NE) tall fescue stands.†

| | Toxic | NE |
|---|---|---|
| **Cow Performance** | | |
| Wt. at end of breeding, lbs. | 1110 | 1236 |
| Wt. at end of weaning, lbs. | 1005 | 1122 |
| BCS at end of breeding‡ | 5.4 | 5.7 |
| Pregnancy Rate, % | 44.7 | 85.1 |
| **Calf Performance** | | |
| Actual Weaning Wt., lbs. | 461 | 529 |
| Adj. (205 d) Weaning Wt., lbs. | 436 | 504 |
| ADG (birth to wean), lbs.§ | 1.7 | 2.1 |
| **Replacement Heifers** | | |
| Actual Weaning Wt., lbs. | 459 | 498 |
| Calving Rate, % | 64.1 | 90.6 |

† Adapted from University of Arkansas Experiment Station Reports by Coffey et al. (2007 and 2008).
‡ BCS: Body Condition Score.
§ ADG: Average Daily Gain.

## Stocker Performance

Stocker cattle performance has been examined for several years at the Central Georgia Research and Education Center near Eatonton, Ga. (Table 2). Similar studies throughout the Southeast have shown similar results, indicating that stocker gains are substantially higher for calves on novel endophyte tall fescue pastures than for those on toxic endophyte-infected tall fescue pastures. Many of these studies also indicate the stockers on novel endophyte tall fescue pastures have smoother hair coats and lower body temperatures, and spend more time grazing and less time standing in the shade or in pools of water (Figure 4).

**Figure 4.** Cattle grazing toxic tall fescue (foreground) spent less time grazing than cattle grazing MaxQTM (in background). Endophyte-free tall fescue had higher intakes and performance (Parish, 2001).

**Table 2.** The effect of endophyte status on stocker performance on tall fescue in the fall and spring.†

| | ADG (lbs/hd/d) | Gain (lb/acre) | Stocking Rate (hd/acre) | Grazing Time (days) |
|---|---|---|---|---|
| **Fall** | | | | |
| Toxic Endophyte-Infected Jesup | 1.5 | 137 | 1.5 | 63 |
| Endophyte-Free Jesup | 2.3 | 211 | 1.5 | 63 |
| Jesup MaxQ™ | 2.1 | 188 | 1.5 | 63 |
| **Spring** | | | | |
| Toxic Endophyte-Infected Jesup | 0.8 | 119 | 1.6 | 91 |
| Endophyte-Free Jesup | 2.2 | 313 | 1.6 | 91 |
| Jesup MaxQ™ | 1.8 | 251 | 1.6 | 91 |

† Adapted from Parish (2001).

Adding clover to both toxic endophyte-infected tall fescue pastures and novel endophyte tall fescue pastures will improve stocker gains (in addition to the benefit of replacing the toxic endophyte) (Table 3). Therefore, adding a legume to novel endophyte tall fescue is highly recommended.

**Table 3.** The effect of tall fescue endophyte status and the use of white clover in the pasture on stocker performance.†

| | ADG (lbs/hd/d) | Gain (lb/acre) |
|---|---|---|
| Toxic Endophyte | 1.1 | 126 |
| Novel Endophyte | 1.8 | 186 |
| Toxic + White Clover | 1.6 | 150 |
| NE + White Clover | 2.6 | 252 |

† Bouton, Andrae, and Hill (unpublished data).

**Subsequent Feedlot Performance**

Following three of these grazing studies in Georgia, the stocker cattle were finished on high-concentrate diets and their feedlot performance was tracked. No difference in animal performance, feed efficiency, or most carcass quality measurements were found in calves that had grazed novel endophyte, endophyte-free, or toxic endophyte tall fescue. However, because of improved stocker performance, the cattle that grazed endophyte-free and novel endophyte tall fescue entered the feedlot heavier and reached targeted harvest weights sooner (Figure 5). While there appeared to be no feedlot performance depression from fescue toxicosis, heavier weights going into the feedlot will either (1) increase finished weights or (2) decrease time-on-feed, both of which translate into more profitable beef production.

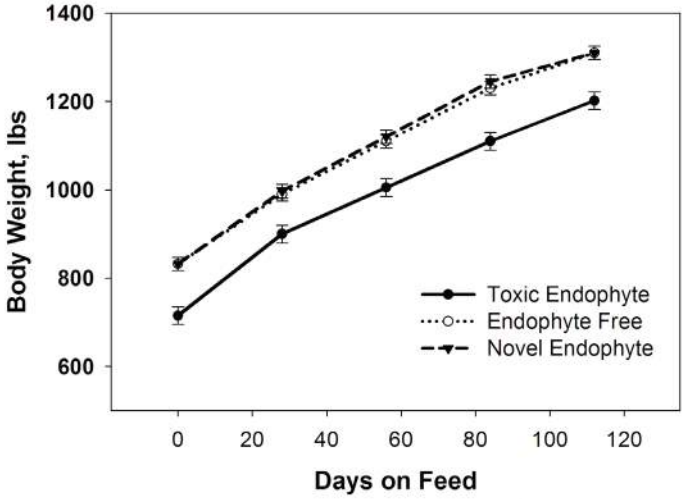


**Figure 5.** Subsequent feedlot performance of cattle that grazed toxic, endophyte-free, and novel tall fescue during the stocker phase. Cattle originally grazed pastures in Eatonton and Calhoun, Ga., and were finished in Stillwater, Okla. (Duckett et al., 2001).

**Equine Performance**

Mares in late gestation are particularly sensitive to alkaloids produced by toxic endophytes. To date, there is limited research studying the effects of novel endophyte tall fescue on mare performance in late gestation and early lactation. In a study conducted in Mississippi, five mares grazed either novel endophyte, endophyte-free, or toxic tall fescue pastures. Of the mares that grazed toxic endophyte tall fescue, 80 percent did not produce milk, 40 percent had compromised deliveries, 60 percent had retained placentas, and one mare (20%) aborted. No problems were noted for mares grazing endophyte-free or novel endophyte tall fescue. Mares grazing toxic endophyte-infected pastures also had longer gestation periods and thicker placental membranes than mares that grazed novel endophyte or endophyte-free tall fescue pastures. These findings suggest that the risk to pregnant mares grazing properly established novel endophyte tall fescue with no toxic contaminants appears to be low to nonexistent.

## Renovating Infected Fescue Pastures

Completely renovating toxic endophyte-infected tall fescue pastures to establish a novel endophyte tall fescue variety is a major operation. The renovated pasture will be out of production for several months. Make plans to supply extra feed or reduce animal numbers during this period. There are four steps in this renovation program: (1) prevent seedhead production in the existing toxic endophyte-infected stand, (2) destroy the existing stand, (3) seed the new variety, and (4) manage the new planting.

**Step 1: Prevent Seedhead Production** – The endophyte in tall fescue is spread via seed. If seed is produced by the existing toxic endophyte tall fescue stand, then chances are high that toxic endophyte-infected plants will regenerate in the new stand. Therefore, it is critical to prevent the existing tall fescue stand from producing a seedhead during the spring prior to planting a novel endophyte tall fescue.

Mow stands when seedheads begin to develop but before they fully emerge. Two such mowings prior to viable seed production are normally required to prevent seed formation. While heavy grazing may prevent some seedhead production or merely delay seedhead emergence, mowing will almost certainly be required.

**Step 2: Destroy Old Stands** – There are two methods for destroying an existing stand of toxic tall fescue. The first method, generally referred to as the "spray-smother-spray" method, involves preventing seedhead formation as described above, spraying the existing stand with a moderate to heavy rate of glyphosate (commonly known by the trade names Roundup, Glyphomax, Touchdown, etc.), growing a smother crop (usually a warm season annual grass, such as pearl millet) during the summer, and then spraying surviving tall fescue plants and weeds again in the fall with a moderate to heavy rate of glyphosate before planting the new stand. Unfortunately, this method is very expensive and more problematic for most small producers than the "spray-spray-plant" method.

The "spray-spray-plant" method was developed by researchers at UGA. Their research showed that spring seedhead suppression and applying glyphosate (Roundup) in late summer and again four to six weeks later (followed by planting within one day of the second herbicide application) will successfully kill the existing fescue. The timing of this application protocol is critical, as sufficient regrowth by the survivors of the first application is needed to get a complete kill.

Destroying the stand with an herbicide using either of these two methods will be faster, cheaper, and much more effective than multiple tillage operations. Plowing alone will not sufficiently kill the existing stand and is not recommended. However, there may be some cases where preparing a tilled seedbed is desirable. In this case, the same protocol of two herbicide applications (regardless of method) is recommended prior to seedbed preparation.

**Step 3: Seed the New Variety** – Planting with a no-till drill should follow immediately (within one day) after the second glyphosate application. Killing fescue pastures with an herbicide and sod-seeding into the killed sod is advantageous for pastures with severe slopes. Plantings can also be made into a firm, prepared seedbed. In the Piedmont region, successful plantings can be made between mid-September and late October. Plantings in the Limestone Valley/Mountains region should occur between early September and early October. Spring seedings are generally not successful and are not recommended. Regardless of region, a planting rate of 15 to 20 pounds per acre is required for successful stand establishment.

Drought and insects frequently cause problems with fall seedings. Dry weather can reduce germination and delay seed emergence. Stands that are not well-established by December can winter-kill. Insects (grasshoppers and pygmy mole crickets) that inhabit the sod can damage new seedlings.

**Step 4: Manage Novel Endophyte Tall Fescue** – Like all tall fescue plantings, new plantings need special treatment. Do not cut or graze new plantings until the plants have grown at least 6 inches. Even then, only a light grazing is recommended to avoid stand damage. A light mowing can help control weeds and encourage the tall fescue to grow (i.e., tiller) and thicken-in; however, take care not to cut tall fescue below a height of 6 inches in the spring following establishment.

An early hay cutting (before May) should not be taken from new tall fescue seedings. If the novel endophyte tall fescue has been clipped to control weeds in early spring, a late hay cutting (after mid-May) can be successfully made if the planting resulted in an acceptable stand. The tall fescue stand should be managed to allow light to reach the base of the plants, which will encourage tillering; however, do not defoliate the plants too frequently or too severely.

Soon after the stand has been established (April or May following a fall seeding), novel endophyte tall fescue should be tested for the extent of novel endophyte infection. This will ensure that the novel endophyte is present in the tall fescue, that at least 80 percent of the tall fescue contains the novel endophyte, and that little or no toxic endophyte-infected tall fescue is present. More information on testing the endophyte status of tall fescue stands can be found at: http://www.caes.uga.edu/commodities/ fieldcrops/forages/questions/testingtallfescue.html.

Although novel endophyte tall fescue generally is as persistent as toxic endophyte-infected tall fescue, some management differences are worth noting. Like all tall fescues, at least 2 ½ to 3 inches of growth should be maintained on novel endophyte tall fescue stands at all times. Unlike toxic tall fescue, livestock may not continue to graze novel endophyte varieties during tall fescue's summer dormancy or in periods of drought (Figure 4). Severe overgrazing can cause stand loss that may not have occurred with toxic endophyte-infected tall fescue. Therefore, it is critical to reduce the stocking rate or rotate the animals to warm season pastures to avoid overgrazing novel endophyte tall fescue, especially when pastures are dormant or under moisture stress.

## Summary

Tall fescue varieties containing a novel endophyte (e.g., Jesup MaxQ™) produce animal gains similar to endophyte-free tall fescue. The persistence of novel endophyte-infected tall fescues approaches or equals toxic endophyte-infected tall fescue and makes the novel endophyte tall fescue products an attractive alternative to either toxic or endophyte-free tall fescue in the pasture. A novel endophyte tall fescue is recommended when establishing or renovating an existing pasture in an area where tall fescue is desired. Information about recommended varieties of novel endophyte tall fescue may be found on the "Forage Species and Varieties Recommended for Use in Georgia" Web site (http://www.caes.uga.edu/commodities/ fieldcrops/forages/species.html).

**extension.uga.edu**

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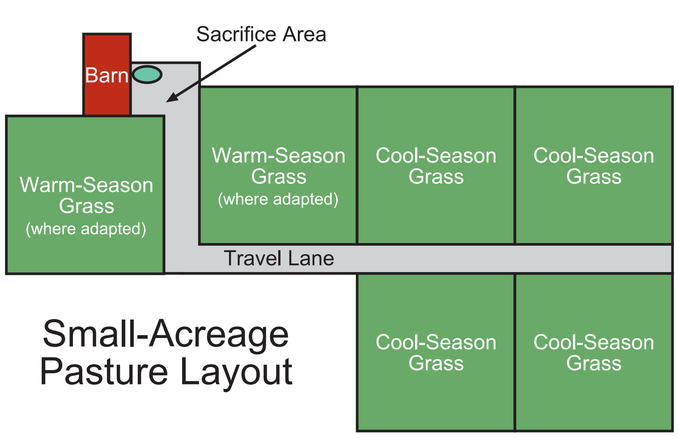
# Maintaining Healthy Horse Pastures

*C.D. Teutsch, Virginia Tech, and S.R. Smith, University of Kentucky*

Well-maintained pastures can serve as an economical and high-quality feed source. Here a mature pleasure horse grazes contently in a field of annual ryegrass.

Horses can graze very closely. In this photo a horse grazes a bermudagrass sod too close.

Close and frequent grazing weakened this sod, resulting in a pasture that is less productive and more susceptible to erosion and weed encroachment.




This is an example of a small-acreage pasture layout for pleasure horses. The inclusion of a warm-season grass provides grazing during the summer.

## Pasture Management

Once pastures have been established (18-24 months after planting), sound pasture management is critical for maintaining a healthy and vigorous sod that benefits the horse, owner, and environment.

**SOIL TEST PASTURES.** Pastures should be soil tested every 2-3 years in order to provide a baseline for tracking changes in pH and fertility.

**MAINTAIN ADEQUATE SOIL PH.** Soil pH can dramatically affect nutrient availability and plant growth. Maintain pH between 6.2 and 6.5 for grass-legume pastures by applying lime according to the soil test.

**MAINTAIN ADEQUATE PHOSPHORUS AND POTASSIUM.** Phosphorus and potassium should be maintained in the high range as determined by soil testing.

**DISTRIBUTE DUNG PILES.** Drag pastures to distribute dung piles and encourage uniform grazing.

**PROVIDE 2-3 ACRES PER HORSE.** If land area is limited, grazing must be controlled to maintain healthy pastures.

**SUBDIVIDE PASTURES.** Establish four or more pastures and graze them rotationally.

**REST PASTURES BETWEEN GRAZING EVENTS.** Resting pastures allows plants to replenish food reserves. Allow pastures to regrow to a height of 8-10". In the spring when cool-season grasses are growing rapidly, rest periods will be shorter. In mid-summer when plant growth is slower, rest periods will be longer.

**LEAVE PLENTY OF LEAF AREA.** Do not graze closer than 2-4". Leaving plenty of leaf area results in faster regrowth and helps maintain a vigorous sod. Horses tend to graze some areas closer than others, so rotate horses to a fresh pasture when heavily grazed areas are at 2-4". Clip ungrazed areas of the pasture.

**DO NOT GRAZE PASTURES WHEN PLANTS ARE NOT GROWING.** Feed hay in a sacrifice area to avoid overgrazing pastures during the winter and summer.

**REMOVE HORSES FROM PASTURES DURING WET WEATHER.** Hoof action can seriously damage established sods during wet periods of the year. Place horses in the sacrifice area and feed hay when the soil is soft.

## Pasture Layout and Design

Proper pasture design allows horse owners to control grazing. In some cases it is advisable to establish a permanent perimeter fence and cross-fence with temporary fencing until a suitable layout is found.

**INDIVIDUAL PASTURES SHOULD BE SQUARE.** Long and narrow or odd shaped pastures are not uniformly grazed.

**PASTURES SHOULD BE UNIFORM.** Pastures should contain similar forage species, soil types, slopes, and aspects.

**HORSES SHOULD HAVE ACCESS TO FRESH WATER AND SHADE.** Ideally, each pasture should contain water and shade. In some cases lanes can allow access to the barn from all pastures (see small-acreage example).

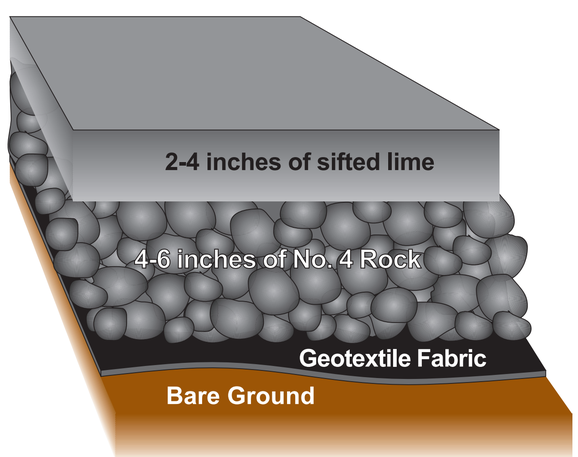
**LIMIT ACCESS TO TREES.** Trees should be fenced out to prevent girdling.

**ESTABLISH A SACRIFICE AREA.** Allow 600 to 1,000 sq ft per horse of well-drained area located near the barn. In most cases a rock pad will be required to keep area from becoming muddy (see diagram of rock pad).

**USE ELECTRIFIED POLYTAPE TO CONTROL GRAZING.** For this type of fencing to be effective, it must be electrified at all times.

Healthy pasture sods supply a safe exercise surface for growing foals.

Sacrifice areas often become muddy and require the construction of a rock pad.




Rock pads are constructed by placing geotextile fabric over the soil, covering it with 4-6" of No. 4 rock, and capping the rock with 2-4" of sifted lime.

Trees must be fenced out to avoid girdling by horses. In this photo an unfenced tree has been fatally injured.

For more information on maintaining healthy horse pastures, contact your local Virginia Cooperative Extension Office or visit the Virginia Cooperative Extension website at http://www.ext.vt.edu/resources/.

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Publication 418-105

Reviewed by Celeste Crisman, Extension specialist, Animal and Poultry Sciences

Virginia Cooperative Extension

PUBLICATION 418-101

# Virginia's Horse Pastures: Grazing Management

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*R.M. Hoffman, Assistant Professor and Extension Specialist, Agricultural Research and Extension Center*

Sound grazing management can decrease feeding expenses and stable cleaning and other chores, leaving more time for the recreational enjoyment of horses. In addition, pastures also help to maintain healthy horses by providing exercise and fresh air. Although properly managed pastures can be beneficial to both the horse and owner; improperly managed pastures can be a serious environmental concern. Poor grazing management results in the loss of groundcover that can lead to soil erosion, the degradation of water quality in neighboring streams and ponds, and increased weed pressure in pastures.

Proper grazing management includes allowing adequate time for the plants to establish themselves, providing adequate land area per horse, utilizing rotation and rest periods, confining horses to a "sacrifice area" or exercise lot during periods of drought or wet soil conditions, managing manure, maintaining soil fertility, and clipping the pasture to even out under-grazed areas and control weed populations.

**Let the pasture become established.** Do not allow new seedlings to be grazed until the plants have become well established. The root systems should be well developed to prevent the seedlings from being pulled out of the soil by grazing animals and to reduce damage by the hooves of running horses. This rule applies not only to newly seeded pastures but also perennial pastures that have been renovated. New forage stands require 18 to 24 months to become fully established. Overgrazing during this period can severely damage developing sods. On the other hand, light and infrequent grazing can be beneficial for sod formation. During the establishment period do not graze sods closer than four to six inches and allow at least 30 days rest for actively growing pastures and longer for slow growing pastures during the summer months.

**Provide adequate land area.** Proper pasture management begins with providing adequate area for each horse. Overstocking pasture areas will lead to the rapid loss of desirable forage species due to overgrazing and trampling. It also will encourage the growth of unpalatable and in some cases poisonous weeds. In Virginia, two to three acres of well-managed pasture should provide adequate grazing and exercise for a mature horse. However, with careful, sustainable pasture management a horse may be adequately kept on less acreage. Regardless of acreage, both the large equine business and the small hobbyist will benefit from sustainable grazing management, which is critical to a healthy sod that benefits the horse, the owner, and the environment.

**Rotate and rest pastures**. Even the best pasture needs rest after grazing to allow plants time to regrow and replenish food reserves. The length of the rest period will depend on the time of the year and weather conditions. It should ultimately be based on the height of the regrowing plant (Table 1). Optimally, pasture acreage should be divided into at least four to six pastures. Continuous grazing weakens and thins stands and allows weeds and poisonous plants to invade pastures. Horses should be rotated from pasture to pasture based on the height of the forage. Never allow pastures or portions of pastures to become overgrazed. *Since horses are spot grazers, rotate to a new pasture when the grazed areas reach the minimum height rather than waiting for the entire pasture area to be grazed to the minimum height.* Target heights for starting and stopping grazing of commonly used forage species are shown in Table 1. Some forage species are more tolerant of grazing than others. For more information on forage species, see *Virginia's Horse Pastures: Forage Species for Horse Pastures*, Virginia Cooperative Extension publication 418-102.

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VIRGINIA STATE UNIVERSITY

**Table 1. Starting and stopping grazing heights for forage species commonly used in horse pastures.**

| Forage Species | Start Grazing (inches) | Stop Grazing (inches) | Usual Rest Period[1] (weeks) |
|---|---|---|---|
| Kentucky Bluegrass + Clover | 8-10 | 2-4 | 2-3 |
| Orchardgrass + Clover | 8-12 | 4-6 | 2-4 |
| Tall Fescue + Clover | 6-8 | 2-4 | 2-4 |
| Bermudagrass | 4-8 | 1-2 | 1-2 |

[1] Usual rest period is based on optimal growing conditions. Temperature and rainfall can dramatically impact regrowth and either shorten or lengthen the rest period significantly.

**Rotating livestock in pastures.** There are advantages to grazing different types of livestock in horse pastures, primarily because it allows more efficient use of the pasture. Although all livestock are selective grazers, compared to horses, cattle and sheep are less selective. Rotating different livestock through the pastures keeps them grazed more uniformly and helps maintain the high-quality leafy stage of growth. Cows and sheep will also graze around manure piles left by horses. Cattle or sheep and horses may be stocked together in the same field or alternately, cattle or sheep may follow horses in the pasture rotation system.

**Utilizing a "sacrifice" or "exercise area."** In cases where land is limited to less than two acres per horse, it is nearly impossible to maintain pasture sod with continuous grazing. Maintaining an exercise area, that is, an exercise lot where no plants will grow is a practical solution. Permit grazing only when the pasture has reached the target height. Proper fertilization and timely irrigation of the pasture area can significantly increase forage growth and reduce the time period between grazing events. The exercise area should be used during periods of wet soil conditions and drought—and during winter/nongrowing season. Hoof action can seriously damage even well-established pasture sods when soil conditions are wet. Do not graze pastures during periods of drought stress and slowed growth. Overgrazing during these periods will significantly weaken and eventually kill even well -established stands. Footing in exercise areas may become unsafe due to mud, so a base comprised of a geotextile (available at many agricultural or landscape supply stores) covered with six to eight inches of one- to two-inch rock capped with two to three inches ground stone dust or sand should be constructed to improve the footing and prevent soil loss. Removing and composting manure and other organic materials such as hay and bedding every three days will also improve footing, and reduce parasite and fly exposure.

**Provide hay as alternate forage.** During times of the year when adequate pasture is not available (e.g. winter or drought conditions), provide hay as a forage alternative to pasture. Hay fed at a rate of 1 to 2 percent of body weight will provide adequate roughage to maintain digestive tract health. Horses will graze pasture during periods of nongrowth if they have no alternative. However, limited forage availability and poor quality of nongrowing pasture do not provide adequate nutrition for horses. Also, the grazing will weaken and kill desirable pasture plants. Since horses will tend to graze even if hay is provided, hay should be fed in the sacrifice area. Hay feeders should be utilized rather than feeding hay on the ground to avoid the ingestion of soil, sand, or stone dust that can lead to colic, and impaction.

**Mowing maintenance.** The tendency of horses to spot graze pastures leaves some areas ungrazed. These areas need to be clipped to approximately four inches to remove mature growth and seed heads, promote new growth, increase forage quality, and encourage grazing. Mowing will also slow weed propagation by removing seed heads. Many grasses (ryegrass, fescue, bluegrass, small grains, etc.) may be susceptible to infection with an ergot mold, which may cause equine ergotism. Normally the ergot is only a problem when the forage is allowed to produce a seed head. Therefore, pastures should be clipped to avoid seed head formation.

## Grazing Management at a Glance

- Allow pastures to become established before grazing.
- Do not graze pastures closer than two to four inches.
- Allow pastures to rest between grazing events.
- Graze pastures only after regrowth has reached a height of six to 12 inches.
- Do not graze pastures that are not actively growing.
- Feed hay when pasture growth is slowed or stopped.
- Do not graze pastures when soil conditions are wet.
- Mow pastures to remove mature forage and encourage grazing.
- Harrow pastures to spread manure.
- Create and utilize an "exercise area" to feed hay when pastures are not ready to be grazed.

**Removing or harrowing manure.** Piles of manure droppings contribute to under-grazed areas of the pasture, because horses will avoid these areas and the nutrients contained in the manure will promote rapid plant growth. Manure piles in the pasture should be scattered periodically, by dragging a chain harrow, spiketooth harrow, or other similar implement across the pasture. Harrowing the manure will promote uniform grazing. Additionally, breaking up and spreading the manure piles may also help to reduce parasite populations. A good time to harrow the manure piles is shortly after the horses have been rotated to a fresh pasture and the resting pasture has been mowed.

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Virginia Cooperative Extension

PUBLICATION 406-208

# Horse Manure Management

*Crystal Smith, Extension Agent, Warren County*
*Carrie Swanson, Extension Agent, Albemarle County*

## Introduction

Manure management is a vital part of modern day horse ownership. Many horses spend a significant portion of their day in stalls, accumulating large amounts of manure and stall waste. Horse owners generally have a limited amount of time to spend caring for their equine charges; thus, efficient manure removal and disposal is crucial. Additionally, horse facilities are often managed on relatively small acreage, limiting manure storage and application options.

The intent of this publication is to educate horse owners on the effective management of horse manure. Horse owners will first gain a thorough understanding of the quantity and characteristics of manure produced by horses. Finally, on-site options for handling, storing and treating manure will be discussed, keeping sound facility management and environmental stewardship in mind.

Managing horse manure can be a complex topic, and the principles presented here should be tailored to your specific situation. Please contact your local Extension agent or Natural Resources Conservation Service Field Office for technical support.

## Horse Manure Production and Characteristics

Horses produce large amounts of manure. In fact, if the manure produced from one horse were allowed to pile up in a 12-foot-by-12-foot box stall for one year, it would accumulate to a height of six feet! On any given day, the average 1,000-pound horse will produce approximately 50 pounds of manure. This amounts to about eight and a half tons per year!

Manure is not the only material being removed when stalls are cleaned. Wet and soiled bedding material must also be removed, and can equal almost twice the volume of the manure itself. The amount of bedding material removed will vary by type (shavings, sawdust, straw), but on average totals between eight and 15 pounds. Total stall waste produced averages between 60 and 70 pounds per day, which amounts to approximately 12 tons of stall waste per year!

When managed properly, horse manure can be a valuable resource. Manure is a source of nutrients for pasture production and can be utilized as part of a pasture management strategy to improve soil quality. The fertilizer value of the eight and a half tons of manure produced annually from a 1000-pound horse can amount to 102 pounds of nitrogen (N), 43 pounds of phosphorous ($P_2O_5$), and 77 pounds of potash ($K_2O$). Nutrient values for manure vary widely. The type and quantity of bedding material included also affects the overall fertilizer value. If a more accurate measure of nutrient content is needed, contact your local Cooperative Extension office for a list of laboratories that perform manure analysis.

## Environmental and Health Impacts

Many horse owners do not have enough land or vegetative cover to properly apply large amounts of manure and nutrients. If not managed properly, manure can deposit excess nutrients into the environment via surface runoff or as leachate (water contaminated with manure) from improper manure storage and land application. This can negatively impact water quality and subject landowners to investigation, and in some cases, legal action under the Virginia Agricultural Stewardship Act. For these reasons, horse operations are encouraged to use best management practices and develop a nutrient man-

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agement plan. Nutrient management plans describe the farm's manure production, soil fertility, and recommended manure application and removal rates. For more information on designing a plan specific to your farms needs or identifying other conservation resources contact your local Cooperative Extension office.

Internal parasites, insects, rodents, and odors can be manure related health concerns on horse farms. These issues can be minimized through carefully planned manure storage and handling. Internal parasites may be found in horse manure and can compromise the health and welfare of the horses stabled or grazing the land. Composting manure and properly timed land application can limit the risk of parasite exposure. Insects, especially flies, become a nuisance on farms where stockpiled manure serves as the fly larvae habitat. Flies breed when spring temperatures rise above 65°F. Flies deposit their eggs in the top few inches of moist manure and these eggs can hatch in as little as seven days under optimal temperature and moisture conditions. Therefore, fewer flies will develop if you remove manure from the site or make it undesirable for fly breeding (through processes such as composting) within a maximum seven-day cycle. Naturally occurring fly predators can also be used to limit the fly population at the manure pile, but are no replacement for sound management practices. Rodents can be a problem when manure is stockpiled for extended periods of time; providing a warm, safe environment. Additionally, nuisance odor from manure piles can result in strained relationships with neighbors. Composting or timely removal of manure piles will help keep odors to a minimum. Finally, keep in mind that large piles of manure are not aesthetically pleasing to your neighbors or those visiting your farm. Keeping the manure storage site screened with vegetation, fencing, or by location will help to enhance the beauty of your farm.

## Horse Manure Storage and Utilization

The average horse produces between 60 and 70 pounds of stall waste per day. Multiply this by several horses, and it is easy to see the importance of having methods in place to manage the manure produced on a daily basis. Letting manure pile up in stalls and paddock areas leads to a host of problems. It is not only unhealthy for your horse, inviting for pests and odors, and aesthetically unpleasing, but the sheer amount of manure produced will overwhelm you! Many handling and storage options exist, but it's up to you to choose the method that best suits your horse operation.

Horse operations with available land may choose to apply stall waste to pastures as fertilizer. This should be done based on soil-test results and nutrient needs. A soil analysis is needed to determine the fertility needs of a pasture. Soil analysis is provided through the Virginia Tech Soil Testing Laboratory for agricultural operations (which includes horse farms) free of charge. Contact your local Cooperative Extension office for instructions on how to take a soil sample. There are also private laboratories that offer soil-testing services.

In many situations, manure can be picked directly from the stall, deposited into a manure spreader, applied to the pasture, and harrowed into the soil. Barns not constructed with a management scheme allowing for stall access by a manure spreader, require manure to be carted from the stall to the manure spreader some distance away. In this case, ramps or dropped spreader parking can be helpful to avoid lifting the heavy, cumbersome stall waste. Keep in mind that when spreading manure from stalls bedded with sawdust or shavings, the applied stall waste can stunt plant growth. Wood products contain carbon that soil microbes use for energy, but not enough nitrogen to build proteins. The microbes draw nitrogen from the soil to make up for this deficit to such a degree that they can actually limit plant growth. To manage this nitrogen deficiency, nitrogen fertilizer can be applied. Or, to avoid the problem completely, manure can be composted before it is applied to the land.

When direct pasture application is not an option, manure storage facilities become a necessity. The storage facility should be convenient to the barn. A general rule of thumb is to plan for 180 days of long-term manure storage. This allows operations the flexibility to store manure when conditions are not ideal for manure application (frozen or wet fields). This storage area should be accessible to the equipment that will ultimately remove the accumulated stall waste. Manure storage facilities should also be downwind and screened from nearby homes to avoid potential complaints about odors and aesthetics. The size, type, and location of manure storage facilities will vary by horse operation based on the amount of manure produced, length of time the manure will be stored, and available land area. Always be sure to contact your local authorities regarding zoning regulations and additional restrictions.

*Minimum separation distances commonly recommended for composting and manure-handling activities. Source: On-Farm Composting Handbook, NRAES-54*

| Sensitive area | Minimum separation distance (feet) |
|---|---|
| Property line | 50-100 |
| Residence or place of business | 200-500 |
| Private well or other potable water source | 100-200 |
| Wetlands or surface water (streams, ponds, lakes) | 100-200 |
| Subsurface drainage pipe or drainage ditch discharging to a natural water course | 25 |
| Water table (seasonal high) | 2-5 |
| Bedrock | 2-5 |

## Manure Storage Construction

Manure storage should be designed to limit the chance of leachate entering surface- and groundwater resources. Ideally, storage piles should be placed on gravel, hardened clay, or concrete pads that slope inward. The construction of manure storage sites will vary based on individual situations and soil types. For instance, concrete pads may be necessary in areas with sandy soils where contaminants are more likely to reach groundwater. Storage piles should not be placed in low-lying or flood-prone areas, and care should be taken to direct water from higher elevations away from the site. The Natural Resources Conservation Service or local Soil and Water Conservation District offices can provide individualized manure storage design specifications.

## Composting

Composting horse manure is relatively simple, but does involve more than simply piling the waste. While many farms stockpile their manure, few truly compost. Composting is essentially managed decomposition. Managing the process can virtually eliminate odor, flies, weed seeds, and internal parasites found in horse manure and create a valuable soil amendment for resale or for pasture application. To manage a compost pile, the following factors must be taken into consideration: carbon to nitrogen ratio, oxygen, moisture, and temperature.

The microorganisms found in compost are most active when their diet contains about 30 times more carbon than nitrogen (or a C:N ratio of 30:1). Horse manure's C:N ratio is typically 40:1 due to the large amounts of bedding mixed with it, but generally doesn't require additional nitrogen provided it has enough moisture and oxygen.

Composting is an aerobic (requires oxygen) process. If a compost pile doesn't get enough oxygen, these anaerobic conditions can result in unpleasant odors (such as those normally associated with stockpiling manure) and slowed decomposition. There are several ways to provide oxygen to a compost pile. The most common way is to turn the pile. For large piles or windrows, turning is generally done using the bucket of a tractor or front-end loader. For smaller piles, a pitchfork will certainly get the job done, but these operations may want to consider using an aerated static pile design which doesn't require turning.

### Benefits of Composting

- Creates valuable soil amendment
- Stabilizes nitrogen into a slow-release form
- Avoids the problem of nitrogen immobilization
- Reduces manure volume by 50 percent
- Destroys weed seeds, fly larvae, and internal parasites
- Eliminates or reduces the cost of off-site disposal

Typical horse-stall waste tends to be dry and will need added moisture to create the ideal conditions for compost microbes. The moisture content should be about 50 percent, or roughly the consistency of a wrung-out sponge. If rainfall does not provide enough additional moisture, the pile may need to be watered periodically. On the other hand, too much water can also be detrimental, displacing oxygen inside the pile and causing anaerobic conditions. If environmental conditions (rain or snow) are providing too much water, the pile may need to be covered. Some compost-storage designs call for permanent roofs, but properly anchored plastic tarps can be just as effective.

## Compost Trouble-Shooting*

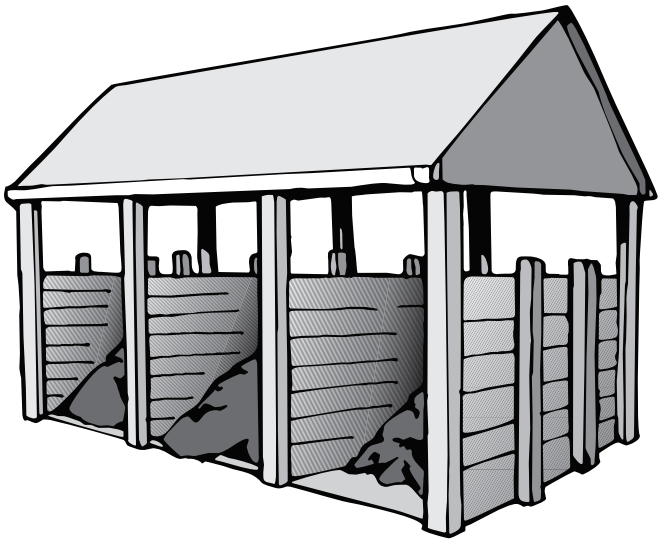
| Problem | Possible Cause | Remedy |
|---|---|---|
| Fresh manure, but pile won't heat up | The pile is:<br>1. Too dry<br>2. Too wet; and/or<br>3. Outside temp is too cold | 1. Add water evenly to pile<br>2. Aerate and cover<br>3. Wait for warmer temps and turn as needed |
| Pile was hot, but now temps are falling | 1. Pile is settling<br>2. Moisture is less than 50% | 1. Turn pile; and/or<br>2. Add water evenly to pile |
| Pile is more than 160ºF and has gray ash-like mold | Pile is too dry | Add water evenly to pile |
| Pile has gone through two or more heat cycles, but still has some material that has not decomposed | Wood shavings decompose slowly. | Ensure that pile has proper moisture content; add water if needed. |
| Pile emits bad odor | Pile is too wet and has become anaerobic inside | Turn to aerate and increase water evaporation, apply cover to limit additional rainwater. |

* Table does not include all scenarios; see Conclusions for more in-depth publications on the subject.

One of the best ways to monitor your compost pile is by using a thermometer. Compost thermometers should have a probe at least 36 inches long and are available through many garden supply stores. The goal is to have sustained temperatures of 130º to 150ºF in the pile interior. This will optimize decomposition and also kill pathogens and weed seeds.

Compost-pile design and storage facilities will depend on the size of the operation and the equipment available. For a farm with two to six horses, small static piles, which use perforated PVC pipes to draw in air and don't require turning, may be ideal. While not necessary, the use of multiple bins can allow separation of distinct "batches." In this situation, horse manure should be piled approximately five to eight feet high with a base that is two times the width and length of the height. For example, a 10-foot-by-10-foot bin could accommodate a pile that is five feet high. PVC pipes should be placed after the pile is about one foot high and so that the ends remain visible as more manure is added.

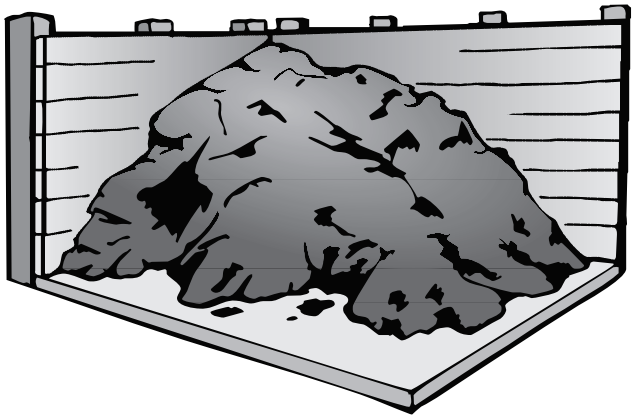
*Aerated static pile with perforated PVC pipes.*



*Example of bins suitable for small farms – doors and roof are optional.*

For larger farms with access to bucket loaders, manure spreaders, and/or specialized composting equipment, larger piles or windrows may be the most efficient design options. These piles may be slightly larger in height and width and considerably longer, but will require periodic turning.

Compost will decompose more efficiently if the mix is uniform. Starting with a uniform mix is even more important in the case of static piles, since they will not be turned during the decomposition process. Some farms utilize a temporary storage and mixing area to aid in this process.



*Example of mixing/storage area with buck wall.*

## Conclusion

With careful planning, proper manure management not only protects the environment and increases the efficiency and aesthetics of your farm, but might also save you money while enhancing your pastures. The following resources provide more information on composting and additional facility design specifications:

Field Guide to On-Farm Composting and the On-Farm Composting Handbook, available from the Natural Resource, Agriculture, and Engineering Service (NRAES) at *www.NRAES.org*.

Horse Facilities Handbook, available from the MidWest Plan Service at *www.mwpshq.org*.

The Virginia Tech Agronomy Handbook contains information on soil production, soil sampling, nutrient management, utilization of organic waste and more; available at *www.ext.vt.edu/pubs/agronomy/index.html*.


## Acknowledgments

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Virginia Tech • Virginia State University

Publication 442-307

# Selection and Location of Poultry and Livestock Manure Storage Structures on Farms

*Jactone Arogo Ogejo, Extension Specialist, Biological Systems Engineering, Virginia Tech*

## Introduction

If you raise dairy cows, broilers, layers, turkeys, horses, beef cattle, sheep, goats, alpacas, or swine for income or a hobby, you will have to deal with the manure they produce. The amount of manure produced by the birds or animals you keep depends on their type, age, size, and diet. Tables 1 and 2 present the manure characteristics of various animal types, compiled by the American Society of Agricultural and Biological Engineers, that can be used to assist in planning and designing manure handling and utilization systems if values for local farms are not available.

Manure storage is part of the manure management system of a facility or property where animals and/or poultry are raised. Manure should be considered a resource – not a waste to be discarded. Manure contains valuable organic matter and nutrients that can be used as a fertilizer and/or to produce energy. Manure will accumulate quickly and must be properly managed to minimize the potential for causing nuisance from odors and contamination of surface water and groundwater if entrained in runoff during rainfall events. Manure storage allows a strategic approach to manure application by providing livestock and poultry owners the flexibility for scheduling application or use

**Table 1. Estimated typical manure characteristics as excreted by meat-producing livestock and poultry**

| Animal type and production grouping | Total manure[1] | | Moisture[2] | Total solids | Volatile solids | Nitrogen (N) | Phosphorus (P) | Potassium (K) | Assumed finishing time (days) |
|---|---|---|---|---|---|---|---|---|---|
| | lb/f-a | cu. ft | % wet basis | Pounds per finished animal (lb/f-a) | | | | | |
| **Beef** | | | | | | | | | |
| Finishing cattle | 9,800 | 160 | 92 | 780 | 640 | 55 | 7.3 | 38 | 153 |
| **Swine** | | | | | | | | | |
| Nursery pig (27.5 lb) | 87 | 1.4 | 90 | 10 | 8.7 | 0.91 | 0.15 | 0.35 | 36 |
| Grow-finish (154 lb) | 1,200 | 20 | 90 | 120 | 99 | 10 | 1.7 | 4.4 | 120 |
| **Poultry** | | | | | | | | | |
| Broiler | 11 | 0.17 | 74 | 2.8 | 2.1 | 0.12 | 0.035 | 0.068 | 48 |
| Male turkey (toms) | 78 | 1.3 | 74 | 20 | 16 | 1.2 | 0.36 | 0.57 | 133 |
| Female turkey (hens) | 38 | 0.61 | 74 | 9.8 | 7.8 | 0.57 | 0.16 | 0.25 | 105 |
| Duck | 14 | 0.23 | 74 | 3.7 | 2.2 | 0.14 | 0.048 | 0.068 | 39 |

Source: ASABE Standard D384.2

1. Total manure is calculated from total solids and manure moisture content.
2. As excreted, manure moisture content ranges from 75-90%. At these moisture levels, manure has a density equal to that of water; a specific gravity of 1.0 was assumed in the calculation of manure volume.
3. f-a = finished animal

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VT/1218/442-307(BSE-243P)

**Table 2. Estimated typical manure characteristics as excreted by all other livestock and poultry**

| Animal type and production grouping | Total manure[1] | | Moisture[2] | Total solids | Volatile solids | Nitrogen (N) | Phosphorus (P) | Potassium (K) |
|---|---|---|---|---|---|---|---|---|
| | lb/d-a | cu. ft. d-a | % wet basis | Pounds per day per animal (lb/d-a) | | | | |
| **Beef** | | | | | | | | |
| Confined cow [3, 4] | – | – | 88 | 15 | 13 | 0.42 | 0.097 | 0.30 |
| Confined growing calf | 50 | 0.81 | 88 | 6.0 | 5.0 | 0.29 | 0.055 | 0.19 |
| **Dairy** | | | | | | | | |
| Lactating cow | 150 | 2.4 | 87 | 20 | 17 | 0.99 | 0.17 | 0.23 |
| Dry cow | 83 | 1.3 | 87 | 11 | 9.2 | 0.50 | 0.066 | 0.33 |
| Heifer (970 lb) | 48 | 0.78 | 83 | 8.2 | 7.1 | 0.26 | – | – |
| **Horse** (1,100 lb)[5] | | | | | | | | |
| Sedentary | 56 | 0.90 | 85 | 8.4 | 6.6 | 0.20 | 0.029 | 0.060 |
| Intensive exercise | 57 | 0.92 | 85 | 8.6 | 6.8 | 0.34 | 0.073 | 0.21 |
| **Poultry** | | | | | | | | |
| Layer | 0.19 | 0.0031 | 75 | 0.049 | 0.036 | 0.0035 | 0.0011 | 0.0013 |
| **Swine** | | | | | | | | |
| Gestating sow (440 lb) | 11 | 0.18 | 90 | 1.1 | 0.99 | 0.071 | 0.020 | 0.048 |
| Lactating sow[6] (423 lb) | 25 | 0.41 | 90 | 2.5 | 2.3 | 0.19 | 0.055 | 0.12 |
| Boar (440 lb) | 8.4 | 0.13 | 90 | 0.84 | 0.75 | 0.061 | 0.021 | 0.039 |

Source: ASABE Standard D384.2

1. Total manure is calculated from total solids and manure moisture content.
2. As excreted, manure moisture content ranges from 75-90%. At these moisture levels as excreted, manure has a density equal to that of water. A specific gravity of 1.0 was assumed in the calculation of manure volume.
3. Solids estimates do not include solids in urine.
4. Beef-cow values are representative of animals during nonlactating periods and the first six months of gestation.
5. These values apply to horses 18 months of age or older that are not pregnant or lactating. The representative number applies to 1,100-lb horses, and the range represents horses from 880 lb to 1,320 lb. "Sedentary" applies to horses not receiving any imposed exercise.
6. Nitrogen and phosphorus values include contribution of nursing pigs.

that takes advantage of the resources in the manure. This publication provides guidelines and information to consider for selecting and locating manure storage facilities.

## Reasons to Store Manure

Manure is stored so that it can be used effectively as a fertilizer to produce crops, decrease handling costs, and minimize the potential to pollute the environment. Storage allows effective use of manure nutrients when applied at a time when nutrients can be available to crops (before planting and on actively growing pastures) and soil conditions are right. When manure is applied at agronomic rates, you receive the maximum benefits of manure as a fertilizer and reduce the risks of groundwater and surface water contamination from nutrients and pathogens that may be contained in the manure.

Manure properties may change over time due to natural degradation processes or loss of volatile compound constituents of the manure. Manure storage keeps manure in one location, making it convenient to sample for content analysis to determine its fertilizer value (e.g., nitrogen, phosphorus, and potassium). When sampling manure, be sure to obtain a representative sample. This information – combined with knowledge of the crop production needs (amount of manure applied per acre) and corresponding losses of nutrients because of application and storage – determines whether additional commercial fertilizer is needed to meet realistic crop production goals.

Adequate manure storage reduces the need for land application when weather and soil conditions are not favorable, i.e., during winter months when soil is saturated or frozen. This improves efficiency, saves wear and tear on equipment, conserves nutrients contained in the manure, and minimizes manure nutrient leaching and runoff. Storage may allow additional farm acreage to be used for manure spreading because applications can be made when the risks of leaching or runoff are minimized.

## Types of Manure Storages

Manure storage type depends on how the manure is handled. Manure can be handled as liquid, slurry, semisolid, or solid. The total solids (dry matter) and preferred method for manure application/utilization (figure 1) influence the choice of storage system.

### Liquid Manure Storage

Used for manure with up to 10 percent solids content. Usually, water is added to make manure flow. Manure storage structures include belowground tanks or pits (either separate or under the animal housing), earthen storage ponds, and aboveground, fabricated concrete or steel tanks. Liquid manure is best handled with manure pumps, but gravity can also be used to transport liquid manure.

Dilution water may need to be added or solids may need to be separated from the liquid to produce liquid manure that can be handled with pumps (separated solids will have to be handled separately). Manure with a solids content of less than 4 percent is best for pumping. Manure with solids content between 4 percent and 10 percent is sometimes called slurry. If you choose to use pumps to move liquid manure, check manure pump manufacturer recommendations for pump operation and for its appropriateness for the type of manure you want to pump. Liquid manure storages are suitable for operations where manure is flushed or scraped with the addition of some liquid, such as on dairy and swine farms.

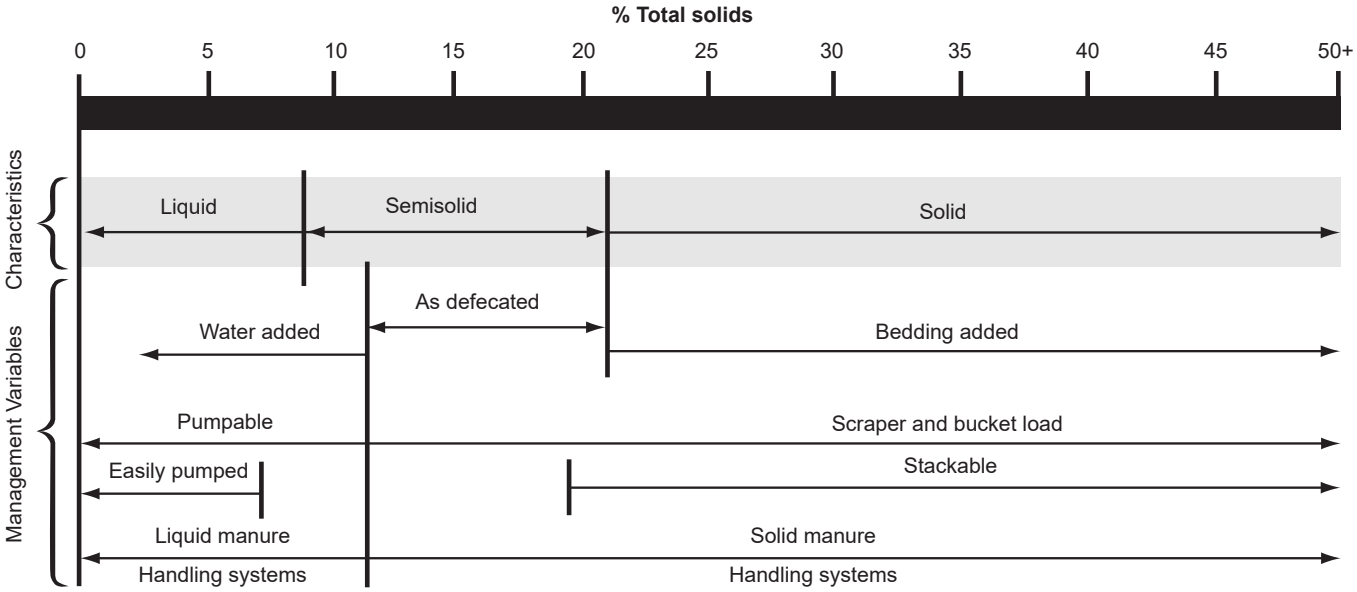
### Semisolid Manure Storage

Used for manure with 10 percent to 20 percent solids content. Semisolid manure may "stack" if some bedding is added, although semisolid manure will not stack as well as solid manure. Semisolid manure storage facilities include aboveground structures – with or without roofs – aboveground silos or rectangular tanks, earthen or concrete banks with concrete floors, and roofed vertical-wall structures. Uncovered semisolid and solid manure storages will need containment for any accidental leaks or runoff due to excessive rainfall events. This storage type is common in dairy cattle, swine, horse, and poultry operations.

### Solid Manure Storage

Used for manure with 20 percent to 25 percent or more solids content. Solid manure can be stacked and is best handled with a scraper and front-end loader. Solid manure is common where bedding is added to absorb

**Figure 1. Manure total solids characterization and handling requirements.**



liquid or drain off liquid and allow it to air dry. Solid manure is common in dairy cattle, beef cattle, horse, sheep, and goat operations. Solid manure can be stored in roofed stacking structures, concrete or earthen-baked structures with concrete floors, picket dams (retain manure solids on one side but the liquid flows through the dam into storage or treatment), and bedded packs.

## Typical Manure Storage for Different Animal Species

### Dairy Cattle

Manure can be stored as liquid in a manure storage pit, tank, or earthen pond. Semisolid or solid manure can be stored in a stacked facility; solid manure can also be stored in a bedded pack. Milking-house wastewater and contaminated runoff must be stored as a liquid. Bedding plays an important role in determining the manure storage for dairy cattle. If sand is used as bedding, the manure storage will most likely be liquid.

### Beef Cattle

Manure can be stored as solid in a bedded pack in a confinement area where bedding is added in sufficient quantities. Manure can also be stored as liquid or slurry, depending on its consistency. Solid manure can also be stored in dry stack structures.

### Poultry

Litter from broiler and turkey operations is stored on the floor of the housing facility; when removed, it can be transported directly to the field for land application. If field conditions are not favorable, litter must be removed and stored outside the house in temporary or permanent structures as described in *Storing and Handling Poultry Litter*, Virginia Cooperative Extension (VCE) publication 442-054. Manure from layers can be stored in a roofed facility. If it is wet, consider using a structural tank or earthen storage pond.

### Swine

Swine manure is usually stored as a liquid or slurry. Manure storage can be in outdoor tanks, earthen pits or part of anaerobic lagoons used for manure treatment.

### Sheep, Goats, and Alpacas

Manure from these animals can be managed as solids. Where animals are grown on the pasture, proper stocking, pasture rotation, and grazing management will assist in nutrient dispersion. For animals in confinement, manure is periodically removed by scraping for immediate land application or storage in stacks.

### Horses

Horse stalls receive liberal beddings and so most manure is handled as solids. If possible, manure should be used from stalls daily if possible and land applied. Manure can be stored as solids in stack structures and/or composted.

## Planning a Manure Storage System

Plan a manure storage and management system carefully in order to ensure production efficiency, allow for future expansion, protect the environment, and meet regulatory guidelines. Some guidelines to use in planning and selecting a manure storage facility are discussed below.

### Size/Capacity of Storage

The required capacity of a manure storage unit depends on the volume of the manure, volume of bedding and other waste streams, extra storage depth required for freeboard and precipitation, and length of time the manure will be stored. The Virginia Natural Resources and Conservation Service (NRCS) provides guidelines on how to properly size storage structures. The document is available at: *https://www.nrcs.usda.gov/wps/portal/nrcs/detail/va/home/?cid=nrcs144p2_027217*. A brief description of what to consider when sizing the storage unit is listed below.

#### Manure, Wastewater, Wasted Feed, Bedding and Other Recoverable Material

Manure volume depends on animal age, species, diet, and other factors. The size of the animal affects the amount of manure produced. In general, the larger the animal, the more manure it produces. Manure production characteristics of different animals are provided in tables 1 and 2. Other sources of waste include spilled feed, overflowed drinking water, cleansers, medicines, hair, etc., that may be included in the manure and must be taken into consideration when designing storage facilities. Reduce other sources of waste when possible because they increase production costs (e.g., additional feed to account for spill, loss of clean water) and may be hard on equipment.

Increase the storage size according to the quantity of other sources of waste to be stored. When possible, actual quantities of bedding and drinking water losses should be used in the design calculations. Include the volume of milking-center wastewater for dairy farms and water for cleaning buildings between cycles for hogs. This amount varies from farm to farm, and the actual volume used on the farm should be measured and used in the design of the storage tank.

### Precipitation and Runoff

Extra storage depth must be provided to allow for precipitation and mandatory freeboard. This is usually based on normal precipitation less the evaporation on the surface area of the storage facility, and the 25-year, 24-hour rainfall on the surface of the facility. The 25-year, 24-hour rainfall information can be obtained from Virginia NRCS offices or at the following website: *www.va.nrcs.usda.gov/technical/hydrology.html*. Include the volume of normal runoff and the 25-year, 24-hour runoff from the facility's drainage area during the storage period. Minimize the discharge of nonpolluted runoff into the storage structure.

Once the capacity of the required storage is known, the dimensions of the storage structure can be calculated.

## Where to Locate a Manure Storage Facility

Consider all farmstead operations, locations of buildings and potable water wells, surface waters, future building expansions, prevailing winds, trees, and neighbors. Locate, size, and construct storage facilities for convenient filling and emptying and provide an all-weather access road.

Minimum separation distances from points of interest listed in table 3 should be observed. All efforts should be made to meet current Virginia recommendations and regulations.

Some other points to note include:

- Locate the manure storage structure as close to the source as possible and outside of flood plains. If site restrictions exist and require location within a flood plain, protect the storage structure from inundation or damage from a 100-year flood event or what is stipulated in the regulations, laws, and rules.

- Observing these separation distances when locating a new facility is a good way to help protect your drinking water. Locate manure storage facilities downslope from the well to protect your water supply. While observing the minimum distance for well separation may help to protect your own well, poorly designed or poorly maintained animal manure storage facilities could still contaminate the groundwater that supplies other local drinking-water wells. Protecting the groundwater resource as a whole can help protect your neighbors' wells, and the quality of drinking water supplies for future generations. If land constraints do not allow for this, it is very important that the manure and livestock lots be covered or contained, reducing or eliminating runoff from these areas.

- Locate facilities to minimize the potential impacts from breach of embankments, accidental release, and liner failure.

- Provide enough separation distance to minimize the impact of odor from the storage facility.

**Table 3. Natural Resources Conservation Service: Virginia guidelines for minimum distance requirements for waste storage facilities**

| Public or private facilities | Minimum distance from waste storage facility |
|---|---|
| Any public-use area (e.g., church, picnic area, playground, park, cemetery) | 700 ft (215 m) |
| Drainage ditch | 100 ft (30 m) |
| Milking parlor | 100 ft (30 m) |
| Natural water course | 200 ft (60 m) |
| Private potable well | 100 ft (30 m) |
| Public potable well | 300 ft (90 m) |
| Residence or place of habitation (other than owner or tenant) | 700 ft (215 m) |
| Area specified by state or local ordinance | Greater of state or local distance or distance shown above |

Locate manure storage areas for practical loading and unloading. When using equipment such as a front-end loader, manure storage areas with a corner push-up wall can be useful. Earthen, wooden, or precast concrete-block walls can also help with containment and with diverting clean storm water from entering the manure storage area.

Figure 2. Types of manure storages (clockwise from top left): aboveground steel tank for liquid or semiliquid manure, aboveground concrete tank for liquid or semiliquid manure, earthen pond for liquid or semisolid manure, and stack shed for solid manure.

### Site Guidelines

- Do not locate unlined storages over limestone, gravel, or fractured bedrock. If any of these conditions are present, check with your local Extension, NCRS, or SWCD to find out if there are any local and state environmental regulations, and consult a registered professional engineer.
- Do not locate unlined storages at/or below the water table. Virginia requires 2 feet or more separation distance between the storage bottom and high-water table, but check with local environmental regulatory agencies before building.
- Do not locate unlined storages in sandy or gravel-like soils, because these soils allow seepage to percolate through to the groundwater more easily. The NRCS can often help analyze the suitability of various sites for manure storage facility sites.
- Check for buried utilities and drainage tiles before building. These must be rerouted before construction or another site must be selected.

### Storage Period

The storage period is the maximum length of time anticipated between emptying events. The minimum storage period is 120 days or what the storage needs to utilize the manure according to the nutrient management plan. Six months is the optimal storage period based on timing required for environmentally safe waste utilization considering climate, crops, soil, equipment, and local, state, and federal regulations.

## Personal Preference

Select a manure storage system that matches your management strengths and abilities. For example, if you have an off-farm job, you may want to avoid systems with a lot of daily labor. For manure storage management and safety, see *Poultry and Livestock Manure Storage: Management and Safety*, VCE publication 442-308.

## Acknowledgements

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Virginia Cooperative Extension
Virginia Tech • Virginia State University

Publication 442-309

# Manure Management and Environmental Stewardship

*By Jactone Arogo Ogejo, Extension Specialist, Biological Systems Engineering, Virginia Tech*

## Introduction

Manure is one resource that – if not managed properly – will affect the quality of the environment. Thus, livestock and poultry producers, regardless of size, need to manage manure for better economic returns and environmental protection. Quite often, we read or hear from news media about conflicts arising from the nuisance of odors from livestock and poultry operations, fish kills in water bodies, or the pollution potential of surface or groundwater that results from poor manure management. These concerns have created strained relationships between animal agriculture and the general public. To avoid or repair these relationships, it is important that we manage manure and other agricultural wastes associated with animal production in a responsible manner.

### Environmental Stewardship

According to the U.S. Environmental Protection Agency, environmental stewardship is the responsibility for environmental quality shared by all those whose actions affect the environment.

Good manure management starts with recognizing and understanding the value of manure as a resource that contains nutrients for crop production as well as the potential negative impacts manure can have on air, water, and soil. This publication outlines the general guidelines about managing livestock and poultry manure and provides a list of resources with detailed information on specific topics of good practices for manure management and use.

## Benefits of Manure

Manure is commonly used as a fertilizer and as an amendment to improve the quality of the soil. When manure is applied and managed properly according to the agronomic needs of crops, manure will improve crop productivity and reduce the demand for commercial fertilizer (see *Phosphorus, Agriculture & the Environment*, Virginia Cooperative Extension [VCE] publication 424-029; and *Impact of Changing From Nitrogen- to Phosphorus-Based Manure Nutrient Management Plans*, VCE publication 442-310). Managing manure to provide balanced nutrients that can be used as fertilizer may require that some nutrients be removed, conserved, or concentrated. For example, if the nitrogen (N) to phosphorus (P) ratio in the manure is one-to-one (1:1) and the agronomic requirement for these nutrients by a crop is four-to-one (4:1), meeting the agronomic needs of the crop using manure may require that some phosphorus be removed. Also, knowing that nitrogen can be lost from manure through volatilization of ammonia, it may be necessary to use management practices that will conserve nitrogen in the manure. If manure must be transported for long distances, it may be important to concentrate the nutrients to reduce the volume of water that has to be transported with manure in order to reduce transportation costs.

Nutrients can be recovered, conserved, or concentrated in manure through one or a combination of physical, chemical, or biological methods (see *Selecting a Treatment Technology for Manure Management*, VCE publication 442-306). Crops usually need more nitrogen than phosphorus; therefore, it would be beneficial to concentrate the nitrogen and remove the excess phosphorus from the manure to get the full benefits of manure using nutrient-recovery technologies that involve chemical, biological – or a combination of both – methods and a manure-separation system.

If handled properly, manure can be used to produce biogas that can be used as an alternative energy source (see

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*Biomethane Technology*, VCE publication 442-881). The biogas can then be used to produce electricity, hot water, steam, and/or transportation fuels. The quantity and quality of gas produced will depend on the digester design, operating temperature, and the type and quality of manure fed to the digester. Animal manure can also be subjected to the process of pyrolysis to produce char, oils, and gas. The oils and chars can be used for fuel or further processed to produce value-added products, such as plastics. Other considerations are to burn dried or solid manure in combustors or gasifiers to produce heat.

Animal manure can also be used for yeast and algae production, which can then be used to produce animal and fish feed and biofuel (see *Microalgae as a Feedstock for Biofuel Production*, VCE publication 442-886). Manures can also be used in the production of mushrooms or composted to produce a weed- and pathogen-free, high-quality soil amendment.

# Manure Management and Water Quality

Water quality is everyone's concern and it is important to remember that poor nutrient management can lead to water quality problems. The EPA reports that manure from animal agriculture is one of the major sources of contamination of our water supply. Manure contains nitrogen, phosphorus, organic matter, and pathogens that are considered four primary contaminants that affect water quality. These pollutants may enter water resources by runoff, leaching, and deposition from the atmosphere. Nutrients from the atmosphere may be deposited on land through precipitation (rain and snow fall) or dry deposition. These contaminants may increase the cost of treating the water for domestic and industrial uses.

## How Manure Constituents Affect Water Quality

### Nitrogen

Nitrogen is one of the basic components of proteins, which is a part of all living things. Nitrogen is usually provided to animals via feed. Animals use only part of the nitrogen in their feed to produce meat, milk, or eggs and for body growth and maintenance. The remaining protein is excreted.

Nitrogen in manure exists in two forms that can be described as inorganic or organic. The inorganic forms include ammonia, nitrate, and nitrite. The organic forms include urea, undigested proteins in manure and feed, and other animal waste products such as hair and feathers. The inorganic forms readily cause pollution when compared to the organic forms. However, when the organic forms of nitrogen decompose, ammonia is produced. Ammonia can be transformed into nitrates and nitrites when oxygen is provided to the manure. Ammonia can easily be lost to the atmosphere from the manure by volatilization. Different forms of nitrogen present different risks to water quality. Ammonia concentration exceeding 2 parts per million (ppm) can lead to fish kills. Nitrates above 10 ppm in drinking water may cause blue baby syndrome when consumed by infants. Excess nitrogen can cause eutrophication of surface-water resources.

### Phosphorus

Phosphorus is an essential nutrient to plant growth and development. Animals require it for bone development and optimum production. Animal manure that is land-applied to supply nutrients for crop growth typically does not match the nitrogen-to-phosphorus (N:P) ratio required by crops. Consequently, if manure is applied to satisfy the nitrogen requirements of a crop, phosphorus is over-applied and the soil phosphorus levels can increase (see *Soil Test Note No. 5: Fertilizing with Manures*, VCE publication 452-705; and *Phosphorus, Agriculture & the Environment*, VCE publication 424-029). When soils become saturated with phosphorus, the potential for losing it in runoff water increases. Phosphorus typically moves with water runoff and soil erosion. It can be attached to minerals containing iron, aluminum, and calcium or to organic matter such as crop residue, bacteria in the soil or manure, or decaying organic matter.

### Pathogens

Pathogens include microorganisms such as viruses, bacteria, and protozoa that cause infection or disease. Disease-causing microorganisms may be present in manure. Therefore, it is important to maintain adequate separation between the potential source of pollutants and water sources. Pathogens are most likely transported to water with surface runoff and erosion or by direct animal access to surface water. Streams and lakes used for drinking water and recreational purposes provide the greatest opportunities for transmitting these pathogens. Human beings may be infected if they consume crops irrigated with untreated manure that contains pathogens.

### Organic Matter

Organic matter in manure can be a valuable environmental resource if managed properly; however, if manure reaches a water body or moves off-site by water runoff, organic matter can become a harmful pollutant. Organic matter can come from manure, silage leachate, and milking center wastewater. Organic matter degrades rapidly in water and may result in oxygen depletion in bodies of water. Organic matter is transported into water by surface runoff. Rarely does organic matter leach through the soil.

## Manure Management and Air Quality

Manure handling, storage, and utilization in livestock and poultry production results in a wide range of air emissions, which may create air quality concerns. The airborne emissions from livestock and animal production systems include hazardous gases, (e.g., ammonia [$NH_3$] and hydrogen sulfide [$H_2S$]), odor, dust, and greenhouse gases (e.g., methane [$CH_4$], nitrous oxide [$N_2O$] and carbon dioxide [$CO_2$]). Dust is generated from regular farm traffic, land preparation, and other crop production activities, as well as from livestock and poultry barns with ventilation exhaust air. The concerns from these emissions include odor, atmospheric visibility, and respiratory health issues (see *Ammonia Emissions and Animal Agriculture*, VCE publication 442-110).

### Relationships and Manure Management

Complex technologies or treatment systems are not the solution to good manure management. Sometimes the often forgotten or ignored relationship with your neighbor can resolve many issues arising from animal agriculture, especially with respect to odor.

### Impacts of Air Emissions

Odorous compounds are commonly considered to be unpleasant or nuisance experiences by neighbors. Neighbors sometimes relate or determine odor nuisance by a number of factors, including frequency and duration of occurrence; intensity of the odor experience; social factors, such as past experience with agriculture and relationship with the producer; and appearance of the production facility. Some neighbors may have strong emotional reactions and possible health-related issues to livestock- and poultry animal-related odor. Their concerns should be taken seriously. Ammonia released into the atmosphere is a loss of fertilizer value of the manure nitrogen. It may also result in formation of particulate matter that contributes to haze in the atmosphere. If the particulate matter is deposited back on land or on surface water, it may lead to area nitrogen enrichment and cause pollution. Livestock production is a source of greenhouse gases, and greenhouse gases contribute to global warming.

## Principles of Environmental Stewardship

According to the EPA, "Environmental stewardship is the responsibility for environmental quality shared by all those whose actions affect the environment." Some good manure management and environmental stewardship principles that may be of benefit to livestock and poultry producers are summarized below.

### Awareness of Environmental Risks

Familiarize yourself with your operation's potential environmental impacts by conducting an evaluation to determine the highest-risk situations or practices on your farm. Develop plans and invest resource to address the high-risk situations, e.g., handling manure emergency spills and manure storage failures. Your local Extension office, the soil and water conservation district office, and the National Resources Conservation Service may provide you with information on how to perform this task.

### Farm Nutrient Balance and Nutrient Management Plan

Animal producers should set a goal to balance nutrients on their farm and also manage soils in ways to minimize nutrient losses. Nutrient balance should consider what is coming into the farm as purchased feed and fertilizer and the nutrients leaving as managed products, such as crops, animals, or animal products. An example of nutrient flow in a farm is provided in figure 1.

If the nutrients coming into the farm are more than what leaves, this will result in an accumulation of those nutrients on the farm. To correct the nutrient concentration, consider a whole-farm approach rather than focusing on a small part of the production, such as nutrients in manure and their losses to the environment. Understand the big picture by identifying the underlying cause of nutrient concentration and develop effective solutions to address the critical areas for better

utilization and management of nutrients on your farm. Some strategies to reduce and manage manure nutrients are presented in *Strategies to Reduce Amounts of Nitrogen and Phosphorus in Dairy Rations*, VCE publication 404-130; and *Selecting a Technology to Manage Manure Nutrients*,VCE publication 442-326.

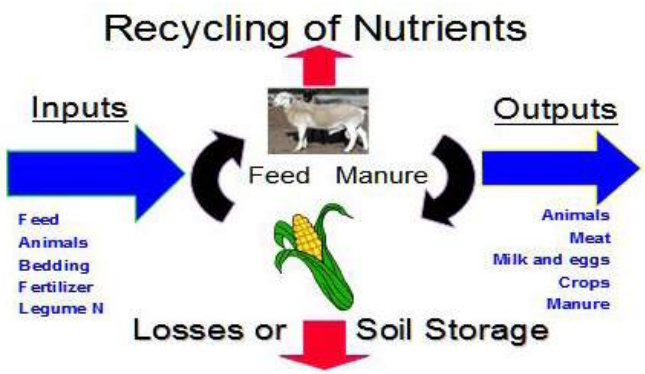


Figure 1. General nutrient balance on a farm.

Recycle nutrients between livestock and crop components within the boundaries of the farm. Manure nutrients are recycled as fertilizer for crop production. Crops are then cycled as feed to livestock or poultry. Nutrients leave the farm as products, i.e., animals or crops products such as milk and eggs and manure sold or given away for use outside the farm. These nutrients are sometimes referred to as "managed outputs." Some nutrients will leave the farm as environmental losses, e.g., nitrogen lost to the atmosphere as ammonia, nitrates to groundwater, and nitrogen and phosphorus in surface-water runoff.

Use manure according to a nutrient management plan. The nutrient management plan should maintain a balance between nutrient application and crop use and the needs of that nutrient. Test manure to know its nutrient content. Test soils to establish existing soil fertility levels to know what is needed for the different crops you grow (see *Soil Test Note No. 1: Explanation of Soil Tests,* VCE publication 452-701; *Soil Test Note No. 2: Field Crops,* VCE publication 452-702; *Soil Test Note No. 3: Forage Crops,* VCE publication 452-703; and *Soil Test Note No. 4: Trace Elements,* VCE publication 452-704).

Apply manure at uniform rates based on crop nutrient needs while avoiding soil contamination, crop damage, and runoff (see *Soil Test Note No. 5: Fertilizing with Manure*, VCE publication 452-705). Adjust the rate of supplemental fertilizer to compensate for the nutrients applied in the manure. Keep records of all your activities.

Use of manure and fertilizer as nutrient sources for crop production must be managed properly to ensure that they do not contaminate groundwater or surface water. Check soil moisture before applying manure and adjust application rates to avoid runoff. Limit the volume of water applied to an amount that brings the soil to field-moisture capacity. Do not apply manure to saturated soils. Incorporate raw or untreated manure to reduce odors and nitrogen losses. Calibrate application equipment to obtain the desired application rate (see *Land Application of Broiler and Turkey Litter for Farming Operations Without a DEQ Permit,* VCE publication 442-052; *Manure Spreader Calibration for Rear-Discharge Equipment: Handling Solid and Semisolid Manures and Poultry Litter,* VCE publication 442-004).

## Be a Good Neighbor

Animal production creates several potential nuisances, including odors, flies, noise, and dust. You need to be fully aware of these nuisances and your neighbors' possible concerns. The demographics of rural areas (where farming has traditionally occurred) are changing and what used to be exclusively rural areas are becoming urbanized. Public awareness of environmental issues is changing. As a result, farm-neighbor conflicts are increasing around the country. Nonfarm communities complain that farming activities near their homes affect their quality of life. Increasingly, farmers are being forced to consider social as well as air-quality concerns in developing manure management plans. Following are some reminders of good practice as part of your manure management strategy:

### Know Your Neighbors

We have numerous and diverse neighbors. Some are long-term residents who farmed in the area and are now retired. Some are the result of urban sprawl. Some live in communities within the city limits but next to agricultural land. Schools, churches, hospitals, and golf courses are also some of your neighbors. It is interesting to note that some nonfarm community members are buying former farms and moving into the country, seeking "fresh" air. The bottom line is that urbaniza-

tion of rural areas and consolidation of livestock farms often lead to tense relationships between farmers and nonfarming neighbors. It is important to recognize this fact and to proactively pursue ways to deal with it. How you handle business on your farm may impact how you resolve conflicts related to your farm.

### Recognize Your Challenges

Large numbers of animals concentrated near nonagricultural residents will produce odor and visual issues related to confined-animal feeding operations. With the changing demographics, rural roads may start experiencing aggressive drivers who do not appreciate or recognize the slower farm traffic. With the hectic pace of life there may be little, if any, communication between the farmer and neighbors. This can create situations for misunderstanding and a greater likelihood that conflicts will occur. Sometimes common ground and mutual agreement is not realized until later. Do not let issues concerning your manure management get out of control. Be proactive in talking to your neighbors. Implement responsible farm management practices while conducting activities that promote the benefits of the farm to neighbors and the community.

### Tell Your Story

There are a variety of outreach efforts you may want to consider to enhance the perception of the farm among neighbors and the larger community. Accept visitors to your farm as your schedule will allow and within the bounds of biosecurity. Tell visitors what you do and why you do it. Visitors should include all ages and groups. If possible, provide neighbors with sample farm products, assist with or volunteer to mow brush in the summer, plow snow in the winter, and consider allowing access to areas of the farm for recreational activities. Let your neighbors know about your farming operations and activities. This should include the manure application schedule. If neighbors have special events occurring at their homes on certain dates that may be impacted by a farming operation, such as land application of manure, work with them to reschedule that operation. Note: Outreach to community, open houses, and neighborly assistance can help cultivate open communication and understanding between the farming and nonfarming communities.

### Engage Local Leadership

Before embarking on new projects or expanding existing enterprises on the farm, arrange to meet with the local authority boards to show them your plans and solicit questions and comments. After finishing the project, hold a neighborhood barbecue and tour to meet the neighbors; show them what you do and why. It is more difficult to carry a disagreement with someone you know and are friendly with or who has made a first move to get to know you.

### Neighbor Relations

When planning farm operations that will impact people in the area (e.g., spraying liquid manure next to a school, church, or golf course), communicate and explain the operation ahead of time. Plan the operation at a time that causes the least disruptions to the other parties. Remember, people are much more accommodating if issues are addressed ahead of time, even if it is something they do not particularly like. In most cases, people will give you more latitude with something they do not like if you make a good faith effort to deal with their concerns about your farming operation.

### Cleanliness

Many times people tend to smell with their eyes more than their noses. It is therefore extremely important to have a neat facility, clean animals, well-tended crops and buildings, and machinery in good repair. Yards

Figure 2. Examples of neatly kept farm surroundings.

Figure 3. Example of undesirable situations around the farm.

around barns and along the road and ditches should be mowed. It is not always possible to prevent all farm odors, but if people are presented with the picture of a clean, orderly, well-managed farm, they will tolerate more actual odor than from a farm that looks untidy (figures 2 and 3).

### Safety and Manure Handling

Liquid manure can produce gases that can be toxic. Production of manure gases is enhanced in hot weather, so practice caution when handling manure in the summer. Remember that outdoor manure storages can be death-traps (see *Manure Storage: Selection and Location of Poultry and Livestock Manure Storage,* VCE publication 442-307; and *Poultry and Livestock Manure Storage: Management and Safety*, VCE publication 442-308).

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*Strategies to Reduce Amounts of Nitrogen and Phosphorus in Dairy Rations*. VCE publication 404-130. *https://pubs.ext.vt.edu/404/404-130/404-130.html*

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STD & SPEC 3.15

# TEMPORARY SLOPE DRAIN

## Definition

A flexible tubing or conduit extending from the top to the bottom of a cut or fill slope.

## Purpose

To temporarily conduct concentrated stormwater runoff safely down the face of a cut or fill slope without causing erosion on or below the slope.

## Conditions Where Practice Applies

On cut or fill slopes where there is a potential for upslope flows to move over the face of the slope causing erosion and preventing adequate stabilization.

## Planning Considerations

There is often a significant lag between the time a cut or fill slope is completed and the time a permanent drainage system can be installed. During this period, the slope is usually not stabilized and is particularly vulnerable to erosion. This situation also occurs on slope construction which is temporarily delayed before final grade is reached. Temporary slope drains can provide valuable protection of exposed slopes until permanent drainage structures can be installed or vegetation can be established.

Temporary slope drains can be used in conjunction with diversion dikes to convey runoff from the entire drainage area above a slope to the base of the slope without erosion. It is very important that these temporary structures be installed properly, since their failure will often result in severe gully erosion on the site and sedimentation below the slope. The entrance section must be securely entrenched, all connections must be watertight, and the conduit must be staked securely.

## Design Criteria

### Drainage Area

The maximum allowable drainage area per slope drain is 5 acres.

### Flexible Conduit

The slope drain shall consist of heavy-duty, flexible material designed for this purpose. The diameter of the slope drain shall be equal over its entire length. Reinforced hold-down grommets shall be spaced at 10-foot (or less) intervals. Slope drains shall be sized as listed in Table 3.15-A.

### Entrance Sections

The entrance to the slope drain shall consist of a standard VDOT flared end-section for metal pipe culverts (see Plates 3.15-2 and 3.15-3) with appropriate inlet protection as set forth in CULVERT INLET PROTECTION, Std. & Spec. 3.08. If ponding will cause a problem at the entrance and make such protection impractical, appropriate sediment-removing measures shall be taken at the outlet of the pipe. Extension collars shall consist of 12-inch long corrugated metal pipe. Watertight fittings shall be provided (see Plate 3.15-1).

**Note:** End-sections made of heavy-duty, flexible material may be utilized if determined by the Plan-Approving Authority to provide a stable inlet or outlet section.

**TABLE 3.15-A**

**SIZE OF SLOPE DRAIN**

| Maximum Drainage Area (acres) | Pipe Diameter (inches) |
|---|---|
| 0.5 | 12 |
| 1.5 | 18 |
| 2.5 | 21 |
| 3.5 | 24 |
| 5.0 | 30 |

Source: Va. DSWC

Dike Design

An earthen dike shall be used to direct stormwater runoff into the temporary slope drain and shall be constructed as set forth in DIVERSION, Std. & Spec. 3.12. See Plate 3.15-1 for placement of dike in relation to the slope drain.

The height of the dike at the centerline of the inlet shall be equal to the diameter of the pipe plus 6 inches. Where the dike height is greater than 18 inches at the inlet, it shall be sloped at the rate of 3:1 or flatter to connect with the remainder of the dike (see Plate 3.15-1).

Outlet Protection

The outlet of the slope drain must be protected from erosion as set forth in OUTLET PROTECTION, Std. & Spec. 3.18.

Construction Specifications

1. The measure shall be placed on undisturbed soil or well-compacted fill.

2. The entrance section shall slope toward the slope drain at the minimum rate of 1/2-inch per foot.

3. The soil around and under the entrance section shall be hand-tamped in 8-inch lifts to the top of the dike to prevent piping failure around the inlet.

4. The slope drain shall be securely staked to the slope at the grommets provided.

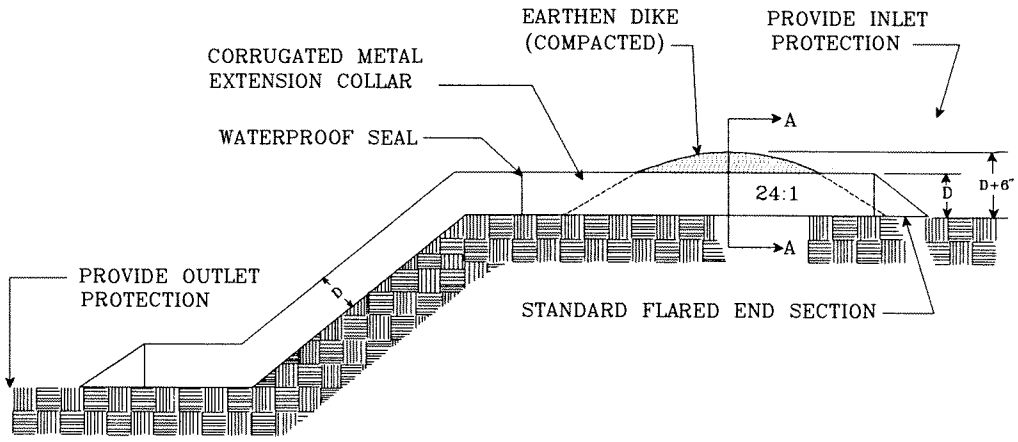
5. The slope drain sections shall be securely fastened together and have watertight fittings.

6. Install CULVERT INLET PROTECTION and OUTLET PROTECTION as per Std. & Spec.'s 3.08 and 3.18, respectively.

## Maintenance

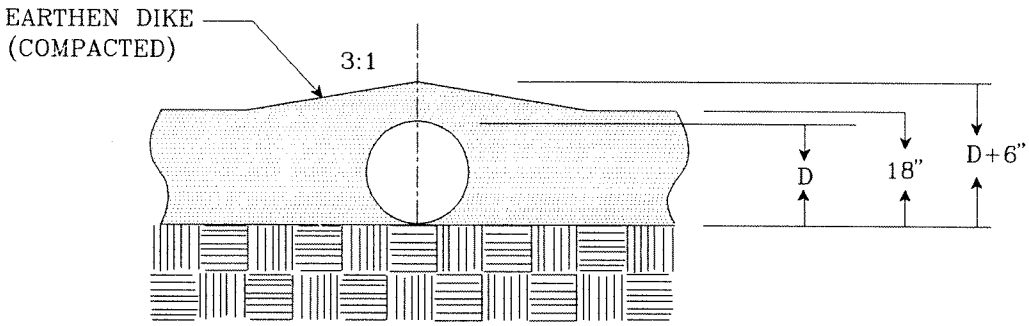
The slope drain structure shall be inspected weekly and after every storm, and repairs made if necessary. The contractor should avoid the placement of any material on and prevent construction traffic across the slope drain.

# TEMPORARY SLOPE DRAIN




SECTION VIEW

NOTE: SEDIMENT MAY BE CONTROLLED AT OUTLET IF UPLAND PONDING WILL CREATE PROBLEMS

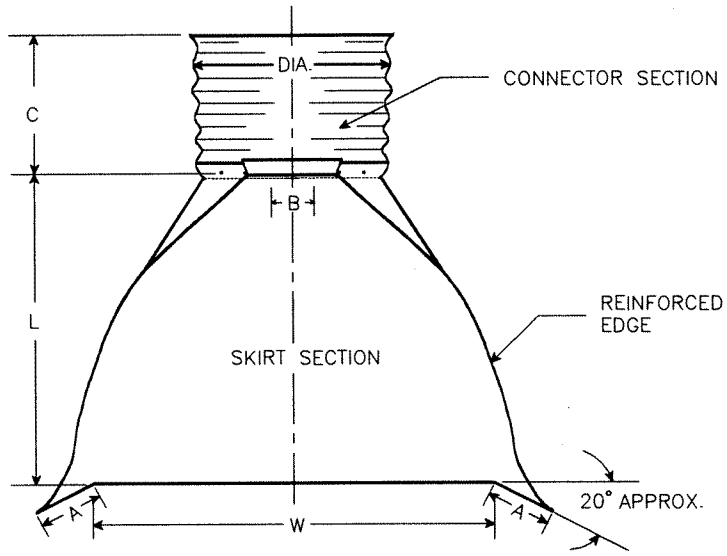



SECTION A – A

Source: Va. DSWC

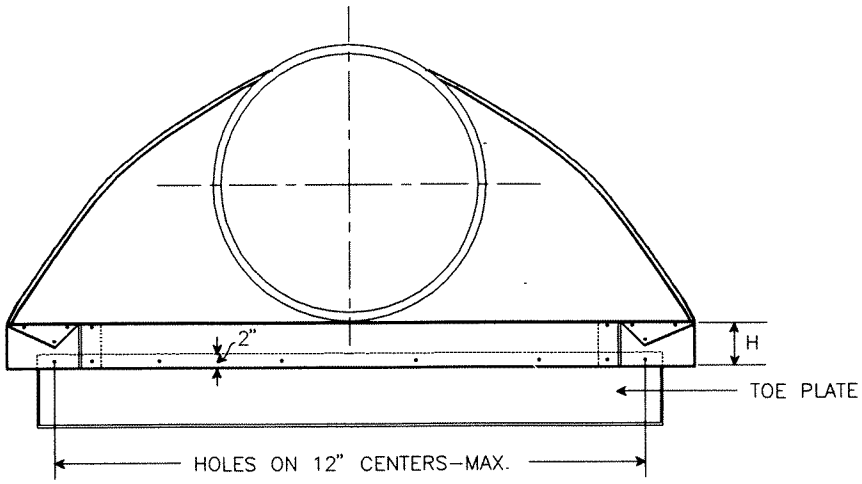
Plate 3.15-1

# FLARED END-SECTION




PLAN

WHERE FLARED END-SECTIONS ARE TO BE USED WITH BITUMINOUS COATED AND PAVED METAL PIPE, THEY ARE TO BE GALVANIZED ONLY.

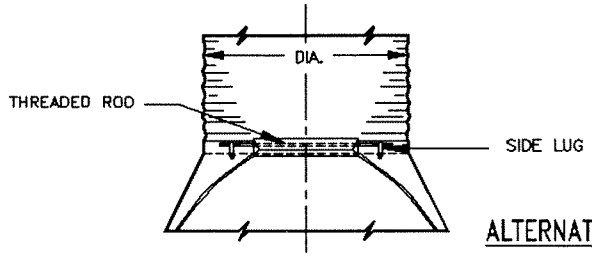



ELEVATION

Source: VDOT Road and Bridge Standards

Plate 3.15-2

# *FLARED END-SECTION*
(CONTINUED)




ALTERNATE CONNECTION

TOE PLATE, WHERE NEEDED, TO BE PUNCHED TO MATCH IN SKIRT LIP. 3/8" GALV. BOLTS TO BE FURNISHED. LENGTH OF TOE PLATE IS W + 10" FOR 12" TO 30" DIA. PIPE AND W + 22" FOR 36" TO 60" DIA. PIPE.

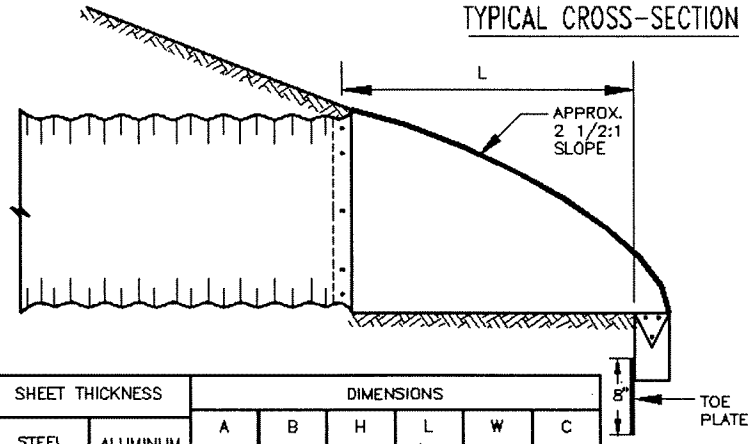
SKIRT SECTION FOR 12" TO 30" DIA. PIPE TO BE MADE IN ONE PIECE.

SKIRT SECTION FOR 36" TO 54" DIA. PIPE MAY BE MADE FROM TWO SHEETS JOINED BY RIVETING OR BOLTING ON CENTER LINE. 60" MAY BE CONSTRUCTED IN 3 PIECES.

CONNECTOR SECTION, CORNER PLATE AND TOE PLATE TO BE SAME SHEET THICKNESS AS SKIRT.

END-SECTIONS AND FITTINGS ARE TO BE GALVANIZED STEEL OR ALUMINUM ALLOY FOR USE WITH LIKE PIPE.

TYPICAL CROSS-SECTION




| PIPE DIA. | SHEET THICKNESS | | DIMENSIONS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | STEEL | ALUMINUM | A 1"TOL. | B MAX. | H 1"TOL. | L 1 1/2"TOL. | W 2"TOL. | C |
| 12" | .064" | .060" | 6" | 6" | 6" | 21" | 24" | 24" |
| 15" | .064" | .060" | 7" | 8" | 6" | 26" | 30" | 24" |
| 18" | .064" | .060" | 8" | 10" | 6" | 31" | 36" | 24" |
| 21" | .064" | .060" | 10" | 12" | 6" | 36" | 42" | 24" |
| 24" | .064" | .060" | 10" | 13" | 6" | 41" | 48" | 24" |
| 27"/30" | .064" | .075" | 12" | 16" | 8" | 51" | 60" | 24" |
| 36" | .064" | .075" | 14" | 19" | 9" | 60" | 72" | 36" |
| 42" | .064" | .105" | 16" | 22" | 11" | 69" | 84" | 36" |
| 48" | .064" | .105" | 18" | 27" | 12" | 78" | 90" | 24" |
| 54" | .064"/.079" | .105" | 18" | 30" | 12" | 84" | 102" | 36" |
| 60" | .064"/.109" | .105"/.135" | 18" | 33" | 12" | 87" | 114" | 36" |

Source: VDOT Road and Bridge Standards

Plate 3.15-3

STD & SPEC 3.06

# BRUSH BARRIER

BB

## Definition

A temporary sediment barrier constructed at the perimeter of a disturbed area from the residue materials available from clearing and grubbing the site.

## Purpose

To intercept and retain sediment from disturbed areas of limited extent, preventing sediment from leaving the site.

## Conditions Where Practice Applies

1. Below disturbed areas subject to sheet and rill erosion, where enough residue material is available for construction of such a barrier.

2. Where the size of the drainage area is no greater than one-fourth of an acre per 100 feet of barrier length; the maximum slope length behind the barrier is 100 feet; and the maximum slope gradient behind the barrier is 50 percent (2:1).

## Planning Considerations

Organic litter and spoil material from site clearing operations is usually burned or hauled away to be dumped elsewhere. Much of this material can be used effectively on the construction site itself. During clearing and grubbing operations, equipment can push or dump the mixture of limbs, small vegetation and root mat along with minor amounts of rock into windrows along the toe of a slope where erosion and accelerated runoff are expected. Because brush barriers are fairly stable and composed of natural materials, maintenance requirements are small. Field experience has shown, however, that many brush barrier installations are not effective when there are large voids created by the use of material which is too large (such as tree stumps) to provide a compact, dense barrier. Therefore, it is necessary to use residual material under 6 inches in diameter which will create a more uniform barrier or utilize a filter fabric overlay to promote enhanced filtration of sediment-laden runoff.

## Design Criteria

A formal design is not required.

## Construction Specifications

### Without Filter Cloth

1. The height of a brush barrier shall be a minimum of 3 feet.

2. The width of a brush barrier shall be a minimum of 5 feet at its base (the sizes of brush barriers may vary considerably based upon the amount of material available and the judgement of the design engineer).

3. The barrier shall be constructed by piling brush, stone, root mat and other material from the clearing process into a mounded row on the contour. Material larger than 6 inches in diameter should not be used to create the mound as the non-homogeneity of the mixture can lead to voids where sediment-laden flows can easily pass.

If a Filter is Used (see Plate 3.06-1)

1. Filter fabric must meet the minimum physical requirements noted in Table 3.05-B.

2. The filter fabric shall be cut into lengths sufficient to lay across the barrier from its up-slope base to just beyond its peak. Where joints are necessary, the fabric shall be spliced together with a minimum 6-inch overlap and securely sealed.

3. A trench shall be excavated 6-inches wide and 4-inches deep along the length of the barrier and immediately uphill from the barrier.

4. The lengths of filter fabric shall be draped across the width of the barrier with the uphill edge placed in the trench and the edges of adjacent pieces overlapping each other.

5. The filter fabric shall be secured in the trench with stakes set approximately 36 inches on center.

6. The trench shall be backfilled and the soil compacted over the filter fabric.

7. Set stakes into the ground along the downhill edge of the brush barrier, and anchor the fabric by tying twine from the fabric to the stakes.

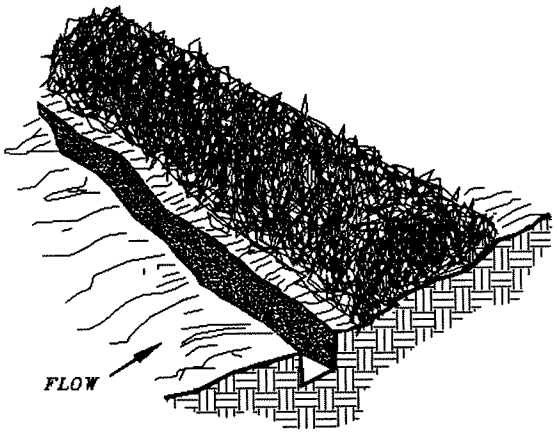
## Maintenance

1. Brush barriers shall be inspected after each rainfall and necessary repairs shall be made promptly.

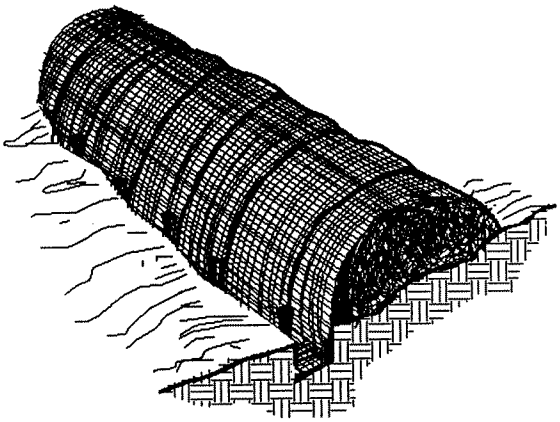
2. Sediment deposits must be removed when they reach approximately one-half the height of the barrier.

# CONSTRUCTION OF A BRUSH BARRIER COVERED BY FILTER FABRIC

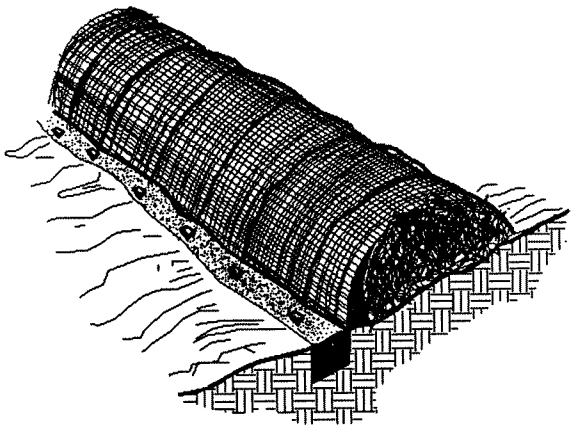
## (TREE/RESIDUAL MATERIAL WITH DIAMETER > 6")



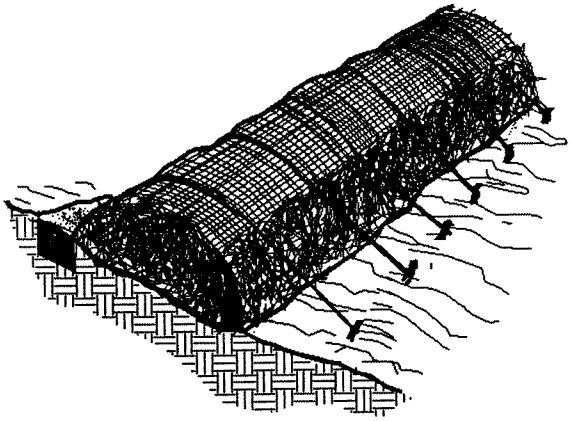

1. EXCAVATE A 4"X 4" TRENCH ALONG THE UPHILL EDGE OF THE BRUSH BARRIER.



2. DRAPE FILTER FABRIC OVER THE BRUSH BARRIER AND INTO THE TRENCH. FABRIC SHOULD BE SECURED IN THE TRENCH WITH STAKES SET APPROXIMATELY 36" O.C.



3. BACKFILL AND COMPACT THE EXCAVATED SOIL.



4. SET STAKES ALONG THE DOWN-HILL EDGE OF THE BRUSH BARRIER, AND ANCHOR BY TYING TWINE FROM THE FABRIC TO THE STAKES.

Source: Va. DSWC

Plate 3.06-1

STD & SPEC 3.05

# SILT FENCE

SF

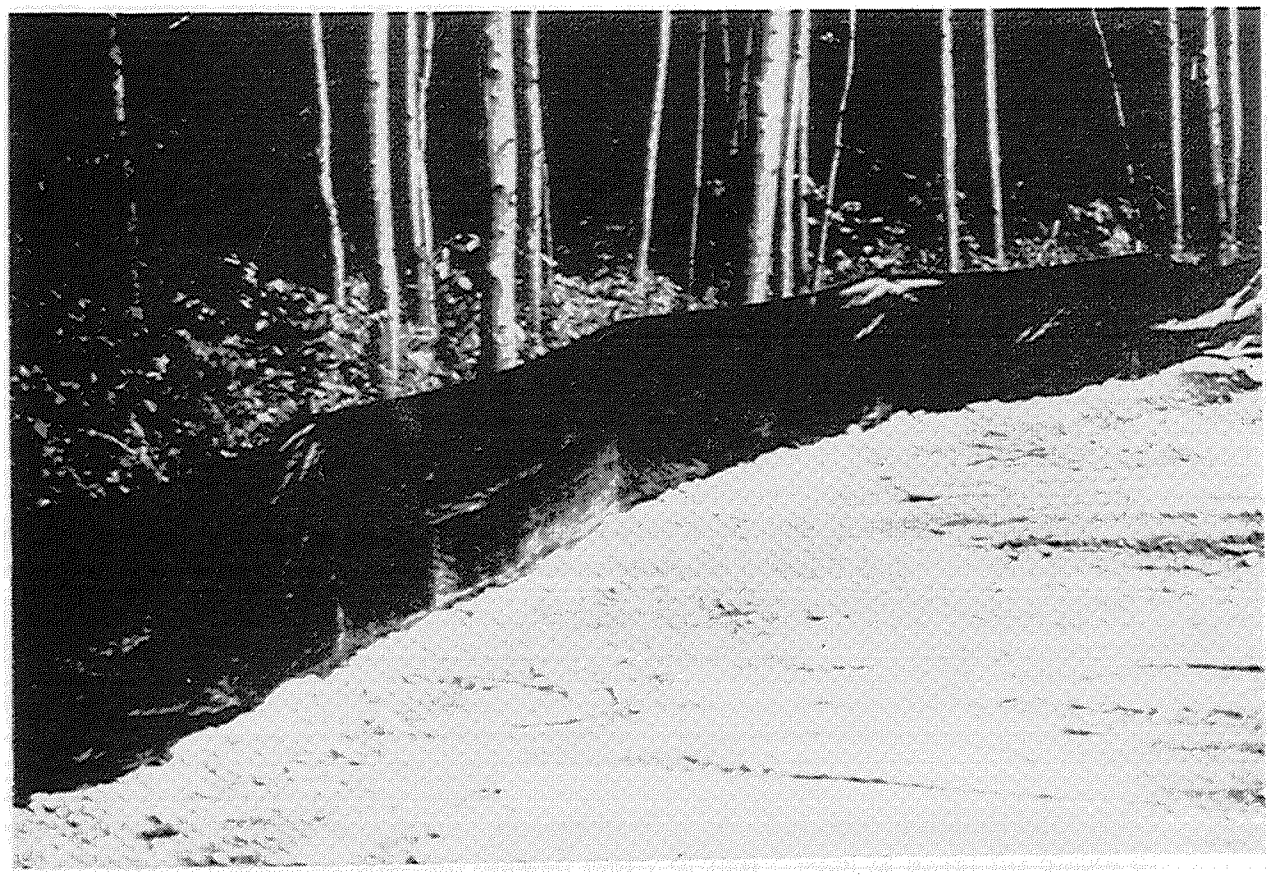
## Definition

A temporary sediment barrier consisting of a synthetic filter fabric stretched across and attached to supporting posts and entrenched.

## Purposes

1. To intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site.

2. To decrease the velocity of sheet flows and low-to-moderate level channel flows.



## Conditions Where Practice Applies

1. Below disturbed areas where erosion would occur in the form of sheet and rill erosion.

2. Where the size of the drainage area is no more than one quarter acre per 100 feet of silt fence length; the maximum slope length behind the barrier is 100 feet; and the maximum gradient behind the barrier is 50 percent (2:1).

3. In minor swales or ditch lines where the maximum contributing drainage area is no greater than 1 acre and flow is no greater than 1 cfs.

4. Silt fence will not be used in areas where rock or some other hard surface prevents the full and uniform depth anchoring of the barrier.

## Planning Considerations

Laboratory work at the Virginia Highway and Transportation Research Council (VHTRC) has shown that silt fences can trap a much higher percentage of suspended sediments than straw bales, though silt fence passes the sediment-laden water slower. Silt fences are preferable to straw barriers in many cases because of their durability and potential cost savings. While the failure rate of silt fences is lower than that of straw barriers, many instances have been observed where silt fences are improperly installed, inviting failure and sediment loss. The installation methods outlined here can improve performance and reduce failures.

As noted, flow rate through silt fence is significantly lower than the flow rate for straw bale barriers. This creates more ponding and hence more time for sediment to fall out. Table 3.05-A demonstrates these relationships.

Both woven and non-woven synthetic fabrics are commercially available. The woven fabrics generally display higher strength than the non-woven fabrics and, in most cases, do not require any additional reinforcement. When tested under acid and alkaline water conditions, most of the woven fabrics increase in strength, while the reactions of non-woven fabrics to these conditions are variable. The same is true of testing under extensive ultraviolet radiation. Permeability rates vary regardless of fabric type. While all of the fabrics demonstrate very high filtering efficiencies for sandy sediments, there is considerable variation among both woven and non-woven fabrics when filtering the finer silt and clay particles.

## Design Criteria

1. No formal design is required. As with straw bale barriers, an effort should be made to locate silt fence at least 5 feet to 7 feet beyond the base of disturbed slopes with grades greater than 7%.

**TABLE 3.05-A**

**TYPICAL FLOW RATES AND FILTERING EFFICIENCIES OF PERIMETER CONTROL**

| Material | Flow Rate (gal./sq.ft./min) | Filter Efficiency(%) |
|---|---|---|
| Straw | 5.6 | 67 |
| Synthetic Fabric | 0.3 | 97 |

Source: VHTRC

2. The use of silt fences, because they have such a low permeability, is limited to situations in which only sheet or overland flows are expected and where concentrated flows originate from drainage areas of 1 acre or less.

3. Field experience has demonstrated that, in many instances, silt fence is installed too short (less than 16 inches above ground elevation). The short fence is subject to breaching during even small storm events and will require maintenance "clean outs" more often. Properly supported silt fence which stands 24 to 34 inches above the existing grade tends to promote more effective sediment control.

## Construction Specifications

### Materials

1. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, polyester or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the requirements noted in Table 3.05-B.

2. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0° F to 120° F.

3. If wooden stakes are utilized for silt fence construction, they must have a diameter of 2 inches when oak is used and 4 inches when pine is used. Wooden stakes must have a minimum length of 5 feet.

**TABLE 3.05-B**

**PHYSICAL PROPERTIES OF FILTER FABRIC IN SILT FENCE**

| Physical Property | Test | Requirements |
|---|---|---|
| Filtering Efficiency | ASTM 5141 | 75% (minimum) |
| Tensile Strength at 20% (max.) Elongation* | VTM-52 | Extra Strength - 50 lbs./linear inch (minimum)<br>Standard Strength - 30 lbs./linear inch (minimum) |
| Flow Rate | ASTM 5141 | 0.2 gal./sq.ft./ minute (minimum) |
| Ultraviolet Radiation Stability % | ASTM-G-26 | 90% (minimum) |

* Requirements reduced by 50% after six months of installation.

Source: VHTRC

4. If steel posts (standard "U" or "T" section) are utilized for silt fence construction, they must have a minimum weight of 1.33 pounds per linear foot and shall have a minimum length of 5 feet.

5. Wire fence reinforcement for silt fences using standard-strength filter cloth shall be a minimum of 14 gauge and shall have a maximum mesh spacing of 6 inches.

## Installation

1. The height of a silt fence shall be a minimum of 16 inches above the original ground surface and shall not exceed 34 inches above ground elevation.

2. The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter cloth shall be spliced together only at a support post, with a minimum 6-inch overlap, and securely sealed.

3. A trench shall be excavated approximately 4-inches wide and 4-inches deep on the upslope side of the proposed location of the measure.

4. When wire support is used, standard-strength filter cloth may be used. Posts for this type of installation shall be placed a maximum of 10-feet apart (see Plate 3.05-1). The wire mesh fence must be fastened securely to the upslope side of the posts using heavy duty wire staples at least one inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of two inches and shall not extend more than 34 inches above the original ground surface. The standard-strength fabric shall be stapled or wired to the wire fence, and 8 inches of the fabric shall be extended into the trench. The fabric shall not be stapled to existing trees.

5. When wire support is not used, extra-strength filter cloth shall be used. Posts for this type of fabric shall be placed a maximum of 6-feet apart (see Plate 3.05-2). The filter fabric shall be fastened securely to the upslope side of the posts using one inch long (minimum) heavy-duty wire staples or tie wires and eight inches of the fabric shall be extended into the trench. The fabric shall not be stapled to existing trees. This method of installation has been found to be more commonplace than #4.

6. If a silt fence is to be constructed across a ditch line or swale, the measure must be of sufficient length to eliminate endflow, and the plan configuration shall resemble an arc or horseshoe with the ends oriented upslope (see Plate 3.05-2). Extra-strength filter fabric shall be used for this application with a maximum 3-foot spacing of posts.

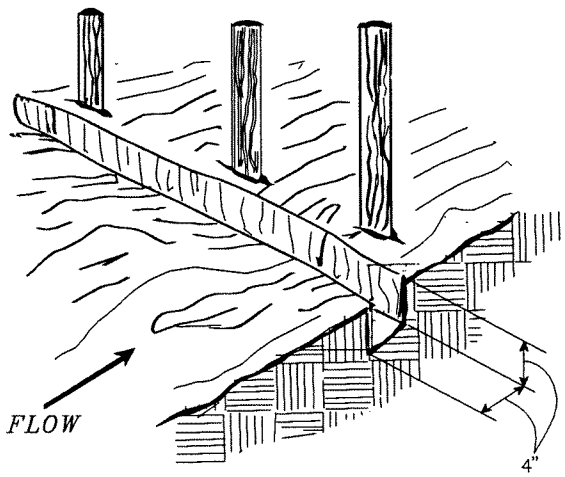
   All other installation requirements noted in #5 apply.

7. The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric.

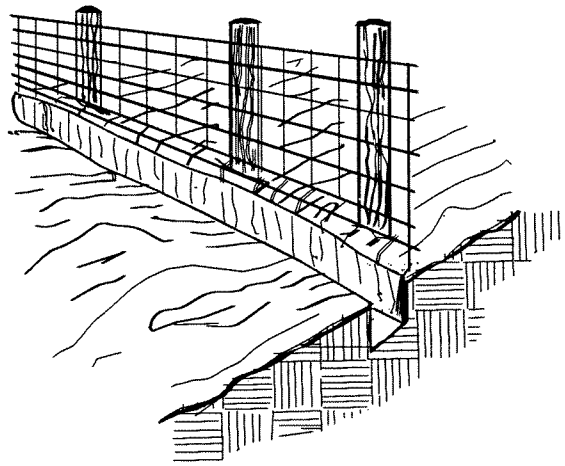
8. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

# CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT)

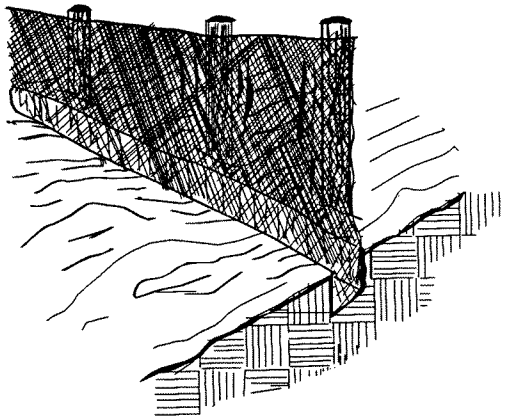
1. SET POSTS AND EXCAVATE A 4"X4" TRENCH UPSLOPE ALONG THE LINE OF POSTS.



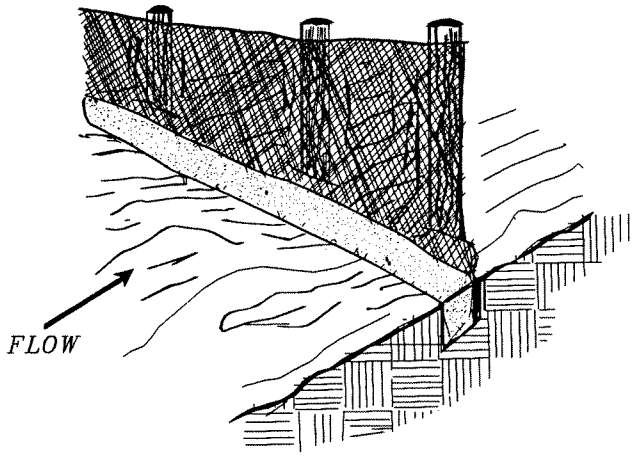

2. STAPLE WIRE FENCING TO THE POSTS.



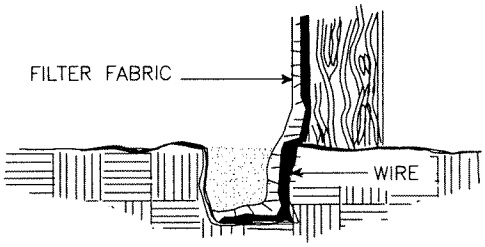
3. ATTACH THE FILTER FABRIC TO THE WIRE FENCE AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.




EXTENSION OF FABRIC AND WIRE INTO THE TRENCH.

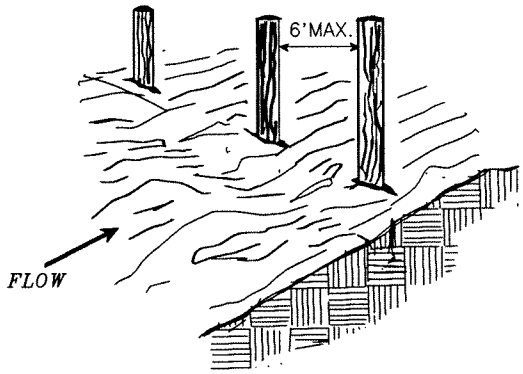



Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant

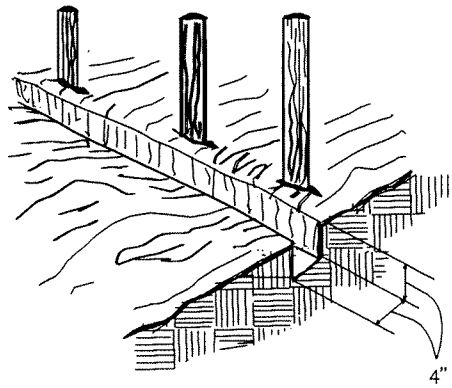
Plate 3.05-1

# CONSTRUCTION OF A SILT FENCE (WITHOUT WIRE SUPPORT)

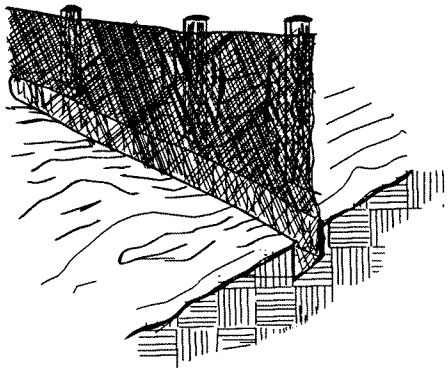
1. SET THE STAKES.



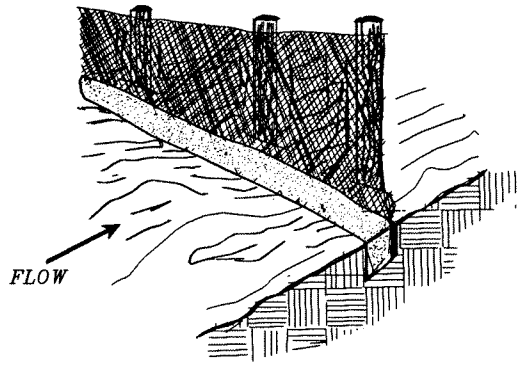

2. EXCAVATE A 4"X 4" TRENCH UPSLOPE ALONG THE LINE OF STAKES.



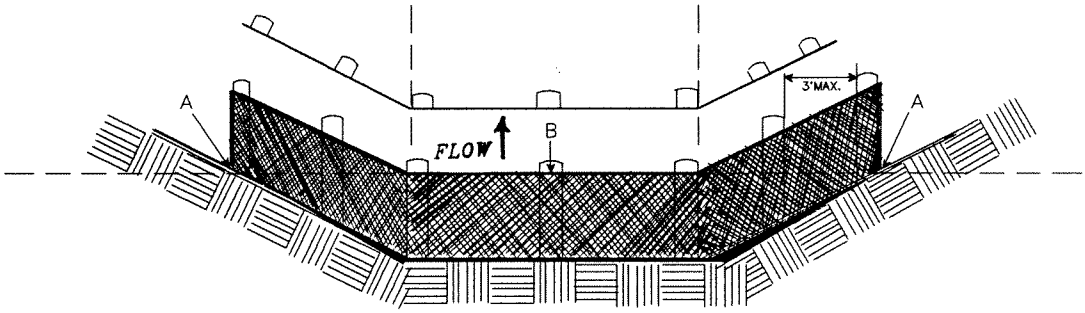

3. STAPLE FILTER MATERIAL TO STAKES AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.




SHEET FLOW INSTALLATION
(PERSPECTIVE VIEW)




POINTS A SHOULD BE HIGHER THAN POINT B.

DRAINAGEWAY INSTALLATION
(FRONT ELEVATION)

Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant

Plate 3.05-2

## Maintenance

1. Silt fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

2. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting.

3. Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.

4. Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.

5. Any sediment deposits remaining in place after the silt fence is no longer required shall be dressed to conform with the existing grade, prepared and seeded.

STD & SPEC 3.04

# STRAW BALE BARRIER

STB

## Definition

A temporary sediment barrier consisting of a row of entrenched and anchored straw bales.

## Purposes

1. To intercept and detain small amounts of sediment from disturbed areas of limited extent in order to prevent sediment from leaving the construction site.

2. To decrease the velocity of sheet flows.

## Conditions Where Practice Applies

1. Below disturbed areas subject to sheet and rill erosion.

2. Where the size of the drainage area is no greater than one-fourth of an acre per 100 feet of barrier length; the maximum slope length behind the barrier is 100 feet; and the maximum slope gradient behind the barrier is 50 percent (2:1).

3. Where effectiveness is required for less than 3 months.

4. Under no circumstances should straw bale barriers be constructed in live streams or in swales where there is the possibility of a washout.

5. The measure should not be used where water may concentrate in defined ditches and minor swales.

6. Straw bale barriers shall not be used on areas where rock or another hard surface prevents the full and uniform anchoring of the barrier.

## Planning Considerations

Based on observations made in Virginia, Pennsylvania, Maryland and other parts of the nation, straw bale barriers have not been as effective as many users had hoped they would be - especially when used to slow down and filter concentrated flows. They should be used judiciously and with caution as erosion control measures. There are three major reasons for such ineffectiveness.

First, improper utilization of straw bale barriers has been a major problem. Straw bale barriers have been used in streams and drainageways where high water depth and velocities have destroyed or damaged the control. Secondly, improper placement and installation of the barriers, such as staking the bales directly to the ground with no soil seal or entrenchment, has allowed undercutting and end flow. This has resulted in additions of, rather than removal of, sediment from runoff waters. Finally, inadequate maintenance lowers the effectiveness of these barriers. Trapping efficiencies of carefully installed straw bale barriers on one project in Virginia dropped from 57% to 16% in one month due to lack of maintenance.

There are serious questions about the continued use of straw bale barriers as they are presently installed and maintained. Averaging from $3 to $6 per linear foot, the thousands of straw bale barriers used annually in Virginia represent such a considerable expense that optimum installation procedures should be emphasized.

## Design Criteria

A formal design is not required. However, an effort should be made to locate the straw bale barrier, as well as other perimeter controls, at least 5 to 7 feet from the base of disturbed slopes with grades greater than 7%. This will help prevent the measure from being rendered useless following the initial movement of soil.

## Construction Specifications

### Sheet Flow Application

1. Bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another.

2. All bales shall be either wire-bound or string-tied. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings (see Plate 3.04-1).

3. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked (gaps filled by wedging), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier (see Plate 3.04-1).

4. Each bale shall be securely anchored by at least two stakes (minimum dimensions 2 inches x 2 inches x 36 inches) or standard "T" or "U" steel posts (minimum weight of 1.33 pounds per linear foot) driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 18 inches deep into the ground to securely anchor the bales.

5. The gaps between bales shall be chinked (filled by wedging) with straw to prevent water from escaping between the bales. Loose straw scattered over the area immediately uphill from a straw bale barrier tends to increase barrier efficiency.

6. Inspection shall be frequent and repair or replacement shall be made promptly as needed.

7. Straw bale barriers shall be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

## Maintenance

1. Straw bale barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.

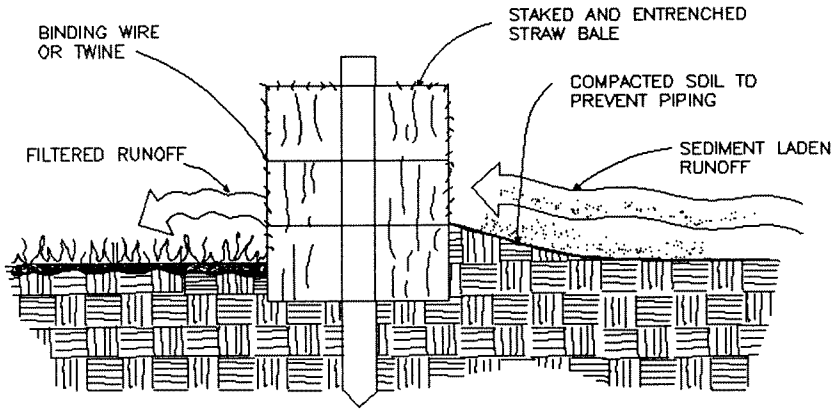
2. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales.

3. Necessary repairs to barriers or replacement of bales shall be accomplished promptly.

4. Sediment deposits should be removed after each rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

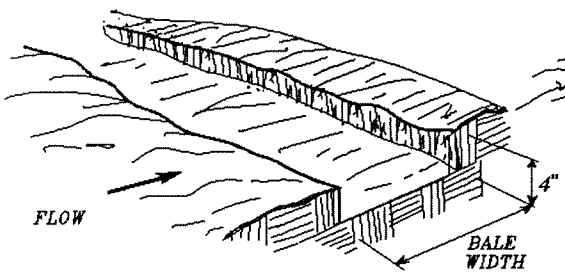
5. Any sediment deposits remaining in place after the straw bale barrier is no longer required shall be dressed to conform to the existing grade, prepared and seeded.

# STRAW BALE BARRIER

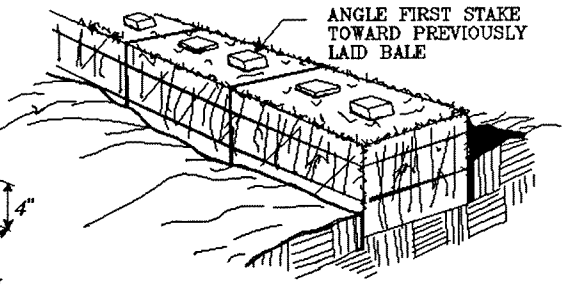


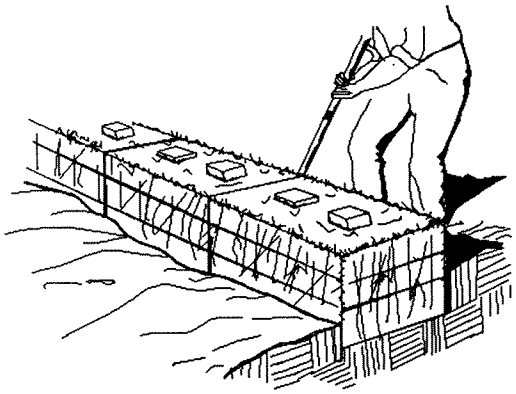

PROPERLY INSTALLED STRAW BALE
(CROSS SECTION)

1. EXCAVATE THE TRENCH.

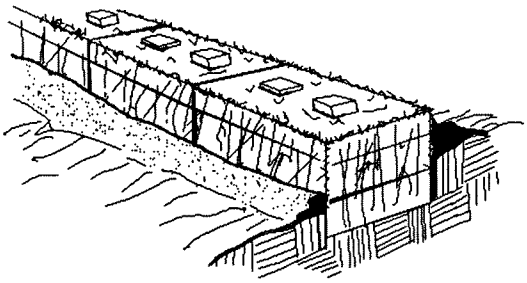



2. PLACE AND STAKE STRAW BALES.



3. WEDGE LOOSE STRAW BETWEEN BALES.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.

CONSTRUCTION OF STRAW BALE BARRIER

Source: Va. DSWC

Plate 3.04-1

STD & SPEC 3.09

# TEMPORARY DIVERSION DIKE

DD

## Definition

A temporary ridge of compacted soil constructed at the top or base of a sloping disturbed area.

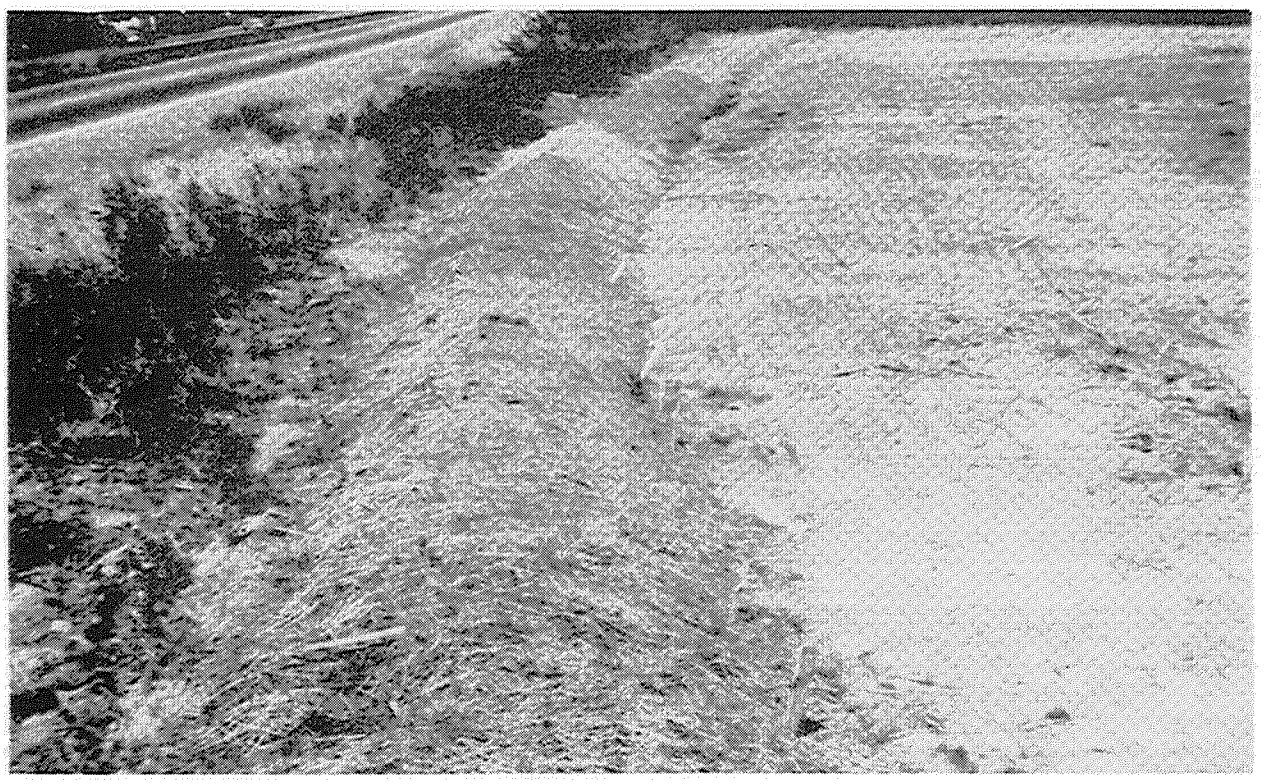
## Purposes

1. To divert storm runoff from upslope drainage areas away from unprotected disturbed areas and slopes to a stabilized outlet.

2. To divert sediment-laden runoff from a disturbed area to a sediment-trapping facility such as a sediment trap or sediment basin.

## Conditions Where Practice Applies

Wherever stormwater runoff must be temporarily diverted to protect disturbed areas and slopes or retain sediment on site during construction. These structures generally have a life expectancy of 18 months or less, which can be prolonged with proper maintenance.



## Planning Considerations

A temporary diversion dike is intended to divert overland sheet flow to a stabilized outlet or a sediment-trapping facility during establishment of permanent stabilization on sloping disturbed areas. When used a the top of a slope, the structure protects exposed slopes by keeping upland runoff away. When used at the base of a slope, the structure protects adjacent and downstream areas by diverting sediment-laden runoff to a sediment trapping facility.

As per M.S. #5, it is very important that a temporary diversion dike be stabilized immediately following installation with temporary or permanent vegetation to prevent erosion of the dike itself. The gradient of the channel behind the dike is also an important consideration. The dike must have a positive grade to assure drainage, but if the gradient is too great, precautions must be taken to prevent erosion due to high-velocity channel flow behind the dike. The cross-section of the channel which runs behind the dike should be of a parabolic or trapezoidal shape to help inhibit a high velocity of flow which could arise in a vee ditch.

This practice is considered an economical one because it uses material available on the site and can usually be constructed with equipment needed for site grading. The useful life of the practice can be extended by stabilizing the dike with vegetation. Diversion dikes are preferable to silt fence because they are more durable, less expensive, and require much less maintenance when constructed properly. Along with a TEMPORARY SEDIMENT TRAP (Std. & Spec. 3.13), they become a logical choice for a control measure once the control limits of the silt fence or straw bale barrier have been exceeded.

Temporary diversion dikes are often used as a perimeter control in association with a sediment trap or a sediment basin, or a series of sediment-trapping facilities, on moderate to large construction sites. If installed properly and in the first phase of grading, maintenance costs are very low. Often, cleaning of sediment-trapping facilities is the only associated maintenance requirement.

As specified herein, this practice is intended to be temporary. However, with more stringent design criteria, it can be made permanent in accordance with DIVERSIONS (Std. & Spec. 3.12).

## Design Criteria

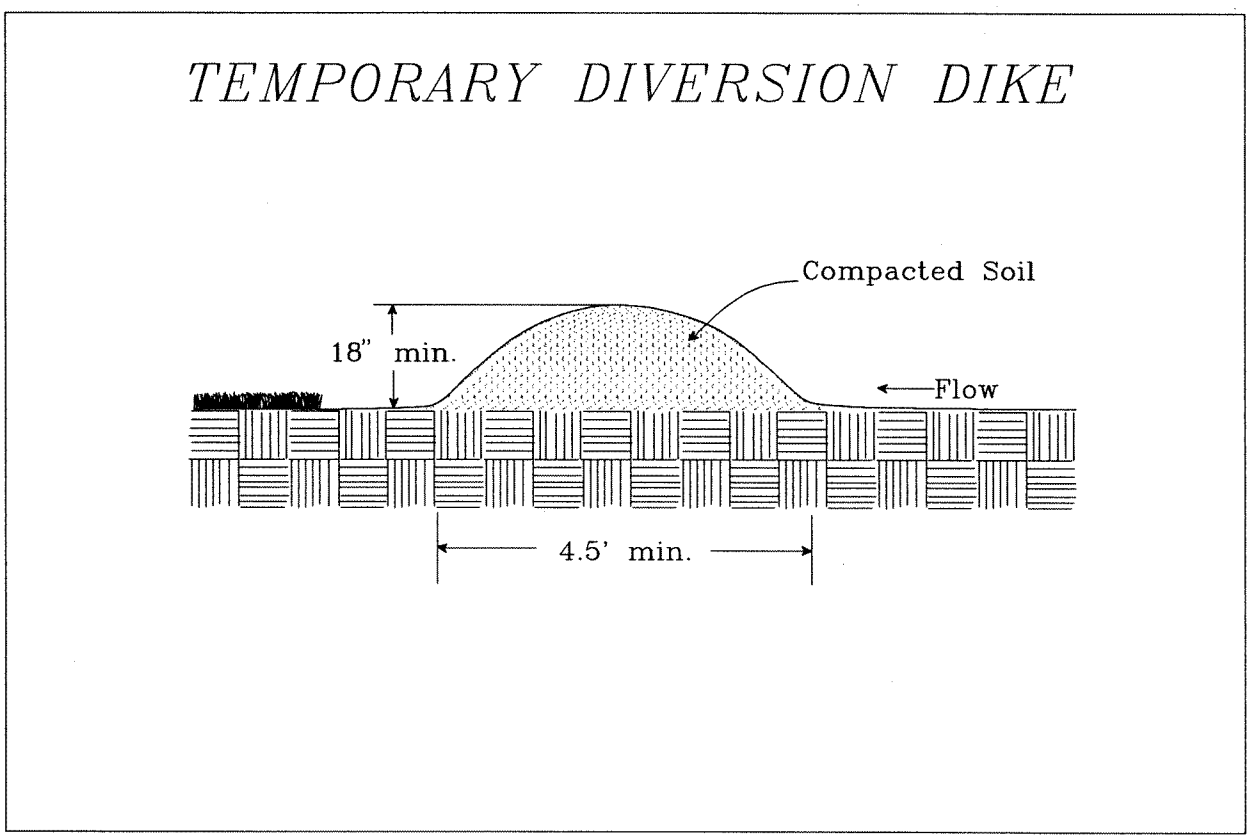
No formal design is required. The following criteria shall be met:

### Drainage Area

The maximum allowable drainage area is 5 acres.

Height

The minimum allowable height measured from the upslope side of the dike is 18 inches (see Plate 3.09-1).




Source: Va. DSWC Plate 3.09-1

Side Slopes

1½:1 or flatter, along with a minimum base width of 4.5 feet (see Plate 3.09-1).

Grade

The channel behind the dike shall have a positive grade to a stabilized outlet. If the channel slope is less than or equal to 2%, no stabilization is required. If the slope is greater than 2%, the channel shall be stabilized in accordance with Std. & Spec. 3.17, STORMWATER CONVEYANCE CHANNEL.

Outlet

1. The diverted runoff, if free of sediment, must be released through a stabilized outlet or channel.

2. Sediment-laden runoff must be diverted and released through a sediment-trapping facility such as a TEMPORARY SEDIMENT TRAP (Std. & Spec. 3.13) or TEMPORARY SEDIMENT BASIN (Std. & Spec. 3.14).

## Construction Specifications

1. Temporary diversion dikes must be installed as a first step in the land-disturbing activity and must be functional prior to upslope land disturbance.

2. The dike should be adequately compacted to prevent failure.

3. Temporary or permanent seeding and mulch shall be applied to the dike immediately following its construction.

4. The dike should be located to minimize damages by construction operations and traffic.

## Maintenance

The measure shall be inspected after every storm and repairs made to the dike, flow channel, outlet or sediment trapping facility, as necessary. Once every two weeks, whether a storm event has occurred or not, the measure shall be inspected and repairs made if needed. Damages caused by construction traffic or other activity must be repaired before the end of each working day.

STD & SPEC 3.31

# TEMPORARY SEEDING

TS

## Definition

The establishment of a temporary vegetative cover on disturbed areas by seeding with appropriate rapidly growing annual plants.

## Purposes

1. To reduce erosion and sedimentation by stabilizing disturbed areas that will not be brought to final grade for a period of more than ~~30~~ 14 days. RWE; DEQ-OTS 3-12-14

2. To reduce damage from sediment and runoff to downstream or off-site areas, and to provide protection to bare soils exposed during construction until permanent vegetation or other erosion control measures can be established.

## Conditions Where Practice Applies

Where exposed soil surfaces will not be at final grade for more than 14 days. ~~are not to be fine-graded for periods longer than 30~~ days. Such areas include denuded areas, soil stockpiles, dikes, dams, sides of sediment basins, temporary roadbanks, etc. (see MS #1 and MS #2). A permanent vegetative cover shall be applied to areas that will be left dormant for a period of more than 1 year.

## Planning Considerations

Sheet erosion, caused by the impact of rain on bare soil, is the source of most fine particles in sediment. To reduce this sediment load in runoff, the soil surface itself should be protected. The most efficient and economical means of controlling sheet and rill erosion is to establish vegetative cover. Annual plants which sprout rapidly and survive for only one growing season are suitable for establishing temporary vegetative cover. Temporary seeding is encouraged whenever possible to aid in "controlling" construction sites.

Temporary seeding also prevents costly maintenance operations on other erosion control systems. For example, sediment basin clean-outs will be reduced if the drainage area of the basin is seeded where grading and construction are not taking place. Perimeter dikes will be more effective if not choked with sediment.

Temporary seeding is essential to preserve the integrity of earthen structures used to control sediment, such as dikes, diversions, and the banks and dams of sediment basins.

Proper seedbed preparation and the use of quality seed are important in this practice just as in permanent seeding. Failure to carefully follow sound agronomic recommendations will often result in an inadequate stand of vegetation that provides little or no erosion control.

## Specifications

Prior to seeding, install necessary erosion control practices such as dikes, waterways, and basins.

### Plant Selection

Select plants appropriate to the season and site conditions from Tables 3.31-B and 3.31-C. Note that Table 3.31-B presents plants which can be used without extensive evaluation of site conditions; Table 3.31-C presents more in-depth information on the plant materials.

### Seedbed Preparation

To control erosion on bare soil surfaces, plants must be able to germinate and grow. Seedbed preparation is essential.

1. Liming: An evaluation should be conducted to determine if lime is necessary for temporary seeding. In most soils, it takes up to 6 months for a pH adjustment to occur following the application of lime. Therefore, it may be difficult to justify the cost of liming a temporary site, especially when the soil will later be moved and regraded. The following table may be used to determine the actual need along with suggested application rates.

**TABLE 3.31-A**

**LIMING REQUIREMENTS FOR TEMPORARY SITES**

| pH Test | Recommended Application of Agricultural Limestone |
|---|---|
| below 4.2 | 3 tons per acre |
| 4.2 to 5.2 | 2 tons per acre |
| 5.2 to 6 | 1 ton per acre |

Source: Va. DSWC

2. Fertilizer: Shall be applied as 600 lbs./acre of 10-20-10 (14 lbs./1,000 sq. ft.) or equivalent nutrients. Lime and fertilizer shall be incorporated into the top 2 to 4 inches of the soil if possible.

3. Surface Roughening: If the area has been recently loosened or disturbed, no further roughening is required. When the area is compacted, crusted, or hardened, the soil surface shall be loosened by discing, raking, harrowing, or other acceptable means (see SURFACE ROUGHENING, Std. & Spec. 3.29).

4. Tracking: Tracking with bulldozer cleats is most effective on sandy soils. This practice often causes undue compaction of the soil surface, especially in clayey soils, and does not aid plant growth as effectively as other methods of surface roughening.

Seeding

Seed shall be evenly applied with a broadcast seeder, drill, cultipacker seeder or hydroseeder. Small grains shall be planted no more than 1½ inches deep. Small seeds, such as Kentucky Bluegrass, should be planted no more than 1/4 inch deep. Other Grasses and Legumes should be planted from 1/4 inch to 1/2 inch deep.

Mulching

1. Seedings made in fall for winter cover and during hot and dry summer months shall be mulched according to MULCHING, Std. & Spec. 3.35, except that hydromulches (fiber mulch) will not be considered adequate. Straw mulch should be used during these periods.

2. Temporary seedings made under favorable soil and site conditions during optimum spring and fall seeding dates may not require mulch.

Re-seeding

Areas which fail to establish vegetative cover adequate to prevent rill erosion will be re-seeded as soon as such areas are identified.

**TABLE 3.31-B**

**ACCEPTABLE TEMPORARY SEEDING PLANT MATERIALS**

**"QUICK REFERENCE FOR ALL REGIONS"**

| Planting Dates | Species | Rate (lbs./acre) |
|---|---|---|
| Sept. 1 - Feb. 15 | 50/50 Mix of Annual Ryegrass (Lolium multi-florum) & Cereal (Winter) Rye (Secale cereale) | 50 - 100 |
| Feb. 16 - Apr. 30 | Annual Ryegrass (Lolium multi-florum) | 60 - 100 |
| May 1 - Aug 31 | German Millet (Setaria italica) | 50 |

Source: Va. DSWC

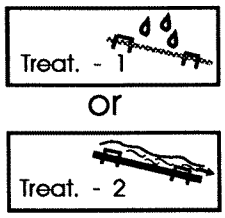
## TABLE 3.31-C

## TEMPORARY SEEDING PLANT MATERIALS, SEEDING RATES, AND DATES

| SPECIES | SEEDING RATE | | NORTH[a] | | | SOUTH[b] | | | PLANT CHARACTERISTICS |
|---|---|---|---|---|---|---|---|---|---|
| | Acre | 1000 $ft^2$ | 3/1 to 4/30 | 5/1 to 8/15 | 8/15 to 11/1 | 2/15 to 4/30 | 5/1 to 9/1 | 9/1 to 11/15 | |
| OATS (Avena sativa) | 3 bu. (up to 100 lbs., not less than 50 lbs.) | 2 lbs. | X | - | - | X | - | - | Use spring varieties (e.g., Noble). |
| RYE[d] (Secale cereale) | 2 bu. (up to 110 lbs., not less than 50 lbs.) | 2.5 lbs. | X | - | X | X | - | X | Use for late fall seedings, winter cover. Tolerates cold and low moisture. |
| GERMAN MILLET (Setaria italica) | 50 lbs. | approx. 1 lb. | - | X | - | - | X | - | Warm-season annual. Dies at first frost. May be added to summer mixes. |
| ANNUAL RYEGRASS[c] (Lolium multi-florum) | 60 lbs. | 1½ lbs. | X | - | X | X | - | X | May be added in mixes. Will mow out of most stands. |
| WEEPING LOVEGRASS (Eragrostis curvula) | 15 lbs. | 5½ ozs. | - | X | - | - | X | - | Warm-season perennial. May bunch. Tolerates hot, dry slopes and acid, infertile soils. May be added to mixes. |
| KOREAN LESPEDEZA[c] (Lespedeza stipulacea) | 25 lbs. | approx. 1½ lbs. | X | X | - | X | X | - | Warm season annual legume. Tolerates acid soils. May be added to mixes. |

[a] Northern Piedmont and Mountain region. See Plates 3.22-1 and 3.22-2.
[b] Southern Piedmont and Coastal Plain.
[c] May be used as a cover crop with spring seeding.
[d] May be used as a cover crop with fall seeding.
X May be planted between these dates.
\- May not be planted between these dates.

STD & SPEC 3.36




# SOIL STABILIZATION BLANKETS & MATTING

## Definition

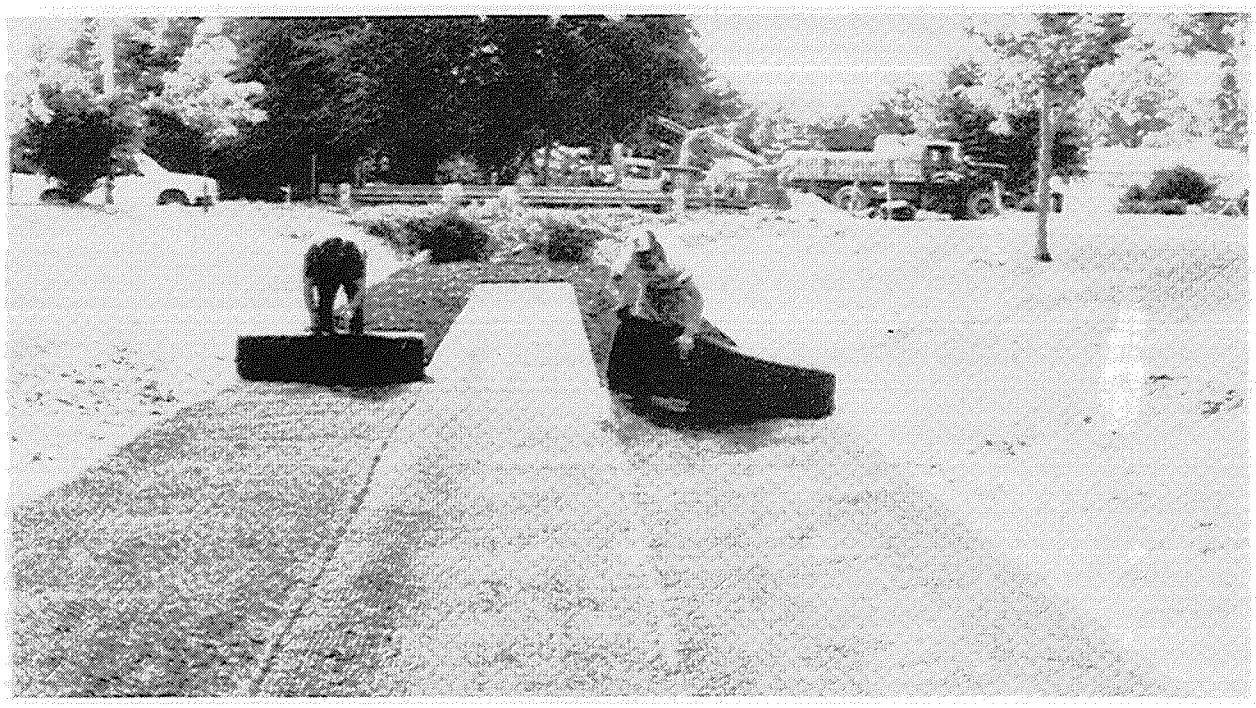
The installation of a protective covering (blanket) or a soil stabilization mat on a prepared planting area of a steep slope, channel or shoreline.

## Purpose

To aid in controlling erosion on critical areas by providing a microclimate which protects young vegetation and promotes its establishment. In addition, some types of soil stabilization mats are also used to raise the maximum permissible velocity of turf grass stands in channelized areas by "reinforcing the turf" to resist the forces of erosion during storm events.

## Conditions Where Practice Applies

On short, steep slopes where erosion hazard is high and planting is likely to be too slow in providing adequate protective cover; in vegetated channels where the velocity of design flow exceeds "allowable" velocity; on streambanks or tidal shorelines where moving water is likely to wash out new plantings; or in areas where the forces of wind prevent standard mulching practices from remaining in place until vegetation becomes established.



## Planning Considerations

Soil stabilization blankets and mats can be applied to problem areas to supplement nature's erosion control system (vegetation) in its initial establishment and in providing a safe and "natural" conveyance for high velocity stormwater runoff. They are being used today in many applications were previously a structural lining would have been required. Care must be taken to choose the type of blanket or matting which is most appropriate for the specific needs of a project. Two general types of blankets and mats are discussed within this specification. However, with the abundance of soil stabilization products available today, it is impossible to cover all the advantages, disadvantages and specifications of all manufactured blankets and mats. Therefore, as with many erosion control-type products, there is no substitute for a thorough understanding of the manufacturer's instructions and recommendations and a site visit by a designer or plan reviewer to verify a product's appropriateness.

**Treatment-1** is a degradable soil stabilization blanket which includes "combination" blankets consisting of a plastic netting which covers and is intertwined with a natural organic or man-made mulch; or, a jute mesh which is typically homogeneous in design and can act alone as a soil stabilization blanket.

It should be used to help establish vegetation on previously disturbed slopes - normally problem slopes of 3:1 or greater. Since the materials which compose the soil stabilization blankets will deteriorate over time, they should be used in permanent conveyance channels with the realization that the system's resistance to erosion is based on the type of vegetation planted and the existing soil characteristics. During the establishment of vegetation, **Treatment-1** should not be subjected to shallow or deep concentrated flows moving at greater than 4 feet/second.

**Treatment-1** provides the following benefits in the achievement of vegetative stabilization when properly applied over seed and required amendments:

1. Protection of the seed and soil from raindrop impact and subsequent displacement.

2. Thermal consistency and moisture retention for seedbed area.

3. Stronger and faster germination of grasses and legumes.

4. Planing off excess stormwater runoff.

5. Prevention of sloughing of topsoil added to steeper slopes.

**Treatment-2** is a soil stabilization matting which consists of a non-degradable, 3-dimensional plastic structure which can be filled with soil prior to planting. This configuration provides a matrix for root growth where the matting becomes entangled and penetrated by roots, forming continuous anchorage for surface growth and promoting enhanced energy

dissipation. **Treatment-2** can be used on problem slopes (normally 3:1 or greater), and in stormwater conveyance channels.

In addition to those benefits noted for **Treatment-1**, **Treatment-2** provides the following benefits in the achievement of vegetative stabilization and in the replacement of more traditional channel linings such as concrete and riprap:

1. Causes soil to drop out of stormwater and fill matrix with fine soils which become the growth medium for the development of roots.

2. When embedded in the soil within stormwater channels, it acts with the vegetative root system to form an erosion resistant cover which resists hydraulic lift and shear forces.

Since **Treatment-2** is non-degradable, it can be used in permanent conveyance channels and can withstand higher velocities of flow than the vegetation and soil would normally allow. However, a 10 feet/second velocity of flow should be the maximum allowed in a conveyance system which utilizes **Treatment-2.**

VDOT Nomenclature and Product Information

The Virginia Department of Transportation has its own nomenclature for many of the standards and specifications found in this handbook; this is true in the case of soil stabilization blankets and matting. The following relationship exists between the two methods of naming the practice:

| Va. E&S-C Handbook | | VDOT Specifications |
|---|---|---|
| **Treatment-1** | (is equivalent to) | EC-2 |
| **Treatment-2** | (is equivalent to) | EC-3 |

It is recommended that most current VDOT "Approved Products List" for these products be consulted prior to installation of a particular blanket or mat. Importantly, the list names those products approved for a certain range of flow velocities when **Treatment-2** (VDOT's EC-3) installation is contemplated.

## TREATMENT-1: SOIL STABILIZATION BLANKET

(Allowable Velocity Range During Vegetation Establishment: 0 - 4 f.p.s.)

Materials

1. Combination Blankets - They shall consist of a photo-degradable plastic netting which covers and is entwined in a natural organic or man-made mulching material.

The mulching material shall consist of wood fibers, wood excelsior, straw, coconut fiber, or man-made fibers, or a combination of the same. The blanket shall be of consistent thickness with the mulching material/fibers evenly distributed over its entire length. The mulching material/fibers must interlock or entwine to form a dense layer which not only resists raindrop impact, but will allow vegetation to penetrate the blanket.

The blanket shall be nontoxic to vegetation and to the germination of seed and shall not be injurious to the unprotected skin of humans. At a minimum, the plastic netting must cover the top side of the blanket and possess a high web strength. The netting shall be entwined with the mulching material/fiber to maximize strength and provide for ease of handling.

2. Jute Mesh - It shall be of a uniform, open, plain weave, of undyed and unbleached single jute yarn. The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one half of its normal diameter. Jute mesh shall be new and shall conform to the following:

   a. Length of jute mesh shall be marked on each roll.

   b. There shall be 0.60-inch openings (± 25%) between strands, lengthwise.

   c. There shall be 0.90-inch openings (± 25%) between strands, lengthwise.

   d. Weight shall average 0.90 lbs./square yard with a tolerance of 5%.

   As previously noted, jute mesh provides such good coverage (large surface area of strands) and contains such small openings that it can be used alone as a blanket.

3. Other **Treatment-1** Products - These shall conform to manufacturer's specifications and be approved by the Plan-Approving Authority prior to being specified for a particular application. These products should be installed in accordance with manufacturer's recommendations, provided those recommendations are at least as stringent as this specification. Again, it is recommended that VDOT's "Approved Products List" be consulted. In no case shall these products cover less than 30% of the soil surface.

4. Staples - Staples for anchoring Treatment-1 shall be No. 11-gauge wire or heavier. Their length shall be a minimum of 6 inches. A larger staple with a length of up to 12 inches should be used on loose, sandy, or unstable soils.

## Installation Requirements

Site Preparation - After site has been shaped and graded to approved design, prepare a friable seedbed relatively free from clods and rocks more than 1½ inches in diameter and any foreign material that will prevent uniform contact of the protective covering with the soil surface.

Planting - Lime, fertilize, and seed in accordance with seeding or other type of planting plan. When using jute mesh on a seeded area, apply approximately one-half the seed after laying the mat. The protective covering can be laid over sprigged areas where small grass plants have been inserted into the soil. Where ground covers are to be planted, lay the protective covering first and then plant through the material as per planting design.

When open-weave nets are used, lime, fertilizer, seed and mulch should be applied before laying the net. When a combination blanket (such as an "excelsior" blanket) is used, seed and soil amendments must also be applied before the blanket is laid.

Orientation - See Plate 3.36-1 for orientation of **Treatment-1** for different topographic conditions.

Laying and Stapling (see Plate 3.36-2) - If instructions have been followed, all needed check slots will have been installed, and the protective covering will be laid on a friable seedbed free from clods, rocks, roots, etc. that might impede good contact.

1. Start laying the protective covering from the top of the channel or top of slope and unroll down-grade.

2. Allow to lay loosely on soil - do not stretch.

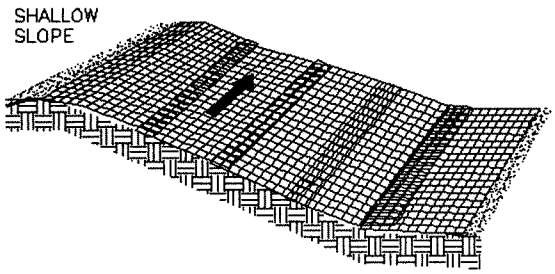
3. Upslope ends of the protective covering should be buried in a anchor slot no less than 6-inches deep. Tamp earth firmly over the material. Staple the material at a minimum of every 12 inches across the top end.

4. Edges of the material shall be stapled every 3 feet. Where multiple widths are laid side by side, the adjacent edges shall be overlapped a minimum of 2 inches and stapled together.

5. Staples shall be placed down the center, staggered with the edges at 3 foot intervals.

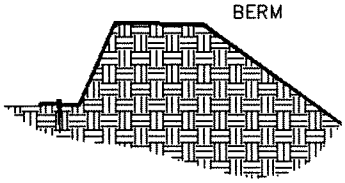
Check slots - On highly erodible soils and on slopes steeper than 4:1, erosion check slots should be made every 50 feet (see Plate 3.36-2). Insert a fold of the material (separate piece) into a 6-inch trench and tamp firmly. Staple fold to "main" blanket at minimum 12-inch intervals across the upstream and downstream portion of the blanket.

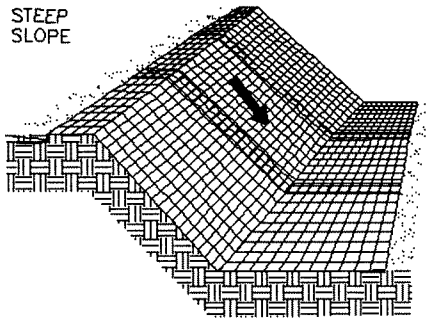
# TYPICAL ORIENTATION OF TREATMENT – 1 (SOIL STABILIZATION BLANKET)




ON SHALLOW SLOPES, STRIPS OF NETTING PROTECTIVE COVERINGS MAY BE APPLIED ACROSS THE SLOPE.

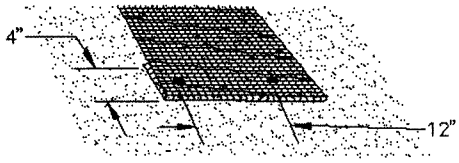
WHERE THERE IS A BERM AT THE TOP OF THE SLOPE, BRING THE MATERIAL OVER THE BERM AND ANCHOR IT BEHIND THE BERM.

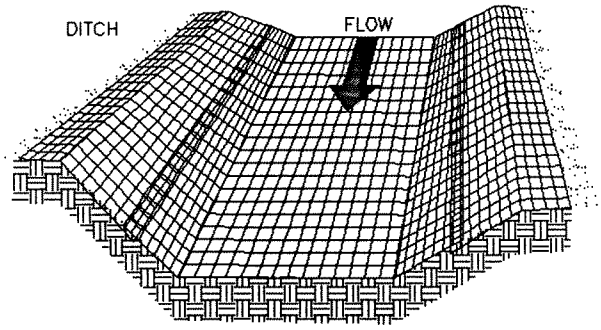



ON STEEP SLOPES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW AND ANCHOR SECURELY.

BRING MATERIAL DOWN TO A LEVEL AREA BEFORE TERMINATING THE INSTALLATION. TURN THE END UNDER 4" AND STAPLE AT 12" INTERVALS.



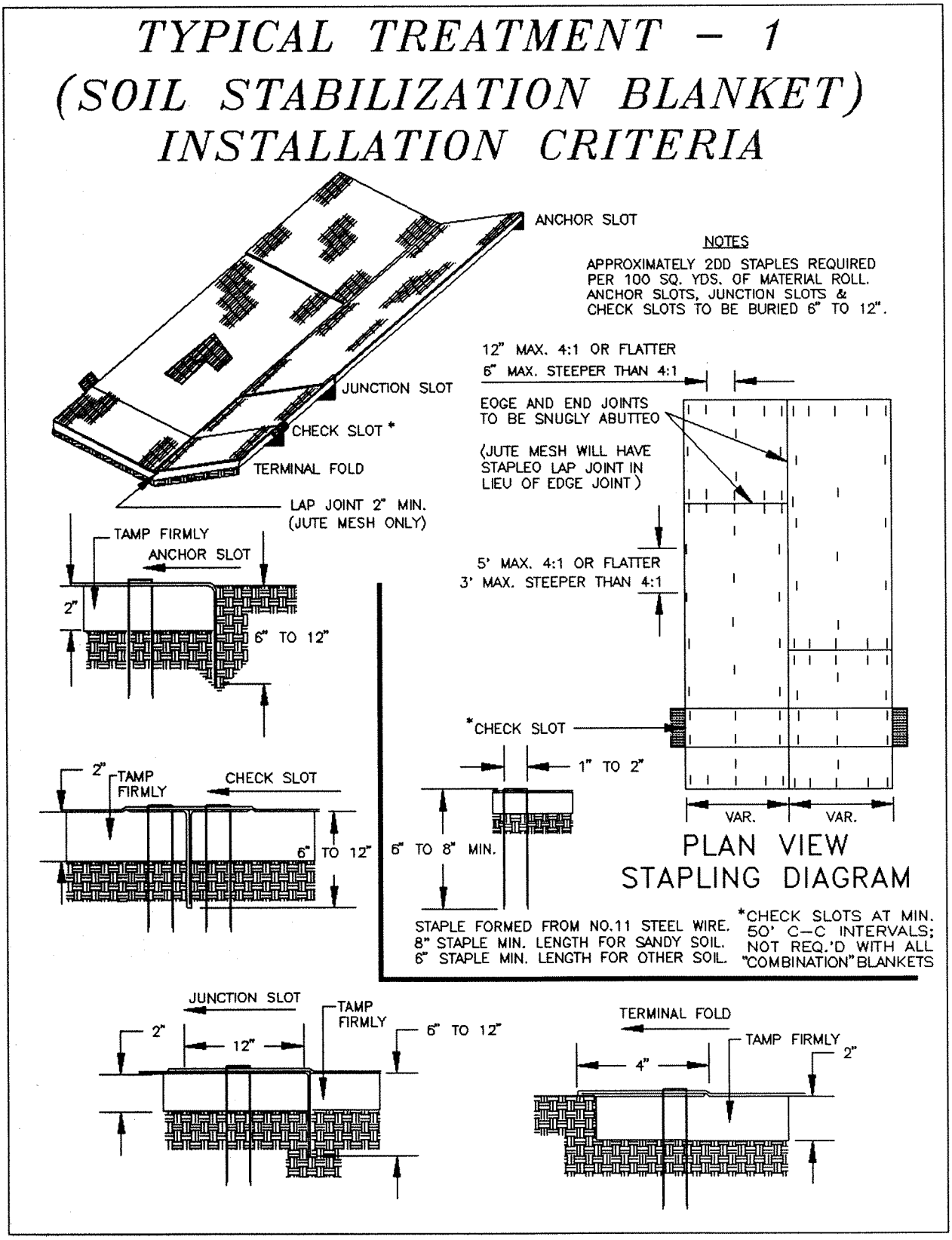




IN DITCHES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW. USE CHECK SLOTS AS REQUIRED. AVOID JOINING MATERIAL IN THE CENTER OF THE DITCH IF AT ALL POSSIBLE.

Source: Adapted from Ludlow Products Brochure

Plate 3.36-1

# TYPICAL TREATMENT – 1 (SOIL STABILIZATION BLANKET) INSTALLATION CRITERIA




Source: VDOT Road and Bridge Standards

Plate 3.36-2

Note: Many combination blankets are designed and manufactured to resist movement and uplift to a point which check slots may not be required. Plan designers and review authorities are urged to study manufacturers' recommendations and site conditions.

Joining Protective Coverings - Insert a new roll of material into an anchor slot, as with upslope ends. Overlap the end of the previous roll a minimum of 12 inches, and staple across the end of the roll just below the anchor slot and across the material every 12 inches.

Terminal End - At the point at which the material is discontinued, or at which time the protective covering meets a structure of some type, fold 4 inches of the material underneath and staple every 12 inches (minimum).

At bottom of slopes - Lead net out onto a level area before anchoring. Turn ends under 4 inches, and staple across end every 12 inches.

Final Check - These installation techniques must be adhered to:

1. Protective blanket is in uniform contact with the soil.
2. All lap joints are secure.
3. All staples are driven flush with the ground.
4. All disturbed areas have been seeded.

## TREATMENT-2: SOIL STABILIZATION MATTING

(Allowable velocity range after vegetative establishment: 0 - 10 f.p.s.)

### Materials

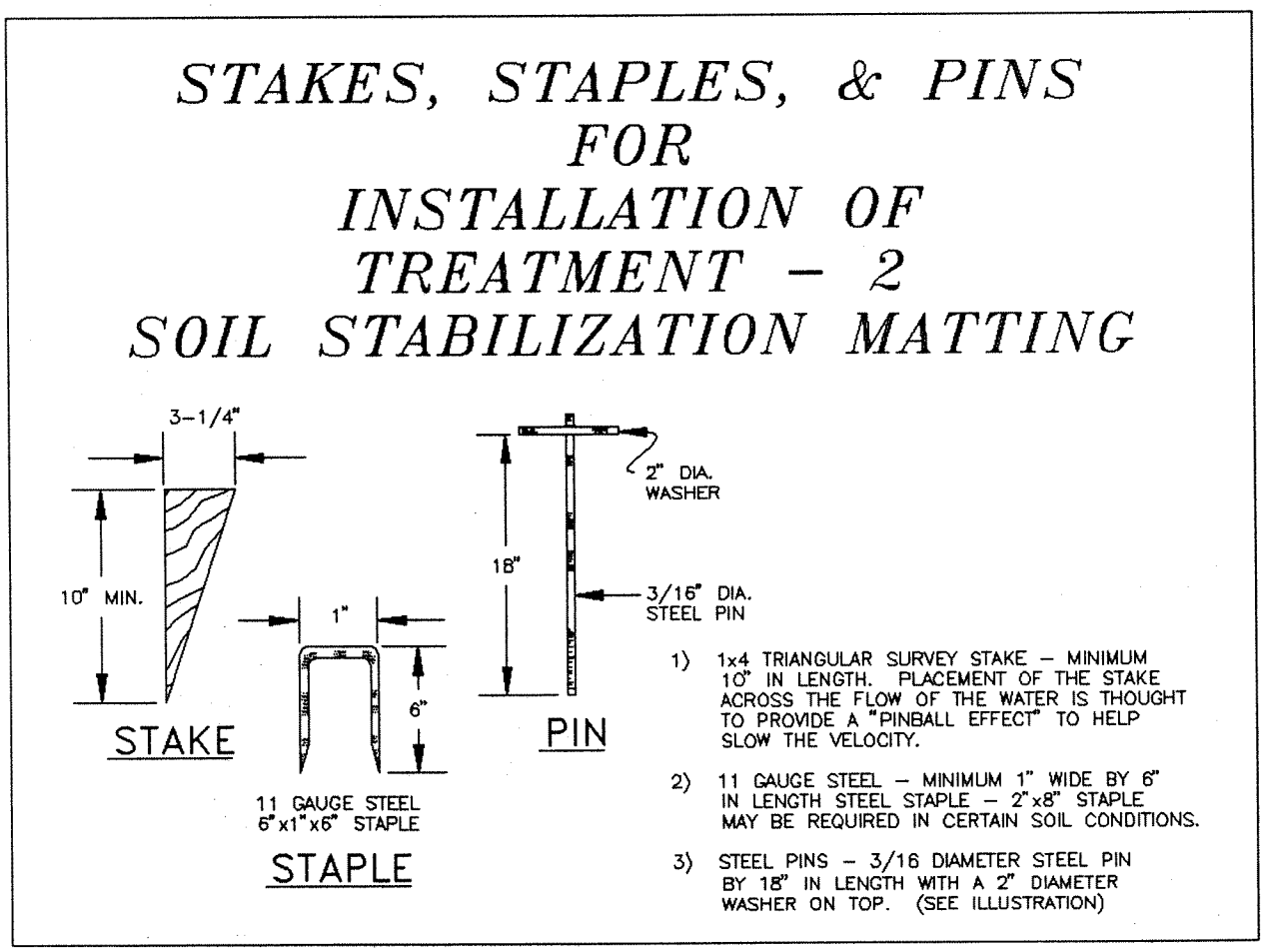
Matting - The majority of these products provide a three dimensional geomatrix of nylon, polyethylene, or randomly oriented monofilaments, forming a mat. These products contain ultra violet (UV) inhibiting stabilizers, added to the compounds to ensure endurance and provide "permanent root reinforcement."

The three dimensional feature creates an open space which is allowed to fill with soil. The roots of the grass plant become established within the mat itself, forming a synergistic root and mat system. As the grass becomes established, the two actually "reinforce" each other, preventing movement or damage to the soil. Allowable velocities are increased considerably over natural turf stands.

Selection of the appropriate matting materials along with proper installation become critical factors in the success of this practice. VDOT's "Approved Products List" can be a real asset in the selection process. Consultation with the supplier or the manufacturer and thorough

evaluation of performance data to ensure proper selection of a soil stabilization matting are also essential. Although many manufacturers claim their products may inhibit erosion associated with channel velocities of up to 20 ft./sec., it is recommended that any velocities that exceed 10 ft./sec. be properly protected with some form of structural lining (see Std. & Spec. 3.17, STORMWATER CONVEYANCE CHANNEL).

Staples - Staples or anchoring methods and recommendations vary by manufacturers. The expectation of high velocities should dictate the use of more substantial anchoring. Some of the typically recommended stakes, staples and pins are depicted in Plate 3.36-3




Source: Product literature from Greenstreak, Inc. Plate 3.36-3

## Installation Requirements

Site Preparation - After site has been shaped and graded to approved design, prepare a friable seedbed relatively free from clods and rocks more than 1 inch in diameter, and any foreign material that will prevent contact of the soil stabilization mat with the soil surface. If necessary, redirect any runoff away from the ditch or slope during installation.

Planting - Lime, fertilize and seed in accordance with MS #1 and the approved plan, paying special attention to the plant selection that may have been chosen for the matted area. If the area has been seeded prior to installing the mat, make sure and reseed all areas disturbed during installation.

Mulching - Mulch (normally straw) should be applied following installation of **Treatment-2** at rates noted in Std. & Spec. 3.35, MULCHING.

Laying and Securing - See Plates 3.36-4, 3.36-5 and 3.36-6. Similar to installing **Treatment-1**, but Plan Approving Authority's requirements or manufacturer's recommendations must be followed as detailed. The key to achieving desired performance is dependent upon proper installation.

Check Slots - See Plate 3.36-4. Matting manufacturers vary significantly in their check slot requirements. Similar to the installation of **Treatment-1**, a check slot may be required when laying **Treatment-2** to "correct" the flow of water if it has the potential to undermine the matting. Most authorities (including VDOT) require that the sides of the matting also be entrenched, creating a slope shelf for the material to rest on, preventing water from entering under the mat on the sides.

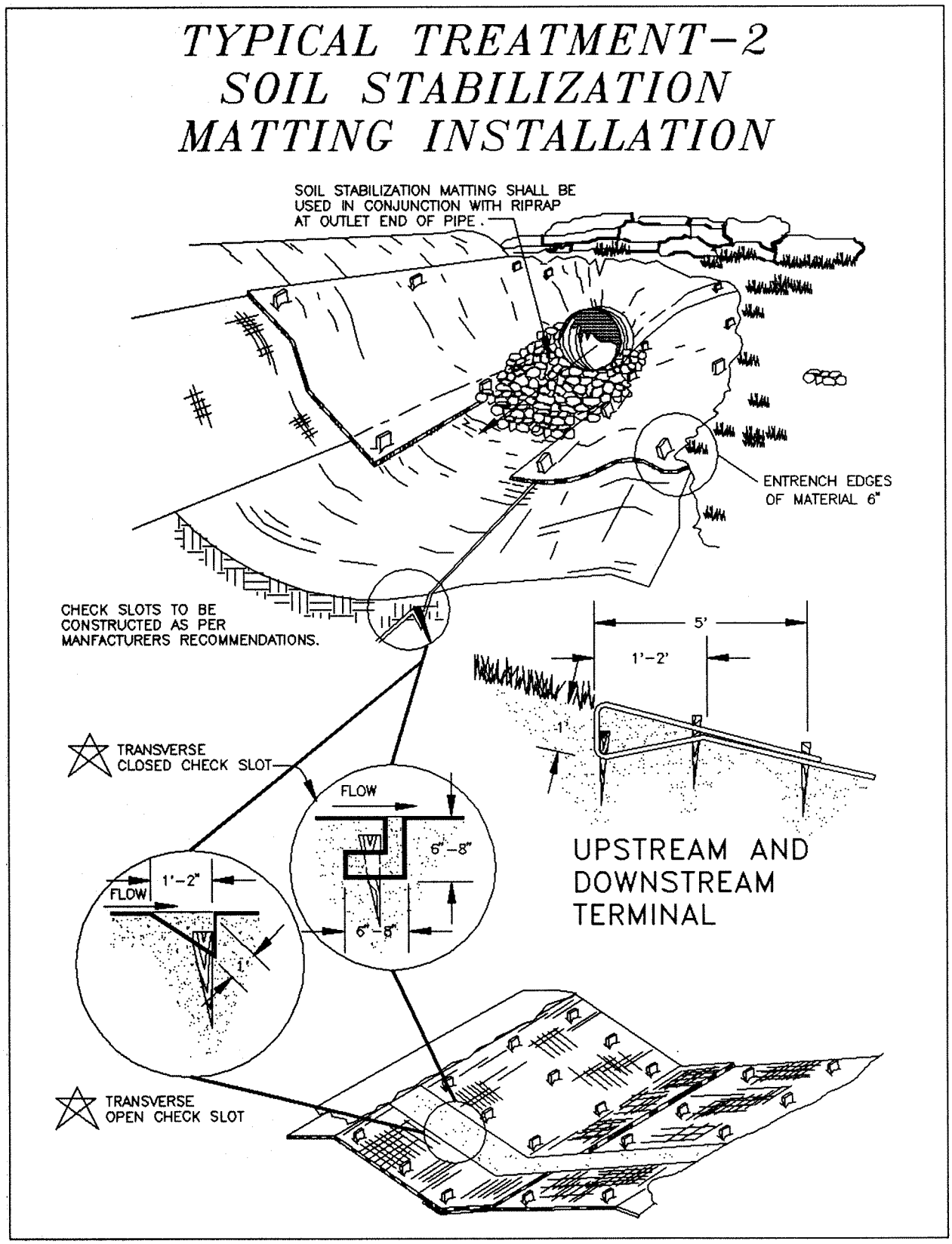
Securing the Material and Joining Mats - Again, product specifications vary - upstream and downstream terminal slots, new roll overlaps and multiple width installations differ by various products and manufacturers.

Final Check - These installation techniques must be adhered to:

1. Soil stabilization mat is in uniform contact with the soil.
2. All required slots and lapped joints are in place.
3. The material is properly anchored.
4. All disturbed areas are seeded.

## Maintenance

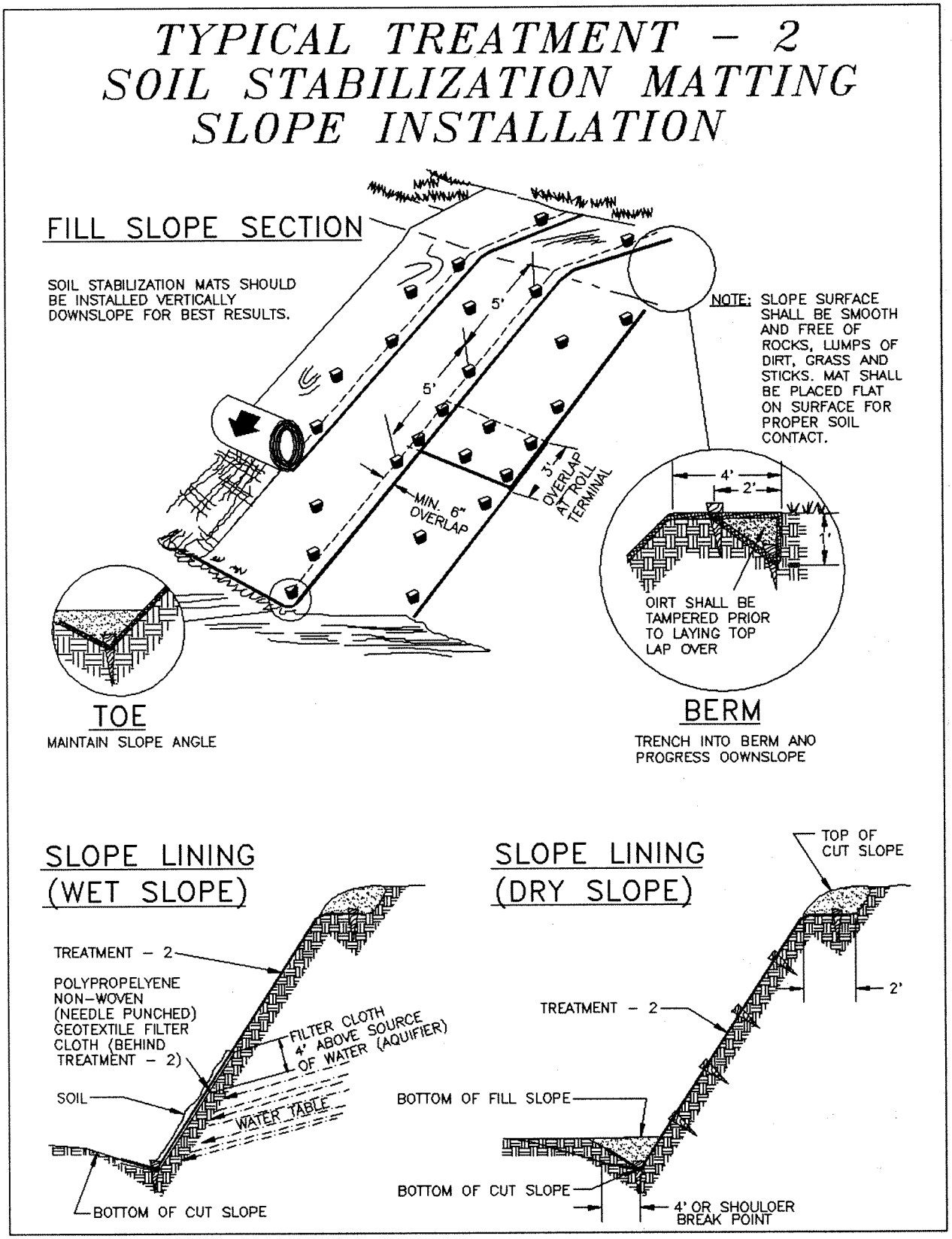
All soil stabilization blankets and matting should be inspected periodically following installation, particularly after rainstorms to check for erosion and undermining. Any dislocation or failure should be repaired immediately. If washouts or breakage occurs, re-install the material after repairing damage to the slope or ditch. Continue to monitor these areas until which time they become permanently stabilized; at that time an annual inspection should be adequate.




Source: VDOT Road and Bridge Standards

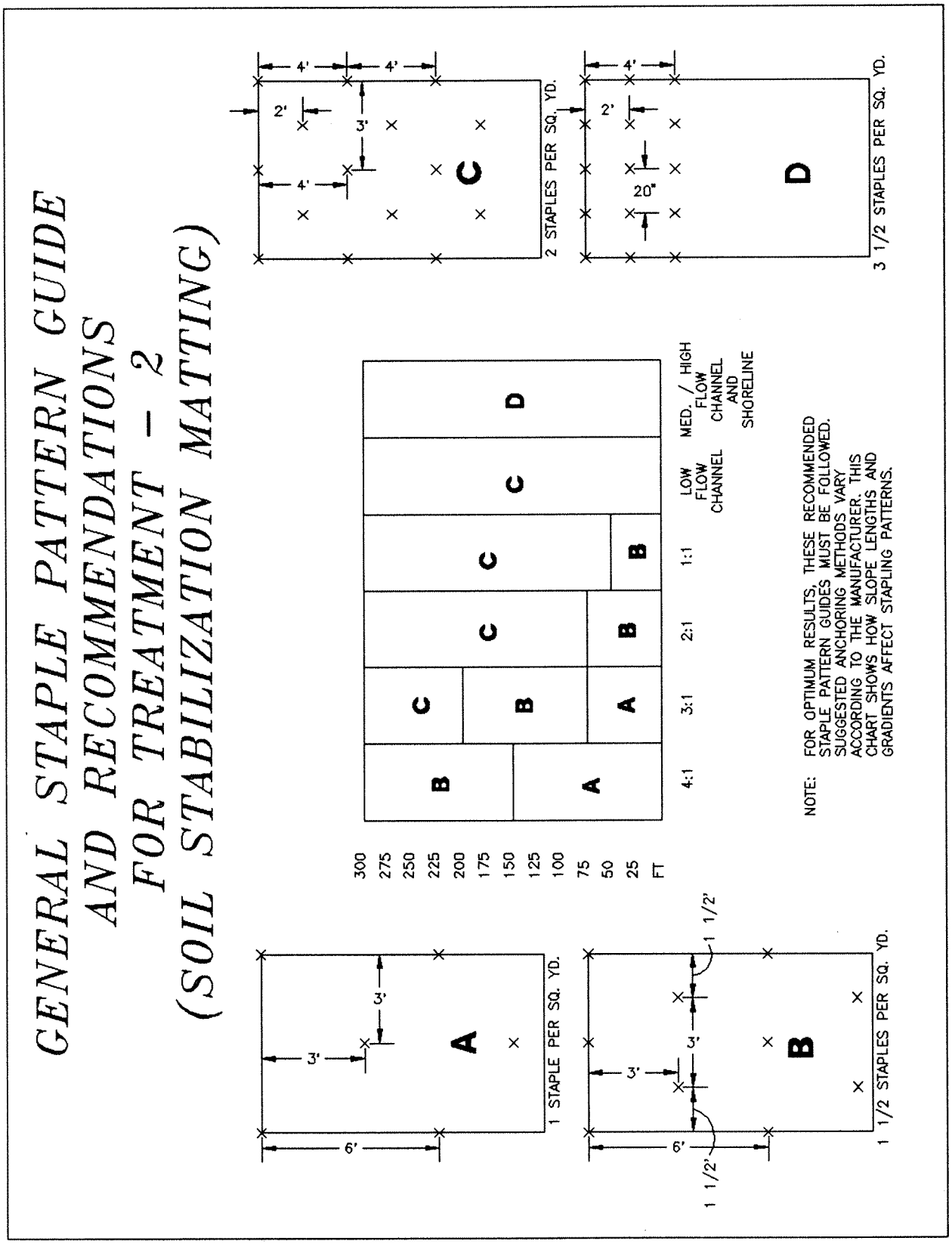
Plate 3.36-4

# TYPICAL TREATMENT – 2
# SOIL STABILIZATION MATTING SLOPE INSTALLATION




Source: VDOT Road and Bridge Standards

Plate 3.36-5




Source: Product literature from North American Green

Plate 3.36-6

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# PB1746 A Landowner's Guide to Native Warm-Season Grasses in the Mid-South

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UT Extension

PB 1746

# A Landowner's Guide to Native Warm-Season Grasses in the Mid-South

THE UNIVERSITY of TENNESSEE

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# A Landowner's Guide to Native Warm-Season Grasses in the Mid-South

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Native warm-season grasses (nwsg) are grasses historically native to an area that grow during the warm months of the year and are dormant during autumn and winter. They differ from cool-season grasses, which make their active growth during spring and fall. There are many warm-season grasses native to the Mid-South region; however, seven species are most commonly promoted as cover for wildlife and/or forage for livestock. These are big bluestem, little bluestem, broomsedge bluestem, indiangrass, switchgrass, sideoats grama and eastern gamagrass. Not all of these, however, have the same quality for wildlife habitat or livestock forage. For example, broomsedge offers excellent nesting habitat for bobwhites, but poor forage for livestock.

## IDENTIFICATION AND DESCRIPTION

***Big bluestem*** may reach 8–9 feet, depending on cultivar and site conditions. One of the best features used to identify this grass before flowering is the presence of fine silky hairs dispersed near the base of the upper leaf surface. The seedhead has three racemes that resemble a turkey's foot. Seed are relatively dark and hairy. Big bluestem grows on a wide variety of soils and is extremely drought-tolerant, with root systems that may grow 12 feet deep. Big bluestem provides excellent wildlife habitat and quality forage for livestock. 'Rountree,' 'Kaw' and 'Oz-70' are cultivars suited for the Mid-South.

Big bluestem

Little bluestem

***Little bluestem*** grows 2–4 feet in height. The stem is flattened at the base and often red or purplish during early growth. Mature plants are reddish-brown. Little bluestem seed also appear hairy. Little bluestem grows on a wide variety of soils and is one of the most attractive grasses in summer and fall. Little bluestem provides quality wildlife habitat and has great potential for landscaping and erosion control on poor, droughty soils. The 'Aldous' cultivar is best suited for the Mid-South.

***Broomsedge bluestem*** grows 2–4 feet in height and is commonly seen throughout the Mid-South. The stem is flattened at the base and smooth. Mature plants are tannish-brown and somewhat resemble little bluestem; however, broomsedge is lighter in color than little bluestem, which usually has a reddish hue. When dormant, broomsedge appears quite orange, while little bluestem is distinctly more reddish-brown. Broomsedge grows on a wide variety of soils and is renowned for growing in fields low in fertility. Broomsedge provides quality nesting habitat for many birds, but its forage quality is low.

Broomsedge bluestem

***Indiangrass*** is typically 4–7 feet in height. Leaves are flat and narrow at the base, growing 10–24 inches long. The seedhead is golden bronze-to-yellow, 6–12 inches long, and usually formed in late August. The seed are tan and very fluffy. Indiangrass produces a deep root system and is quite drought-tolerant. Indiangrass provides quality wildlife habitat and quality forage for livestock. ‘Newberry,’ ‘Osage’ and ‘Rumsey’ are cultivars best-suited for the Mid-South.

Indiangrass

***Switchgrass*** typically reaches 3–6 feet in height. Switchgrass is an early-maturing warm-season grass, flowering in early to mid-June. Switchgrass is adapted to a wide variety of soils and site conditions. With an extensive root system, switchgrass is extremely drought-tolerant, but also does well on relatively wet sites with at least one cultivar (‘Kanlow’) tolerant of extended flooding. Seed from switchgrass are small, smooth and hard, somewhat resembling millet in size and color. There are many cultivars of switchgrass. In the Mid-South, ‘Kanlow’ (uplands and lowlands) and ‘Cave-in-Rock’ (uplands) are well-suited for wildlife cover and livestock forage. ‘Durham’ and ‘Blackwell’ are well-suited for wildlife habitat.

Switchgrass

***Sideoats grama*** grows to a height of 1–3 feet. Seedstalks begin to appear in June and July. The oat-like seeds hang down uniformly along one side of the slender rachis, thus the name “sideoats.” Leaf blades are fine and have single hairs evenly spaced along the edges of the blade. Sideoats grama grows well on well-drained uplands and shallow ridges, but is not well-adapted to lowlands. ‘El Reno’ and ‘Trailway’ are cultivars best-suited for the Mid-South.

Sideoats grama

***Eastern gamagrass*** may reach 6–8 feet in height, producing conspicuous stools up to 4 feet in diameter. Over time, stool size increases with age and the center will lack stems and leaves. Eastern gamagrass will grow to 5–9 feet tall. The seedhead is comprised of two or three terminal spikes 6–10 inches long. Seed somewhat resemble corn kernels. It is highly recommended to use cold-stratified seed when planting to maximize germination. Eastern gamagrass is extremely deep-rooted and drought-tolerant. It grows best on relatively moist, well-drained fertile soils, but does not tolerate standing water for long periods. 'Highlander,' 'Pete' and 'Iuka' are cultivars well-suited for the Mid-South.

Eastern gamagrass

Other nwsg found in the Mid-South include splitbeard bluestem, Elliot's bluestem, bushy bluestem, purpletop, giant cane, beaked panicum, Scribner's panicum, Florida paspalum, silver plumegrass, knotroot bristlegrass and lovegrass. Their value to wildlife varies, but their value as forage is minimal.

## USING NATIVE WARM-SEASON GRASSES FOR WILDLIFE HABITAT

Native grasslands are the most endangered ecosystem in the Mid-South. Historically, the region contained vast acreages of native grassland and savannas with scattered trees and shrub cover, which was maintained by fire. Today, that acreage has been replaced with non-native grasses (e.g., tall fescue, orchardgrass and bermudagrass), agricultural crops, forest cover and suburban development. As a result, several wildlife species dependent upon quality early successional habitat have experienced significant declines in population.

Historically, mixed grassland savannas were prevalent across the Mid-South. This scene in southeast Tennessee was a high-graded oak-hickory stand through most of the 20th century until it was cleared of all but a few select trees. After timber removal, the area has been maintained with fire. Note the big and little bluestem – they were **not** planted, but arose naturally from the seedbank, remaining viable after at least 80 years. In addition, this site has never been sprayed. When invasive, non-native species (e.g., tall fescue, crabgrass, johnsongrass, bermudagrass) are not present, native plants can colonize an area easily and herbicide applications are often not necessary.

Nwsg can be used to enhance early successional cover for species such as bobwhite quail, cottontail rabbit, field sparrow, Henslow's sparrow, grasshopper sparrow, indigo bunting, prairie warbler, dickcissel, eastern meadowlark, loggerhead shrike, American kestrel, northern harrier and others. Fields of nwsg and associated forbs (broadleaf herbaceous plants) are also used by wild turkeys for nesting and brood rearing and by white-tailed deer for bedding and escape cover. **Nwsg are established for wildlife primarily because of the structure of cover provided**. Suitable cover is more often a limiting factor for species such as quail, rabbits and grassland songbirds than food. Nwsg are not planted as food plots.

### Importance of open structure

Because most nwsg grow in "bunches," open space at ground level can be provided when bunches are not too dense. An open structure at ground level allows mobility for small wildlife (e.g., quail, rabbits, sparrows and young turkeys) through the field. Dense vegetation and thatch build-up (such as that presented by perennial cool-season grasses) inhibits movement and makes finding food (seed and invertebrates) difficult. When these conditions prevail, the number of animals an area can support is reduced, leading to stagnant or declining populations.

Sparse stands of nwsg with an open structure at ground level are obviously attractive for brood rearing, but they are also used for nesting – one bunch of nwsg represents a potential nesting site – if the field has not been burned or disced in the past year. Birds and rabbits use senescent (dead) leaves of previous years' growth to construct and line nests. An attractive characteristic of nwsg is that senescent leaves and stems remain erect into the following growing season. This reduces thatch build-up, provides protective cover through winter and allows birds, such as Henslow's and field sparrows, dickcissels and indigo buntings, to nest above ground amongst the senescent stems the following spring.

Although moderately dense stands of nwsg may not be as attractive for brooding, they are used for nesting and escape cover. Obviously, these stands may have more potential as nesting sites than sparse stands, but they also offer more protective cover, especially during winter. Extremely dense stands, however, inhibit movement of some small animals and become less attractive. At this point, management is needed to thin the stand.

This is what a field planted for wildlife should look like in early June. Sparse nwsg, abundant forbs (ragweed, partridge pea) and open ground space provide the optimum structure for brooding and a seed source for fall and winter.

Bobwhite quail nest situated at the base of a 2-year-old bunch of broomsedge. Note how the senescent leaves from last year are used to construct the nest.

### Importance of forbs and shrubs

An open structure at ground level also enables the seedbank (seed in the top few inches of soil) to germinate. Arising from the seedbank are plants such as ragweed, blackberry, partridge pea, beggar's-lice, pokeweed, native lespedezas and annual sunflowers. Forb cover is critical in making a field of nwsg most attractive to wildlife. These plants provide an excellent canopy of brood-rearing cover for quail and wild turkeys; quality forage for deer, rabbits and groundhogs; and later produce seed and soft mast that is an important source of energy through summer and into fall and winter for many wildlife species. Scattered brush and small trees also can make a field of nwsg and associated forbs more attractive to wildlife, particularly bobwhites and several spe-

Forbs (e.g., blackberries, partridge pea and ragweed) provide excellent brooding cover and a source of seed for bobwhites and other species.

cies of songbirds. Bobwhites often use brushy cover as a "covey headquarters" during fall and winter. Indigo buntings, dickcissels, yellow-breasted chats, cardinals, prairie warblers, white-eyed vireos, eastern kingbirds, loggerhead shrikes and others use scattered clumps of shrubs and small trees for perching and nesting. Many of these shrubs and small trees also offer a valuable food source for many birds and mammals. Examples include American crabapple, wild plum, hawthorn, sumac, wild cherry, persimmon, elderberry, hazelnut, witch-hazel, dogwoods, Carolina buckthorn, viburnums and devil's walkingstick.

### Winter cover

Nwsg provide quality cover during winter if the grasses are not previously bushhogged or otherwise destroyed. Fields of nwsg are often magnets for rabbits, over-wintering songbirds and deer. This can be especially critical for small wildlife at a time when quality cover is at a premium. Tall nwsg, such as big bluestem, indiangrass and switchgrass, are especially valuable as their stems "lodge" (remain somewhat upright, leaning against each other), continuing to provide cover even after winter rains, snow and wind. Deer seek out nwsg fields on cold, clear days because they can remain hidden in the tall grasses, yet are able to absorb the sun's warm rays. In low-lying bottomlands that periodically flood in winter, fields of switchgrass (especially the Kanlow variety) can attract large numbers of ducks when shallowly flooded.

Taller nwsg species (e.g., big bluestem, indiangrass and switchgrass) provide excellent cover in winter because their stems "lodge," creating usable space for wildlife. Here, a rabbit finds a winter home. This type of structure is not available in cool-season grass fields.

## PROBLEMS ASSOCIATED WITH TALL FESCUE AND OTHER PERENNIAL COOL-SEASON GRASSES

There are many problems associated with tall fescue and other perennial cool-season grasses, both for wildlife and livestock. Problems for livestock are associated with an endophyte fungus found within tall fescue that is highly toxic. Cattle consuming tall fescue (either grazing or as hay) often experience poor weight gains, reduced conception rates, intolerance to heat, failure to shed the winter hair coat, elevated body temperature and loss of hooves. Problems with horses are more severe, especially 60–90 days prior to foaling. Fescue toxicity in horses often leads to abortion, prolonged gestation, difficulty with birthing, thick placenta, foal deaths, retained placentas, reduced (or no) milk production and death of mares during foaling. As a forage, tall fescue and other perennial grasses (e.g., orchardgrass) are

Fields of tall fescue are common throughout the Mid-South. This is poor wildlife habitat and, for many species, it might as well be covered in asphalt.

least preferred by white-tailed deer among cool-season forages. Cottontail rabbits had lower weights and smaller litters in tall fescue habitats. When fed a diet of tall fescue seed, bobwhites exhibited cloacal swelling, which ultimately led to increased mortality. Undoubtedly, many of the toxic effects from tall fescue on wildlife that consume the seed or foliage are unknown.

This is the structure presented in a field of tall fescue (and other perennial cool-season grasses) for a quail chick, sparrow, turkey poult or young rabbit 4–5 inches tall. If you were 5 inches tall and had to travel through this, where would you go? To the edge – and that's where small wildlife are forced to go. Tall fescue has displaced more wildlife habitat in the Mid-South than any other practice.

Known problems of tall fescue for wildlife are associated more with the structure created by the growth habit. Other introduced cool-season perennial grasses (e.g., orchardgrass, bromegrasses, timothy and Kentucky bluegrass) also develop sub-optimal growing conditions (dense growth and deep thatch) near ground level, making travel and foraging difficult for many wildlife species (especially ground birds). The dense growth structure and thatch layer not only prevent birds from picking seed up off the ground, but also prevent seeds in the seedbank from germinating. Thus, vegetative diversity and weed seed available as food are drastically reduced. Cool-season grasses also provide poor winter cover for wildlife because of a lack of overhead structure.

Cool-season perennial grasses (especially tall fescue and bromegrass) are very competitive. When grown in association with nwsg, perennial cool-season grasses will, over time, lead to reduced coverage of nwsg and make the field less attractive to wildlife. When grown in association with clovers in a firebreak or forage food plot, tall fescue, orchardgrass and bromegrasses will dominate the site within 18 months, leaving little or no clover available for forage.

## MANAGING NATIVE WARM-SEASON GRASS FIELDS FOR WILDLIFE

A field of nwsg is no better than the technique(s) used to manage it. If not managed correctly, nwsg can become rank and unattractive to many wildlife species. Management is needed to set back succession and create the vegetative composition and structure desired. **An open structure at ground level within a nwsg field is determined largely by the density of grass bunches and stand management, especially burning**. If the field is not disturbed periodically by prescribed burning or discing, an open structure at ground level will not be maintained.

### Burning

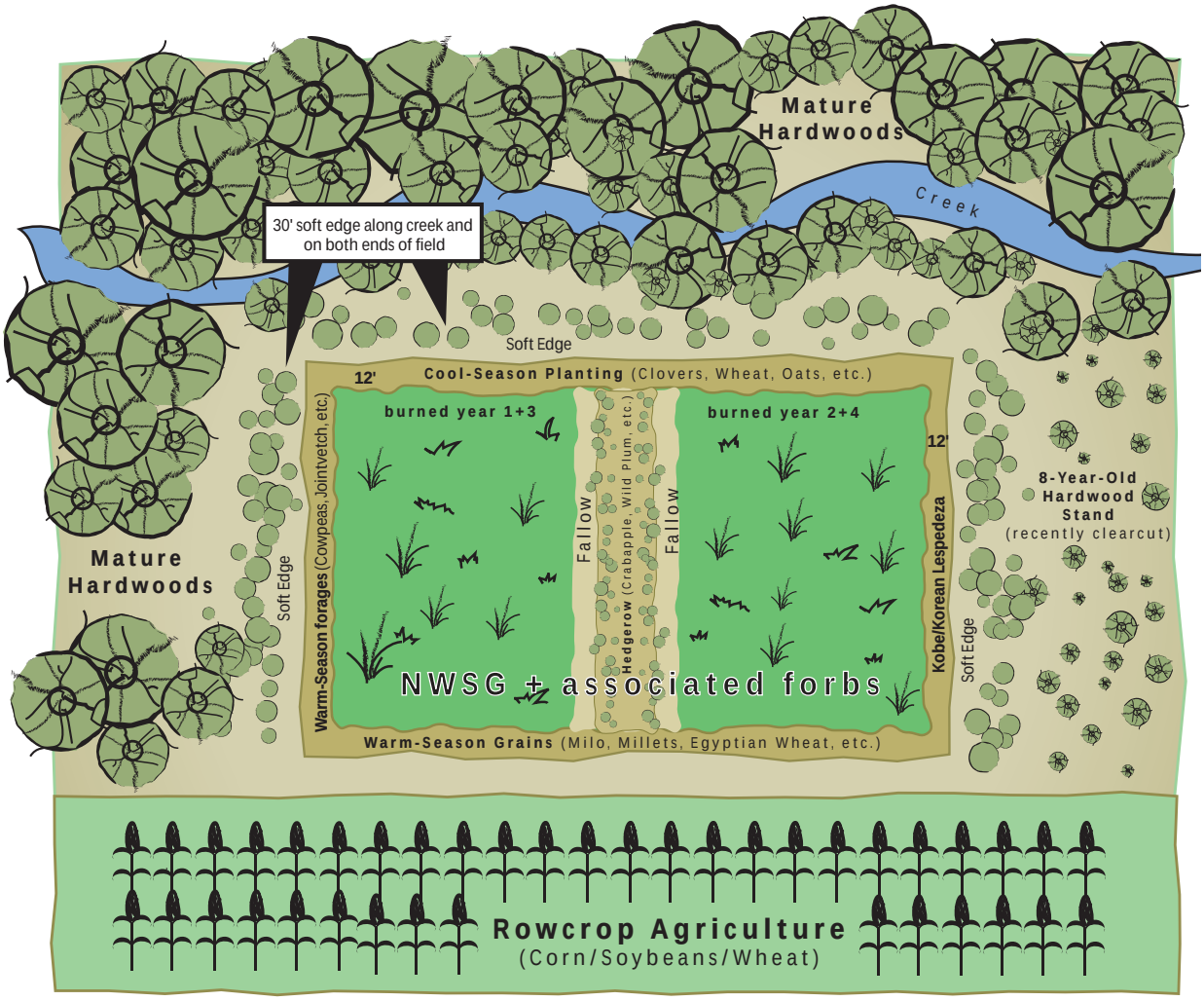
Prescribed fire reduces litter buildup, sets back succession, increases nutrient availability and stimulates herbaceous growth. Fields are most often burned in late winter, just before spring green-up. This reduces winter cover only for a short time and does not disrupt nesting birds and rabbits. If woody succession is a problem, fields can be burned just after bud break to kill woody competition. Prescribed fire in late summer/early fall can be used when nwsg have become too dense and additional forb growth is desired. Burning at this

time also can be used to reduce woody succession, if completed before leaf senescence. Using prescribed fire is efficient, effective, cheap and easy; however, planning and experience are necessary. Burning is controlled and objectives are met only when conducted under the appropriate conditions. State wildlife and forestry agencies and/or local chapters of Quail Unlimited often help landowners who need burning assistance.

Prescribed fire is contained by creating firebreaks (disced strips 10–30 feet wide) around the area to be burned. Firebreaks should be planted for increased food resources around nwsg fields. By planting various mixtures in different sections of the firebreak, a supplemental food source is available year-round. Other sections can be left fallow for weed growth. Examples of mixtures for firebreaks are on page 10. [For additional mixtures and planting information, refer to ***Growing and Managing Successful Wildlife Food Plots in the Mid-South***, UT Extension PB 1743.] Regardless of the mixture used, introduced perennial grasses (e.g., orchardgrass and tall fescue) should never be planted to a firebreak because of reasons stated previously.

Burning is strongly recommended to manage fields of nwsg. This series of pictures shows a nwsg field just before, during, immediately after and the growing season after burning. Burning stimulates growth, recycles nutrients to the soil and creates excellent early successional habitat.

| Planting Mixtures for Firebreaks (rates are per acre) | |
|---|---|
| **Cool-season mixture (annual)**<br>25# wheat or oats<br>20# Austrian winter peas<br>10# crimson clover<br>3# arrowleaf clover<br>**Cool-season mixture (perennial)**<br>25# wheat or oats<br>6# red clover<br>5# ladino white clover<br>2# birdsfoot trefoil | **Warm-season mixture (annual)**<br>20# soybeans<br>15# iron-clay cowpeas<br>10# buckwheat<br>5# browntop millet<br>5# grain sorghum (milo)<br>**Warm-season mixture (annual)**<br>15# Kobe or Korean lespedeza<br>2# partridge pea |




This diagram shows a field of nwsg and how it might be placed in arrangement with other cover types. Note how the firebreak is planted in different sections with various plantings to provide a supplemental food source throughout the year.

### Discing

In some areas, it is difficult to burn because of smoke-management issues. Also, many landowners are reluctant to burn because of inexperience. In these situations, nwsg fields should be managed by discing. Discing sets back succession, increases open space at ground level, facilitates litter decomposition and stimulates the seedbank. Discing can be completed in blocks (≥ 1 acre) or strips (≥ 50 feet wide) oriented with the contour of the field (to prevent erosion). Undisced strips should be about twice as wide as disced strips. This allows one-third of the field to be disced each year.

This field is being managed by discing alternate strips in winter. This will provide brooding cover adjacent to nesting cover.

Discing at different times of the year affects vegetation composition, depending on site conditions and the seedbank present. For example, discing in the fall may produce a different suite of forbs than discing in spring. Discing in the fall also creates walking and shooting lanes for hunting quail or rabbits. A good way to determine the preferred time to disc and the seedbank response within individual fields is to disc strips at various times through the year. Disced areas can be interseeded with legumes and other forbs if needed. **Bushhogging (without burning or discing) is not a recommended practice for managing nwsg** because it increases the litter layer, makes travel through the field difficult for small wildlife and inhibits the seedbank from germinating. It is usually necessary, however, to bushhog before discing is possible. Bushhogging along a firebreak prior to burning also may be used to reduce flame heights.

### Herbicide applications

Another management practice often necessary is herbicide applications. Strip spraying a grass-selective herbicide (e.g., Select♦) in late April using alternate spray nozzles can decrease grass density, create additional open space at ground level and stimulate the seedbank. Strip spraying should be conducted in patterns similar to those recommended for discing. Spot spraying or broadcast spraying other selective herbicides (see Appendix 1) may be necessary to reduce several problem grasses (e.g., crabgrass, tall fescue) and forbs (e.g., sericea lespedeza, thistles), as well as woody competition (e.g., sweetgum, winged elm). In all cases, herbicide labels should be read before use and followed closely with regard to restrictions, precautions, rates, recommended tank mixtures, surfactants and sprayer-cleaning recommendations.

### Managing on rotation

Because structural requirements vary among wildlife species and among seasons, it is not recommended to set back succession on an entire field (depending upon field size) or on all fields (depending upon the number of fields and their proximity on a property) in one year. Instead, fields (or portions of) should be burned or disced on a 2- to 4-year rotation. For example, if brood habitat and forage quality are prime in a field the summer after a winter burn and nesting habitat is prime two or three years after a burn, then it is undesirable to burn all available habitat every year. Escape cover may be best three or four years after burning. Large individual fields can be managed by discing firebreaks and creating smaller sections within the field. Sections then can be managed on rotation. Smaller fields can be burned or disced entirely.

This landowner has gone out of his way to juxtapose different successional stages. Burning in a checkerboard fashion ensures quality brooding cover is adjacent to nesting cover. While burning half the field one year and the other half the following year is fine, burning sections such as this provides a very diverse structure across the field.

## MANAGING THE ARRANGEMENT

When a property is managed specifically for wildlife, the most important consideration is matching the habitat types available to the preferred habitat composition and arrangement for the targeted species (see Appendix 2). Arranging cover, food and water in close proximity helps minimize travel and exposure for animals. Size, shape and *placement* of the field in the arrangement should be considered. When managing for bobwhites and other species with small home ranges (e.g., rabbits), all habitats needed to meet various seasonal requirements should be within a 40–50-acre area and, optimally, should be *juxtaposed* in close proximity. While the amount of nwsg acreage needed varies among wildlife species, quality early successional habitat should be well interspersed across the entire property.

Another important consideration is the surrounding properties (i.e., the surrounding landscape), especially for properties or landowner cooperatives less than 1,000 acres. If suitable habitat is lacking on surrounding properties for animals to immigrate to and emigrate from, it is possible the local population may become stagnant or begin to decline. It is also in these situations where predation can become a limiting factor. Predators are fully capable of identifying areas with an abundance of prey. Once located, predation rates can become artificially increased and limit small game populations, even where quality habitat exists.

### Using nwsg when wildlife is a secondary objective to farming

Nwsg can be an integral part of a productive, profitable and environmentally sound farm operation. Most producers are interested in conserving natural resources, which includes providing adequate wildlife habitat. Sites not suitable for cropping can be targeted for nwsg establishment. Highly erodible soils, rocky soils, riparian buffers, field corners and other unproductive areas can be managed for wildlife, while dedicating better soils for production agriculture.

Recent research has shown creating field borders around crop fields can increase bobwhite and songbird populations. In fact, even on farms where exhaustive predator removal took place, bobwhite populations remained steady or declined, **unless field borders were established**. Researchers at North Carolina State University showed *predator* control alone did not work, unless *predation* was controlled by providing quality nesting and brood-rearing cover. Wildlife populations weren't the only things to increase – so did farm profits! By taking field borders out of production, lime, fertilizer, fuel, seed and herbicide costs were reduced. This coupled with the fact that borders along wooded areas naturally produce less yield (because of competition for nutrients and sunlight), helped increase crop profit margins.

Establishing nwsg borders (>30 feet wide) can provide excellent nesting, brooding and escape cover around fields. Using this practice alone will help increase local populations of quail and various songbirds.

Planting field borders (>50–120 feet wide) and "odd areas" to nwsg not only provides enhanced cover for wildlife, but also reduces runoff and increases infiltration, which improves water quality by trapping and preventing sediments, fertilizers, animal waste and pesticides from entering creeks and rivers. Interested landowners should contact their county USDA-NRCS office to learn of the many programs that provide cost-share and technical assistance to establish nwsg buffers, hay, pasture and wildlife habitat.

## USING NATIVE WARM-SEASON GRASSES FOR LIVESTOCK FORAGE

Nwsg can provide excellent forage for livestock and, when properly managed, can still provide quality nesting and brood-rearing habitat. Nwsg are attractive as a forage crop because nwsg produce the majority of their growth during the summer, when cool-season grasses produce relatively little. Yields of two to five tons per acre of nwsg forage can be expected, depending on rainfall, soil type and other conditions. Crude protein can be as high as 16–17 percent, but normally is 8–12 percent at optimum harvest. Just as with any forage species, nutrient content of nwsg is influenced by plant maturity. As plants mature, percent protein and digestible energy decrease, while fiber content increases. Maximum tonnage and high forage quality do not occur at the same time. From a practical standpoint, all grass hay should be cut just before seedheads begin to emerge, whether warm- or cool-season.

### Haying

Delayed harvest and exposure to the environment are major factors influencing hay quality; thus, nwsg have fewer problems in hay production than cool-season grasses because rain is less likely during summer. Once hay is cut, higher temperatures enable faster drying, resulting is less nutrient loss from respiration. Nwsg are similar in available protein and digestible nutrients as cool-season grasses, but the weather provides better haymaking conditions.

Nwsg can provide excellent hay for livestock. Here, Gene Hartman harvests approximately 7,000–8,000 pounds per acre of big bluestem and indiangrass hay. Gene makes sure to cut his hay just before it begins to seed out, ensuring optimum nutrition with the highest yield. One cutting per year allows plenty of grass re-growth before fall, leaving ample cover for wildlife during winter.

Excellent hay can be produced from single-species plantings or mixtures. Switchgrass and eastern gamagrass are often planted in pure stands and cut for the first time in June. Big and little bluestem are often planted with indiangrass and hayed for the first time in early July, which is advantageous to wildlife species nesting in May and June.

### Grazing

The advantage of nwsg for grazing is similar to their advantage as a hay crop. During summer, high temperatures and limited rainfall cause cool-season grasses to be relatively unproductive, and pastures can be overgrazed. Overgrazing stresses the pasture even further, resulting in stand loss and increased weed pressure. By converting 25 percent of the pasture acreage to nwsg, animals may be grazed on actively growing forage during the summertime, which can provide higher-quality forage while allowing cool-season grasses to rest. This strategy reduces the need for hay, which can be required to supplement cool-season pasture during mid-summer.

Nwsg can offer excellent grazing opportunities for livestock. Grazing nwsg during summer can produce daily weight gains for cattle of more than 2 pounds. Grazing nwsg also allows cool-season paddocks to rest and minimize overgrazing. Nwsg should not be grazed regularly below 4 or 5 inches.

### Cutting and grazing heights

Nutrient reserves can be limiting for nwsg if an adequate stubble height is not maintained or if overgrazing occurs. Nwsg should not be consistently grazed or cut below 4 or 5 inches; otherwise, yield and persistence may be reduced and increased weed problems will occur. If a stubble height of 6 inches is left, more leaf area will be present for rapid re-growth. If cut or grazed after early August, the ability of nwsg to rebuild carbohydrate reserves is limited, which can reduce next year's growth. This can lead to increased weed pressure, es-

pecially winter annuals. A controlled grazing program should be used to prevent overgrazing. Big bluestem, indiangrass, switchgrass and eastern gamagrass should be grazed when they reach approximately 12–18 inches or hayed when they reach 30 inches in height.

### Fertilization, burning and weed control

Soil fertility is very important and soil testing is key to knowing lime and fertilizer requirements. Although nwsg are adapted to poor soil fertility, they will respond to lime and fertilizer applications when appropriate (see ***pH and fertilizer recommendations*** on page 17). Burning rejuvenates nwsg and improves forage quality. Burning in late March and early April can help reduce invasion of cool-season grasses while stimulating nwsg growth. When managing pure grass stands, forb-selective herbicides (e.g., 2,4-D, Banvel®, Overdrive®) will help control problem broadleaf weeds. Local Extension offices can provide specific recommendations for herbicide applications. Read and follow all herbicide label recommendations and restrictions.

### Maximizing forage production and wildlife habitat

Nwsg are hayed and grazed when many wildlife species are nesting and rearing young. Waiting until after the nesting season to hay or graze will result in poor-quality forage, especially if switchgrass or eastern gamagrass is used. Because big and little bluestem and indiangrass flower later in the growing season (July through early August), they may be most appropriate to use when wildlife is a primary consideration. Including little bluestem in the mixture is especially important for nesting cover.

Another important consideration for wildlife is to cut or graze the stand only once per year. A second cutting can reduce winter cover for wildlife and render the field similar to a field of cool-season grasses. Rotational haying and grazing is another way to improve wildlife habitat in an nwsg forage system. By resting (i.e., excluding livestock and refraining from haying) a different portion of a field every year, additional wildlife habitat is made available.

## ESTABLISHING NATIVE WARM-SEASON GRASSES

The benefits of nwsg cannot be realized until establishment is successful. Unfortunately, some landowners' attempts to establish nwsg have failed and it is widely acknowledged that establishing nwsg can be slow, especially if certain steps are not taken. Reasons for inconsistent success vary, but the most common include drilling (or covering) seed too deep (> ¼ inch), inadequate weed control and planting too late in the growing season. Recent equipment innovations and information concerning the use of various herbicides have helped increase the success of establishment efforts.

### Competition control

Nwsg do not compete well with non-native grasses (e.g., tall fescue, bermudagrass, crabgrass, johnsongrass), so it is critical to control these competitors (as well as problem broadleaf plants) prior to planting. Most often, a glyphosate herbicide (e.g., Roundup♦, Gly-4 Plus♦) is used to kill existing cover.

**Perennial cool-season grasses** (e.g., tall fescue and orchardgrass) – spray in the fall prior to planting with a glyphosate herbicide (two quarts per acre).

**Top five reasons establishment efforts fail:**

1) Planted too deep
   - bluestems, indiangrass, switchgrass and sideoats grama should not be planted any deeper than ¼ inch
2) Inadequate weed control
   - existing sod must be killed prior to planting; post-emergence competition can be limiting factor
3) Planted too late
   - mid-April to early June is the ideal planting window
4) Drill not calibrated and/or PLS not calculated
   - these are absolutely necessary
5) No patience!
   - landowners often have a perfect stand, but just don't realize what it should look like

Roundup♦-only applications in the spring have been less than successful. However, by tank-mixing 2 quarts of Roundup♦ with 8 ounces of Plateau♦ and 2 pints of Methylated Seed Oil (or 22 ounces of Journey♦ with 1 1/2 quarts of Roundup♦), a spring herbicide application can be successful. Before existing sod is sprayed, the field should be burned, hayed, grazed or mowed and allowed to re-grow 6–10 inches. This ensures the herbicide comes in contact with an actively growing plant, not dead thatch from the previous year's growth. After killing cool-season grasses, expect warm-season competitors (e.g., johnsongrass, crabgrass) to emerge from the seedbank.

Herbicide applications are often necessary when establishing nwsg. Existing sod must be sprayed before planting. Pre-emergence applications are usually necessary at planting. Post-emergence applications are often necessary for adequate weed control.

**Johnsongrass, crabgrass and broadleaf control** – Spray during the growing season prior to planting with a glyphosate herbicide or a grass-selective herbicide. This will help reduce the seedbank, but there will be some residual growth the following growing season. Thus, **a pre-emergence application of an imazapic herbicide, such as Plateau♦ (6–8 ounces per acre) or Journey♦ (16–20 ounces per acre), is strongly recommended when planting bluestems, indiangrass or sideoats grama to provide adequate control for several weeks after planting. When planting switchgrass or eastern gamagrass, a pre-emergence application of OutRider® (2 ounces per acre) should control johnsongrass and many broadleaf competitors**.

**Bermudagrass control** – Burn the field in late winter and allow bermudagrass to re-grow. Spray bermudagrass as it begins to flower with imazapyr (24 ounces of Arsenal® AC per acre with two pints of Methylated Seed Oil). Research by the Georgia Department of Natural Resources found imazapyr very effective in controlling bermudagrass; however, it is virtually impossible to eliminate bermudagrass entirely with a single spraying. Patience and persistence are required. The field should be checked for bermudagrass re-growth through the *following* growing season after the initial treatment and spot-sprayed as necessary. The next growing season (two years after initial treatment), the field should be ready to plant nwsg.

**Mechanical control** – Another practice is to mow non-desirable broadleaf weeds before they flower and seed. Shading limits growth of nwsg considerably and prolonged shading can kill them. The mower (or bushhog) should be set relatively high so nwsg are not clipped any more than necessary. Mowing weeds is less successful than herbicide applications, but nwsg (including switchgrass and eastern gamagrass) will often out-compete non-desirable plants during the second growing season.

### Seedbed preparation

Once the competition has been controlled, the seedbed should be prepared before planting. If the seed is to be drilled, a firm and "clean" seedbed, free of deep thatch and other material, is desired. This is best accomplished by burning. If the dead material on the field is sparse and only a few inches high, no preparation may be necessary. If the seed is to be topsown, the seedbed should be prepared by conventional tillage techniques. If the soil needs amending, it is best to do so before plowing/discing to ensure the lime and fertilizer are well-incorporated.

### pH and fertilizer recommendations

Although nwsg are adapted to nutrient-deficient soils low in pH, soil fertility is important and soil testing is recommended to determine pH and nutrient availability. This is particularly important when growing nwsg for livestock forage. For optimum growth on pasture or hayfields, pH should be raised to 6.0–6.5, P and K brought to medium or high levels (31–120 and 161–320 pounds available per acre, respectively) and up to 60 pounds of N should be applied in April/May and after cutting hay or after removing livestock from the paddock. An application of N at planting is not necessary (when growing nwsg for wildlife) or recommended (when growing nwsg for livestock forage) because of weed competition. However, if bluestems and/or indiangrass are planted and an imazapic herbicide is applied pre-emergence, 15–30 pounds of N per acre may be added once the grasses are 4–6 inches high if adequate moisture is available. When planting pure stands of switchgrass or eastern gamagrass, N should not be applied until the stand is established and weeds controlled. When planting nwsg solely for wildlife, lime and fertilizer are not normally needed unless pH is below 5.0.

### Seed quality and estimating PLS

Buying quality seed is an important consideration when establishing nwsg. Seed purity commonly runs 50–70 percent because of an inordinate amount of inert material (stems, leaves and other debris) and the germination rate may be only 50–60 percent. Therefore, it is critical to plant according to percentage of pure live seed (PLS), which is determined from information on the seed tag.

PLS is calculated as follows:

Seed: Indiangrass (Osage)

| | |
|---|---|
| Pure seed: 67.62% | Germination: 64.00% |
| Other crop: 0.05% | Firm/Dormant: 22.00% |
| Weed Seed: 0.42% | Total Germination: 86.00% |
| Inert: 26.23% | Noxious Weeds: NONE |
| Origin: MISSOURI | Test date: 28 December 2003 |

[67.62% (pure seed) □ 86.00% (total germination)] √ 100 = 58.15% PLS. To plant 6 lbs. PLS per acre: [6 lbs (desired rate) √ 58.15 (PLS)] □ 100 = 10.32. Therefore, approximately 10 lbs of bulk material from the seed bag should be planted.

### Seed dormancy

Switchgrass and eastern gamagrass tend to have a high dormancy rate. Germination can be improved by treating the seed. Switchgrass seed can be wet-chilled by soaking it in a mesh sack overnight and allowing it to drip-dry the following morning. The seed then should be stored in a cool location (e.g., a cellar or walk-in cooler set at approximately 40–45$^0$ F) for at least two weeks. For best germination, remove seed from chill treatment and allow to air dry with a fan blowing over the seed until seed flows freely. Plant immediately. Eastern gamagrass requires a six-week chilling process. The best option for planting eastern gamagrass is to buy cold-stratified seed direct from a seed dealer and plant immediately upon receiving shipment.

### Planting date and methods

Nwsg should be planted mid-April through early June. Later plantings can be successful, but germination and growth may be reduced, as rain is less dependable in June and July. Seed may be top-sown or drilled, but **should not be planted any deeper than ¼ inch**. In fact, when drilled, at least one-third of the seed should be obvious on top of the planting furrow. The exception to this rule is eastern gamagrass, which should be planted approximately 1 inch deep. Drilling is usually the preferred method for planting nwsg (especially larger fields). As mentioned under ***Competition control*** on page 15, **a pre-emergence herbicide application at planting is strongly recommended** to ensure adequate weed control.

Planting with a no-till drill designed for nwsg seed is highly recommended. Do not drill seed any deeper than ¼ inch! In fact, as much as 30 percent of the seed should be obvious on top of the planting furrow.

**Drilling** – For even grass distribution and a continuous, solid stand, nwsg planted for haying or grazing should be planted with a drill. When drilling bluestems or indiangrass, a drill with a specialized seed box containing "picker wheels" is necessary or the fluffy seed of these grasses lodge in the seed chute. These drills often are available for use through state wildlife agencies, soil conservation districts, the Natural Resources Conservation Service and some local chapters of Quail Unlimited. Switchgrass can be planted with a conventional drill. Any drill, however, must be calibrated before planting. Eastern gamagrass is usually planted with a corn planter in rows 18–24 inches apart, but some producersß like to plant rows only 12 inches apart to reduce stool size and make stems more upright so haying is easier.

**Broadcasting** – Nwsg fields intended for wildlife habitat can be established successfully by broadcast seeding. When planting bluestems and indiangrass, a broadcast seeder with picker wheels (similar to those found in drills designed for fluffy seed) is helpful; otherwise, some type of carrier (pelletized lime, fertilizer, cracked corn, cottonseed hulls) is needed to distribute the seed. Prior to broadcasting, it is **critical** to thoroughly prepare the seedbed and cultipack after seeding to ensure firm seed-to-soil contact and improve germination rate.

### Seeding rates and mixtures

Seeding rates depend upon landowner objectives. If sown for wildlife, a sparse stand of grasses with abundant forbs and adequate bare ground is desired. If sown for hay or pasture, a denser stand without forbs and less bare ground is desired. Thus, a relatively light seeding rate (4–6 pounds PLS per acre) is recommended when establishing nwsg for wildlife and a heavier seeding rate (8–12 pounds PLS) is recommended when establishing hayfields or pasture.

Tall mixtures provide cover for ground-nesting birds, as well as those that nest above-ground (e.g., dickcissel, field sparrow, Henslow's sparrow and red-winged blackbird). Tall mixtures also provide excellent cover for brood rearing and escaping predators. In addition, sufficient structure is present in tall nwsg fields for deer to bed during the day and excellent cover is available through winter for many wildlife species. Short mixtures provide quality nesting cover for ground-nesting birds and can provide attractive brood-rearing cover. Selected forbs should be added to wildlife mixtures to enhance brood habitat, invertebrate availability, seed production, forage and/or aesthetic value. Planted forbs are intended to complement the forb community that should arise naturally from the seedbank. Forbs most often added to nwsg mixtures include partridge pea, Illinois bundleflower, roundhead lespedeza, perennial sunflowers, purple prairieclover, purple coneflower, black-eyed susan, blazing star and lance-leaved coreopsis.

Tall mixtures of nwsg usually include some combination of big bluestem, indiangrass and switchgrass. These stands can provide excellent cover for nesting, brooding and foraging, as well as winter and escape cover.

| **Seeding mixture (lbs PLS per acre)** | **Objectives & Considerations** |
|---|---|
| **Wildlife – tall grass mixture**<br>1.5 lbs big bluestem<br>1.5 lbs indiangrass<br>1.0 lb little bluestem<br>0.5 lb switchgrass<br>1.0 lb native forbs | Nesting cover<br>Brooding cover<br>Winter cover |
| **Wildlife – short grass mixture**<br>3.0 lbs little bluestem<br>1.0 lb sideoats grama<br>0.5 lb indiangrass<br>1.0 lb native forbs | Nesting cover<br>Brooding cover |
| **Forage –**<br>3.5 lbs big bluestem<br>3.5 lbs indiangrass<br>3.0 lbs little bluestem | Hayed after primary nesting season<br>Imazapic can be used for competition control |
| **Forage –**<br>8–10 lbs switchgrass | Wet-chill seed before planting<br>Seed with conventional equipment |
| **Forage –**<br>10–12 lbs eastern gamagrass | Buy cold-stratified seed<br>Plant with corn planter with rows 12–24 inches apart |

Species and mixtures for livestock forage are generally determined by preference and potential problems with competitive weeds. For example, pure stands of switchgrass or eastern gamagrass can provide excellent forage for livestock. However, if crabgrass and/or johnsongrass are prevalent, a mixture of big and little bluestem and indiangrass might be a better choice, because an imazapic herbicide can be used to help ensure successful establishment.

Short mixtures of nwsg usually are dominated by little bluestem, broomsedge and/or sideoats grama. These stands can provide excellent cover for nesting, brooding and foraging.

### Evaluating success – what to expect

Nwsg develop relatively slowly during the year of establishment. Most of the first-year plant growth is root development. Leaf and stem growth may not reach more than 2 feet high by the end of the first growing season. Typically, it is not until the second growing season that most nwsg develop considerable aboveground biomass, flower and produce seed. However, if the correct planting procedures are followed and soil moisture is not limiting, excellent growth will occur during the year of establishment, with considerable aboveground biomass and extensive flowering.

This is what you are looking for! This is a big bluestem seedling with its characteristic “fountain” appearance. Note the bare ground and lack of weeds germinating around the seedling. This is what should be expected from a properly applied pre-emergence herbicide.

Nwsg planted for wildlife **should be very sparse** during the year of establishment. Remember, bare ground space between bunches is desirable! “Weeds” may be numerous and should be expected. Many, hopefully most, of the “weeds” will be desirable forbs (as described earlier). Landowners planting nwsg should not expect the field to look like a field planted to cool-season grasses. Patience is necessary!

This field was planted in May 2000. By July, most people would consider this effort a failure. However, this rate of development is not unusual, especially with little rainfall in soil that has not been amended with lime and fertilizer. Remember, the structure will become more dense in the second year and bare ground space is desired!

Even with little rain and low nutrient availability, this amount of growth should be expected by the end of the first growing season (with proper weed control).

By the second growing season, excellent cover for wildlife was available and quail were found in the field regularly.

With adequate rainfall and nutrient availability, this amount of growth can be expected by the end of the first growing season.

## CONCLUSION

Nwsg can provide excellent wildlife habitat. Converting perennial cool-season grass acreage to nwsg and establishing field borders around crop fields will help increase wildlife populations dependent upon early successional habitats. Nwsg also can produce high-quality forage for livestock. For producers interested in wildlife, nwsg are a much better alternative than non-native, warm-season grasses, such as bermudagrass, sorghum-sudan and the Old World bluestems.

Establishing and managing nwsg is quite different from cool-season grasses. However, **landowners should not be skeptical**. The advantages for wildlife and the quality of forage produced have been proven time and again throughout the Mid-South and in other regions as well. Technical assistance is as close as the county NRCS or Extension office. Advice and assistance is also available through state wildlife resources agencies. For comprehensive and detailed information on establishing and managing nwsg, ask for a copy of ***Native Warm-Season Grasses: Identification, Establishment and Management for Wildlife and Forage Production in the Mid-South***, available through UT Extension.

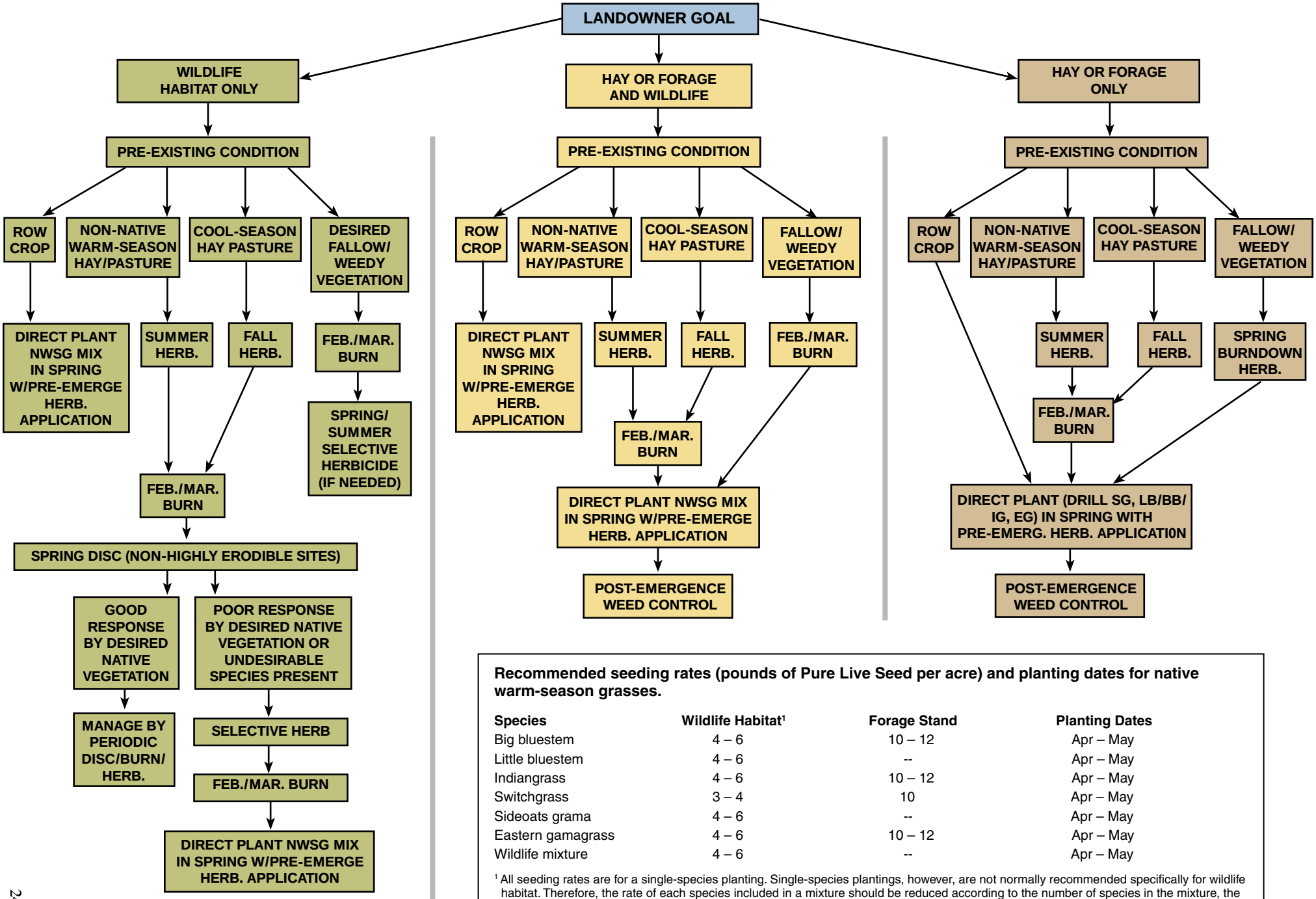
## Appendix 1. Herbicide use guide for common native warm-season grass applications.

| Herbicide | Use | Application Rate | Objectives/Considerations |
|---|---|---|---|
| *Glyphosate* (Roundup, Accord, Gly-4, others) | Eradicating tall fescue and other existing cover prior to nwsg establishment, or while nwsg are dormaant.<br><br>Controlling woody saplings, sericea lespedeza, thistles, bermudagrass, dallisgrass, yellow nutsedge | Fall – 1.5-2.0 qts/ac<br>Spring – 2.0 qts/ac<br><br>2.5 – 4.0 qts/ac | Broad spectrum herbicide, not selective. Post-emergence only – no soil activity or residual control.<br><br>Additional applications may be necessary. Better control may be realized by tank mixing with other herbicides. |
| *Imazapic* (Plateau) | Pre-emergence weed control when planting bluestems, indiangrass and sideoats grama.<br><br>Eradicating tall fescue and other select cover to allow the seedbank to respond.<br><br>Post-emergence weed control of johnsongrass, crabgrass, cocklebur and others in established nwsg. | 6 – 8 oz/ac<br><br>12 oz/ac<br><br>6-8 oz/ac | Residual weed control for approximately 60 days. Contact state wildlife agency if unavailable through private distributor. Check label for tolerance of specific nwsg and select forbs. |
| *Imazapic + Glyphosate* (Journey) | Pre-emergence weed control when planting bluestems, indiangrass and sideoats grama. Also for eradicating tall fescue and other existing cover prior to nwsg establishment, or while nwsg are dormant.<br><br>Post-emergence weed control of johnsongrass, crabgrass, cocklebur and others in established nwsg. | 11 – 32 oz/ac<br><br>11 oz/ac | May damage nwsg and forbs if applied after greenup. Residual weed control for approximately 60 days. Additional glyphosate is necessary to effectively kill tall fescue when using lower rates of Journey. |
| 2,4-D | Controlling unwanted broadleaf plants, such as thistles & cocklebur. | 1 – 4 pts/ac<br>Post-emergence application | Will also kill desired legumes and other broadleaf plants. May damage nwsg seedlings. |
| *Dicamba* (Banvel, Clarity) | Controlling unwanted broadleaf plants and woody species. | 2 – 4 pts/ac<br>Pre- or post-emergence application | Will also kill desired legumes and other broadleaf plants. |
| *Sulfosulfuron* (OutRider) | Pre- and post-emergence control of johnsongrass and other weeds in nwsg (including switchgrass). | 0.75 – 2.0 oz/ac<br>Pre- or post-emergence application | Groundwater may be contaminated when used in areas where soils are permeable or shallow water table. |
| *Triclopyr* (Garlon 3A) | Controlling sericea lespedeza and other broadleaf plants in established nwsg.<br><br>Controlling woody saplings | 1.0 qt/ac<br>Post-emergence application<br><br>1 – 5 gal/ac;<br>see label for various applications | Apply in early summer when sericea is in early vegetative stage. Does not damage nwsg, but kills most broadleaf plants. Refer to label for rates to control other species.<br><br>High-volume and low-volume treatments require different rates. |
| *Metsulfuron methyl* (Escort, Cimarron) | Control of sericea lespedeza, bicolor lespedeza and other broadleaf plants. | 0.1 – 2.0 oz/ac<br>Post-emergence application | For sericea control, apply in bloom stage (August – September). Fall application may provide spring residual control. Does not affect grasses. |
| *Imazapyr* (Arsenal) | Control of woody saplings. Sometimes best accomplished with tank mixes of other herbicides. | See label for selected woody plants, application rates & mixes | Use as spot treatment where tree or shrub seedlings are invading. |
| *Sethoxydim* (Poast Plus) | Controlling undesirable cool-season grasses before nwsg emerge in spring. Reducing nwsg coverage when growth becomes too dense. | 2 pts/ac<br>Post-emergence application | When reducing nwsg density, use only every third spray nozzle (i.e., 1 open/2 closed). |
| *Clethodim* (Select) | Controlling undesirable cool-season grasses before nwsg emerge in spring. Reducing nwsg coverage when growth becomes too dense. | 10 oz/ac<br>Post-emergence application | When reducing nwsg density, use only every third spray nozzle (i.e., 1 open/2 closed). |
| *Imazethapyr* (Pursuit) | Controlling undesirable grass and broadleaf plants, including yellow nutsedge. | 1 – 2 oz/ac<br>Pre- or post-emergence application | Will not control legumes; thus, Pursuit can be sprayed over desirable legumes to control non-leguminous forbs. |

## Appendix 2. Major habitat types and arrangement preferred by selected wildlife.

| Primary species managed | Percent nwsg and associated forbs | Arrangement of nwsg | Percent cool-season legumes and annual grains | Percent row cropland | Percent mast-producing hardwoods | Percent brushy cover (incl. 0–3-year-old hardwood and pine stands) |
|---|---|---|---|---|---|---|
| Bobwhite quail | 20 – 80 | Blocks ≥ 2 acres or strips ≥ 50’ wide | 2; In firebreaks | 5 – 50 | 5 – 20 | 20 – 50 |
| Cottontail rabbit | 10 – 80 | Blocks 1 – 5 acres or strips ≥ 50’ wide | 2; In firebreaks or small fields | 5 – 50 | 10 – 40 | 20 – 50 |
| Wild turkey | 10 – 30 | Blocks ≥ 2 acres | 2 – 5; In firebreaks or fields | 5 – 50 | 30 – 60 | 10 – 30 |
| White-tailed deer | 5 – 30 | Blocks ≥ 2 acres | 2 – 5; In firebreaks or fields | 5 – 50 | 30 – 60 | 20 – 40 |
| Grass/shrub songbirds (field sparrow, blue grosbeak, indigo bunting, yellow-breasted chat) | 30 – 70 | Blocks ≥ 5 acres or strips ≥ 50’ | In firebreaks | <10 | 0 | 50 – 70 |
| Grassland songbirds (grasshopper sparrow, Henslow’s sparrow, eastern meadowlark, dickcissel) | 70 – 100 | Blocks or complexes ≥ 100 acres | In firebreaks | <10 | 0 | <20 |

## Appendix 3. Flow chart for landowners planning to plant native warm-season grasses.




**Recommended seeding rates (pounds of Pure Live Seed per acre) and planting dates for native warm-season grasses.**

| Species | Wildlife Habitat[1] | Forage Stand | Planting Dates |
|---|---|---|---|
| Big bluestem | 4 – 6 | 10 – 12 | Apr – May |
| Little bluestem | 4 – 6 | -- | Apr – May |
| Indiangrass | 4 – 6 | 10 – 12 | Apr – May |
| Switchgrass | 3 – 4 | 10 | Apr – May |
| Sideoats grama | 4 – 6 | -- | Apr – May |
| Eastern gamagrass | 4 – 6 | 10 – 12 | Apr – May |
| Wildlife mixture | 4 – 6 | -- | Apr – May |

[1] All seeding rates are for a single-species planting. Single-species plantings, however, are not normally recommended specifically for wildlife habitat. Therefore, the rate of each species included in a mixture should be reduced according to the number of species in the mixture, the composition preferred and the desired structure of the resulting stand.

**Disclaimer**: Use of brand or trade names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others, which may be of similar, suitable composition. Always be sure to read, understand and follow directions and precautions on herbicide labels before use. As herbicides, herbicide labels and their availability and recommendations may change, it is best to consult your local Extension agent for the latest recommendations on herbicide use.

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Craig Harper, Mike Hansbrough, Steve Capel, Jimmy May and Dick Conley

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**December 2004**

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**September, 2019** **FINAL REPORT**
**Norman A. Berg National Plant Materials Center**
**Beltsville, MD**

# Native Warm Season Grass Varieties for the Mid-Atlantic

Shawn Belt

## ABSTRACT

Native warm-season grasses are highly diverse and serve fundamental roles in many conservation plant mixes (e.g., for forage, biofuel, and wildlife habitat). However, evaluations comparing their performance are relatively few. This study's objective was to compare the performance or adaptability of 42 varieties of native warm-season grasses grown at Beltsville, Maryland from 2015 to 2017. Variation exists between species and varieties regarding establishment, performance, size, and timing of their phenological growth stages. Species evaluated include: eastern gamagrass, Indiangrass, big bluestem and switchgrass. Evaluations included survival percentage, green-up date, boot stage date, size at boot stage, flowering date, seed maturity date, and disease susceptibility.

In this study these varieties performed best: *Forage* - Big bluestem OZ-70 Germplasm, Suther Germplasm and 'Niagara'. Indiangrass 'Rumsey', Prairie View Germplasm and Coastal Germplasm. *Size* - Largest switchgrass varieties are Timber Germplasm, BoMaster and 'Kanlow'. *Wildlife Habitat* - Indiangrass varieties are Coastal Germplasm, Prairie View Germplasm and 'Americus'.

## INTRODUCTION

Native warm-season grasses (NWSG) such as eastern gamagrass (*Tripsacum dactyloides)*, Indiangrass *(Sorghastrum nutans)*, big bluestem (*Andropogon gerardii)* and switchgrass (*Panicum virgatum)* are important in the Mid-Atlantic for summer forage, wildlife habitat, and potentially for biofuel production. NWSG are drought tolerant and typically long-lived perennials that develop deep roots. Some NWSG are beneficial in producing forage during the summer slump (July to September) when hot, dry conditions typically limit cool-season grass production. NWSG can produce 3 to 5.5 tons/acre of dry matter yield annually (Ugiansky, Vough 2013). In meadows, smaller NWSG increase plant diversity attracting diverse species of wildlife (Sarver 2010). Larger, late season NWSG produce more and higher quality summer forage. The long establishment period of 2 to 3 years may limit their use with producers and land owners. Comparative performance evaluations benefit producers and conservation planners in matching the right NWSG to the right use. The most suitable NWSG for pollinator plantings are likely those whose provenance is closest to the planting (Sarver, 2010). Smaller NWSG typically allow for a more physically diverse wildlife habitat; conversely, NWSG should also be sizeable enough to sustain prescribed burns in locations where maintenance burns are feasible.

Switchgrass and big bluestem tend to dominate plantings and should be used in moderation if at all (Sarver 2010). Indiangrass has less tendency to dominate and is a better choice for wildlife plantings.

## MATERIALS AND METHODS

In 2008 and 2009, the National Plant Materials Center (NPMC) planted 20 plants of each variety on one-foot centers in twenty-foot-long rows with ten feet between blocks (Figure 1). Plugs received minimal irrigation during establishment. Lime was applied at planting to correct for low soil pH and soil tests were conducted every 2 years. No supplemental fertilizer was applied. Plots were mowed between the rows as needed, broadleaf weeds were controlled with spot herbicide applications, and NWSG were mowed to 8 inches in height after the first killing frost. From 2009 to 2015, plants were left to fully establish and mature.

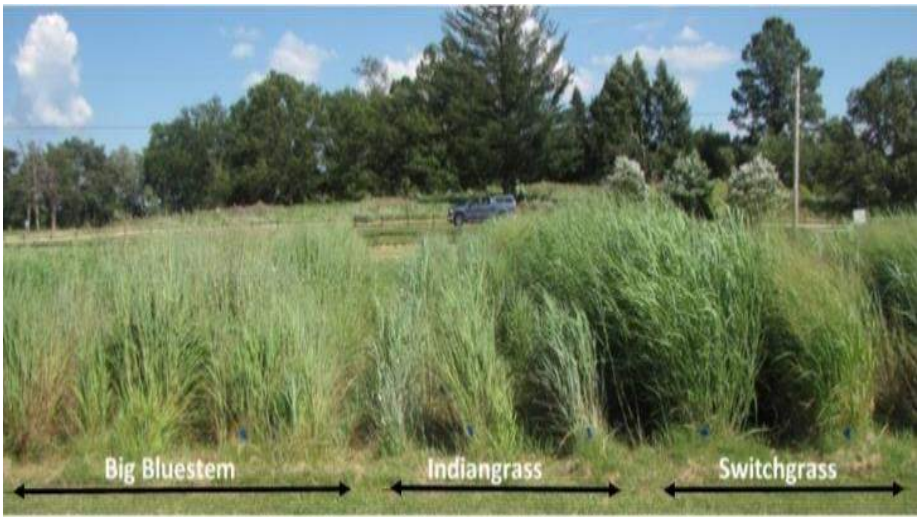


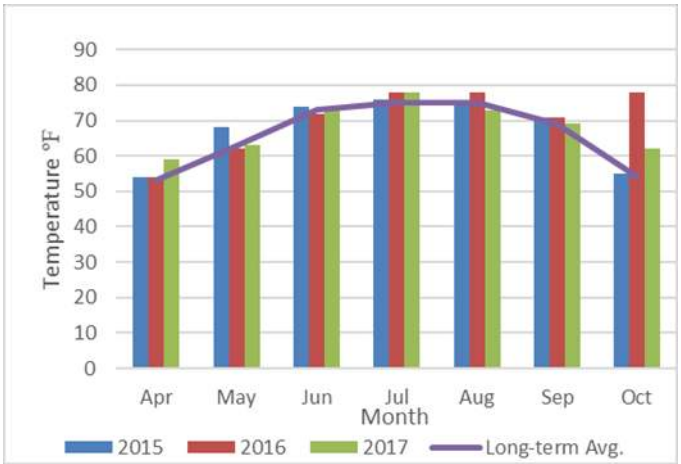

Figure 1. Native warm season grass evaluation plot, NPMC, Beltsville, MD.

Data was collected weekly (May through September) from 2015 through 2017. Varieties were evaluated for survival in 2009-2011 and again in 2014-2015. Varieties were also evaluated for plant height and width at the boot stage, green up date, 75% boot stage date, 75% flowering date, and hard dough seed maturity. Basal area was calculated by multiplying height x width. Species evaluated were primarily NRCS plant materials releases (Table 1)

Table 1. Native Warm Season Grass varieties evaluated in Beltsville, MD, the origin of the variety, the year the material was released commercially, and the developer of the material.

| | Variety* | Origin* | Year | Developer |
|---|---|---|---|---|
| **Eastern Gama Grass** | 'Meadowcrest' | Beltsville, MD | 2006 | NY PMC |
| | 'Highlander' | Montgomery Co., TN | 2003 | MS PMC |
| | 'Pete' | KS and OK | 1988 | KS PMC |
| **Big Bluestem** | WV PMC (unreleased 9093698) | Kingwood, WV | N/A | WV PMC |
| | NJ PMC (unreleased 9094220) | South MA | N/A | NJ PMC |
| | Suther Germplasm | Cabarrus Co., NC | 2002 | NJ PMC |
| | 'Niagara' | Erie Co., NY | 1986 | NY PMC |
| | NY PMC (unreleased 9046932) | New England composite | N/A | NY PMC |
| | Southlow Germplasm | Southern MI | 2001 | MI PMC |
| | Mammoth | KY composite | N/A | Roundstone Seed Co. |
| | OZ-70 Germplasm | Pawnee Co., NE | 2004 | MO PMC |
| | 'Bonanza' | Pawnee derivation | 2004 | ARS NE |
| | 'Goldmine' | Kaw derivation | 2004 | ARS NE |
| | 'Roundtree' | Manhattan, KS | 1950 | MO PMC |
| | 'Kaw' | Riley Co., KS | 1950 | KS PMC |
| | 'Earl' | Parker Co., TX | 1996 | TX PMC |
| | 'Bonilla' | Bonilla, SD | 1986 | ND PMC |
| **Indianrass** | NJ PMC (unreleased 9046933) | New England composite | N/A | NY PMC |
| | Coastal Germplasm | CT, RI & MA composite | 2007 | NJ PMC |
| | NY PMC (unreleased 591811) | NY | N/A | NY PMC |
| | Prairie View Germplasm | Central & Southern IN | 2005 | MI PMC |
| | Southlow MI Germplasm | Southern MI | 2001 | MI PMC |
| | 'Americus' | AL & GA composite | 2002 | GA PMC |
| | 'Rumsey' | Jefferson Co., IL | 1983 | MO PMC |
| | 'Nebraska-54' | NE composite | 1957 | H. Hummel (private) |
| **Switchgrass** | High Tide Germplasm | Perryville, MD | 2007 | NJ PMC |
| | Timber Germplasm | NC | 2009 | NJ PMC |
| | 'Shelter' | Pleasants Co., WV | 1978 | NY PMC |
| | 'Carthage' | Carthage, NC | 2006 | NJ PMC |
| | 'BoMaster' | Southeastern US | 2006 | ARS/NC State Univ. |
| | Southlow MI Germplasm | Southern MI | 2001 | MI PMC |
| | 'Sunburst' | Union Co, SD | 1983 | SD AES |
| | 'Cave-in-Rock' | Southern IL | 1974 | MO PMC |
| | 'Shawnee' | Southern IL | 1995 | NE ARS |
| | 'Dacotah' | Breien, ND | 1989 | ND PMC |
| | 'Forestburg' | Sanborn Co., SD | 1987 | ND PMC |
| | 'Trail Blazer' | NE composite | 1984 | Univ. of NE/ARS |
| | 'Pathfinder' | NE, KS | 1967 | NRCS/ARS |
| | 'Kanlow' | Wetumah, OK. | 1963 | KS PMC |
| | 'Blackwell' | Blackwell, OK | 1944 | KS PMC |
| | 'Alamo' | Frio River, TX | 1978 | TX PMC |
| | EG 1101 | Improved Alamo (proprietary) | 2009 | Ceres Energy Co. |
| | EG 1102 | Improved Kanlow (proprietary) | 2009 | Ceres Energy Co. |

*Varieties listed in order of increasing distance from Beltsville, MD to origin.



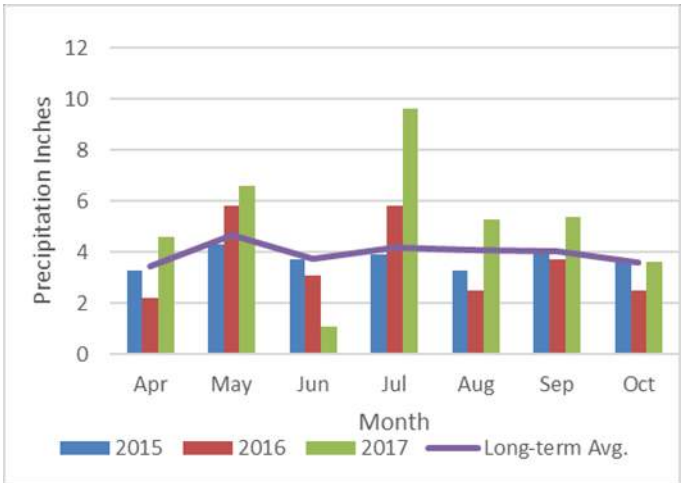




Figure 2. 2015 - 2017 Temperature and precipitation during the growing season for native warm season grass, Beltsville, MD.

## RESULTS AND DISCUSSION

*Survival and Adaptability.*

After the two-year establishment period, all three eastern gamagrass varieties died and were removed. All three varieties were found to be infested with stalk borer larvae (*Papaipema nebris).* While the southern cornstalk borer is a known eastern gamagrass pest (Springer et al 2011), this was the first time the stalk borer was been documented affecting eastern gamagrass. The larvae probably migrated from nearby Conservation Reserve Program areas (Gesell and Calvin 2000). The stalk borer did not affect adjacent big bluestem, Indiangrass and switchgrass plants.

Overwintering survival evaluations of the remaining species occurred the spring following the first (2009 to 2010) and second growing seasons (2010 to 2011). All varieties had overwinter survival above 70%, except for switchgrass variety EG1101 which had only 40%. Switchgrass varieties 'Forestburg', 'Pathfinder', 'Trailblazer' and Southlow MI Germplasm performed poorly after establishment and were removed from the study in 2015. The upper Midwest varieties were not well adapted well to mid-Atlantic warm, humid growing conditions (Figure 2).

*Boot Stage.*
With proper management, NWSG provides large amounts of high quality and palatable summer forage. Producers are reticent to wait 2 to 3 years necessary for their establishment. As NWSG begin to flower and set seed, the stems contain more lignin decreasing palatability. Haying or grazing NWSG harvested prior to the boot stage allows for maximized biomass accumulation and palatability. Big bluestem and Indiangrass varieties varied in phenological response more than switchgrass. Most big bluestem and all Indiangrass were found to vary about 1000 growing degree days or about 5 weeks, whereas switchgrass started boot stage earlier and showed more uniform responses (Figure 3). Nine big bluestem varieties reached the boot stage in July and five in early August. All but two Indiangrass varieties booted in August. All switchgrass varieties booted over a two-week period in July. Later booting big bluestem varieties, OZ-70, Suther Germplasm and Niagara along with Indiangrass varieties 'Rumsey', Prairie View Germplasm and Coastal Germplasm may be a better summer forage than earlier booting switchgrass. 'Americus' Indiangrass booted regularly in October, much later than all other NWSG.

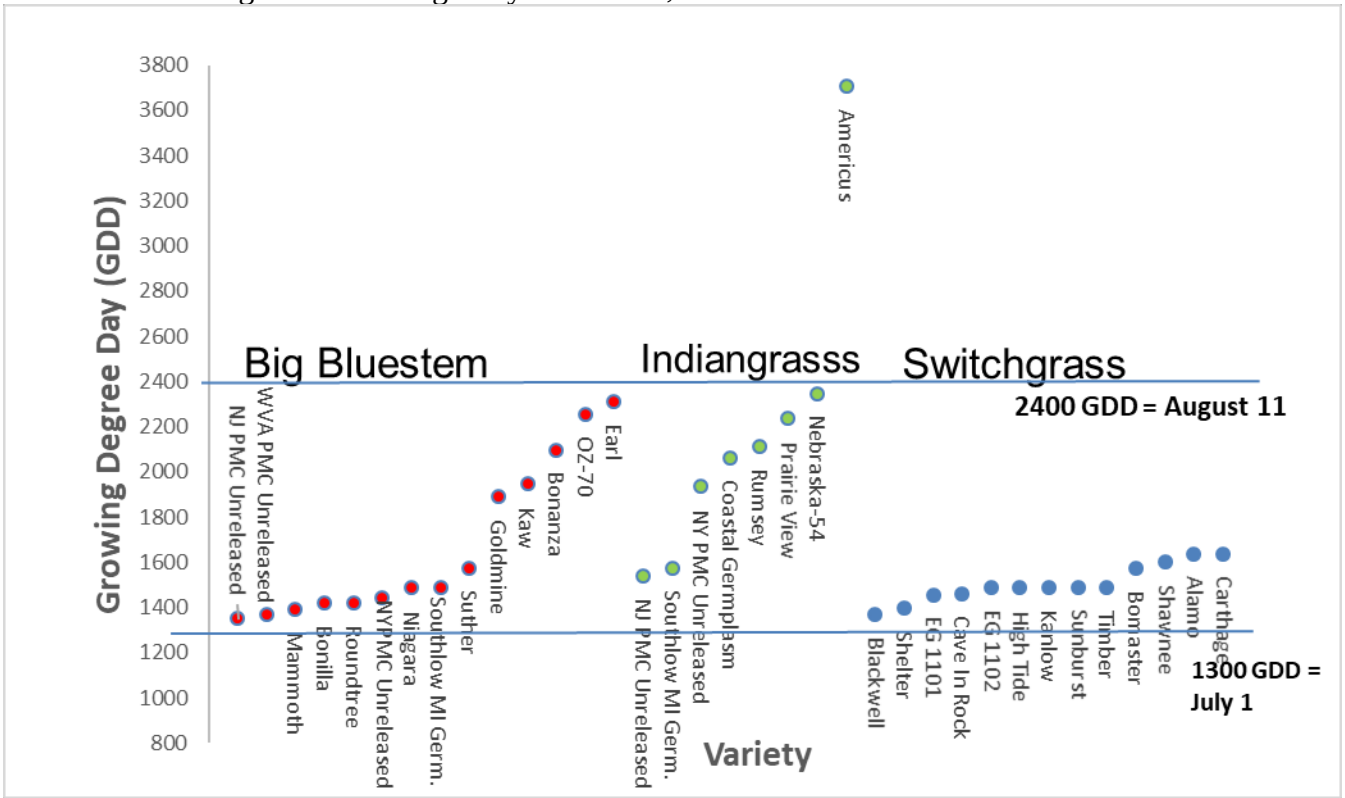



Figure 3. Boot Stage Timing - average (2015-2017) growing degree days (50º/86ºF) required to reach 75%boot stage of selected NWSG varieties.

*Size.*
NWSG size was measured at 75% boot stage. On average, switchgrasses were largest followed by big bluestem, then Indiangrass (Figure 4). Intervarietal variation was similar for each species, where the smallest to largest variety difference was about 200% in basal area, 750 in² to 1500 in² for Indiangrass. Diverse plant size and morphology are generally beneficial for associated animals and insects. Smaller NWSG are more useful in meadows creating perennial niches for animals and insects to use for nesting, protection from predators, and other uses while still

providing fuel for prescribed burns (Sarver 2010). Switchgrass and big bluestem tend to dominate plantings while Indiangrass is less apt to overshadow forbs.

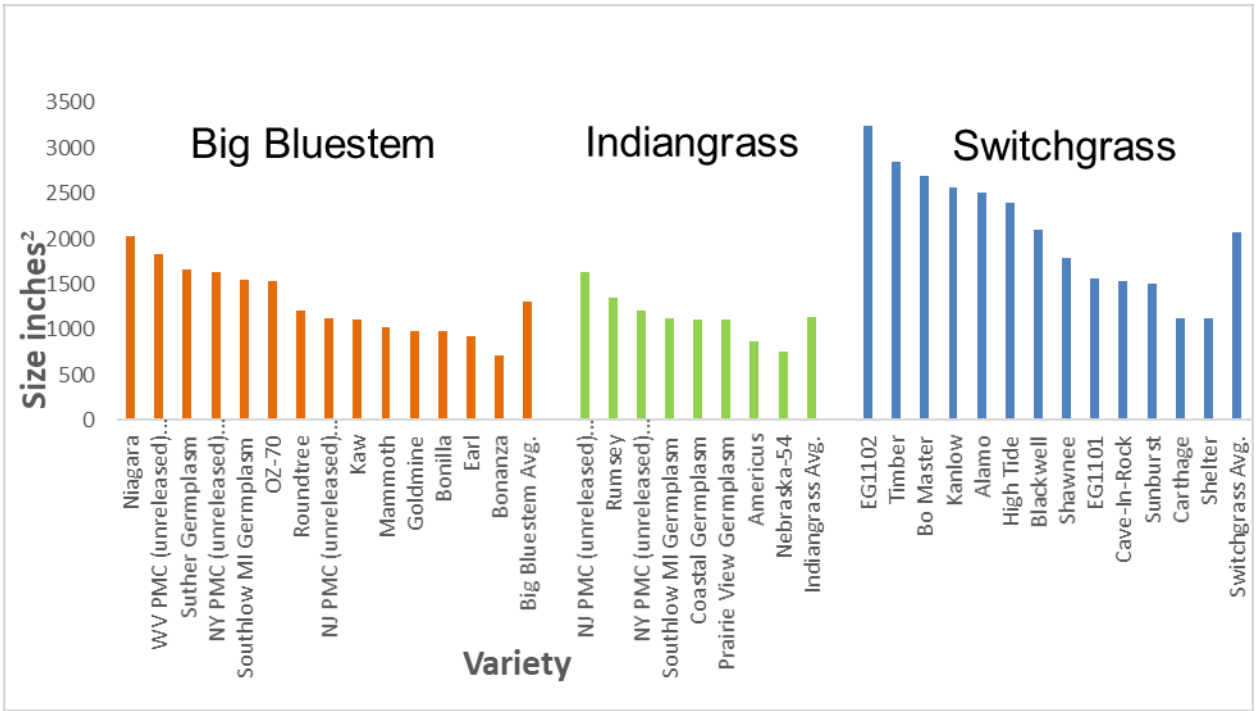



Figure 4. Average size (in.²) at 75% boot stage of selected NWSG varieties grown at Beltsville, MD (2015 to 2017).

## CONCLUSIONS

We attempted to provide an overall qualifier for each variety by ranking it against all varieties within the same species separately for each trait (Table 2).

*Forage.*
The best NWSG for livestock forage is generally those that provide ample biomass, boot later, and are resilient to grazing pressure. Several varieties of each species may be promising for grazing in the mid-Atlantic. All switchgrass varieties booted in early July, earlier than big bluestem and Indiangrass (Figure 3) and unless actively managed the switchgrass varieties may become stemmy (Keyser 2013). Several later booting big bluestem and Indiangrass varieties may be promising for grazing by providing a later summer grazing window. Big bluestem varieties OZ-70, Suther Germplasm and Niagara boot later and are larger. Most of the later boot stage Indiangrass varieties tested averaged 1000-1500 in² in size, which is smaller than OZ-70.

*Wildlife Habitat.*
The smallest and most local Indiangrass varieties tested were Coastal Germplasm, Prairie View Germplasm and 'Americus'.

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***Helping People Help the Land***

**MINUTES**
**JAMES CITY COUNTY**
**AGRICULTURAL AND FORESTAL DISTRICT ADVISORY COMMITTEE**
**REGULAR MEETING**
**101 Mounts Bay Road, Williamsburg, VA 23185**
**Building D Conference Room**
**October 21, 2021**
**4:00 PM**

---

## A. CALL TO ORDER

Mr. Chris Taylor called the Agricultural and Forestal District (AFD) Advisory Committee meeting to order at 4 p.m.

## B. ROLL CALL

**Present:**
Chris Taylor, Chair
Bruce Abbott, Vice Chair
Richard Bradshaw (late)
Loretta Garrett
Payten Harcum
William Harcum
Thomas Hitchens
Sue Sadler (by phone)
Sandy Wanner

**Staff:**
Tammy Rosario, Community Development Assistant Director
Josh Crump, Principal Planner
Katie Pelletier, Community Development Assistant

Mr. Taylor requested a motion to amend the agenda to add consideration of a Remote Participation Policy.

Ms. Loretta Garrett motioned to amend the agenda and consider the Remote Participation Policy.

Mr. Sandy Wanner seconded the motion.

On an 8-0 voice vote, the Committee approved the motion.

Mr. Taylor reviewed the AFD Committee Policy for Remote Participation and asked for any discussion. He then requested a motion to adopt the policy as presented.

Mr. Wanner motioned to adopt the Remote Participation Policy.

Mr. Bruce Abbott seconded the motion, and the Committee adopted the policy on an 8-0 voice vote.

Mr. Josh Crump stated that Ms. Sue Sadler would participate remotely in accordance with the adopted Remote Participation Policy.

Ms. Tammy Rosario then addressed the Committee to give an update on a County Open Space initiative called the Natural and Cultural Assets Plan. She explained a new committee will work with the community to identify assets, priorities, risks, and opportunities. She said they will provide updates to the AFD Committee and invite their input throughout the process.

Mr. Payten Harcum asked if the new committee was involved in the Comprehensive Plan.

Ms. Rosario replied no, but the new committee would help accomplish some of the actions items in the Comprehensive Plan. She said the Comprehensive Plan was being considered for adoption at the upcoming Board of Supervisors meeting.

Ms. Garrett commented on the number of committees for rural lands over the years. She asked if any were still in effect.

Ms. Rosario replied that past committees shared their work and recommendations with the Board of Supervisors then were disbanded. She stated the terms of the Purchase of Development Rights Committee have expired, but members were invited to apply for the new committee for the Natural and Cultural Assets Plan.

Mr. Tom Hitchens commented on continued residential development and effects on taxes.

Ms. Rosario said she would keep the AFD Committee informed on opportunities to give input.

## C. MINUTES

1. Minutes of the January 21, 2021 Organizational Meeting

Mr. Abbott motioned to approve the minutes of the January 21, 2021, Organizational Meeting.

Mr. Thomas Hitchens seconded the motion.

On a voice vote, the motion was approved 8-0.

## D. OLD BUSINESS

There was no old business for discussion.

## E. NEW BUSINESS

1. Case No. AFD-21-0002. 9958 Mill Pond Run, Barnes Swamp AFD Addition

Mr. Crump stated that Mr. David Hogue has applied to enroll approximately 60 acres of land located at 9958 Mill Pond Run into the Barnes Swamp AFD. He said the parcel is currently undeveloped and is located more than one mile away from the core of the District. Mr. Crump noted that when a parcel is located more than one mile away from the core, state code allows it to be added to the AFD if the governing body finds that the property contains agriculturally and forestally significant land.

Mr. Crump stated that the applicant has been working with the Virginia Department of Forestry and the Colonial Soil and Water Conservation District for harvesting and resource management plans. He noted that approximately five acres of harvested land will be reforested, and the remaining harvested acreage will be converted into pasture.

Mr. Crump said, should the AFD Advisory Committee find that the property contains agriculturally and forestally significant land, staff recommends that the Committee recommend approval of the application to the Planning Commission and Board of Supervisors. He then asked if there were any questions from Committee members.

Mr. Taylor asked if there was currently a residence on the property.

Mr. Crump replied no. He stated the parcel is landlocked in the Stonehouse subdivision with no frontage on the public right-of-way. He noted a 50-foot ingress/egress easement was granted in 2004 to allow vehicle and equipment access for any harvesting, but a residence or subdivision would prove difficult.

Mr. Abbott asked about the plan in the packet that showed a potential barn and future house site.

Mr. Crump said the applicant might attend the meeting late to answer questions.

Mr. Hitchens asked if they should defer the case until the applicant is present to answer questions.

The applicant Mr. Hogue arrived and joined the meeting.

Mr. Hitchens asked Mr. Hogue what he planned to do with the property.

Mr. Hogue said he understood they would not be able to subdivide the property.

Mr. Payten Harcum said he might be able to subdivide but would pay rollback taxes.

Mr. Wanner asked how many years he would put the property in the AFD.

Mr. Crump replied that the Barnes Swamp AFD will expire on October 31, 2022. He said this property would join that district timeline and be renewed for either four or eight years.

Mr. Abbott said the Commissioner of Revenue, Mr. Richard Bradshaw, would determine the land use taxation for the property.

Mr. Abbott motioned to recommend approval of Case No. AFD-21-0002, 9958 Mill Pond Run, Barnes Swamp AFD Addition, to the Planning Commission and Board of Supervisors.

Mr. Payten Harcum seconded the motion.

On a voice vote of 8-0, the motion was approved.

Mr. Crump thanked Mr. Hogue for attending the meeting and said that staff expects the Planning Commission will hear the case at its meeting on December 1, 2021.

Mr. Bradshaw joined the meeting late.

Mr. Hogue said they plan to build a house on the property in two to three years. He asked Mr. Bradshaw about the tax implications.

Mr. Bradshaw replied that the applicant would not need to take the acre out of the AFD, but he would need to take the acre out of land use. Mr. Bradshaw said the entire parcel can enter the AFD and any future residential acreage could be kept out of land use to avoid roll-back taxes. Mr. Bradshaw said it would be different if there is a change of ownership or subdivision of property.

Mr. Bradshaw explained that a timber parcel must be in an AFD in order to get a land use valuation. He said crop land does not have to be in an AFD to receive a land use valuation, but it must be actively farmed. He also explained that pasture and timber have different land use rates or value, but both are qualified uses. He said converting the land use does not trigger a roll-back in taxes.

Mr. Abbott commented that the County has always required 25 feet of road frontage to build a house or have any subdivision approved.

Mr. Crump suggested the applicant contact the Planning Division to discuss options at that time and submit a Conceptual Plan.

Mr. Bradshaw suggested the applicant put the entire parcel in the AFD and land use, then apply for any adjustments in the future. He said to contact him in Building B with any questions.

Mr. Hogue thanked the Committee and left the meeting.

## F. DISCUSSION ITEMS

1. 2022 Agricultural and Forestal District Renewal Process

Mr. Crump reviewed the memo in the meeting packet that outlines the upcoming AFD renewal process. He said the process will being in January 2022, and most AFD term limits are four years. Mr. Crump stated the Board of Supervisors has requested that the Committee survey property owners regarding their preferred length of term renewal, and a draft survey card was also included in the packet for review.

Mr. Bradshaw commented that the four-year renewal term has received the most interest in the past, with the exception of Wright's Island AFD which has preferred their eight-year renewal term schedule. He said only withdrawals have to be filed during the renewal period, otherwise the properties stay in the districts.

Mr. Crump confirmed the state limit for an AFD term is 10 years.

Mr. Hitchens asked why he receives a letter each year from Mr. Bradshaw's office.

Mr. Bradshaw said the annual letter pertains to land use, and property owners must confirm how they are using their land each year for tax rate purposes.

Mr. Crump said that staff will be conducting the survey in a few weeks and created draft templates. He requested any feedback from the Committee. He noted an eight-year renewal period would require less staff and Committee time compared to a four-year renewal period.

Mr. Bradshaw commented that fewer people will likely want to tie up their property for eight years.

Mr. Abbott inquired about rollback taxes when a property is taken out of an AFD.

Mr. Bradshaw said it depends, but timber land use would be affected. He said timber land use must be in an AFD, and timber would no longer be a qualified use if taken out of an AFD. He said rollback taxes include the current year and back five years.

Mr. Crump asked if there were any other comments or questions. He said the Committee also has a copy of the latest roster and upcoming meeting schedule.

Mr. Abbott corrected his phone number.

Mr. Will Harcum asked if the survey included advantages of a four- verses eight-year renewal schedule.

Mr. Crump replied they will rely on the preferences of property owners.

Ms. Garrett asked if there would be an additional meeting in December 2021.

Mr. Crump replied that the additional meeting would not be necessary, but the Committee may consider an AFD withdrawal application at the next scheduled meeting on January 20, 2022.

## G. ADJOURNMENT

Mr. Wanner motioned to adjourn the meeting.

Mr. Abbott seconded the motion.

The meeting was adjourned at 5 p.m. after a unanimous 9-0 voice vote.

**Unapproved Minutes of the December 1, 2021**
**Planning Commission Regular Meeting**

## AFD-21-0002. 9958 Mill Pond Run, Barnes Swamp AFD Addition

Ms. Tori Haynes, Senior Planner, stated that Mr. David Hogue has applied to enroll approximately 60 acres located at 9958 Mill Pond Run into the Barnes Swamp Agricultural and Forestal District (AFD). Ms. Haynes stated that the parcel is currently undeveloped and is located more than one mile away from the core of the District. Ms. Haynes stated that when a parcel is located more than one mile away from the core, State Code allows it to be added to the AFD if the governing body finds that the property contains agriculturally and forestally significant land.

Ms. Haynes further stated that the applicant has been working with the Virginia Department of Forestry and the Colonial Soil and Water Conservation District (CSWCD) for harvesting and resource management plans. Ms. Haynes noted that approximately five acres of harvested land will be reforested, and the remaining harvested acreage will be converted into pasture.

Ms. Haynes stated that at its October 21 meeting, the AFD Advisory Committee voted 8-0 to recommend that the property is agriculturally and forestally significant, and recommended approval of the application.

Ms. Haynes stated that, should the Planning Commission concur, staff recommends that the Commission recommend approval to the Board of Supervisors.

Mr. Haldeman called for disclosures from the Commission.

There were no disclosures.

Mr. Haldeman opened the Public Hearing.

As no one wished to speak, Mr. Haldeman closed the Public Hearing.

Mr. Polster stated that he found the report from the CSWCD to be very informative. Mr. Polster noted that he was particularly interested on the information on equine stocking. Mr. Polster further noted that he hopes the applicant will go forward with that plan. Mr. Polster stated that he was also pleased to see that the applicant was looking at a plan for reforestation of parts of the property.

Mr. Krapf made a motion to recommend approval of the AFD addition.

On a roll call vote, the Commission voted to recommend approval of AFD-21-0002. 9958 Mill Pond Run, Barnes Swamp AFD Addition. (7-0)

**AGENDA ITEM NO. G.6.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Thomas Wysong, Senior Planner II

SUBJECT: Z-21-0012 and MP-21-0003. Proffer and Master Plan Amendment for the Continuing Care Retirement Facility at Ford's Colony (Ford's Village)

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**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Staff Report | Staff Report |
| | 1. Ordinance | Ordinance |
| | 2. Location Map | Exhibit |
| | 3. CIS | Backup Material |
| | 4. Proposed Proffers | Backup Material |
| | 5. Proposed Master Plan | Backup Material |
| | 6. Existing Proffers | Backup Material |
| | 7. Existing Master Plan | Backup Material |
| | 8. Fiscal Impact Analysis | Backup Material |
| | 9. Housing Types Example | Backup Material |
| | 10. DRW Memo | Backup Material |
| | 11. Parks and Recreation Exception Request | Backup Material |
| | 12. Public Input | Backup Material |
| | 13. Unapproved minutes from the December 1, 2021 Planning Commission meeting | Backup Material |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Planning | Holt, Paul | Approved | 12/22/2021 - 3:53 PM |
| Development Management | Holt, Paul | Approved | 12/22/2021 - 3:53 PM |
| Publication Management | Daniel, Martha | Approved | 12/22/2021 - 4:08 PM |
| Legal Review | Kinsman, Adam | Approved | 12/28/2021 - 7:37 AM |
| Board Secretary | Saeed, Teresa | Approved | 12/28/2021 - 8:36 AM |
| Board Secretary | Purse, Jason | Approved | 1/4/2022 - 2:13 PM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:56 PM |

## SUMMARY FACTS

| | |
|---|---|
| Applicant: | Mr. Vernon Geddy, III, on behalf of Frye Development, LLC |
| Land Owners: | SWR-HOCKADAY, LLC & MCMURRAN, MARTHA |
| Proposal: | A request to amend the adopted proffers and master plan for the Continuing Care Retirement Facility at Ford's Colony. The proposal would permit up to 286 age-restricted residential units consisting of single-family dwellings and multifamily dwellings, as well as a facility containing a total of no more than 230 age-restricted assisted living/memory care rooms/skilled nursing beds, with no more than 75 apartments, no more than 155 assisted living rooms/memory care rooms, and no more than 40 skilled nursing beds. This development would include accessory amenities intended for the residents and employees of the development and not the general public. |
| Location: | 3889 News Road |
| Tax Map/Parcel No.: | 3730100004 |
| Current Zoning: | R-4, Residential Planned Community District with proffers |
| Project Acreage: | +/- 179.2 acres |
| Comprehensive Plan: | Low Density Residential |
| Primary Service Area: (PSA) | Inside |
| Staff Contact: | Thomas Wysong, Senior Planner II |

## PUBLIC HEARING DATES

| | |
|---|---|
| Planning Commission: | November 3, 2021, 6:00 p.m. (Postponed)<br>December 1, 2021, 6:00 p.m. |
| Board of Supervisors: | January 11, 2022 |

## FACTORS FAVORABLE

1. Staff finds the proposal to be consistent with the adopted 2045 Comprehensive Plan.

2. Pursuant to the Fiscal Impact Analysis (FIA) submitted for this application, the proposal is expected to have a positive fiscal impact.

3. Due to the proffered age restriction, the proposal is not anticipated to generate any schoolchildren.

4. The applicant has proffered cash contributions that are intended to mitigate the impacts of this proposal.

5. The applicant has proffered transportation improvements that adequately mitigate impacts to News Road and the surrounding transportation network.

6. The applicant has proffered for the 286 single-family and multifamily units to be constructed to Energy Star (or equivalent independent) residential certification.

7. The applicant has proffered for the submittal of a Nutrient Management Plan for all landscaped areas within the development.

8. The applicant has proffered the installation of a bus stop and shelter on News Road adjacent to the main entrance into the Property, upon request of Williamsburg Area Transit Authority (WATA) or any successor agencies.

9. The applicant has proffered to reserve two assisted living beds for Medicaid-qualified individuals under the Auxiliary Grant Program administered by the Virginia Department of Social Services.

10. The applicant has proffered the submittal of a traffic management plan for construction of the project in order to mitigate the traffic impacts on News Road related to construction.

11. Impacts: See Impact Analysis on Pages 10-12.

**FACTORS UNFAVORABLE**

1. Impacts: See Impact Analysis on Pages 10-12.

2. See Affordable/Workforce Analysis on Page 8.

**SUMMARY STAFF RECOMMENDATION**

Staff recommends that the Planning Commission recommend approval of the proposed amendment to the proffers and master plan to the Board of Supervisors.

**PLANNING COMMISSION RECOMMENDATION**

At its December 1, 2021, Regular Meeting, the Planning Commission recommended approval of the application with the proposed conditions by a vote of 5-1.

**CHANGES SINCE PLANNING COMMISSION MEETING**

In response to public input, the applicant has included an additional proffer requiring the submittal of a traffic management plan for construction of the project prior to site development. The applicant has also revised the proffer and master plan note for the emergency access to ensure an updated traffic study will be provided and improvements installed in the event this entrance is proposed for conversion to a full entrance.

**PROJECT DESCRIPTION**

This application proposes to amend the currently adopted Ford's Colony Master Plan and related proffers for the Continuing Care Retirement Community (CCRC) proposed on the property. This previously approved CCRC, which has not commenced development, is known as Ford's Village and is identified as Section 37 on the approved Ford's Colony Master Plan. The use of the property for continuing care is not proposed to change, though this amendment does significantly change the proposed unit mixture and internal site layout for Ford's Village.

<u>Master Plan Amendment</u>

Under the currently approved Master Plan (MP-0008-2007), the access to Ford's Village is proposed to be provided via an entrance on News Road, located across from the Firestone residential entrance to Ford's Colony. The streets internal to Ford's Village are proposed to

be privately maintained and the project is shown connecting to public water and sewer provided by James City Service Authority (JCSA).

In terms of internal layout, the currently approved 2007 Plan shows a total of 36 principal buildings, along with several smaller accessory structures. Nineteen of the buildings are two-unit townhouses (duplexes), which account for 38 units. The remaining 17 buildings and accessory structures are intended to house the various independent living units, assisted living rooms, and skilled nursing beds planned for the CCRC, which account for a total of 703 units/rooms/beds. There is also a wide variety of support uses including a health center, community meeting facility, parking and storage functions, maintenance and support functions, dining halls and kitchens, and on-site services (such as a barbershop, beauty parlor, post office, etc.).

The proposed Master Plan amendment would change the proposed unit mixture by significantly increasing the amount of single-family and multifamily units and significantly decreasing the amount of proposed apartments, resulting in a more balanced mix within the development. In this proposal, the land use would be divided into two categories: the single-family and multifamily units would account for 286 units and be dispersed along the private road network proposed in Land Areas designated A, B, or C. The proposed apartments, memory care/assisted living, and skilled nursing beds would account for a maximum of 230 units and be located within Land Area D, which is the hub of apartments, medical, and institutional uses.

Both categories of development would be part of the same continuing care facility, with residents and employees able to access the shared amenities within the parcel. These amenities include recreational amenities and limited commercial uses intended for the residents and employees of the development (not the general public) and including a café/coffee shop; education room; spa and wellness center; physical therapy and/or physician's office(s), and pharmacy.

As detailed in the following table, the unit mixture within the proposed Master Plan amendment would significantly increase the amount of single-family and multifamily units on-site, while also significantly reducing the amount of apartments. In terms of medical and institutional uses, the potential development for assisted living/memory care is increased, while the potential development of skilled nursing beds decreases.

*Table 1: Master Plan Unit Mix Comparison*

| Unit/Bed Type | Adopted 2007 Master Plan | Proposed 2021 Amendment | Difference |
|---|---|---|---|
| Single-Family and Multifamily Units | 38 | 286 | +248 |
| Apartments | 558 | 75 | -483 |
| Assisted Living/Memory Care | 85 | 155 | +72 |
| Skilled Nursing | 60 | 40 | -20 |
| Total Max | 741 | 516* | -225 |

**Per the amended proffers, the total amount of apartments, assisted living/memory care rooms/skilled nursing beds within the institutional facility (Land Use "D" on the Master Plan) shall not exceed 230 (see rows shaded blue in the Table), which is why this number is capped at 516.*

Proffer Amendment

In conjunction with the proposed Master Plan amendment, the applicant is proposing to amend and restate the proffers for the parcel. This proposal includes revisions to the existing proffer language as well as the proposed removal of certain proffers as follows:

- Revision to the proffered unit max and type to match what is proposed on the amended Master Plan (see Table 1 on Page 3 for details).

- Revisions to the details of the proffered Stormwater Plan to reflect the amended approach to stormwater management on the Master Plan.

- Revisions to the recreational amenities proffers to clarify that the proposed amenities are not open to the general public and are intended for residents of Ford's Village.

- Inclusion of a proffer requiring the submittal and approval of an updated traffic signal warrant analysis for the News Road/Firestone Drive/project entrance intersection prior to site plan or subdivision plan approval.

- Inclusion of a proffer requiring the submittal of a traffic management plan for construction of the project in order to mitigate the traffic impacts on News Road related to construction.

- Inclusion of a proffer requiring an updated traffic study and installation of required road improvements to the emergency entrance, in the event it is proposed to be converted to a full entrance.

- Revisions to the build-out trigger point for when traffic counts need to be submitted to the County (current approved number is at 247 units, then at 494 units; the proposed trigger point is at 400 units, roughly halfway between the two). The purpose of the trigger points is to determine the traffic impacts at certain points during project build-out such that any additional needed transportation improvements (such as entrance or turn lane improvements) can be installed prior to continued build-out.

- Removal of the Greenway Trail proffer, which proposes the construction and dedication to the public of this trail portion, on account of the lack of an interconnecting easement being made available from the Monticello Woods property (See Impact Analysis Table on Page 10 for further analysis).

- Removal of redundant proffers that establish standards already required by the Zoning Ordinance, including the proffer regulating lighting, archaeology study, natural resource study, etc.

- Removal of proffers limiting heights for buildings no longer shown on the Master Plan.

- Removal of the proffer requiring the submittal of the Cold Spring Swamp Drainage Analysis, on account of an analysis being completed for the swamp since the original rezoning and master plan approval for this property.

Per the Planning Commission's recommendation, Planning staff held a follow-up meeting with Stormwater and Resource Protection (SRP) to discuss the potential for upstream flooding on the property and the impact of removing Proffer No. 19 and Proffer No. 10(b) on flooding and erosion control. SRP confirmed that the Powhatan Creek Floodplain Study (which analyzes the full build-out of the Powhatan Creek Watershed) eliminates the need for Proffer No. 19, which would require a drainage analysis of Cold Spring Swamp (part of the Powhatan Creek Study) at full build-out.

SRP also confirmed that the removal of Proffer No. 10(b), which requires the submittal of a stream monitoring plan on the subject property and annual monitoring of erosion for a period of 10 years, would not prevent the Stormwater Division from adequately addressing erosion concerns on the parcel during the development plan process.

The stream monitoring plan required by this proffer requires a baseline assessment and monitoring of stream segments delineated on sheet 7 of the Master Plan. Furthermore, this proffer requires the property owner to install additional up-stream run-off control measures, as approved by SRP, to prevent further erosion if the stream monitoring indicates the presence of new erosion not shown in the baseline assessment. These additional upstream run-off control measures would include measures on the other side of News Road on parcels not included with this application, which would make enforcement of this proffer impractical for the County. Finally, mitigating any potential impacts of this development on the Powhatan Creek watershed and the Cold Spring Swamp would be accomplished at the site plan stage, should this project be approved, and the development would be held to the current standards and requirements of the Erosion and Sediment Control, Stormwater Management, and Chesapeake Bay Preservation Ordinances.

As detailed within Table 2, the proposed proffers also include revisions and updates to the cash commitments associated with this project. Specifically, the applicant is proposing to update and increase the per unit/room/bed commitment for the 2021 amendment to account for the Marshall & Swift Building Cost Index. The proposed proffers also remove the cash commitments to specific improvements from the 2007 rezoning related to infrastructure development, namely sewer and road improvements. The $60,000 cash commitment to sewer infrastructure has been proposed for removal, as has the $36,000 cash commitment to road improvements for the Monticello Avenue/News Road Intersection and Monticello Avenue Corridor. The $60,000 proffered for off-site sewer improvements is proposed for removal by the applicant. JCSA has raised no concerns with this proposed removal.

The $36,000 proffered for off-site transportation improvements to the News Road/Monticello Avenue intersection and the Monticello Avenue Corridor is proposed for removal by the applicant on account of these improvements having been completed since the original rezoning.

Overall, the total development amount of cash contribution for the project is expected to decrease by approximately 25% from $1,757,475 to $1,326,095.15, depending on final unit mix. This is largely attributed to the overall proposed reduction in dwelling units resulting from the amended Master Plan and proffers, in which the current proffered amount of 596 residential units is being decreased by 40% to 361 dwelling units.

*Table 2: The Village at Ford's Colony: Cash Contribution Proffer Comparison*

| Cash Contribution Proffer Summary | Approved 2007 Proffers (in 2008 dollars) | 2021 Proffer Amendment |
|---|---|---|
| Proffer Use: | Amount: | Amount: |
| Fire, Police, Emergency Services, Library, Public Facilities: | $1,000 per Dwelling Unit<br>(x 596 Dwelling Units = $596,000 | $1,277.61 per Dwelling Unit<br>(x 361 Dwelling Units) = $461,217.21 |
| *Fire, Police, Emergency Services, Library, Public Facilities:* | $250 per Room/Bed<br>(x 83 Rooms) + (x 60 Beds) = $35,750 | $319.40 per Room/Skilled Nursing Unit*<br>(x 115 Rooms) + (20 Skilled Nursing Units) = $43,119 |
| Water Infrastructure Development: | $870 per Dwelling Unit<br>(x 596 Dwelling Units) = $518,520 | $1,111.52 per Dwelling Unit<br>(x 361 Dwelling Units) = $401,258.72 |
| *Water Infrastructure Development:* | $435 per Room/Bed<br>(x 83 Rooms) + (x 60 Beds) = $62,205 | $555.76 per Room/Skilled Nursing Unit<br>x (115 Rooms +20 Skilled Nursing Units) = $75,027.60 |
| Sewer Infrastructure Development: | $60,000 (one-time payment) | $0 |
| Monticello Avenue / News Road Intersection and Monticello Avenue Corridor Improvements: | $36,000 (one-time payment) | $0 |
| Road Improvements: | $750 per Dwelling Unit<br>(x 596 Dwelling Units = $447,000) | $958.20 per Dwelling Unit<br>(x 361) = $345,910.20 |
| Total Cash Contribution Per Dwelling Unit: | Up to: $2,620 per Dwelling Unit<br>(x 596 Dwelling Units = $1,561,520) | Up to $3,347.33 per Dwelling Unit<br>(x 361 Dwelling Units) = $1,208,386.13 |
| *Total Cash Contribution Per Room/Bed:* | $685 per Room/Bed<br>(x 143 Rooms/Beds) = $97,955 | $875.16 per Room/Skilled Nursing Unit<br>(x 135 Rooms/Unit) = $118,146.60 |
| Total Development Cash Contribution:** | Up to: $1,757,475 | Up to $1,326,095.15*** |

**Per the proffers, one skilled nursing unit is equal to two beds.*
***Cash amount is stated as "up to" on account of the different unit mix possibilities, per the proffers in both proposals.*
****Per the proffers, two of the four beds within one of the assisted living rooms will be reserved for Medicaid qualified individuals and are exempt from the proffered cash contribution, which is why half a unit's worth of cash contributions (2 beds = $437.58) has been subtracted from the estimated total.*

Transportation Analysis

Separate from the cash contributions, the applicant has proffered the same on-site transportation improvements included within the 2007 rezoning, with the exception of the shoulder bike lane on News Road, which is not recommended by the County's bicycle/pedestrian maps and has been removed from the proffers. These on-site improvements include the following:

- A signal at the intersection of News Road, Firestone Drive, and the project entrance (if warranted by updated traffic signal warrant analysis that is proffered to be completed prior to development plan approval).
- An exclusive left-turn lane from westbound News Road into the Property.
- An exclusive right-turn lane from eastbound News Road into the Property at the main entrance into the Property at the intersection of News Road and Firestone Drive.
- The restriping of the existing southbound left-turn lane on Firestone Drive at News Road to be a shared left and through lane.
- The installation of an exclusive left-turn on westbound News Road at the intersection with Powhatan Secondary
- The installation or payment for a traffic signal at the intersection of News Road and Powhatan Secondary at the time such signal is warranted.

The applicant has submitted a trip generation calculation memorandum (see Attachment on Page 9) for this proposal that compares the proposed unit mix to information within the previously approved traffic studies for Ford's Colony, including the study performed for the rezoning of this parcel in 2007 and the 2020 Kimley-Horn Associates traffic study. The traffic study from the 2007 rezoning showed a daily trip generation of 2,697, while the proposed generation for this amendment shows a total of 1,916 trips, a reduction of 781 daily trips.

The County adopted the Adequate Transportation Facilities Test by resolution on August 14, 2018. This policy requires for a proposed Special Use Permit (SUP) or rezoning to be tested during the application process to ensure that transportation facilities are adequate to mitigate traffic impacts. Per the adopted policy, a proposed rezoning or SUP application will pass the test if:

i. No off-site improvements are required by the Traffic Impact Analysis (TIA) that is approved by both the Planning Director and the Virginia Department of Transportation (VDOT); or

ii. All off-site improvements recommended by a TIA that is approved by both the Planning Director and the VDOT are guaranteed in a form approved by the Planning Director and County Attorney.

The transportation improvements proffered with this application ensure that this proposal passes the Adequate Transportation Facilities Test.

Parks and Recreation Analysis

This project is required to meet the R-4 Zoning Ordinance requirements, which requires 40% of the overall planned development of Ford's Colony to be open space. If approved, this proposal would result in no change in the overall open space for Ford's Colony, which is 52.3%. The R-4 District also requires one acre of recreational open space per 350 dwelling units. This proposal exceeds this requirement by proposing a minimum of four acres of dedicated recreation area.

The R-4 requirements do not encompass all aspects of the Parks and Recreation Development Guidelines, which include trails, courts/pools, and fields. Please see below for the proposal analysis.

- Requirement: Park land (0.83 acres minimum).
- Applicant Proposal: The Master Plan guarantees a minimum of four acres of recreational land and facility, which substantially exceeds the recommended amount.

- Requirement: Playground (minimum of five activities) or other age-appropriate alternative facility.
- Applicant Proposal: The Master Plan shows eight pocket parks, in which playgrounds can be located; however, the Master Plan and proffers do not commit to facilities in the pocket parks.

- Requirement: Hard surface sport court or pool.
- Applicant Proposal: The applicant has proffered pickleball courts, to be located within the Land Use areas designated for single-family and multifamily development.

- Requirement: Graded athletic field.
- Applicant Proposal: The applicant is not proposing a graded athletic field as part of this proposal.

- Requirement: Paved multiuse trail.
- Applicant Proposal: The applicant is proposing the Greenway Trail to serve the site, as well as a multiuse path along News Road.

The Parks and Recreation Development Guidelines state that the Board of Supervisors may approve alternatives to the recommended facility categories listed above. The applicant has submitted an exception request (see Attachment on Page 10). While playgrounds/age-appropriate alternative facilities and a graded athletic field are not included in this proposal, other recreational amenities proposed for the site include a spa and wellness center, an outdoor pool, and walking/biking paths.

The County's *2002 Greenway Master Plan* proposed a Greenway Trail traversing this property from News Road to Monticello Avenue. The currently adopted Master Plan shows the proposed Greenway Trail connecting from News Road to the southern portion of the property. The proposed Master Plan shows the Greenway Trail traversing the southern portion of the property and connecting to the "Park" and "Clubhouse/Recreation" area, but offering no connection to the southern property line.

Housing Affordability Analysis

The Comprehensive Plan encourages inclusion of affordable and workforce units within new residential development. The 361 proposed units are planned to be a mix of single-family, multifamily, or apartments, all to be offered at market rate within the context of the Continuing Care development. At this time, it is undetermined what the exact unit mix will be. The tables below and on the next page provide the sales and rental prices affordable at distinct percentages of Area Median Income (AMI) level, which is $84,500 for 2021.

*Affordable Sales Price by AMI %*

| % AMI | Upper limit of the sales price affordable to this AMI level (2021 Prices) |
|---|---|
| 30% | $129,750 |
| 60% | $257,250 |
| 80% | $341,950 |
| 100% | $427,125 |
| 120% | $512,000 |

*Affordable Rental Price by AMI %*

| % AMI | Upper limit of the rental price affordable to this AMI level (2021 Prices) |
|---|---|
| 30% | $ 634 |
| 60% | $1,268 |
| 80% | $1,689 |
| 100% | $2,113 |
| 120% | $2,535 |

## PLANNING AND ZONING HISTORY

The subject property is currently an undeveloped parcel of land (formerly known as the "Warburton Tract") which is largely in a natural, undisturbed state. The land has previously been timbered, and remnants of several logging roads cross it in various locations. The parcel is heavily vegetated with a mixture of pines, hardwoods, and dense underbrush. The ground is higher in the center of the property, and slopes away steeply toward the eastern, southern, and western edges. Cold Spring Swamp runs along the eastern boundary of the property, and the main stem of Powhatan Creek runs along the western property boundary. The property is approximately 179.20 acres in size.

This parcel was rezoned in 2008 from the R-8, Rural Residential Zoning District to the R-4, Residential Planned Community with proffers and incorporated into the Ford's Colony Master Plan. The proposed use for the property on the approved Master Plan is a CCRC consisting of 38 townhomes, 558 independent living units, 83 assisted living rooms, and 60 skilled nursing beds. In conjunction with this rezoning and master plan, the parcel was removed from the Gordon Creek Agricultural and Forestal District (AFD). No development has commenced within the property and no cash proffers have been collected.

## SURROUNDING ZONING AND DEVELOPMENT

North: R-2, General Residential (Springhill Subdivision) R-4, Residential Planned Community District (Ford's Colony).

West: A-1, General Agricultural.

South: PUD-R, Planned Unit Development Residential Community District (Monticello Woods).

East: R-4, Residential Planned Community District (Powhatan Secondary.

**IMPACT ANALYSIS**

| **Impacts/Potentially Unfavorable Conditions** | **Status** *(No Mitigation Required/Mitigated/Not Fully Mitigated)* | **Considerations/Proposed Mitigation of Potentially Unfavorable Conditions** |
|---|---|---|
| Please note the information in the Status column indicated below does not include information from the Financial Impacts of Residential Units section of this staff report. | | |
| Public Transportation: Vehicular | Mitigated | - Please see the Transportation Analysis on Page 7.<br>- Per the proffers, upon the request of the WATA, the Owner shall install a bus stop, and shelter on News Road adjacent to the main entrance into the Property, with the exact location being subject to the approval of WATA. |
| Public Transportation: Pedestrian/Bicycle | Not Fully Mitigated | - The County's *Pedestrian Accommodation Master Plan* and *Regional Bikeways Map* shows the need for a multiuse path along the property frontage on News Road.<br>- The proposed Master Plan shows a multiuse path abutting the News Road frontage in between the primary entrance and emergency access entrance for the property, but not the entirety of the property as recommended on the maps.<br>- Pursuant to Section 24-35 of the Zoning Ordinance, the proposed improvements shown on these maps are required to be shown on the site plan and installed at development.<br>- The County's *2002 Greenway Master Plan* proposed a Greenway Trail traversing this property from News Road to Monticello Avenue.<br>- The currently adopted Master Plan shows the proposed Greenway Trail connecting from News Road to the southern portion of the property. The proposed Master Plan shows the Greenway Trail traversing the southern portion of the property and connecting to the "Park" and "Clubhouse/Recreation" areas, but offering no connection to the southern property line. |
| Public Safety | Mitigated | - Located within a six-minute radius of Fire Station 5.<br>- The proposal is expected to generate impacts that are mitigated by the proffered cash contributions (see Table 2 on Page 6 for details). |
| Public Schools | No Mitigation Required | - Ford's Village is proposed as a CCRC. Per the proffers, all proposed units are age-restricted and are not expected to generate schoolchildren. |

| **Impacts/Potentially Unfavorable Conditions** | **Status** *(No Mitigation Required/Mitigated/Not Fully Mitigated)* | **Considerations/Proposed Mitigation of Potentially Unfavorable Conditions** |
|---|---|---|
| Please note the information in the Status column indicated below does not include information from the Financial Impacts of Residential Units section of this staff report. | | |
| Public Parks and Recreation | No Mitigation Required | - See Analysis on Pages 7 and 8. |
| Public Libraries and Cultural Centers | Mitigated | - Per the proposed proffers, the applicant is contributing a portion of the $1,277.61 to mitigate impacts to the library. |
| Groundwater and Drinking Water Resources | Mitigated | - The Master Plan proposes to connect to the existing water and sewer facilities currently located within News Road. JCSA has reviewed and approved the water and sewer flows within the CIS, as well as the proposed utility layout within the Master Plan.<br>- Per the proposed proffers, the property will be developed with water conservation standards approved by JCSA. |
| Watersheds, Streams, and Reservoirs<br>The property is located within the Powhatan Creek Watershed. | Mitigated | - The Master Plan shows a conceptual layout for stormwater management facilities.<br>- The proposed proffers require the Master Stormwater Management Plan (MSWMP) for the Property be approved prior to the first site plan submittal and comply with the standards within the adopted Watershed Management Plan in place at time of submittal. |
| Cultural/Historic | No Mitigation Required | - This property is identified as a Moderate sensitive area on the James City County Archaeological Assessment, meaning no archaeological study is required for this application as part of the legislative submittal.<br>- Per Section 24-145 of the Zoning Ordinance, a Phase 1 Archaeological Study will be required for submittal and review as part of the initial site plan submittal. |
| Nearby and Surrounding Properties | No Mitigation Required | - The proposed area to be developed as Ford's Village will be residential in nature and age-restricted throughout, per the proposed proffers. The impacts related to nuisances such as noise and light are not anticipated to impact neighboring and surrounding proffers due to adequate buffering and Ordinance requirements regarding lighting. |

| **Impacts/Potentially Unfavorable Conditions** | **Status** *(No Mitigation Required/Mitigated/Not Fully Mitigated)* | **Considerations/Proposed Mitigation of Potentially Unfavorable Conditions** |
|---|---|---|
| Please note the information in the Status column indicated below does not include information from the Financial Impacts of Residential Units section of this staff report. | | |
| Community Character | Mitigated | - News Road is identified as a Wooded Community Character Corridor (CCC).<br>- The Master Plan shows a 150-foot wide CCC buffer along the entire frontage of News Road on the property. This property is heavily wooded and consists of mature trees that provide substantial screening from the News Road right-of-way. |

## FINANCIAL IMPACTS OF RESIDENTIAL UNITS

On September 10, 2019, the Board of Supervisors adopted a resolution directing staff to produce a fact sheet that outlines general financial impacts of residential dwellings based on the Adopted Budget, the Capital Improvements Program, the Comprehensive Plan, the Strategic Plan, and any other relevant data. The resolution further directs that the fact sheet should address the immediate and long-range fiscal impacts related to increased use and demand on the following public facilities and resources. The per unit Residential Impacts are based on the Fiscal Year (FY) 2022 data provided by the Department of Financial and Management Services (FMS) and JCSA, as well as the projected number of annual residential unit data through 2034 (the Comprehensive Plan horizon year). The per unit impacts are detailed in Table 1 below.

*Table 1-Per Unit Fiscal Residential Impacts Information*

| Category | Residential Impact | Proffered with current application* |
|---|---|---|
| Public Transportation | $ 299.21 | $958.20 |
| Public Safety | - | $1,277.61 |
| Public Schools | $1,417.63 | $0** |
| Public Parks & Recreation | $4,156.19 | $0 |
| Public Libraries and Cultural Centers | $ 170.88 | $1,277.61 (portion of Public Safety) |
| Groundwater and Drinking Water Resources | $3,542.69 | $1,111.52 |
| Watersheds, Streams & Reservoirs | $1,954.03 | $0 |

**The rooms/beds are excluded from this analysis, per the CCRC analysis guidance in the Comprehensive Plan.*
***All units are age-restricted and not expected to generate school children.*

The general financial impacts of dwelling units described above are for the County and residential development as a whole. Submission of a development-specific FIA is required for all rezonings that include a residential component. The FIA takes into account all development components, including both residential and non-residential uses and the results are also affected by types of residential units and projected assessed values.

- The County's FIA worksheet was submitted per the Fiscal Year 2021 calculations provided by the Department of FMS (see Attachment No. 7).

- Per that analysis, the development would result in a $727,922 annual positive fiscal impact to the County. When not accounting for schoolchildren generation (which is not anticipated as a result of this age-restricted development), the impact is $1,887,000.

### Comprehensive Plan

The 2045 Comprehensive Plan states that the use of land should be consistent with the capacity of existing and planned public facilities and services and the County's ability to provide such facilities and services. The Plan also states "expect developments subject to zoning or SUP review to mitigate their impacts." Information on impacts and the mitigation provided by this application are included in this staff report.

The property is designated Low Density Residential (LDR) on the adopted 2045 Comprehensive Plan Land Use Map and is located inside the PSA. The following general guidance is stated for the LDR designation in the Comprehensive Plan:

Single-family homes, multifamily units, and retirement and care facilities/communities are all recommended uses in LDR areas provided that development:

- Complements the residential character of the surrounding area;
- Has traffic, noise, and lighting impacts similar to surrounding uses;
- Is generally located on collector or arterial roads at intersections;
- Provides adequate screening and buffering to protect the character of nearby residential areas; and
- Act as a transitional use between residential and commercial areas or, if located within a residential community, be integrated with the residential character of the area rather than altering its nature.

Staff finds this proposal meets all of these criteria. Additionally, the Comprehensive Plan recommends a gross density of one to four units per acre in LDR areas. When describing the review process for a CCRC, the Comprehensive Plan recommends the density be based on the number of independent living units (361 units), with the assisted living rooms and/or skilled nursing beds excluded from this calculation as these are considered institutional uses.

As such, this application would result in a significant decrease in the density on the subject parcel from the 3.59 units per acre to 2.17 dwelling units per acre. This proposal would also result in a marginal decrease within the overall density of Ford's Colony from 1.25 unit per acre to 1.13 units per acre.

## STAFF RECOMMENDATION

Staff recommends that the Planning Commission recommend approval of the proposed Master Plan and proffer amendment application.

TW/md
RZ21-12MP21-3FordsVllg

Attachments:
1. Ordinance
2. Location Map
3. Community Impact Statement
4. Proposed Proffers
5. Proposed Master Plan
6. Existing Proffers
7. Existing Master Plan
8. Fiscal Impact Analysis
9. Housing Examples
10. DRW Memo
11. Parks and Recreation Exception Request
12. Public Input
13. Unapproved minutes from the December 1, 2021, Planning Commission meeting

ORDINANCE NO. _____

AN ORDINANCE TO AMEND EXISTING PROFFERS RECORDED AS INSTRUMENT NUMBER 080017656, APPROVED AS PART OF Z-08-07 TO PERMIT A DIFFERENT MIX OF UNIT TYPES AND REVISED DEVELOPMENT STANDARDS AND AS DESCRIBED IN CASE NO. Z-21-0012

WHEREAS, on July 8, 2008, the Board of Supervisors approved Case No. Z-08-07 which included proffers regulating the development of a proposed Community Care Retirement Facility, including but not limited to the number of units, unit type, cash contributions for impact mitigation, and stormwater management, on the parcel located at 3889 News Road, James City County, Virginia, further identified as James City Tax ID Parcel No. 3730100004 (the "Property"); and

WHEREAS, Mr. Vernon Geddy has applied for an amendment to the existing proffers on behalf of the owners, SWR-Hockaday LLC & Martha McMurran, to permit a different unit mixture, site design, and development approach; and

WHEREAS, the Planning Commission, following its public hearing on December 1, 2021, recommended approval of Case No. Z-21-0012 by a vote of 5-1; and

WHEREAS, the Board of Supervisors of James City County, Virginia, finds Case No. Z-21-0012 to be required by public necessity, convenience, general welfare, and good zoning practice.

NOW, THEREFORE, BE IT ORDAINED by the Board of Supervisors of James City County, Virginia, that Case No. Z-21-0012 is hereby approved as described therein and the amended voluntary proffers are accepted.

_____

Chairman, Board of Supervisors

ATTEST:

_____

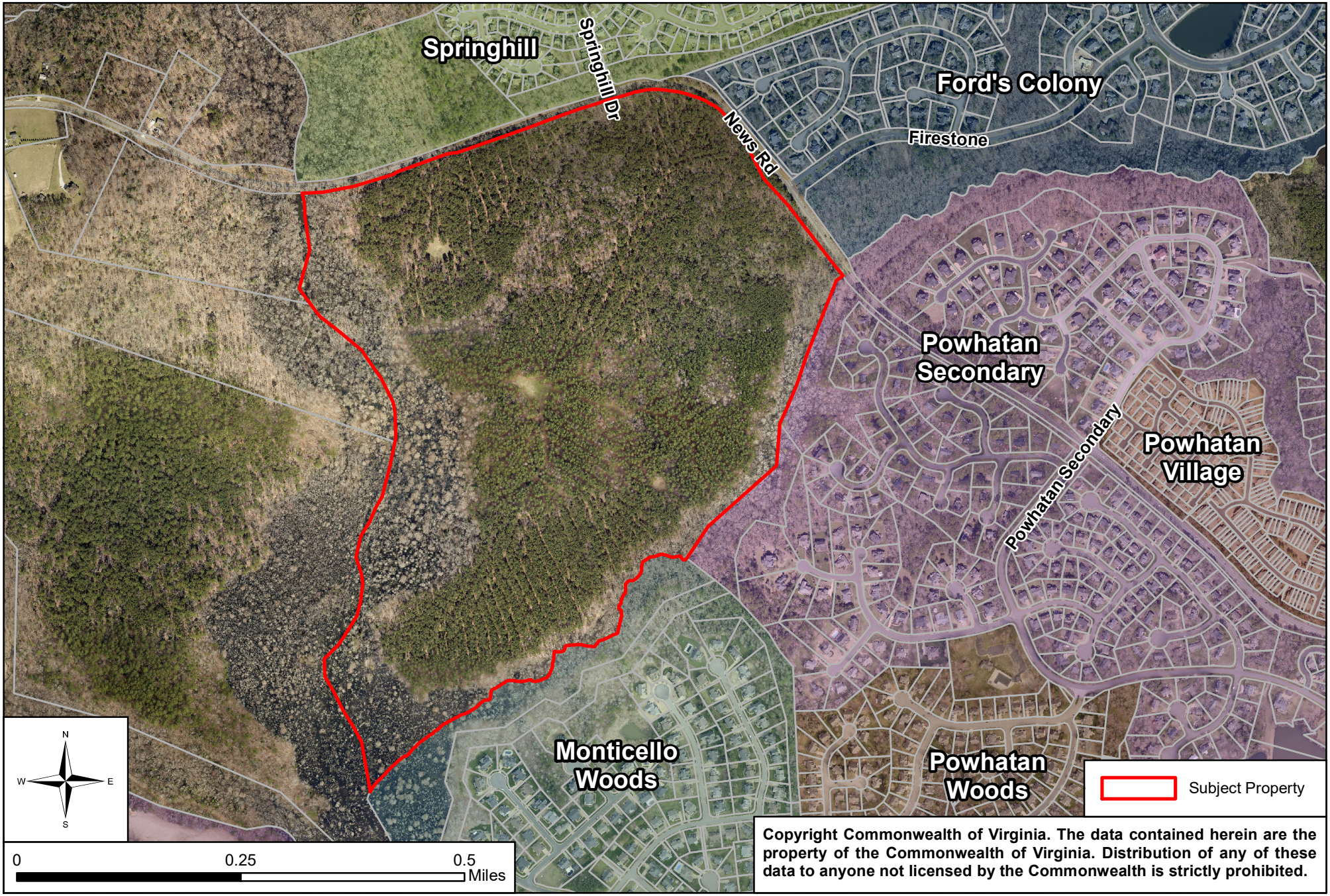
Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

RZ21-12MP21-3FordsVllg-ord

# Z-21-0012 & MP 21-0003. Proffer and Master Plan Amendment for Ford's Colony (Ford's Village)

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# *Community Impact Statement*

***For***

# *Ford's Village*

*Prepared For*

***Frye Development, LLC***
***Norfolk, VA 23510***

*Revised October 2021*
*AES Project Number W10514*

Prepared by:

AES CONSULTING ENGINEERS

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Williamsburg, Virginia 23188
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## *I. INTRODUCTION*

Frye Development, LLC, proposes to amend the previously approved master plan for Ford's Colony at Williamsburg to create a revised mix of senior residential housing and skilled care units. The amended master plan covers 180.79 acres located along News Road located directly across from Firestone Drive.

## *II. THE PROJECT TEAM*

The organizations that participated in the preparation of the information provided with this rezoning submission are as follows:

- Developer - Frye Development, LLC
- Senior Living Operator - Retirement Unlimited, Inc.
- Civil Engineering - AES Consulting Engineers
- Environmental/Wetlands - Wetlands Solutions, Inc./Kerr Environmental
- Traffic - DRW & Associates
- Land Planning - Michael Watkins Architect
- Attorney - Geddy, Harris, Franck & Hickman, LLP

Frye Development, LLC, a wholly owned subsidiary of Frye Properties, Inc.. Frye Properties, Inc. Headquartered in Norfolk, Virginia, Frye provides real estate development, property management, construction, and full-service real estate brokerage services. The recipient of multiple regional and national awards for its developments, Frye Properties, Inc. has earned the respect of government officials, residents and clients. Frye is a trusted and highly experienced design, development, build group that specializes in creating traditional, walkable neighborhoods that seamlessly integrate into the special communities where they build. Frye's dedicated team represents a collection of experience that ranges from master planning, land development, architecture and building, to historic rehabilitation and management of a large portfolio of residential and commercial properties. Frye's extensive experience in developing quality residential projects, including East Beach in Norfolk and The Cavalier Residences in Virginia Beach, demonstrates its long-standing commitment to the highest level of design standards within the urban context. Frye believes its philosophy of respecting the land and its natural assets, its surroundings, and community history leads to the creation of vibrant, memorable communities which will compliment James City County's development goals and standards. Frye is excited about the chance to make that vision a reality.

Frye Development has partnered with Retirement Unlimited, Incorporated (RUI) to operate the senior living building on the property. RUI is a family run business, focused on senior living throughout the state of Virginia. RUI honors the values and traditions set forth by their founders and strives to take the senior living experience to the next level by offering diverse enrichment programs, social experiences, and levels of care in a comfortable and elegant setting. RUI operates multiple properties across the state Virginia including sites in Newport News, Virginia Beach and Richmond.

## *III. EXISTING CONDITIONS*

Site Location:

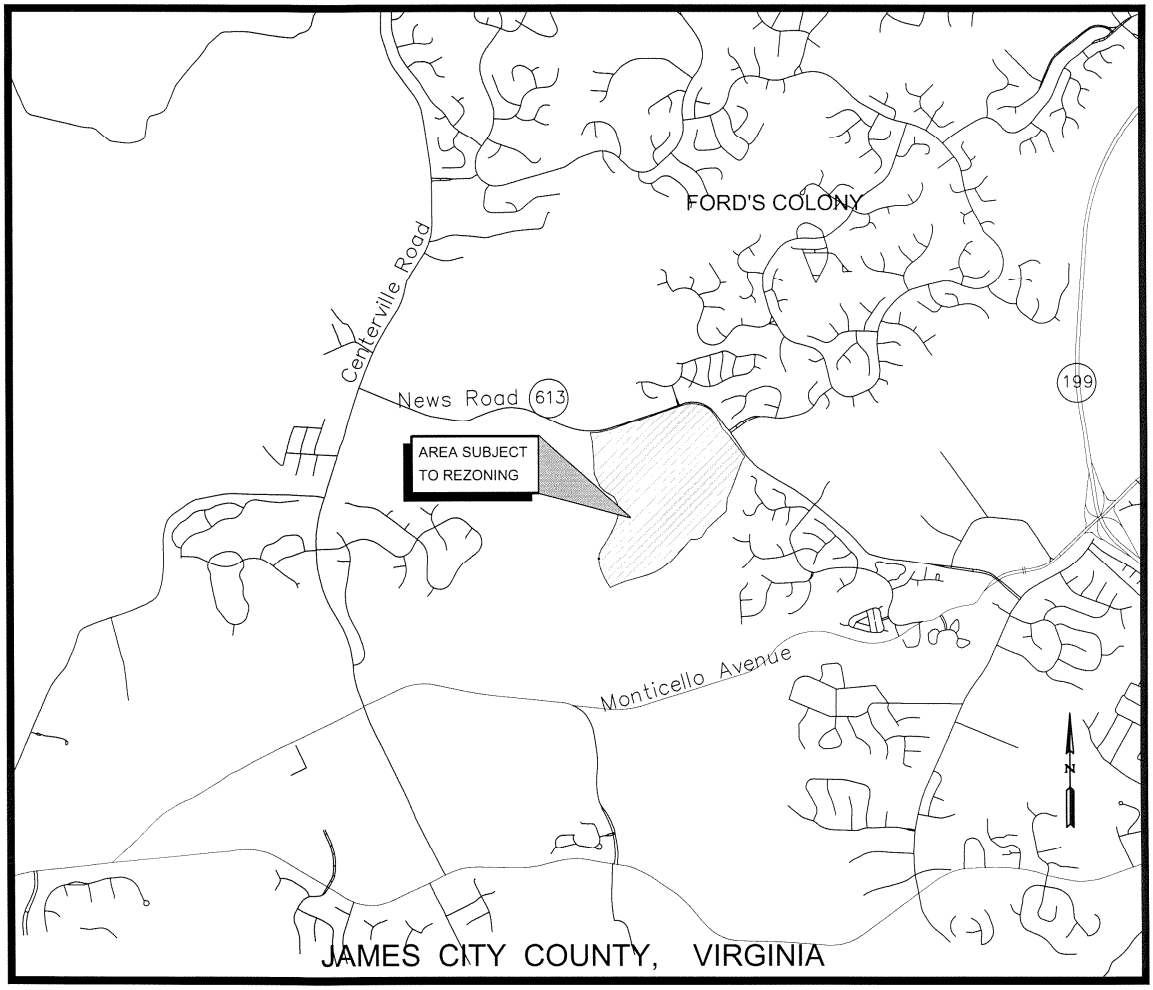



**Figure 1**

Master Plan Sheet 3 and 4 contain detailed information on wetlands, buffers, soils, and slopes. A pre-development site analysis revealed the following results:

| | |
|---|---|
| *Wetland areas:* | *47.42 acres* |
| *Buffers:* | *58.81 acres* |
| ***Subtotal*** | ***106.23 acres*** |
| | |
| *Uplands* | *74.56 acres* |
| ***Total*** | ***180.79 acres*** |

## IV. PROJECT DESCRIPTION

*The Village* is approximately 181 acres in area and located across from the Firestone Entrance to Ford's Colony on News Road in James City County. The Village is envisioned as a full-service Continuing Care Retirement Community (CCRC) with 286 age restricted single family, townhome and condominium units; and a senior living building housing a combination of 230 independent-living apartment units, assisted-living units, and skilled/memory care beds. The CCRC development will provide on-site shared amenities available for those living in the senior living ("big house") and those living in the independent homes. The 286 age restricted units are envisioned as for sale product with a small reservation of 5 units available for short term rentals for guests of community residences. The model of this development differs from similar existing CCRC developments in James City as the senior living operator intends to offer their units on a rental model rather than the upfront buy-in model and the housing units are to be fee simple. Additionally, the property while part of the overall Ford's Colony master plan is intended to be autonomous, having its own internal homeowner's association. Approximately 70% of the total site is preserved in open space; much of that open space is to remain natural through the preservation of wetlands, streams, and associated buffers in compliance with James City County ordinances and policies. Other developable lands have been provided as common open space either in the form of buffer areas or recreation open space (as noted on Sheet 4 of the Master Plan set, *The Village Land-Use Master Plan*).

## V. PLANNING CONSIDERATIONS

### A. Land Use

The proposed land use for The Village is consistent with the current property zoning and designation of CCRC on the Ford's Colony at Williamsburg Master Plan and the surrounding land uses in the vicinity; Ford's Colony and Springhill to the north, Powhatan Secondary to the east, Monticello Woods to the south, and Greensprings Plantation to the west. The Village property is designated Low-Density Residential on the current James City County Comprehensive Plan, with a gross density of 1 to 4 units per acre. The revised mix of residential age restricted units reduces the previously approved density on the property (from 10 units/acre to 7 units/acre) and is shown in the residential count of the Ford's Colony Master Plan which produces an overall density of approximately 1.2 DUA. The maximum residential density in the R-4 District (which is also generally consistent with surrounding zoning districts) is 2.0 Dwelling Units per Acre.

### B. Environmental

A detailed environmental site analysis was conducted on this property. The Warburton Tract was subjected to thorough soft and hardwood timbering less than twenty years ago. Thick undergrowth is prevalent on the property. Recent work performed by the Environmental Services Division of Wetlands Solutions identified 47 acres of wetlands and streams or 26% of the site. Wetland Solutions has also conducted a perennial stream analysis on the property and is in the process of coordinating a review with the James City County Environmental Department. The Warburton Tract Preliminary Layout and Grading plan sheet found in the environmental studies report at page 4 shows both the Resource Protection Area (RPA) buffers; based on changes in the perennial scoring system areas previously covered by 50' non-RPA buffers have been revised to have full 100-ft RPA buffers. Additional areas containing slopes of 25% or greater have been mapped but account for limited portions of the developable area of the site (outside

RPA buffers). Updated research and field verification also indicated that habitat for the Small Whorled Pogonia and Virginia Least Trillium are not present on this site.

### *C. Parks and Recreation*

Frye Development, LLC, proposes to provide both active and passive recreational amenities designed to meet the needs of the anticipated residents while exceeding James City County policy standards. There are two sets of amenities for the project; those within the CCRC building and those scattered throughout the development in the form of pocket parks, soft and hard surface trails and passive open space. Frye proposes to dedicate a minimum of 4 acres of park/recreation space within Land Uses A,B&C; including a pool and community center building, walking trails a series of parks, several passive open space areas, nature trails and sidewalks. The project envisions the potential to provide existing Ford's Colony residents the ability to share in the development amenities.

## *VI. ANALYSIS OF IMPACTS TO PUBLIC FACILITIES AND SERVICES*

The subject property is located within the Primary Service Area of James City County. Parcels and subsequent land development activities within the Primary Service Area are required to connect to public water and sanitary sewer service provided by the James City Service Authority (JCSA). Sheet 5 of the Master Plan, *The Master Utility Plan* is intended to supplement this report for information on public water and public sanitary sewer.

### *A. Public Water Facilities*

The subject property will be served with public drinking water by the existing JCSA water distribution system in the area. JCSA currently maintains an existing 12-inch water main along News Road. This line is supported by loops through existing Ford's Colony as well as a loop from Monticello Avenue. The system facilities in this area are anticipated to be adequate for this development based upon previous flow data taken at a hydrant at the entrance to the adjacent Spring Hill subdivision. This would indicate adequate pressures and flows will be present throughout the proposed development. While our projected flows anticipate water and sewage demands based on residential housing as outlined by JCSA and the State Health Department, it is significant to note, that case studies and previous projects within JCC demonstrate reduced water consumption in age restricted communities.

A detailed water distribution system model will be completed and submitted as part of the subdivision review process. The model will examine flow rates and pressures throughout the immediate water system area to ensure adequate flow and pressure to accommodate the required fire flows.

### *B. Public Sewer Facilities*

Sanitary sewer service is provided to the subject property via the adjacent Powhatan Secondary interceptor sewer. This pipeline is a 21-inch gravity interceptor which flows to JCSA Lift Station 1-2. Lift Station 1-2 pumps directly into a HRSD Force Main. All flows from the project are to be

collected by onsite gravity sewers and connected to the existing 21-inch interceptor line. The connection point will be in the vicinity of manhole on News Road as indicated on the Utility Master Plan. Capacity in the existing gravity sewer and receiving Lift Station was evaluated by JCSA as part of the original application. The current application represents a 42% reduction in total daily anticipated sewer flows from the project. Additionally, JCSA made improvements to the Powhattan Sewer main since the 2008 rezoning which we anticipate would have improved the current sewer capacity.

**Table 1 – Projected Wastewater Flows from *The Village***

| Type of Development | No. of Units | Flow (GPD/ Unit) | Average Daily Flow (GPD) | Duration (hrs) | Avg. Flow (GPM) | Peak Flow (GPM) |
|---|---|---|---|---|---|---|
| RESIDENTIAL | | | | | | |
| Single-family/Multi Family | 286 | 310 | 88,660 | 24 | 46.3 | 115.7 |
| IL Apartments | 75 | 310 | 23,250 | 24 | 25.8 | 64.5 |
| Subtotal | 361 | | 111,910 | | 77.7 | 194.3 |
| NON-RESIDENTIAL | | | | | | |
| Nursing/Skilled | 155 Beds | 160 | 24,800 | 24 | 17.2 | 42.5 |
| Subtotal | | | 24,800 | | 17.2 | 42.5 |
| **Total (Amendment)** | | | **136,710** | | **94.9** | **237.3** |
| *Total (Original)* | | | *219,420* | | *152.4* | *381.0* |

## C. Fire Protection and Emergency Services

There are currently five fire stations providing fire protection and Emergency Medical Services (EMS) to James City County. The closest fire station to the subject site is Station #5 located at 3201 Monticello Avenue, approximately 3.25 miles southwest of this project. According to the James City County Deputy Fire Marshal, the official response time is based on the arrival of both fire and EMS personnel. Currently, EMS services are only available from Station #4 on Olde Towne Road. From this station, an estimated response time will be less than eight minutes. However, EMS is planned for Station #5 in the near future. The CCRC will have medical first responders, as well as CPR and First Aid certified personnel, on staff. Limited medical facilities are onsite in the main CCRC and the Assisted Living buildings.

The next closest fire station to the subject site is station number 3 at 5077 John Tyler Highway. Only slightly more distant than the Monticello station (approximately 3.9 miles), response time to the site is reasonable if an emergency event occurs requiring additional fire and life safety support. These two fire stations, and the emergency medical staff available at these stations, will provide a more than adequate response to potential emergencies. In

addition, through cooperative agreements between Williamsburg, James City County, and York County, the site may also be served by the York County station at Lightfoot.

### *D. Solid Waste*

The proposed development on the subject property will generate solid wastes that will require collection and disposal to promote a safe and healthy environment. Reputable, private contractors, hired by the Homeowners Association will handle the collection of solid waste. Both trash and recyclable material will be removed from this site to a solid waste transfer station.

### *E. Utility Service Providers*

Virginia Natural Gas, Dominion Virginia Power, and Cox Communications provide, respectively, natural gas, electricity, cable TV service, and telephone service to this area. The current policy of these utility service providers is to extend service to the development at no cost to the developer when positive revenue is identified; plus, with new land development, these utility service providers are required to place all new utility service underground.

### *F. Schools*

*The Village* is located within the Matoka Elementary School, James Blair Middle School, and Lafayette High School districts. However, under the proposed Master Plan, the CCRC facility and all residential units will be age-restricted removing the residency potential for school age children. Thus, the proposed development, consistent with the previously approved zoning for the property will not generate any school children.

## *VII. ANALYSIS OF ENVIRONMENTAL IMPACTS*

### *A. Preliminary Wetland Determination*

Investigations were conducted by Wetland Solutions (WSSI/Kerr Environmental Services Corp in the fall of 2016 and were reinvestigated in 2020 for the property. The extent of wetland features is shown on Master Conceptual Plan Sheet 3. The U.S. Army Corps of Engineers confirmation of delineated wetlands is currently underway.

Based on the investigation by WSSI, approximately 47 acres of wetlands are present on the property. In the Master Plan for the proposed development, we have attempted to avoid all impacts to the wetlands, however it may be necessary to provide minor impacts to the wetlands for utility crossings and stormwater outfalls. In addition, there may be some temporary disturbances of some steep slopes associated with the construction of the sanitary sewer pump station and the stormwater management facilities. All of the above-described items may require proper state and federal permitting prior to the issuance of James City County Land Disturbance Permits.

### *B. Resource Protection Areas*

The property contains Resource Protection Areas (RPA) and associated buffers which are shown on Master Plan Sheet 2- Existing Conditions. Also illustrated is an expanded Powhatan Creek buffer as previously coordinated with James City County.

### *C. Soils*

The Soil Survey of James City and York Counties and the City of Williamsburg, Virginia (USDA 1985) shows several soil types within the property boundary. This property is predominantly situated on well-drained soils of Craven-Uchee, Emporia Complex, Emporia, and Slagle soil types. Detailed soils breakdown are noted on sheet 3 of the master plan.

## *VIII. ANALYSIS OF STORMWATER MANAGEMENT*

As the property falls within the Powhatan Creek Watershed, additional measures of watershed management are suggested by James City County policy to protect the natural resource of the watershed, and prevent further degradation of the watershed's water quality. These measures, in the form of Special Stormwater Criteria (SSC), further enhance the quality of stormwater runoff from the development site and assist in the preservation of pre-development hydrology. In addition to the main structural BMP, seven (7) SSC measures are required to meet minimum requirements set forth by the James City County policy. Furthermore, five (5) additional measures will be provided to improve the water quality of the Powhatan Creek Watershed "over and above" the state stormwater requirements. Water quality measures to be implemented include: bioretention facilities; dry swales at locations not draining to a BMP; enhanced outlet protection at all piped outfalls of BMP; enhanced cut/fill slope stabilization measure applied site-wide. Please refer to the Stormwater Plan for the water quality calculation work sheet as well as the preliminary list of measures to be implemented.

A preliminary stormwater management analysis and design has been performed as a component of the planning for this proposed project. The purpose of the stormwater management plan is to address the Department of Environmental Quality (DEQ) requirements for water quality and quantity control of flow generated by the proposed development. AES performed initial design BMP sizing and determined that the proposed wet ponds and bioretention cells will satisfy a significant amount of the water quality and quantity requirements as outlined in the Virginia Runoff Reduction Method. Preliminary estimates suggest the development will need to remove a proposed 30 lbs. of phosphorus a year with our current envisioned design removing as much as 38 lbs. per year. In evaluating stormwater management solutions on the subject site, unique site characteristics were considered. Preliminary site investigation identified the following site characteristics to be considered in stormwater management planning:

- The entire project is situated within the Powhatan Creek Watershed of the James River. The property nearly equally drains to the Powhatan Creek mainstem and to Cold Spring Swamp (Powhatan Creek Subwatershed 209).
- The property is currently young forest and overall unimproved. Extensive landscaping will be used within the developed areas of the site and large perimeter area buffers will be left in the current natural state.

In summary, with the preliminary analysis of *The Village*, the stormwater management plan proposed will protect overall downstream water quality, help preserve the natural hydrology of the watershed, and reduce the tendency of development to cause downstream erosion to receiving channels.

## *IX. ANALYSIS OF IMPACTS TO TRAFFIC*

A traffic study memo has been prepared by DRW & Associates to supplement previously prepared studies of the News Road Corridor and Ford's Colony Firestone entrances. In summary of that memo, the impacts associated with the amendment represent a roughly 14% reduction in the Total Daily traffic from the currently proposed development over the previously approved rezoning application (7% less traffic volume than anticipated in the recent 2020 Kimley Horn Study). The developer is still pledging to address the remaining traffic proffers as proposed under the original development.

## *X. FISCAL IMPACT STUDY*

A fiscal impact analysis was completed utilizing the James City County provided worksheet. The worksheet demonstrates that the proposed community will generate a positive fiscal contribution of roughly $505,000 annually however it should be noted that this worksheet considers school children for all the residential units within the community. Not wanting to modify the JCC forms we have submitted them as required, however as this project is proffered to be age restricted, we feel that this fiscal analysis provides for an overly conservative evaluation of the benefit this community will provide James City County. If we were to remove the school children from the worksheets calculation this development is anticipated to positively contribute $1,887,000 annually to James City County's tax base.

.

## *XI. CONCLUSIONS*

In summary, the Community Impact Statement for the rezoning and subsequent development of *The Village* highlights the following conclusions and public benefits:

- This project will provide a significant financial benefit to James City County; with a net positive contribution of approximately $1.9 million per year.
- The rezoning is consistent with the intended land use designated on the current Comprehensive Plan for this area. Further, the proposed residential development is consistent with adjacent neighborhoods and represents reduced impacts from the current master plan.
- There is adequate capacity in the system of roads serving this project and developer is maintaining the previously proffered traffic improvements with the project.
- Adequate public services (water and sewer, fire) and utility services (gas, electricity, cable television, and telephone) are available for development.
- James City County's stormwater requirements, including the incorporation of SSC associated with the Powhatan Creek are being met. Additional use of Low-Impact Design (LID) techniques ensures those requirements are exceeded.

Tax Parcel: 3730100004
Prepared by: Vernon M. Geddy, III (VSB#21902)
Geddy, Harris, Franck & Hickman, LLP
1177 Jamestown Road
Williamsburg, Virginia 23185

# AMENDMENT TO AMENDED AND RESTATED FORD'S COLONY PROFFERS

This AMENDMENT TO AMENDED AND RESTATED FORD'S COLONY PROFFERS are made this 20th day of December, 2021 by **SWR-HOCKADAY, LLC**, a Georgia limited liability company, and **MARTHA WARBURTON MCMURRAN** (collectively, together with their successors in title to the Property, the "Owner") and **FRYE DEVELOPMENT, LLC**, a Virginia limited liability company ("Developer"), each to be indexed as Grantor, and **JAMES CITY COUNTY, VIRGINIA**, a political subdivision of the Commonwealth of Virginia (the "County), to be indexed as Grantee.

## RECITALS

A. Owner is the owner of the real property with an address of 3889 News Road, Parcel ID# 3730100004, containing approximately 180 acres, which property is more particularly described on Exhibit A (the "Property"). Developer is the contract purchaser of the Property.

B. Upon application in 2008 by Realtec, Incorporated, the then owner of the Property and developer of the Ford's Colony at Williamsburg development, the County approved an amendment of the Ford's Colony Master Plan to include the Property as Section 37 of Ford's Colony (the "Approved Master Plan") and the rezoning of the Property from R-8 to R-4, subject to Amended and Restated Ford's Colony Proffers made by Realtec, Incorporated dated June 10, 2008 and recorded in the Clerk's Office of the Circuit Court for the City of Williamsburg and County of James City as Instrument

No. 080017656 (the "2008 Proffers"). The 2008 Proffers restated the prior proffers applicable to the Ford's Colony development not including the Property (defined as the "Existing Property" in the 2008 Proffers) and added new proffers applicable only to the Property. Realtec no longer owns the Property and is no longer involved in the development of Ford's Colony. The proffers applicable to the Existing Property were amended by Amendment to Ford's Colony Proffers dated March 11, 2020 and recorded in the aforesaid Clerk's Office as Instrument No. 200008078 (the "2020 Amendment"). The 2008 Proffers, as amended by the 2020 Amendment, are hereinafter called the "Existing Proffers."

C. Owner and Developer have submitted to the County an application to (i) amend the Approved Master Plan and in connection therewith have submitted a master plan entitled "Master Plan Amendment for Ford's Village" prepared by AES Consulting Engineers dated June 2021 (the "Amended Master Plan") in accordance with the County Zoning Ordinance and (ii) amend the Existing Proffers applicable to the Property to offer to the County certain revised conditions on the development of the Property not generally applicable to land zoned R-4.

D. In consideration of the approval of the amendment of the Approved Master Plan, Owner desires to amend the Existing Proffers as set forth below. If the requested rezoning and amendment of the Approved Master Plan is not approved by James City County, this Amendment to Amended and Restated Ford's Colony Proffers shall be void and the Existing Proffers applicable to the Property shall remain unchanged, in full force and effect. Owner shall have no obligation under this Amendment to Amended and Restated Ford's Colony Proffers unless and until the Property is developed pursuant to

the Amended Master Plan.

AMENDMENT OF PROFFERS APPLICABLE TO THE PROPERTY

Sections 2 through 22 of the Existing Proffers are hereby deleted and replaced by the following:

**2.** **Master Plan**. The Property shall be developed generally as shown and set out on sheets 4 through 6 of the Amended Master Plan. Final plans (as defined in Section 24-276(b)(1) of the Zoning Ordinance) may vary from the Amended Master Plan to the extent permitted by Section 24-276(b)(1) of the Zoning Ordinance.

**3.** **Density**. (a) There shall be no more than 230 dwelling units comprised of independent living units, assisted living/memory care units consisting of up to four beds, and skilled nursing units consisting of up to two beds (each a "dwelling unit") on the portion of the Property designated on the Master Plan as CCRC-D, of which no more than 75 shall be independent dwelling units, no more than 155 shall be AL units (defined below) and no more than 40 shall be skilled nursing beds. The term "assisted living/memory care unit" (an "AL Unit") shall mean a non-medical residential dwelling unit in the assisted living facility area or memory care area of the independent and assisted living community licensed in accordance with Sections 63.2-1800 et seq. of the Virginia Code and Sections 22 VAC 40-73 et seq. of the Virginia Administrative Code where adults who are aged, infirm or disabled are provided personal and health care services and 24-hour supervision and assistance. An AL Unit must meet the standards set forth in 22 VAC 40-73-750 and 900.

(b) There shall be no more than a total of 286 independent living dwelling units on the portion of the Property designated on the Master Plan as CCRC-A, CCRC-B or

CCRC-C.

(c) All dwelling units developed on the Property shall be occupied by persons eighteen (18) years of age or older in accordance with applicable federal and state laws and regulations, including but not limited to: the Fair Housing Act, 42 U.S.C. 3601 et seq. and the exemption therefrom provided by 42 U.S.C. 3607(b)(2)(C) regarding discrimination based on familial status; the Housing for Older Persons Act of 1995, 46 U.S.C. 3601 et seq.; the Virginia Fair Housing Law Va. Code 36-96.1 et seq.; any regulations adopted pursuant to the foregoing; any judicial decisions arising thereunder; any exemptions and/or qualifications thereunder; and any amendments to the foregoing as now or may hereafter exist. Specific provisions of the age restriction described above and provisions for enforcement of same shall be set forth in a recorded document which shall be subject to the review and approval of the County Attorney prior to issuance of the first building permit for dwelling units on the Property.

(d) Any accessory commercial uses located on the Property, such as bank offices, beauty salons and barbershops, shall be located and designed to serve residents of the Property as verified by the Director of Planning.

**4.** **Water Conservation.** The Owner shall be responsible for developing water conservation standards to be submitted to and approved by the James City Service Authority ("JCSA") and subsequently for enforcing these standards. The standards shall address such water conservation measures as limitations on the installation and use of irrigation systems and irrigation wells, the use of drought resistant native and other adopted low water use landscaping materials and warm season turf on common areas in areas with appropriate growing conditions for such turf and the use of

water conserving fixtures and appliances to promote water conservation and minimize the use of public water resources. The standards shall be approved by the JCSA prior to final subdivision or site plan approval.

**5. Contributions for Community Impacts**. (a) A contribution of $1,277.61 for each independent living dwelling unit ("IL Dwelling Unit") on the Property shall be made to the County for fire, police or emergency services, library uses, and other public facilities, uses or infrastructure.

(b) A contribution of $319.40 for each AL Unit and skilled nursing dwelling unit (each an "AL/MC/SN Dwelling Unit") on the Property shall be made to the County for fire, police or emergency services uses.

(c) A contribution of $1,111.52 for each IL Dwelling Unit and $555.76 for each AL/MC/SN Dwelling Unit on the Property shall be made to the JCSA for water system improvements.

(d) A contribution of $958.20 for each IL Dwelling Unit on the Property, subject to a credit for the costs of engineering and construction related to the improvements proffered by Owner in Section 6(b) calculated as set forth below, shall be made to the County for improvements to the News Road/Powhatan Secondary intersection, flood control measures where News Road crosses Cold Spring swamp, improvements at the News Road/Centerville Road intersection and other off-site road improvements in the News Road corridor. Owner shall receive a credit in an amount equal to its actual costs of the engineering and construction of the improvements proffered by Owner in Section 6(b) against the initial per unit contributions proffered under paragraph (d) of this Section (the "Credit Amount"). If construction of such

improvements is not complete at the time the initial per unit contributions are due under paragraph (e) of this Section, the Credit Amount shall equal an engineer's estimate of such costs submitted by the Owner and approved by the Director of Planning, The Credit Amount divided by $958.20 is the number of IL Dwelling Units for which the Credit Amount offsets the cash contribution otherwise due and payable. After application of the Credit Amount, the $958.20 per IL Dwelling Unit cash contribution shall be payable on all subsequent IL Dwelling Units on the Property. Owner shall provide the County with copies of invoices and other supporting documentation of the costs of the improvements. If the Credit Amount is based on an agreed upon costs estimate, it shall be adjusted to equal the final actual costs of engineering and construction ("Actual Costs"). If the Credit Amount is more than the Actual Costs, Owner shall pay to the County an amount equal to the difference. If the Credit Amount is less than the Actual Costs, Owner shall receive a credit equal to the difference between the Actual Costs and the Credit Amount at the time the next cash contributions are due this paragraph.

(e) The contributions described above in paragraphs (a), (b), (c) and (d) shall be paid to the County for each dwelling unit on the Property after completion of the final inspection and prior to the time of the issuance of any certificate of occupancy for the dwelling unit in question.

(f) The per dwelling unit contribution amounts shall consist of the amounts set forth in the above paragraphs plus any adjustments included in the Marshall and Swift Building Costs Index (the "Index") from 2021 to the year a payment is made if payments are made after on or after January 1, 2022. In no event shall the per dwelling unit

contribution be adjusted to a sum less than the amounts set forth in the preceding paragraphs of this Section. In the event that the Index is not available, a reliable government or other independent publication evaluating information heretofore used in determining the Index (approved in advance by the County Manager of Financial Management Services) shall be relied upon in establishing an inflationary factor for purposes of increasing the per dwelling unit contribution to approximate the rate of annual inflation in the County.

(g) The Subsidized Beds defined in Paragraph 15 shall not be included in the number of dwelling units contemplated in this Paragraph 5 and therefore shall not be subject to the contribution amounts described in subparagraphs (a), (b), (c) and (d).

**6. Entrances; Traffic Improvements**. (a) Prior to approval of any site or subdivision plans for development on the Property there shall be an updated traffic signal warrant analysis for the News Road/Firestone Drive/project entrance intersection submitted to and approved by VDOT and the County. If the updated analysis shows a signal is warranted and the installation of the signal is approved by VDOT, Owner shall install or pay for the installation of the traffic signal as a part of the construction of the project entrance. At the main entrance into the Property at the intersection of News Road and Firestone Drive, an exclusive left-turn lane from westbound News Road into the Property and an exclusive right-turn lane from eastbound News Road into the Property shall be constructed. The existing southbound left turn lane on Firestone Drive at News Road will be restriped to a shared left and through lane.

(b) Prior to the County issuing final approval on any site or subdivision plan for any dwelling units on the Property, Owner shall submit plans to the County and Virginia

Department of Transportation ("VDOT") for the installation of an exclusive left-turn lane on westbound News Road at the intersection with Powhatan Secondary. Owner will complete construction of the left-turn lane within twelve months of County and VDOT approvals to construct this exclusive left-turn lane. Owner is not responsible for road right of way acquisition or landscape/screening other than stabilization of disturbed soils. The County may elect to accept the cash equivalent contribution outlined in Proffer 5(d), (with any adjustments as may be appropriate as provided for in Proffer 5(g)), in lieu of construction of the turn lane by the Owner, in the event that acquisition of any needed right-of-way proves to be prohibitive. In the event that VDOT constructs this turn lane as part of its Six Year Secondary Road Plan, the County may elect to divert some or all of the cash equivalent contribution to other road projects in the News Road Corridor, at the News Road/Monticello Avenue intersection, or in the western Monticello Avenue Corridor. If VDOT traffic signal warrants are met and VDOT has approved the installation of a traffic signal at the intersection of News Road with Powhatan Secondary on or before the date that control of the homeowners' association created for the areas designated in the Master Plan as CCRC-A, CCRC-B or CCRC-C has transitioned from developer to homeowner control, Owner shall install or pay for the installation of the traffic signal.

(c) The improvements proffered hereby shall be constructed in accordance with VDOT standards. The improvements listed in paragraph (a) shall be completed or all required permits and plans for such approvals shall have been approved by all necessary governmental agencies and their completion guaranteed in form satisfactory to the County Attorney prior to the issuance of any certificates of occupancy for any

building on the Property.

(d) The second entrance to the Property shall be located in the general location shown on the Master Plan and shall be limited by gate to emergency access only unless and until an updated traffic study identifying the impacts of a full entrance is submitted to and reviewed and approved by VDOT and the County. This updated study shall be approved prior to the submission of any site plan for the full entrance and shall document required turn lane and other roadway improvements for the full entrance which improvements shall be shown on the submitted site plan. The entrance shall be limited to emergency access only until such improvements have been constructed and, to the extent necessary, accepted by VDOT.

(e) Owner shall convey free of charge to VDOT or the County any right of way from the Property necessary for the widening or realignment of News Road or the improvements proffered herein within 60 days of a written request for such conveyance together with final plans for the widening or realignment.

(f) Owner shall conduct traffic counts at its entrance prior to the County being obligated to issue certificates of occupancy for more than 400 dwelling units on the Additional Property. If these counts show a trip generation from the Additional Property more than 10% higher than the trip generation projected by the TIS Update for Ford's Colony Master Plan – Phased Development, Kimley-Horn and Associates., Inc. January 2020 on file with the Planning Division, Owner shall submit an updated traffic impact study, including a listing of any entrance or turn lane improvements necessary to accommodate the increased traffic and the appropriate trigger for their construction, for review and approval by the County and VDOT. Owner shall install the necessary

improvements, including any warranted traffic signal, as approved by the County and VDOT at the time recommended in the updated approved traffic study.

**7. Sustainable Building**. (a) Independent living dwelling units in the areas designated in the Master Plan as CCRC-A, CCRC-B or CCRC-C shall be built to an Energy Star (or equivalent independent) residential certification.

(b) The development in the area designated on the Master Plan as CCRC-D shall contain the following elements: (i) Carpool or Vanpool parking; (ii) Hybrid or Low-Emissions Vehicle Parking; (iii) Low Flow Plumbing Fixtures; (iv) Green Label Carpet and Carpet Padding; and (v) Energy Star Appliances.

**8. Master Stormwater Management Plan**. The Master Stormwater Management Plan (MSWMP) for the Property shall be approved prior to the first site plan submittal. The MSWMP shall comply with the standards within the adopted watershed management plan in place at time of submittal and all outside agency permits shall be issued prior to the third submittal of the MSWMP. The approved master stormwater management plan, as revised and/or updated, shall be implemented in all development plans for the Property.

**9. Nutrient Management Plan**. The Owner shall be responsible for contacting an agent of the Colonial Soil and Water Conservation District ("CSWCD") or, if a CSWCD agent is unavailable, a soil scientist licensed in the Commonwealth of Virginia, or other qualified professional to conduct soil tests and to develop, based upon the results of the soil tests, customized nutrient management plans (the "Plans") for all landscaped common areas within the Property shown on site plans for the Property. The Plans shall be submitted to the County's Director of Stormwater and Resource

Protection for his review and approval prior to the issuance of building permits for more than 50% of the dwelling units shown on the Master Plan. Upon approval, the Owner, until such time as the homeowners association is established and thereafter the association, shall be responsible for ensuring that any nutrients applied to common areas be applied in strict accordance with the Plan.

**10.** **Private Streets**. All streets and alleys on the Property shall be private and shall be maintained by the Owner.

**11.** **Ford's Colony at Williamsburg Homeowners Association**. The Additional Property shall not be subjected to the Declaration of Protective Covenants, Section II, Ford's Colony at Williamsburg, dated April 2, 1985, as the same may have been amended and/or restated ("DPC") or the Bylaws of the Ford's Colony Homeowners Association ("FCHOA"), as amended from time to time ("Bylaws") nor shall owners or residents of units, lots or parcels on the Additional Property be "Owner(s)" as such term is defined in the DPC or the Bylaws or be Members (as defined in the DPC) of the FCHOA.

**12.** **Public Transit**. Upon the request of the Williamsburg Area Transit Authority ("WATA") or any successor entity to WATA as may become appropriate on or before the date that control of the homeowners' association created for the areas designated in the Master Plan as CCRC-A, CCRC-B or CCRC-C has transitioned from developer to homeowner control and after such time as WATA provides bus service along News Road to the Property, Owner shall install a bus stop and shelter on News Road adjacent to the main entrance into the Property, with the exact location being subject to the approval of WATA.

**13.** **Recreation**. The portion of the Property designated as CCRC-D on the Master Plan shall include, but shall not be limited to, the following amenities: main lobby and living room; dining room; activities/card room; fitness center; beauty/barber salon; library; multipurpose room and landscaped grounds and courtyards generally as shown on the Master Plan. CCRC-D may also include, but shall not be limited to, the following additional amenities: a bar/lounge; café/coffee shop; education room, spa and wellness center; physical therapy and/or physician's office(s), home health, and pharmacy. The amenities listed above are intended for residents and employees of Ford's Village and their guests and not the general public. The portions of the Property designated as CCRC-A, CCRC-B and CCRC-C on the Master Plan shall include the following amenities: a clubhouse with studio room for classes, and a recreation room; an outdoor pool; pocket parks; pickleball courts and walking and biking paths all generally as shown on the Master Plan. The exact recreational facilities provided in portions of the Property designated as CCRC-A, CCRC-B and CCRC-C on the Master Plan and their location may be changed with the prior approval of the Development Review Committee.

**14.** **Off-Site Sewer Easements**. Upon the request of JCSA and at no costs to JCSA, Owner shall grant JCSA utility easements over, across and under the portion of the Additional Property along Powhatan Creek to permit future connections from the gravity sewer on the Additional Property to Tax Parcel 3640100007. The location of the easement shall be determined during the site plan approval process. The easements shall be recorded prior to JCSA issuing a Certificate to Construct.

**15.** **Social Services.** Owner shall reserve two assisted living beds ("Subsidized

Beds") for Medicaid qualified individuals at a rate that is no greater than what such individuals' out-of-pocket expense would be under the Auxiliary Grant Program administered by the Virginia Department of Social Services. Such individuals shall be subject to all admission and discharge criteria of the facility and all other generally applicable rules and regulations of the facility.

**16. Construction Traffic Management Plan.** Owner shall prepare and submit to the County a construction traffic management plan which seeks to minimize impacts from construction traffic entering and exiting the Property to the extent reasonably practical. The plan will be submitted with the initial site plan for development on the Property and shall be subject to review and approval by the Planning Director. A copy of the approved plan shall be provided to all contractors working on the Property and all construction contracts entered into by Owner shall require compliance with the plan by the contractor.

[*signatures appear on following pages*]

WITNESS the following signatures and seals:

OWNER:

SWR-HOCKADAY, LLC, a Georgia Limited liability company

A.M. REDD, JR., INC., a Georgia corporation, Its Manager

By: Margaret P. Staats
Title: PRESIDENT

STATE OF GEORGIA
CITY/COUNTY OF FULTON, to-wit:

The foregoing instrument was acknowledged before me this 20th day of OCTOBER, 2021 by Margaret P. Staats, President of A.M. REDD, JR., INC., a Georgia corporation, as Manager of SWR-HOCKADAY, LLC, a Georgia Limited liability company on behalf of the company.

Sarah Ann Staats
NOTARY PUBLIC

My commission expires: 1/14/2023
Registration No.:

SARAH ANN STAATS
MY COMMISSION EXPIRES
NOTARY
PUBLIC
JANUARY 14, 2023
DEKALB COUNTY, GEORGIA

OWNER:

MARTHA WARBURTON MCMURRAN

By: _____
Channing M. Hall, III, Her Attorney-in-Fact
under Limited Power of Attorney recorded
as James City County Instrument No.
180010230

COMMONWEALTH OF VIRGINIA
COUNTY OFJAMES CITY, to-wit:

The foregoing instrument was acknowledged before me this 21st day of December, 2021 by CHANNING M. HALL, III, Attorney-in-Fact for MARTHA WARBURTON MCMURRAN.

_____
NOTARY PUBLIC

My commission expires: 03/31/2024
Registration No.: 7515065

PAULA A. DAZLEY
NOTARY PUBLIC
REGISTRATION # 7515065
COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES
MARCH 31, 2024

DEVELOPER:

FRYE DEVELOPMENT, LLC, a Virginia limited liability company

By: _____
D. B. Frye, Jr., Manager

STATE OF Virginia
CITY/COUNTY OF Norfolk, to-wit:

The foregoing instrument was acknowledged before me this 21st day of December, 2021 by D. B. Frye, Jr., Manager of FRYE DEVELOPMENT, LLC, a Virginia limited liability company, on behalf of the company.

_____
NOTARY PUBLIC

My commission expires: 7/31/2025
Registration No.: 7315880

APRIL ALBRIGHT NOLAN
NOTARY PUBLIC
REGISTRATION # 7315880
COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES
7-31-25



19950310v6

Exhibit A

Property Description

PARCEL A

All of that certain piece or parcel of land, lying and being in Jamestown District, James City County, Virginia, known as Hockaday, containing one hundred flirty-seven and one-half (147-1/2) acres, more or less, bounded on the East; South and West.by the land of the Shaw Land & Timber Co., known as the Pyle tract, the land of J. A. Barnes and Powhatan Swamp, and on the North by the land of New Brothers.

PARCEL B

All of that certain piece or parcel of land situate in Jamestown District, James City County, Virginia, containing fifty-five and two fifths (55-2/5) acres, more or less, and known as Cypress Swamp, and adjoining the lands of William Martin' s estate on the East, Greenspring on the South and Thomas N. Ratcliffe on the West and D. S. Jones on the North.

LESS AND EXCEPT that property conveyed to the Commonwealth of Virginia by Order Confirming Commissioner's Report, entered February 20, 1974, in the Circuit Court for the City of Williamsburg and County of James City, Virginia, and recorded in the Office of the Clerk of Court of such Court in James City County Deed Book 150, at Page 420, containing 3.74 acres, more or less, confirming that certain Certificate Number C-21570, filed by State Highway Commissioner of Virginia against the Heirs at Law of John G. Warburton, dated May 24, 1972, and recorded June 12, 1972, in the aforesaid Clerk's Office in James City County Deed Book 137, at Page 213, and SUBJECT TO the easements conveyed to the Commonwealth of Virginia in such Order and such Certificate.

The property herein conveyed, commonly known as the "Hockaday-Cypress Tract," is further described in its entirety on that certain plat of survey, entitled "BOUNDARY SURVEY OF A PORTION OF THE JOHN G. WARBURTON ESTATE, KNOWN AS THE HOCKADAY-CYPRESS TRACT," made by V. Monroe Mallory, of Dillard & Mallory, P.C., Certified Land Surveyors, Tappahanock, Virginia, dated October 25, 2001, recorded November 7, 2001, in the aforesaid Clerk's Office in James City County Plat Book 83, at Page 82, to which plat reference is made for a more complete description of such property.

Being the same property conveyed to Martha Warburton McMurran, and SWR-Hockaday, LLC, a Georgia limited liability company, by Deed from Peter G. Zemanian, Substitute Trustee, dated February 12, 2010, and recorded February 22, 2010, in the aforesaid Clerk's Office, as James County Instrument No. 100003372.

# MASTER PLAN AMENDMENT FOR FORD'S VILLAGE

AT

FORD'S COLONY · WILLIAMSBURG ·

FOR

# FRYE DEVELOPMENT, LLC

PROJECT TEAM

DEVELOPER: FRYE DEVELOPMENT, LLC

CCRC OPERATOR: RETIREMENT UNLIMITED, INC

LAND PLANNING: MICHAEL WATKINS ARCHITECT, LLC

ENVIRONMENTAL: WETLANDS SOLUTIONS, INC.

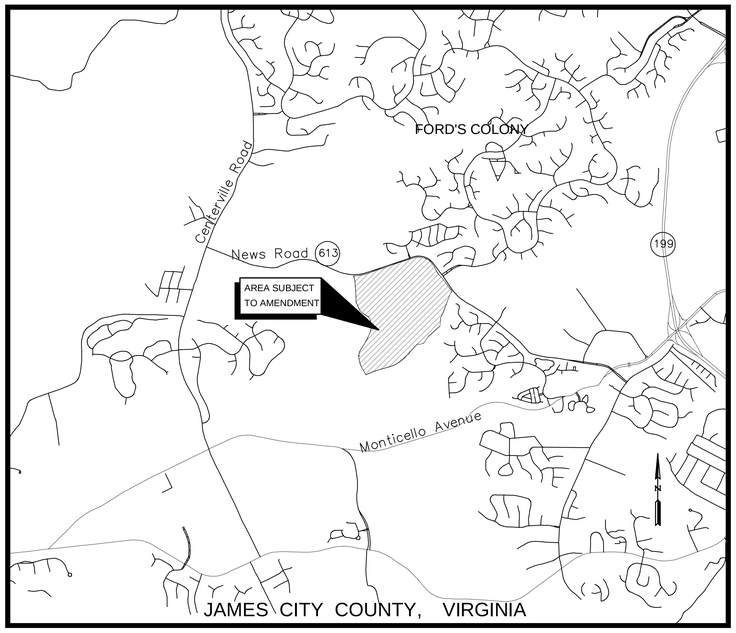
TRAFFIC: DRW & ASSOCIATES

CIVIL CONSULTING: AES CONSULTING ENGINEERS

LEGAL COUNSEL: GEDDY, HARRIS, FRANK & HICKMAN, LLP

SITE DATA:

| | |
|---|---|
| PARCEL ID: | 3730100004 |
| PROPERTY OWNERS: | SWR-HOCKADAY, LLC & MARTHA WARBURTON McMURRAN |
| PROPERTY ADDRESS: | 3889 NEWS ROAD |
| CURRENT ZONING: | R-4 W/PROFFERS |
| PROPERTY ACREAGE: | 180.7 AC. ± |




VICINITY MAP

(APROX. SCALE 1"=2000')

ORIGINALLY SUBMITTED: JUNE 2021

INDEX OF SHEETS


| | |
|---|---|
| 1 | COVER SHEET |
| 2 | FORD'S COLONY LAND USE MASTER PLAN |
| 3 | ENVIRONMENTAL INVENTORY |
| 4 | BINDING MASTER PLAN |
| 5 | MASTER UTILITY PLAN |
| 6 | MASTER STORMWATER MANAGEMENT PLAN |


NOTE: THIS PROJECT LIES WITHIN THE POWHATAN CREEK WATERSHED OF THE JAMES RIVER. THE EASTERN HALF OF THE PROPERTY IS PART OF POWHATAN CREEK SUBWATERSHED 209 (COLD SPRING SWAMP) AND THE WESTERN HALF IS PART OF THE NON-TIDAL POWHATAN CREEK MAINSTEM.


AES

CONSULTING ENGINEERS

WILLIAMSBURG • RICHMOND • GLOUCESTER

5248 Olde Towne Road, Suite 1 • Williamsburg, Virginia 23188

(757) 253-0040 • Fax (757) 220-8994


Master Plan Amendment - Ford's Village
JCC CASE # Z-21-0012 / MP-21-0003
AES Project # W10514-01

FORD'S COLONY · WILLIAMSBURG ·

## NON RESIDENTIAL AMENITY AND SERVICE SITES

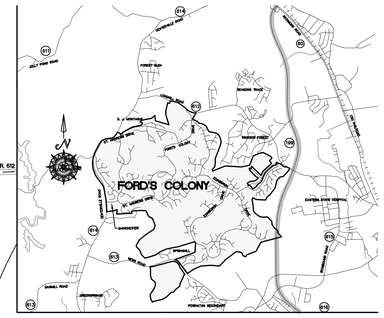
| | | |
|---|---|---|
| 1 | 100 HOTEL CONDOMINIUMS, EXECUTIVE MEETING FACILITIES AND GOLF ACADEMY | 4.71 AC. |
| 2 | GOLF CLUB AND PRO SHOP | 5.05 AC. |
| 3 | INFORMATION AND SALES CENTER | 1.81 AC. |
| 4 | ADMINISTRATIVE BUILDING | 3.50 AC. |
| 5 | PUBLIC SERVICE AREA * | 28.05 AC. |
| 6 | GOLF MAINTENANCE | 3.90 AC. |
| 7 | COMMUNITY CLUB | 7.72 AC. |
| 8 | PROJECT MAINTENANCE | 10.59 AC. |
| 9 | DRIVING RANGE/CART STORAGE | 10.34 AC. |
| 10 | ADDITIONAL RECREATION AREA | 6.36 AC. |
| 11 | ADDITIONAL PUBLIC SERVICE AREA | 6.76 AC. |
| 12 | CONTINUING CARE RETIREMENT COMMUNITY (CCRC) | 180.8 AC. |
| | TOTAL | 269.49 AC. |

* NOTE: 1.21 AC. PORTION OF ORIGINAL 30.0 AC. P.S.A. SOLD TO FORD'S COLONY

## LEGEND

- RESIDENTIAL "A"
- RESIDENTIAL "B"
- RESIDENTIAL "D"
- OPEN SPACE
- WILLIAMSBURG WEST SUBDIVISION AND APARTMENTS NOT A PORTION OF MASTER PLAN

NOTE:
VARIABLE WIDTH (25' MIN) BUFFER ALONG THE FORD'S COLONY TRACT WHERE IT ADJOINS CENTERVILLE ROAD SHALL BE RESERVED FOR FUTURE WIDENING AND REALIGNMENT OF S.R. 614




## VICINITY MAP
SCALE 1"= 4000'

## GENERAL NOTES:

1. RECORDATION OF THIS PLAN IS SOLELY FOR THE PURPOSE OF IDENTIFYING THE LAND COVERED BY THE PROFFERS RECORDED HEREWITH AND DOES NOT CONSTITUTE A PLAT OF SUBDIVISION NOR DOES IT DEDICATE TO PUBLIC OR PRIVATE USE ANY ROADS, COMMON AREAS, GREEN AREAS, OR RECREATION AREAS.
2. THE PROPERTY SHOWN ON THIS PLAN IS COVERED BY PROTECTIVE COVENANTS OF RECORD IN THE CLERK'S OFFICE IN THE COURTHOUSE OF JAMES CITY COUNTY, VIRGINIA, WHICH PROVIDE FOR THE MAINTENANCE OF COMMON OPEN SPACE, RECREATION AREAS, SIDEWALKS, PARKING, PRIVATE STREETS AND OTHER PRIVATELY OWNED, BUT COMMON FACILITIES SERVING THIS PROJECT.
3. LOTS NUMBERED REPRESENT RECORDED SECTIONS OR SECTIONS THAT HAVE RECEIVED PRELIMINARY APPROVAL.
4. THE 2008 MASTER PLAN AMENDMENT WILL BE CONSIDERED A STAND ALONE PROJECT FOR THE PURPOSES OF STORMWATER MANAGEMENT POINTS AND CREDITS.

## LAND USE TABULATION

| RESIDENTIAL "A" | 2021 | 2008 |
|---|---|---|
| TOTAL NUMBER OF UNITS | 2,856 UNITS | 2,856 UNITS |
| GROSS AREA OF RESIDENTIAL "A" | 1,868.77± AC.=(63.09%) | 1,868.77± AC.=(63.09%) |
| PERMITTED DESTINY | 4.00 UNITS/ ACRE | 4.00 UNITS/ ACRE |
| UNIT DENSITY | 1.53 UNITS/ ACRE | 1.53 UNITS/ ACRE |
| **RESIDENTIAL "B"** | | |
| TOTAL NUMBER OF UNITS | 80 UNITS | 80 UNITS |
| GROSS AREA OF RESIDENTIAL "B" | 22.9± AC.=(0.77%) | 22.9± AC.=(0.77%) |
| PERMITTED DENSITY | 9.60 UNITS/ ACRE | 9.60 UNITS/ ACRE |
| UNIT DENSITY | 3.49 UNITS/ ACRE | 3.49 UNITS/ ACRE |
| **RESIDENTIAL "D"** | | |
| TOTAL NUMBER OF UNITS | 314 UNITS | 314 UNITS |
| GROSS AREA OF RESIDENTIAL "D" | 31.82 AC.=(1.07%) | 31.82 AC.=(1.07%) |
| PERMITTED DENSITY | 18.00 UNITS/ ACRE | 18.00 UNITS/ ACRE |
| UNIT DENSITY | 9.67 UNITS/ ACRE | 9.87 UNITS/ ACRE |
| **C.C.R.C. "A","B" & "C"** | | |
| TOTAL NUMBER OF UNITS | 286 UNITS | 38 UNITS |
| **C.C.R.C. "D"** | | |
| TOTAL NUMBER OF UNITS | 75 UNITS | 558 UNITS |
| TOTAL NUMBER OF BEDS | 155 BEDS | 145 BEDS |
| ACREAGE FOR DENSITY | 166.22 AC. | 166.22 AC. |
| OVERALL C.C.R.C. DENSITY (SEE NOTE) | 2.17 UNITS/ AC. | 3.59 UNITS/ AC. |

NOTE: BEDS ARE NOT INCLUDED IN DENSITY CALCULATIONS

| OPEN SPACE | | |
|---|---|---|
| WITHIN NON-RESIDENTIAL AMENITY AND SERVICE SITES | 150.27 AC. | 150.27 AC. |
| * GOLF COURSE, LAKES AND BUFFERS, MARSH RESERVE | 844.71 AC. | 844.71 AC. |
| OPEN SPACE WITHIN RESIDENTIAL "A" | 514.12 AC. | 514.12 AC. |
| OPEN SPACE WITHIN RESIDENTIAL "B" & "D" | 38.77 AC. | 38.77 AC. |
| TOTAL AREA OF OPEN SPACE | 1,547.87 AC. | 1,547.87 AC. |
| TOTAL AREA OF PROJECT | 2,962.24 AC. | 2,962.24 AC. |
| % OF OPEN AREA | 52.3% | 52.3% |
| **OVERALL DENSITY** | | |
| TOTAL PROJECT AREA | 2,962.28 AC. | 2,962.28 AC. |
| TOTAL NUMBER OF RESIDENTIAL UNITS | 3,340 UNITS | 3,701 UNITS |
| OVERALL PROJECT DENSITY | 1.13 UNITS/ AC. | 1.25 UNITS/ AC. |

| * NOTES | |
|---|---|
| MARSH RESERVES, LAKES AND BUFFERS | 278.12 AC. |
| GOLF COURSE (INCLUDES LAKES IN PLAY) | 491.09 AC. |
| RESERVED FOR ROUTE 199 | 20.0 AC. |
| ASSOCIATED GREENBELTS NATURAL OPEN SPACE IN 1993 ADDITION | 3.30 AC. |
| OPEN SPACE IN 1995 ADDITION | 5.00 AC. |
| OPEN SPACE IN 1998 ADDITION | 47.20 AC. |
| OPEN SPACE IN 2008 ADDITION | 112.49 AC. |

| No. | DATE: | REVISION / COMMENT / NOTE | |
|---|---|---|---|
| 2 | 5/20/08 | REVISIONS PER RELOCATION OF BUILDINGS | AES JAG |
| 1 | 4/14/08 | REVISIONS PER JCC COMMENTS DATED MARCH 25, 2008 | AES JAG AES RKWD BY |


5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994

CONSULTING ENGINEERS
WILLIAMSBURG • RICHMOND • GLOUCESTER


# LAND USE MASTER PLAN
# FORD'S COLONY
AT WILLIAMSBURG
OWNER / DEVELOPER: REALTEC, INCORPORATED
JAMES CITY COUNTY VIRGINIA
POWHATAN DISTRICT

| Designed | Drawn |
|---|---|
| AES | AES |
| Scale | Date |
| 1"= 600' | 6/2021 |
| Project No. | |
| W10514-01 | |
| Drawing No. | |
| 2 | |

## SOIL CHARACTERISTICS

| SOIL # | SOIL NAME | TYPICAL SLOPES | EROSION FACTOR (K) | EROSION FACTOR (T) |
|---|---|---|---|---|
| 5 | BETHERA | 0–2% | 0.28–0.32 | 5 |
| 10B | CRAVEN | 2–6% | 0.32–0.37 | 3 |
| 10C | CRAVEN | 6–10% | 0.32–0.37 | 3 |
| 11C | CRAVEN–UCHEE COMPLEX | 6–10% | 0.32–0.37 | 3 |
| 14B | EMPORIA | 2–6% | 0.20–0.28 | 4 |
| 15D | EMPORIA COMPLEX | 10–15% | 0.20–0.28 | 4 |
| 15E | EMPORIA COMPLEX | 15–25% | 0.20–0.28 | 4 |
| 19B | KEMPSVILLE EMPORIA | 2–6% | 0.20–0.32 | 3 |
| 26B | PAMUNKEY | 2–6% | 0.28 | 4 |
| 27 | PEAWICK | RELATIVELY FLAT | 0.24–0.37 | 4 |
| 29A | SLAGLE | 0–2% | 0.24 | 3 |

INFORMATION TAKEN FROM "SOIL SURVEY OF JAMES CITY AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG, VIRGINIA" ISSUED IN APRIL, 1985 BY THE UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE IN COOPERATION WITH VIRGINIA POLYTECHNIC INSTITUTE AND STATE

SOIL SUSCEPTIBILITY TO EROSION CLASSIFICATION (K)
0.23 AND LOWER – LOW ERODIBILITY
0.23–0.36 – MODERATE ERODIBILITY
0.36 AND UP – HIGH ERODIBILITY

THE MAP SHOWN IS A "BEST FIT MODEL" OF THE SCS MAPS WITH EXISTING BASE INFORMATION.

## ENVIRONMENTAL IMPACTS

| | |
|---|---|
| TIDAL WETLANDS: | NONE |
| TIDAL SHORES: | NONE |
| 100 FT RPA BUFFER: | 5,685 S.F.; 0.13 AC. |
| NON-TIDAL WETLANDS IN RMA: | 17,055 S.F.; 0.39 AC. |
| NON-TIDAL WETLANDS IN RPA: | 8,050 S.F.; 0.18 AC. |
| HYDRIC SOILS: | NOT MODIFIED |
| 25% OR GREATER SLOPES: | 8,000± S.F.; 0.18 AC. |
| NON-RPA BUFFERS: | 52,383 S.F.; 1.20 AC. |

## SITE DATA:

TOTAL SITE AREA=
7,871,302 S.F.; 180.7 AC±
DISTURBED AREA=
2,981,056 S.F.; 68.43 AC±
(37.8% OF TOTAL SITE)
SITE IMPERVIOUS COVER=
1,178,353 S.F.; 27.05 AC±
(15.0% OF TOTAL SITE)
CCRC BUILDING IMPERVIOUS COVER=
370,200 S.F.; 8.50 AC±
SINGLE FAMILY IMPERVIOUS COVER=
808,153 S.F.; 18.55 AC±
OPEN SITE AREA =
5,480,470 S.F.; 125.8 AC±
(69.6% OF TOTAL SITE)

STEEP SLOPE IMPACT=
7,998 S.F.; 0.18 AC.

WETLAND IMPACT 2=
3,736 S.F.; 0.08 AC.
ROAD CROSSING
100 LF OF STREAM IMPACT
RPA BUFFER IMPACT=
18,336 S.F.; 0.42 AC.

PILE SEWER BRIDGE
RPA BUFFER IMPACT=
7,069 S.F.; 0.16 AC.

POWHATAN SECONDARY SUBDIVISION

SPRINGHILL SUBDIVISION

COLD SPRING SWAMP

APPROX. LOCATION OF 100 YR. FLOOD PLAIN VARIABLE ELEV. 23–21 FT.

LIMITS OF RPA WETLANDS

100' RPA BUFFER

EXISTING ACCESS/LOGGING ROAD TO REMAIN WITHIN THE RPA AS PEDESTRIAN PATH

APPROX. LOCATION OF 100–YR. FLOOD PLAIN VARIABLE ELEVATION 23–21

ZONE 2 BUFFER

ZONE 3 BUFFER

LIMITS OF NON–RPA WETLANDS

NOTE: SITE CONTAINS SOILS CLASSIFIED AS C AND D HYDROLOGIC GROUP. (11C SOILS HAVE BEEN CONSIDERED GROUP C FOR THE PURPOSES OF CALCULATIONS) SOILS TESTING IS BEING PERFORMED TO DETERMINE INFILTRATION RATES ON SITE.

GRAPHIC SCALE
100' 0' 100' 200'
SCALE: 1" = 100'

- RPA WETLAND
- NON-RPA WETLAND
- RPA BUFFER (100')
- ZONE 2 RIPARIAN BUFFER (VARIABLE WIDTH)
- ZONE 3 IMPERVIOUS COVER SETBACK (25')
- NON-RPA BUFFER (50')
- WETLAND (STORMWATER) IMPACTS
- ROAD WETLAND IMPACTS
- WETLAND IMPACTS (PILE CONSTRUCTION)
- STEEP SLOPE IMPACTS

| Rev. | Date | Description | Revised By |
|---|---|---|---|
| 2 | 5/20/08 | REVISIONS PER RELOCATION OF BUILDINGS | JAG |
| 1 | 4/14/08 | REVISIONS PER JCC COMMENTS DATED MARCH 25, 2008 | JAG |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ENVIRONMENTAL INVENTORY AT
# FORDS' VILLAGE
AT
FORD'S COLONY OF WILLIAMSBURG
FOR
FRYE DEVELOPMENT, LLC
POWHATAN DISTRICT | JAMES CITY COUNTY | VIRGINIA

| | |
|---|---|
| Project Contacts: | JAG |
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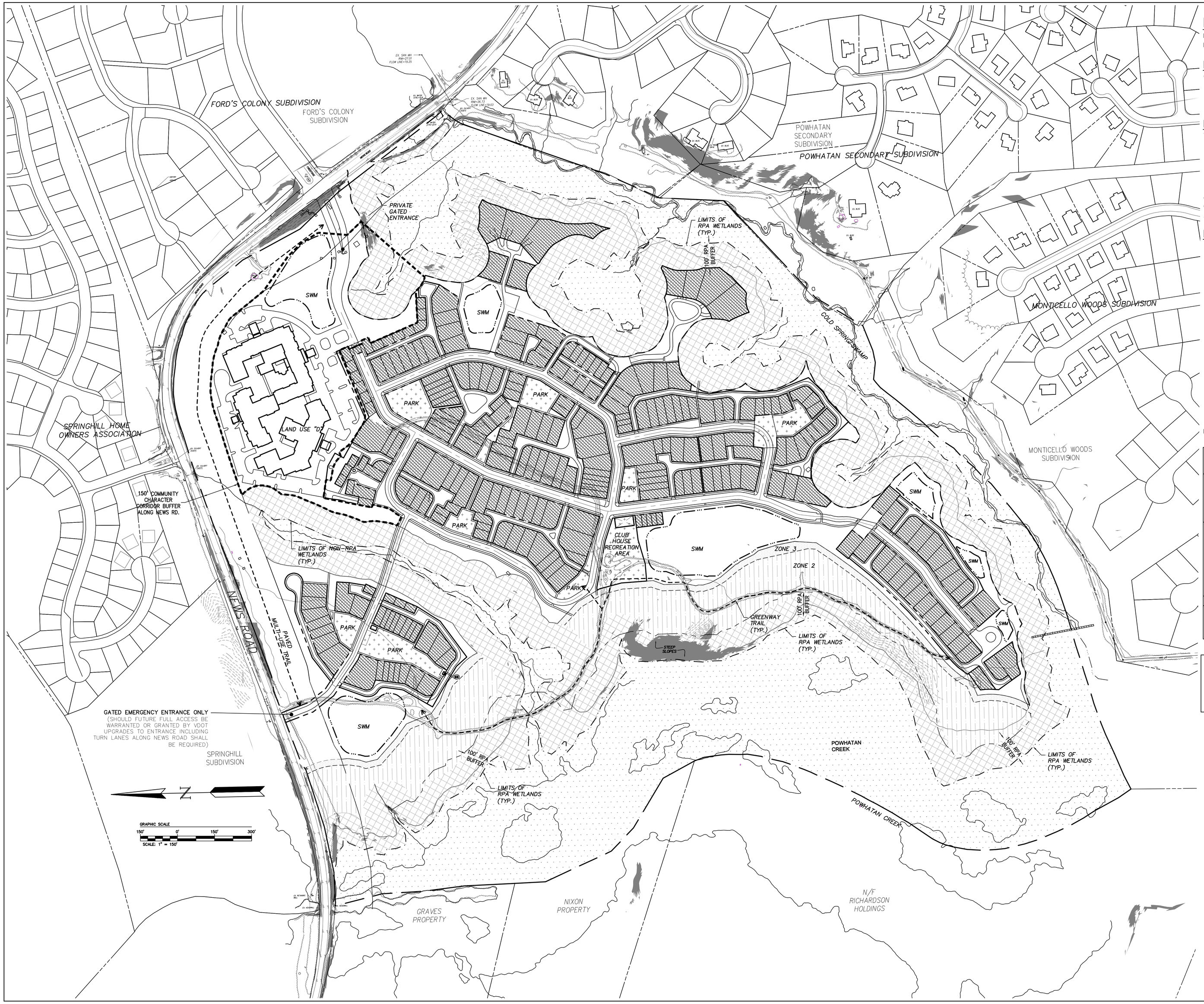


# DEVELOPMENT TABULATIONS:

| | |
|---|---|
| EXISTING ZONING (AND LAND USE DESIGNATION) | R-4 (B & D) |
| PROPOSED LAND USE DESIGNATION: | R-4 (A, B, C, & D) |

## DENSITY TABULATIONS:

| | | |
|---|---|---|
| GROSS ACREAGE: | 180.79 AC. +/- | |
| LESS RPA WETLANDS: | 47.42 AC. +/- | |
| LESS 25% SLOPES: | 1.4 AC. +/- | (OUTSIDE WETLANDS AREAS) |
| TOTAL NON-DEVELOPABLE AREA: | 48.82 AC. +/- (27.0% OF TOTAL PARCEL) | |

## LAND-USE TABULATIONS:

| | |
|---|---|
| TOTAL PARCEL: | **180.79 AC. +/-** |
| LANDUSES A, B, C, & D (1): | 74.56 AC. +/- |
| OPEN SPACE: | |
| RPA WETLANDS: | 47.42 AC. +/- |
| BUFFER AREAS (2) ; | 58.81 AC. +/- |
| TOTAL OPEN SPACE: | 106.23 AC. +/- |

(1) INCLUDES (±4 AC.) RECREATIONAL-AMENITY OPEN SPACE AREA.
(2) BUFFER AREAS INCLUDE RPA BUFFER (35.36 AC.), ZONE 2 RIPARIAN BUFFER (11.17 AC.), ZONE 3 RIPARIAN BUFFER (1.37 AC.), COMMUNITY CHARACTER CORRIDOR BUFFER (10.91 AC.).

## LEGEND:

- RPA WETLAND (47.42 AC. ±)
- RPA BUFFER (100') (35.35 AC. ±)
- ZONE 2 RIPARIAN BUFFER (7.10 AC. ±) (VARIABLE WIDTH)
- ZONE 3 RIPARIAN BUFFER (25') (1.38 AC. ±)
- LAND USE "B" — LANDUSE BOUNDARIES (61.59 AC. ± "A, B, & C"; 12.90 AC.± "D")
- APPROX. LOCATIONS OF RECREATIONAL-AMENITY OPEN SPACE (4 AC. ±)
- SLOPES 25% OR GREATER
- PEDESTRIAN CIRCULATION
- STORMWATER FEATURE

NOTE: 15 FT. BUILIDNG SETBACK TO RPA BUFFER ALONG COLD SPRING SWAMP.

| Land Use Density Chart | Max. # Units | Max. Non-Residential Floor Space | Maximum Developable Acreage |
|---|---|---|---|
| Land Use A, B, & C<br>A - Single Family<br>B - Multifamily (2-4 unit buildings)<br>C- Multifamily (2 over 4 unit buildings)<br>TOTAL | 286 (1) UNITS | N/A | ±61 Acres |
| D - Independent Living Apartments | 75 Units | | |
| D - Commom Areas<br>Dining Areas<br>Administration Offices<br>Other Amenities<br>Other Limited Commercial Uses (2) | | UP TO 150,000 S.F. | ±13 Acres |
| D - Health Care Center<br>Assisted Living/Memory Care<br>Skilled Nursing | 125 Rooms<br>30 Beds | | |
| MAXIMUMS: | 516 UNITS | 150,000 gsf | ±74 Acres |

NOTES
(1) MASTERPLAN WILL CONSIST OF A MIX OF SINGLE FAMILY, TOWNHOME, AND CONDOMINIUM, STYLE UNITS. MASTER PLAN LAYOUT SHOWN FOR DENSITY PURPOSES; FINAL CONFIGURATION TO BE REVIEWED AND APPROVED AT SITE PLAN.
(2) LIMITED COMMERCIAL USES SHALL BE PERMITTED FOR USE BY RESIDENTS, GUEST OF THE COMMUNITY, & EMPLOYEES.

ADDITIONAL MASTER PLAN NOTES

- NO STRUCTURES WITHIN THE "D" PORTION OF THE SITE SHALL EXCEED 60-FT IN HEIGHT.
- ALL STREETS, ALLEYS AND DRIVEWAYS SHALL BE PRIVATELY MAINTAINED. ALL ENTRANCES TO THE VDOT RIGHT OF WAY SHALL BE DESIGNED IN ACCORDANCE WITH VDOT COMMERCIAL ENTRANCE DESIGN STANDARDS.
- A MINIMUM OF 4 ACRES OF DEDICATED RECREATION AREAS SHALL BE PROVIDED. THESE AREAS SHALL BE GENERALLY AS SHOWN ON THE MASTER PLAN AND PROVIDE BASIC AMMENITIES SUCH AS A POOL, CLUBHOUSE, PARK BENCHES AND LANDSCAPED AREAS. ADDITIONALLY PASSIVE OPEN SPACES AND WALKING TRAILS SHALL BE PROVIDED.

| Rev. | Date | Description | Revised By |
|---|---|---|---|

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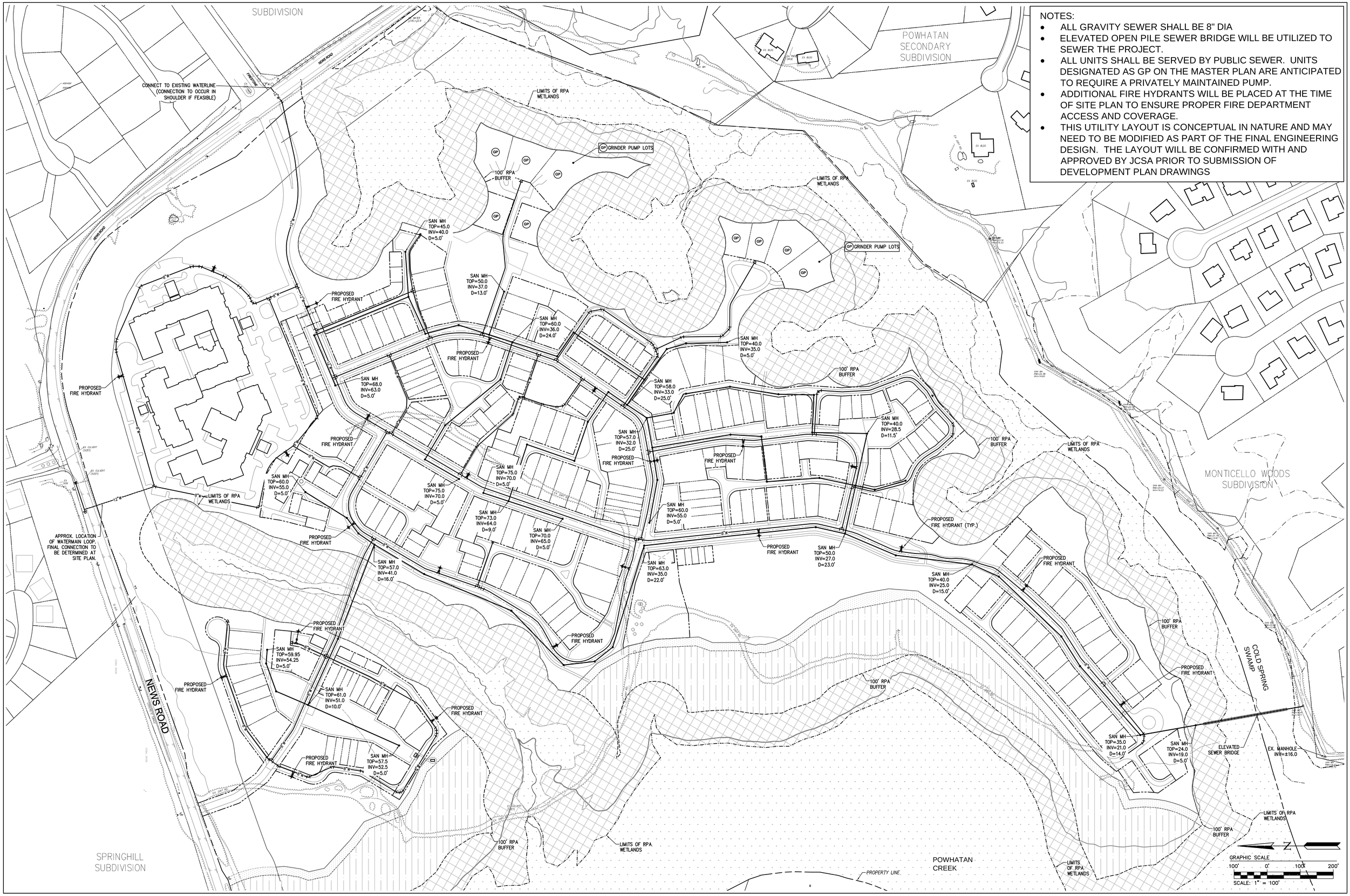
AMENDED LAND-USE MASTER PLAN
# FORDS' VILLAGE
AT
FORD'S COLONY OF WILLIAMSBURG
FOR
FRYE DEVELOPMENT, LLC
POWHATAN DISTRICT JAMES CITY COUNTY VIRGINIA

| | |
|---|---|
| Project Contacts: | JAG |
| Project Number: | W10514-01 |
| Scale: 1"=100' | Date: 6/2021 |
| Sheet Number | 4 |

NOTES:

- ALL GRAVITY SEWER SHALL BE 8" DIA
- ELEVATED OPEN PILE SEWER BRIDGE WILL BE UTILIZED TO SEWER THE PROJECT.
- ALL UNITS SHALL BE SERVED BY PUBLIC SEWER. UNITS DESIGNATED AS GP ON THE MASTER PLAN ARE ANTICIPATED TO REQUIRE A PRIVATELY MAINTAINED PUMP.
- ADDITIONAL FIRE HYDRANTS WILL BE PLACED AT THE TIME OF SITE PLAN TO ENSURE PROPER FIRE DEPARTMENT ACCESS AND COVERAGE.
- THIS UTILITY LAYOUT IS CONCEPTUAL IN NATURE AND MAY NEED TO BE MODIFIED AS PART OF THE FINAL ENGINEERING DESIGN. THE LAYOUT WILL BE CONFIRMED WITH AND APPROVED BY JCSA PRIOR TO SUBMISSION OF DEVELOPMENT PLAN DRAWINGS

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CONCEPTUAL UTILITY PLAN OF

# FORDS' VILLAGE

AT

FORD'S COLONY OF WILLIAMSBURG

FOR

FRYE DEVELOPMENT, LLC

POWHATAN DISTRICT | JAMES CITY COUNTY | VIRGINIA

| | |
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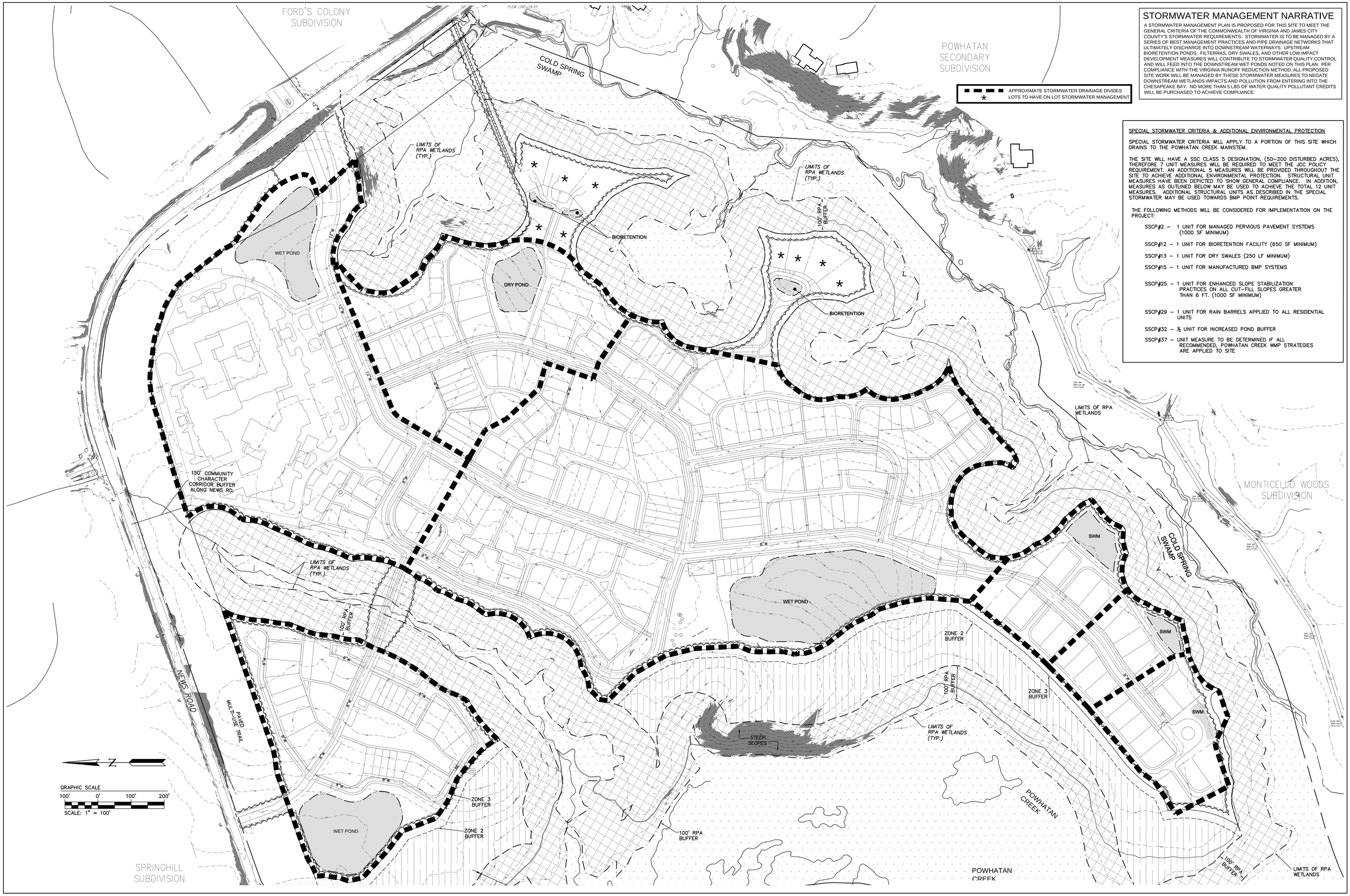
| 5 | |




## STORMWATER MANAGEMENT NARRATIVE

A STORMWATER MANAGEMENT PLAN IS PROPOSED FOR THIS SITE TO MEET THE GENERAL CRITERIA OF THE COMMONWEALTH OF VIRGINIA AND JAMES CITY COUNTY'S STORMWATER REQUIREMENTS. STORMWATER IS TO BE MANAGED BY A SERIES OF BEST MANAGEMENT PRACTICES AND PIPE DRAINAGE NETWORKS THAT ULTIMATELY DISCHARGE INTO DOWNSTREAM WATERWAYS. UPSTREAM BIORETENTION PONDS, FILTERRAS, DRY SWALES, AND OTHER LOW IMPACT DEVELOPMENT MEASURES WILL CONTRIBUTE TO STORMWATER QUALITY CONTROL AND WILL FEED INTO THE DOWNSTREAM WET PONDS NOTED ON THIS PLAN. PER COMPLIANCE WITH THE VIRGINIA RUNOFF REDUCTION METHOD, ALL PROPOSED SITE WORK WILL BE MANAGED BY THESE STORMWATER MEASURES TO NEGATE DOWNSTREAM WETLANDS IMPACTS AND POLLUTION FROM ENTERING INTO THE CHESAPEAKE BAY. NO MORE THAN 5 LBS OF WATER QUALITY POLLUTANT CREDITS WILL BE PURCHASED TO ACHIEVE COMPLIANCE.

### SPECIAL STORMWATER CRITERIA & ADDITIONAL ENVIRONMENTAL PROTECTION

SPECIAL STORMWATER CRITERIA WILL APPLY TO A PORTION OF THIS SITE WHICH DRAINS TO THE POWHATAN CREEK MAINSTEM.

THE SITE WILL HAVE A SSC CLASS 5 DESIGNATION, (50–200 DISTURBED ACRES), THEREFORE 7 UNIT MEASURES WILL BE REQUIRED TO MEET THE JCC POLICY REQUIREMENT. AN ADDITIONAL 5 MEASURES WILL BE PROVIDED THROUGHOUT THE SITE TO ACHIEVE ADDITIONAL ENVIRONMENTAL PROTECTION. STRUCTURAL UNIT MEASURES HAVE BEEN DEPICTED TO SHOW GENERAL COMPLIANCE. IN ADDITION, MEASURES AS OUTLINED BELOW MAY BE USED TO ACHIEVE THE TOTAL 12 UNIT MEASURES. ADDITIONAL STRUCTURAL UNITS AS DESCRIBED IN THE SPECIAL STORMWATER MAY BE USED TOWARDS BMP POINT REQUIREMENTS.

THE FOLLOWING METHODS WILL BE CONSIDERED FOR IMPLEMENTATION ON THE PROJECT:

- SSCP#2 – 1 UNIT FOR MANAGED PERVIOUS PAVEMENT SYSTEMS (1000 SF MINIMUM)
- SSCP#12 – 1 UNIT FOR BIORETENTION FACILITY (650 SF MINIMUM)
- SSCP#13 – 1 UNIT FOR DRY SWALES (250 LF MINIMUM)
- SSCP#15 – 1 UNIT FOR MANUFACTURED BMP SYSTEMS
- SSCP#25 – 1 UNIT FOR ENHANCED SLOPE STABILIZATION PRACTICES ON ALL CUT–FILL SLOPES GREATER THAN 6 FT. (1000 SF MINIMUM)
- SSCP#29 – 1 UNIT FOR RAIN BARRELS APPLIED TO ALL RESIDENTIAL UNITS
- SSCP#32 – ½ UNIT FOR INCREASED POND BUFFER
- SSCP#37 – UNIT MEASURE TO BE DETERMINED IF ALL RECOMMENDED, POWHATAN CREEK WMP STRATEGIES ARE APPLIED TO SITE

| Rev. | Date | Description | Revised By |
|---|---|---|---|

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CONCEPTUAL STORMWATER MANAGEMENT PLAN OF
# FORDS' VILLAGE
AT
FORD'S COLONY OF WILLIAMSBURG
FOR
FRYE DEVELOPMENT, LLC
POWHATAN DISTRICT | JAMES CITY COUNTY | VIRGINIA

| | |
|---|---|
| Project Contacts: | JAG |
| Project Number: | W10514-01 |
| Scale: 1"=100' | Date: 6/2021 |
| Sheet Number | 6 |

080017656

AMENDED AND RESTATED FORD'S

COLONY PROFFERS

These AMENDED and RESTATED FORD'S COLONY PROFFERS are made this 10th day of June, 2008 by REALTEC INCORPORATED, a North Carolina corporation (together with its successors in title, the "Owner").

RECITALS

A. Owner is the developer of the Ford's Colony at Williamsburg development containing approximately 2,962 acres and which is zoned R-4, Residential Planned Community, with proffers, and subject to a Master Plan heretofore approved by James City County (the "Existing Master Plan").

B. In connection with prior Master Plan amendments, Owner has entered into and James City County has accepted Amended and Restated Ford's Colony Proffers dated as of January 6, 2005 and recorded in the Clerk's Office of the Circuit Court for the City of Williamsburg and County of James City as Instrument No. 050001465 and Richard J. Ford has entered into and James City County has accepted Richard J. Ford/Ford's Colony Proffers dated as of September 29, 1995 and recorded in the Clerk's Office of the Circuit Court for the City of Williamsburg and County of James City in James City Deed Book 757 at page 529 (together, the "Existing Proffers"). The property now subject to the Existing Proffers and Existing Master Plan is hereinafter called the "Existing Property".

C. Owner has applied to amend its Existing Master Plan to include as Section 37 of Ford's Colony a tract of land with an address of 3889 News Road, Parcel ID# 3730100004, containing approximately 180 acres, which property is more particularly described on Exhibit A (the "Additional Property") and to rezone the Additional Property from R-8 to R-4, with proffers.

Prepared by: Vernon M. Geddy, III, Esq., 1177 Jamestown Rd., Williamsburg, VA 23185 (757- 220-6500)

Return to: Adam R. Kinsman, Deputy County Attorney, 101-C Mounts Bay Rd., Williamsburg, VA 23185 (757-253-6612)



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D. Owner has submitted to the County a master plan entitled "Master Plan for Rezoning of The Village at Ford's Colony at Williamsburg for Realtec Incorporated" prepared by AES Consulting Engineers dated July 20, 2007, last revised May 20, 2008 (the "Amended Master Plan") in accordance with the County Zoning Ordinance.

E. Owner desires to offer to the County certain conditions on the development of the Property not generally applicable to land zoned R-4.

F. In consideration of the approval of the amendment of its Amended Master Plan and the rezoning, Owner desires to amend and restate the Existing Proffers as set forth below. If the requested rezoning and amendment of Owner's Existing Master Plan is not approved by James City County, these Amended and Restated Ford's Colony Proffers shall be void and the Existing Proffers shall remain unchanged, in full force and effect.

RESTATEMENT

1. **Restatement**. The Existing Proffers are hereby restated and incorporated herein by reference and shall continue to apply only to the Existing Property.

PROFFERS APPLICABLE TO THE ADDITIONAL PROPERTY

The following proffers apply only to the Additional Property:

2. **Master Plan**. The Additional Property shall be developed generally as shown and set out on sheets 4 through 8 of the Amended Master Plan. Final plans (as defined in Section 24-279 of the Zoning Ordinance) may vary from the Amended Master Plan to the extent permitted by Section 24-279 of the Zoning Ordinance.

3. **Density**. (a) There shall be no more than 596 independent living dwelling units ("dwelling units"), 83 assisted living/memory care rooms and 60 skilled nursing beds (together, the "rooms/beds") and two AG Beds (as defined in Proffer 22) on the Additional Property. The

terms "assisted living room" or "room" shall mean a non-medical residential room in the assisted living facility area of the continuing care retirement community licensed in accordance with Sections 63.2-1800 et seq. of the Virginia Code and Sections 22 VAC 40-72 et seq. of the Virginia Administrative Code where adults who are aged, infirm or disabled are provided personal and health care services and 24-hour supervision and assistance. Rooms must meet the standards set forth in 22 VAC 40-72-730 and 880. Typically rooms are occupied by one person. No more than two persons may occupy a room and only persons directly related by blood or marriage may occupy the same room.

(b) All dwelling units developed on the Additional Property shall be occupied by persons eighteen (18) years of age or older in accordance with applicable federal and state laws and regulations, including but not limited to: the Fair Housing Act, 42 U.S.C. 3601 et seq. and the exemption therefrom provided by 42 U.S.C. 3607(b)(2)(C) regarding discrimination based on familial status; the Housing for Older Persons Act of 1995, 46 U.S.C. 3601 et seq.; the Virginia Fair Housing Law Va. Code 36-96.1 et seq.; any regulations adopted pursuant to the foregoing; any judicial decisions arising thereunder; any exemptions and/or qualifications thereunder; and any amendments to the foregoing as now or may hereafter exist. Specific provisions of the age restriction described above and provisions for enforcement of same shall be set forth in a recorded document which shall be subject to the review and approval of the County Attorney prior to issuance of the first building permit for dwelling units on the Additional Property.

(c) Any accessory commercial uses located on the Additional Property, such as bank offices, beauty salons and barbershops, shall be located and designed to serve residents of the Additional Property as verified by the Director of Planning.

4. **Water Conservation.** (a) The Owner shall be responsible for developing water

conservation standards to be submitted to and approved by the James City Service Authority ("JCSA") and subsequently for enforcing these standards. The standards shall address such water conservation measures as limitations on the installation and use of irrigation systems and irrigation wells, the use of drought resistant native and other adopted low water use landscaping materials and warm season turf on common areas in areas with appropriate growing conditions for such turf and the use of water conserving fixtures and appliances to promote water conservation and minimize the use of public water resources. The standards shall be approved by the JCSA prior to final subdivision or site plan approval.

(b) If the Owner desires to have outdoor watering of the Additional Property it shall provide water for irrigation utilizing surface water collection from the surface water ponds ("Impoundments") or other collection devices such as cisterns or rain barrels ("Collection Devices"). In the design phase, the Owner and design engineer shall take into consideration the design of stormwater systems that can be used to collect stormwater for outdoor water use for the development. In no circumstance shall the JCSA public water supply be used for irrigation purposes, except as otherwise provided by this condition. If the Owner demonstrates to the satisfaction and approval of the General Manager of JCSA through drainage area studies and irrigation water budgets that the Impoundments and Collection Devices cannot provide sufficient water for all irrigation, the General Manager of the JCSA may, in writing, approve a shallow (less than 100 feet) irrigation well to supplement the water provided by the Impoundments and the Collection Devices.

5. **Contributions for Community Impacts**. (a) A contribution of $1,000 for each dwelling unit on the Additional Property shall be made to the County for fire, police or emergency services, library uses, and other public facilities, uses or infrastructure.

(b) A contribution of $250.00 for each room/bed (excluding the AG Beds) on the Additional Property shall be made to the County for fire, police or emergency services uses.

(c) A contribution of $870.00 for each dwelling unit and $435.00 for each room/bed on the Additional Property shall be made to the JCSA for water system improvements.

(d) A one-time cash contribution in the amount of $36,000.00 shall be made to the County prior to the County being obligated to issue any certificates of occupancy for dwelling units/rooms/beds on the Additional Property for off-site improvements at the News Road/Monticello Avenue intersection and in the Monticello Avenue corridor.

(e) A contribution of $750.00 for each dwelling unit on the Additional Property, subject to a credit for the costs of engineering and construction related to the improvements proffered by Owner in Section 6(b) calculated as set forth below, shall be made to the County for improvements to the News Road/Powhatan Secondary intersection, flood control measures where News Road crosses Cold Spring swamp, improvements at the News Road/Centerville Road intersection and other off-site road improvements in the News Road corridor. Owner shall receive a credit in an amount equal to its actual costs of the engineering and construction of the improvements proffered by Owner in Section 6(b) against the initial per unit contributions proffered under paragraph (d) of this Section (the "Credit Amount"). If construction of such improvements is not complete at the time the initial per unit contributions are due under paragraph (e) of this Section, the Credit Amount shall equal an engineer's estimate of such costs submitted by the Owner and approved by the Director of Planning, The Credit Amount divided by $750.00 is the number of dwelling units for which the Credit Amount offsets the cash contribution otherwise due and payable. After application of the Credit Amount, the $750.00 per dwelling unit cash contribution shall be payable on all subsequent dwelling units on the

Additional Property. Owner shall provide the County with copies of invoices and other supporting documentation of the costs of the improvements. If the Credit Amount is based on an agreed upon costs estimate, it shall be adjusted to equal the final actual costs of engineering and construction ("Actual Costs"). If the Credit Amount is more than the Actual Costs, Owner shall pay to the County an amount equal to the difference. If the Credit Amount is less than the Actual Costs, Owner shall receive an additional credit equal to the difference between the Actual Costs and the Credit Amount at the time the next cash contributions are due this paragraph.

(f) The contributions described above in paragraphs (a), (b), (c) and (e) shall be payable for each dwelling unit or room/bed, as applicable, on the Additional Property at the time of final subdivision or site plan approval for the residential unit or non-residential building unless the County adopts a policy calling for the payment of cash proffers at a later time in the development process, in which case the contributions described in paragraphs (a), (b), (c) and (e) above shall be payable at the time specified in the policy. In the event dwelling units, such as townhouse units, require both a site plan and subdivision plat, the contributions described above shall be paid at the time of final subdivision plat approval.

(g) A one-time cash contribution shall be made to JCSA in the amount of $60,000.00 prior to the County being obligated to issue any certificates of occupancy for dwelling units/rooms/beds on the Additional Property for use by JCSA for off-site sewer improvements.

(h) The per unit/room/bed contribution amounts shall consist of the amounts set forth in the above paragraphs plus any adjustments included in the Marshall and Swift Building Costs Index (the "Index") from 2008 to the year a payment is made if payments are made after on or after January 1, 2009. In no event shall the per unit/room/bed contribution be adjusted to a sum less than the amounts set forth in the preceding paragraphs of this Section. In the event that the

Index is not available, a reliable government or other independent publication evaluating information heretofore used in determining the Index (approved in advance by the County Manager of Financial Management Services) shall be relied upon in establishing an inflationary factor for purposes of increasing the per unit/room/bed contribution to approximate the rate of annual inflation in the County.

6. **Entrances; Traffic Improvements**. (a) At the main entrance into the Additional Property at the intersection of News Road and Firestone Drive, an exclusive left-turn lane from westbound News Road into the Additional Property and an exclusive right-turn lane, including a shoulder bike lane, from eastbound News Road into the Additional Property shall be constructed. A shoulder bike lane along the Additional Property's News Road frontage shall be constructed. The existing southbound left turn lane on Firestone Drive at News Road will be restriped to a shared left and through lane.

(b) Prior to the County issuing final approval on any site or subdivision plan for any dwelling units/rooms/beds on the Additional Property, Owner shall submit plans to the County and Virginia Department of Transportation ("VDOT") for the installation of an exclusive left-turn lane on westbound News Road at the intersection with Powhatan Secondary. Owner will complete construction of the left-turn lane within twelve months of County and VDOT approvals to construct this exclusive left-turn lane. Owner is not responsible for road right of way acquisition or landscape/screening other than stabilization of disturbed soils. The County may elect to accept the cash equivalent contribution outlined in Proffer 5(d), (with any adjustments as may be appropriate as provided for in Proffer 5(g)), in lieu of construction of the turn lane by the Owner, in the event that acquisition of any needed right-of-way proves to be prohibitive. In the event that VDOT constructs this turn lane as part of its Six Year Secondary Road Plan, the

County may elect to divert some or all of the cash equivalent contribution to other road projects in the News Road Corridor, at the News Road/Monticello Avenue intersection, or in the western Monticello Avenue Corridor. Owner shall install or pay for the installation of a traffic signal at the intersection of News Road with Powhatan Secondary at such time as VDOT traffic signal warrants are met and VDOT has approved the installation of such a traffic signal.

(c) The improvements proffered hereby shall be constructed in accordance with VDOT standards. The improvements listed in paragraph (a) shall be completed or all required permits and plans for such approvals shall have been approved by all necessary governmental agencies and their completion bonded in form satisfactory to the County Attorney prior to the issuance of any certificates of occupancy for any building on the Additional Property.

(d) The second entrance to the Additional Property shall be located in the general location shown on the Master Plan and shall be limited by gate to emergency access only unless and until turn lanes approved by VDOT at this entrance have been installed.

(e) Owner shall convey free of charge to VDOT any right of way from the Additional Property necessary for the widening or realignment of News Road within 60 days of a written request for such conveyance together with final plans for the widening or realignment.

(f) Owner shall conduct traffic counts at its entrances prior to the County being obligated to issue certificates of occupancy for more than 247 dwelling units/rooms/beds on the Additional Property and again prior to the County being obligated to issue certificates of occupancy for more than 494 dwelling units/rooms/beds on the Additional Property. If these counts show a trip generation from the Additional Property more than 10% higher than the trip generation projected by the News Road Corridor Traffic Forecast and Analysis dated April 4, 2008 prepared by DRW Consultants, LLC filed with the rezoning application and on file with the Planning Division,

Owner shall submit an updated traffic impact study, including a listing of any entrance or turn lane improvements necessary to accommodate the increased traffic and the appropriate trigger for their construction, for review and approval by the County and VDOT. Owner shall install the necessary improvements, including any warranted traffic signal, as approved by the County and VDOT at the time recommended in the updated approved traffic study.

7. **Archaeology**. A Phase I Archaeological Study for the entire Additional Property shall be submitted to the Director of Planning for review and approval prior to land disturbance. A treatment plan shall be submitted and approved by the Director of Planning for all sites in the Phase I study that are recommended for a Phase II evaluation and/or identified as eligible for inclusion on the National Register of Historic Places. If a Phase II study is undertaken, such a study shall be approved by the Director of Planning and a treatment plan for said sites shall be submitted to, and approved by, the Director of Planning for sites that are determined to be eligible for inclusion on the National Register of Historic Places and/or those sites that require a Phase III study. If in the Phase III study, a site is determined eligible for nomination to the National Register of Historic Places and said site is to be preserved in place, the treatment plan shall include nomination of the site to the National Register of Historic Places. If a Phase III study is undertaken for said sites, such studies shall be approved by the Director of Planning prior to land disturbance within the study areas. All Phase I, Phase II, and Phase III studies shall meet the Virginia Department of Historic Resources' *Guidelines for Preparing Archaeological Resource Management Reports* and the Secretary of the Interior's *Standards and Guidelines for Archaeological Documentation*, as applicable, and shall be conducted under the supervision of a qualified archaeologist who meets the qualifications set forth in the Secretary of the Interior's *Professional Qualification Standards*. All approved treatment plans shall be incorporated into

the plan of development for the Additional Property and the clearing, grading or construction activities thereon.

**8. Off-Site Sewer Easements**. Upon the request of JCSA, Owner shall grant JCSA utility easements over, across and under the portion of the Additional Property along Powhatan Creek to permit future connections from the gravity sewer on the Additional Property to Tax Parcel 3640100007. The location of the easement shall be determined during the site plan approval process. The easements shall be recorded prior to JCSA issuing a Certificate to Construct.

**9. Sustainable Building**. The project shall be designed and constructed to obtain at least 200 points under the EarthCraft House Virginia, EarthCraft Multi-Family program certification process and a copy of the project worksheet shall be provided to the Director of Planning prior to the issuance of a certificate of occupancy for buildings in the phase in question.

**10. Master Stormwater Management Plan**. (a) Owner shall submit to the County a master stormwater management plan for the Additional Property consistent with the Master Stormwater Conceptual Plan prepared by AES Consulting Engineers dated July 20, 2007, last revised April 14, 2008 ("Stormwater Plan") and included in the Master Plan set submitted herewith and on file with the County, including facilities and measures necessary to meet the County's general stormwater management system requirements and the special stormwater criteria applicable in the Powhatan Creek watershed ("SSC") and, in addition, including features and measures over and above those necessary to meet the general requirements and SSC requirements and which will provide at least an additional five SSC credits, which shall include, without limitation, the features and measures listed on the Stormwater Plan subject to the criteria and conditions set forth on the Stormwater Plan. The master stormwater plan shall be approved

by the Environmental Director or his designee prior to the submission of any development plans for the Additional Property. The master stormwater management plan may be revised and/or updated during the development of the Additional Property based on on-site conditions discovered in the field with the prior approval of the Environmental Division. The approved master stormwater management plan, as revised and/or updated, shall be implemented in all development plans for the Additional Property.

(b) Prior to final site plan approval of the first site plan on the Additional Property, Owner shall submit a stream monitoring plan to the Environmental Division for their review and approval including a baseline assessment of the existing condition of the stream segments delineated on sheet 7 of the Master Plan and providing for annual monitoring beginning upon the date of the issuance of the first certificate of occupancy for a building on the Additional Property and continuing for a period of ten years from that date of the geomorphology of such stream segments. If such monitoring indicates the presence of new erosion not shown in the baseline assessment, Owner shall install additional upstream run-off control measures to prevent further erosion as approved by the Environmental Division.

(c) The warehouse building constructed in the area shown on the Master Plan as "Maintenance Area" shall be constructed using "green roof" technology. "Green roof" is defined as a roof which includes vegetation planted in soil or another growing medium spread over a waterproof membrane and may include drainage and/or irrigation systems.

**11.** **Nutrient Management Plan**. The Owner shall be responsible for contacting an agent of the Virginia Cooperative Extension Office ("VCEO") or, if a VCEO agent is unavailable, a soil scientist licensed in the Commonwealth of Virginia, an agent of the Soil and Water Conservation District or other qualified professional to conduct soil tests and to develop,

based upon the results of the soil tests, customized nutrient management plans (the "Plans") for all common areas within the Additional Property shown on site plans for the Additional Property. The Plans shall be submitted to the County's Environmental Director for his review and approval prior to the issuance of the any certificates of occupancy for units/rooms/beds shown on the site plan. Upon approval, the Owner shall be responsible for ensuring that any nutrients applied to common areas be applied in strict accordance with the Plan.

12. **Private Streets**. All streets and alleys on the Additional Property shall be private and shall be maintained by the Owner.

13. **Lighting**. All light poles on the Additional Property shall not exceed 30 feet in height. All external lights on the Additional Property shall be recessed fixtures with no globe, bulb or lens extending below the casing or otherwise unshielded by the case so that the light source is visible from the side of the fixture. No light spillage defined as 0.1 footcandle or higher shall extend outside the property lines of the Additional Property unless otherwise approved by the Director of Planning. Owner shall submit a lighting plan to the Director of Planning for review and approval for consistency with this Proffer prior to final site plan approval.

14. **Greenway Trail**. Subject to the issuance of all required permits by the County and other agencies as may be needed, Owner shall construct a trail with a minimum eight foot wide travel path with a mulch or other natural surface (which will be open to the general public during daylight hours only), including necessary bridges, if any, generally in the location shown on the Master Plan. In addition, Owner shall grant the County an easement eight feet in width from the centerline of the trail as constructed for public access as described above and the maintenance and improvement of the trail by the County. The exact location of the trail and

greenway easement may be varied with the prior written approval of the Environmental Division. The trail shall be constructed within twelve months of the issuance of necessary permits by the County and other agencies as may be needed.

15. **Natural Resources.** A natural resource inventory of suitable habitats for S1, S2, S3, G1, G2, or G3 resources as defined in the County's Natural Resources Policy on the Additional Property shall be submitted to the Director of Planning for his/her review and approval prior to the submittal of any development plans for the Additional Property. If the inventory confirms that a natural heritage resource exists, a conservation management plan shall be submitted to and approved by the Director of Planning for the affected area. All inventories and conservation management plans shall meet the Virginia Department of Conservation and Recreation's Division of Natural Resources ("DCR/DNH") standards for preparing such plans, and shall be conducted under the supervision of a qualified biologist as determined by the DCR/DNH or the United States Fish and Wildlife Service. All approved conservation management plans shall be incorporated into the plan of development for the site, and the clearing, grading or construction activities thereon, to the maximum extent possible. Upon approval by the Director of Planning, a mitigation plan may substitute for the incorporation of the conservation management plan into the plan of development for the site. This proffer shall be interpreted in accordance with the County's Natural Resources Policy adopted by the County on July 27, 1999.

16. **Public Transit.** Owner shall install a bus stop and shelter on News Road adjacent to the main entrance into the Additional Property, with the exact location being subject to the approval of Williamsburg Area Transit ("WAT"), or any successor entity to WAT as may become appropriate. The bus stop shall be installed upon the request of WAT at such time as

WAT provides bus service along News Road to the Additional Property.

17. **Ford's Colony at Williamsburg Homeowners Association.** Owner shall not subject the Additional Property to the Declaration of Protective Covenants, Section II, Ford's Colony at Williamsburg, dated April 2, 1985 ("DPC") or the Bylaws of the Ford's Colony Homeowners Association ("FCHOA"), as amended from time to time ("Bylaws") nor shall owners or residents of units, lots or parcels on the Additional Property be "Owner(s)" as such term is defined in the DPC or the Bylaws or be Members (as defined in the DPC) of the FCHOA.

18. **Recreation**. Owner will provide recreational and social facilities and programs appropriate for residents of a continuing care retirement community, which includes senior adult housing, assisted living beds, and nursing beds, as determined by Owner and generally as described below and in the general locations shown on the Master Plan. Facilities will be both indoor and outdoor and will be managed and maintained on a year round basis by Owner. Hard surface and soft surface trails and sidewalks will be installed for walking and bicycling and shown on the site plan for each phase of the development. The phase one construction shall include an outdoor pool and areas designated for lawn games, and accessible gardens. The phase one main CCRC building will contain terraces and covered porch areas that will be programmed for community social events such as cookouts and concerts and will have benches and chairs to be used during non-programmed time. The phase one main CCRC building will contain a comprehensive wellness center and pool for aerobic and strength conditioning, physical therapy, swimming and water aerobics, rooms for dining, formal lounges and bar, activities such as arts and crafts and woodworking, convenience shopping, health, beauty and other spa features, and a chapel. A multi-purpose facility will be built in conjunction with phase one for social and educational programming with a capacity of approximately 400 people. A private transportation

system will be employed to transport groups to Williamsburg area entertainment venues and shopping. All residents shall have full access to all indoor and outdoor facilities and programming. The dedicated assisted living buildings and skilled nursing care building will feature health care-related exercise areas and indoor and outdoor respite areas.

Associated Functions:

Building A: Lobby, Main Hall, Front Desk, Work Room, Mail Room, Administration, Sales, Security, Living Room, Community Center/Chapel, Library, Card Room, Terrace Room, Deli, Dining Room, Kitchen, Game Room, Crafts, Shop, Movie Auditorium, Bank, Toilets, Beauty/Barber, Business, Wellness/Spa, Pool, Staff Support, Maintenance, Housekeeping, Mechanical, Loading Dock, Receiving and Training

Building B: Lobby, Main Hall, Front Desk, Work Room, Mail Room, Administration, Sales, Security, Living Room, Community Center/Chapel, Library, Card Room, Terrace Room, Deli, Dining Room, Kitchen, Game Room, Crafts, Shop, Movie Auditorium, Bank, Toilets, Beauty/Barber, Business, Wellness/Spa, Pool, Staff Support, Maintenance, Housekeeping, Mechanical, Loading Dock, Receiving and Training, Service

Building C: main community meeting & multi-purpose, terrace, parking

Building D: spa, beauty/barber, arts/crafts, & chapel

**19.** **Cold Spring Swamp Drainage Analysis**. Prior to the County being obligated to grant final approval of the first site plan for development on the Additional Property, Owner shall cause a duly licensed professional engineer to prepare and submit to the County an analysis of the Cold Spring swamp drainage basin assuming full development in the drainage basin, subject to the review and approval of the County's Environmental Division Director, evaluating the adequacy of the existing culverts under News Road for use by the County in determining whether or not improvements to the culverts are necessary for flood control purposes.

**20.** **Height Restrictions**. No building on the Additional Property shall exceed 60 feet in height (with building height as defined in Section 24-2 of the County Zoning Ordinance) nor have more than four stories above grade. Building P as designated on the Master Plan shall not

exceed 106 feet above sea level (or 38 feet above finished grade) in height (with building height as defined in Section 24-2 of the County Zoning Ordinance). The buildings shown on the Master Plan as Duplexes shall not contain more than one and one-half stories. Building A shall not contain more than three stories or exceed 50 feet above finished grade in height (with building height as defined in Section 24-2 of the County Zoning Ordinance). Building Q shall not contain more than two stories. The buildings shown on the Master Plan as Maintenance, Transportation and Warehouse shall not contain more than two stories.

**21.** **Building P.** All mechanical equipment and vehicular entrances to underground parking for Building P shall be located on the sides of the building. All mechanical equipment serving Building P shall be screened for sound attenuation purposes by solid walls approved by the Director of Planning. Owner shall install evergreen trees behind Building P pursuant to a landscape plan approved by the Development Review Committee in the site plan review process in order to provide additional screening of the basement level of Building P from the Monticello Woods subdivision.

**22.** **Social Services.** Owner shall reserve two assisted living beds ("AG Beds") in Phase 2 of the project for individuals receiving auxiliary grants under the Auxiliary Grant Program (the "Program") administered by the Virginia Department of Social Services and shall participate in the Program with respect to the AG Beds. Such individuals must meet applicable Program eligibility criteria as determined by the County Department of Social Services and are subject to all admission and discharge criteria of the facility other than ability to pay for services and all other generally applicable rules and regulations of the facility.

WITNESS the following signatures and seals:

REALTEC INCORPORATED

By: _____

Title: VICE PRESIDENT

STATE OF VIRGINIA
~~CITY~~/COUNTY OF James City to-wit:

The foregoing instrument was acknowledged before me this 30th day of June, 2008 by Drew Mulhare, Vice President of REALTEC INCORPORATED, a North Carolina corporation, on behalf of the corporation.

_____
NOTARY PUBLIC

My commission expires: _____
Registration No.: _____

LYNN D. COMBS
Notary Public
Commonwealth of Virginia
185766
My Commission Expires Nov 30, 2011

# Additional Property Description

EXHIBIT A

PARCEL A

All of that certain piece or parcel of land, lying and being in Jamestown District, James City County, Virginia, known as Hockaday, containing one hundred forty-seven and one-half (147-1/2) acres, more or less, bounded on the East, South and West by the land of the Shaw Land & Timber Co., known as the Pyle tract, the land of J. A. Barnes and Powhatan Swamp, and on the North by the land of Now Brothers.

PARCEL B

All of that certain piece or parcel of land situate in Jamestown District, James City County, Virginia, containing fifty five and two fifths (55-2/5) acres, more or less, and known as Cypress Swamp, and adjoining the lands of William Martin's estate on the East, Greenspring on the South and Thomas N. Ratcliffe on the West and D. S. Jones on the North.

LESS AND EXCEPT that property conveyed to the Commonwealth of Virginia by Order Confirming Commissioner's Report, entered February 20, 1974, in the Circuit Court for the City of Williamsburg and County of James City, Virginia, and recorded in the Office of the Clerk of Court of such Court in James City County Deed Book 150, at Page 420, containing 3.74 acres, more or less, confirming that certain Certificate Number C-21570, filed by State Highway Commissioner of Virginia against the Heirs at Law of John G. Warburton, dated May 24, 1972, and recorded June 12, 1972, in the aforesaid Clerk's Office in James City County Deed Book 137, at Page 213, and SUBJECT TO the easements conveyed to the Commonwealth of Virginia in such Order and such Certificate.

The property herein conveyed, commonly known as the "Hockaday-Cypress Tract," is further described in its entirety on that certain plat of survey, entitled "BOUNDARY SURVEY OF A PORTION OF THE JOHN G. WARBURTON ESTATE, KNOWN AS THE HOCKADAY-CYPRESS TRACT," made by V. Monroe Mallory, of Dillard & Mallory, P.C., Certified Land Surveyors, Tappahannock, Virginia, dated October 25, 2001, recorded November 7, 2001, in the aforesaid Clerk's Office in James City County Plat Book 83, at Page 82, to which plat reference is made for a more complete description of such property.

Being a portion of the same property conveyed to John G. Warburton by Deed from C. H. Matthews and Mary Matthews, his wife, dated April 22, 1925, and recorded April 27, 1925, in the aforesaid Clerk's Office in James City County Deed Book 22, at Page 76, and by Deed from C. C. Hall and Beulah B. Hall, his wife, and T. C. Hall and Elsie G. Hall, his wife, dated March 18, 1952, and recorded April 3, 1952, in the aforesaid Clerk's Office in James City County Deed Book 47, at Page 183, the aforesaid John G. Warburton, having departed this life on October 15, 1966, and by his Last Will and Testament, dated February 3, 1964, and duly probated and recorded in the aforesaid Clerk's Office in City of Williamsburg Will Book 11, at Page 393, and duly recorded in the James City County probate records in Will File Number 374, devised such property to his daughters, Martha W. McMurran, and Sue Gregory Warburton Redd, subject to a life estate devised to Sarah Warburton, widow of John G. Warburton, who thereafter departed this life on September 25, 1991 (and whose Last Will and Testament, dated July 30, 1984, was duly probated and duly recorded in the aforesaid Clerk's Office in City of Williamsburg Will Book 45, at Page 18, and duly recorded in the James City County probate records in Will File Number 3234), leaving Martha W. McMurran and Sue Gregory Warburton Redd as the sole fee simple owners of such property, the said Sue Gregory Warburton Redd having conveyed her undivided one-half interest in and to such property to SWR-Hockaday, LLC, by Deed of Gift, dated February 24, 2003, and recorded March 3, 2003, in the aforesaid Clerk's Office as James City County Instrument Number 030006334, and by Deed of Correction, dated February 15, 2005, and recorded March 2, 2005, in the aforesaid Clerk's Office as James City County Instrument Number 050004430 and being the same property conveyed to Realtec, Incorporated, a North Carolina corporation, by Deed dated August 6, 2007, from Martha Warburton McMurran, widow and SWR-Hockaday, LLC, a Georgia limited liability company, and recorded in the said Clerk's Office as Instrument Number 070024542.

VIRGINIA: CITY OF WILLIAMSBURG & COUNTY OF JAMES CITY
This document was admitted to record on 16 July 08
at 2:47 AM/PM. The taxes imposed by Virginia Code
Section 58.1-801, 58.1-802 & 58.1-814 have been paid.

| STATE TAX | LOCAL TAX | ADDITIONAL TAX |
|---|---|---|
| $ — | $ — | $ — |

TESTE: BETSY B. WOOLRIDGE, CLERK

BY: Betsy B. Woolridge Clerk

# MASTER PLAN FOR REZONING OF THE VILLAGE

AT

FORD'S COLONY · WILLIAMSBURG ·

FOR

# REALTEC INCORPORATED

PROJECT TEAM

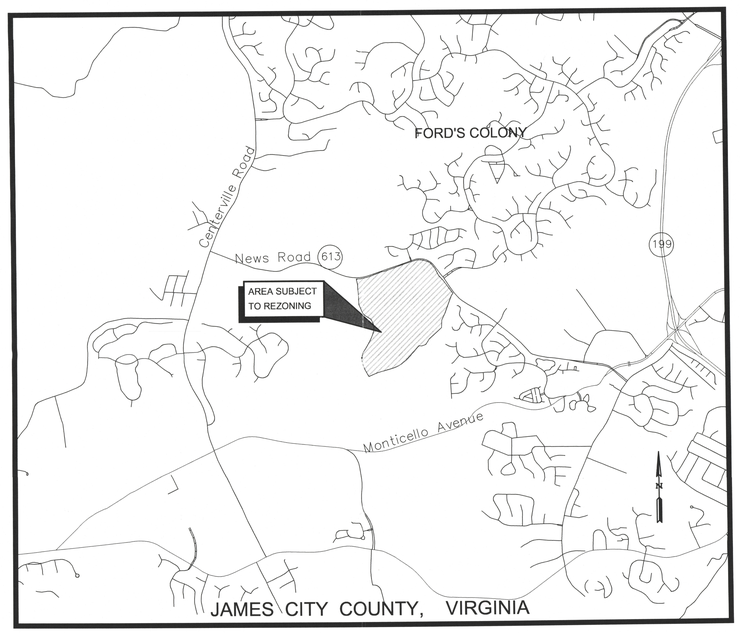
DEVELOPER: REALTEC INCORPORATED

LAND PLANNING: EDWARDS ASSOCIATES ARCHITECTS
MCBRIDE HESS DESIGN GROUP P.A.

ENVIRONMENTAL: CAHILL ASSOCIATES
KOONTZ-BRYANT, P.C.
KERR ENVIRONMENTAL SERVICES CORPORATION

TRAFFIC: DRW & ASSOCIATES

CIVIL CONSULTING: AES CONSULTING ENGINEERS




VICINITY MAP

(APROX. SCALE 1"=2000')

ORIGINALLY SUBMITTED: JULY 20, 2007
RESUBMITTED: APRIL 14, 2008
RESUBMITTED: MAY 20, 2008

JCC CASE # Z-0008-2007 / MP-0006-2007

INDEX OF SHEETS


| | |
|---|---|
| 1 | COVER SHEET |
| 2 | 2008 FORD'S COLONY MASTER PLAN |
| 3 | ENVIRONMENTAL INVENTORY |
| 4 | SECTION 37 LAND-USE MASTER PLAN |
| 5 | BINDING MASTER PLAN |
| 6 | MASTER UTILITY PLAN |
| 7 | MASTER STORMWATER MANAGEMENT PLAN |
| 8 | GRADING PLAN |


NOTE: THIS PROJECT LIES WITHIN THE POWHATAN CREEK WATERSHED OF THE JAMES RIVER. THE EASTERN HALF OF THE PROPERTY IS PART OF POWHATAN CREEK SUBWATERSHED 209 (COLD SPRING SWAMP) AND THE WESTERN HALF IS PART OF THE NON-TIDAL POWHATAN CREEK MAINSTEM.

FINAL VERSION OF CCRC MASTER PLAN
10/9/08

RECEIVED JUN 2008 Planning Department

MP-0006-2007 | Z-0008-2007


Edwards Associates architects

AES CONSULTING ENGINEERS
WILLIAMSBURG • RICHMOND • GLOUCESTER
5248 Olde Towne Road, Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994

Cahill Associates
ENVIRONMENTAL CONSULTANTS


Master Plan for Rezoning - The Village at Ford's Colony
JCC CASE # Z-0008-2007 / MP-0006-2007
AES Project # 5652-22

FORD'S COLONY · WILLIAMSBURG ·

## NON RESIDENTIAL AMENITY AND SERVICE SITES

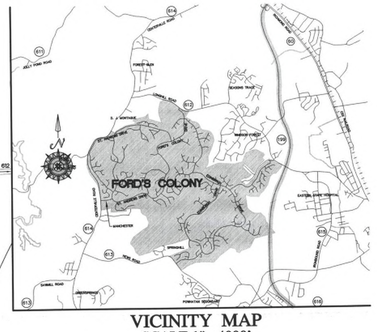
| | | |
|---|---|---|
| 1 | 100 HOTEL CONDOMINIUMS, EXECUTIVE MEETING FACILITIES AND GOLF ACADEMY | 4.71 AC. |
| 2 | GOLF CLUB AND PRO SHOP | 5.05 AC. |
| 3 | INFORMATION AND SALES CENTER | 1.81 AC. |
| 4 | ADMINISTRATIVE BUILDING | 3.50 AC. |
| 5 | PUBLIC SERVICE AREA * | 28.05 AC. |
| 6 | GOLF MAINTENANCE | 3.90 AC. |
| 7 | COMMUNITY CLUB | 7.72 AC. |
| 8 | PROJECT MAINTENANCE | 10.59 AC. |
| 9 | DRIVING RANGE/CART STORAGE | 10.34 AC. |
| 10 | ADDITIONAL RECREATION AREA | 6.36 AC. |
| 11 | ADDITIONAL PUBLIC SERVICE AREA | 6.76 AC. |
| 12 | CONTINUING CARE RETIREMENT COMMUNITY (CCRC) | 180.7 AC. |
| | TOTAL | 269.49 AC. |

* NOTE: 1.21 AC. PORTION OF ORIGINAL 30.0 AC. P.S.A. SOLD TO FORD'S COLONY

## LEGEND

- RESIDENTIAL "A"
- RESIDENTIAL "B"
- RESIDENTIAL "D"
- OPEN SPACE
- WILLIAMSBURG WEST SUBDIVISION AND APARTMENTS NOT A PORTION OF MASTER PLAN

NOTE:
VARIABLE WIDTH (25' MIN) BUFFER ALONG THE FORD'S COLONY TRACT WHERE IT ADJOINS CENTERVILLE ROAD SHALL BE RESERVED FOR FUTURE WIDENING AND REALIGNMENT OF S.R. 614




## VICINITY MAP
SCALE 1"= 4000'

## GENERAL NOTES:

1. RECORDATION OF THIS PLAN IS SOLELY FOR THE PURPOSE OF IDENTIFYING THE LAND COVERED BY THE PROFFERS RECORDED HEREWITH AND DOES NOT CONSTITUTE A PLAT OF SUBDIVISION NOR DOES IT DEDICATE TO PUBLIC OR PRIVATE USE ANY ROADS, COMMON AREAS, GREEN AREAS, OR RECREATION AREAS.
2. THE PROPERTY SHOWN ON THIS PLAN IS COVERED BY PROTECTIVE COVENANTS OF RECORD IN THE CLERK'S OFFICE IN THE COURTHOUSE OF JAMES CITY COUNTY, VIRGINIA, WHICH PROVIDE FOR THE MAINTENANCE OF COMMON OPEN SPACE, RECREATION AREAS, SIDEWALKS, PARKING, PRIVATE STREETS AND OTHER PRIVATELY OWNED, BUT COMMON FACILITIES SERVING THIS PROJECT.
3. LOTS NUMBERED REPRESENT RECORDED SECTIONS OR SECTIONS THAT HAVE RECEIVED PRELIMINARY APPROVAL.
4. THE 2008 MASTER PLAN AMENDMENT WILL BE CONSIDERED A STAND ALONE PROJECT FOR THE PURPOSES OF STORMWATER MANAGEMENT POINTS AND CREDITS.

## LAND USE TABULATION

| | 2008 | 2004 |
|---|---|---|
| **RESIDENTIAL "A"** | | |
| TOTAL NUMBER OF UNITS | 2,856 UNITS | 2,856 UNITS |
| GROSS AREA OF RESIDENTIAL "A" | 1,868.77± AC.=(63.09%) | 1,868.77± AC.=(67.19%) |
| PERMITTED DESTINY | 4.00 UNITS/ ACRE | 4.00 UNITS/ ACRE |
| UNIT DENSITY | 1.53 UNITS/ ACRE | 1.53 UNITS/ ACRE |
| **RESIDENTIAL "B"** | | |
| TOTAL NUMBER OF UNITS | 80 UNITS | 80 UNITS |
| GROSS AREA OF RESIDENTIAL "B" | 22.9± AC.=(0.77%) | 22.9± AC.=(0.79%) |
| PERMITTED DENSITY | 9.60 UNITS/ ACRE | 9.60 UNITS/ ACRE |
| UNIT DENSITY | 3.49 UNITS/ ACRE | 3.49 UNITS/ ACRE |
| **RESIDENTIAL "D"** | | |
| TOTAL NUMBER OF UNITS | 314 UNITS | 314 UNITS |
| GROSS AREA OF RESIDENTIAL "D" | 31.82 AC.=(1.07%) | 31.82 AC.=(1.14%) |
| PERMITTED DENSITY | 18.00 UNITS/ ACRE | 18.00 UNITS/ ACRE |
| UNIT DENSITY | 9.87 UNITS/ ACRE | 9.87 UNITS/ ACRE |
| **C.C.R.C. "B"** | | |
| TOTAL NUMBER OF UNITS | 38 UNITS | N/A |
| GROSS AREA OF C.C.R.C. "B" | 10.97± AC.=(0.37%) | N/A |
| PERMITTED DENSITY | 9.60 UNITS/ ACRE | N/A |
| UNIT DENSITY | 3.46 UNITS/ ACRE | N/A |
| **C.C.R.C. "D"** | | |
| TOTAL NUMBER OF UNITS | 558 UNITS | N/A |
| GROSS AREA OF C.C.R.C. "D" | 57.33 AC. =(1.94%) | N/A |
| PERMITTED DENSITY | 18.00 UNITS/ ACRE | N/A |
| UNIT DENSITY | 9.73 UNITS/ ACRE | N/A |
| **OPEN SPACE** | | |
| WITHIN NON-RESIDENTIAL AMENITY AND SERVICE SITES | 150.27 AC. | 39.27 AC. |
| * GOLF COURSE, LAKES AND BUFFERS, MARSH RESERVE | 844.71 AC. | 844.71 AC. |
| OPEN SPACE WITHIN RESIDENTIAL "A" | 514.12 AC. | 514.12 AC. |
| OPEN SPACE WITHIN RESIDENTIAL "B" & "D" | 38.77 AC. | 38.77 AC. |
| TOTAL AREA OF OPEN SPACE | 1,547.87 AC. | 1,436.87 AC. |
| TOTAL AREA OF PROJECT | 2,962.24 AC. | 2,781.49 AC. |
| % OF OPEN AREA | 52.3% | 51.7% |
| **OVERALL DENSITY** | | |
| TOTAL PROJECT AREA | 2,962.28 AC. | 2,781.49 AC. |
| TOTAL NUMBER OF RESIDENTIAL UNITS | 3846 UNITS | 3,250 UNITS |
| OVERALL PROJECT DENSITY | 1.30 UNITS/ AC. | 1.17 UNITS/ AC. |

| * NOTES | |
|---|---|
| MARSH RESERVES, LAKES AND BUFFERS | 278.12 AC. |
| GOLF COURSE (INCLUDES LAKES IN PLAY) | 491.09 AC |
| RESERVED FOR ROUTE 199 | 20.0 AC |
| ASSOCIATED GREENBELTS NATURAL OPEN SPACE IN 1993 ADDITION | 3.30 AC. |
| OPEN SPACE IN 1995 ADDITION | 5.00 AC. |
| OPEN SPACE IN 1998 ADDITION | 47.20 AC. |
| OPEN SPACE IN 2008 ADDITION | 111.0 AC. |

| No. | DATE | REVISION / COMMENT / NOTE | BY |
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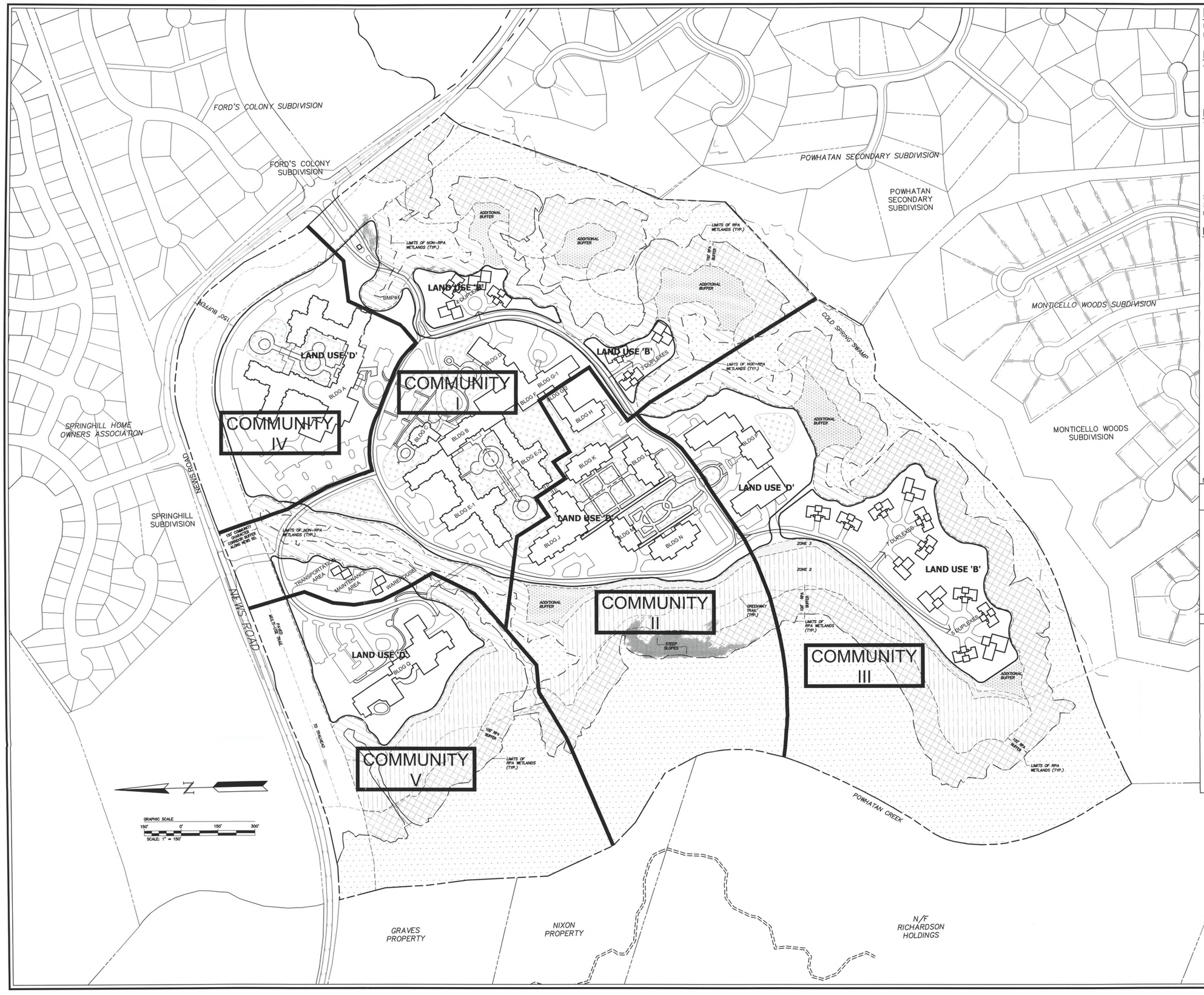
# 2008 LAND USE MASTER PLAN
# FORD'S COLONY
AT WILLIAMSBURG
OWNER / DEVELOPER : REALTEC, INCORPORATED
VIRGINIA
JAMES CITY COUNTY
POWHATAN DISTRICT

| Designed | Drawn |
|---|---|
| AES | AES |
| Scale | Date |
| 1"= 600' | 2/4/08 |
| Project No. | |
| 5652-70 | |
| Drawing No. | |
| 2 | |




# DEVELOPMENT TABULATIONS:

| | |
|---|---|
| PROPOSED ZONING (AND LAND USE DESIGNATION) | R-4 (B & D) |
| EXISTING ZONING: | R-8 |

## DENSITY TABULATIONS:

| | |
|---|---|
| GROSS ACREAGE: | 180.79 AC. +/- |
| LESS RPA WETLANDS: | 42.20 AC. +/- |
| LESS 25% SLOPES: | 1.4 AC. +/- |
| TOTAL NON-DEVELOPABLE AREA: | 43.60 AC. +/- (24.1% OF TOTAL PARCEL) |

## LAND-USE TABULATIONS:

| | |
|---|---|
| TOTAL PARCEL: | **180.79 AC. +/-** |
| LANDUSES B & D (1): | 68.30 AC. +/- |
| OPEN SPACE: | 112.49 AC. +/- |
| RPA WETLANDS: | 42.20 AC. +/- |
| NON-RPA WETLANDS | 9.23 AC. +/- |
| BUFFER AREAS (2): | 61.06 AC. +/- |

1. INCLUDES (±9 AC.) RECREATIONAL-AMENITY OPEN SPACE AREA.
2. BUFFER AREAS INCLUDE RPA BUFFER (22.00 AC.), ZONE 2 RIPARIAN BUFFER (11.87 AC.), ZONE 3 RIPARIAN BUFFER (1.77 AC.), NON-RPA BUFFER (9.96 AC.), COMMUNITY CHARACTER COORIDOR BUFFER (10.91 AC.) & ADDITIONAL BUFFERS (4.55 AC.).

## LEGEND:

- RPA WETLAND (42.20 AC. ±)
- NON-RPA WETLAND (9.23 AC. ±)
- RPA BUFFER (100') (22.00 AC. ±)
- ZONE 2 RIPARIAN BUFFER (11.87 AC. ±) (VARIABLE WIDTH)
- ZONE 3 RIPARIAN BUFFER (25') (1.77 AC. ±)
- NON-RPA BUFFER (50') (9.96 AC. ±)
- LAND USE "B" — LANDUSE BOUNDARIES (68.30 AC. ±)
- ADDITIONAL BUFFER (4.55 AC. ±)
- APPROX. LOCATIONS OF RECREATIONAL-AMENITY OPEN SPACE (9 AC. ±)
- SLOPES 25% OR GREATER
- VEHICULAR CIRCULATION
- PEDESTRIAN CIRCULATION

NOTE: 15 FT. BUILIDNG SETBACK TO RPA BUFFER ALONG COLD SPRING SWAMP.

| Land Use Density Chart | Max. # Units | Area Density | Max. Non-Residential Floor Space | Maximum Acreage |
|---|---|---|---|---|
| B - Townhomes | 38 | 0.17 Dwelling Units (du) per Acre | N/A | 180.8 Acres |
| D - Independent Living Units | 558 | 3.44 | N/A | |
| D - Commom Areas (1)<br>Dining Areas<br>Administration<br>Service/Loading Dock<br>Wellness Center<br>Other Amenities<br>Other Limited Commercial Uses (3) | | | 297,800 gsf | |
| D - Health Care Center (2)<br>Assisted Living<br>Skilled Nursing<br>Auxiliary Grant Program | 83 Rooms<br>60 Beds<br>2 Beds | N/A | N/A | |
| TOTALS: | 596 | 3.30 du / ac. | 297,800 gsf | 180.8 Acres |

Note (1): Exclusive of "Community Buildings" (identified as Building "C" on the Illustrative Masterplan).
Note (2): Health Care Center units not part of Land Use Density Tabulation.
Note (3): Limited commercial uses to include but not be limited to doctor's office, book store, pharmacy, deli, farmers market, craft store for use by residents only

## COMMUNITY BREAKDOWN

| | |
|---|---|
| COMMUNITY 1: | BUILDINGS B, C, D, E-1/E-2, F, G-1, 14 DUPLEXES, WAREHOUSE, STORAGE & EMPLOYEE PARKING<br>TOTAL INDEPENDENT LIVING UNITS = 230; TOTAL BEDS/ROOMS = 54 |
| COMMUNITY 2: | BUILDINGS G-2, H, J, K, L, M & N<br>TOTAL INDEPENDENT LIVING UNITS = 168; TOTAL BEDS/ROOMS = 54 |
| COMMUNITY 3: | BUILDING P, 24 DUPLEXES<br>TOTAL INDEPENDENT LIVING UNITS = 60; TOTAL BEDS/ROOMS = 0 |
| COMMUNITY 4: | BUILDING A<br>TOTAL INDEPENDENT LIVING UNITS = 138; TOTAL BEDS/ROOMS = 0 |
| COMMUNITY 5: | BUILDING Q<br>TOTAL INDEPENDENT LIVING UNITS = 0; TOTAL BEDS/ROOMS = 35 |

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at
FORD'S COLONY OF WILLIAMSBURG
for
REALTEC INCORPORATED

POWHATAN DISTRICT JAMES CITY COUNTY VIRGINIA

| | |
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| Designed AES | Drawn AES |
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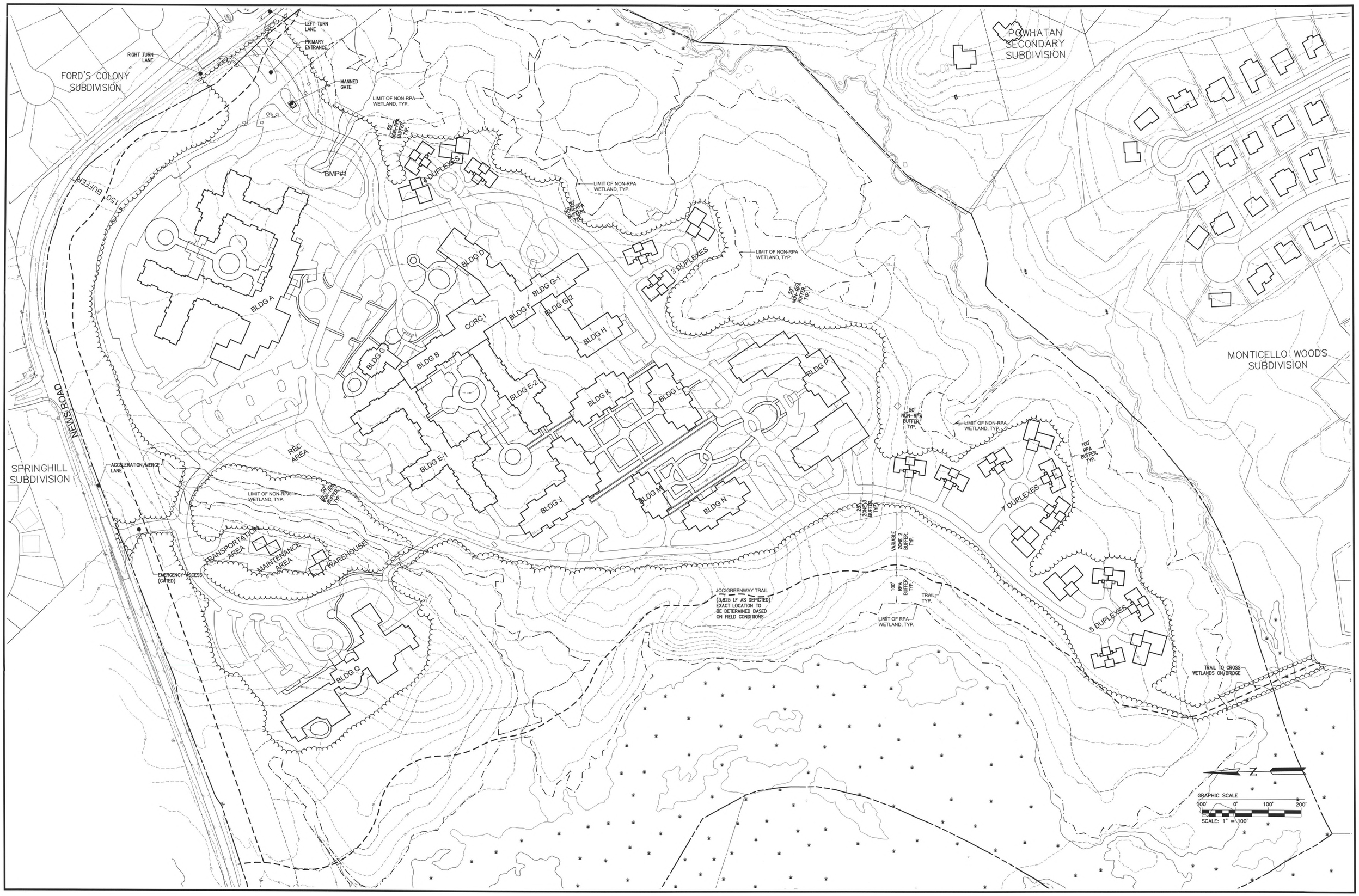
| Drawing No. 4 | |

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| AES | AES |
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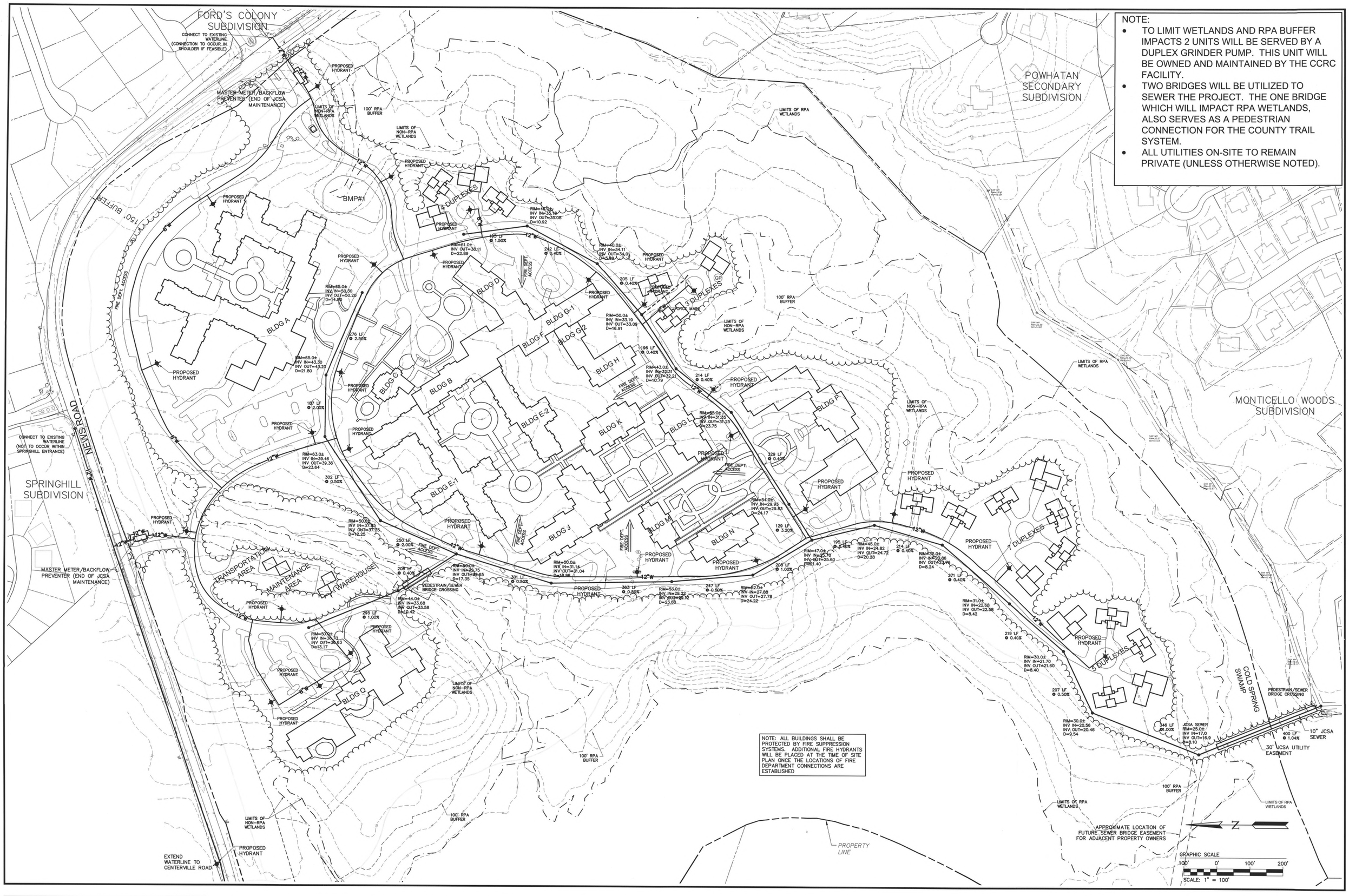
| 5652-22 | |
| Drawing No. | |
| 5 | |

NOTE:

- TO LIMIT WETLANDS AND RPA BUFFER IMPACTS 2 UNITS WILL BE SERVED BY A DUPLEX GRINDER PUMP. THIS UNIT WILL BE OWNED AND MAINTAINED BY THE CCRC FACILITY.
- TWO BRIDGES WILL BE UTILIZED TO SEWER THE PROJECT. THE ONE BRIDGE WHICH WILL IMPACT RPA WETLANDS, ALSO SERVES AS A PEDESTRIAN CONNECTION FOR THE COUNTY TRAIL SYSTEM.
- ALL UTILITIES ON-SITE TO REMAIN PRIVATE (UNLESS OTHERWISE NOTED).




NOTE: ALL BUILDINGS SHALL BE PROTECTED BY FIRE SUPPRESSION SYSTEMS. ADDITIONAL FIRE HYDRANTS WILL BE PLACED AT THE TIME OF SITE PLAN ONCE THE LOCATIONS OF FIRE DEPARTMENT CONNECTIONS ARE ESTABLISHED

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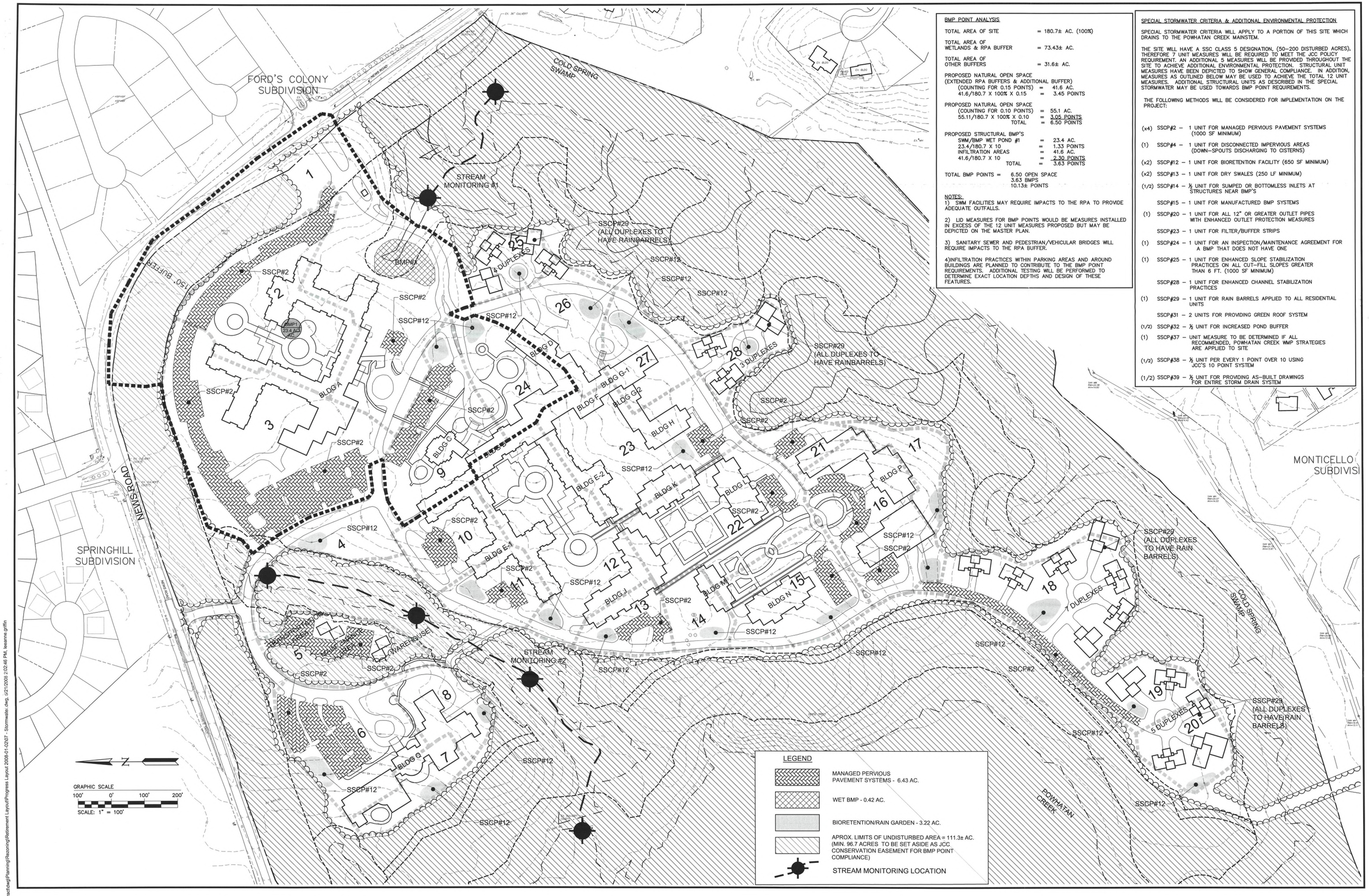
Project No. 5652-22

Drawing No. 6




BMP POINT ANALYSIS

TOTAL AREA OF SITE = 180.7± AC. (100%)

TOTAL AREA OF WETLANDS & RPA BUFFER = 73.43± AC.

TOTAL AREA OF OTHER BUFFERS = 31.6± AC.

PROPOSED NATURAL OPEN SPACE (EXTENDED RPA BUFFERS & ADDITIONAL BUFFER)
(COUNTING FOR 0.15 POINTS) = 41.6 AC.
41.6/180.7 X 100% X 0.15 = 3.45 POINTS

PROPOSED NATURAL OPEN SPACE
(COUNTING FOR 0.10 POINTS) = 55.1 AC.
55.11/180.7 X 100% X 0.10 = 3.05 POINTS
TOTAL = 6.50 POINTS

PROPOSED STRUCTURAL BMP'S
SWM/BMP WET POND #1 = 23.4 AC.
23.4/180.7 X 10 = 1.33 POINTS
INFILTRATION AREAS = 41.6 AC.
41.6/180.7 X 10 = 2.30 POINTS
TOTAL = 3.63 POINTS

TOTAL BMP POINTS = 6.50 OPEN SPACE
3.63 BMPS
10.13± POINTS

NOTES:
1) SWM FACILITIES MAY REQUIRE IMPACTS TO THE RPA TO PROVIDE ADEQUATE OUTFALLS.

2) LID MEASURES FOR BMP POINTS WOULD BE MEASURES INSTALLED IN EXCESS OF THE 12 UNIT MEASURES PROPOSED BUT MAY BE DEPICTED ON THE MASTER PLAN.

3) SANITARY SEWER AND PEDESTRIAN/VEHICULAR BRIDGES WILL REQUIRE IMPACTS TO THE RPA BUFFER.

4)INFILTRATION PRACTICES WITHIN PARKING AREAS AND AROUND BUILDINGS ARE PLANNED TO CONTRIBUTE TO THE BMP POINT REQUIREMENTS. ADDITIONAL TESTING WILL BE PERFORMED TO DETERMINE EXACT LOCATION DEPTHS AND DESIGN OF THESE FEATURES.

SPECIAL STORMWATER CRITERIA & ADDITIONAL ENVIRONMENTAL PROTECTION

SPECIAL STORMWATER CRITERIA WILL APPLY TO A PORTION OF THIS SITE WHICH DRAINS TO THE POWHATAN CREEK MAINSTEM.

THE SITE WILL HAVE A SSC CLASS 5 DESIGNATION, (50–200 DISTURBED ACRES), THEREFORE 7 UNIT MEASURES WILL BE REQUIRED TO MEET THE JCC POLICY REQUIREMENT. AN ADDITIONAL 5 MEASURES WILL BE PROVIDED THROUGHOUT THE SITE TO ACHIEVE ADDITIONAL ENVIRONMENTAL PROTECTION. STRUCTURAL UNIT MEASURES HAVE BEEN DEPICTED TO SHOW GENERAL COMPLIANCE. IN ADDITION, MEASURES AS OUTLINED BELOW MAY BE USED TO ACHIEVE THE TOTAL 12 UNIT MEASURES. ADDITIONAL STRUCTURAL UNITS AS DESCRIBED IN THE SPECIAL STORMWATER MAY BE USED TOWARDS BMP POINT REQUIREMENTS.

THE FOLLOWING METHODS WILL BE CONSIDERED FOR IMPLEMENTATION ON THE PROJECT:

(x4) SSCP#2 – 1 UNIT FOR MANAGED PERVIOUS PAVEMENT SYSTEMS (1000 SF MINIMUM)

(1) SSCP#4 – 1 UNIT FOR DISCONNECTED IMPERVIOUS AREAS (DOWN–SPOUTS DISCHARGING TO CISTERNS)

(x2) SSCP#12 – 1 UNIT FOR BIORETENTION FACILITY (650 SF MINIMUM)

(x2) SSCP#13 – 1 UNIT FOR DRY SWALES (250 LF MINIMUM)

(1/2) SSCP#14 – ½ UNIT FOR SUMPED OR BOTTOMLESS INLETS AT STRUCTURES NEAR BMP'S

SSCP#15 – 1 UNIT FOR MANUFACTURED BMP SYSTEMS

(1) SSCP#20 – 1 UNIT FOR ALL 12" OR GREATER OUTLET PIPES WITH ENHANCED OUTLET PROTECTION MEASURES

SSCP#23 – 1 UNIT FOR FILTER/BUFFER STRIPS

(1) SSCP#24 – 1 UNIT FOR AN INSPECTION/MAINTENANCE AGREEMENT FOR A BMP THAT DOES NOT HAVE ONE

(1) SSCP#25 – 1 UNIT FOR ENHANCED SLOPE STABILIZATION PRACTICES ON ALL CUT–FILL SLOPES GREATER THAN 6 FT. (1000 SF MINIMUM)

SSCP#28 – 1 UNIT FOR ENHANCED CHANNEL STABILIZATION PRACTICES

(1) SSCP#29 – 1 UNIT FOR RAIN BARRELS APPLIED TO ALL RESIDENTIAL UNITS

SSCP#31 – 2 UNITS FOR PROVIDING GREEN ROOF SYSTEM

(1/2) SSCP#32 – ½ UNIT FOR INCREASED POND BUFFER

(1) SSCP#37 – UNIT MEASURE TO BE DETERMINED IF ALL RECOMMENDED, POWHATAN CREEK WMP STRATEGIES ARE APPLIED TO SITE

(1/2) SSCP#38 – ½ UNIT PER EVERY 1 POINT OVER 10 USING JCC'S 10 POINT SYSTEM

(1/2) SSCP#39 – ½ UNIT FOR PROVIDING AS–BUILT DRAWINGS FOR ENTIRE STORM DRAIN SYSTEM

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POWHATAN DISTRICT JAMES CITY COUNTY VIRGINIA

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Project No. 5652–22
Drawing No. 7

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FORD'S COLONY SUBDIVISION

POWHATAN SECONDARY SUBDIVISION

MONTICELLO WOODS SUBDIVISION

SPRINGHILL SUBDIVISION

NEWS ROAD

150' BUFFER

BMP#1

BLDG A

BLDG B

BLDG C

BLDG D

BLDG E

BLDG E-2

BLDG F

BLDG G

BLDG G-2

BLDG H

BLDG J

BLDG K

BLDG L

BLDG M

BLDG N

BLDG P

BLDG Q

4 DUPLEXES

3 DUPLEXES

7 DUPLEXES

5 DUPLEXES

RETAINING WALL

RETAINING WALL

TRANSPORTATION AREA

MAINTENANCE AREA

WAREHOUSE

GRAPHIC SCALE

100' 0' 100' 200'

SCALE: 1" = 100'

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| AES | AES |
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Project No. 5652-22

Drawing No. 8

Version FY2022
(Last Updated 7/19/2021)

**Please use the accompanying Excel spreadsheet to calculate the numbers below.**

# FISCAL IMPACT WORKSHEET AND ASSUMPTIONS

Please complete all *applicable* sections. Please use the provided spreadsheet to perform calculations. If space provided is insufficient, please feel free to include additional pages. If you have any questions please contact the Planning Office at 757-253-6685 or planning@jamescitycountyva.gov

1a) PROPOSAL NAME: Ford's Village

1b) Does this project propose residential units? Yes x☐ No☐ (if no, skip Sec. 2)

1c) Does this project include commercial or industrial uses? Yes ☒ No☐ (If no skip Sec. 3)

**Fiscal Impact Worksheet Section 2: Residential Developments**

2a) TOTAL NEW DWELLING UNITS. Please indicate the total number of each type of proposed dwelling unit. Then, *add* the total number of new dwelling units.

| | | | |
|---|---|---|---|
| Single-Family Detached | 158 | Apartment | 75 |
| Townhome/Condominium/Single-Family | 128 | Manufactured Home | 0 |
| Total Dwelling Units | 361 | | |

Are any units affordable? Yes ☐ No ☐ (If yes, how many?)_____

**Residential Expenses – School Expenses**

2b) TOTAL NEW STUDENTS GENERATED. *Multiply* the number of each type of proposed unit from (2a) its corresponding Student Generation Rate below. Then, *add* the total number of students generated by the proposal.

| Unit Type | Number of Proposed Units (from 2a) | Student Generation Rate | Students Generated |
|---|---|---|---|
| Single-Family Detached | 184 | 0.4 | 73.6 |
| Townhome/Condo/Attached | 102 | 0.17 | 17.34 |
| Apartment | 75 | 0.31 | 23.25 |

| | | | |
|---|---|---|---|
| Manufactured Home | | 0.46 | |
| Total | | | 114.19 |

2c) TOTAL SCHOOL EXPENSES. *Multiply* the total number of students generated from (2b) by the Per-Student Total Expenses below.

| **Total Students Generated** | Per-Student Operating Expenses | Per-Student Capital Expenses | **Per-Student Total Expenses** | **Total School Expenses** |
|---|---|---|---|---|
| 114.19 | *$8,762.38* | *$1,948.32* | ***$10,710.70*** | $1,223,054 |

**Residential Expenses - Non-School Expenses**

2d) TOTAL POPULATION GENERATED. *Multiply* the number of proposed units from (2a) and multiply by the Average Household Size number below.

| **Total Units Proposed** | **Average Household Size** | **Total Population Generated** |
|---|---|---|
| 361 | **2.49** | 612.5 |

2e) TOTAL NON-SCHOOL EXPENSES. *Multiply* the population generated from (2d) by the Per Capita Non-School Expenses below.

| **Total Population Generated** | **Per-Capita Non-School Expenses** | **Total Non-School Expenses** |
|---|---|---|
| 612.5 | ***$680.24*** | $ 416,647.00 |

2f) TOTAL RESIDENTIAL EXPENSES. *Add* school expenses from (2c) and non-school expenses (2e) to determine total residential expenses.

| **Total School Expenses** | **Non-School Expenses** | **Total Residential Expenses** |
|---|---|---|
| $ 1,223,055 | $ 416,647.00 | $ 1,639,701.83 |

**Residential Revenues**

2g) TOTAL REAL ESTATE EXPECTED MARKET VALUE. Write the number of each type of units proposed from (2a). Then *determine the average* expected market value for each type of unit. Then, *multiply* the number of unit proposed by their average expected market value. Finally, *add* the total expected market value of the proposed units.

| **Unit Type:** | **Number of Units:** | **Average Expected Market Value:** | **Total Expected Market Value:** |
|---|---|---|---|
| Single-Family Detached | 158 | $ 730,000 | $ 115,340,000 |
| Townhome/Condo/Multi-family | 128 | $ 568,164 | $ 72,725,000 |

| | | | |
|---|---|---|---|
| Apartments | 75 | $ 200,000 | $ 15,000,000 |
| Total: | 0 | N/A | $ 203,065,000 |

2h) TOTAL REAL ESTATE TAXES PAID. *Multiply* the total market value from (2g) by the real estate tax rate blow.

| Total Market Value | Real Estate Tax Rate | Total Real Estate Taxes Paid |
|---|---|---|
| $ 203,065,000 | **.0084** | $ 1,705,746 |

2i) TOTAL PERSONAL PROPERTY TAXES PAID. *Multiply* the total real estate taxes paid (2h) by the property tax average below.

| Real Estate Tax Paid | Personal Property Tax Average | Personal Property Taxes Paid |
|---|---|---|
| $ 1,705,746 | **0.15** | $ 255,862 |

2j) TOTAL SALES & MEALS TAXES PAID. *Multiply* the total real estate taxes paid (2h) by the sales and meals tax average below:

| Real Estate Tax Paid | Sales and Meals Tax Average | Total Sales & Meals Taxes Paid |
|---|---|---|
| $ 1,705,746 | **.09** | $ 153,517 |

2k) TOTAL CONSERVATION EASEMENT TAXES PAID. If the proposal contains a conservation easement, *multiply* the size of the proposed conservation easement by the conservation easement assessment rate.

| Proposed Conservation Easement Size | Assessment Rate | Conservation Easement Taxes Paid |
|---|---|---|
| 0 | **$2000/acre** (prorated) | 0 |

2l) TOTAL HOA TAXES PAID. If the HOA will own any property that will be rented to non- HOA members, *multiply* the expected assessed value of those rentable facilities by the real estate tax rate below.

| HOA Property Type | Total Assessed Value | Real Estate Tax Rate | Total HOA Taxes Paid |
|---|---|---|---|
| 0 | 0 | **.0084** | $ 0 |

2m) TOTAL RESIDENTIAL REVENUES. *Add* all residential taxes paid to the County from (2h) through (2l).

| | |
|---|---|
| **Total Residential Revenues** | **$2,115,125** |

2n) RESIDENTIAL FISCAL IMPACT. Subtract total residential revenues (2m) from total residential expenses (2f).

| Total Residential Ex | Total Residential Revenues | Total Residential Fiscal Impact |
|---|---|---|
| $ 1,575,652 | $ 2,115,125 | $ 539,473 |

**Fiscal Impact Analysis Worksheet Section 3: Commercial and Industrial Developments**

**Commercial and Industrial Expenses**

3a) TOTAL NEW BUSINESSES. How many new businesses are proposed? _____
(Include all businesses that will rent or lease space at the location as part of the proposal, including probable tenants of an office park or strip mall).

3b) TOTAL COMMERCIAL EXPENSES. *Multiply* the total business real estate expected assessment value from (3c) below by the Commercial Expenses Rate below.

| Total Expected Assessment Value | Commercial Expense Rate | Total Commercial Expenses |
|---|---|---|
| **$30,000,000** | **0.00468** | **$** 140,400 |

**Commercial & Industrial Revenues**

3c) TOTAL REAL ESTATE EXPECTED ASSESSMENT VALUE. E*stimate* the expected real estate assessment value, at buildout, of all proposed commercial element properties below.

| Proposed Business Properties (by use and location) | Expected Assessment Value |
|---|---|
| Elder Care | $ 30,000,000 |
| | |
| | |
| | |
| Total: | $ 30,000,000 |

3d) TOTAL REAL ESTATE TAXES PAID. *Multiply* the total expected market property value from (3c) by the real estate tax rate below.

| Expected Market Value | Real Estate Tax Rate | Real Estate Taxes Paid |
|---|---|---|
| 30,000,000 | **.0084** | $ 252,000 |

3e) TOTAL BUSINESS PERSONAL PROPERTY TAXES PAID. *Multiply* the total business capitalization for each proposed commercial element by the business personal property tax rate below. Then *add* the total personal property taxes paid.

| Proposed Business Name | Total Business Capitalization | Personal Property Tax Rate | Total Business Property Taxes Paid |
|---|---|---|---|
| Elder Care | $2,500,000 | .001 | $25,000.00 |
| | | | |
| | | | |
| Total: | | | $25,000 |

3f) TOTAL BUSINESS MACHINERY AND TOOLS TAXES PAID. If any manufacturing is proposed, *multiply* the total business capitalization for each proposed manufacturing element by the business machinery and tools tax rate below. Then, *add* the machinery and tools tax paid.

| Proposed Business Name | Total Business Capitalization | Machinery and Tools Tax Rate | Total Business Property Taxes Paid |
|---|---|---|---|
| | | **0.01** | |
| | | **0.01** | |
| Total: | | N/A | |

3g) TOTAL SALES TAXES PAID. *Estimate* the applicable total gross retail sales, prepared meals sales, and hotel/motel room sales for proposal's commercial elements below. Then, *multiply* the projected commercial gross sales by the applicable sales tax rates. Then, *add* the total sales taxes paid.

| Tax Type | Projected Gross Sales | Sales Tax Rates | Sales Taxes Paid |
|---|---|---|---|
| | | **0.015 of Gross Retail Sales** | |
| Food Services | 500,000 | **0.04 of Prepared Sales** | $22,000.00 |
| | | **0.02 of Gross Sales*** | |
| Total: | **N/A** | **N/A** | $ 22,000.00 |

*Actual Occupancy Tax is 5% of Gross Sales; however, 60% of those funds are targeted to tourism.

3h) TOTAL BUSINESS LICENSES FEES PAID. Estimate each business element's total gross sales. Multiply each business element's projected gross sales by the Annual Business License rate to determine annual business licenses fee paid.

| Proposed Business Name(s) | Business Type* (see exhibit sheet) | Projected Total Gross Sales | Business License Rate | Annual Business License Fees Paid |
|---|---|---|---|---|
| | Professional Services | 10,500,000 | **0.0058** | $ 60,900 |

| | | | | |
|---|---|---|---|---|
| | Retail Services | 0 | **0.0020** | |
| | Other Services | 500,000.00 | **0.0036** | $1,800.00 |
| | Total | N/A | N/A | $ 62,700.00 |

3i) TOTAL COMMERCIAL AND INDUSTRIAL REVENUES. *Add* the total taxes and fees paid by all of the business elements from (3d) through (3h).

| | |
|---|---|
| **Total Commercial and Industrial Revenues** | $ 361,700.00 |

3j) COMMERCIAL FISCAL IMPACT. *Subtract* total commercial and industrial revenues (3i) from total commercial and industrial expenses (3b).

| Total Commercial | Total Commercial Revenues | Total Commercial Fiscal Impact |
|---|---|---|
| | | 221,300.00 |

3k) TOTAL PROPOSED FISCAL IMPACT. *Add* residential fiscal impacts (2n) and commercial fiscal impacts (3j).

| Residential Fiscal Impact | Commercial Fiscal Impact | Total Proposed Fiscal Impact |
|---|---|---|
| $ 539,473 | $ 221,300 | $ 727,922 |

**Fiscal Impact Analysis Worksheet Section 4: Current Land Use**

**Current Residential Use** (If there are no existing residential units, skip to (4g)).

4a) TOTAL CURRENT DWELLING UNITS. Please indicate the total number of each type of existing dwelling unit. Then, *add* the total number of existing dwelling units.

| | | | |
|---|---|---|---|
| Single-Family Detached | 1 | Apartment | |
| Townhome/Condominium/Single-Family Attached | | Manufactured Home | |
| Total Dwelling Units | 1 | | |

**Residential Expenses - School Expenses**

4b) TOTAL CURRENT STUDENTS. *Multiply* the number of existing units from (4a) by its corresponding Student Generation Rate below. Then, *add* the total number of existing students.

| Unit Type | Number of Existing Units | Student Generation Rate | Existing Students |
|---|---|---|---|
| Single-Family Detached | 0.4 | 0.4 | 0.4 |
| Townhome/Condo/Attached | 0 | 0.17 | |
| Apartment | 0 | 0.31 | |
| Manufactured Home | 0 | 0.46 | |

| | | | |
|---|---|---|---|
| Total | | **N/A** | 0.4 |

4c) TOTAL CURRENT SCHOOL EXPENSES. *Multiply* the total number of current students from (4b) by the per-student school cost below.

| Number of Existing Students | Per-Student School Cost | Current School Expenses |
|---|---|---|
| 0.4 | ***$11,828*** | $ 4,731.20 |

**Residential Expenses - Non-School Expenses**

4d) TOTAL CURRENT POPULATION. *Multiply* the total number of existing units from (4a) by average household size below.

| Total Existing Units | Average Household Size | Total Current Population |
|---|---|---|
| 0 | **2.45** | |

4e) TOTAL CURRENT NON-SCHOOL EXPENSES. *Multiply* the current population from (4d) by per-capita non-school expenses below.

| Total Current Population | Per-Capita Non-School Expenses | Current Non-School Expenses |
|---|---|---|
| | ***$1,284.00*** | |

4f) TOTAL RESIDENTIAL EXPENSES. *Add* school expenses from (4c) and non-school expenses from (4e).

| School Expenses | Non-School Expenses | Residential Expenses |
|---|---|---|
| $ | $ 3145.80 | |

**Residential Revenues**

4g) TOTAL CURRENT ASSESSMENT VALUE. *Search* for each residential property included in the proposal on the Parcel Viewer at http://property.jccegov.com/parcelviewer/Search.aspx . *Indicate* each property's total assessment value below. Then, *add* total assessment values.

| Property Address and Description | Assessment Value |
|---|---|
| 3889 News Road | $ 3,153,900.00 |
| | |
| | |
| Total: | $ 3,153,900.00 |

4h) TOTAL CURRENT REAL ESTATE TAXES PAID. *Multiply* the total assessment value from (4g) by the real estate tax rate below.

| Total Assessment Value | Real Estate Tax Rate | Real Estate Taxes Paid |
|---|---|---|
| 3,153,900.00 | **.0084** | $ 26,493 |

4i) TOTAL CURRENT PERSONAL PROPERTY TAXES PAID. *Multiply* total real estate taxes paid from (4h) by the personal property tax average below.

| Real Estate Tax Paid | Personal Property Tax Average | Personal Property Paid |
|---|---|---|
| $26,492 | **0.15** | $3,974 |

4j) TOTAL CURRENT SALES AND MEALS TAXES PAID. *Multiply* the total real estate taxes paid from (4h) by the sales and meals tax average below.

| Real Estate Tax Paid | Sales and Meals Tax Average | Average Excise Tax Paid |
|---|---|---|
| $26,492 | **.09** | $ 2,384 |

4k) TOTAL CURRENT RESIDENTIAL REVENUES. *Add* all current residential taxes paid to the County from (4h) through (4j).

| | |
|---|---|
| **Total Current Residential Revenues** | $ 32,851 |

4l) CURRENT RESIDENTIAL FISCAL IMPACT. *Subtract* total residential revenues (4k) from total residential expenses (4f).

| Total Residential | Total Residential Revenues | Total Residential Fiscal Impact |
|---|---|---|
| $32,851 | | $32,851 |

4m) FINAL RESIDENTIAL FISCAL IMPACT. *Subtract* current residential fiscal impact from (4l) from proposed residential fiscal impact from (2n).

| Proposed Residential Impact | Current Residential Impact | Final Residential Fiscal Impact |
|---|---|---|
| $539,473 | $32,851 | $ 506,622 |

**Current Commercial Use**

**Current Commercial Expenses** (if there are no current businesses or commercial properties, skip to (5k).

5a) TOTAL CURRENT BUSINESSES. How many businesses exist on the proposal properties? 0 (Include all businesses that rent or lease space at the location).

5b) TOTAL CURRENT COMMERCIAL EXPENSES. *Multiply* the current number of businesses operating on the proposal properties by the per-business expense rate below.

| Total Expected Assessment Value | Commercial Expense Rate | Total Commercial Expenses |
|---|---|---|
| | **0.00468** | $ |

**Current Commercial Revenues**

5c) TOTAL CURRENT ASSESSMENT VALUE. *Search* for each commercial property included in the proposal on the Parcel Viewer at http://property.jccegov.com/parcelviewer/Search.aspx . *Indicate* each property's total assessment value below. Then, *add* total assessment values.

| Addresses | Assessment Value | Real Estate Tax Rate | Real Estate Tax Paid |
|---|---|---|---|
| | | **.0084** | |
| | | **.0084** | |
| Total: | | | $ |

5d) TOTAL CURRENT BUSINESS PERSONAL PROPERTY TAXES PAID. *Multiply* the total business capitalization for each current commercial element by the business personal property tax rate below. Then *add* the total personal property taxes paid.

| Current Business | Total Business | Personal Property Tax Rate | Business Property Taxes Paid |
|---|---|---|---|
| | | **0.01** | |
| | | **0.01** | |
| | | **0.01** | |
| Total: | | N/A | $ |

5e) TOTAL CURRENT MACHINERY AND TOOLS TAX PAID. If any manufacturing exists, *multiply* the total capitalization for manufacturing equipment by the business machinery and tools tax rate below.

| Current Business | Total Business Capitalization | Personal Property Tax Rate | Machinery and Tools Tax Paid |
|---|---|---|---|
| 0 | | **0.01** | $ 0 |

5f) TOTAL CURRENT SALES TAXES PAID. *Estimate* the applicable total gross retail sales, prepared meals sales, and hotel/motel sales for existing commercial elements below. Then, *multiply* the projected commercial gross sales by the applicable sales tax rates. Then, *add* the total sales taxes paid.

| Activity | Projected Gross Sales | Tax Rate | Sales Taxes Paid |
|---|---|---|---|
| Retail Sales | 0 | **0.01 of Gross Retail Sales** | 0 |
| Prepared Meals | 0 | **0.04 of Prepared Sales** | 0 |
| Hotel, Motel | 0 | **0.02 of Gross Sales*** | 0 |
| Total: | **N/A** | **N/A** | $ 0 |

*Actual Occupancy Tax is 5% of Gross Sales; however, 60% of those funds are targeted to tourism.

5g) TOTAL CURRENT BUSINESS LICENSES FEES PAID. *Estimate* each current business element's total gross sales. Then, *multiply* each business element's projected gross sales by the Annual Business License rate to determine annual business licenses fee paid. Then, *add* the total business license fees paid.

| Business Type | Gross Sales | Business License Rate | Annual Business License Fees Paid |
|---|---|---|---|
| Professional Services | 0 | **$0.0058** | |
| Retail Sales | 0 | **$0.0020** | |
| Contractors | 0 | **$0.0016** | |
| Wholesalers | 0 | **$0.0005** | |
| Manufacturers | 0 | **No tax** | |
| Other Services | 0 | **$0.0036** | |
| | | | |

5h) TOTAL CURRENT COMMERCIAL REVENUES. *Add* all current commercial revenues paid by existing businesses from (5c) through (5g).

| **Total Current Commercial Revenues** | $ 0.00 |
|---|---|

5i) CURRENT COMMERCIAL FISCAL IMPACT. *Subtract* total commercial revenues (5h) from total residential expenses (5b).

| Total Commercial Expenses | Total Commercial Revenues | Total Commercial Fiscal Impact |
|---|---|---|
| | | $ 0.00 |

5j) FINAL COMMERCIAL FISCAL IMPACT. *Subtract* current commercial fiscal impact from (5i) from proposed commercial fiscal impact from (3j).

| Proposed Commercial Impact | Current Commercial Impact | Final Commercial Fiscal Impact |
|---|---|---|
| $221,300 | 0 | $221,300 |

5k) FINAL FISCAL IMPACT. *Subtract* the final commercial fiscal impact from (5i) from final residential fiscal impact from (4m).

| Final Residential Impact | Final Commercial Impact | Final Fiscal Impact |
|---|---|---|
| $ 506,622 | $221,300 | $ 727,922 |

**Fiscal Impact Worksheet Section 6: Phasing**

**Residential Phasing**

6a) Copy *and paste* the residential phasing template from the accompanying Excel sheet to the page below.

**Commercial Phasing**

6b) *Copy* and *paste* the commercial phasing template from the accompanying Excel sheet to the page below.

**Final Phasing Projections**

6c) *Copy* and *paste* the final phasing projection from the accompanying Excel sheet to the page below.

**Fiscal Impact Worksheet Section 7: Employment**

7a) *Copy and paste* the employment projections from the accompanying Excel sheet to the page below.

## DEFINITIONS AND ASSUMPTIONS

**Apartment** – A building used, or intended to be used as the residence of three or more families living independently of each other. Tenants have no equity in the dwelling.

**Assessment Value –** Assessment value is assumed to be within 1% of market value. Market value drives assessment value.

**Buildout** – All data and assumptions reflect the fiscal impact of the proposal at buildout.

**Commercial Expense Rate** – The commercial expense rate uses the proportional valuation method to determine individual business expenses. Under that method businesses are collectively responsible for impact related to the commercial property valuation.

This rate assumes that the costs of providing County services to a business are directly correlated with that business's property assessment. This assumes more valuable properties have generally more intense uses incurring greater County expenses.

**Condominium** – A building, or group of buildings, in which units are owned individually and the structure, common areas and common facilities are owned by all the owners on a proportional, undivided basis.

**Contractor** – Any person, firm or corporation accepting or offering to accept orders or contracts for doing any work on or in any building or structure, any paving, curbing or other work on sidewalks, streets, alleys or highways, any excavation of earth, rock or other materials, any construction of sewers and any installation of interior building components.

**Direct Impact** – The worksheet only calculates direct financial impacts on the County budget. The worksheet is only one of many development management tools and as such, does not make a determination whether any type of development "should" happen based solely on that proposal's fiscal impact. The tool is not designed to measure non-budget impacts, such as increased traffic or nonbudget benefits, such as forwarding the goals of the Comprehensive Plan. Costs incurred by other entities, such as other localities or the state, remain uncounted.

**Dwelling** – Any structure which is designed for use for residential purposes, except hotels, motels, boardinghouses, lodging houses and tourist cabins.

**Exempt** – Certain types of business activities or products are exempted from annual County business licenses. These include manufacturers, insurance agencies, apartment complexes and gasoline sales.

**Fees & Licenses** – All fees collected by the County, including business and professional licenses, planning fees, building permit fees, stormwater fees, environmental inspection fees, septic tank fees, dog licenses and motor vehicle licenses, are deducted from the per-capita and per-business budgetary costs of each department that collects them.

**Fiscal Impact Analysis** – The County has created a set of standardized data and assumptions to streamline both the creation and review of fiscal impact studies. The County had no itemized list of questions for fiscal impact study creators to answer, resulting in portions of fiscal impact studies with no bearing on the County's budgetary bottom line. The guesswork is removed from the creation of these documents. The data used by fiscal impact study authors also came from myriad sources, often within the County, which were difficult to verify. The fiscal impact worksheet allows consistency across multiple fiscal impact studies.

**Fiscal Impact Worksheet** – The worksheet helps the applicant present relevant data to the County, using data verified by the County. The worksheet provides consistency across all fiscal impact analyses.

**Non-School Expenses** – Non-school expenses include all non-school budget spending. Non-school expenses are calculated using the Proportional Variation method. Using the Proportional Variation method, residents and businesses are assumed to be responsible for differing percentages of the County's non-school spending.

**Manufacturing** – Assembly of components, pieces, or subassemblies, or the process of converting raw, unfinished materials into different products, substances or purposes.

**Market Value** – Market value is assumed to be within 1% of assessment value. Market value drives assessment value.

**Manufactured Home** – A manufactured home is a structure not meeting the specifications or requirements or a manufactured home, designed for transportation after fabrication. The only manufactured homes counted in the Student Generation figure are those in designated manufactured home parks. Manufactured homes on individual lots are indistinguishable from single-family detached dwellings for the purposes of the worksheet.

**Phasing** – All residential developments are assumed to have an absorption rate of 20% per annum. All commercial development are assumed to have an absorption rate of 20% per annum. The date stamp Year 1 in the phasing template represents 365 days after the Board of Supervisors approval.

**Professional Services** – Work performed by an independent contractor within the scope of the practice of accounting, actuarial services, architecture, land surveying, landscape architecture, law, dentistry, medicine, optometry, pharmacy or professional engineering. Professional services shall also include the services of an economist procured by the State Corporation Commission.

**Proportional Valuation Impact** – Proportional valuation impact assumes that a proposed residential or commercial project's fiscal impact is proportional to the percentage of the total tax base that is either residential or commercial. James City's proportional valuation is calculated using the County's Real Estate Mapping GIS program.

Furthermore, individual business expenses to the County are calculated using the proportional valuation impact method. (See Commercial Expense Rate)

**Per-Business Expense Rate** – The per-business expense rate assumes that the County incurs non-school expenses equal to 0.04% of the commercial real estate assessment of any given business.

**Per Capita Evaluation Method** – This worksheet uses the Per Capita Evaluation method to assign per-capita and per-business costs to non-school expenses. This method assumes that current per-capita and per-business expenditures and service levels are consistent with future per-capita and per-business expenditures and service levels.

**Per Capita** – Per capita calculations divide each department's spending, minus fees and state contributions, by the current County population. This number excludes institutional residents in detention at correctional facilities and mental institutions. Total population is determined from James City County Planning Division figures.

**Per Student** – Per student calculations divide County contributions to WJCC Schools by the total number of K-12 students living in James City and also attending WJCC Schools. Total students are determined from Williamsburg-James City County Schools enrollment reports.

**Per Business** – Per business calculations divide each departments spending, minus fees and state contributions, by the total number of County businesses. Total businesses are determined by the number of business licenses issued.

| | |
|---|---|
| **Total Number of JCC Businesses** | **5490*** |
| **Percentage of Property Tax Assessments** | **13%**** |

*James City County Commissioner of the Revenue

**Commercial impacts are calculated on a proportional variation process

**Proffer** – Proffers paid for schools can only be applied toward the capital expense portion of per-student school expenses. (See Board of Supervisors' Proffer Policy.)

**Retail Services** – Display and sale of merchandise at retail or the rendering of personal services, such as food, drugs, clothing, furniture, hardware, appliances, barber and beauty, antiques, and household uses and other uses.

**Single-Family Detached Dwelling –** A detached structure arranged or designed to be occupied by one family, the structure only having one dwelling unit.

**State Contributions** – The state contributes both targeted and unspecified funds to the James City County budget.

**Student Generation Rate** – The student generation rate the number of students produced by an individual dwelling unit per year. Different domestic units produce students are different rates. Using WJCC enrollment figures, an address was found for WJCC students residing in James City County. Using the James City County Real Estate Division's Property Information map on the James City County website, the number of students from each subdivision was determined. Using the Real Estate Division's Real Estate Parcel Count, the number of improved lots in each neighborhood was determined. Total students from each neighborhood were divided by the total number of units from that neighborhood to determine the average number of students per housing unit. The student generation numbers for 256 subdivisions were determined this way, along with the same method for counting students from apartments and manufactured home parks.

**Townhome** –In a structure containing three or more dwelling units, a dwelling unit for single-family occupancy, not more than three stories in height, attached by one or more vertical party walls extending to the roof sheathing without passageway openings to one or more additional such dwelling units, each of which is served by an individual exterior entrance or entrances.

**Fiscal Impact Analysis Worksheet - Version 2021- Proposed Land Use** Last updated on 7/19

This Excel file will assist you with most of the Fiscal Impact Worksheet's calculations. Please skip inapplicable questions.
Use the numbers in this program to fill in the identical section on the worksheet.

**Please enter the information requested in the relevant yellow highlighted cells**

2a) How many residential units are proposed? What types?

| | |
|---|---|
| **Single Family Detached** | 158 |
| **Townhome/Condominium/Multifamily** | 128 |
| **Apartment** | 75 |
| **Manufactured Home Park Unit** | 0 |
| **Total** | 361 |
| Are any units affordable? If yes, how many? | 0 |

**Residential Expenses - School Expenses**

2b) How many students are generated?

| | Student Generation Rate | Students Generated |
|---|---|---|
| **Single Family Detached** | 0.4 | 63.2 |
| **Townhome/Condominium/Multifamily** | 0.17 | 21.76 |
| **Apartment** | 0.31 | 23.25 |
| **Manufactured Home Park Unit** | 0.46 | 0 |
| **Total** | | 108.21 |

2c) What is the schools expenses?

| | |
|---|---|
| **Total Students** | 108.21 |
| **Per Student Operating Costs** | $8,762.38 |
| **Per Student Capital Costs** | $1,948.32 |
| **Per Student School Costs** | $10,710.70 |
| **Total School Fiscal Impact** | $ 1,159,004.85 |

**Residential Expenses - Non-School Expenses**

2d) What is the total population generated?

| | |
|---|---|
| **Total Units** | 361 |
| **Average Household Size** | 2.49 |
| **Total Population Generated** | 612.5 |

2e) What are the total non-school expenses?

| | |
|---|---|
| **Total Population Generated** | 612.5 |
| **Per-Capita Non School Costs** | $ 680.24 |
| **Total Non-School Costs** | $ 416,647.00 |

2f) What is the total residential expenses?

| | | |
|---|---|---|
| **Total School Expenses** | $ | 1,159,004.85 |
| **Total Non-School Expenses** | $ | 416,647.00 |
| **Total Residential Expenses** | $ | 1,575,651.85 |

**Residential Revenues**

2g) What is the average expected market value for each type of unit sold?

| | Unit Type | Number of Type | Price for Each Unit Type |
|---|---|---|---|
| **Single Family Detached** | | 158 | $ 730,000.00 |
| **Bungalows** | | 26 | $ 400,000.00 |
| | | 0 | $ - |
| **Townhomes** | | 69 | $ 700,000.00 |
| **Condos** | | 33 | $ 425,000.00 |
| | | 0 | $ - |
| | | 0 | $ - |
| | | 0 | $ - |
| **Apartment (Value of Apartment Complex (Total))** | | | 15,000,000 |
| **Manufactured Home Park Unit (Value of Park Property (Total))** | | 0 | |
| **Total Expected Real Estate Sales Amount** | | | $ 203,065,000.00 |

2h) What are the total real estate taxes paid?

| | | |
|---|---|---|
| **Total Expected Real Estate Sales Amount** | | 203065000 |
| **Real Estate Tax Rate** | | 0.0084 |
| **Total Real Estate Tax Revenue** | $ | 1,705,746.00 |

2i) What is are total personal property taxes paid?

| | | |
|---|---|---|
| **Total Real Estate Tax Revenue** | | 1705746 |
| **Personal property Tax Revenue (as % of Real Estate Taxes Paid)** | | 0.15 |
| **Total Personal Property Tax Revenue** | $ | 255,861.90 |

2j) What are the total sales and meals taxes paid?

| | | |
|---|---|---|
| **Total Real Estate Tax Revenue** | | 1705746 |
| **Sales and Meals Tax Revenue (as % of real estate taxes paid)** | | 0.09 |
| **Total Personal Property Tax Revenue** | $ | 153,517.14 |

2k) What are total conservation easement taxes paid? (If any)

| | | |
|---|---|---|
| **Total Acreage in Conservation Easement** | | 0 |
| **Conservation Easement Real Estate Tax Rate** | | 2000 |
| **Total Conservation Easement Tax Revenue** | $ | - |

2l) What are the total HOA taxes paid (for property rentable to non-HOA members, if any)?

| | |
|---|---|
| **Total Market Value of any HOA Property Rentable to non-HOA Members** | 0 |
| **Real Estate Tax Rate** | 0.0084 |
| **Total Rentable HOA Property Tax Revenue** | $ - |

2m) What is the total residential tax revenue? $ 2,115,125.04

**Residential Fiscal Impact**

2n) What is the residential fiscal impact? $ 539,473.19

**Commercial Expenses**

3a) How many new businesses are proposed? (Include all businesses that will rent or lease space)

| | |
|---|---|
| **Total Number of New Businesses** | 1 |

3b) What is the expected real estate market value for each business property (at buildout)?

| | Business Property | Expected Market Value |
|---|---|---|
| 1 | Elderly Care | $ 30,000,000.00 |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| Total Commercial Real Estate Expected Market Value | | $ 30,000,000.00 |

3c) What are the commercial expenses?

| | |
|---|---|
| **Total Commercial Real Estate Taxes Paid** | 252000 |
| **Per-Business Commercial Expense Rate** | 0.00468 |
| **Total Commercial Expenses** | $ 140,400.00 |

**Commercial Revenues**

3d) What are the commercial real estate taxes paid?

| | |
|---|---|
| **Total Commercial Real Estate Assessment Value** | 30000000 |
| **Real Estate Tax Rate** | 0.0084 |
| **Total Commercial Real Estate Taxes Paid** | $ 252,000.00 |

3e) What are the business personal property taxes paid?

| | Proposed Businesses Name (s) | Initial Capital Investment | | |
|---|---|---|---|---|
| 1 | Elderly Care | $ 2,500,000.00 | $ | 25,000.00 |
| 2 | | | $ | - |
| 3 | | | $ | - |
| 4 | | $ - | $ | - |
| 5 | | $ - | $ | - |
| 6 | | $ - | $ | - |
| | Total Business Personal Property Taxes Paid | | $ | 25,000.00 |

3f) What are the business machinery and tools taxes paid (for manufacturers only)? -

| | Proposed Businesses Name(s) | Initial Capital Investment | | |
|---|---|---|---|---|
| 1 | | | $ | - |
| 2 | | $ - | $ | - |
| 3 | | $ - | $ | - |
| 4 | | $ - | $ | - |
| 5 | | $ - | $ | - |
| 6 | | $ - | $ | - |
| | Total Business Personal Property Taxes Paid | | $ | - |

3g) What are retail sales-based taxes paid? (if any)

| | Proposed Business Name(s) | Estimated Retail Sales | Estimated Prepared Meals Sales | Estimated Hotel/Motel/Condo Room Sales | | |
|---|---|---|---|---|---|---|
| 1 | Elderly Care | $ 200,000.00 | $ 500,000.00 | $ - | $ | 22,000.00 |
| 2 | | | $ - | $ - | $ | - |
| 3 | | | $ - | $ - | $ | - |
| 4 | | | $ - | $ - | $ | - |
| 5 | | $ - | $ - | $ - | $ | - |
| 6 | | $ - | $ - | $ - | $ | - |
| | Total Sales-Based Tax Paid | $ 200,000.00 | $ 500,000.00 | $ - | $ | 22,000.00 |
| | Total Business Sales Tax Revenue | | | | $ | 22,000.00 |

3h) What are the proposed annual business license fees paid?

| | Proposed Business Name(s) | Business Type | Estimated Sales | License Fee Rate | | |
|---|---|---|---|---|---|---|
| 1 | | Contractors | $ - | 0.0016 | $ | - |
| 2 | | Manufacturers | | 0 | $ | - |
| 3 | | Other Services | $ 500,000.00 | 0.0036 | $ | 1,800.00 |
| 4 | | Professional Services | $ 10,500,000.00 | 0.0058 | $ | 60,900.00 |
| 5 | | Retail Sales | | 0.002 | $ | - |
| 6 | | Wholesalers | | 0.0005 | $ | - |

| | | |
|---|---|---|
| Total Business License Revenue | $ | 62,700.00 |
| 3i) What are the total commercial revenues? | $ | 361,700.00 |

**Commercial Fiscal Impact**

| | | |
|---|---|---|
| 3j) What is the net commercial fiscal impact? | $ | 221,300.00 |
| 3k) What is the proposed fiscal impact? | $ | 760,773.19 |

**You will now estimate the current conditions of the proposal property. Please click on worksheet tab labeled "Current" below and follow the instructions.**

| | | |
|---|---|---|
| What is the final fiscal impact? | $ | 727,922.17 |

**Phasing - Residential Phasing**

6a) When will proposed residential units be built?

Total Units Proposed 361

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Buildout |
|---|---|---|---|---|---|---|
| Homes Built | 61 | 75 | 75 | 75 | 75 | 361 |
| Total Res Exp | $ 1,575,651.85 | $ 1,575,651.85 | $ 1,575,651.85 | $ 1,575,651.85 | $ 1,575,651.85 | |
| Per Unit Exp | $ 4,364.69 | $ 4,364.69 | $ 4,364.69 | $ 4,364.69 | $ 4,364.69 | $ 4,364.69 |
| Total Res Exp | $ 266,245.88 | $ 327,351.49 | $ 327,351.49 | $ 327,351.49 | $ 327,351.49 | $ 1,575,651.85 |
| Total Res Rev | $ 2,115,125.04 | $ 2,115,125.04 | $ 2,115,125.04 | $ 2,115,125.04 | $ 2,115,125.04 | |
| Per Unit Rev | $ 5,859.07 | $ 5,859.07 | $ 5,859.07 | $ 5,859.07 | $ 5,859.07 | $ 5,859.07 |
| Total Res Rev | $ 357,403.40 | $ 357,403.40 | $ 357,403.40 | $ 357,403.40 | $ 357,403.40 | $ 1,787,017.00 |
| Per Unit Impact | $ (1,494.39) | $ (1,494.39) | $ (1,494.39) | $ (1,494.39) | $ (1,494.39) | $ (1,494.39) |
| Res Impact | $ (85,606.52) | $ (190,860.43) | $ (296,114.34) | $ (401,368.26) | $ (506,622.17) | $ 506,622.17 |

**Phasing - Commercial Phasing**

6b) When will proposed commercial units be built?

Total New Businesses 1

| | Year 1 | Year 2 | Buildout |
|---|---|---|---|
| Bus Built | 0.5 | 0.5 | 1 |
| Bus Exp | $ 140,400.00 | $ 140,400.00 | |
| Per Bus Exp | $ 140,400.00 | $ 140,400.00 | |
| Year Bus Exp | $ 70,200.00 | $ 70,200.00 | |
| Bus Rev | $ 361,700.00 | $ 361,700.00 | |
| Per Bus Rev | $ 361,700.00 | $ 361,700.00 | |
| Year Bus Rev | $ 180,850.00 | $ 180,850.00 | |

| | | | | |
|---|---|---|---|---|
| Bus Impact | $ | 110,650.00 | $ | 221,300.00 |

6c) What is the final phasing projection?

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Buildout |
|---|---|---|---|---|---|---|
| Res Impact | $ (85,606.52) | $ (190,860.43) | $ (296,114.34) | $ (401,368.26) | $ (506,622.17) | $ (506,622.17) |
| Bus Impact | $ 110,650.00 | $ 221,300.00 | $ 221,300.00 | $ 221,300.00 | $ 221,300.00 | |
| Final Impact | $ 25,043.48 | $ 30,439.57 | $ (74,814.34) | $ (180,068.26) | $ (285,322.17) | |

**Employment**

7a) How many fill-time equivalent jobs (FTE)will be generated from the proposal? What will be the average payroll?

| | Business | FTE Jobs Generated | Average Payroll |
|---|---|---|---|
| 1 | Nursing | 50 | $ 1,650,000.00 |
| 2 | Professional | 11 | $ 600,000.00 |
| 3 | Administrative | 5 | $ 300,000.00 |
| 4 | Support Services | 22 | $ 650,000.00 |
| 5 | | | $ - |
| 6 | | | $ - |

# Proposed Home Types

Note: these are photos of our projects in Hampton Roads. The architecture of Ford's Village will be less coastal, and more in keeping with the historic vernacular of the Peninsula and Williamsburg area.

# Drive Under Gateway Apartment

Manor Home
4 units per building

Single Family Homes
2200-3000+ sf

Cottage  detached Garage
1800-2400 sf

Village House- 2 Story Bungalows
1400-1900 sf

Detached Townhomes
(blank wall one side)
2200-2400 sf

Images are taken from downtown Norfolk Virginia,
and Savannah, Georgia.

# Townhomes
# 2600-2900 sf

Mews Large (Typically face a park or courtyard)
1300-1700 SF

# Mews Small
# 1250-1350 sf  Attached and Detached Examples

# Bungalows
# 800-1000 sf

DRW Consultants, LLC
Traffic Impact Studies
Development Access
Condemnation Damages

TO: Jason Grimes, P. E.
FROM: Dexter R. Williams, P. E.
SUBJECT: Response To 22 July, 2021 VDOT Letter:
RE: Ford's Village (a.k.a Ford's Bluff, Village at Ford's Colony)
3889 News Rd. (Rt. 613)
James City County plan Z-21-0012, MP-21-003
DATE: September 7, 2021

This memo and enclosed documents are provided to inform VDOT and any other interested parties on the extensive history of traffic analysis at the Rt. 613 News Road/Firestone Drive as well as respond to points in the July 22, 2021 letter from VDOT. As reference documents, enclosed are the most recent and relevant traffic studies to date:

1. TIS Update for Ford's Colony Master Plan – Phased Development, Kimley-Horn and Assc., Inc. January 2020
2. Traffic Analysis For Ford's Colony CRC, DRW Consultants, LLC, July 12, 2007
3. News Road Corridor Traffic Forecast And Analysis, DRW Consultants, LLC, April 22, 2008

Exhibit 1b in the 2008 DRW study has a useful reference map identifying various development properties around Ford's Colony and News Road.

Following is a history of traffic analysis at Rt. 613 News Road/Firestone Drive intersection:

1. The intersection is part of the Ford's Colony development approval in 1988 with proffered road improvements and a requirement for traffic study update every five years to determine if unbuilt proffered improvements are warranted.
2. The first study update in 1993 by DRW included the intersection and the other three points of access to Ford's Colony. At that time, the Rt. 613 News Road/Firestone Drive intersection has been constructed in its current state by the Ford's Colony development company with proffered left and right turn lanes on News Road at Firestone Drive serving Ford's Colony traffic. The only remaining proffered item at that time and now is signalization when warranted.
3. DRW provided subsequent traffic study updates in 1998 and 2003.
4. In 2006, DRW provided a traffic study for what is now called Ford's Village (a.k.a Ford's Bluff, Village at Ford's Colony) for proposed single family use (then called the Warburton Tract). Sole access to this tract of land is aligned at the Rt. 613 News Road/Firestone Drive intersection.
5. In 2007, DRW provided at TIA dated 07-12-07 for The Village At Ford's Colony (CRCC

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style development) that focused only on the News Road/Firestone Drive intersection as the sole access to The Village.

6. In 2008, DRW provided a traffic study of the News Road corridor that was triggered by the Village At Ford's Colony zoning proposal for CCRC senior housing and care development.
7. Beginning in 2019, DRW provided a series of memos to JCC documenting the degree of change in trip generation between the evolving CCRC development plans (Ford's Bluff to Ford's Village) and the original The Village At Ford's Colony.
8. In early 2020, KHA included the Rt. 613 News Road/Firestone Drive intersection in a study for a Ford's Colony master plan update on behalf of Ford's Colony Home Owners Association. This work included a signal warrant analysis at Rt. 613 News Road/Firestone Drive.
9. DRW provided a memo dated January 21, 2021 that documented changes in proposed trip generation from 2008 study (updated July 9, 2021) and changes in traffic counts at the Rt. 613 News Road/Firestone Drive intersection between 2007 (2008 study) and 2017 (2020 study).
10. DRW has provided an updated memo dated Aug. 31, 2021 that addresses comments from JCC regarding the changes in proposed trip generation from 2008 and the 2020 KHA study and changes in traffic counts at the Rt. 613 News Road/Firestone Drive intersection between 2007 and 2017.

At the time of the 2008 DRW study, the Village At Ford's Colony (now Ford's Village) was under the control of the developer of Ford's Colony (Realtec, Inc). Realtec, Inc. is no longer active, and Ford's Village is proposed for development by different developers and the proffer from 2008 can no longer be guaranteed. It may be a consideration for the current rezoning proposal going forward but there may be no way to guarantee action by the developers of Ford's Village on other privately owned land in Ford's Colony. A review of Google Earth indicates that Firestone Drive has been resurfaced several times over the years and a stop bar has been replaced after each resurfacing, but it does not appear that the two lanes of pavement on the Firestone Drive exit have ever been striped.

The Aug. 31, 2021 DRW memo documented that:

1. PM peak hour counts are higher than AM counts (2007 and 2017).
2. Trip generation for Ford's Village as proposed is less than that for The Village At Ford's Colony in the 2008 study and the 2020 Kimley Horn study in the PM peak hour and for daily traffic, and not appreciably greater in the AM peak hour.
3. Traffic hasn't grown much from 2007 to 2017: 1.8% per year in the AM and 0.5% in the PM. Buildout forecast in the 2008 study is 58% and 46% greater than 2017 counts in the AM and PM peak hours, respectively. The 2027 forecast in the 2020 KHA study is 42% and 39% greater than 2017 counts in the AM and PM peak hours, respectively.
4. In summary, the August 31, 2021 memo demonstrates that there is nothing new about foreseeable traffic forecasts with Ford's Village that wasn't addressed in the 2008 study

for The Village at Ford's Colony and the 2020 KHA study and there is no justification for a new study: traffic generation for Ford's Village has been deliberately kept at or below previous levels, increases in traffic volumes over the last ten years are meager, and previous traffic forecasts are well in excess of existing conditions.

Regarding any commitment for signalization at the Rt. 613 News Road/Firestone Drive intersection, Ford's Colony proffered signalization in 1988 and the most recent 2020 KHA study addressed that issue and concluded that signalization is not warranted. If VDOT needs to see native files for the 2020 KHA study, then VDOT needs to contact KHA.

There has never been any analysis for a signal warranted by The Village At Ford's Colony/Ford's Village because traffic forecast are far below signal warrant thresholds as follows:

1. For exiting left turn traffic on site entrance at News Road/Firestone Drive to meet minor warrants, it must meet/exceed 53 vehicles per hour for eight hours for Warrant 1, 60 vehicles per hour for four hours for Warrant 2 and 75 vehicles per hour for the peak hour.
2. Exiting left turn traffic forecasts are as follows:
    a. 2008 Study: 7 vehicles per hour AM, 16 vehicles per hour PM
    b. 2020 KHA Study: 14 vehicles per hour AM, 23 vehicles per hour PM
3. For entering left turn traffic on site entrance at News Road/Firestone Drive to meet minor warrants, it must meet the thresholds cited above for exiting left turns.
4. Entering left turn traffic forecasts are as follows:
    a. 2008 Study: 44 vehicles per hour AM, 77 vehicles per hour PM
    b. 2020 KHA Study: 31 vehicles per hour AM, 59 vehicles per hour PM
5. Use of entering left turns requires the westbound approach on News Road at Firestone Drive to meet/exceed 420 vehicles per hour for eight hours and generally more for Warrants 2 and 3.
6. Westbound through traffic forecasts are as follows:
    a. 2008 Study: 300 vehicles per hour AM, 243 vehicles per hour PM
    b. 2020 KHA Study: 269 vehicles per hour AM, 218 vehicles per hour PM

There is no possibility for Ford's Village traffic to warrant a signal at News Road/Firestone Drive:

- Forecast exiting left turns, peak hour volumes are nowhere near minimum thresholds for minor streets
- For entering left turns, forecast westbound through traffic peak hour volumes are nowhere near minimum thresholds for major streets.

Regarding access to Ford's Village at News Road/Firestone Drive, the anticipated design includes previous proffers: "a left turn lane from westbound News Road into the Additional Property and a right turn radius from eastbound News Road into the Additional Property shall be constructed". Left turn lane warrants were addressed in the 2007 study, and right turn warrants were addressed in the 2007 and 2008 studies.

DRW Consultants, LLC
Traffic Impact Studies
Development Access
Condemnation Damages

TO: Jason Grimes, P. E., AES
FROM: Dexter R. Williams, P. E.
SUBJECT: Ford's Bluff Trip Generation And Traffic Forecasts: Relative Need For Peak Hour Traffic Study Update
DATE: August 31, 2021

This memo and enclosed exhibits present a summary of peak hour trip generation for proposed and prior development inventories for Ford's Bluff and a comparison of peak hour traffic counts and background traffic forecasts presented in previous studies. There are two previous studies of relevance:

1. News Road Corridor Traffic Forecast And Analysis, DRW Consultants, April 22, 2008. This study was the culmination of JCC review of the original Village At Fords' Colony traffic impact study. The original study was expanded to include the News Road corridor and ten other developments in addition to the News Road/Firestone Drive intersection which is to provide access to previous and proposed Ford's Bluff.
2. Ford's Colony Master Plan – Phased Development, Kimley-Horn & Associates, January 2020. This study primarily focused on points of access to Ford's Colony. It includes trip generation for the Village At Ford's Colony based on zoned units which differed from the units assumed in the 2008 study.

Enclosed Exhibit A shows trip generation for Ford's Bluff (formerly Village At Ford's Colony) as follows:

1. Table One shows the Trip Generation, 7th Edition (TG7) land uses, and units used for the Village At Ford's Colony traffic studies in 2008. There are five different land uses with separate trip generation by beds and units, 952 beds and units total.
2. Table Two shows the current proposal for Ford's Bluff five land uses and the translation to TGM10 trip generation uses.
3. Table Three shows the currently proposed Ford's Bluff lots translated to detached and attached single family housing units.
4. Table Four shows Trip Generation Manual, 10th Edition (TGM10) trip generation for five land uses in proposed Ford's Bluff, 516 beds and units total. The KHA 2020 trip generation used equations for congregate care AM and PM peak hour trip generation. My previous work used rates for congregate care AM and PM peak hour. I think rates are the appropriate source vs. equations, but the guidelines for choosing equations vs. rates are murky and the differences are trivial (equations are slightly higher for 75 units). Therefore, I used congregate care AM and PM equations on enclosed Exhibit A for consistency with previous KHA work.

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5. Table Five presents a comparison of proposed Ford's Bluff units and trip generation relative to previous values as follows:
    a. Row 1 is trip generation in the 2008 traffic studies for The Village At Ford's Colony using TG7.
    b. Row 2 is trip generation for the units defined in the 2008 proffers and presented in the 2020 KHA study using TGM10. 2008 proffers cited development limits of 596 independent living units, 83 assisted living/memory care rooms and 60 skilled nursing beds.
    c. The 2008 proffers allow up to 2 persons per room in the AL rooms. Row 3 assumes 2 beds in each assisted living rooms with 166 maximum beds. TGM10 is used for trip generation.
    d. In all cases, proposed development units, PM trip generation and daily trip generation are reduced from the previous prior units and trip generation values. Proposed development AM trip generation is higher than the previous benchmarks.

Regarding other traffic growth on News Road, enclosed Exhibit B shows April 2007 counts from the 2008 study and June 2017 counts from the 2020 KHA study at the News Road/Firestone Drive/future Ford's Bluff intersection. For 2007 counts shown on top row, PM peak hour counts (570 vehicles per hour [vph]) are 35% higher than AM counts (421 vph). For 2017 counts shown on middle row, PM peak hour counts (599 vehicles per hour [vph]) are 20% higher than AM counts (498 vph). In the ten years between 2007 and 2017 counts, traffic increased at an overall rate of 1.8% per year in the AM peak hour (18% over 10 years) and 0.5% per year in the PM peak hour (5% over ten years). These comparative results are summarized below:

TABLE ONE: NEWS ROAD/FIRESTONE DRIVE
2007/2017 PEAK HOUR COUNT COMPARISON (TOTAL ALL APPROACHES)

| | AM PEAK HOUR | PM PEAK HOUR |
|---|---|---|
| 2007 COUNTS | 421 | 570 |
| 2017 COUNTS | 498 | 599 |
| 10 YEAR % INCREASE | 18% | 5% |
| ANNUAL % INCREASE | 1.8% | 0.5% |

Regarding forecast background traffic (i.e., without Ford's Bluff site), Exhibit C shows the 2008 traffic study build out forecast at the News Road/Firestone Drive/future Ford's Bluff intersection on the top row. The second row on Exhibit C shows the increase in the 2008 build out forecast over 2017 counts: overall increase of 23% in the AM peak hour and 38% in the PM peak hour. Even on a percentage basis, the build out forecast in the 2008 study is appreciably higher than the actual increases from 2007 to 2017. The following table illustrates the relative size of the 2008 study peak hour forecast to the 2017 counts:

TABLE TWO: NEWS ROAD/FIRESTONE DRIVE
2008 STUDY FORECAST VS. 2017 COUNTS (TOTAL ALL APPROACHES)

| | AM PEAK HOUR | PM PEAK HOUR |
|---|---|---|
| 2017 COUNTS | 498 | 599 |
| 2008 STUDY FORECAST | 614 | 827 |
| INCREASE | 116 | 228 |
| % INCREASE | 23% | 38% |

The buildout forecast for the 2027 KHA forecast shown on the third row of Exhibit C. The fourth row on Exhibit C shows the increase in the 2027 KHA forecast over 2017 counts: overall increase of 17% in the AM peak hour and 24% in the PM peak hour.

TABLE THREE: NEWS ROAD/FIRESTONE DRIVE
2020 STUDY FORECAST VS. 2017 COUNTS (TOTAL ALL APPROACHES)

| | AM PEAK HOUR | PM PEAK HOUR |
|---|---|---|
| 2017 COUNTS | 498 | 599 |
| 2020 STUDY FORECAST | 583 | 745 |
| INCREASE | 85 | 146 |
| % INCREASE | 17% | 24% |

In summary, trip generation for the proposed development plan has adequately been addressed in previous studies because the critical PM peak hour is lower than previous studies and overall daily traffic is lower. In addition, the 2008 and the 2020 study has overall background forecast that is well in excess of 2017 counts. There is nothing in terms of known traffic sources (both proposed site, other site development and general background growth) that has not been addressed in previous studies. There is no justification for additional peak hour traffic study because any reasonable order of magnitude for known traffic increase sources has been addressed.

| VALUE | LAND USE | LAND USE CODE | SQ.FT., OTHER UNITS | WEEKDAY TRIP GENERATION AM PEAK HOUR Enter | Exit | Total | PM PEAK HOUR Enter | Exit | Total | DAILY |
|---|---|---|---|---|---|---|---|---|---|---|
| **TABLE ONE - THE VILLAGE AT FORD'S COLONY TRIP GENERATION - 2008 TG7** | | | | | | | | | | |
| eq./adj. st. | Elderly Detached | 251 | 32 units | 4 | 6 | 10 | 13 | 9 | 22 | 206 |
| rate/adj. st. | Elderly Attached | 252 | 332 units | 12 | 15 | 27 | 23 | 14 | 37 | 1155 |
| rate/adj. st. | Congregate Care | 253 | 290 units | 10 | 7 | 17 | 27 | 22 | 49 | 586 |
| rate/adj. st. | Assisted Living | 254 | 118 occ.bed | 15 | 5 | 20 | 18 | 16 | 34 | 323 |
| rate/adj. st. | Nursing Home | 620 | 180 beds | 21 | 10 | 31 | 13 | 27 | 40 | 427 |
| | | TOTAL | 952 bed/unit | 62 | 43 | 105 | 94 | 88 | 182 | 2697 |

**TABLE TWO: 2021 FORD'S BLUFF UNITS IN ITE TERMS**

| 2020 Updated Units | | TGM10 |
|---|---|---|
| Independent Living Apts | 75 | Congregate Care |
| Assisted Living/ Memory Care Beds | 125 | Assisted Living |
| Skilled Nursing Facility Beds | 30 | Nursing Home |
| Independent Living Homes - Attached | 102 | Sr. Adult Attached |
| Independent Living Homes - Detached | 184 | Sr. Adult Detached |
| Total | 516 | |

**TABLE THREE: 2020 FORD'S BLUFF LOTS IN DETACHED AND ATTACHED UNITS**

| Lot Type Description | Detached | Attached |
|---|---|---|
| Single Family - general | 67 | |
| Village House 2-story Bungalow | 46 | |
| Cottage | 27 | |
| Bungalow | 31 | |
| Detached Townhouse | 13 | |
| Townhouse | | 37 |
| Mews Large | | 9 |
| Mews Small | | 23 |
| Manor House Multi Family | | 32 |
| Drive-Through Apartment | | 1 |
| Total | 184 | 102 |

**TABLE FOUR: FORD'S BLUFF FIVE LAND USES - 2020 TGM10**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| eq.-adj. st. | Sr. Adult Detached | 251 | 184 units | 21 | 44 | 65 | 47 | 30 | 77 | 962 |
| eq.-adj. st. | Sr. Adult Attached | 252 | 102 units | 7 | 13 | 20 | 15 | 12 | 27 | 385 |
| eq/rate-adj. st. | Congregate Care | 253 | 75 units | 4 | 2 | 6 | 8 | 8 | 16 | 152 |
| rate-adj. st. | Assisted Living | 254 | 125 beds | 15 | 9 | 24 | 13 | 20 | 33 | 325 |
| rate/adj. st. | Nursing Home | 620 | 30 beds | 4 | 1 | 5 | 2 | 5 | 7 | 92 |
| | | | 516 bed/unit | 51 | 69 | 120 | 85 | 75 | 160 | 1916 |

**TABLE FIVE: PROPOSED DEVELOPMENT CHANGE FROM PRIOR VALUES**

| PRIOR TRIP GENERATION VALUES | | UNITS | AM PEAK | PM PEAK | TOTAL |
|---|---|---|---|---|---|
| 1 | April 2008 Study (TG7) | 952 | 105 | 182 | 2697 |
| | Change With Proposed Plan | -436 | 15 | -22 | -781 |
| 2 | KHA 2020 (TGM10) 83 AL Beds | 739 | 101 | 161 | 2078 |
| | Change With Proposed Plan | -223 | 19 | -1 | -162 |
| 3 | 2008 Proffer Limits (TGM10) 166 AL Beds | 822 | 117 | 182 | 2294 |
| | Change With Proposed Plan | -306 | 3 | -22 | -378 |

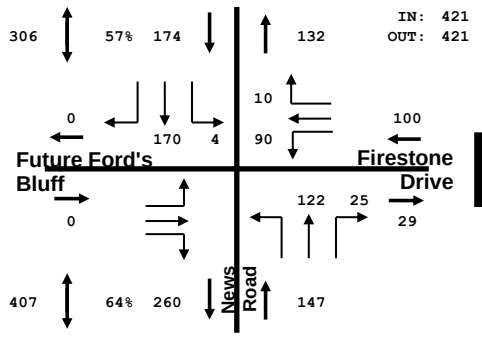
FORD'S BLUFF
TRIP GENERATION AUG. 31, 2021

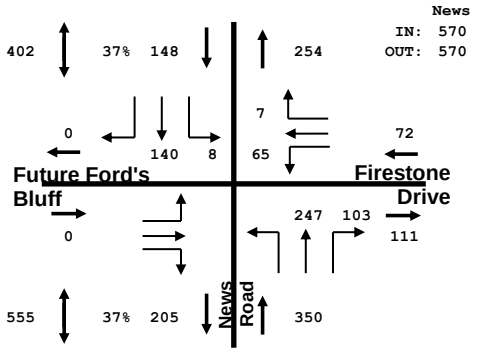
***DRW Consultants, LLC***
***804-794-7312***

Trip generation rates from Trip Generation, 7th Edition (TG7) and Trip Generation Manual, 10th Edition (TGM10) by the Institute of Transportation Engineers (ITE) Unless Otherwise Noted

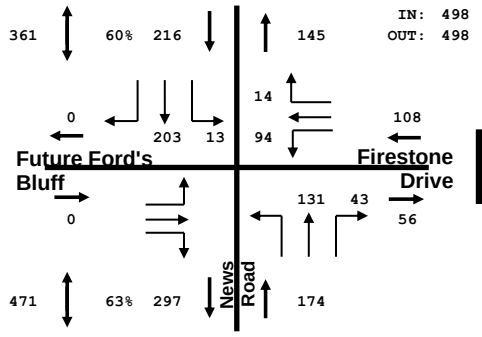
Exhibit A

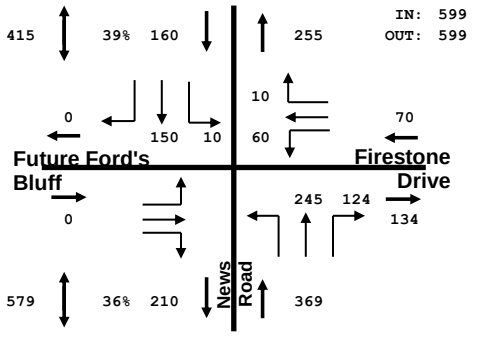
## April 2007 Counts



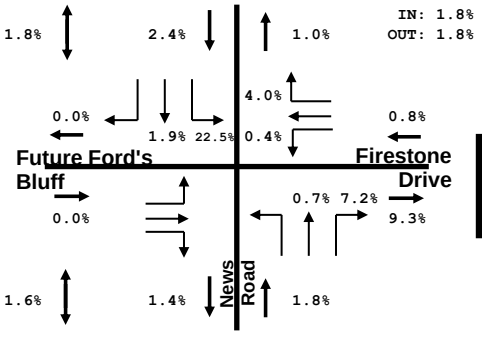



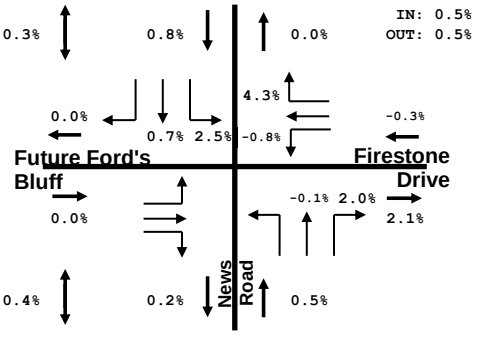

## June 2017 Counts




## % Increase/Year 2007 To 2017




**AM PEAK HOUR**

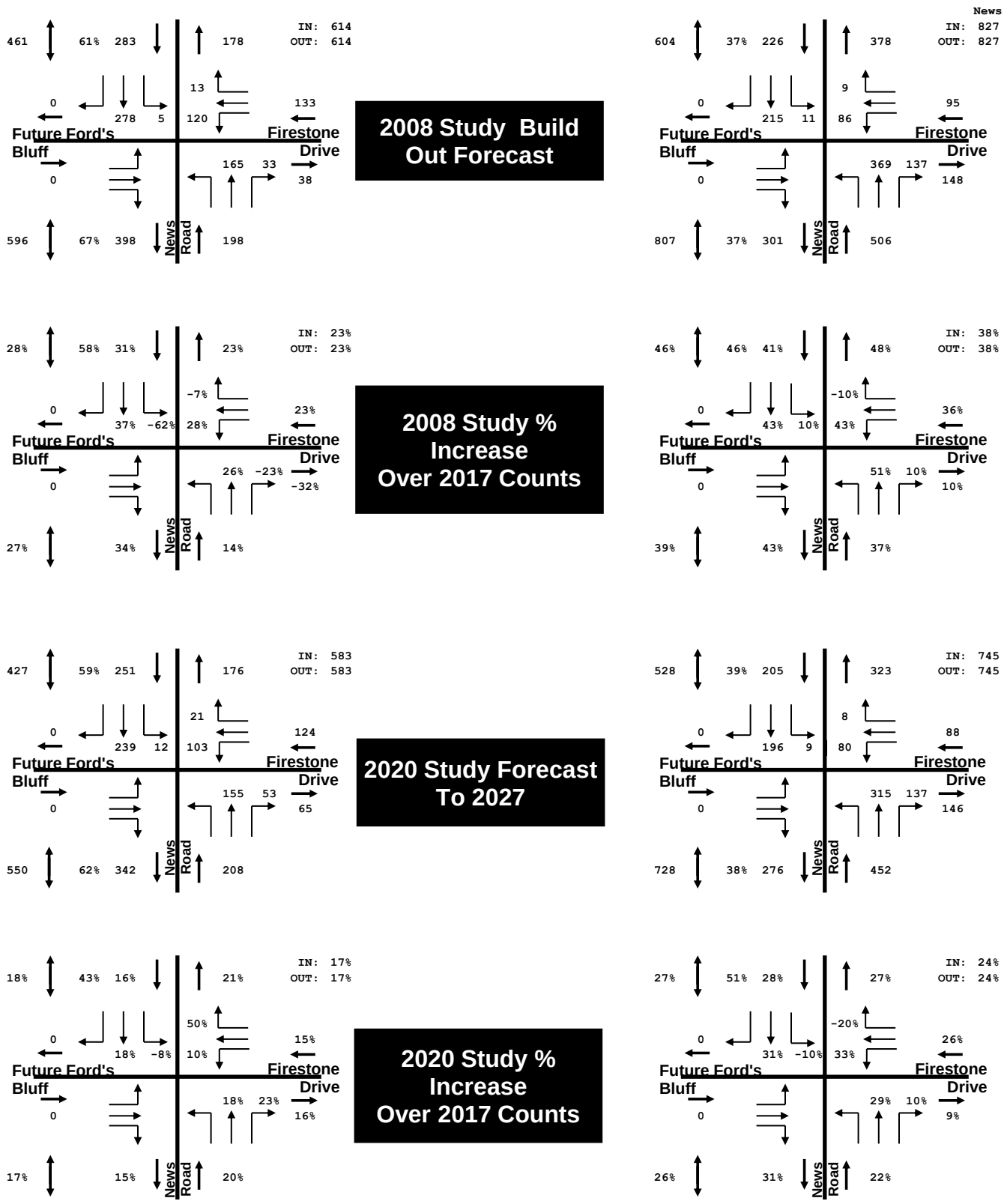
Exhibit Reference

**PM PEAK HOUR**

NEWS ROAD 2007/2017 PEAK HOUR COUNT COMPARISON


*DRW Consultants, LLC*
*804-794-7312*


Exhibit B




NEWS ROAD TRAFFIC FORECASTS WITHOUT FORD'S BLUFF AND PERCENT INCREASE OVER 2017 COUNTS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit C

TRAFFIC IMPACT STUDY (TIS) UPDATE

# Ford's Colony Master Plan – Phased Development

James City County, Virginia

**Prepared for:**

Ford's Colony Home Owners Association (FCHOA)

**Prepared by:**

Kimley»Horn

**January 2020**

# Traffic Impact Study (TIS) Update
# for
# Ford's Colony Master Plan – Phased Development
# James City County, Virginia

**Prepared for:**
Ford's Colony Home Owners Association (FCHOA)

**Prepared by:**
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Suite 100
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**117079000**
**January 2020**

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# 1 EXECUTIVE SUMMARY

Ford's Colony Homeowners Association (FCHOA), with support of REDUS VA Housing, LLC (REDUS) is pursuing a Master Plan and Proffer Amendment which includes proposing the construction of 60 residential condominium/townhouse units (Eaglescliff) within the Ford's Colony development (i.e., Ford's Colony) in James City County, Virginia. Ford's Colony is a master planned community bounded by Longhill Road (State Route 612) to the north, Centerville Road (State Route 614) to the west, News Road (State Route 613) to the south, and a combination of retail/commercial land uses, residential areas, and Humelsine Parkway (State Route 199) to the east.

Through conversations with FCHOA, REDUS, and James City County staff as well as our review of the Ford's Colony Proffers (MP-2-87) dated June 20, 1988 and the Amended and Restated Ford's Colony Proffers (Z-04-98/MP-3-98) dated January 24, 1999, it was determined that a traffic impact study (TIS) must be prepared every five (5) years and/or prior to any proposed expansion or development within the Ford's Colony Master Planned residential development. The previous update was the *Ford's Colony Traffic Impact Study 2003-2004 Update*, completed in February 2004.

The purpose of this report is to satisfy the TIS requirement of the aforementioned proffers by summarizing existing and projected future traffic volumes as well as the associated operational conditions to determine if any of the identified off-site roadway, intersection, or traffic control (i.e., intersection signalization) improvements have been triggered for construction and/or may require accelerated implementation. In addition to the 60 residential condominium/townhouse units, the following units were included in this TIS as part of the background traffic to represent the totality of the Ford's Colony Master Plan.

- 295 platted, unbuilt lots
- 30 un-platted Windsor development lots
- 14 un-platted Brian Ford's property lots

This study will identify the potential impacts to the intersections and roadway network as a result of the proposed development.

Based on the analysis of the existing traffic volumes and operation findings provided in this traffic study, the following recommendations were identified and are summarized below for the Existing conditions:

- **Longhill Road at Williamsburg W. Drive/Lane Place Drive**
  - Maintain the existing geometric configuration and traffic control measures
  - Continue to monitor and implement new timing and coordination plans as part of regular VDOT operations and maintenance
  - It is noted that the Longhill Road Phase 1 Widening Project (VDOT UPC – 100921) includes improvements that will enhance the capacity at this intersection, is fully funded, and currently under construction
- **Longhill Road at Fords Colony Drive**
  - Relocate and restripe the northbound approach STOP bar so driver sight distance is not impeded by the Ford's Colony monument sign and/or vegetation located in the median
  - Restripe the 24-foot wide northbound approach to consist of a 12-foot shared through/left-turn lane and a 12-foot exclusive right-turn lane with 150 feet of storage

- Continue to monitor traffic volumes to identify when/if the full turn-lane warrant for the eastbound right-turn movement is satisfied
- Existing traffic volumes and the associated operational conditions (i.e., level of service (LOS)/side street delay) do not warrant or justify the installation of the traffic signal at this time.
- Although the installation of a traffic signal is specifically referenced in the Ford's Colony proffers, per VDOT policy and roadway design manual guidelines, should volumes warrant the consideration of a traffic signal the intersection will also need to be analyzed for the consideration of a roundabout.

- **Centerville Road at Manchester Drive**
  - Maintain the existing geometric configuration and traffic control measures
- **News Road at Firestone Drive**
  - Maintain the existing geometric configuration and traffic control measures

From the analysis of the Build conditions which included the background traffic growth and approved developments, the following recommendations were identified and are summarized below for the Build conditions:

- **Longhill Road at Williamsburg W. Drive/Lane Place Drive**
  - Continue to monitor and implement new timing and coordination plans as part of regular VDOT operations and maintenance
  - The Longhill Road Phase 1 Widening Project (UPC – 100921) is currently under construction. The widening project includes the following improvements to this intersection:
    - Widen Longhill Road to a four-lane divided typical section
    - Upgrade the traffic signal equipment to accommodate the additional through lanes
    - Pedestrian accommodations such as crosswalks, ADA ramps, and pedestrian signal displays for the crossing of select legs of the intersection

      <u>Eastbound Longhill Road</u>
      - Widen and construct an additional approach and receiving through lane

      <u>Westbound Longhill Road</u>
      - Widen and construct an additional approach and receiving through lane
  - Improvements associated with Longhill Road Phase 1 Widening Project (UPC – 100921) address several of the proffered improvements associated with the Ford's Colony Master Plan. Proffers should be updated/modified to account for/recognize these changes in responsibility.

- **Longhill Road at Fords Colony Drive**
  - Based on future traffic volume projections, construct a full width right-turn lane consisting of 200-feet of storage and a 200-foot taper for the eastbound approach.

- Future traffic volumes and the associated future operational conditions (i.e., level of service (LOS)/side street delay) continue to reflect that a traffic signal is not warranted and do not justify the installation of a traffic signal at this intersection.
- It is noted that the installation of a traffic signal is specifically referenced in the Ford's Colony proffers. However, per VDOT policy and roadway design manual guidelines, if volumes warrant the consideration of a traffic signal then the intersection will also need to be analyzed for the consideration of a roundabout.
- Additionally, it is noted that the Longhill Road Corridor Study, completed in October 2014, did not recommended the installation of a traffic signal at this intersection as part of the long term (horizon year 2034) improvements. Therefore, it is recommended that a traffic signal should no longer be proffered as a means of traffic control for this intersection.

- **Centerville Road at Manchester Drive**
  - Maintain the existing geometric configuration and traffic control measures.
- **News Road at Firestone Drive**
  - Maintain the existing geometric configuration and traffic control measures.

Given the minimal residual development potential in Ford's Colony, no additional or proffered improvements are triggered beyond those that were identified under the Existing or Build operational conditions.

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# 2 INTRODUCTION

Ford's Colony Homeowners Association (FCHOA), with support of REDUS VA Housing, LLC (REDUS) is pursuing a Master Plan and Proffer Amendment which includes proposing the construction of 60 residential condominium/townhouse units within the Ford's Colony development (i.e., Ford's Colony) in James City County, Virginia. Ford's Colony is a master planned community bounded by Longhill Road (State Route 612) to the north, Centerville Road (State Route 614) to the west, News Road (State Route 613) to the south, and a combination of retail/commercial land uses, residential areas, and Humelsine Parkway (State Route 199) to the east.

Through conversations with FCHOA, REDUS, and James City County staff as well as our review of the Ford's Colony Proffers (MP-2-87) dated June 20, 1988 and the Amended and Restated Ford's Colony Proffers (Z-04-98/MP-3-98) dated January 24, 1999, it was determined that a traffic impact study (TIS) must be prepared every five (5) years and/or prior to any proposed expansion or development within the Ford's Colony Master Planned residential development. The previous update was the *Ford's Colony Traffic Impact Study 2003-2004 Update*, completed in February 2004.

The purpose of this report is to satisfy the TIS requirement of the aforementioned proffers by summarizing existing and projected future traffic volumes as well as the associated operational conditions to determine if any of the identified off-site roadway, intersection, or traffic control (i.e., intersection signalization) improvements have been triggered for construction and/or may require acceleration. In addition, this study will identify the impacts to the intersections and roadway network due to the proposed development.

The proposed development will be located south of the roundabout intersection of Fords Colony Drive at St. Andrews Drive and is bounded by Eaglescliffe Condominiums to the west, single family units to the south, and the Marriott Manor Club at Ford's Colony to the east. **Figure 1** illustrates the proposed development's location. It is anticipated that the construction of the 60 residential condominium/townhouse units will be completed and operational for business by 2021. In addition to the 60 residential condominium/townhouse units, the following units were included in this TIS as part of the background traffic to represent the totality of the Ford's Colony Master Plan.

- 295 platted, unbuilt lots
- 30 un-platted Windsor development lots
- 14 un-platted Ford's property lots

Kimley-Horn has been retained to prepare a report that meets the requirements of updating the Ford's Colony TIS per the proffers as well as provides an assessment of the traffic impacts associated with the proposed development of the site. This report has been prepared for submittal to James City County and the Virginia Department of Transportation (VDOT) to evaluate existing conditions as well as future traffic conditions that include development related traffic volumes. Assumptions regarding the study area, access, and trip distribution were discussed with and approved by James City County staff prior to the completion of this analysis. The assumptions document is provided in **Appendix A**.

# 3 PROJECT BACKGROUND

## 3.1 STUDY AREA

Consistent with the previously completed TIS, the study area for this analysis, as illustrated in **Figure 1**, includes the following intersections:

**Intersections**

- Longhill Road at Williamsburg W. Drive/Lane Place Drive (signalized)
- Longhill Road at Fords Colony Drive (unsignalized)
- Centerville Road at Manchester Drive (unsignalized)
- News Road at Firestone Drive (unsignalized)

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| | | | |
|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | Study Area | FIGURE<br>1 |

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## 3.2 PREVIOUS STUDIES

As mentioned in **Chapter 2**, the previous *Ford's Colony Traffic Impact Study 2003-2004 Update*, was completed in February 2004. This study was conducted pursuant to the proffer requirements and included a schedule of roadway improvements at the four (4) intersections that provide access to/from the Ford's Colony development, as shown in **Table 1**.

***Table 1: Ford's Colony Traffic Impact Study 2003-2004 Update Recommendations***

| Proffered Improvement Description | | Recommended Action |
|---|---|---|
| **(a)** | **Installation of Traffic Signals** | |
| (i) | Longhill Road at Williamsburg W. Drive | Monitor traffic volumes in future to determine signal warrant justification |
| (ii) | News Road at Firestone Drive | Not warranted |
| (iii) | Longhill Road at Fords Colony Drive | Not warranted |
| **(d)** | **Construction of Longhill Road at Williamsburg W. Drive Intersection** | |
| (ii) | Add two through lanes on Longhill Road | Operational analysis determined improvement was not required |
| (iii) | Add second westbound left-turn lane on Longhill Road | Operational analysis determined improvement was not required |
| (iv) | Add second northbound right-turn lane on Williamsburg W. Drive | Operational analysis determined improvement was not required |
| **(e)** | **Construct eastbound right-turn lane on Longhill road at Fords Colony Drive** | **Continue to monitor traffic volumes in future to determine turn lane warrant justification.** |
| **(f)** | **Dedication of a 15-foot strip of land and construction of four lanes on Longhill Road from Williamsburg W. to Route 199** | **Operational analysis determined improvement was not required** |

## 3.3 EXISTING ZONING

The project site for the proposed development is located within the Ford's Colony Master Planned development. This parcel is currently unoccupied and is zoned as Residential Planned Community (R4). **Figure 2** illustrates the existing zoning adjacent to the site.

Zoning in this area primarily consists of the following districts: General Residential (R2), Residential Planned Community (R4), Rural Residential (R8), and General Agriculture (A1). The Marriott's Manor Club at Ford's Colony is located to the east of the proposed site and the Ford's Colony Country Club is located to the north of the proposed site, which contains hotel accommodations, restaurants, services, and various recreational golf uses. To the south and west of the proposed residential condominium/townhouse site are additional residential areas.

## 3.4 EXISTING CONDITIONS

Longhill Road, Centerville Road, and News Road are the primary thoroughfares within the study area that provide connections to Williamsburg W. Drive, Ford's Colony Drive, Manchester Drive, and Firestone Drive, which provide access to/from the Ford's Colony community. **Figure 3** depicts existing roadway geometry, lane assignments, and conditions for study area roadways and intersections. The following provides a brief description of existing roadway characteristics for each facility:

**Longhill Road** (State Route 612) is a two-lane, undivided minor arterial that runs in an approximate east/west direction between Centerville Road to the west and the Humelsine Parkway (Route 199) interchange to the east. Traffic counts collected by VDOT in 2018 indicate that Longhill Road carried approximately 7,600 vehicles per day (vpd) between Centerville Road and Season's Trace and approximately 16,000 vpd between Season's Trace and Humelsine Parkway. The posted speed limit along this segment of roadway within the study area is 45 miles per hour (mph).

**Centerville Road** (State Route 614) is a two-lane, undivided minor arterial in James City County. Centerville Road runs in an approximate north/south direction in the study area between Longhill Road to the north and News Road to the south. Traffic counts collected by VDOT in 2018 indicate that Centerville Road carried approximately 4,900 vpd between News Road and Jolly Pond Road. The posted speed limit along this segment of Centerville Road is 45 mph.

**News Road** (State Route 613) is a two-lane, undivided major collector road that runs in an approximate east/west direction that extends from Centerville Road in the west to Ironbound Road in the east. Traffic counts collected by VDOT in 2018 indicate that News Road carried approximately 3,900 vpd within the study area. The posted speed limit is 45 mph.

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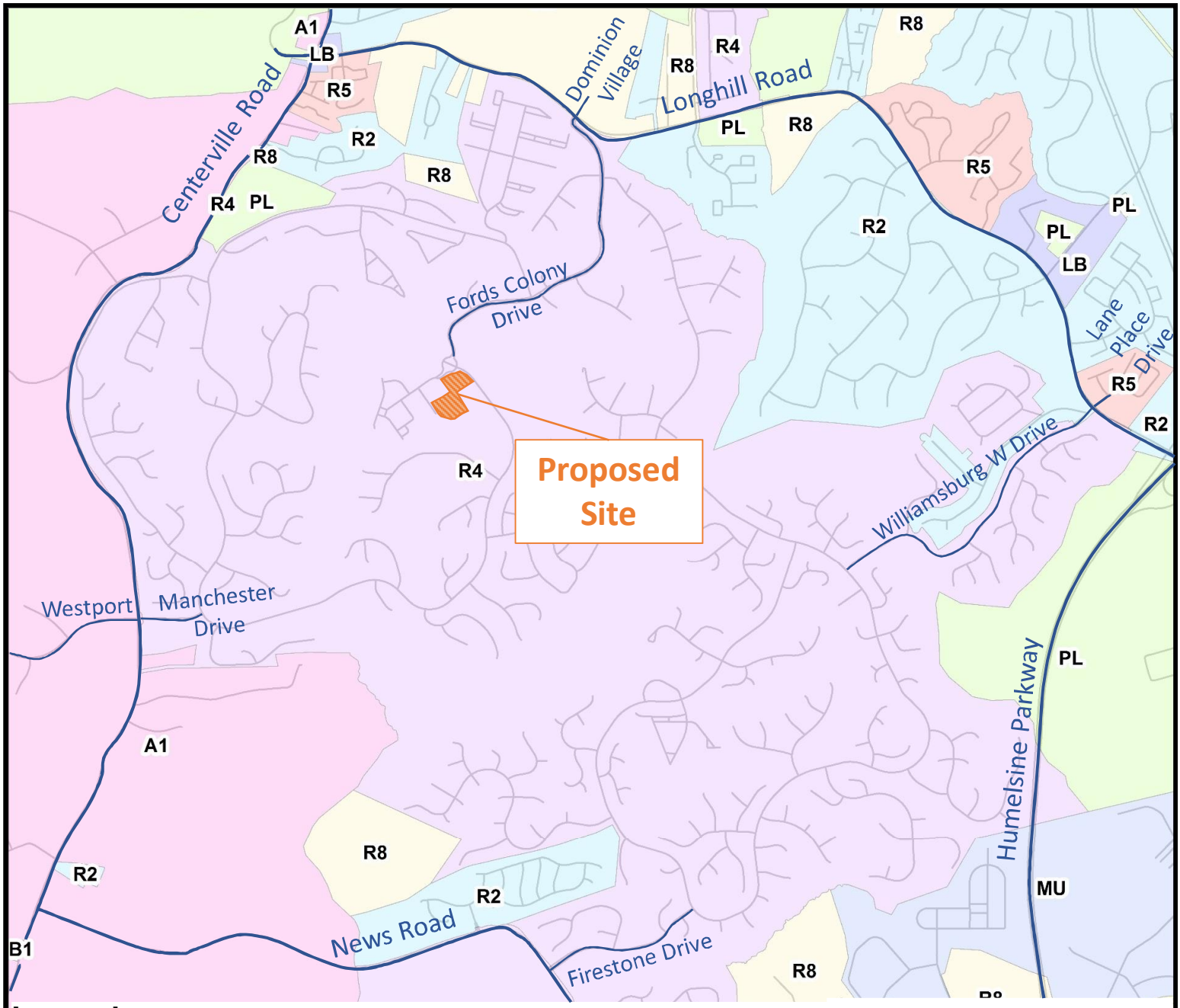


## Legend

- General Agriculture (A1)
- General Business (B1)
- General Industrial (M2)
- General Residential (R2)
- Limited Business (LB)
- Limited Business/Industrial (M1)
- Limited Residential (R1)
- Low-Density Residential (R6)
- Mixed Use (MU)
- Multi-Family Residential (R5)
- Planned Unit Development Commercial (PUD-C)
- Planned Unit Development Residential (PUD-R)
- Public Lands (PL)
- Residential Planned Community (R4)
- Rural Residential (R8)

*Source: James City County GIS Zoning Layer*

| | | | |
|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | Existing Zoning | FIGURE<br>2 |

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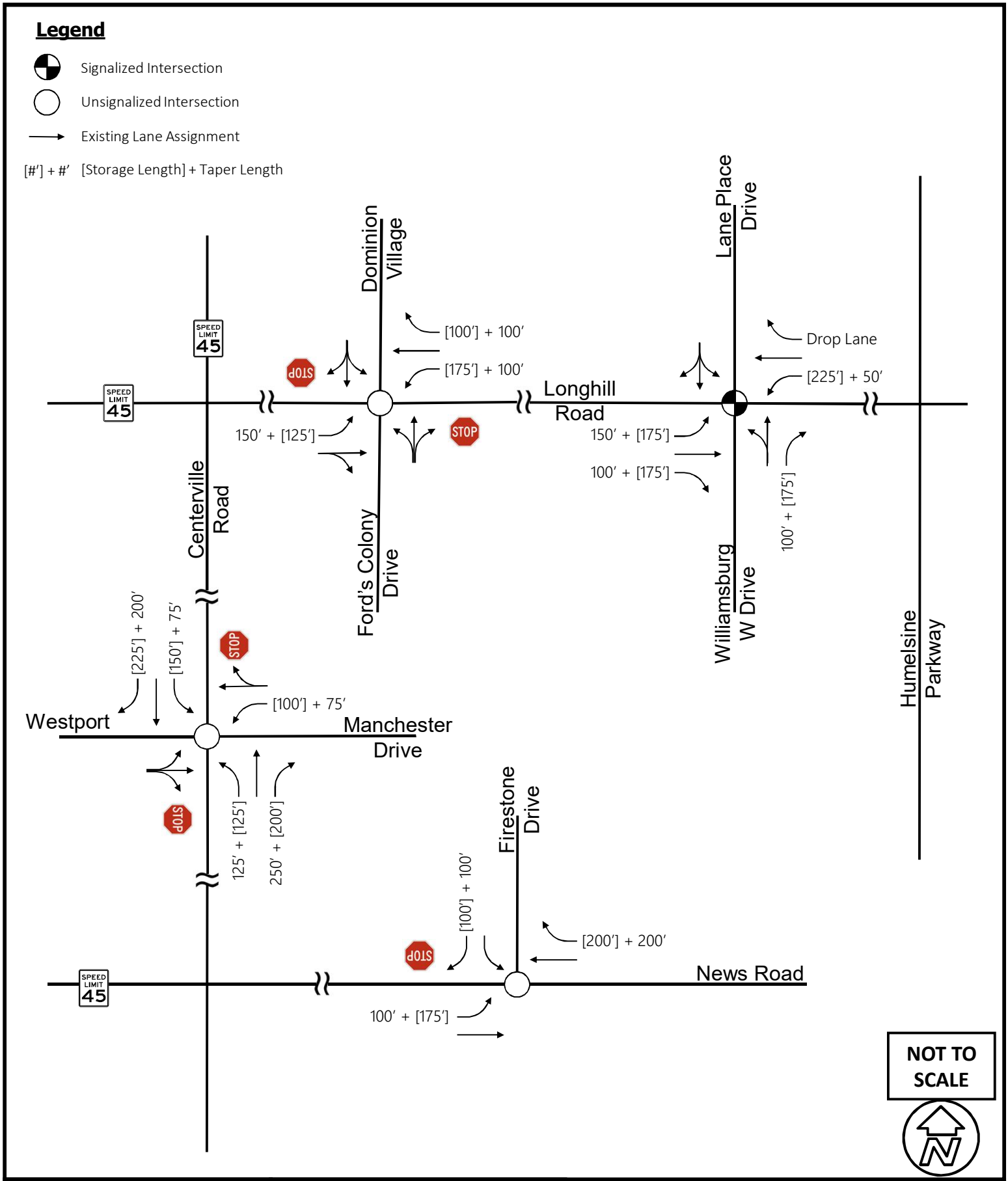


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|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | Existing Roadway Conditions | FIGURE<br>3 |

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## 3.5 EXISTING PEDESTRIAN AND BICYCLE ACCOMMODATIONS

Pedestrian accommodations (i.e., crosswalks, pedestrian signal heads) are not provided at any of the study intersections. However, sidewalk is provided on the north side of Longhill Road from Williamsburg W. Drive/Lane Place Drive to Warhill Trail. Portions of sidewalk are located along Centerville Road but lack connectivity throughout the study area.

In addition, paved shoulders allow for bicycle traffic on Longhill Road from Williamsburg W. Drive to Old Towne Road. Dedicated bike lane pavement markings traversing through the intersections are provided at major intersections along Longhill Road to enhance the visibility and safety of the bicyclists. A dedicated bike lane is provided along southbound Centerville Road from Longhill Road to just north of Mallory Place. Paved shoulders allow for bicyclist traffic on Centerville Road, south of Mallory Place. Pedestrian and bicycle accommodations are not provided along either side of News Road.

## 3.6 EXISTING TRAFFIC

Consistent with the previously completed TIS, AM and PM peak conditions were analyzed to evaluate potential impacts of the proposed development. To coincide with these times, turning movement counts (TMC) which included vehicular, truck, and pedestrian traffic were collected at the following study area intersections on June 8, 2017:

- Longhill Road at Williamsburg W. Drive/Lane Place Drive
- Longhill Road at Fords Colony Drive
- Centerville Road at Manchester Drive
- News Road at Firestone Drive

The uniform peak hours for these intersections were found to be 7:30 AM to 8:30 AM and 4:45 PM to 5:45 PM for the AM and PM peak hours, respectively. It should be noted that peak hour volumes were not adjusted and/or balanced, due to the location and number of access driveways between study area intersections.

Each movement of the 2017 TMCs were grown using annualized growth rates detailed in **Section 6.1** to calculate the 2019 volumes for each intersection. The AM and PM peak hour turning movement volumes from the abovementioned data sources are shown in **Figure 4**. Detailed count data is also provided in **Appendix B**.

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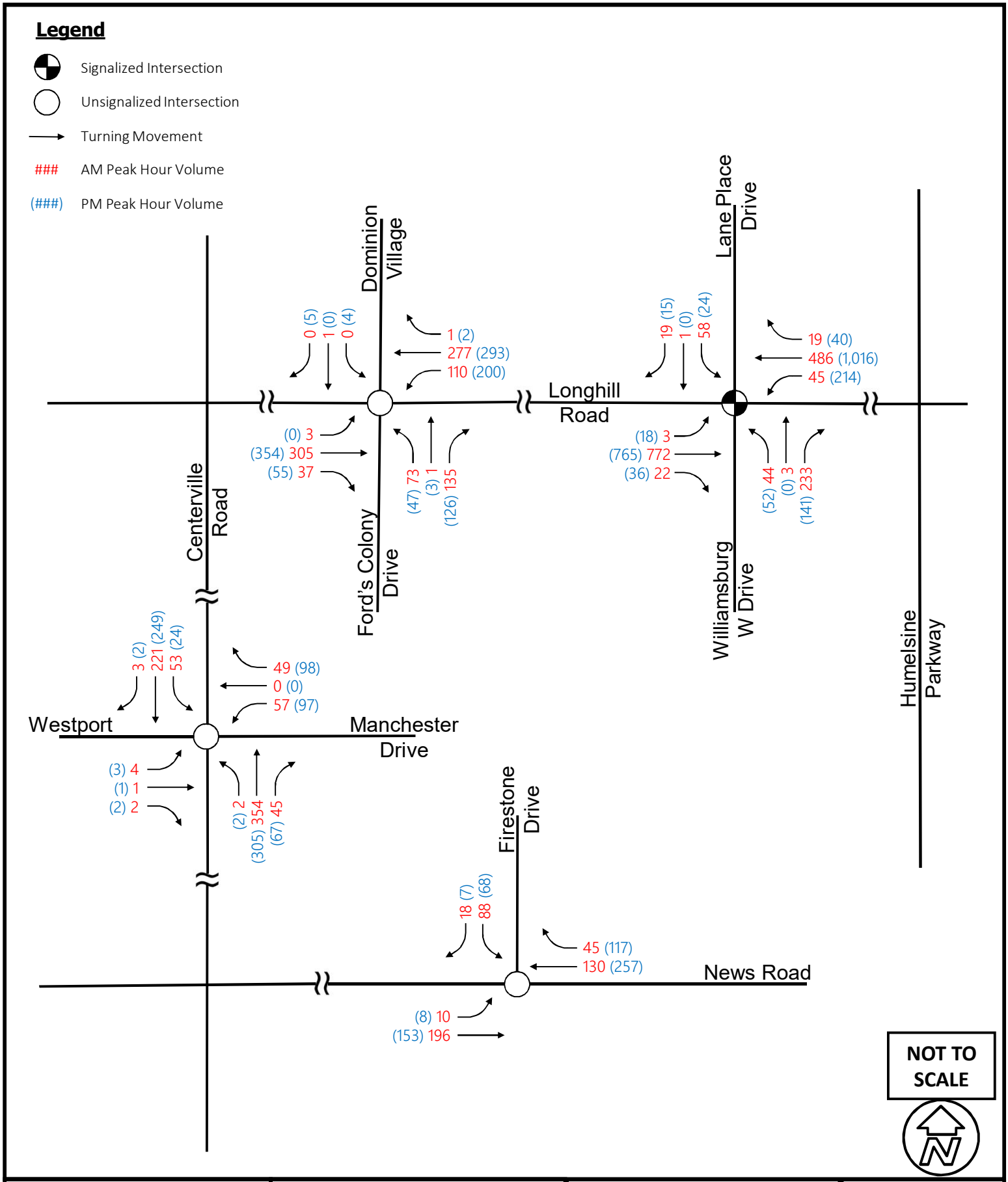


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2019 Existing AM and PM<br>Peak Hour Traffic Volumes | FIGURE<br>4 |
|---|---|---|---|

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# 4 TRIP GENERATION

To determine the anticipated number of trips generated by the proposed residential condominium/townhouse development, the *Trip Generation Manual*, published by the Institute of Transportation Engineers [ITE], 10th Edition, 2017 was used to estimate the new traffic on the adjacent roadway network.

The proposed development will consist of 60 residential condominium/townhouse units. Based on this land use type and intensity, trip generation estimates were calculated as shown in **Table 2**.

***Table 2: ITE Trip Generation Summary (10th Edition)***

| ITE Code | ITE Description | Density | Daily | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Enter (23%) | Exit (77%) | Total | Enter (63%) | Exit (37%) | Total |
| 220 | Multifamily Housing (Low-Rise) | 60 Dwelling Units | 413 | 7 | 22 | 29 | 23 | 14 | 37 |

*Source: ITE Trip Generation Manual, 10th Edition*

The total amount of traffic generated by the proposed development is anticipated to consisted of 413 daily trips, of which 29 trips will occur during the AM peak and 37 trips will occur during the PM peak hour, respectively. No pass-by or internal capture rate reductions were included as part of this analysis.

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# 5 TRAFFIC DISTRIBUTION AND ASSIGNMENT

The directional distribution and assignment of trips generated by the proposed redevelopment was based on a review of existing traffic volumes, site access, the *Ford's Colony Traffic Impact Study 2003-2004 Update*, and an understanding of travel patterns within the study area. From this review and conversations with VDOT, the following traffic distributions were derived for the analysis of the study area:

- AM Peak Hour
  - 80% of the trips generated will travel to/from the north on Ford's Colony Drive
    - 60% to/from the east on Longhill Road
    - 20% to/from the west on Longhill Road
  - 20% of the trips generated will travel to/from the west on Manchester Drive
- PM Peak Hour
  - 70% of the trips generated will travel to/from the north on Ford's Colony Drive
    - 55% to/from the east on Longhill Road
    - 15% to/from the west on Longhill Road
  - 30% of the trips generated will travel to/from the west on Manchester Drive

Based on conversations with VDOT, this TIS assumes site trips will not utilize the Williamsburg W. Drive or Firestone Drive access points due to the distance to/from the proposed development site.

As shown previously in and consistent with the previous TIS, the proposed development site will not introduce any new access points to existing/adjacent study area roadways.

Detailed AM and PM peak hour trip distribution and trip assignment is shown in **Figure 5** and **Figure 6**, respectively.

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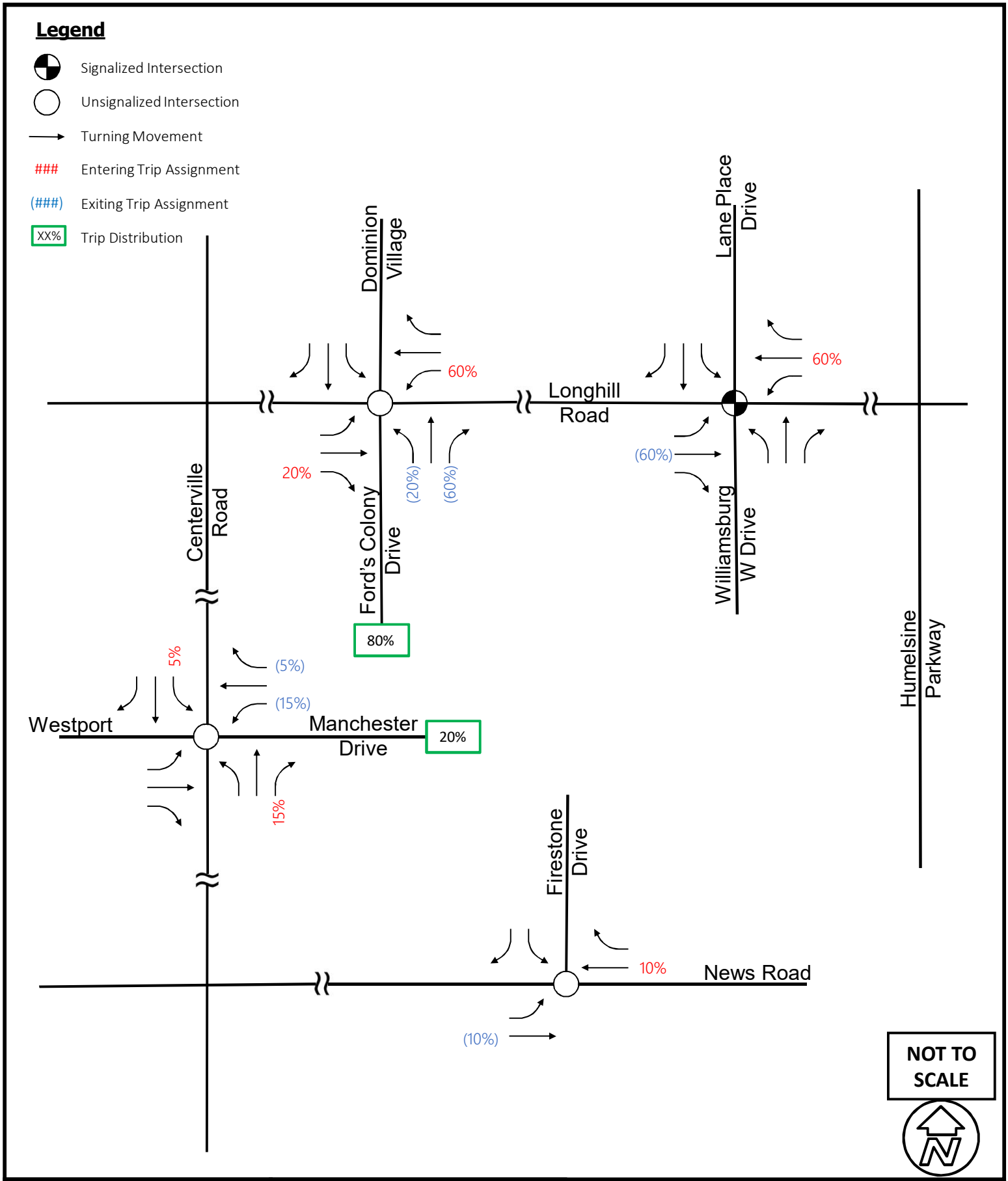


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | AM Condominium Site<br>Distribution and Assignment | FIGURE<br>5 |
|---|---|---|---|

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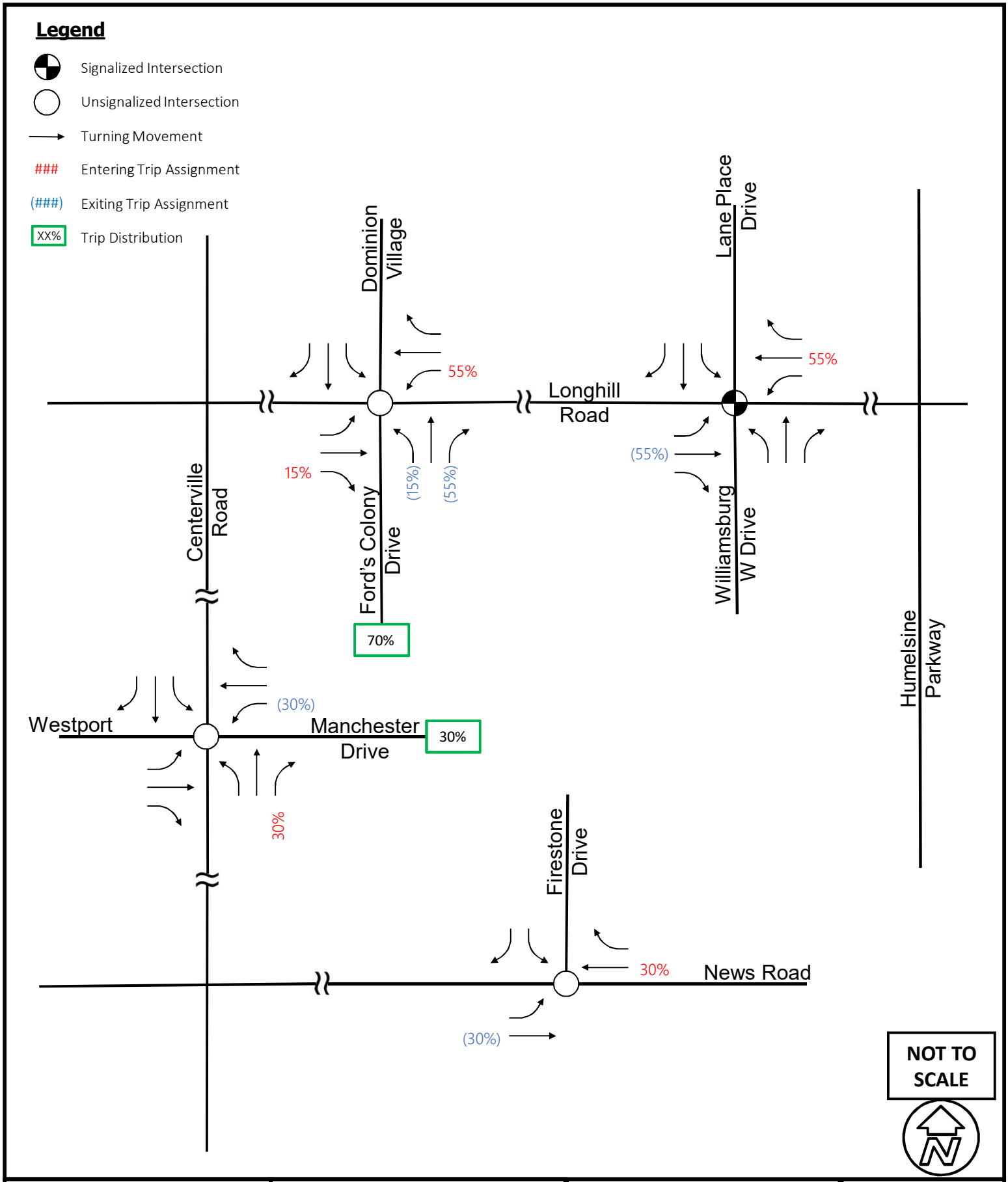


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | PM Condominium Site<br>Distribution and Assignment | FIGURE<br>6 |
|---|---|---|---|

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# 6 PROJECTED TRAFFIC VOLUMES

Based on discussions with James City County, the following existing and horizon year scenarios were agreed to and analyzed to determine future impacts of the proposed development based on the anticipated schedule for construction and opening:

- Scenario 1 – 2019 Existing traffic conditions
- Scenario 2 – 2021 Opening Year No-Build conditions – Build-out year traffic conditions ***with*** only background development trips applied (i.e., approved adjacent development traffic)
- Scenario 3 – 2021 Opening Year Build conditions – Build-out year traffic conditions ***with*** background development trips applied ***plus*** traffic volumes generated by the proposed development
- Scenario 4 – 2027 Opening Year +6 years No-Build conditions – Build-out year traffic conditions ***with*** only background development trips applied (i.e., approved adjacent development traffic)
- Scenario 5 – 2027 Opening Year +6 years Build conditions – Build-out year traffic conditions ***with*** background development trips applied ***plus*** traffic volumes generated by the proposed development

## 6.1 BACKGROUND TRAFFIC GROWTH

Background traffic growth rates were determined by using rates developed as part of the *Longhill Road Corridor Study*, completed and adopted in October 2014, and historical traffic volume trends over the previous six (6) years (i.e., 2011 to 2016) from VDOT data.

- Longhill Road – 2.0% per year (consistent with *Longhill Road Corridor Study*)
- Centerville Road – 2.5% per year
- News Road – 2.0% per year

Since November 2019, approximately 2,851 of 3,250 total units have been built within Ford's Colony with a remainder of 399 unbuilt units, as shown in **Figure 7**. The 399 unbuilt units are as follows:

- 295 platted, unbuilt lots
- 60 un-platted Eaglescliff development lots
- 30 un-platted Windsor development lots
- 14 un-platted Ford's property lots

With the addition of 90 units, Ford's Colony has a remainder of 309 units available. The additional 90 units consist of 60 units in the Eaglescliff development (described in Chapter 4) and 30 units in the Windsor development (described in Section 6.1.1.). The aforementioned traffic growth rates were applied to all intersection movements to account for the trip generation potential of the remaining 309 units; thus, accounting for the full build-out of Ford's Colony.

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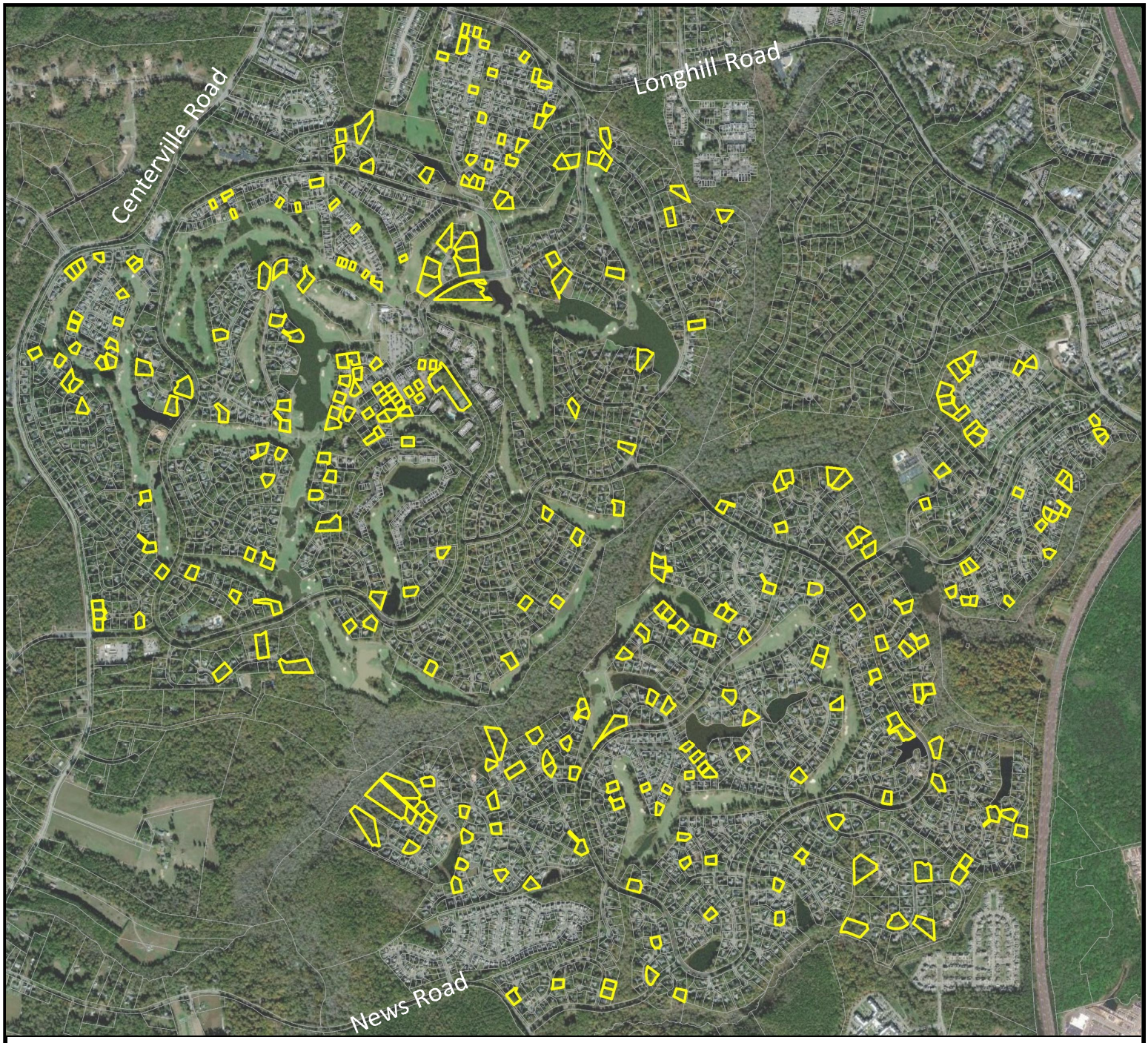


| | | | |
|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | Ford's Colony Unbuilt Lots | FIGURE<br>7 |

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### 6.1.1 OTHER DEVELOPMENT TRAFFIC

Since the 2004 study was completed, there has been minimal to no residential development/expansion occurring within the Ford's Colony Master Plan development. However, three additional developments adjacent to Ford's Colony were provided by James City County for inclusion in the analysis of future traffic operational conditions: The Villages at Ford's Colony (The Villages), Westport Subdivision at Ford's Colony (Westport), and Windsor Property (Windsor).

Per the *News Road Corridor Traffic Forecast and Analysis*, completed in April 2008, the Villages at Ford's Colony has a proposed entrance on the northbound approach of the News Road at Firestone Drive intersection. The Westport development's entrance is currently located on the eastbound approach (west leg) of the Manchester Drive at Centerville Road intersection.

In addition, the Windsor development is anticipated to be located along Ford's Colony Drive across from N. Knob Hill. Future traffic volumes associated with these other approved developments were accounted for and calculated using the most recent version of the *ITE Trip Generation Manual.*

Trip generation densities as well as the trip distribution and assignment percentages for The Villages and Westport developments will remain consistent with the *News Road Corridor Traffic Forecast and Analysis.* The trip distribution and assignment for the Windsor property will be consistent with the proposed redevelopment as detailed in **Chapter 5**.

The Villages development will consist of attached and detached senior adult housing, congregate care housing, assisted living, and a nursing home, for a total of 739 units. The trip generation was calculated, and the results are shown in **Table 3.** The total amount of traffic generated by The Villages development consisted of 2,078 daily trips, of which 101 and 161 trips will occur during the AM and PM peak hours, respectively.

***Table 3: ITE Trip Generation Summary for The Villages at Ford's Colony Development***

| ITE Code | ITE Description | Density | Unit | Daily | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Enter | Exit | Total | Enter | Exit | Total |
| 251 | Senior Adult Housing - Detached | 38 | Dwelling Units | 240 | 7 | 13 | 20 | 14 | 9 | 23 |
| 252 | Senior Adult Housing - Attached | 168 | Dwelling Units | 650 | 12 | 21 | 33 | 24 | 19 | 43 |
| 253 | Congregate Care Housing | 390 | Dwelling Units | 788 | 13 | 9 | 22 | 32 | 28 | 60 |
| 254 | Assisted Living | 83 | Beds/Rooms | 216 | 10 | 6 | 16 | 8 | 14 | 22 |
| 620 | Nursing Home | 60 | Beds/Rooms | 184 | 7 | 3 | 10 | 4 | 9 | 13 |
| **Total** | | **739** | | **2,078** | **49** | **52** | **101** | **82** | **79** | **161** |

*Note: It is assumed that there is one bed per room, and therefore each bed is considered one dwelling unit.*

The Westport development will consist of 43 units of single-family detached housing. The trip generation estimates for the proposed Westport development are shown in **Table 4**. The total amount of traffic generated by the Westport development consisted of 478 daily trips, of which 35 will occur during the AM peak hour and 45 will occur during the PM peak hour, respectively.

*Table 4: ITE Trip Generation Summary for Westport Subdivision at Ford's Colony Development*

| ITE Code | ITE Description | Density | Unit | Daily | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Enter | Exit | Total | Enter | Exit | Total |
| 210 | Single-Family Detached Housing | 43 | Dwelling Units | 478 | 9 | 26 | 35 | 28 | 17 | 45 |

The Windsor development will consist of 30 units of multifamily attached housing. The trip generation estimates for the proposed Windsor development are shown in **Table 5.** The total amount of traffic generated by the Windsor development consisted of 186 daily trips, of which 15 will occur during the AM peak hour and 20 will occur during the PM peak hour, respectively. **Figure 8** through **Figure 13** illustrate the approved development site trip distributions and assignments.

*Table 5: ITE Trip Generation Summary for Windsor Development*

| ITE Code | ITE Description | Density | Unit | Daily | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Enter | Exit | Total | Enter | Exit | Total |
| 220 | Multifamily Housing (Low-Rise) | 30 | Dwelling Units | 186 | 3 | 12 | 15 | 13 | 7 | 20 |

## 6.2 TOTAL TRAFFIC

Traffic associated with the proposed residential condominium/townhouse development was added to the future background traffic volumes as well as the approved development traffic volumes to develop the total traffic volumes for 2021 and 2027 future Build conditions. **Figure 14** through **Figure 17** illustrate the peak hour traffic volumes used in the analysis of future conditions (i.e., No-Build and Build). Worksheets detailing the volumes for the study area intersections are provided in **Appendix C**.

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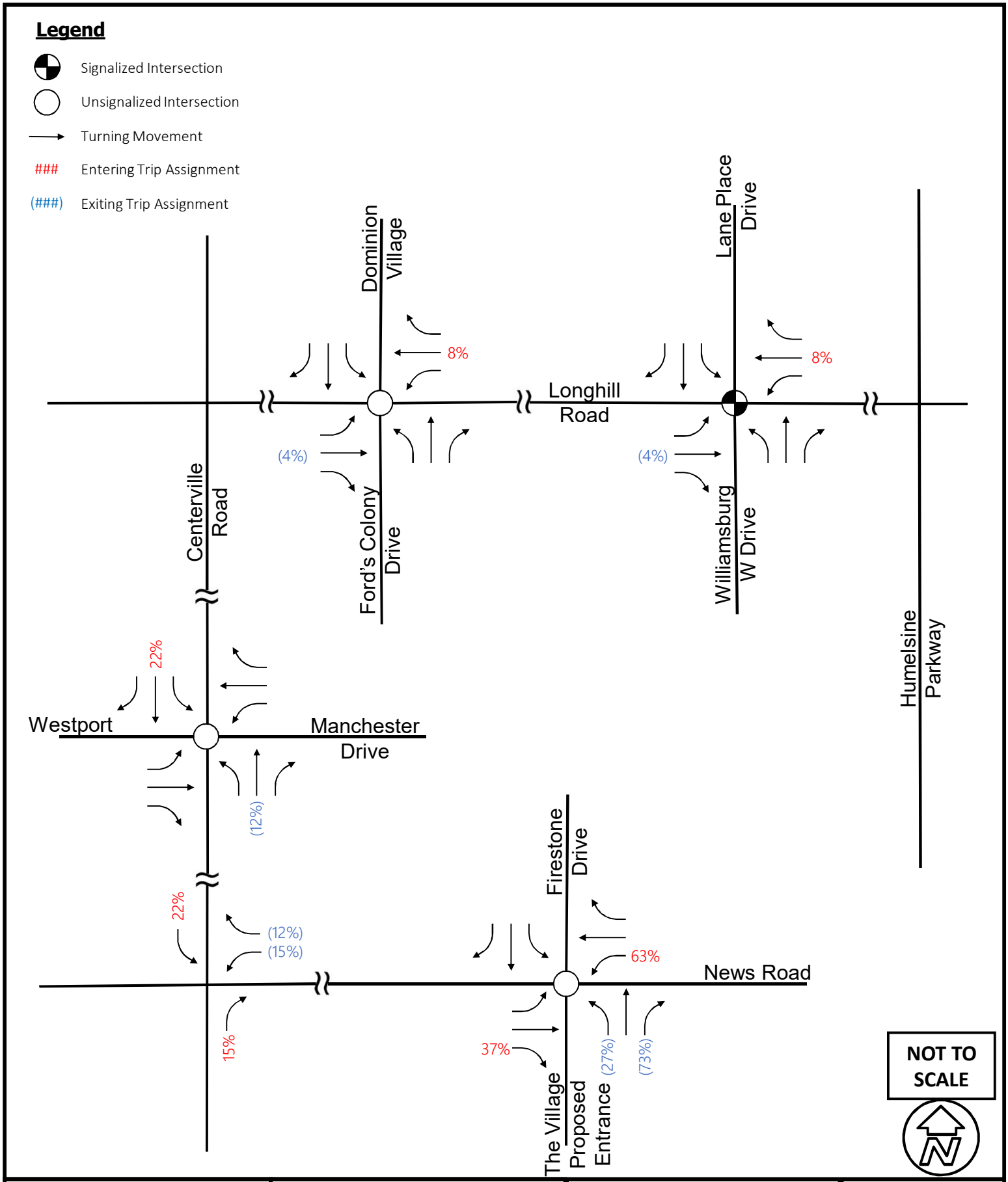


| | | | |
|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | The Villages AM Background Site Distribution | FIGURE 8 |

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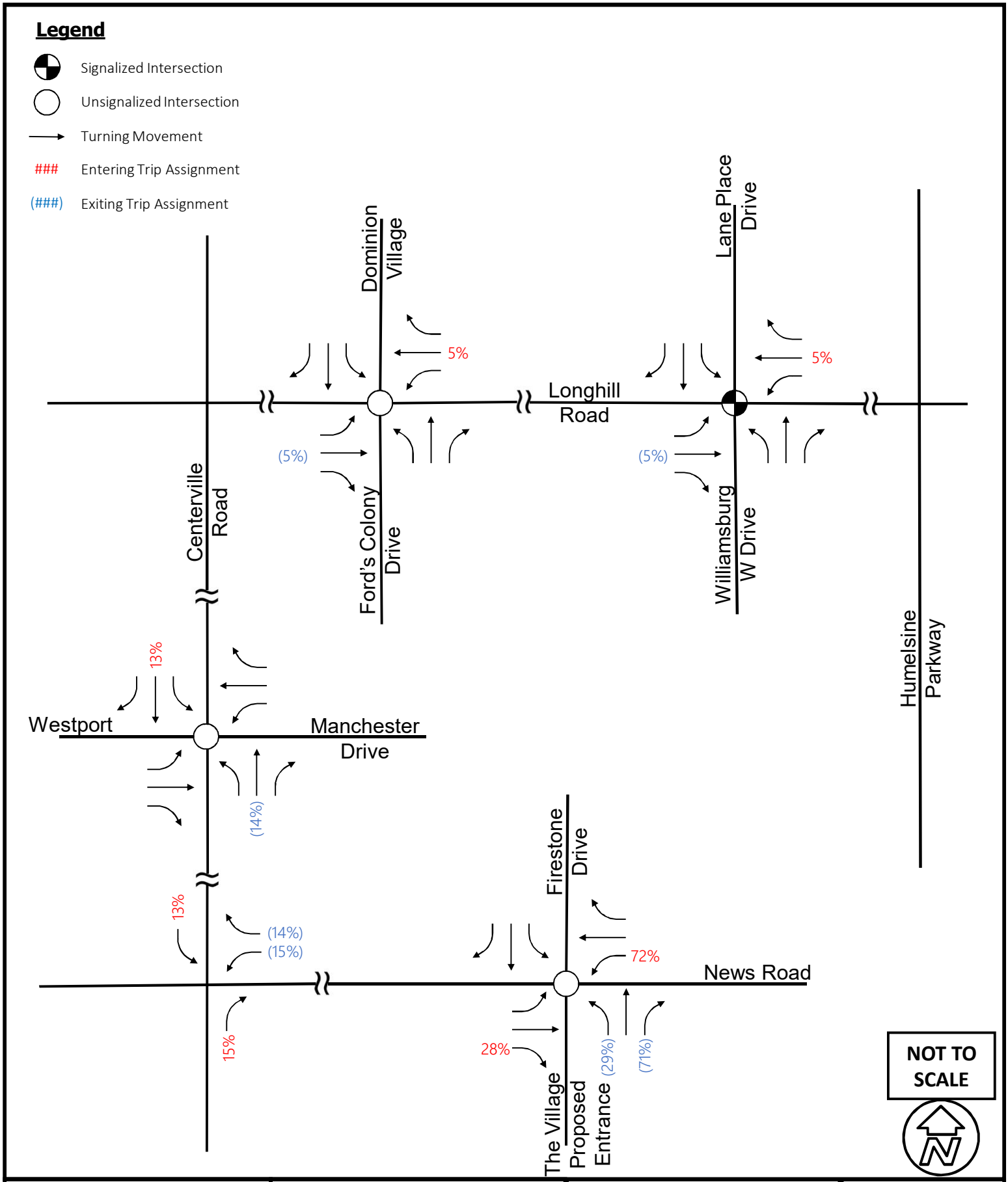


| | | | |
|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | The Villages PM Background Site Distribution | FIGURE 9 |

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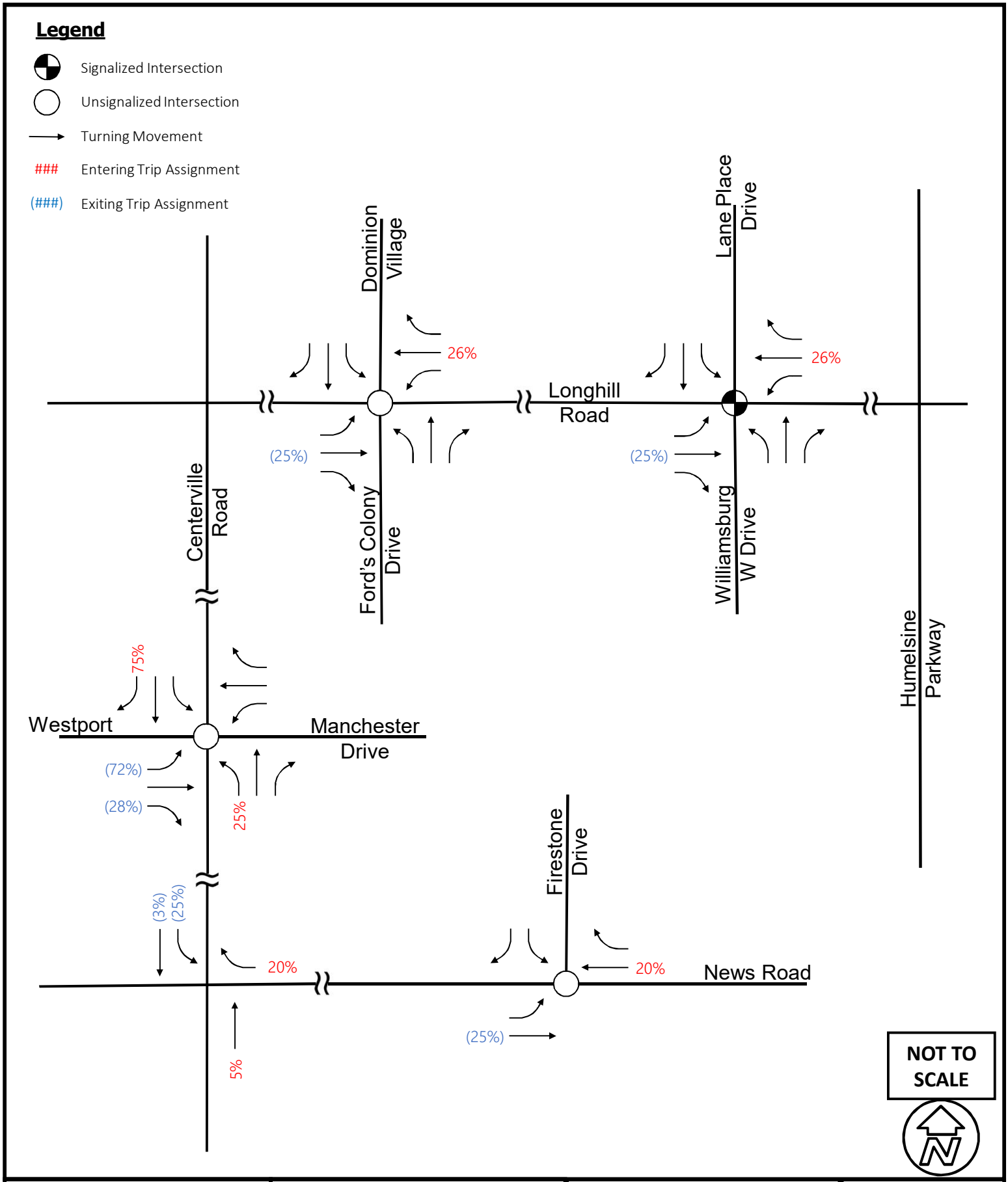


| | | | |
|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | Westport AM Background<br>Site Distribution | FIGURE<br>10 |

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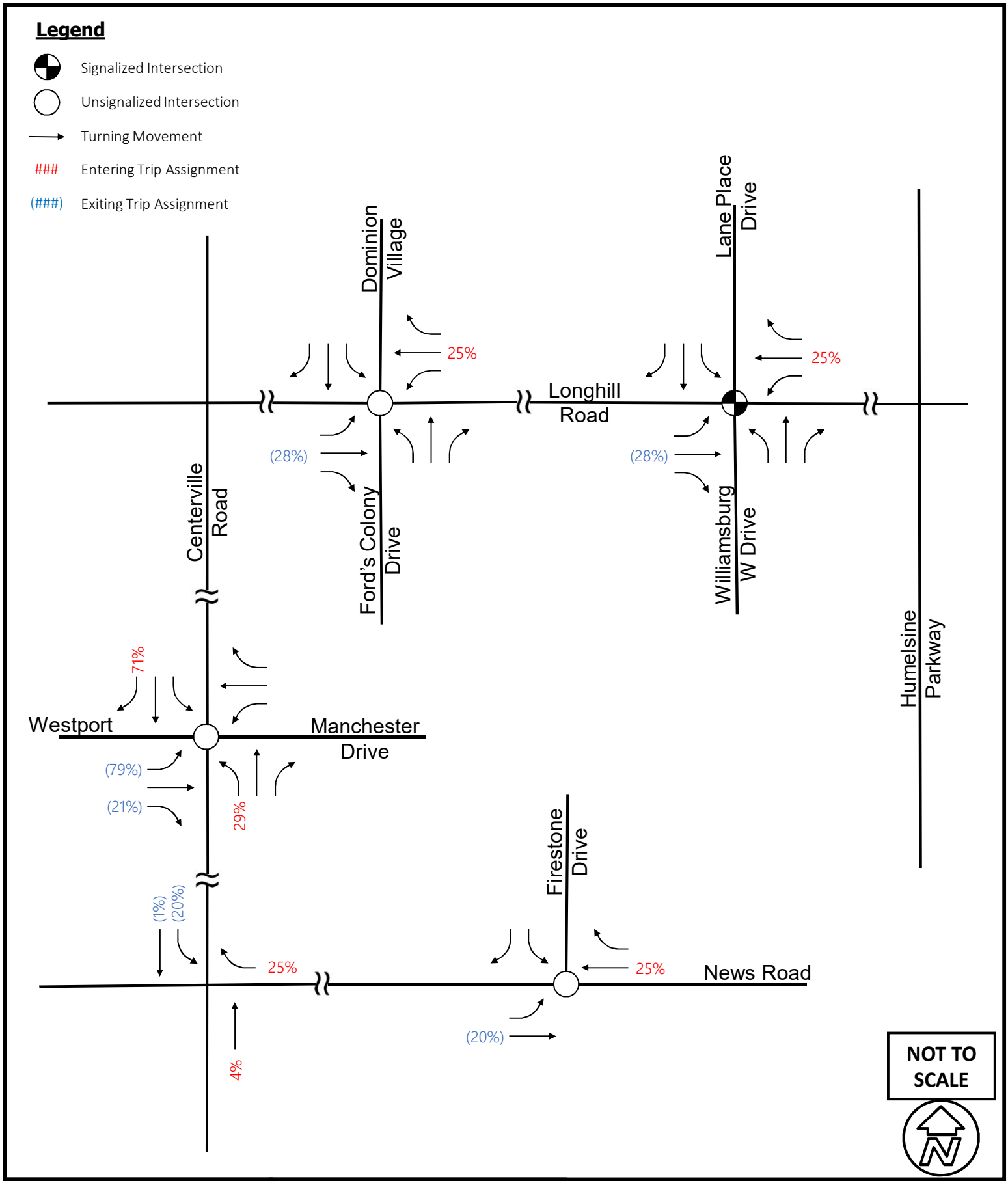


| | | | |
|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | Westport PM Background<br>Site Distribution | FIGURE<br>11 |

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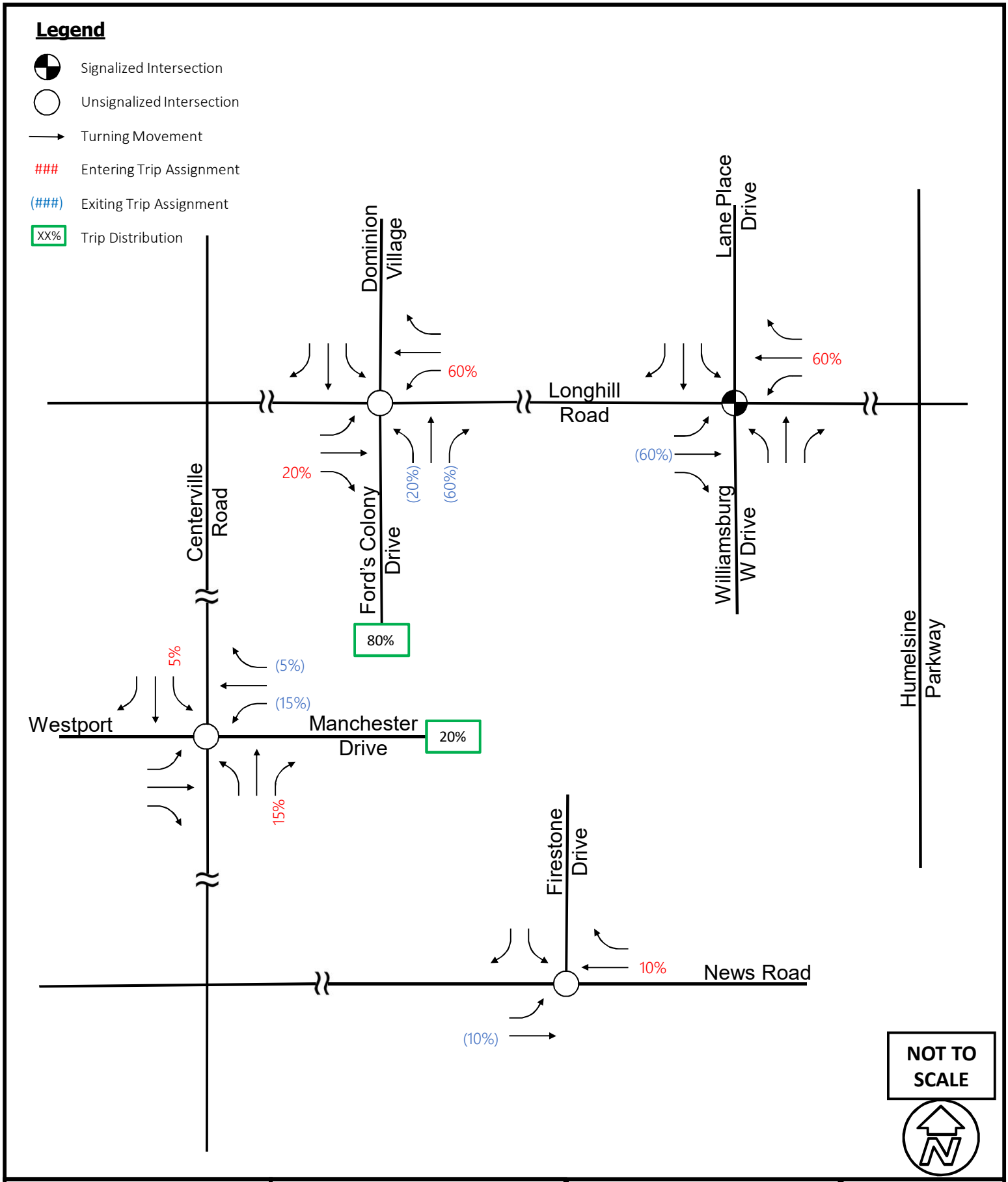


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | Windsor AM Background<br>Site Distribution | FIGURE<br>12 |
|---|---|---|---|

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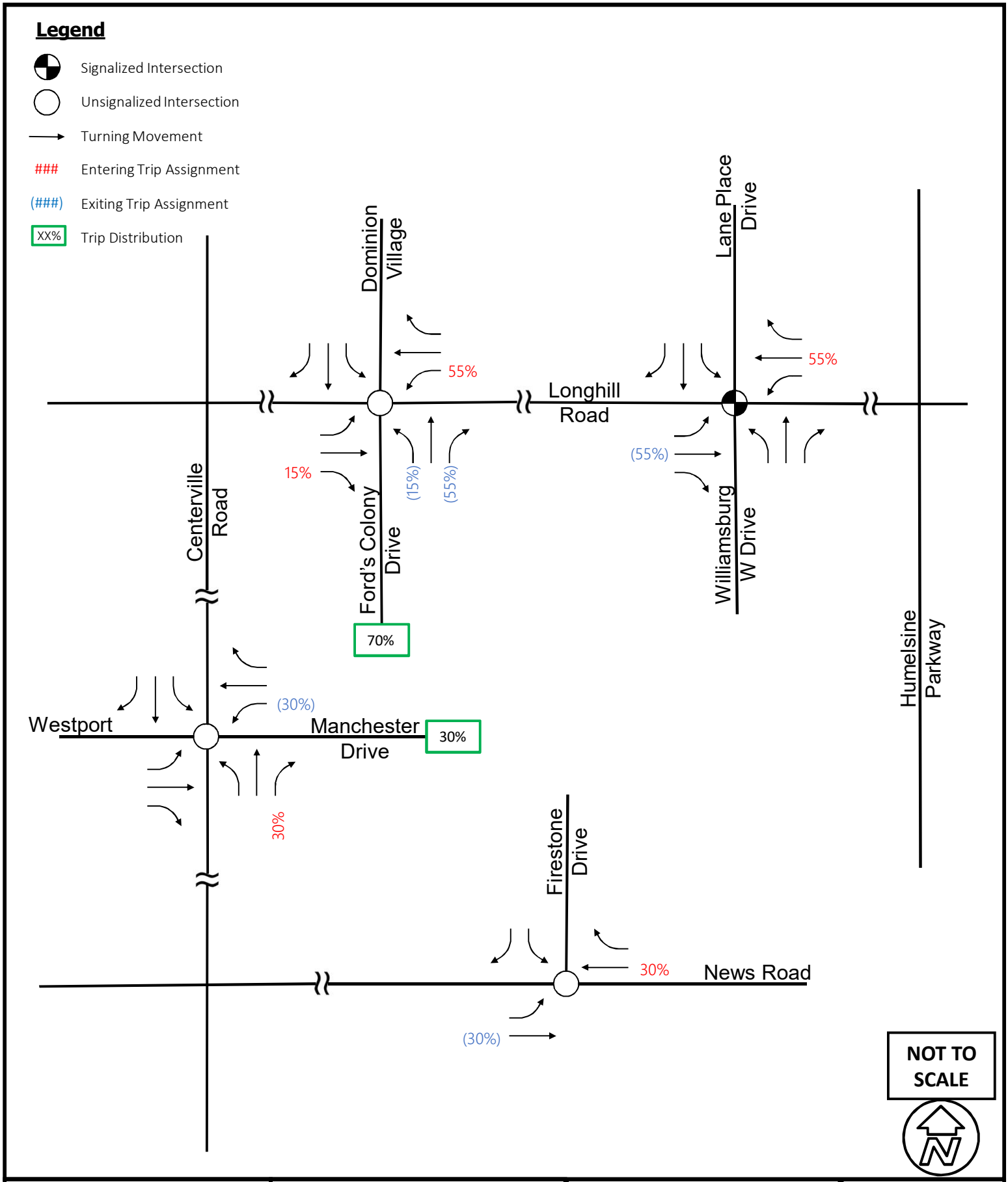


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | Windsor PM Background<br>Site Distribution | FIGURE<br>13 |
|---|---|---|---|

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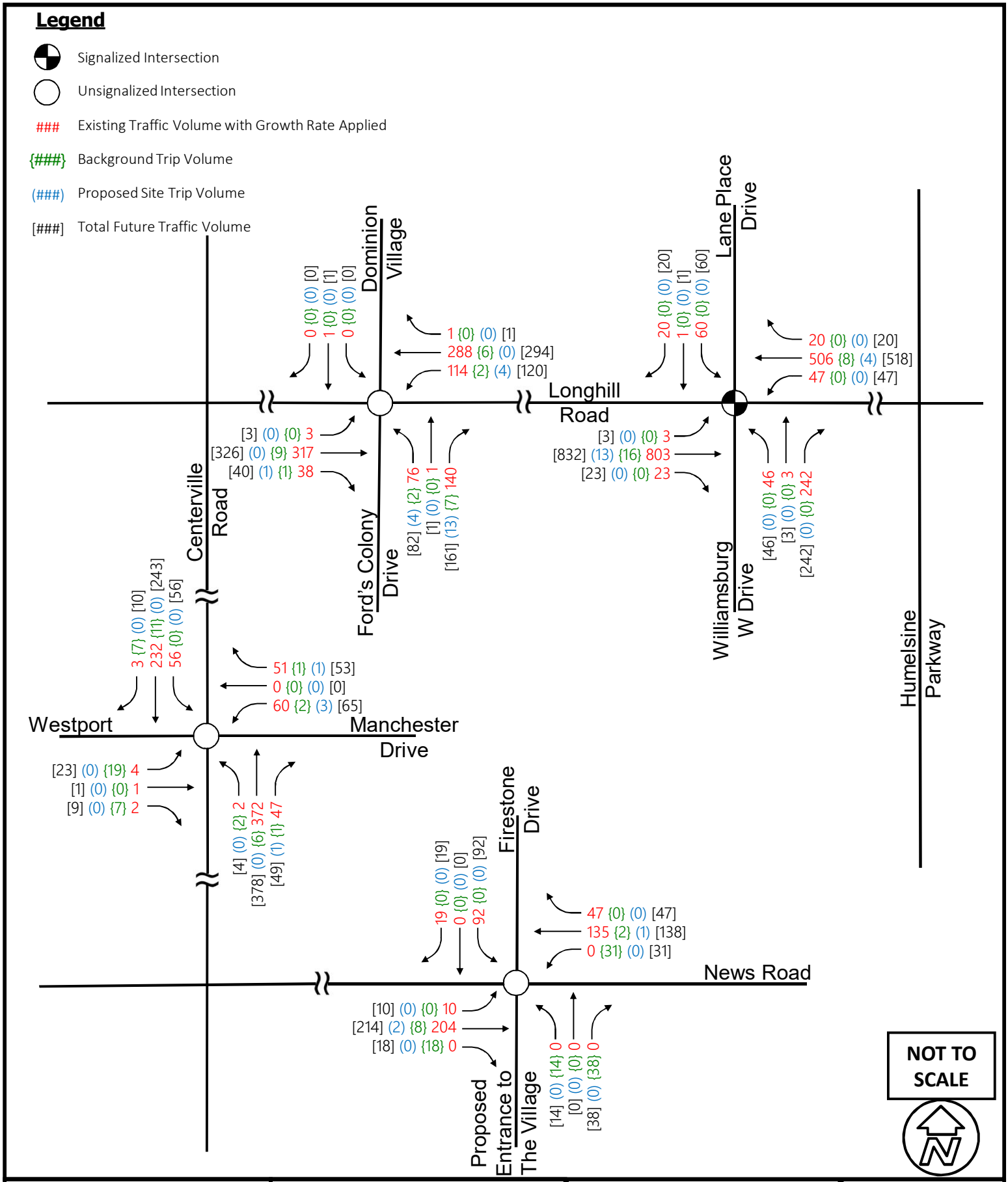


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2021 Build<br>AM Peak Hour Volumes | FIGURE<br>14 |
|---|---|---|---|

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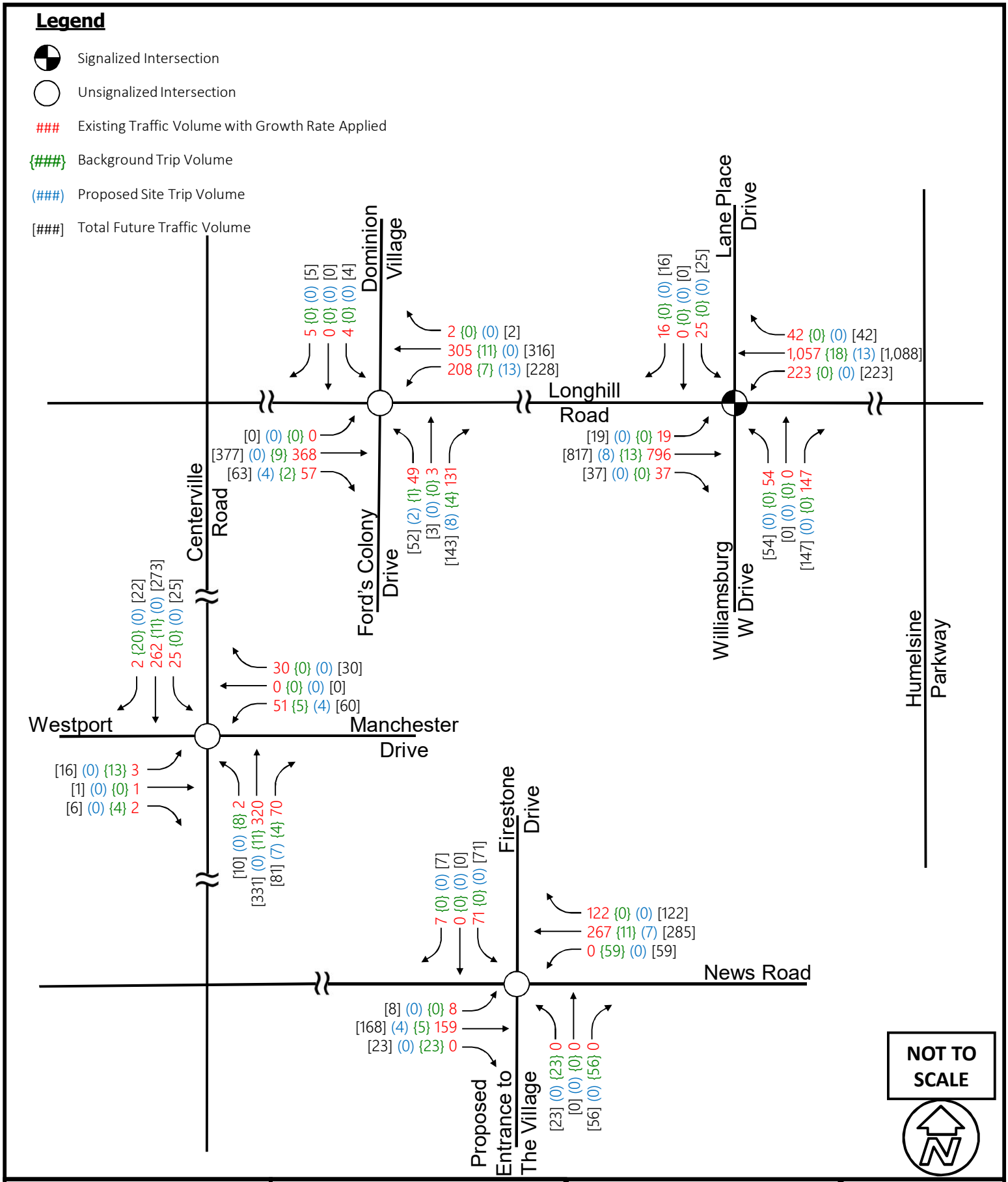


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2021 Build<br>PM Peak Hour Volumes | FIGURE<br>15 |
|---|---|---|---|

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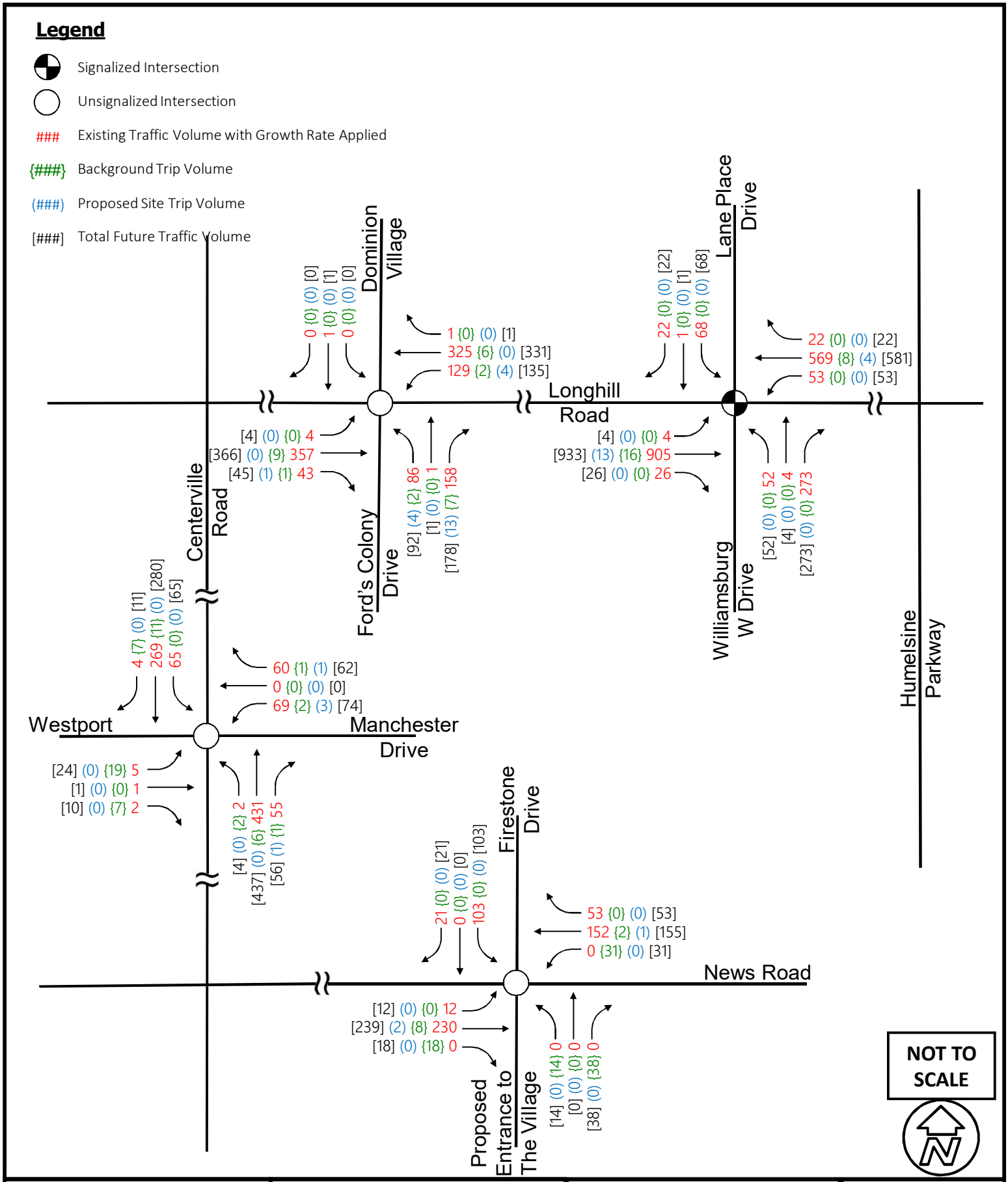


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2027 Build<br>AM Peak Hour Volumes | FIGURE<br>16 |
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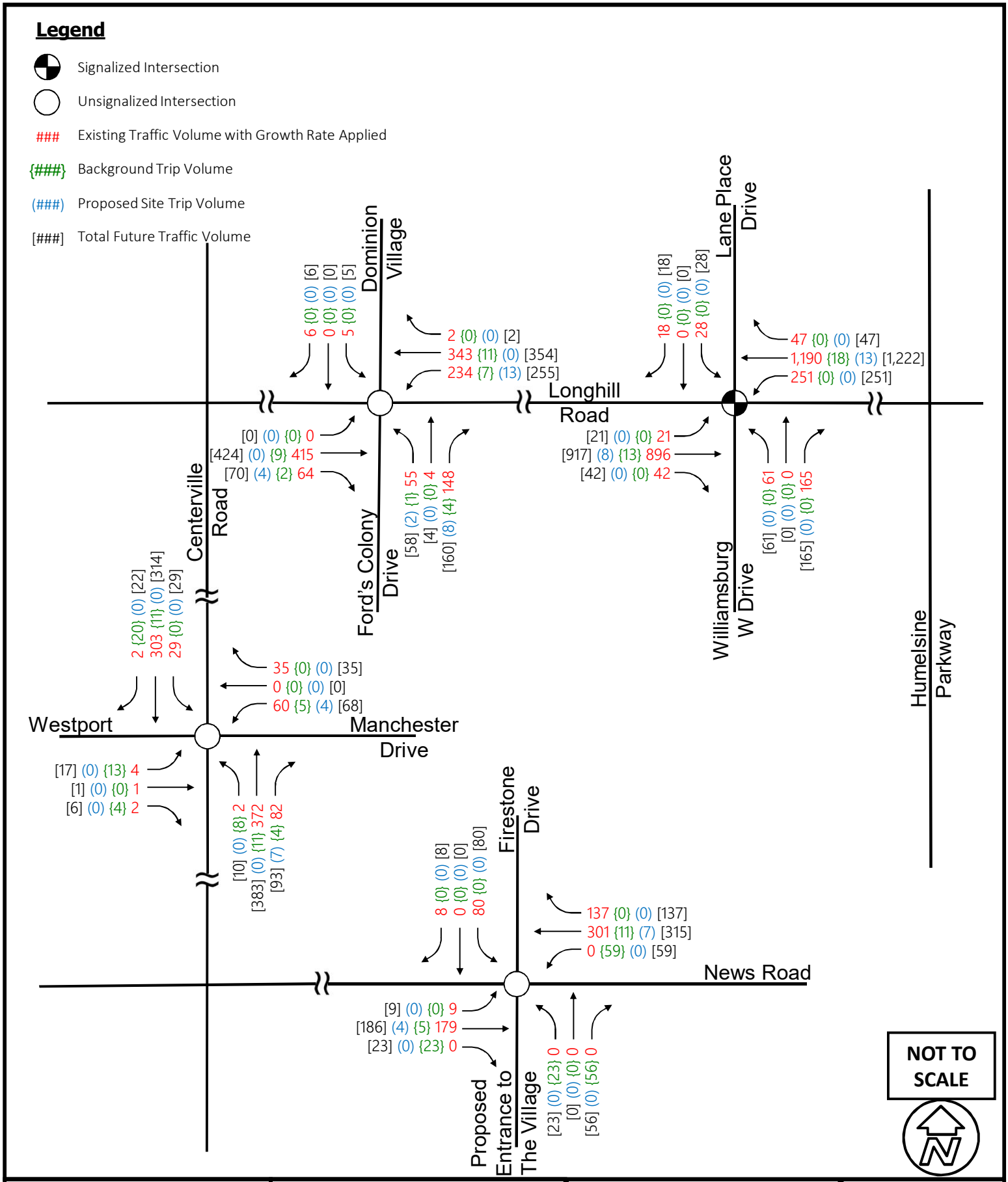


Kimley»Horn

Ford's Colony TIS Update
James City County, VA

2027 Build
PM Peak Hour Volumes

FIGURE
17

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# 7 TRAFFIC ANALYSIS

The traffic analysis for the proposed condominium/townhouse development as well as the improvements outlined in the proffers consisted of right-turn lane warrants, traffic signal warrants, and intersection operations. Analyses of study area intersections for AM and PM peak hours were performed for the following scenarios:

- 2019 Existing
- 2021 No-Build (background traffic only)
- 2021 Build (background traffic with proposed development trips)
- 2027 No-Build (background traffic only) – *Includes planned Longhill Road widening and intersection improvements currently under construction*
- 2027 Build (background traffic with proposed development trips) – *Includes planned Longhill Road widening and intersection improvements currently under construction*

The planned Longhill Road widening and intersection improvements currently under construction included in the study area are shown in **Figure 18**.

***Figure 18: Longhill Road Widening and Intersection Improvements***

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## 7.1 RIGHT-TURN LANE WARRANT

A right-turn lane warrant analysis was performed for the eastbound approach of Longhill Road at the Fords Colony Drive intersection to assess the need for a full-width exclusive right-turn treatment, as outlined by the proffers. This was conducted in accordance with VDOT right turn-lane warrant analysis guidelines per *Appendix F Access Management Design Standards for Entrances and Intersections*. Detailed data sheets for the turn lane warrant under each scenario are provided in **Appendix D.** Based on these guidelines, **Table 6** illustrates that a full-width, right-turn lane and taper is warranted for the PM peak hour under 2021 Build, 2027 No Build, and 2027 Build scenarios.. Based on these turn-lane warrant analysis findings, it is recommended that a full width right-turn lane be constructed for the eastbound approach Longhill Road at Fords Colony Drive.

***Table 6: Summary of Right-Turn Lane Warrant Analysis for Fords Colony Drive at Longhill Road***

| Scenario | Warrants Analysis | |
|---|---|---|
| | Right-Turn Lane Warrant | |
| | AM | PM |
| **Existing (2019)** | ✓ (taper required) | ✓ (taper required) |
| **No Build (2021)** | ✓ (taper required) | ✓ (taper required) |
| **Build (2021)** | ✓ (taper required) | ✓ (full-width turn lane and taper required) |
| **No Build (2027)** | ✓ (taper required) | ✓ (full-width turn lane and taper required) |
| **Build (2027)** | ✓ (taper required) | ✓ (full-width turn lane and taper required) |

*Notes:* ✗ *- Warrant not met*
✓ *- Warrant met*

## 7.2 TRAFFIC SIGNAL WARRANT ANALYSIS

Traffic signal warrant analyses were performed for the unsignalized intersection of Longhill Road at Fords Colony Drive and the unsignalized intersection of News Road at Firestone Drive, consistent with the methodologies provided in the *Manual on Uniform Traffic Control Devices* (MUTCD), to evaluate the need for traffic signalization under existing and future traffic conditions. These warrants are based on mainline and minor street traffic volumes, the number of travel lanes, approach turn-lanes, and mainline posted speed limit. According to the MUTCD, a traffic control signal should not be installed unless one or more of the signal warrants are met. The warrants used in this analysis are as follows:

- **Warrant 1 (Eight-Hour Vehicular Volume)** - is satisfied if ONE of the following conditions exists for any eight hours of an average day:
  - Condition A (Minimum Vehicular Volume) - volumes meet or exceed the necessary hourly thresholds for any eight hours of an average day. Thresholds may be modified based on vehicle speeds and population of the local community.

- Condition B (Interruption of Continuous Traffic) - volumes meet or exceed the necessary hourly thresholds for any eight hours of an average day. Thresholds may be modified based on vehicle speeds and population of the local community.
- Combination of Condition A and B - intended to be used where Conditions A and B are not individually met and where volume thresholds may be reduced based on anticipated traffic delay at the intersection.

- **Warrant 2 (Four-Hour Vehicular Volume)** - volumes meet or exceed the necessary hourly thresholds for any four hours of an average day. Thresholds are typically higher than those for Warrant 1 and may be applicable when high traffic volumes are concentrated over a shorter time period (less than eight hours). The thresholds may also be modified based on vehicle speeds and population of the local community

- **Warrant 3 (Peak Hour Volume)** - volumes meet or exceed the necessary hourly thresholds for any one hour of an average day. This warrant should only be applied in unusual cases where an area is expected to discharge a large volume of traffic over a short period of time. Thresholds may be modified based on vehicle speeds and population of the local community.

Under each warrant analysis, existing turning movement volumes were used to determine if the volume thresholds provided in the MUTCD were met. This provides a baseline to establish the potential for needing a signal under current traffic loads. For future No-Build and Build conditions, the signal warrant analysis was performed accounting for future growth in traffic associated with and without the proposed development traffic. For the Longhill Road at Fords Colony Drive intersection, the westbound right-turn volumes were not accounted for as part of this analysis under the existing and future conditions since an exclusive right-turn lane is provided to accommodate this movement. In addition, the northbound right-turn lane volumes on Fords Colony Drive were not included in the signal warrant analysis as drivers are utilizing the 24-foot pavement width to turn right as other vehicles are stopped for the through or left-turn movements. For the News Road at Firestone Drive intersection, the southbound and westbound right-turn vehicles were not accounted for as part of this analysis under the existing conditions. In addition, the northbound right-turn vehicles were not included as part of this analysis for the Villages driveway under the future conditions.

To assign the hourly site traffic for the future warrant analysis, all assumptions and methods (i.e., trip generation, pass-by reduction, distribution, background traffic growth, other development traffic) were followed, with an additional step of applying hourly variations to the daily trip generation total. The hourly variation breakdown for Multifamily Housing (Low-Rise) (220), as provided in the ITE Trip Generation Manual, were used for this purpose, as shown in **Table 7.**

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*Table 7: Hourly Variations in Residential Traffic*

| Time | Average Weekday | |
|---|---|---|
| | Percent of 24-Hour Entering Traffic | Percent of 24-Hour Exiting Traffic |
| 6 am – 7 am | 1.6% | 5.7% |
| 7 am – 8 am | 2.5% | 9.0% |
| 8 am – 9 am | 3.7% | 9.1% |
| 9 am – 10 am | 3.7% | 6.5% |
| 10 am – 11 am | 4.1% | 5.5% |
| 11 am – 12 pm | 4.5% | 5.7% |
| 12 pm – 1 pm | 5.3% | 5.3% |
| 1 pm – 2 pm | 5.4% | 5.7% |
| 2 pm – 3 pm | 6.5% | 5.9% |
| 3 pm – 4 pm | 8.1% | 6.3% |
| 4 pm – 5 pm | 9.8% | 6.3% |
| 5 pm – 6 pm | 10.8% | 6.5% |

*Source: ITE Trip Generation Manual, 10th Edition*

The results of the signal warrant analyses are provided in **Table 8** and **Table 9**, with complete tables outlining the traffic volumes used, in **Appendix D**.

*Table 8: Summary of Warrant Analysis for Longhill Road at Fords Colony Drive*

| Scenario | Warrants Analysis | | | | |
|---|---|---|---|---|---|
| | Warrant 1 (8 Hour) | | | Warrant 2 (4 Hour) | Warrant 3 (1 Hour) |
| | Condition A | Condition B | Combination (A & B) | | |
| **Existing (2019)** | ✗ (0 out of 8) | ✗ (4 out of 8) | ✗ (0 out of 8) | ✗ | ✗ |
| **No Build (2021)** | ✗ (0 out of 8) | ✗ (6 out of 8) | ✗ (0 out of 8) | ✗ | ✗ |
| **Build (2021)** | ✗ (0 out of 8) | ✓ | ✗ (1 out of 8) | ✗ | ✗ |
| **No Build (2027)** | ✗ (0 out of 8) | ✓ | ✗ (1 out of 8) | ✓ | ✗ |
| **Build (2027)** | ✗ (0 out of 8) | ✓ | ✗ (3 out of 8) | ✓ | ✗ |

*Notes:* ✗ *- Warrant not met*
✓ *- Warrant met*
*(# out of 8) – Number of hours that could meet the 8-hour warrant requirement*

The warrant analysis for the Longhill Road at Fords Colony Drive intersection indicate that under the Existing and No Build future scenarios, Condition A, Condition B, and the Combination (A & B) Condition were not met except for the 2021 Build, 2027 No Build, and Build models, where Condition B was met.

Warrant 2 (4-hour volume) was not met under Existing and 2021 future scenarios for the Longhill Road at Fords Colony Drive intersection but was met for 2027 No Build and Build scenarios. From the warrant analysis, the traffic volumes on Longhill Road did not meet the minimum thresholds under Condition A and a maximum of 3 out of 8 volumes were met for the Combination Warrant. Since the intersection does not meet both Warrant 1 Condition A and Condition B or the Combination as well as low demand on Longhill Road, the traffic signal is not warranted and not recommended for further consideration as a part of the Fords Colony Master Plan.

***Table 9: Summary of Warrant Analysis for News Road at Firestone Drive***

| Scenario | Warrants Analysis | | | | |
|---|---|---|---|---|---|
| | Warrant 1 (8 Hour) | | | Warrant 2 (4 Hour) | Warrant 3 (1 Hour) |
| | Condition A | Condition B | Combination (A & B)* | | |
| **Existing (2019)** | ✗ (0 out of 8) | ✗ (0 out of 8) | ✗ (0 out of 8) | ✗ | ✗ |
| **No Build (2021)** | ✗ (1 out of 8) | ✗ (0 out of 8) | ✗ (3 out of 8) | ✗ | ✗ |
| **Build (2021)** | ✗ (1 out of 8) | ✗ (0 out of 8) | ✗ (3 out of 8) | ✗ | ✗ |
| **No Build (2027)** | ✗ (6 out of 8) | ✗ (3 out of 8) | ✗ (6 out of 8) | ✗ | ✗ |
| **Build (2027)** | ✗ (6 out of 8) | ✗ (3 out of 8) | ✗ (7 out of 8) | ✗ | ✗ |

*Notes:* ✗ *- Warrant not met*
✓ *- Warrant met*
*(# out of 8) – Number of hours that could meet the 8-hour warrant requirements*

The warrant analysis for the News Road at Firestone Drive indicated that under existing, No Build future, and Build future scenarios, conditions for Warrant 1 were not met. Under these scenarios, traffic generated by the current developments in Ford's Colony and approved developments were not high enough to meet the volume thresholds. Additionally, the 4-hour volume warrant was not met under existing conditions the News Road at Firestone Drive intersection. When taking into consideration the future site traffic generated by the background development and proposed residential condominium/townhouse development, a traffic signal is not warranted at the intersection for News Road at Firestone Drive.

## 7.3 PROFFER SCHEDULE OF IMPROVEMENTS

In addition to the turn lane and signal warrant analyses, the proffers identified the schedule of improvements based on the number of residential building permits when the hotel was or was not built. Since the hotel has not been constructed, the number of remaining undeveloped parcels was identified as 399 undeveloped within Ford's Colony out of the total 3,250 parcels identified from the previously completed TIS. The 399 undeveloped units consist of the following:

- 295 platted, unbuilt lots
- 60 un-platted Eaglescliff development lots
- 30 un-platted Windsor development lots

- 14 un-platted Brian Ford's property lots

Therefore, 2,841 parcels have been developed to date. **Table 10** illustrates the schedule of improvements, satisfaction of schedule, and construction of improvements.

Under Proffer Item A, the Longhill Road at Fords Colony Drive intersection satisfies the number of units, but the intersection of News Road at Firestone Drive does not satisfy the number of units. The Proffer Item E improvement is satisfied by the number of units constructed. Although several of the schedule of improvements are satisfied by the number of units, traffic operations and warrant analyses results proceed this schedule of improvements as the traffic operations are acceptable and warrants are not met for signalization.

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*Table 10: Proffered Improvements Triggered by Ford's Colony Permits*

| Proffer Item | Proffer Improvement | Residential Building Permits if Hotel Not Built | Number of Units Constructed | Number of Units Satisfied | Improvement Constructed | Improvement for Full Build Out (3,250 Units) |
|---|---|---|---|---|---|---|
| **A. Installation of Traffic Signals** | | | | | | |
| i | Longhill Road at Williamsburg W. Drive | 2,236 | 2,851 | ✓ | ✓ | - |
| ii | News Road at Firestone Drive | 3,250 | 2,851 | X | X | X |
| iii | Longhill Road at Fords Colony Drive | 947 | 2,851 | ✓ | X | X |
| **B. Installation of Left and Right-Turn Lanes** | | | | | | |
| i | News Road at Firestone Drive (Left-Turn) | 2,603 | 2,851 | ✓ | ✓ | - |
| | News Road at Firestone Drive (Right-Turn) | | 2,851 | ✓ | ✓ | - |
| ii | Centerville Road at Manchester Drive (Left-Turn) | 947 | 2,851 | ✓ | ✓ | - |
| | Centerville Road at Manchester Drive (Right-Turn) | | 2,851 | ✓ | ✓ | - |
| **C. Construct Williamsburg W. Drive** | | | | | | |
| i. | Establish right-of-way for four-lane road to Longhill Road | 1,545 | 2,851 | ✓ | ✓ | - |
| ii. | Construct two-lane private road Williamsburg W. Drive to Longhill Road | 1,545 | 2,851 | ✓ | ✓ | - |
| iii. | If VDOT does not permit construction of an intersection with Route 199 as set forth in paragraph below, widen the initial two-lane road to a four-lane road | 2,928 | 2,851 | X | X | X |
| **D. Longhill Road at Williamsburg W. Drive Intersection Improvements** | | | | | | |
| i. | Construct intersection of Williamsburg W. Drive and Longhill Road with: Right-turn lane on Williamsburg W. Drive onto Longhill Road; Right turn-lane on Longhill Road onto Williamsburg W. Drive; and left-turn lane on Longhill Road onto Williamsburg W. Drive | 1,545 | 2,851 | ✓ | ✓ | - |
| ii. | Add two through lanes on Longhill Road | 2,603 | 2,851 | ✓ | Under construction | - |
| iii. | Add lane for dual left-turn lanes on westbound Longhill Road onto Williamsburg W. Drive | 2,928 | 2,851 | ✓ | X | X |
| iv. | Add lane for dual right-turn on Williamsburg W. Drive onto Longhill Road | 3,250 | 2,851 | X | X | X |
| **E. Installation of right-turn lane on Longhill Road onto Ford's Colony Drive** | | 947 | 2,851 | ✓ | X | ✓ |

## 7.4 INTERSECTION OPERATIONAL ANALYSIS

Operational analyses were conducted for the study area intersections for the AM and PM peak hours under the existing and future scenarios. The existing signal timings, including cycle lengths, clearance intervals, and splits, were provided by VDOT. Under 2019 No Build and Build conditions, all signal timings, coordination offsets, and phasing were optimized. Additionally, splits were generally kept similar between scenario as well, with only minor changes made to compensate for additional site traffic.

In addition, the peak hour factor (PHF) used for the existing (2019) conditions represents the actual PHF based on recent traffic count data. Per VDOT's Traffic Operations and Safety Analysis Manual (TOSAM) guidance, PHFs less than 0.92 should be adjusted up to 0.92 for all future analyses. Therefore, under future conditions, the intersections with PHFs less than 0.92 were adjusted up to 0.92 for this purpose of this study.

Analyses were completed to determine the operating characteristics of the study area intersections using *Synchro Professional 10.0* modeling software, which uses methodologies contained in the 2010 Highway Capacity Manual (HCM) [TRB Special Report 209, 2000]. The intersection operational analysis inputs and analysis methodologies were consistent with VDOT's TOSAM. Intersection turning movement counts were used with information about the number of lanes, current traffic control, and signal timings to determine the operational conditions of each study area intersection. Level of service (LOS) is reported for each of the study area intersections.

LOS describes the amount of traffic congestion at an intersection or on a roadway and ranges from A to F (A indicating a condition of little to no congestion and F a condition with severe congestion, unstable traffic flow, and stop-and-go conditions). LOS is based on the average delay experienced by all traffic using the intersection during the busiest (peak) 15-minute period. Generally, LOS A through LOS D are considered acceptable. Delay and associated LOS for both signalized and unsignalized intersections are reported from the Synchro analysis. In the LOS/delay tables for each of the study area intersections, values highlighted in "bold" represent movements operating at LOS E or worse. **Table 11** shows the corresponding thresholds in delay for unsignalized and signalized intersections.

The queuing results represent the maximum simulated queues for each movement as they compare to the effective storage lengths. Effective storage lengths represent the amount of distance available to vehicles to queue without generally impacting the adjacent lanes and consist of the full width storage, plus half of the taper distance. By using the effective storage, vehicles that can use a portion of the taper length as additional room for storage can be accounted for. All traffic models were developed and analyzed with the effective storage lengths coded into the network. Values highlighted as "bold" represent queue lengths that exceed the available storage lengths/spill back to an upstream intersection. As part of the queuing analysis, "percent blocking" was noted in instances where queues impact adjacent turn- and/or through-lanes. This percentage represents the approximate amount of time during the peak hour when a lane was observed to be blocked (e.g., "10% blocking" indicates that during the peak hour, the turn-lane storage was exceeded and impacted 10 percent of the adjacent lane volume). The results are presented in the following summaries and supporting calculations are presented in **Appendix E**.

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*Table 11: LOS Control Delay Thresholds*

| LOS | Signalized Intersections Control Delay Per Vehicle [sec/veh] | Unsignalized Intersections Average Control Delay [sec/veh] | Relative Delay |
|---|---|---|---|
| A | ≤ 10 | ≤ 10 | Short Delays |
| | Free-flow traffic operations at average travel speeds. Vehicles completely unimpeded in ability to maneuver. Minimal delay at signalized intersections. | | |
| B | > 10 – 20 | > 10 – 15 | |
| | Reasonably unimpeded traffic operations at average travel speeds. Vehicle maneuverability slightly restricted. Low traffic delays. | | |
| C | > 20 – 35 | > 15 – 25 | |
| | Stable traffic operations. Lane changes becoming more restricted. Travel speeds reduced to half of average free flow travel speeds. Longer intersection delays. | | |
| D | >35 – 55 | > 25 – 35 | Moderate Delays |
| | Small increases in traffic flow can cause increased delays. Delays likely attributable to increase traffic, reduced signal progression and adverse timing. | | |
| E | >55 – 80 | > 35 – 50 | |
| | Significant delays. Travel speeds reduced to one third of average free flow travel speed. | | |
| F | > 80 | > 50 | Long Delays |
| | Extremely low speeds. Intersection congestion. Long delays. Extensive traffic queues at intersections. | | |

*Source: Highway Capacity Manual, Transportation Research Board, Washington, D.C., 2010*

The following sections summarizes each study area intersection's operations as it relates to vehicle traffic demand for the analysis scenarios. Results are presented in **Table 12** through **Table 19** and **Figure 19** through **Figure 28**.

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### 7.4.1 LONGHILL ROAD AT WILLIAMSBURG W. DRIVE/LANE PLACE DRIVE

Results of the capacity and queuing analysis for this signalized intersection are shown in **Table 12** and **Table 13**. Under existing and future conditions, the AM and PM peak hours are anticipated to experience an overall intersection LOS D or better with individual movements also expected to operate at LOS D or better. The overall intersection LOS improves to LOS C or better under 2027 No-Build and Build conditions due to the Longhill Road widening improvements.

Queuing results indicate that the intersection does not currently, nor is it projected to experience significant queuing or blocking. **Table 13** does show that the westbound left-turn and right-turn lanes have the potential to periodically meet or exceed its available storage length during the PM peak hour under 2019 Existing, 2021 No Build, and 2021 Build conditions. However, this is attributed to the adjacent through-lane stacking up and blocking access to this turn lane, and not due to the capacity of the turn lane. It has been observed with the SimTraffic software, that maximum queues can be recorded when vehicles are blocked from being able to enter a turn lane, because as soon as a vehicle is able to enter the turn lane, it meets the speed thresholds that the software uses to record maximum queue, which always happens at the back of the turn lane (i.e., 250 feet in this case).

***Table 12: Longhill Road at Williamsburg W. Drive/Lane Place Drive Intersection Level of Service***

| Scenario | Overall LOS | Level of Service per Movement by Approach (Delay in sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| **AM Peak Hour** | | | | | | | | | | | | | |
| 2019 Existing | C (28.5) | A (9.8) | C (33.7) | B (10.9) | B (17.9) | B (14.5) | A (9.4) | D (39.7) | | D (38.5) | D (44.0) | | |
| | | C (33.0) | | | B (14.6) | | | D (38.7) | | | D (44.0) | | |
| 2021 No Build | C (27.8) | A (9.3) | C (33.0) | B (10.1) | B (17.2) | B (14.1) | A (9.0) | D (38.0) | | D (37.5) | D (44.8) | | |
| | | C (32.3) | | | B (14.1) | | | D (37.6) | | | D (44.8) | | |
| 2021 Build | C (28.9) | A (9.4) | D (35.2) | B (10.1) | B (17.7) | B (14.1) | A (9.0) | D (38.0) | | D (37.6) | D (44.8) | | |
| | | C (34.5) | | | B (14.2) | | | D (37.7) | | | D (44.8) | | |
| 2027 No Build | C (21.0) | B (10.8) | B (19.1) | B (13.0) | B (12.7) | B (13.8) | B (11.2) | C (32.5) | | D (35.2) | D (47.2) | | |
| | | B (18.9) | | | B (13.6) | | | D (34.7) | | | D (47.2) | | |
| 2027 Build | C (21.1) | B (10.8) | B (19.2) | B (12.9) | B (12.8) | B (13.8) | B (11.2) | C (32.6) | | D (35.5) | D (47.5) | | |
| | | B (19.0) | | | B (13.6) | | | D (35.0) | | | D (47.5) | | |
| **PM Peak Hour** | | | | | | | | | | | | | |
| 2019 Existing | C (31.2) | C (20.46) | C (26.0) | B (10.8) | C (25.7) | D (36.1) | A (7.9) | D (40.9) | | D (39.0) | D (42.9) | | |
| | | C (25.2) | | | C (33.5) | | | D (39.5) | | | D (42.9) | | |
| 2021 No Build | D (41.2) | C (22.3) | C (29.2) | B (10.9) | D (48.6) | D (51.4) | A (7.6) | D (42.4) | | D (40.1) | D (44.4) | | |
| | | C (28.3) | | | D (49.5) | | | D (40.7) | | | D (44.4) | | |
| 2021 Build | D (43.0) | C (22.4) | C (29.6) | B (10.9) | D (52.4) | D (54.2) | A (7.5) | D (42.6) | | D (40.2) | D (44.6) | | |
| | | C (28.7) | | | D (52.4) | | | D (40.9) | | | D (44.6) | | |
| 2027 No Build | B (17.3) | A (9.0) | B (17.7) | B (12.6) | B (14.4) | B (13.3) | A (8.1) | D (39.3) | | D (37.3) | D (42.7) | | |
| | | B (17.3) | | | B (13.4) | | | D (37.8) | | | D (42.7) | | |
| 2027 Build | B (17.3) | A (9.1) | B (17.7) | B (12.6) | B (14.6) | B (13.4) | A (8.1) | D (39.4) | | D (37.4) | D (42.8) | | |
| | | B (17.3) | | | B (13.5) | | | D (38.0) | | | D (42.8) | | |

### *Table 13: Longhill Road at Williamsburg W. Drive/Lane Place Drive Maximum Queuing*

| Scenario | Maximum Queue Length by Movement (feet) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| Effective Storage Length | 250 | Cont. | 225 | 250 | Cont. | 250* | Cont. | | 225 | Cont. | | |
| AM Peak Hour | | | | | | | | | | | | |
| 2019 Existing | 69 | 479 | 164 | 81 | 230 | 41 | 92 | | 120 | 112 | | |
| 2021 No Build | 46 | 563 | 205 | 67 | 206 | 51 | 93 | | 133 | 115 | | |
| 2021 Build | 66 | 561 | 187 | 65 | 217 | 49 | 92 | | 141 | 124 | | |
| 2027 No Build | 27 | 233 | 67 | 78 | 157 | 55 | 94 | | 168 | 132 | | |
| 2027 Build | 49 | 264 | 29 | 67 | 166 | 44 | 98 | | 167 | 124 | | |
| PM Peak Hour | | | | | | | | | | | | |
| 2019 Existing | 148 | 519 | 206 | **250** | 763 | **690** | 97 | | 109 | 81 | | |
| 2021 No Build | 167 | 562 | 224 | **250** | 772 | **777** | 115 | | 83 | 88 | | |
| 2021 Build | 209 | 553 | 204 | **250** | 784 | **777** | 140 | | 87 | 83 | | |
| 2027 No Build | 59 | 238 | 33 | 211 | 251 | 73 | 109 | | 110 | 90 | | |
| 2027 Build | 69 | 262 | 53 | 215 | 244 | 115 | 128 | | 103 | 88 | | |

*Notes: Results displayed are the average results across 10 microsimulation runs*
**denotes the No Build and Build effective storage length associated with the Longhill Road widening*

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### 7.4.2 LONGHILL ROAD AT FORDS COLONY DRIVE

Results of the capacity and queuing analysis for this unsignalized intersection are shown in **Table 14** and **Table 15**. Under existing and future conditions, the AM and PM peak hours are anticipated to experience an overall intersection LOS B or better with all movements at LOS D or better with the exception of the following movements/approaches:

- AM Peak Hour
  - 2019 Existing – Northbound Approach (LOS E)
  - 2027 No Build - Northbound Approach (LOS F)
- PM Peak Hour
  - 2021 No Build – Northbound Approach (LOS E)
  - 2027 No Build – Northbound Approach (LOS F)/Southbound Approach (LOS E)
  - 2027 Build – Northbound Approach (LOS E)/Southbound Approach (LOS E)

Restriping the northbound approach noticeably improves operations under the future 2027 No Build conditions from LOS F during the AM and PM peak hours to LOS D and LOS E respectively, under the 2027 Build conditions. Queuing results also indicate that the intersection is not projected to experience significant queuing or blocking issues. Based on these operational conditions (i.e., existing and future) the existing two-way STOP configuration provides sufficient traffic control for this intersection.

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### *Table 14: Longhill Road at Fords Colony Drive Intersection Level of Service*

| Scenario | Overall LOS | Level of Service per Movement by Approach (Delay in sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| **AM Peak Hour** | | | | | | | | | | | | | |
| 2019 Existing | A (8.9) | A (7.9) | A (0.0) | | A (8.6) | A (0.0) | A (0.0) | **E (35.5)** | | | C (22.2) | | |
| | | A (0.1) | | | A (2.4) | | | **E (35.5)** | | | C (22.2) | | |
| 2021 No Build | A (7.8) | A (7.9) | A (0.0) | | A (8.5) | A (0.0) | A (0.0) | D (30.1) | | | C (21.0) | | |
| | | A (0.1) | | | A (2.4) | | | D (30.1) | | | C (21.0) | | |
| 2021 Build | A (5.6) | A (7.9) | A (0.0) | A (0.0) | A (8.5) | A (0.0) | A (0.0) | C (19.2) | | A (0.0) | C (21.3) | | |
| | | A (0.1) | | | A (2.5) | | | C (19.2) | | | C (21.3) | | |
| 2027 No Build | B (13.5) | A (8.0) | A (0.0) | | A (8.7) | A (0.0) | A (0.0) | **F (55.5)** | | | C (24.4) | | |
| | | A (0.1) | | | A (2.5) | | | **F (55.5)** | | | C (24.4) | | |
| 2027 Build | A (7.1) | A (8.0) | A (0.0) | A (0.0) | A (8.7) | A (0.0) | A (0.0) | D (25.9) | | A (0.0) | C (24.8) | | |
| | | A (0.1) | | | A (2.5) | | | D (25.9) | | | C (24.8) | | |
| **PM Peak Hour** | | | | | | | | | | | | | |
| 2019 Existing | A (6.5) | A (0.0) | A (0.0) | | A (8.9) | A (0.0) | A (0.0) | D (28.8) | | | C (24.5) | | |
| | | A (0.0) | | | A (3.6) | | | D (28.8) | | | C (24.5) | | |
| 2021 No Build | B (8.3) | A (0.0) | A (0.0) | | A (9.2) | A (0.0) | A (0.0) | **E (39.7)** | | | D (28.3) | | |
| | | A (0.0) | | | A (3.7) | | | **E (39.7)** | | | D (28.3) | | |
| 2021 Build | A (6.1) | A (0.0) | A (0.0) | A (0.0) | A (9.3) | A (0.0) | A (0.0) | C (24.7) | | A (0.0) | D (27.3) | | |
| | | A (0.0) | | | A (3.9) | | | C (24.7) | | | D (27.3) | | |
| 2027 No Build | B (17.0) | A (0.0) | A (0.0) | | A (9.6) | A (0.0) | A (0.0) | **F (92.0)** | | | **E (39.8)** | | |
| | | A (0.0) | | | A (3.9) | | | **F (92.0)** | | | **E (39.8)** | | |
| 2027 Build | A (8.6) | A (0.0) | A (0.0) | A (0.0) | A (9.7) | A (0.0) | A (0.0) | **E (38.8)** | | A (0.0) | **E (37.7)** | | |
| | | A (0.0) | | | A (4.0) | | | **E (38.8)** | | | **E (37.7)** | | |

### *Table 15: Longhill Road at Fords Colony Drive Maximum Queuing*

| Scenario | Maximum Queue Length by Movement (feet) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| Effective Storage Length | 200 | Cont. | | 225 | Cont. | 150 | Cont. | | 175* | Cont. | | |
| **AM Peak Hour** | | | | | | | | | | | | |
| 2019 Existing | 14 | 10 | | 70 | 0 | 0 | 192 | | | 6 | | |
| 2021 No Build | 5 | 22 | | 77 | 0 | 0 | 209 | | | 14 | | |
| 2021 Build | 9 | 8 | 0 | 103 | 0 | 0 | 115 | | 93 | 14 | | |
| 2027 No Build | 7 | 19 | | 84 | 0 | 0 | 291 | | | 5 | | |
| 2027 Build | 16 | 4 | 8 | 87 | 0 | 0 | 196 | | 132 | 9 | | |
| **PM Peak Hour** | | | | | | | | | | | | |
| 2019 Existing | 0 | 21 | | 88 | 4 | 0 | 156 | | | 17 | | |
| 2021 No Build | 0 | 33 | | 105 | 0 | 0 | 246 | | | 22 | | |
| 2021 Build | 0 | 2 | 17 | 125 | 0 | 0 | 155 | | 106 | 26 | | |
| 2027 No Build | 0 | 32 | | 138 | 0 | 0 | 500 | | | 26 | | |
| 2027 Build | 0 | 5 | 19 | 134 | 0 | 0 | 357 | | 156 | 24 | | |

*Notes: Results displayed are the average results across 10 microsimulation runs*
**denotes the Build effective storage length associated with the Fords Colony Drive widening*

### 7.4.3 CENTERVILLE ROAD AT MANCHESTER DRIVE

Results of the capacity and queuing analysis for this unsignalized intersection are shown in **Table 16** and **Table 17**. Under existing and future conditions, the AM and PM peak hours are anticipated to experience movements with LOS C or better. Queuing results also indicate that the intersection is not projected to experience significant queuing or blocking issues.

***Table 16: Centerville Road at Manchester Drive Intersection Level of Service***

| Scenario | Overall LOS | Level of Service per Movement by Approach (Delay in sec/veh) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| **AM Peak Hour** | | | | | | | | | | | | | |
| 2019 Existing | A (2.8) | C (16.0) | | | C (19.7) | B (11.0) | | A (7.7) | A (0.0) | A (0.0) | A (8.6) | A (0.0) | A (0.0) |
| | | C (16.0) | | | C (15.7) | | | A (0.0) | | | A (1.6) | | |
| 2021 No Build | A (3.5) | C (18.7) | | | C (22.2) | B (11.2) | | A (7.8) | A (0.0) | A (0.0) | A (8.7) | A (0.0) | A (0.0) |
| | | C (18.7) | | | C (17.2) | | | A (0.1) | | | A (1.6) | | |
| 2021 Build | A (3.6) | C (18.7) | | | C (22.6) | B (11.2) | | A (7.8) | A (0.0) | A (0.0) | A (8.7) | A (0.0) | A (0.0) |
| | | C (18.7) | | | C (17.5) | | | A (0.1) | | | A (1.6) | | |
| 2027 No Build | A (4.1) | C (22.6) | | | D (29.4) | B (11.9) | | A (7.9) | A (0.0) | A (0.0) | A (9.0) | A (0.0) | A (0.0) |
| | | C (22.6) | | | C (21.3) | | | A (0.1) | | | A (1.7) | | |
| 2027 Build | A (4.2) | C (22.7) | | | D (29.9) | B (11.9) | | A (7.9) | A (0.0) | A (0.0) | A (9.0) | A (0.0) | A (0.0) |
| | | C (22.7) | | | C (21.7) | | | A (0.1) | | | A (1.7) | | |
| **PM Peak Hour** | | | | | | | | | | | | | |
| 2019 Existing | A (1.9) | B (13.5) | | | C (15.9) | B (10.3) | | A (7.7) | A (0.0) | A (0.0) | A (8.1) | A (0.0) | A (0.0) |
| | | B (13.5) | | | B (13.8) | | | A (0.0) | | | A (0.7) | | |
| 2021 No Build | A (2.4) | C (15.6) | | | C (18.2) | B (10.5) | | A (7.9) | A (0.0) | A (0.0) | A (8.5) | A (0.0) | A (0.0) |
| | | C (15.6) | | | C (15.5) | | | A (0.2) | | | A (0.7) | | |
| 2021 Build | A (2.4) | C (15.6) | | | C (18.4) | B (10.5) | | A (7.9) | A (0.0) | A (0.0) | A (8.5) | A (0.0) | A (0.0) |
| | | C (15.6) | | | C (15.7) | | | A (0.2) | | | A (0.7) | | |
| 2027 No Build | A (2.6) | C (17.9) | | | C (22.0) | B (10.9) | | A (8.0) | A (0.0) | A (0.0) | A (8.7) | A (0.0) | A (0.0) |
| | | C (17.9) | | | C (18.1) | | | A (0.2) | | | A (0.7) | | |
| 2027 Build | A (2.7) | C (17.9) | | | C (22.5) | B (10.9) | | A (8.0) | A (0.0) | A (0.0) | A (8.7) | A (0.0) | A (0.0) |
| | | C (17.9) | | | C (18.5) | | | A (0.2) | | | A (0.7) | | |

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### *Table 17: Centerville Road at Manchester Drive Maximum Queuing*

| Scenario | Maximum Queue Length by Movement (feet) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| Effective Storage Length | Cont. | | | Cont. | 140 | | 190 | Cont. | 325 | 190 | Cont. | 325 |
| AM Peak Hour | | | | | | | | | | | | |
| 2019 Existing | 30 | | | 60 | 54 | | 8 | 0 | 0 | 64 | 0 | 0 |
| 2021 No Build | 45 | | | 72 | 52 | | 9 | 0 | 0 | 60 | 0 | 0 |
| 2021 Build | 47 | | | 68 | 55 | | 7 | 2 | 0 | 64 | 0 | 0 |
| 2027 No Build | 47 | | | 69 | 58 | | 10 | 2 | 5 | 72 | 0 | 0 |
| 2027 Build | 51 | | | 77 | 56 | | 8 | 2 | 4 | 69 | 0 | 0 |
| PM Peak Hour | | | | | | | | | | | | |
| 2019 Existing | 28 | | | 42 | 46 | | 4 | 0 | 0 | 30 | 0 | 0 |
| 2021 No Build | 40 | | | 56 | 46 | | 16 | 0 | 0 | 50 | 0 | 0 |
| 2021 Build | 39 | | | 58 | 47 | | 16 | 0 | 0 | 53 | 0 | 0 |
| 2027 No Build | 38 | | | 70 | 46 | | 14 | 0 | 0 | 54 | 0 | 0 |
| 2027 Build | 42 | | | 63 | 49 | | 19 | 0 | 0 | 49 | 0 | 2 |

*Notes: Results displayed are the average results across 10 microsimulation runs*

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### 7.4.4 NEWS ROAD AT FIRESTONE DRIVE

Results of the capacity and queuing analysis for this unsignalized intersection are shown in **Table 18** and **Table 19**. Under existing and future conditions, the AM and PM peak hours are anticipated to experience movements with LOS C or better. Queuing results also indicate that the intersection is not projected to experience significant queuing or blocking issues.

***Table 18: News Road at Firestone Drive Intersection Level of Service***

| Scenario | Overall LOS | Level of Service per Movement by Approach (Delay in sec/veh) AM Peak Hour | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| **AM Peak Hour** | | | | | | | | | | | | | |
| 2019 Existing | A (2.6) | A (7.8) | A (0.0) | - | - | A (0.0) | A (0.0) | - | - | - | B (11.2) | - | A (0.0) |
| | | A (0.4) | | | A (0.0) | | | - | | | B (11.2) | | |
| 2021 No Build | A (4.0) | A (7.8) | A (0.0) | | A (7.8) | A (0.0) | | B (10.5) | | A (0.0) | B (14.2) | | A (0.0) |
| | | A (0.3) | | | A (1.1) | | | B (10.5) | | | B (14.2) | | |
| 2021 Build | A (4.0) | A (7.8) | A (0.0) | | A (7.8) | A (0.0) | | B (10.6) | | A (0.0) | B (14.2) | | A (0.0) |
| | | A (0.3) | | | A (1.1) | | | B (10.6) | | | B (14.2) | | |
| 2027 No Build | A (4.1) | A (7.9) | A (0.0) | | A (7.9) | A (0.0) | | B (10.8) | | A (0.0) | C (15.5) | | A (0.0) |
| | | A (0.4) | | | A (1.0) | | | B (10.8) | | | C (15.5) | | |
| 2027 Build | A (4.1) | A (7.9) | A (0.0) | | A (7.9) | A (0.0) | | B (10.9) | | A (0.0) | C (15.6) | | A (0.0) |
| | | A (0.4) | | | A (1.0) | | | B (10.9) | | | C (15.6) | | |
| **PM Peak Hour** | | | | | | | | | | | | | |
| 2019 Existing | A (1.6) | A (8.1) | A (0.0) | - | - | A (0.0) | A (0.0) | - | - | - | B (12.0) | - | A (0.0) |
| | | A (0.4) | | | A (0.0) | | | - | | | B (12.0) | | |
| 2021 No Build | A (3.5) | A (8.4) | A (0.0) | | A (7.7) | A (0.0) | | B (11.1) | | A (0.0) | C (18.6) | | A (0.0) |
| | | A (0.3) | | | A (1.0) | | | B (11.1) | | | C (18.6) | | |
| 2021 Build | A (3.5) | A (8.5) | A (0.0) | | A (7.7) | A (0.0) | | B (11.2) | | A (0.0) | C (18.9) | | A (0.0) |
| | | A (0.3) | | | A (1.0) | | | B (11.2) | | | C (18.9) | | |
| 2027 No Build | A (3.7) | A (8.6) | A (0.0) | | A (7.8) | A (0.0) | | B (11.5) | | A (0.0) | C (21.0) | | A (0.0) |
| | | A (0.3) | | | A (0.9) | | | B (11.5) | | | C (21.0) | | |
| 2027 Build | A (3.7) | A (8.6) | A (0.0) | | A (7.8) | A (0.0) | | B (11.5) | | A (0.0) | C (21.4) | | A (0.0) |
| | | A (0.3) | | | A (0.9) | | | B (11.5) | | | C (21.4) | | |

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### *Table 19: News Road at Firestone Drive Maximum Queuing*

| Scenario | Maximum Queue Length by Movement (feet) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| Effective Storage Length | 225 | Cont. | | 225 | Cont. | 300 | Cont. | | 150 | Cont. | | 150 |
| AM Peak Hour | | | | | | | | | | | | |
| 2019 Existing | 40 | 0 | - | - | 4 | 0 | - | | - | 69 | - | 31 |
| 2021 No Build | 28 | 0 | | 31 | 0 | | 40 | | 54 | 82 | | 33 |
| 2021 Build | 30 | 0 | | 28 | 0 | | 40 | | 54 | 71 | | 33 |
| 2027 No Build | 28 | 0 | | 26 | 0 | | 38 | | 54 | 79 | | 33 |
| 2027 Build | 37 | 0 | | 26 | 0 | | 36 | | 52 | 82 | | 37 |
| PM Peak Hour | | | | | | | | | | | | |
| 2019 Existing | 27 | 0 | - | - | 0 | 5 | - | | - | 71 | - | 31 |
| 2021 No Build | 35 | 1 | | 34 | 4 | | 57 | | 68 | 76 | | 33 |
| 2021 Build | 33 | 1 | | 34 | 0 | | 49 | | 59 | 87 | | 32 |
| 2027 No Build | 37 | 0 | | 32 | 0 | | 52 | | 67 | 99 | | 33 |
| 2027 Build | 44 | 0 | | 37 | 6 | | 54 | | 54 | 94 | | 33 |

*Notes: Results displayed are the average results across 10 microsimulation runs*

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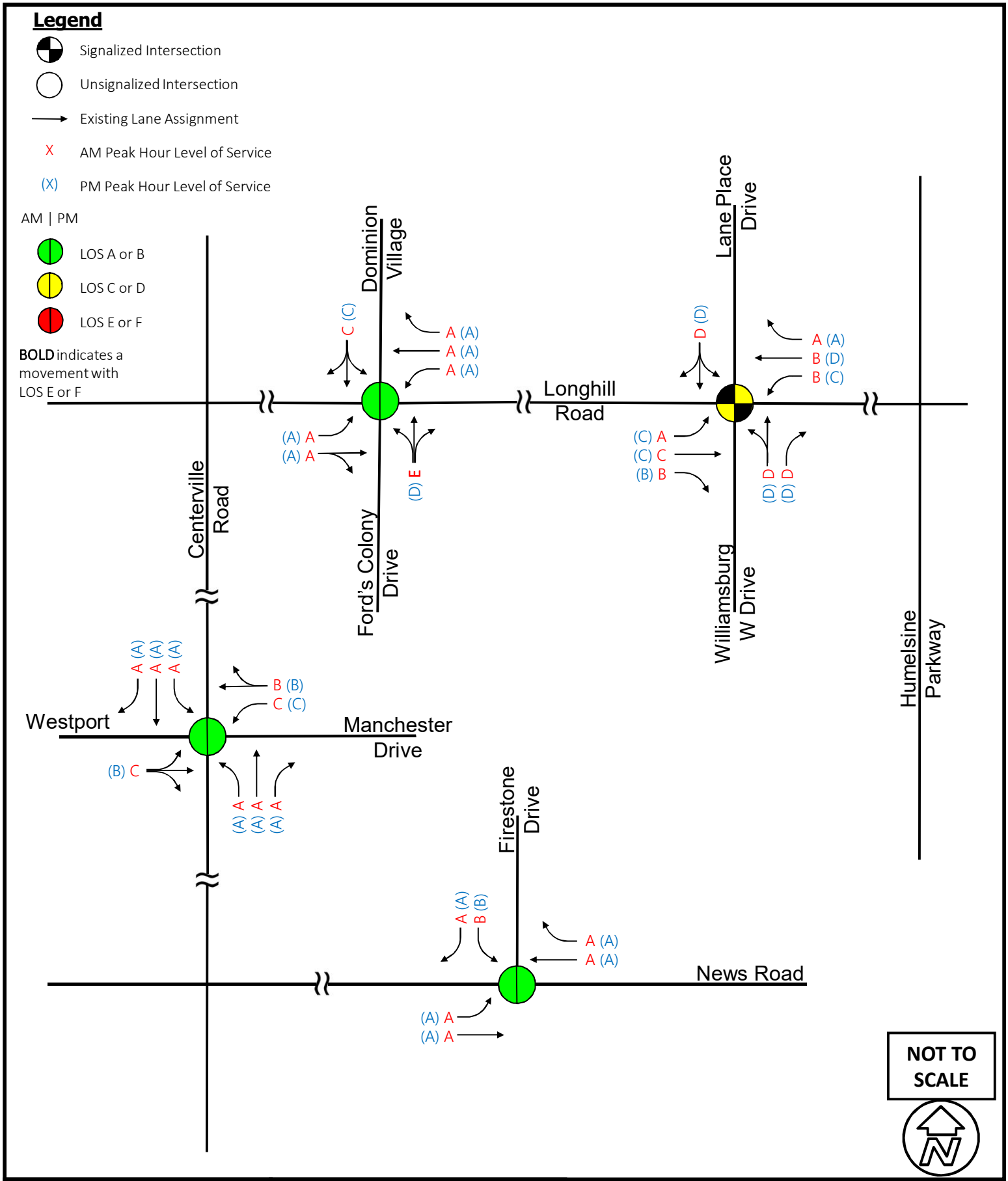


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2019 Existing Conditions<br>Level of Service | FIGURE<br>19 |
|---|---|---|---|

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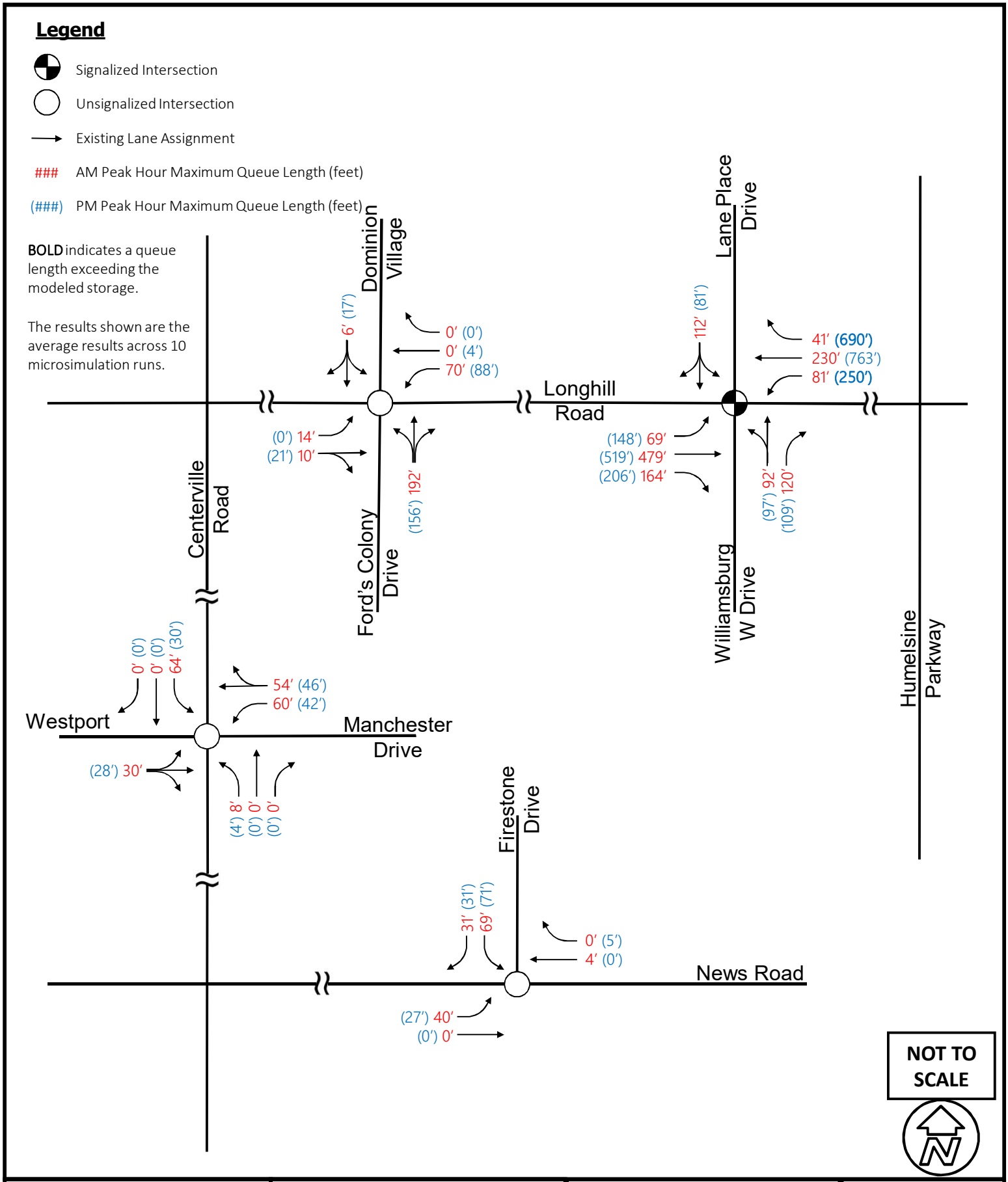


| | | | |
|---|---|---|---|
| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2019 Existing Conditions<br>Maximum Queue Length | FIGURE<br>20 |

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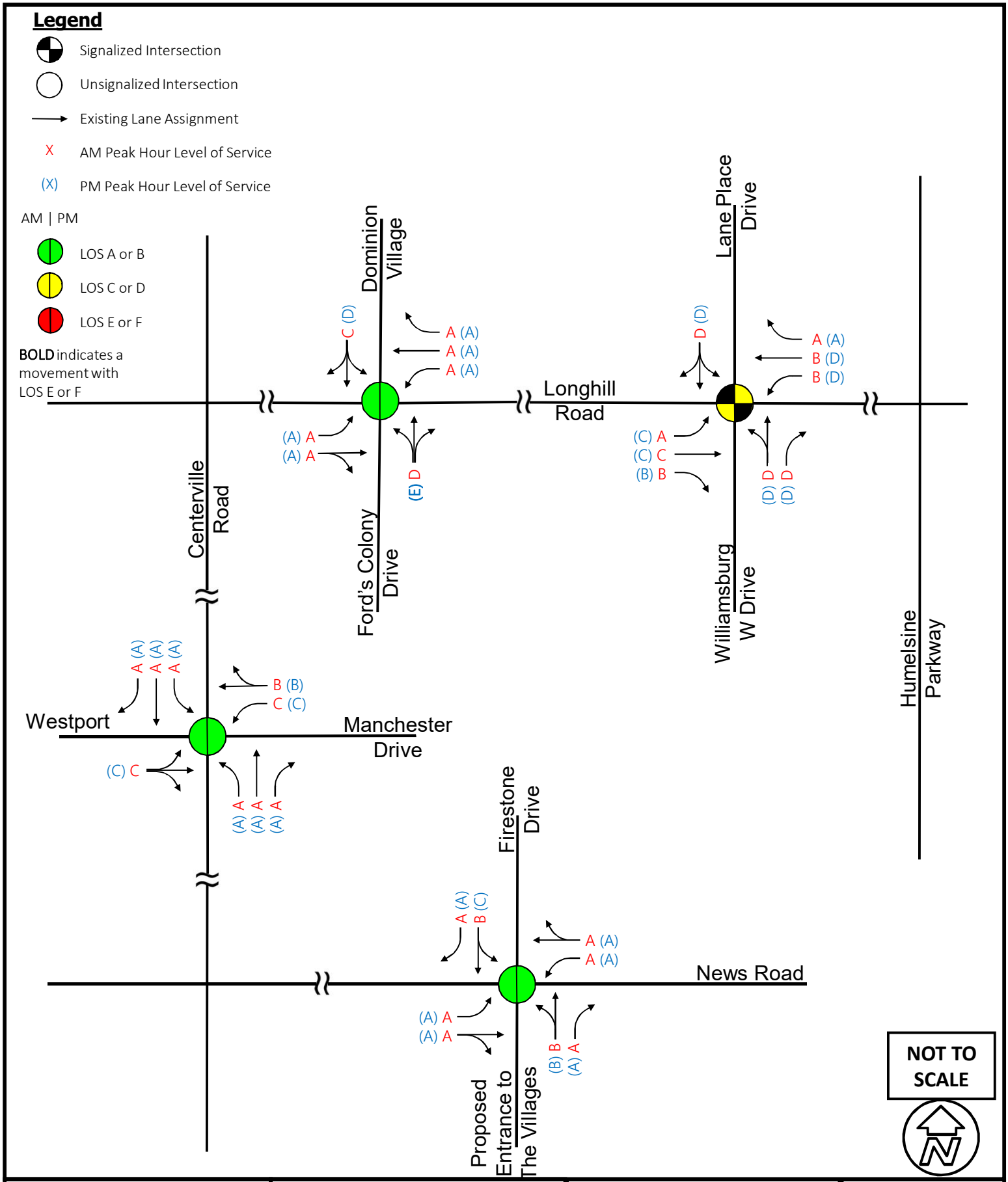


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2021 No Build Conditions<br>Level of Service | FIGURE<br>21 |
|---|---|---|---|

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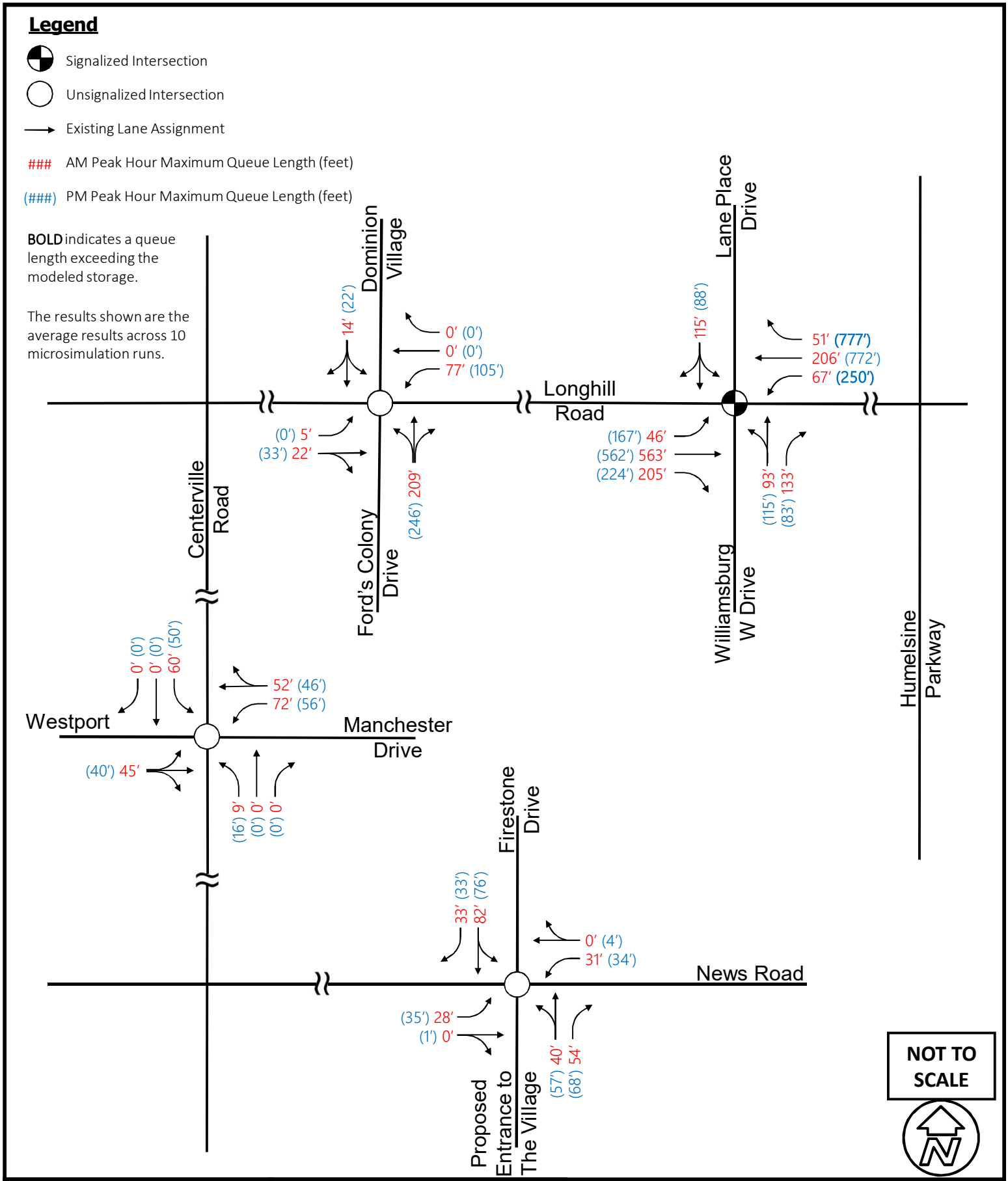


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Ford's Colony TIS Update
James City County, VA

2021 No Build Conditions
Maximum Queue

FIGURE
22

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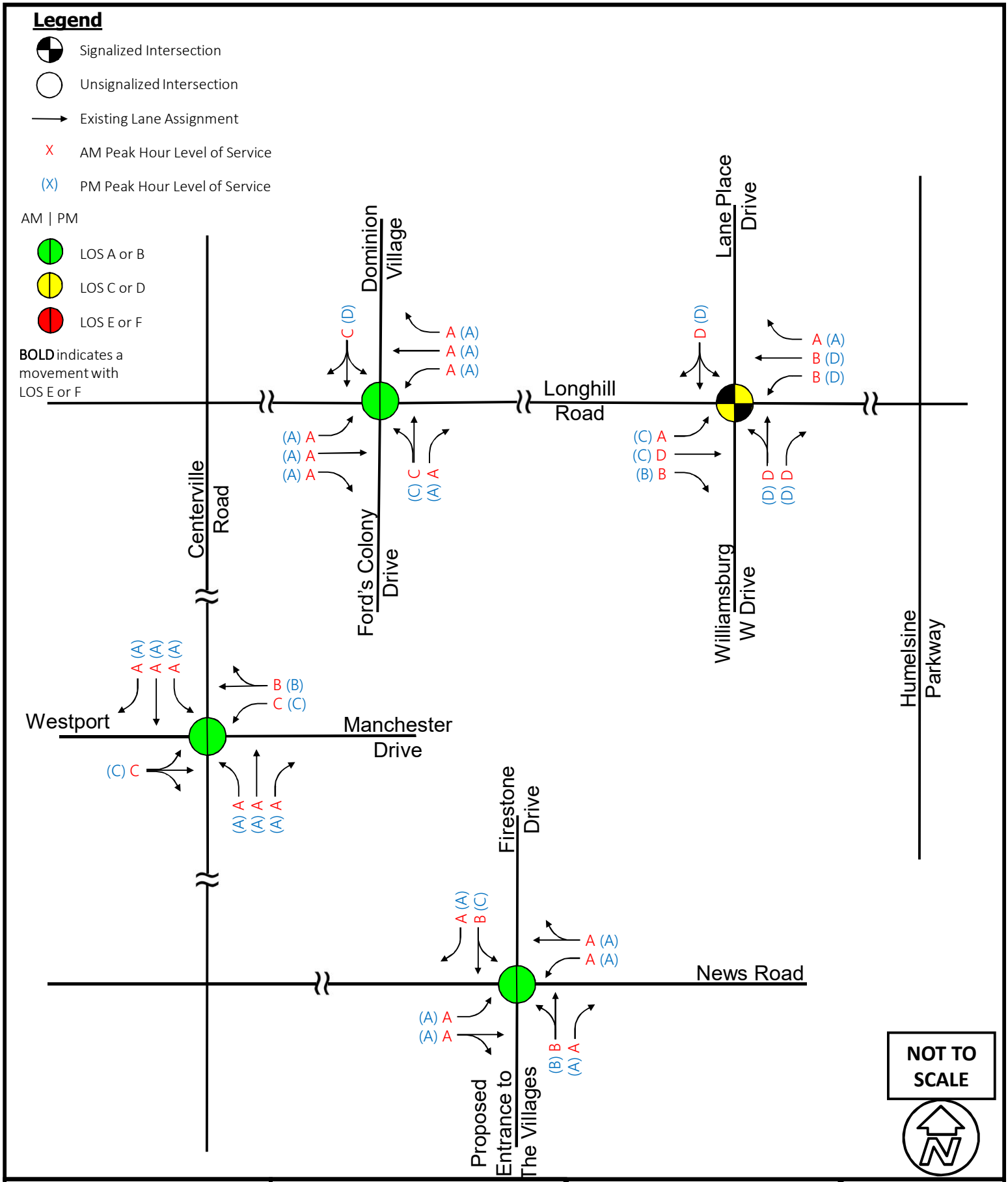


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2021 Build Conditions Level of Service | FIGURE<br>23 |
|---|---|---|---|

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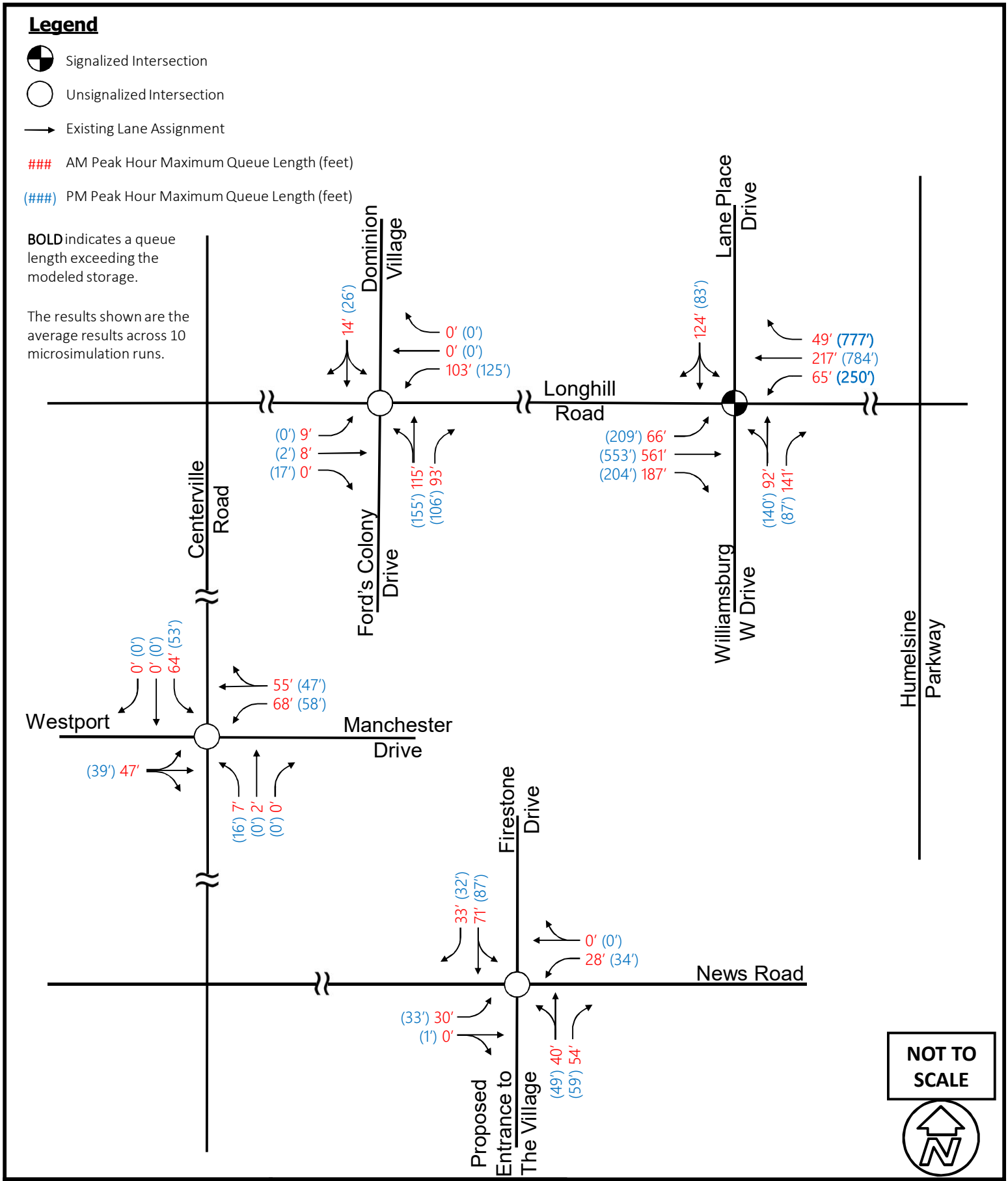


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2021 Build Conditions<br>Maximum Queue | FIGURE<br>24 |
|---|---|---|---|

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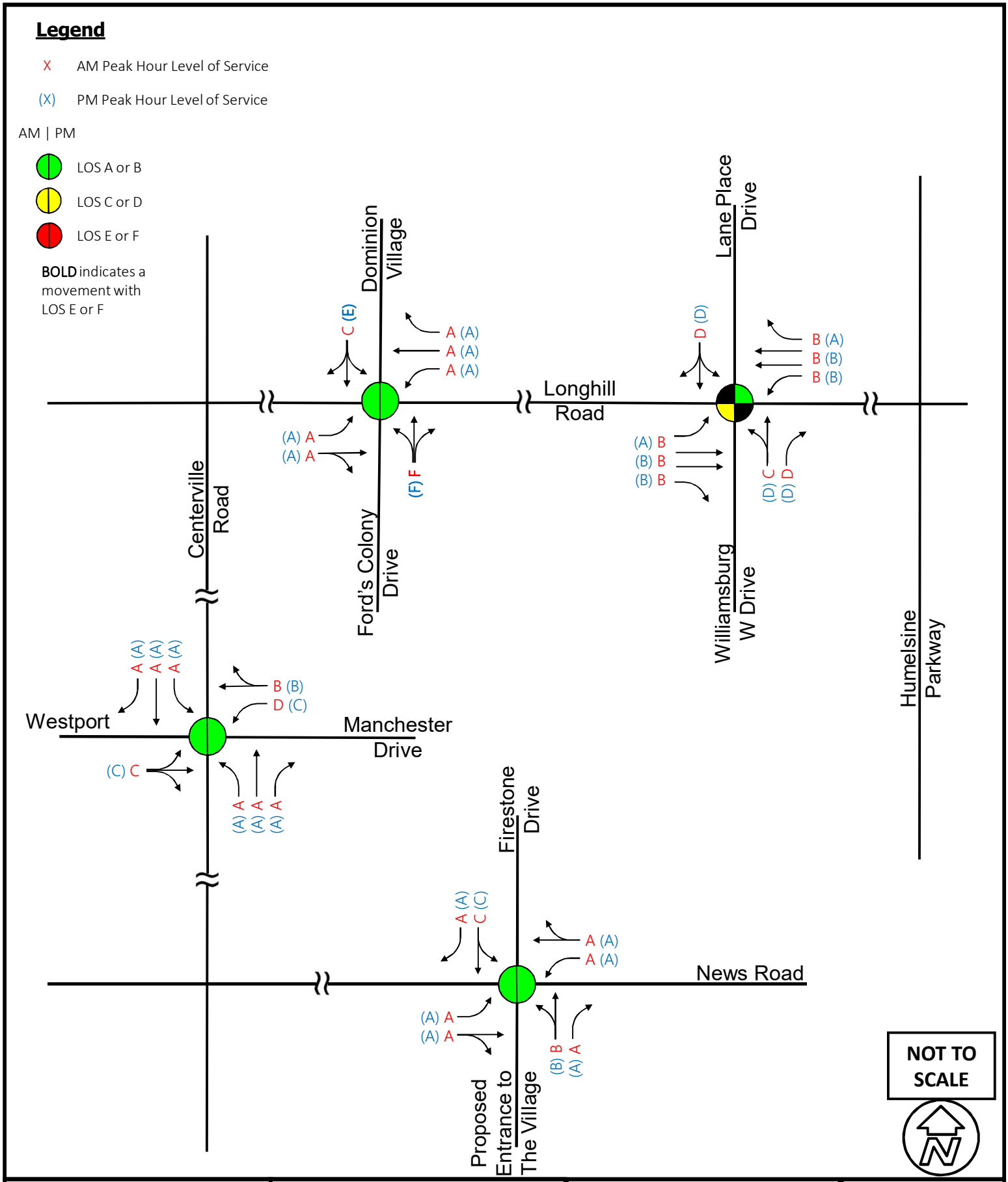


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2027 No Build Conditions<br>Level of Service | FIGURE<br>25 |
|---|---|---|---|

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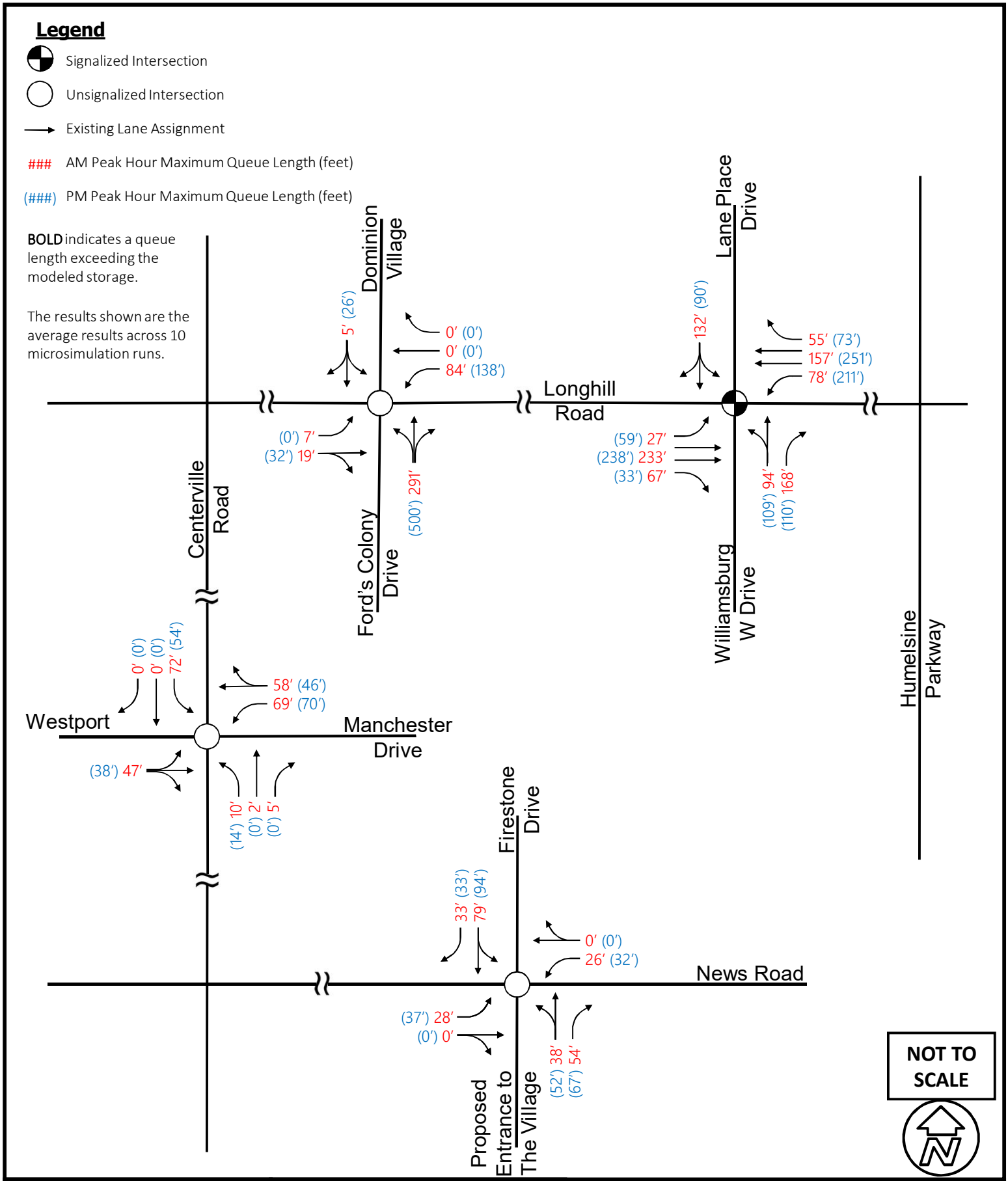


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Ford's Colony TIS Update
James City County, VA

2027 No Build Conditions
Maximum Queue Length

FIGURE
26

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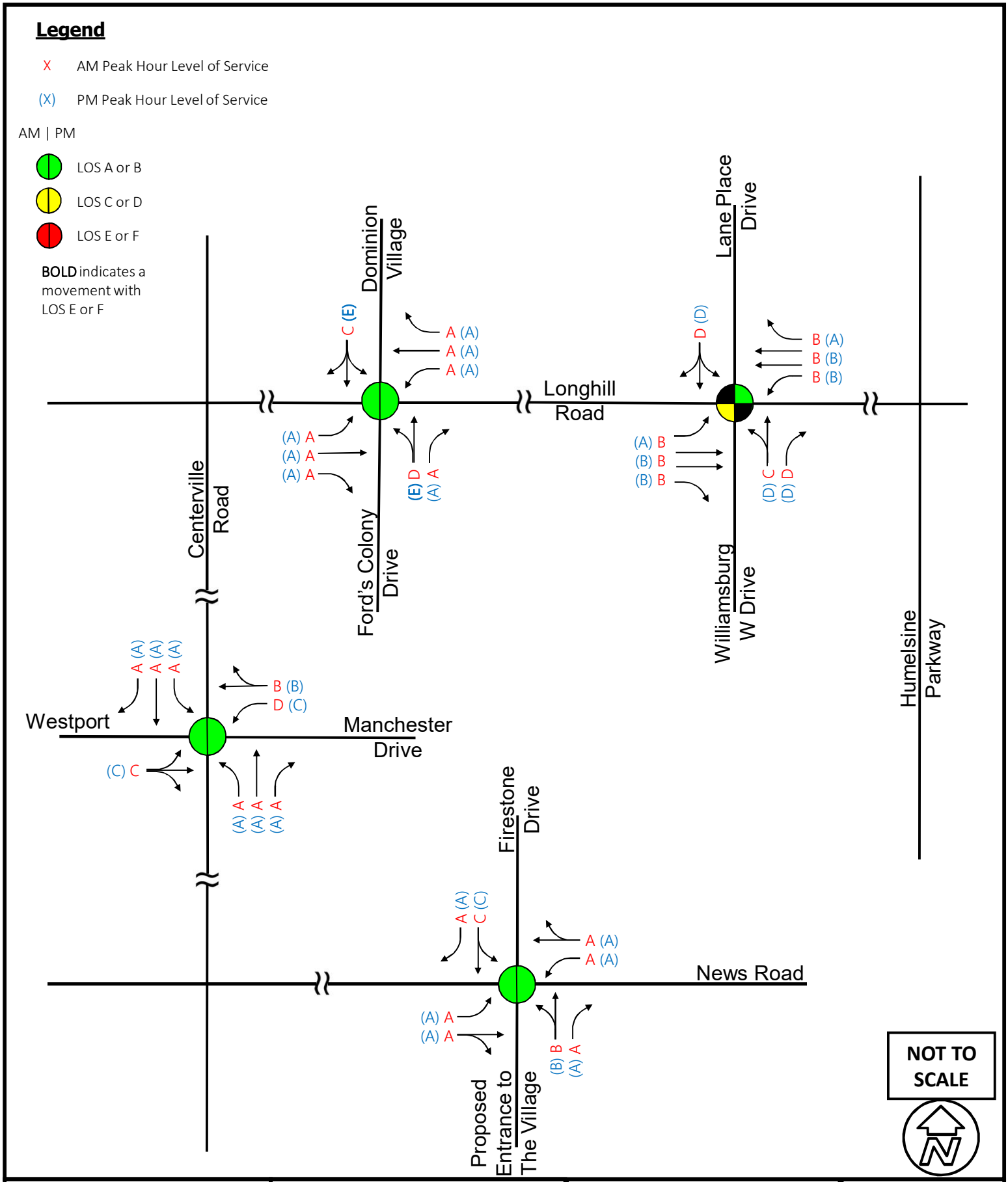


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2027 Build Conditions<br>Level of Service | FIGURE<br>27 |
|---|---|---|---|

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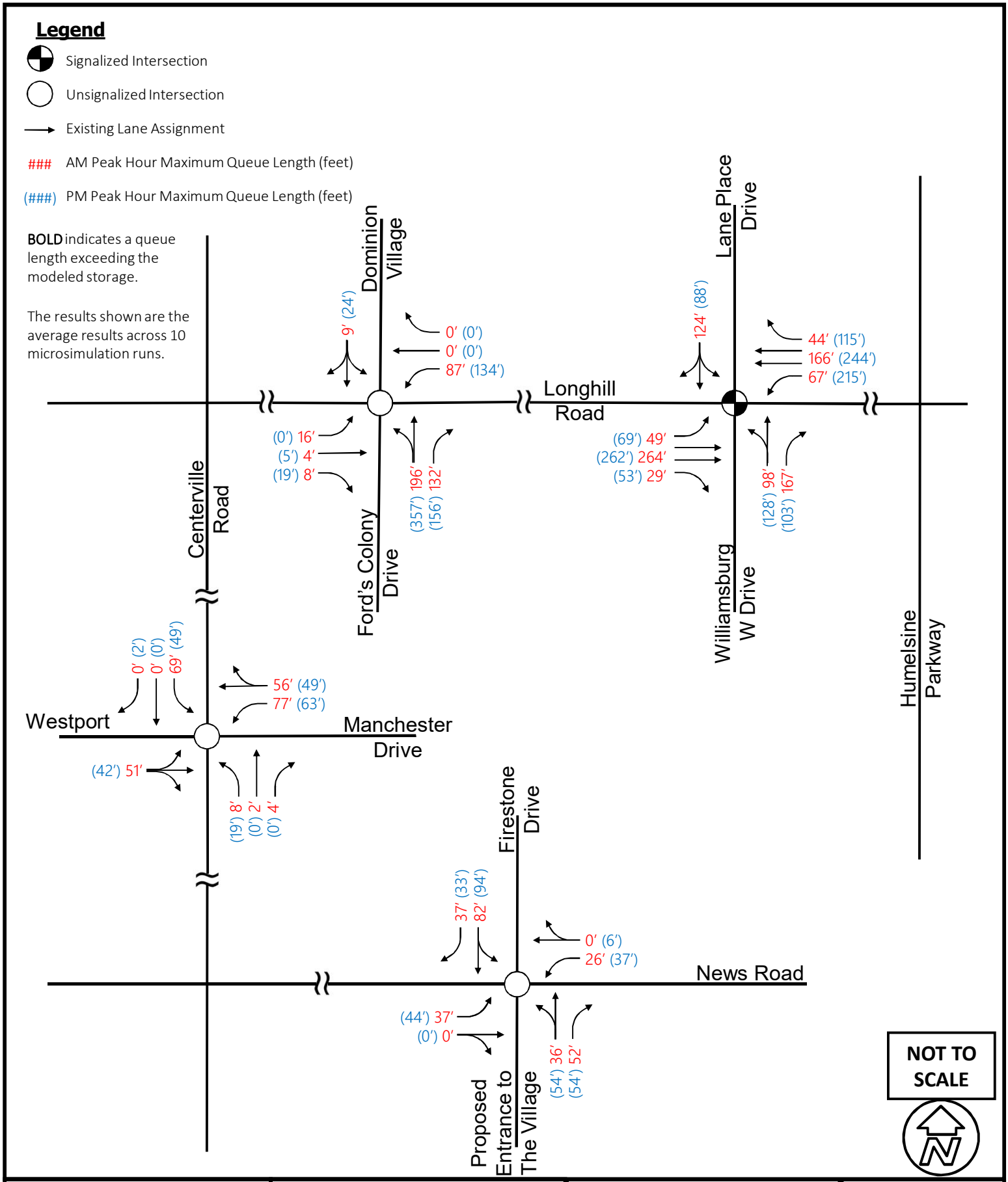


| Kimley»Horn | Ford's Colony TIS Update<br>James City County, VA | 2027 Build Conditions<br>Maximum Queue Length | FIGURE<br>28 |
|---|---|---|---|

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# 8 CONCLUSIONS AND RECOMMENDATIONS

This traffic study examined the existing operational characteristics of the Ford's Colony study area intersections as well as the anticipated impacts associated with the proposed residential condominium/townhouse development located in Ford's Colony in James City County, Virginia. Additionally, this study was completed to meet the requirements of the original proffers (i.e., FCHOA to prepare and submit an updated Traffic Impact Study every five (5)), as well as determine if any of the identified proffered off-site roadway, intersection, or traffic control improvements have been triggered for construction and/or may require accelerated implementation. Based on the results of the No Build and Build traffic analysis, the future impacts of vehicular traffic associated with the background traffic and the proposed development are anticipated to be minimal, with conditions at the study area intersections expected to be maintained at levels comparable to that under existing conditions. Based on the analysis of the existing traffic volumes and operation findings provided in this traffic study, the following recommendations were identified and are summarized below for the Existing conditions:

- **Longhill Road at Williamsburg W. Drive/Lane Place Drive**
  - Maintain the existing geometric configuration and traffic control measures
  - Continue to monitor and implement new timing and coordination plans as part of regular VDOT operations and maintenance
  - It is noted that the Longhill Road Phase 1 Widening Project (VDOT UPC – 100921) includes improvements that will enhance the capacity at this intersection, is fully funded, and currently under construction
- **Longhill Road at Fords Colony Drive**
  - Relocate and restripe the northbound approach STOP bar so driver sight distance is not impeded by the Ford's Colony monument sign and/or vegetation located in the median
  - Restripe the 24-foot wide northbound approach to consist of a 12-foot shared through/left-turn lane and a 12-foot exclusive right-turn lane with 150 feet of storage
  - Continue to monitor traffic volumes to identify when/if the full turn-lane warrant for the eastbound right-turn movement is satisfied
  - Existing traffic volumes and the associated operational conditions (i.e., level of service (LOS)/side street delay) do not warrant or justify the installation of the traffic signal at this time.
  - Although the installation of a traffic signal is specifically referenced in the Ford's Colony proffers, per VDOT policy and roadway design manual guidelines, should volumes warrant the consideration of a traffic signal the intersection will also need to be analyzed for the consideration of a roundabout.
- **Centerville Road at Manchester Drive**
  - Maintain the existing geometric configuration and traffic control measures
- **News Road at Firestone Drive**
  - Maintain the existing geometric configuration and traffic control measures

From the analysis of the Build conditions which included the background traffic growth and approved developments, the following recommendations were identified and are summarized below for the Build conditions:

- **Longhill Road at Williamsburg W. Drive/Lane Place Drive**
  - Continue to monitor and implement new timing and coordination plans as part of regular VDOT operations and maintenance
  - The Longhill Road Phase 1 Widening Project (UPC – 100921) is currently construction. The widening project includes the following improvements to this intersection:
    - Widen Longhill Road to a four-lane divided typical section
    - Upgrade the traffic signal equipment to accommodate the additional through lanes
    - Pedestrian accommodations such as crosswalks, ADA ramps, and pedestrian signal displays for the crossing of select legs of the intersection

    <u>Eastbound Longhill Road</u>
      - Widen and construct an additional approach and receiving through lane

    <u>Westbound Longhill Road</u>
      - Widen and construct an additional approach and receiving through lane
  - Improvements associated with Longhill Road Phase 1 Widening Project (UPC – 100921) address several of the proffered improvements associated with the Ford's Colony Master Plan. Proffers should be updated/modified to account for/recognize these changes in responsibility.
- **Longhill Road at Fords Colony Drive**
  - Based on future traffic volume projections, construct a full width right-turn lane consisting of 200-feet of storage and 200-foot taper for the eastbound approach.
  - Future traffic volumes and the associated future operational conditions (i.e., level of service (LOS)/side street delay) continue to reflect that a traffic signal is not warranted and do not justify the installation of a traffic signal at this intersection.
  - It is noted that the installation of a traffic signal is specifically referenced in the Ford's Colony proffers. However, per VDOT policy and roadway design manual guidelines, if volumes warrant the consideration of a traffic signal then the intersection will also need to be analyzed for the consideration of a roundabout.
  - Additionally, it is noted that the Longhill Road Corridor Study, completed in October 2014, did not recommended the installation of a traffic signal at this intersection as part of the long term (horizon year 2034) improvements. Therefore, it is recommended that a traffic signal should no longer be proffered as a means of traffic control for this intersection.
- **Centerville Road at Manchester Drive**
  - Maintain the existing geometric configuration and traffic control measures
- **News Road at Firestone Drive**
  - Maintain the existing geometric configuration and traffic control measures

Given the minimal residual development potential in Ford's Colony, no additional or proffered improvements are triggered beyond those that were identified under the Existing or Build operational conditions.

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TRAFFIC IMPACT STUDY (TIS) UPDATE

# Ford’s Colony Master Plan – Phased Development

James City County, Virginia

# Technical Appendices

**Prepared for:**

Ford's Colony Home Owners Association (FCHOA)

**Prepared by:**

Kimley»Horn

**January 2020**

# Appendix A: Assumptions Document

The following documentation outlines our proposed traffic impact study (TIS) assumptions for the Ford's Colony Master Plan development, located in James City County and bounded by Longhill Road (State Route 612) to the north, Centerville Road (State Route 614) to the west, News Road (State Route 613) to the south, and a combination of retail/commercial land uses, residential land uses, and Route 199 to the east. As part of this analysis, existing traffic data will be collected and future traffic volumes developed to identify if any of the proffered but unbuilt roadway, intersection, or traffic control improvements at the four (4) access points/study area intersections are experiencing or will experience traffic conditions that are or will trigger the need for construction. Proffered improvements are those described in the Ford's Colony original proffers dated March 11, 1987 and the associated Ford's Colony Phasing Plan for Roadway Improvements agreement approved by the County on June 20, 1988. This includes traffic signal and turn-lane warrant analyses that will be conducted at the defined study area intersections. Recommendations and opinions of probable cost for relevant improvements associated with the potential development will be described in the DRAFT and FINAL report.

## Study Area

The study area for the TIS update and the associated proposed development site includes the following signalized and unsignalized intersections:

- County Club Drive/Williamsburg W. Drive at Longhill Road *(signalized)*
- Ford's Colony Drive at Longhill Road *(unsignalized)*
- Manchester Drive at Centerville Road *(unsignalized)*
- Firestone Drive at News Road *(unsignalized)*

## Data Collection

Turning movement counts (TMC) were collected at the study area intersections on Thursday, June 8, 2017 which included vehicular, truck, and pedestrian volumes. Four-hour TMCs were conducted during the AM and PM peak periods (6:30 AM to 8:30 AM and 4:00 PM to 6:00 PM) at the following intersections:

- Manchester Drive at Centerville Road
- Country Club Drive/Williamsburg W. Drive at Longhill Road

In preparation for potential signal warrant analysis, 12-hour TMCs (i.e., 6:00 AM to 6:00 PM) were performed at the following intersections:

- Ford's Colony Drive at Longhill Road
- Firestone Drive at News Road

## Future Traffic

The proposed development will have an opening year of 2019. Future analyses will coincide with this year. Growth rates will be determined by using rates developed as part of the *Longhill Road Corridor Study*, completed and adopted in October 2014, and historical traffic volume trends over the previous six (6) years (i.e., 2011 to 2016) from the Virginia Department of Transportation (VDOT) data.

- Longhill Road – 2.0% per year (consistent with Longhill Road Corridor Study)
- Centerville Road – 2.5% per year
- News Road – 2.0% per year

Two additional developments adjacent to Ford's Colony have been approved for development and were provided by James City County: The Village's at Ford's Colony and Westport Subdivision at Ford's Colony. These two developments will be included in the background traffic projections in addition to the general traffic growth. For the Villages at Ford's Colony, Kimley-Horn will use *ITE Trip Generation 9th Edition* (2012) Trip Generation Rates and Land Use Code 251: Senior Adult Housing-Detached, Code 252: Senior Adult Housing-Attached, Code 253: Congregate Care Housing, Code 254: Assisted Living, and Code 620: Nursing Home. For the Westport Subdivision at Ford's Colony, Kimley-Horn will use Code 210: Single-Family Detached-Housing. This is consistent with the land use provided in the *Ford's Colony Traffic Impact Study 2003-2004 Update.* The trip distribution and assignment for these approved developments will be based on the previous study's trip distribution percentages. Trip generation calculations for the approved developments are shown in **Table 1 and Table 2**.

**Table 1: Trip Generation for The Villages at Ford's Colony Development**

| ITE Code | ITE Description | Density | Unit | Daily | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | In | Out | Total | In | Out | Total |
| 251 | Senior Adult Housing - Detached | 38 | Dwelling Units | 200 | 13 | 23 | 36 | 13 | 9 | 22 |
| 252 | Senior Adult Housing - Attached | 168 | Dwelling Units | 522 | 11 | 22 | 33 | 23 | 19 | 42 |
| 253 | Congregate Care Housing | 390 | Dwelling Units | 788 | 14 | 9 | 23 | 36 | 30 | 66 |
| 254 | Assisted Living | 83 | Beds/Rooms | 256 | 8 | 4 | 12 | 8 | 10 | 18 |
| 620 | Nursing Home | 60 | Beds/Rooms | 120 | 7 | 3 | 10 | 4 | 9 | 13 |
| **Total** | | **739** | | **1,886** | **53** | **61** | **114** | **84** | **77** | **161** |

*Note: It is assumed that there is one bed per room, and therefore each bed is considered one dwelling unit.*

**Table 2: Trip Generation for Westport Subdivision at Ford's Colony Development**

| ITE Code | ITE Description | Density | Unit | Daily | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | In | Out | Total | In | Out | Total |
| 210 | Single-Family Detached Housing | 43 | Dwelling Units | 483 | 10 | 30 | 40 | 31 | 18 | 49 |

**Proposed Land Use**

Kimley-Horn will use *ITE Trip Generation 9th Edition* (2012) Trip Generation Rates and Land Use Code 230: Residential Condominium/Townhouse. This is consistent with the land use provided in the *Ford's Colony Traffic Impact Study 2003-2004 Update*. Trip generation calculations for the proposed development are shown in **Table 3**. No pass-by or internal capture rate reductions will be included as part of this analysis.

**Table 3: Trip Generation for Residential Development**

| Land Use (ITE Code) | Dwelling Units | Weekday Total | AM | | | PM | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Enter (17%) | Exit (83%) | Total | Enter (67%) | Exit (33%) |
| Residential Condominium/Townhouse (230) | 60 units | 412 | 34 | 6 | 28 | 40 | 27 | 13 |

To assign the hourly site traffic for the future traffic signal warrant analysis, hourly variations will be used for Residential Uses Combined – Excluding Senior-Oriented Facilities as provided in the *Hourly Variation in Trip Generation for Office and Residential Land Uses* article published in the ITE Journal January 2015, as shown in **Table 4** below. It is noted that the hourly trip generation variation for residential land uses is proposed since it is a similar land use and ITE does not provide an applicable hourly variation breakdown for Residential Condominium/Townhouse (230).

**Table 4: Hourly Trip Generation Variations for Residential Land Uses**

| Time | Average Weekday | |
|---|---|---|
| | Percent of 24-Hour Entering Traffic | Percent of 24-Hour Exiting Traffic |
| 6 AM – 7 AM | 1.6 | 5.7 |
| 7 AM – 8 AM | 2.5 | 9.0 |
| 8 AM – 9 AM | 3.7 | 9.1 |
| 9 AM – 10 AM | 3.7 | 6.5 |
| 10 AM – 11 AM | 4.1 | 5.5 |
| 11 AM – 12 PM | 4.5 | 5.7 |
| 12 PM – 1 PM | 5.3 | 5.3 |
| 1 PM – 2 PM | 5.4 | 5.7 |
| 2 PM – 3 PM | 6.5 | 5.9 |
| 3 PM – 4 PM | 8.1 | 6.3 |
| 4 PM – 5 PM | 9.8 | 6.3 |
| 5 PM – 6 PM | 10.8 | 6.5 |

Site traffic distributions will be determined from existing travel patterns, site location within Ford's Colony, access to/from the external adjacent street network, and employment/activity center destinations in the surrounding area. Based on this, we are assuming that the following distributions will be used for the proposed development:

- 65% of the trips generated will travel to/from the north on Ford's Colony Drive
- 20% of the trips generated will travel to/from the west on Manchester Drive
- 10% of the trips generated will travel to/from the east on Williamsburg W. Drive
- 5% of the trips generated will travel to/from the south on Firestone Drive

**Analysis Years**

The proposed development is anticipated to be completed in 2019. Therefore, the following analysis scenarios for the AM and PM peak hours will be studied as part of this TIS update.

- Scenario 1 – Existing (2017) traffic conditions
- Scenario 2 – Opening Year (2019) No-Build conditions – Build-out year traffic conditions *with* only background development trips applied (i.e., approved adjacent development traffic)
- Scenario 3 – Opening Year (2019) Build-out conditions – Build-out year traffic conditions *with* background development trips applied *plus* traffic volumes generated by the proposed development
- Scenario 4 – Opening Year +6 years (2025) No-Build conditions – Build-out year traffic conditions *with* only background development trips applied (i.e., approved adjacent development traffic)
- Scenario 5 – Opening Year +6 years (2025) Build-out conditions – Build-out year traffic conditions *with* background development trips applied *plus* traffic volumes generated by the proposed development

**Traffic Operations Analysis**

Proposed inputs and analysis methodologies will be consistent with VDOT's Traffic Operations and Safety Analysis Manual (TOSAM). Operational analyses for the study area intersections will be conducted using traffic analysis tools (e.g., Synchro 9.1 Professional, SimTraffic 9.1) and Highway Capacity Manual (HCM) methodologies.

The following warrants will be analyzed for the study area intersections for future no-build and build conditions: *Warrant 1 – Eight Hour* and *Warrant 2 – Four Hour*. Kimley-Horn will conduct a traffic signal warrant analysis using the standards provided in the *Manual of Uniform Traffic Control Devices (MUTCD)*. The traffic signal warrant analysis will be performed for the following intersections:

- Ford's Colony Drive at Longhill Road
- Firestone Drive at News Road

Turn-lane warrant analyses will be prepared and evaluated for the intersection of Ford's Colony Drive at Longhill Road. The turn-lane warrant analysis will be consistent with methodologies shown in Appendix C of the VDOT Road Design Manual as well as guidelines provided in Appendix F of the VDOT Access Management Design Standards for Entrances and Intersections. Should a turn-lane be warranted, recommendations for storage length and taper length will be provided.

The future conditions analyses will confirm the need and define the geometric configurations necessary for the proposed roadway and intersection capacity improvements. Measures of effectiveness that will be reported for each scenario will consist of delay per vehicle, level of service (LOS), and maximum queue lengths. These measures of effectiveness will be presented in tabular format. Vehicle delay and LOS will be summarized by movement, approach, and overall intersection, while maximum queue lengths will be summarized for each movement.

**Reporting**

A TIS report with an accompanying appendix (including all analysis files) will be prepared that summarizes the analysis methodology and results. The report and associated analysis files will be provided in electronic format as a part of the FINAL traffic analysis submittal.

# Appendix B: Traffic Count Data

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Country Club
Site Code :
Start Date : 6/8/2017
Page No : 1

**Groups Printed- Passenger Veh - Trucks**

| | Lane Place From North | | | | | Longhill From East | | | | | Country Club From South | | | | | Longhill From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| 06:30 AM | 4 | 0 | 4 | 0 | 8 | 2 | 71 | 1 | 0 | 74 | 26 | 0 | 5 | 0 | 31 | 1 | 84 | 0 | 0 | 85 | 198 |
| 06:45 AM | 3 | 0 | 9 | 0 | 12 | 3 | 123 | 4 | 0 | 130 | 35 | 1 | 11 | 0 | 47 | 1 | 107 | 0 | 0 | 108 | 297 |
| Total | 7 | 0 | 13 | 0 | 20 | 5 | 194 | 5 | 0 | 204 | 61 | 1 | 16 | 0 | 78 | 2 | 191 | 0 | 0 | 193 | 495 |
| 07:00 AM | 1 | 1 | 12 | 0 | 14 | 2 | 147 | 6 | 0 | 155 | 57 | 0 | 15 | 0 | 72 | 4 | 164 | 0 | 0 | 168 | 409 |
| 07:15 AM | 3 | 0 | 8 | 0 | 11 | 4 | 100 | 7 | 0 | 111 | 52 | 0 | 6 | 0 | 58 | 4 | 158 | 1 | 0 | 163 | 343 |
| 07:30 AM | 4 | 0 | 17 | 0 | 21 | 5 | 92 | 10 | 0 | 107 | 53 | 1 | 15 | 0 | 69 | 3 | 168 | 1 | 0 | 172 | 369 |
| 07:45 AM | 9 | 0 | 19 | 0 | 28 | 7 | 121 | 9 | 0 | 137 | 77 | 2 | 10 | 0 | 89 | 9 | 200 | 1 | 0 | 210 | 464 |
| Total | 17 | 1 | 56 | 0 | 74 | 18 | 460 | 32 | 0 | 510 | 239 | 3 | 46 | 0 | 288 | 20 | 690 | 3 | 0 | 713 | 1585 |
| 08:00 AM | 5 | 1 | 11 | 0 | 17 | 4 | 125 | 10 | 0 | 139 | 50 | 0 | 11 | 0 | 61 | 4 | 182 | 1 | 0 | 187 | 404 |
| 08:15 AM | 0 | 0 | 9 | 0 | 9 | 2 | 129 | 14 | 0 | 145 | 44 | 0 | 6 | 0 | 50 | 5 | 192 | 0 | 0 | 197 | 401 |
| Total | 5 | 1 | 20 | 0 | 26 | 6 | 254 | 24 | 0 | 284 | 94 | 0 | 17 | 0 | 111 | 9 | 374 | 1 | 0 | 384 | 805 |
| 04:00 PM | 2 | 0 | 6 | 0 | 8 | 11 | 192 | 45 | 0 | 248 | 33 | 0 | 7 | 0 | 40 | 10 | 155 | 6 | 0 | 171 | 467 |
| 04:15 PM | 2 | 0 | 4 | 0 | 6 | 7 | 227 | 61 | 0 | 295 | 33 | 0 | 9 | 0 | 42 | 13 | 174 | 4 | 0 | 191 | 534 |
| 04:30 PM | 8 | 0 | 6 | 0 | 14 | 11 | 211 | 50 | 0 | 272 | 27 | 1 | 5 | 0 | 33 | 11 | 180 | 3 | 0 | 194 | 513 |
| 04:45 PM | 4 | 0 | 7 | 0 | 11 | 6 | 239 | 61 | 0 | 306 | 33 | 0 | 12 | 0 | 45 | 10 | 181 | 3 | 0 | 194 | 556 |
| Total | 16 | 0 | 23 | 0 | 39 | 35 | 869 | 217 | 0 | 1121 | 126 | 1 | 33 | 0 | 160 | 44 | 690 | 16 | 0 | 750 | 2070 |
| 05:00 PM | 2 | 0 | 4 | 0 | 6 | 10 | 237 | 49 | 0 | 296 | 34 | 0 | 10 | 0 | 44 | 8 | 198 | 9 | 0 | 215 | 561 |
| 05:15 PM | 4 | 0 | 6 | 0 | 10 | 16 | 266 | 60 | 0 | 342 | 29 | 0 | 14 | 0 | 43 | 8 | 182 | 2 | 0 | 192 | 587 |
| 05:30 PM | 4 | 0 | 6 | 0 | 10 | 6 | 235 | 36 | 0 | 277 | 40 | 0 | 14 | 0 | 54 | 9 | 174 | 3 | 0 | 186 | 527 |
| 05:45 PM | 5 | 0 | 1 | 0 | 6 | 11 | 244 | 44 | 0 | 299 | 32 | 0 | 10 | 0 | 42 | 8 | 172 | 5 | 0 | 185 | 532 |
| Total | 15 | 0 | 17 | 0 | 32 | 43 | 982 | 189 | 0 | 1214 | 135 | 0 | 48 | 0 | 183 | 33 | 726 | 19 | 0 | 778 | 2207 |
| Grand Total | 60 | 2 | 129 | 0 | 191 | 107 | 2759 | 467 | 0 | 3333 | 655 | 5 | 160 | 0 | 820 | 108 | 2671 | 39 | 0 | 2818 | 7162 |
| Apprch % | 31.4 | 1 | 67.5 | 0 | | 3.2 | 82.8 | 14 | 0 | | 79.9 | 0.6 | 19.5 | 0 | | 3.8 | 94.8 | 1.4 | 0 | | |
| Total % | 0.8 | 0 | 1.8 | 0 | 2.7 | 1.5 | 38.5 | 6.5 | 0 | 46.5 | 9.1 | 0.1 | 2.2 | 0 | 11.4 | 1.5 | 37.3 | 0.5 | 0 | 39.3 | |
| Passenger Veh | 55 | 2 | 126 | 0 | 183 | 103 | 2688 | 464 | 0 | 3255 | 650 | 2 | 154 | 0 | 806 | 107 | 2602 | 37 | 0 | 2746 | 6990 |
| % Passenger Veh | 91.7 | 100 | 97.7 | 0 | 95.8 | 96.3 | 97.4 | 99.4 | 0 | 97.7 | 99.2 | 40 | 96.2 | 0 | 98.3 | 99.1 | 97.4 | 94.9 | 0 | 97.4 | 97.6 |
| Trucks | 5 | 0 | 3 | 0 | 8 | 4 | 71 | 3 | 0 | 78 | 5 | 3 | 6 | 0 | 14 | 1 | 69 | 2 | 0 | 72 | 172 |
| % Trucks | 8.3 | 0 | 2.3 | 0 | 4.2 | 3.7 | 2.6 | 0.6 | 0 | 2.3 | 0.8 | 60 | 3.8 | 0 | 1.7 | 0.9 | 2.6 | 5.1 | 0 | 2.6 | 2.4 |

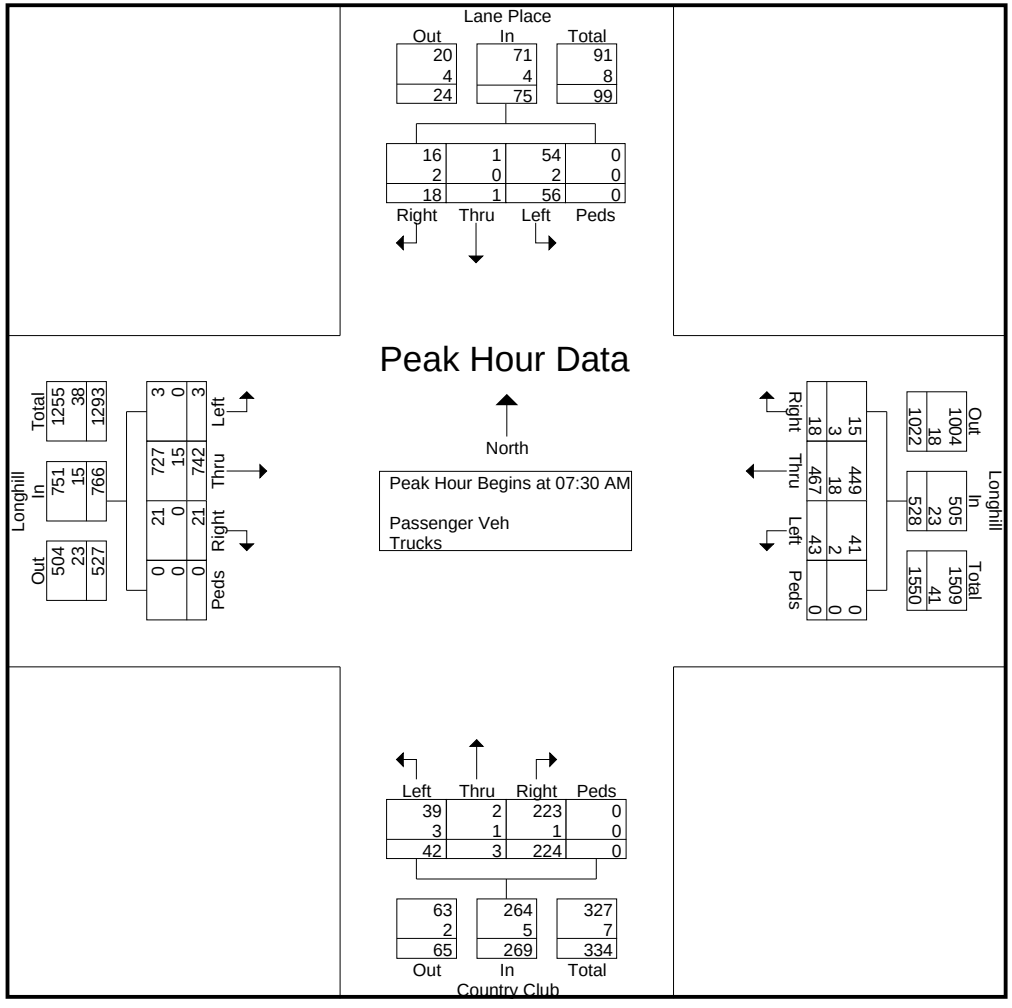
# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Country Club
Site Code :
Start Date : 6/8/2017
Page No : 2

| | Lane Place From North | | | | | Longhill From East | | | | | Country Club From South | | | | | Longhill From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 06:30 AM to 11:45 AM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 07:30 AM | | | | | | | | | | | | | | | | | | | | | |
| 07:30 AM | 4 | 0 | 17 | 0 | 21 | 5 | 92 | 10 | 0 | 107 | 53 | 1 | **15** | 0 | 69 | 3 | 168 | **1** | 0 | 172 | 369 |
| 07:45 AM | **9** | 0 | **19** | 0 | **28** | **7** | 121 | 9 | 0 | 137 | **77** | **2** | 10 | 0 | **89** | **9** | **200** | 1 | 0 | **210** | **464** |
| 08:00 AM | 5 | **1** | 11 | 0 | 17 | 4 | 125 | 10 | 0 | 139 | 50 | 0 | 11 | 0 | 61 | 4 | 182 | 1 | 0 | 187 | 404 |
| 08:15 AM | 0 | 0 | 9 | 0 | 9 | 2 | **129** | **14** | 0 | **145** | 44 | 0 | 6 | 0 | 50 | 5 | 192 | 0 | 0 | 197 | 401 |
| Total Volume | 18 | 1 | 56 | 0 | 75 | 18 | 467 | 43 | 0 | 528 | 224 | 3 | 42 | 0 | 269 | 21 | 742 | 3 | 0 | 766 | 1638 |
| % App. Total | 24 | 1.3 | 74.7 | 0 | | 3.4 | 88.4 | 8.1 | 0 | | 83.3 | 1.1 | 15.6 | 0 | | 2.7 | 96.9 | 0.4 | 0 | | |
| PHF | .500 | .250 | .737 | .000 | .670 | .643 | .905 | .768 | .000 | .910 | .727 | .375 | .700 | .000 | .756 | .583 | .928 | .750 | .000 | .912 | .883 |
| Passenger Veh | 16 | 1 | 54 | 0 | 71 | 15 | 449 | 41 | 0 | 505 | 223 | 2 | 39 | 0 | 264 | 21 | 727 | 3 | 0 | 751 | 1591 |
| % Passenger Veh | 88.9 | 100 | 96.4 | 0 | 94.7 | 83.3 | 96.1 | 95.3 | 0 | 95.6 | 99.6 | 66.7 | 92.9 | 0 | 98.1 | 100 | 98.0 | 100 | 0 | 98.0 | 97.1 |
| Trucks | 2 | 0 | 2 | 0 | 4 | 3 | 18 | 2 | 0 | 23 | 1 | 1 | 3 | 0 | 5 | 0 | 15 | 0 | 0 | 15 | 47 |
| % Trucks | 11.1 | 0 | 3.6 | 0 | 5.3 | 16.7 | 3.9 | 4.7 | 0 | 4.4 | 0.4 | 33.3 | 7.1 | 0 | 1.9 | 0 | 2.0 | 0 | 0 | 2.0 | 2.9 |

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Country Club
Site Code :
Start Date : 6/8/2017
Page No : 3



# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Country Club
Site Code :
Start Date : 6/8/2017
Page No : 4

| | Lane Place From North | | | | | Longhill From East | | | | | Country Club From South | | | | | Longhill From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 04:45 PM | | | | | | | | | | | | | | | | | | | | | |
| 04:45 PM | **4** | 0 | **7** | 0 | **11** | 6 | 239 | **61** | 0 | 306 | 33 | 0 | 12 | 0 | 45 | **10** | 181 | 3 | 0 | 194 | 556 |
| 05:00 PM | 2 | 0 | 4 | 0 | 6 | 10 | 237 | 49 | 0 | 296 | 34 | 0 | 10 | 0 | 44 | 8 | **198** | **9** | 0 | **215** | 561 |
| 05:15 PM | 4 | 0 | 6 | 0 | 10 | **16** | **266** | 60 | 0 | **342** | 29 | 0 | **14** | 0 | 43 | 8 | 182 | 2 | 0 | 192 | **587** |
| 05:30 PM | 4 | 0 | 6 | 0 | 10 | 6 | 235 | 36 | 0 | 277 | **40** | 0 | 14 | 0 | **54** | 9 | 174 | 3 | 0 | 186 | 527 |
| Total Volume | 14 | 0 | 23 | 0 | 37 | 38 | 977 | 206 | 0 | 1221 | 136 | 0 | 50 | 0 | 186 | 35 | 735 | 17 | 0 | 787 | 2231 |
| % App. Total | 37.8 | 0 | 62.2 | 0 | | 3.1 | 80 | 16.9 | 0 | | 73.1 | 0 | 26.9 | 0 | | 4.4 | 93.4 | 2.2 | 0 | | |
| PHF | .875 | .000 | .821 | .000 | .841 | .594 | .918 | .844 | .000 | .893 | .850 | .000 | .893 | .000 | .861 | .875 | .928 | .472 | .000 | .915 | .950 |
| Passenger Veh | 13 | 0 | 23 | 0 | 36 | 38 | 967 | 206 | 0 | 1211 | 132 | 0 | 49 | 0 | 181 | 35 | 716 | 17 | 0 | 768 | 2196 |
| % Passenger Veh | 92.9 | 0 | 100 | 0 | 97.3 | 100 | 99.0 | 100 | 0 | 99.2 | 97.1 | 0 | 98.0 | 0 | 97.3 | 100 | 97.4 | 100 | 0 | 97.6 | 98.4 |
| Trucks | 1 | 0 | 0 | 0 | 1 | 0 | 10 | 0 | 0 | 10 | 4 | 0 | 1 | 0 | 5 | 0 | 19 | 0 | 0 | 19 | 35 |
| % Trucks | 7.1 | 0 | 0 | 0 | 2.7 | 0 | 1.0 | 0 | 0 | 0.8 | 2.9 | 0 | 2.0 | 0 | 2.7 | 0 | 2.6 | 0 | 0 | 2.4 | 1.6 |

# Data Collection Group
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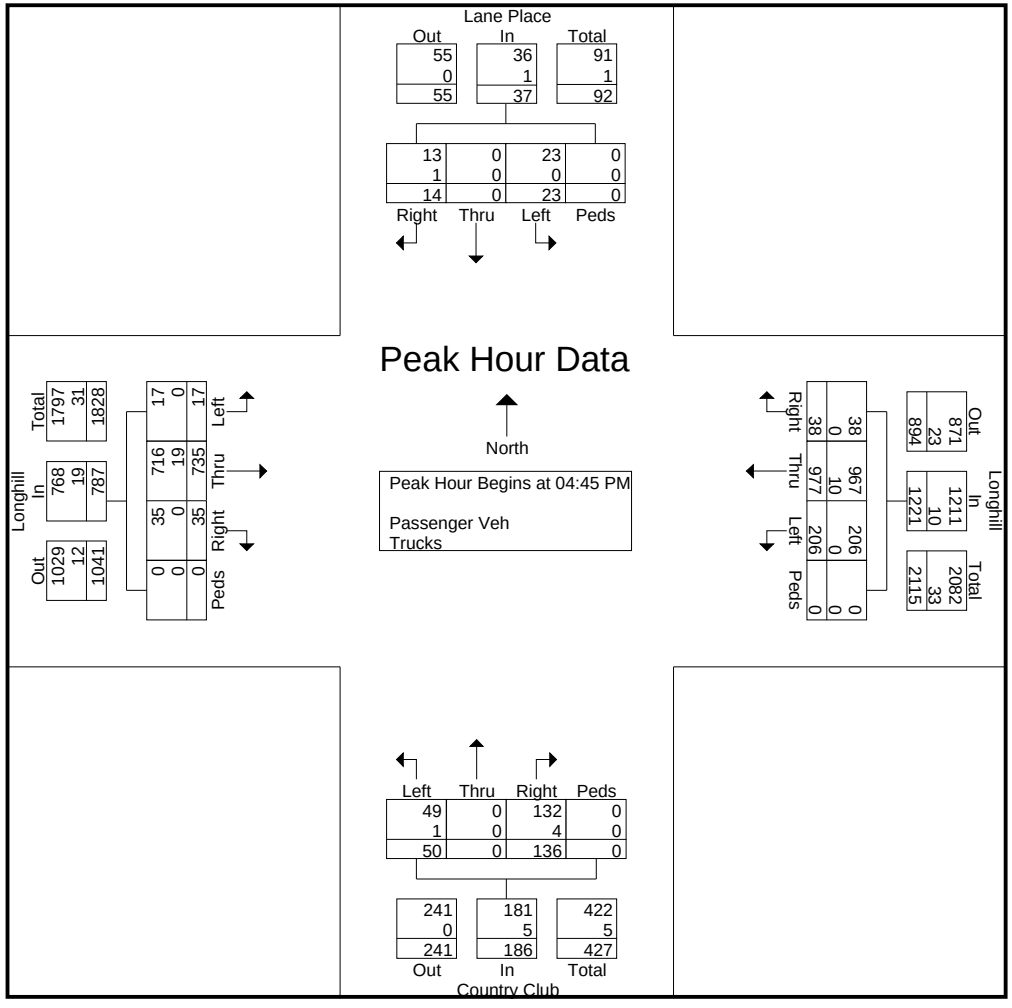
File Name : Longhill and Country Club
Site Code :
Start Date : 6/8/2017
Page No : 5



# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Fords Colony
Site Code : 13333333
Start Date : 6/8/2017
Page No : 1

Groups Printed- Passenger Veh - Trucks

| | Entrance From North | | | | | Longhill From East | | | | | Fords Colony From South | | | | | Longhill From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| 06:00 AM | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 3 | 0 | 14 | 8 | 0 | 4 | 0 | 12 | 3 | 16 | 0 | 0 | 19 | 45 |
| 06:15 AM | 1 | 0 | 1 | 0 | 2 | 1 | 13 | 1 | 0 | 15 | 6 | 0 | 2 | 0 | 8 | 2 | 21 | 1 | 0 | 24 | 49 |
| 06:30 AM | 0 | 0 | 0 | 0 | 0 | 1 | 19 | 7 | 0 | 27 | 7 | 0 | 2 | 0 | 9 | 0 | 26 | 0 | 0 | 26 | 62 |
| 06:45 AM | 0 | 0 | 0 | 0 | 0 | 1 | 36 | 9 | 0 | 46 | 25 | 0 | 6 | 0 | 31 | 2 | 55 | 1 | 0 | 58 | 135 |
| Total | 1 | 0 | 1 | 0 | 2 | 4 | 78 | 20 | 0 | 102 | 46 | 0 | 14 | 0 | 60 | 7 | 118 | 2 | 0 | 127 | 291 |
| 07:00 AM | 0 | 0 | 1 | 0 | 1 | 1 | 46 | 11 | 0 | 58 | 39 | 1 | 3 | 0 | 43 | 2 | 51 | 0 | 0 | 53 | 155 |
| 07:15 AM | 1 | 0 | 0 | 0 | 1 | 0 | 55 | 20 | 0 | 75 | 26 | 0 | 16 | 0 | 42 | 8 | 64 | 0 | 0 | 72 | 190 |
| 07:30 AM | 0 | 0 | 0 | 0 | 0 | 0 | 68 | 19 | 0 | 87 | 28 | 0 | 15 | 0 | 43 | 4 | 56 | 0 | 0 | 60 | 190 |
| 07:45 AM | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 30 | 0 | 85 | 37 | 0 | 15 | 0 | 52 | 7 | 84 | 1 | 0 | 92 | 229 |
| Total | 1 | 0 | 1 | 0 | 2 | 1 | 224 | 80 | 0 | 305 | 130 | 1 | 49 | 0 | 180 | 21 | 255 | 1 | 0 | 277 | 764 |
| 08:00 AM | 0 | 0 | 0 | 0 | 0 | 1 | 53 | 28 | 0 | 82 | 36 | 0 | 15 | 0 | 51 | 10 | 69 | 2 | 0 | 81 | 214 |
| 08:15 AM | 0 | 1 | 0 | 0 | 1 | 0 | 90 | 29 | 0 | 119 | 29 | 1 | 25 | 0 | 55 | 15 | 84 | 0 | 0 | 99 | 274 |
| 08:30 AM | 0 | 0 | 0 | 0 | 0 | 0 | 63 | 39 | 0 | 102 | 42 | 0 | 10 | 0 | 52 | 14 | 80 | 0 | 0 | 94 | 248 |
| 08:45 AM | 0 | 0 | 1 | 0 | 1 | 1 | 52 | 45 | 0 | 98 | 32 | 0 | 10 | 0 | 42 | 12 | 56 | 0 | 0 | 68 | 209 |
| Total | 0 | 1 | 1 | 0 | 2 | 2 | 258 | 141 | 0 | 401 | 139 | 1 | 60 | 0 | 200 | 51 | 289 | 2 | 0 | 342 | 945 |
| 09:00 AM | 0 | 0 | 0 | 0 | 0 | 1 | 56 | 27 | 0 | 84 | 22 | 0 | 11 | 0 | 33 | 12 | 58 | 1 | 0 | 71 | 188 |
| 09:15 AM | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 25 | 0 | 73 | 25 | 0 | 9 | 0 | 34 | 10 | 66 | 0 | 0 | 76 | 183 |
| 09:30 AM | 0 | 0 | 1 | 0 | 1 | 1 | 36 | 20 | 0 | 57 | 37 | 0 | 12 | 0 | 49 | 11 | 61 | 1 | 0 | 73 | 180 |
| 09:45 AM | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 48 | 0 | 86 | 43 | 0 | 10 | 0 | 53 | 12 | 63 | 0 | 0 | 75 | 214 |
| Total | 0 | 0 | 1 | 0 | 1 | 2 | 178 | 120 | 0 | 300 | 127 | 0 | 42 | 0 | 169 | 45 | 248 | 2 | 0 | 295 | 765 |
| 10:00 AM | 1 | 0 | 0 | 0 | 1 | 0 | 53 | 30 | 0 | 83 | 44 | 0 | 17 | 0 | 61 | 9 | 36 | 0 | 0 | 45 | 190 |
| 10:15 AM | 0 | 0 | 1 | 0 | 1 | 0 | 41 | 28 | 0 | 69 | 41 | 0 | 16 | 0 | 57 | 14 | 49 | 0 | 0 | 63 | 190 |
| 10:30 AM | 1 | 0 | 0 | 0 | 1 | 1 | 41 | 20 | 0 | 62 | 34 | 0 | 14 | 0 | 48 | 5 | 39 | 1 | 0 | 45 | 156 |
| 10:45 AM | 1 | 0 | 1 | 0 | 2 | 0 | 40 | 28 | 0 | 68 | 29 | 3 | 14 | 0 | 46 | 10 | 42 | 1 | 0 | 53 | 169 |
| Total | 3 | 0 | 2 | 0 | 5 | 1 | 175 | 106 | 0 | 282 | 148 | 3 | 61 | 0 | 212 | 38 | 166 | 2 | 0 | 206 | 705 |
| 11:00 AM | 1 | 0 | 1 | 0 | 2 | 1 | 37 | 32 | 0 | 70 | 35 | 0 | 6 | 0 | 41 | 15 | 39 | 1 | 0 | 55 | 168 |
| 11:15 AM | 0 | 0 | 0 | 0 | 0 | 2 | 38 | 30 | 0 | 70 | 24 | 0 | 9 | 0 | 33 | 11 | 48 | 0 | 0 | 59 | 162 |
| 11:30 AM | 0 | 0 | 1 | 0 | 1 | 0 | 45 | 33 | 0 | 78 | 25 | 2 | 14 | 0 | 41 | 12 | 53 | 1 | 0 | 66 | 186 |
| 11:45 AM | 0 | 0 | 3 | 0 | 3 | 0 | 49 | 41 | 0 | 90 | 33 | 0 | 12 | 0 | 45 | 17 | 49 | 0 | 0 | 66 | 204 |
| Total | 1 | 0 | 5 | 0 | 6 | 3 | 169 | 136 | 0 | 308 | 117 | 2 | 41 | 0 | 160 | 55 | 189 | 2 | 0 | 246 | 720 |
| 12:00 PM | 1 | 1 | 0 | 0 | 2 | 2 | 56 | 51 | 0 | 109 | 29 | 1 | 13 | 0 | 43 | 9 | 44 | 0 | 0 | 53 | 207 |
| 12:15 PM | 2 | 0 | 0 | 0 | 2 | 3 | 48 | 33 | 0 | 84 | 30 | 0 | 5 | 0 | 35 | 18 | 34 | 2 | 0 | 54 | 175 |
| 12:30 PM | 0 | 1 | 0 | 0 | 1 | 0 | 46 | 33 | 0 | 79 | 29 | 1 | 9 | 0 | 39 | 11 | 37 | 0 | 0 | 48 | 167 |
| 12:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 34 | 0 | 80 | 36 | 0 | 19 | 0 | 55 | 21 | 52 | 0 | 0 | 73 | 208 |
| Total | 3 | 2 | 0 | 0 | 5 | 5 | 196 | 151 | 0 | 352 | 124 | 2 | 46 | 0 | 172 | 59 | 167 | 2 | 0 | 228 | 757 |

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Fords Colony
Site Code : 13333333
Start Date : 6/8/2017
Page No : 2

Groups Printed- Passenger Veh - Trucks

| | Entrance From North | | | | | Longhill From East | | | | | Fords Colony From South | | | | | Longhill From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| 01:00 PM | 2 | 0 | 0 | 0 | 2 | 1 | 35 | 31 | 0 | 67 | 38 | 0 | 15 | 0 | 53 | 12 | 38 | 0 | 0 | 50 | 172 |
| 01:15 PM | 0 | 0 | 1 | 0 | 1 | 4 | 62 | 40 | 0 | 106 | 28 | 0 | 10 | 0 | 38 | 11 | 59 | 0 | 0 | 70 | 215 |
| 01:30 PM | 0 | 1 | 3 | 0 | 4 | 2 | 45 | 27 | 0 | 74 | 20 | 0 | 8 | 0 | 28 | 11 | 38 | 0 | 0 | 49 | 155 |
| 01:45 PM | 2 | 0 | 3 | 0 | 5 | 2 | 32 | 20 | 0 | 54 | 28 | 0 | 9 | 0 | 37 | 8 | 59 | 1 | 0 | 68 | 164 |
| Total | 4 | 1 | 7 | 0 | 12 | 9 | 174 | 118 | 0 | 301 | 114 | 0 | 42 | 0 | 156 | 42 | 194 | 1 | 0 | 237 | 706 |
| 02:00 PM | 0 | 0 | 0 | 0 | 0 | 1 | 64 | 42 | 0 | 107 | 42 | 1 | 18 | 0 | 61 | 12 | 51 | 3 | 0 | 66 | 234 |
| 02:15 PM | 1 | 0 | 1 | 0 | 2 | 1 | 60 | 51 | 0 | 112 | 29 | 0 | 5 | 0 | 34 | 15 | 43 | 0 | 0 | 58 | 206 |
| 02:30 PM | 2 | 0 | 2 | 0 | 4 | 1 | 83 | 37 | 0 | 121 | 29 | 0 | 10 | 0 | 39 | 16 | 55 | 1 | 0 | 72 | 236 |
| 02:45 PM | 2 | 0 | 0 | 0 | 2 | 0 | 86 | 51 | 0 | 137 | 34 | 0 | 19 | 0 | 53 | 8 | 55 | 1 | 0 | 64 | 256 |
| Total | 5 | 0 | 3 | 0 | 8 | 3 | 293 | 181 | 0 | 477 | 134 | 1 | 52 | 0 | 187 | 51 | 204 | 5 | 0 | 260 | 932 |
| 03:00 PM | 1 | 0 | 2 | 0 | 3 | 0 | 58 | 41 | 0 | 99 | 31 | 0 | 15 | 0 | 46 | 16 | 45 | 0 | 0 | 61 | 209 |
| 03:15 PM | 1 | 0 | 4 | 0 | 5 | 1 | 73 | 32 | 0 | 106 | 29 | 0 | 14 | 0 | 43 | 30 | 105 | 0 | 0 | 135 | 289 |
| 03:30 PM | 3 | 0 | 1 | 0 | 4 | 1 | 77 | 45 | 0 | 123 | 30 | 0 | 14 | 0 | 44 | 20 | 75 | 1 | 0 | 96 | 267 |
| 03:45 PM | 0 | 0 | 1 | 0 | 1 | 0 | 60 | 43 | 0 | 103 | 36 | 2 | 27 | 0 | 65 | 15 | 63 | 1 | 0 | 79 | 248 |
| Total | 5 | 0 | 8 | 0 | 13 | 2 | 268 | 161 | 0 | 431 | 126 | 2 | 70 | 0 | 198 | 81 | 288 | 2 | 0 | 371 | 1013 |
| 04:00 PM | 0 | 1 | 0 | 0 | 1 | 0 | 68 | 31 | 0 | 99 | 32 | 0 | 16 | 0 | 48 | 12 | 77 | 0 | 0 | 89 | 237 |
| 04:15 PM | 0 | 0 | 1 | 0 | 1 | 1 | 61 | 37 | 0 | 99 | 27 | 0 | 9 | 0 | 36 | 16 | 84 | 6 | 0 | 106 | 242 |
| 04:30 PM | 1 | 0 | 0 | 0 | 1 | 0 | 74 | 38 | 0 | 112 | 27 | 1 | 13 | 0 | 41 | 9 | 77 | 1 | 0 | 87 | 241 |
| 04:45 PM | 1 | 0 | 0 | 0 | 1 | 0 | 65 | 50 | 0 | 115 | 30 | 1 | 14 | 0 | 45 | 19 | 93 | 0 | 0 | 112 | 273 |
| Total | 2 | 1 | 1 | 0 | 4 | 1 | 268 | 156 | 0 | 425 | 116 | 2 | 52 | 0 | 170 | 56 | 331 | 7 | 0 | 394 | 993 |
| 05:00 PM | 3 | 0 | 0 | 0 | 3 | 1 | 63 | 39 | 0 | 103 | 31 | 2 | 4 | 0 | 37 | 11 | 78 | 0 | 0 | 89 | 232 |
| 05:15 PM | 0 | 0 | 1 | 0 | 1 | 1 | 79 | 47 | 0 | 127 | 25 | 0 | 14 | 0 | 39 | 9 | 86 | 0 | 0 | 95 | 262 |
| 05:30 PM | 1 | 0 | 3 | 0 | 4 | 0 | 75 | 56 | 0 | 131 | 35 | 0 | 13 | 0 | 48 | 14 | 83 | 0 | 0 | 97 | 280 |
| 05:45 PM | 0 | 0 | 0 | 0 | 0 | 0 | 53 | 44 | 0 | 97 | 39 | 0 | 5 | 0 | 44 | 13 | 81 | 0 | 0 | 94 | 235 |
| Total | 4 | 0 | 4 | 0 | 8 | 2 | 270 | 186 | 0 | 458 | 130 | 2 | 36 | 0 | 168 | 47 | 328 | 0 | 0 | 375 | 1009 |
| Grand Total | 29 | 5 | 34 | 0 | 68 | 35 | 2551 | 1556 | 0 | 4142 | 1451 | 16 | 565 | 0 | 2032 | 553 | 2777 | 28 | 0 | 3358 | 9600 |
| Apprch % | 42.6 | 7.4 | 50 | 0 | | 0.8 | 61.6 | 37.6 | 0 | | 71.4 | 0.8 | 27.8 | 0 | | 16.5 | 82.7 | 0.8 | 0 | | |
| Total % | 0.3 | 0.1 | 0.4 | 0 | 0.7 | 0.4 | 26.6 | 16.2 | 0 | 43.1 | 15.1 | 0.2 | 5.9 | 0 | 21.2 | 5.8 | 28.9 | 0.3 | 0 | 35 | |
| Passenger Veh | 29 | 4 | 34 | 0 | 67 | 35 | 2433 | 1538 | 0 | 4006 | 1443 | 15 | 551 | 0 | 2009 | 537 | 2645 | 27 | 0 | 3209 | 9291 |
| % Passenger Veh | 100 | 80 | 100 | 0 | 98.5 | 100 | 95.4 | 98.8 | 0 | 96.7 | 99.4 | 93.8 | 97.5 | 0 | 98.9 | 97.1 | 95.2 | 96.4 | 0 | 95.6 | 96.8 |
| Trucks | 0 | 1 | 0 | 0 | 1 | 0 | 118 | 18 | 0 | 136 | 8 | 1 | 14 | 0 | 23 | 16 | 132 | 1 | 0 | 149 | 309 |
| % Trucks | 0 | 20 | 0 | 0 | 1.5 | 0 | 4.6 | 1.2 | 0 | 3.3 | 0.6 | 6.2 | 2.5 | 0 | 1.1 | 2.9 | 4.8 | 3.6 | 0 | 4.4 | 3.2 |

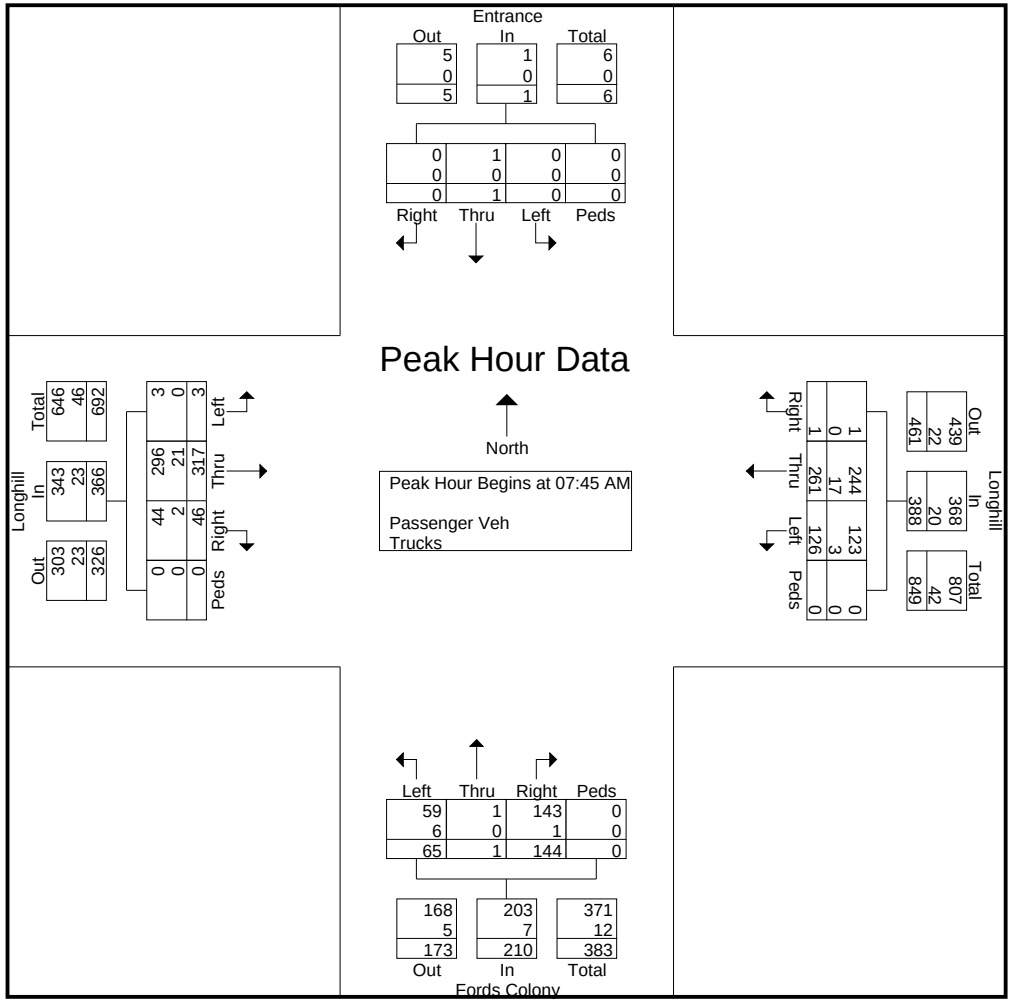
# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Fords Colony
Site Code : 13333333
Start Date : 6/8/2017
Page No : 3

| | Entrance From North | | | | | Longhill From East | | | | | Fords Colony From South | | | | | Longhill From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 06:00 AM to 09:45 AM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 07:45 AM | | | | | | | | | | | | | | | | | | | | | |
| 07:45 AM | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 30 | 0 | 85 | 37 | 0 | 15 | 0 | 52 | 7 | **84** | 1 | 0 | 92 | 229 |
| 08:00 AM | 0 | 0 | 0 | 0 | 0 | **1** | 53 | 28 | 0 | 82 | 36 | 0 | 15 | 0 | 51 | 10 | 69 | **2** | 0 | 81 | 214 |
| 08:15 AM | 0 | **1** | 0 | 0 | **1** | 0 | **90** | 29 | 0 | **119** | 29 | **1** | **25** | 0 | **55** | **15** | 84 | 0 | 0 | **99** | **274** |
| 08:30 AM | 0 | 0 | 0 | 0 | 0 | 0 | 63 | **39** | 0 | 102 | **42** | 0 | 10 | 0 | 52 | 14 | 80 | 0 | 0 | 94 | 248 |
| Total Volume | 0 | 1 | 0 | 0 | 1 | 1 | 261 | 126 | 0 | 388 | 144 | 1 | 65 | 0 | 210 | 46 | 317 | 3 | 0 | 366 | 965 |
| % App. Total | 0 | 100 | 0 | 0 | | 0.3 | 67.3 | 32.5 | 0 | | 68.6 | 0.5 | 31 | 0 | | 12.6 | 86.6 | 0.8 | 0 | | |
| PHF | .000 | .250 | .000 | .000 | .250 | .250 | .725 | .808 | .000 | .815 | .857 | .250 | .650 | .000 | .955 | .767 | .943 | .375 | .000 | .924 | .880 |
| Passenger Veh | 0 | 1 | 0 | 0 | 1 | 1 | 244 | 123 | 0 | 368 | 143 | 1 | 59 | 0 | 203 | 44 | 296 | 3 | 0 | 343 | 915 |
| % Passenger Veh | 0 | 100 | 0 | 0 | 100 | 100 | 93.5 | 97.6 | 0 | 94.8 | 99.3 | 100 | 90.8 | 0 | 96.7 | 95.7 | 93.4 | 100 | 0 | 93.7 | 94.8 |
| Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 3 | 0 | 20 | 1 | 0 | 6 | 0 | 7 | 2 | 21 | 0 | 0 | 23 | 50 |
| % Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 6.5 | 2.4 | 0 | 5.2 | 0.7 | 0 | 9.2 | 0 | 3.3 | 4.3 | 6.6 | 0 | 0 | 6.3 | 5.2 |

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Fords Colony
Site Code : 13333333
Start Date : 6/8/2017
Page No : 4



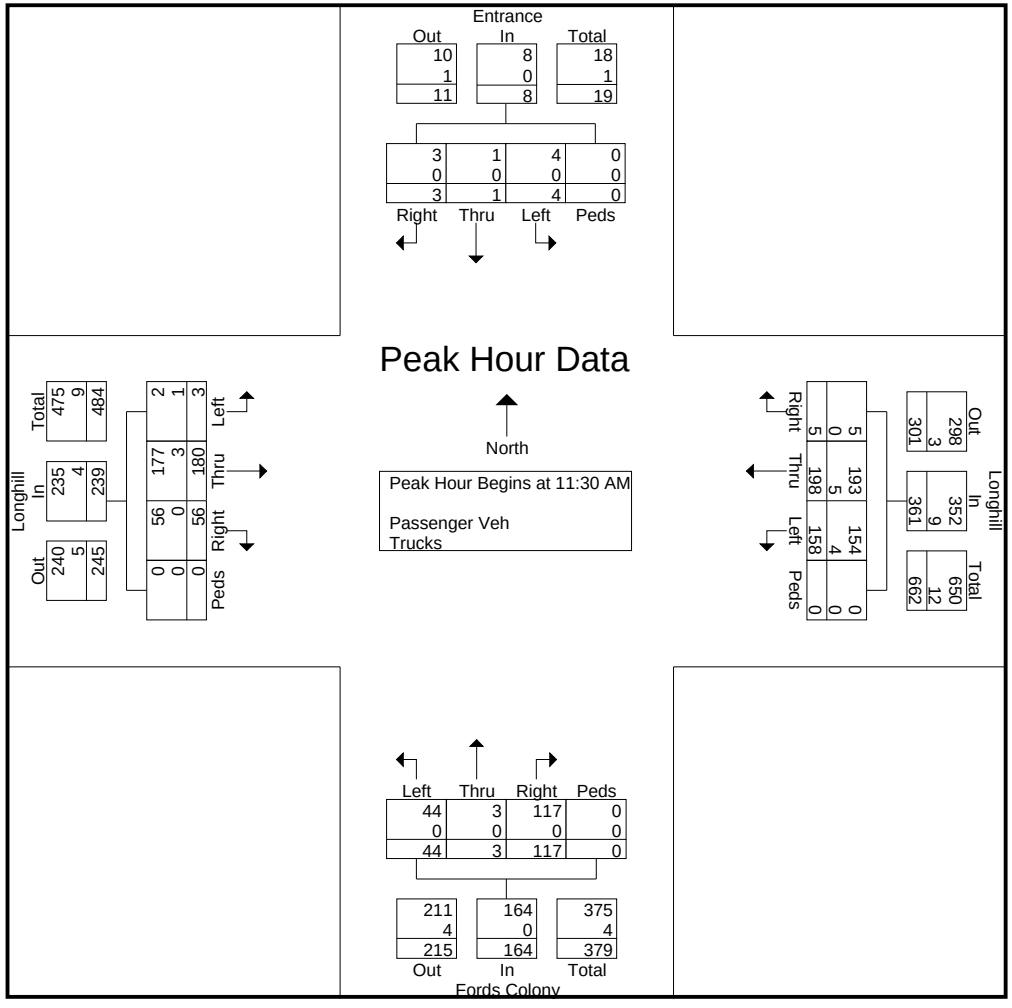
# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Fords Colony
Site Code : 13333333
Start Date : 6/8/2017
Page No : 5

| | Entrance From North | | | | | Longhill From East | | | | | Fords Colony From South | | | | | Longhill From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 11:30 AM | | | | | | | | | | | | | | | | | | | | | |
| 11:30 AM | 0 | 0 | 1 | 0 | 1 | 0 | 45 | 33 | 0 | 78 | 25 | **2** | **14** | 0 | 41 | 12 | **53** | 1 | 0 | **66** | 186 |
| 11:45 AM | 0 | 0 | **3** | 0 | **3** | 0 | 49 | 41 | 0 | 90 | **33** | 0 | 12 | 0 | **45** | 17 | 49 | 0 | 0 | 66 | 204 |
| 12:00 PM | 1 | **1** | 0 | 0 | 2 | 2 | **56** | **51** | 0 | **109** | 29 | 1 | 13 | 0 | 43 | 9 | 44 | 0 | 0 | 53 | **207** |
| 12:15 PM | **2** | 0 | 0 | 0 | 2 | **3** | 48 | 33 | 0 | 84 | 30 | 0 | 5 | 0 | 35 | **18** | 34 | **2** | 0 | 54 | 175 |
| Total Volume | 3 | 1 | 4 | 0 | 8 | 5 | 198 | 158 | 0 | 361 | 117 | 3 | 44 | 0 | 164 | 56 | 180 | 3 | 0 | 239 | 772 |
| % App. Total | 37.5 | 12.5 | 50 | 0 | | 1.4 | 54.8 | 43.8 | 0 | | 71.3 | 1.8 | 26.8 | 0 | | 23.4 | 75.3 | 1.3 | 0 | | |
| PHF | .375 | .250 | .333 | .000 | .667 | .417 | .884 | .775 | .000 | .828 | .886 | .375 | .786 | .000 | .911 | .778 | .849 | .375 | .000 | .905 | .932 |
| Passenger Veh | 3 | 1 | 4 | 0 | 8 | 5 | 193 | 154 | 0 | 352 | 117 | 3 | 44 | 0 | 164 | 56 | 177 | 2 | 0 | 235 | 759 |
| % Passenger Veh | 100 | 100 | 100 | 0 | 100 | 100 | 97.5 | 97.5 | 0 | 97.5 | 100 | 100 | 100 | 0 | 100 | 100 | 98.3 | 66.7 | 0 | 98.3 | 98.3 |
| Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 4 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 4 | 13 |
| % Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 2.5 | 2.5 | 0 | 2.5 | 0 | 0 | 0 | 0 | 0 | 0 | 1.7 | 33.3 | 0 | 1.7 | 1.7 |

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Fords Colony
Site Code : 13333333
Start Date : 6/8/2017
Page No : 6



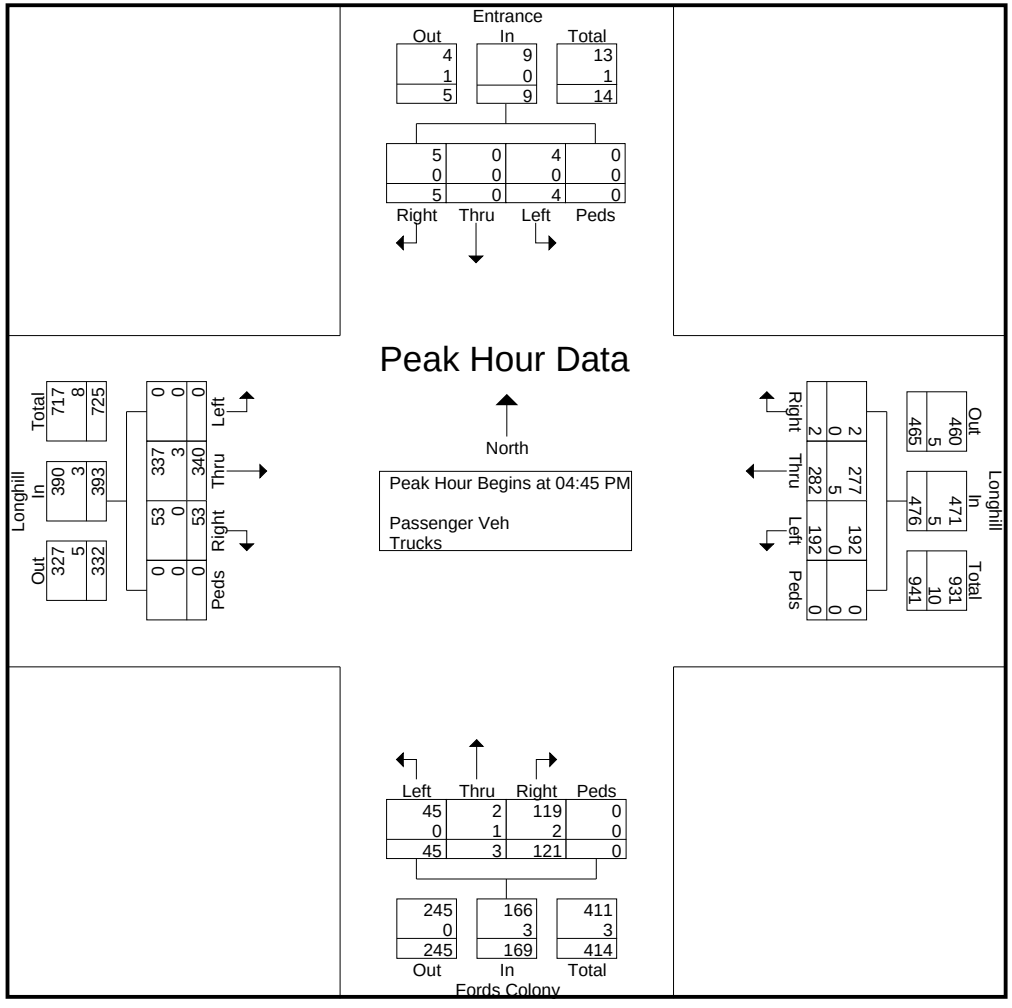
# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Fords Colony
Site Code : 13333333
Start Date : 6/8/2017
Page No : 7

| | Entrance From North | | | | | Longhill From East | | | | | Fords Colony From South | | | | | Longhill From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 04:45 PM | | | | | | | | | | | | | | | | | | | | | |
| 04:45 PM | 1 | 0 | 0 | 0 | 1 | 0 | 65 | 50 | 0 | 115 | 30 | 1 | **14** | 0 | 45 | **19** | **93** | 0 | 0 | **112** | 273 |
| 05:00 PM | **3** | 0 | 0 | 0 | 3 | **1** | 63 | 39 | 0 | 103 | 31 | **2** | 4 | 0 | 37 | 11 | 78 | 0 | 0 | 89 | 232 |
| 05:15 PM | 0 | 0 | 1 | 0 | 1 | 1 | **79** | 47 | 0 | 127 | 25 | 0 | 14 | 0 | 39 | 9 | 86 | 0 | 0 | 95 | 262 |
| 05:30 PM | 1 | 0 | **3** | 0 | **4** | 0 | 75 | **56** | 0 | **131** | **35** | 0 | 13 | 0 | **48** | 14 | 83 | 0 | 0 | 97 | **280** |
| Total Volume | 5 | 0 | 4 | 0 | 9 | 2 | 282 | 192 | 0 | 476 | 121 | 3 | 45 | 0 | 169 | 53 | 340 | 0 | 0 | 393 | 1047 |
| % App. Total | 55.6 | 0 | 44.4 | 0 | | 0.4 | 59.2 | 40.3 | 0 | | 71.6 | 1.8 | 26.6 | 0 | | 13.5 | 86.5 | 0 | 0 | | |
| PHF | .417 | .000 | .333 | .000 | .563 | .500 | .892 | .857 | .000 | .908 | .864 | .375 | .804 | .000 | .880 | .697 | .914 | .000 | .000 | .877 | .935 |
| Passenger Veh | 5 | 0 | 4 | 0 | 9 | 2 | 277 | 192 | 0 | 471 | 119 | 2 | 45 | 0 | 166 | 53 | 337 | 0 | 0 | 390 | 1036 |
| % Passenger Veh | 100 | 0 | 100 | 0 | 100 | 100 | 98.2 | 100 | 0 | 98.9 | 98.3 | 66.7 | 100 | 0 | 98.2 | 100 | 99.1 | 0 | 0 | 99.2 | 98.9 |
| Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 5 | 2 | 1 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 3 | 11 |
| % Trucks | 0 | 0 | 0 | 0 | 0 | 0 | 1.8 | 0 | 0 | 1.1 | 1.7 | 33.3 | 0 | 0 | 1.8 | 0 | 0.9 | 0 | 0 | 0.8 | 1.1 |

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Longhill and Fords Colony
Site Code : 13333333
Start Date : 6/8/2017
Page No : 8



# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Centerville and Manchester
Site Code :
Start Date : 6/8/2017
Page No : 1

**Groups Printed- Passenger Veh - Trucks**

| | Centerville From North | | | | | Manchester From East | | | | | Centerville From South | | | | | Westport From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| 06:30 AM | 0 | 19 | 6 | 0 | 25 | 3 | 0 | 4 | 0 | 7 | 2 | 31 | 1 | 0 | 34 | 1 | 0 | 0 | 0 | 1 | 67 |
| 06:45 AM | 0 | 28 | 10 | 0 | 38 | 7 | 0 | 7 | 0 | 14 | 4 | 54 | 0 | 0 | 58 | 0 | 0 | 0 | 0 | 0 | 110 |
| Total | 0 | 47 | 16 | 0 | 63 | 10 | 0 | 11 | 0 | 21 | 6 | 85 | 1 | 0 | 92 | 1 | 0 | 0 | 0 | 1 | 177 |
| 07:00 AM | 1 | 29 | 1 | 0 | 31 | 7 | 0 | 9 | 0 | 16 | 5 | 57 | 0 | 0 | 62 | 1 | 0 | 0 | 0 | 1 | 110 |
| 07:15 AM | 0 | 52 | 7 | 0 | 59 | 10 | 0 | 13 | 0 | 23 | 6 | 77 | 2 | 0 | 85 | 0 | 0 | 0 | 0 | 0 | 167 |
| 07:30 AM | 2 | 36 | 9 | 0 | 47 | 11 | 0 | 12 | 0 | 23 | 11 | 123 | 1 | 0 | 135 | 0 | 1 | 2 | 0 | 3 | 208 |
| 07:45 AM | 0 | 58 | 10 | 0 | 68 | 10 | 0 | 15 | 0 | 25 | 10 | 85 | 1 | 0 | 96 | 0 | 0 | 1 | 0 | 1 | 190 |
| Total | 3 | 175 | 27 | 0 | 205 | 38 | 0 | 49 | 0 | 87 | 32 | 342 | 4 | 0 | 378 | 1 | 1 | 3 | 0 | 5 | 675 |
| 08:00 AM | 0 | 55 | 14 | 0 | 69 | 8 | 0 | 16 | 0 | 24 | 10 | 61 | 0 | 0 | 71 | 0 | 0 | 1 | 0 | 1 | 165 |
| 08:15 AM | 1 | 61 | 17 | 0 | 79 | 18 | 0 | 11 | 0 | 29 | 12 | 68 | 0 | 0 | 80 | 2 | 0 | 0 | 0 | 2 | 190 |
| Total | 1 | 116 | 31 | 0 | 148 | 26 | 0 | 27 | 0 | 53 | 22 | 129 | 0 | 0 | 151 | 2 | 0 | 1 | 0 | 3 | 355 |
| 04:00 PM | 0 | 59 | 11 | 0 | 70 | 5 | 2 | 11 | 0 | 18 | 17 | 74 | 0 | 0 | 91 | 1 | 0 | 1 | 0 | 2 | 181 |
| 04:15 PM | 0 | 58 | 4 | 0 | 62 | 1 | 0 | 9 | 0 | 10 | 16 | 65 | 0 | 0 | 81 | 0 | 0 | 1 | 0 | 1 | 154 |
| 04:30 PM | 1 | 45 | 5 | 0 | 51 | 6 | 0 | 7 | 0 | 13 | 13 | 85 | 0 | 0 | 98 | 2 | 1 | 0 | 0 | 3 | 165 |
| 04:45 PM | 0 | 61 | 5 | 0 | 66 | 7 | 0 | 15 | 0 | 22 | 21 | 71 | 0 | 0 | 92 | 1 | 1 | 2 | 0 | 4 | 184 |
| Total | 1 | 223 | 25 | 0 | 249 | 19 | 2 | 42 | 0 | 63 | 67 | 295 | 0 | 0 | 362 | 4 | 2 | 4 | 0 | 10 | 684 |
| 05:00 PM | 0 | 60 | 6 | 0 | 66 | 9 | 0 | 12 | 0 | 21 | 16 | 66 | 0 | 0 | 82 | 0 | 0 | 0 | 0 | 0 | 169 |
| 05:15 PM | 2 | 59 | 7 | 0 | 68 | 5 | 0 | 8 | 0 | 13 | 14 | 74 | 2 | 0 | 90 | 1 | 0 | 0 | 0 | 1 | 172 |
| 05:30 PM | 0 | 57 | 5 | 0 | 62 | 7 | 0 | 12 | 0 | 19 | 13 | 79 | 0 | 0 | 92 | 0 | 0 | 1 | 0 | 1 | 174 |
| 05:45 PM | 1 | 58 | 9 | 0 | 68 | 5 | 0 | 13 | 0 | 18 | 13 | 46 | 2 | 0 | 61 | 1 | 0 | 2 | 0 | 3 | 150 |
| Total | 3 | 234 | 27 | 0 | 264 | 26 | 0 | 45 | 0 | 71 | 56 | 265 | 4 | 0 | 325 | 2 | 0 | 3 | 0 | 5 | 665 |
| Grand Total | 8 | 795 | 126 | 0 | 929 | 119 | 2 | 174 | 0 | 295 | 183 | 1116 | 9 | 0 | 1308 | 10 | 3 | 11 | 0 | 24 | 2556 |
| Apprch % | 0.9 | 85.6 | 13.6 | 0 | | 40.3 | 0.7 | 59 | 0 | | 14 | 85.3 | 0.7 | 0 | | 41.7 | 12.5 | 45.8 | 0 | | |
| Total % | 0.3 | 31.1 | 4.9 | 0 | 36.3 | 4.7 | 0.1 | 6.8 | 0 | 11.5 | 7.2 | 43.7 | 0.4 | 0 | 51.2 | 0.4 | 0.1 | 0.4 | 0 | 0.9 | |
| Passenger Veh | 6 | 752 | 117 | 0 | 875 | 114 | 2 | 170 | 0 | 286 | 165 | 1050 | 8 | 0 | 1223 | 9 | 3 | 10 | 0 | 22 | 2406 |
| % Passenger Veh | 75 | 94.6 | 92.9 | 0 | 94.2 | 95.8 | 100 | 97.7 | 0 | 96.9 | 90.2 | 94.1 | 88.9 | 0 | 93.5 | 90 | 100 | 90.9 | 0 | 91.7 | 94.1 |
| Trucks | 2 | 43 | 9 | 0 | 54 | 5 | 0 | 4 | 0 | 9 | 18 | 66 | 1 | 0 | 85 | 1 | 0 | 1 | 0 | 2 | 150 |
| % Trucks | 25 | 5.4 | 7.1 | 0 | 5.8 | 4.2 | 0 | 2.3 | 0 | 3.1 | 9.8 | 5.9 | 11.1 | 0 | 6.5 | 10 | 0 | 9.1 | 0 | 8.3 | 5.9 |

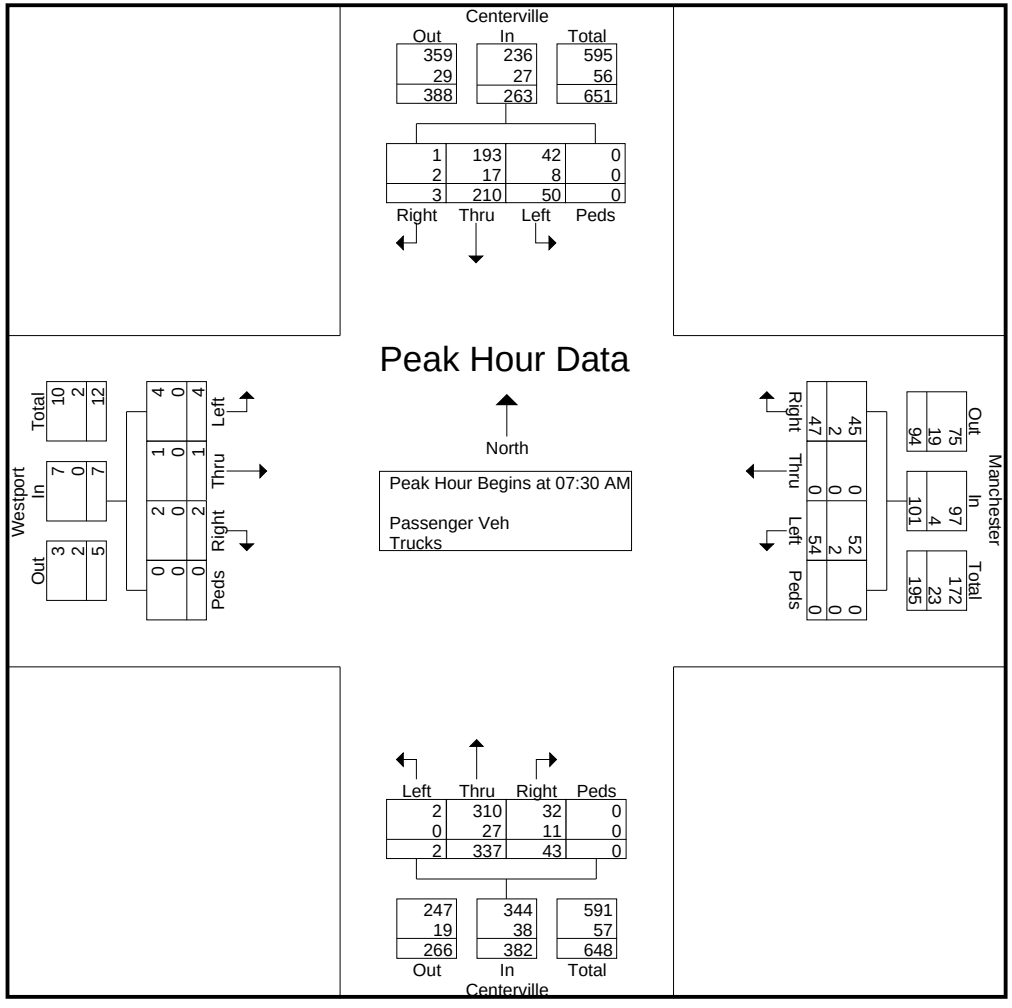
# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Centerville and Manchester
Site Code :
Start Date : 6/8/2017
Page No : 2

| | Centerville From North | | | | | Manchester From East | | | | | Centerville From South | | | | | Westport From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 06:30 AM to 11:45 AM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 07:30 AM | | | | | | | | | | | | | | | | | | | | | |
| 07:30 AM | **2** | 36 | 9 | 0 | 47 | 11 | 0 | 12 | 0 | 23 | 11 | **123** | **1** | 0 | **135** | 0 | **1** | **2** | 0 | **3** | **208** |
| 07:45 AM | 0 | 58 | 10 | 0 | 68 | 10 | 0 | 15 | 0 | 25 | 10 | 85 | 1 | 0 | 96 | 0 | 0 | 1 | 0 | 1 | 190 |
| 08:00 AM | 0 | 55 | 14 | 0 | 69 | 8 | 0 | **16** | 0 | 24 | 10 | 61 | 0 | 0 | 71 | 0 | 0 | 1 | 0 | 1 | 165 |
| 08:15 AM | 1 | **61** | **17** | 0 | **79** | **18** | 0 | 11 | 0 | **29** | **12** | 68 | 0 | 0 | 80 | **2** | 0 | 0 | 0 | 2 | 190 |
| Total Volume | 3 | 210 | 50 | 0 | 263 | 47 | 0 | 54 | 0 | 101 | 43 | 337 | 2 | 0 | 382 | 2 | 1 | 4 | 0 | 7 | 753 |
| % App. Total | 1.1 | 79.8 | 19 | 0 | | 46.5 | 0 | 53.5 | 0 | | 11.3 | 88.2 | 0.5 | 0 | | 28.6 | 14.3 | 57.1 | 0 | | |
| PHF | .375 | .861 | .735 | .000 | .832 | .653 | .000 | .844 | .000 | .871 | .896 | .685 | .500 | .000 | .707 | .250 | .250 | .500 | .000 | .583 | .905 |
| Passenger Veh | 1 | 193 | 42 | 0 | 236 | 45 | 0 | 52 | 0 | 97 | 32 | 310 | 2 | 0 | 344 | 2 | 1 | 4 | 0 | 7 | 684 |
| % Passenger Veh | 33.3 | 91.9 | 84.0 | 0 | 89.7 | 95.7 | 0 | 96.3 | 0 | 96.0 | 74.4 | 92.0 | 100 | 0 | 90.1 | 100 | 100 | 100 | 0 | 100 | 90.8 |
| Trucks | 2 | 17 | 8 | 0 | 27 | 2 | 0 | 2 | 0 | 4 | 11 | 27 | 0 | 0 | 38 | 0 | 0 | 0 | 0 | 0 | 69 |
| % Trucks | 66.7 | 8.1 | 16.0 | 0 | 10.3 | 4.3 | 0 | 3.7 | 0 | 4.0 | 25.6 | 8.0 | 0 | 0 | 9.9 | 0 | 0 | 0 | 0 | 0 | 9.2 |

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Centerville and Manchester
Site Code :
Start Date : 6/8/2017
Page No : 3



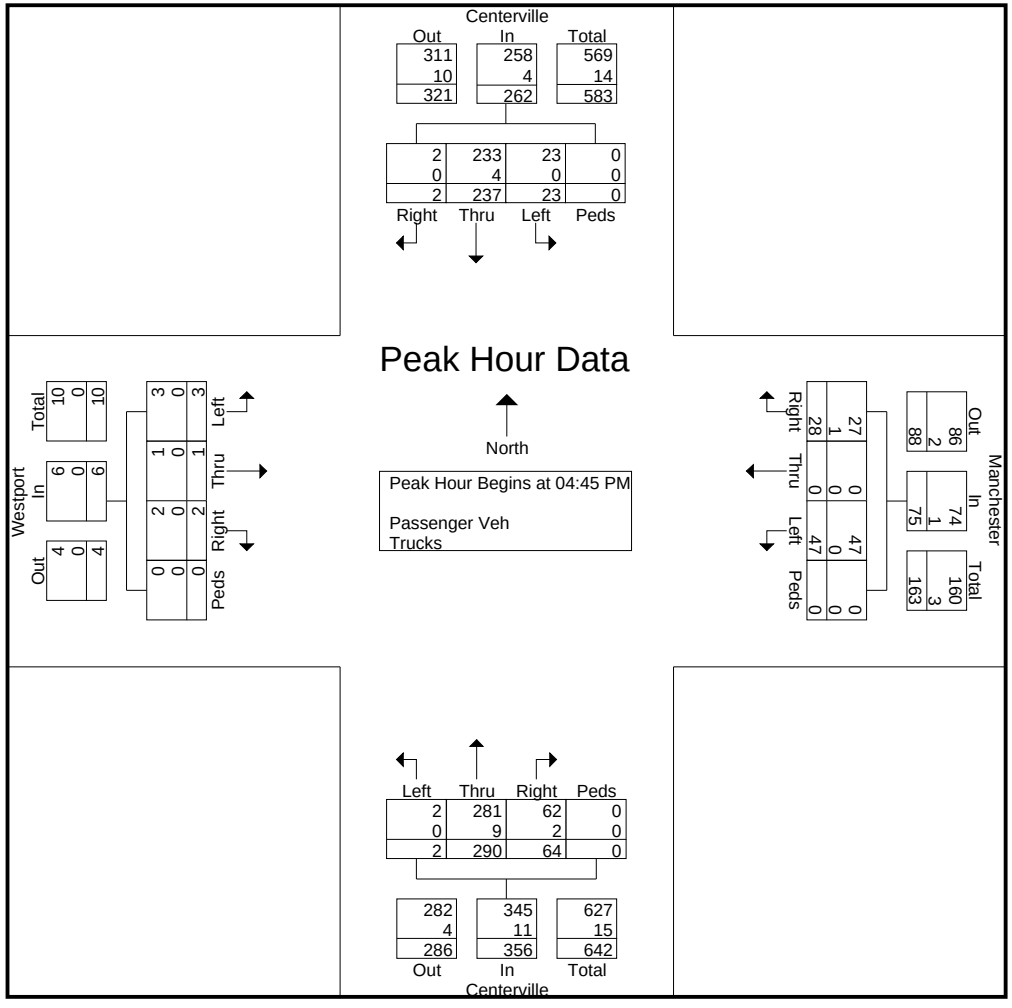
# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Centerville and Manchester
Site Code :
Start Date : 6/8/2017
Page No : 4

| | Centerville From North | | | | | Manchester From East | | | | | Centerville From South | | | | | Westport From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 04:45 PM | | | | | | | | | | | | | | | | | | | | | |
| 04:45 PM | 0 | **61** | 5 | 0 | 66 | 7 | 0 | **15** | 0 | **22** | **21** | 71 | 0 | 0 | **92** | **1** | **1** | **2** | 0 | **4** | **184** |
| 05:00 PM | 0 | 60 | 6 | 0 | 66 | **9** | 0 | 12 | 0 | 21 | 16 | 66 | 0 | 0 | 82 | 0 | 0 | 0 | 0 | 0 | 169 |
| 05:15 PM | **2** | 59 | **7** | 0 | **68** | 5 | 0 | 8 | 0 | 13 | 14 | 74 | **2** | 0 | 90 | 1 | 0 | 0 | 0 | 1 | 172 |
| 05:30 PM | 0 | 57 | 5 | 0 | 62 | 7 | 0 | 12 | 0 | 19 | 13 | **79** | 0 | 0 | 92 | 0 | 0 | 1 | 0 | 1 | 174 |
| Total Volume | 2 | 237 | 23 | 0 | 262 | 28 | 0 | 47 | 0 | 75 | 64 | 290 | 2 | 0 | 356 | 2 | 1 | 3 | 0 | 6 | 699 |
| % App. Total | 0.8 | 90.5 | 8.8 | 0 | | 37.3 | 0 | 62.7 | 0 | | 18 | 81.5 | 0.6 | 0 | | 33.3 | 16.7 | 50 | 0 | | |
| PHF | .250 | .971 | .821 | .000 | .963 | .778 | .000 | .783 | .000 | .852 | .762 | .918 | .250 | .000 | .967 | .500 | .250 | .375 | .000 | .375 | .950 |
| Passenger Veh | 2 | 233 | 23 | 0 | 258 | 27 | 0 | 47 | 0 | 74 | 62 | 281 | 2 | 0 | 345 | 2 | 1 | 3 | 0 | 6 | 683 |
| % Passenger Veh | 100 | 98.3 | 100 | 0 | 98.5 | 96.4 | 0 | 100 | 0 | 98.7 | 96.9 | 96.9 | 100 | 0 | 96.9 | 100 | 100 | 100 | 0 | 100 | 97.7 |
| Trucks | 0 | 4 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 1 | 2 | 9 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 16 |
| % Trucks | 0 | 1.7 | 0 | 0 | 1.5 | 3.6 | 0 | 0 | 0 | 1.3 | 3.1 | 3.1 | 0 | 0 | 3.1 | 0 | 0 | 0 | 0 | 0 | 2.3 |

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : Centerville and Manchester
Site Code :
Start Date : 6/8/2017
Page No : 5



# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : News and Firestone
Site Code : 00681114
Start Date : 6/8/2017
Page No : 1

Groups Printed- Passenger Veh - Trucks

| | Firestone From North | | | | | News From East | | | | | From South | | | | | News From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| 06:00 AM | 0 | 0 | 7 | 0 | 7 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 17 | 27 |
| 06:15 AM | 0 | 0 | 5 | 0 | 5 | 1 | 6 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 21 | 33 |
| 06:30 AM | 1 | 0 | 16 | 0 | 17 | 3 | 6 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 26 | 52 |
| 06:45 AM | 1 | 0 | 14 | 0 | 15 | 1 | 14 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 27 | 57 |
| Total | 2 | 0 | 42 | 0 | 44 | 5 | 29 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 91 | 0 | 0 | 91 | 169 |
| 07:00 AM | 2 | 0 | 18 | 0 | 20 | 2 | 23 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 36 | 81 |
| 07:15 AM | 2 | 0 | 15 | 0 | 17 | 2 | 21 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 47 | 87 |
| 07:30 AM | 1 | 0 | 24 | 0 | 25 | 9 | 30 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 0 | 0 | 49 | 113 |
| 07:45 AM | 5 | 0 | 15 | 0 | 20 | 11 | 29 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 2 | 0 | 57 | 117 |
| Total | 10 | 0 | 72 | 0 | 82 | 24 | 103 | 0 | 0 | 127 | 0 | 0 | 0 | 0 | 0 | 0 | 187 | 2 | 0 | 189 | 398 |
| 08:00 AM | 4 | 0 | 27 | 0 | 31 | 11 | 31 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 3 | 0 | 42 | 115 |
| 08:15 AM | 7 | 0 | 19 | 0 | 26 | 12 | 35 | 0 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 5 | 0 | 50 | 123 |
| 08:30 AM | 1 | 0 | 30 | 0 | 31 | 9 | 25 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 58 | 4 | 0 | 62 | 127 |
| 08:45 AM | 2 | 0 | 18 | 0 | 20 | 11 | 40 | 0 | 0 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 61 | 1 | 0 | 62 | 133 |
| Total | 14 | 0 | 94 | 0 | 108 | 43 | 131 | 0 | 0 | 174 | 0 | 0 | 0 | 0 | 0 | 0 | 203 | 13 | 0 | 216 | 498 |
| 09:00 AM | 3 | 0 | 25 | 0 | 28 | 13 | 46 | 0 | 0 | 59 | 0 | 0 | 0 | 0 | 0 | 0 | 66 | 0 | 0 | 66 | 153 |
| 09:15 AM | 5 | 0 | 22 | 0 | 27 | 16 | 25 | 0 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 1 | 0 | 39 | 107 |
| 09:30 AM | 4 | 0 | 18 | 0 | 22 | 13 | 29 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 1 | 0 | 37 | 101 |
| 09:45 AM | 4 | 0 | 22 | 0 | 26 | 19 | 22 | 0 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 35 | 102 |
| Total | 16 | 0 | 87 | 0 | 103 | 61 | 122 | 0 | 0 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 175 | 2 | 0 | 177 | 463 |
| 10:00 AM | 1 | 0 | 19 | 0 | 20 | 22 | 28 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 2 | 0 | 36 | 106 |
| 10:15 AM | 4 | 0 | 29 | 0 | 33 | 10 | 32 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 | 0 | 37 | 112 |
| 10:30 AM | 3 | 0 | 27 | 0 | 30 | 13 | 22 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 1 | 0 | 40 | 105 |
| 10:45 AM | 3 | 0 | 35 | 0 | 38 | 33 | 35 | 0 | 0 | 68 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 1 | 0 | 44 | 150 |
| Total | 11 | 0 | 110 | 0 | 121 | 78 | 117 | 0 | 0 | 195 | 0 | 0 | 0 | 0 | 0 | 0 | 153 | 4 | 0 | 157 | 473 |
| 11:00 AM | 3 | 0 | 22 | 0 | 25 | 31 | 30 | 0 | 0 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 2 | 0 | 33 | 119 |
| 11:15 AM | 6 | 0 | 22 | 0 | 28 | 20 | 35 | 0 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 1 | 0 | 42 | 125 |
| 11:30 AM | 0 | 0 | 31 | 0 | 31 | 21 | 52 | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 43 | 147 |
| 11:45 AM | 2 | 0 | 29 | 0 | 31 | 33 | 35 | 0 | 0 | 68 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 3 | 0 | 34 | 133 |
| Total | 11 | 0 | 104 | 0 | 115 | 105 | 152 | 0 | 0 | 257 | 0 | 0 | 0 | 0 | 0 | 0 | 146 | 6 | 0 | 152 | 524 |
| 12:00 PM | 3 | 0 | 19 | 0 | 22 | 29 | 23 | 0 | 0 | 52 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 3 | 0 | 35 | 109 |
| 12:15 PM | 3 | 0 | 26 | 0 | 29 | 33 | 40 | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 2 | 0 | 38 | 140 |
| 12:30 PM | 0 | 0 | 21 | 0 | 21 | 29 | 44 | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 2 | 0 | 35 | 129 |
| 12:45 PM | 6 | 0 | 17 | 0 | 23 | 35 | 65 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 4 | 0 | 45 | 168 |
| Total | 12 | 0 | 83 | 0 | 95 | 126 | 172 | 0 | 0 | 298 | 0 | 0 | 0 | 0 | 0 | 0 | 142 | 11 | 0 | 153 | 546 |

# Data Collection Group
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File Name : News and Firestone
Site Code : 00681114
Start Date : 6/8/2017
Page No : 2

Groups Printed- Passenger Veh - Trucks

| | Firestone From North | | | | | News From East | | | | | From South | | | | | News From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| 01:00 PM | 6 | 0 | 32 | 0 | 38 | 28 | 39 | 0 | 0 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 47 | 152 |
| 01:15 PM | 0 | 0 | 30 | 0 | 30 | 25 | 44 | 0 | 0 | 69 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 4 | 0 | 35 | 134 |
| 01:30 PM | 1 | 0 | 27 | 0 | 28 | 21 | 34 | 0 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 40 | 123 |
| 01:45 PM | 3 | 0 | 25 | 0 | 28 | 32 | 41 | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 1 | 0 | 29 | 130 |
| Total | 10 | 0 | 114 | 0 | 124 | 106 | 158 | 0 | 0 | 264 | 0 | 0 | 0 | 0 | 0 | 0 | 146 | 5 | 0 | 151 | 539 |
| 02:00 PM | 4 | 0 | 28 | 0 | 32 | 22 | 40 | 0 | 1 | 63 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 6 | 0 | 55 | 150 |
| 02:15 PM | 2 | 0 | 32 | 0 | 34 | 29 | 46 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 29 | 138 |
| 02:30 PM | 3 | 0 | 26 | 0 | 29 | 37 | 66 | 0 | 0 | 103 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 2 | 0 | 45 | 177 |
| 02:45 PM | 8 | 0 | 26 | 0 | 34 | 30 | 59 | 0 | 0 | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 2 | 0 | 39 | 162 |
| Total | 17 | 0 | 112 | 0 | 129 | 118 | 211 | 0 | 1 | 330 | 0 | 0 | 0 | 0 | 0 | 0 | 158 | 10 | 0 | 168 | 627 |
| 03:00 PM | 2 | 0 | 18 | 0 | 20 | 27 | 48 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 5 | 0 | 35 | 130 |
| 03:15 PM | 1 | 0 | 24 | 0 | 25 | 38 | 56 | 0 | 0 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 35 | 154 |
| 03:30 PM | 2 | 0 | 19 | 0 | 21 | 34 | 60 | 0 | 0 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | 64 | 8 | 0 | 72 | 187 |
| 03:45 PM | 3 | 0 | 20 | 0 | 23 | 24 | 56 | 0 | 0 | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 3 | 0 | 47 | 150 |
| Total | 8 | 0 | 81 | 0 | 89 | 123 | 220 | 0 | 0 | 343 | 0 | 0 | 0 | 0 | 0 | 0 | 173 | 16 | 0 | 189 | 621 |
| 04:00 PM | 4 | 0 | 14 | 0 | 18 | 39 | 51 | 0 | 0 | 90 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 5 | 0 | 57 | 165 |
| 04:15 PM | 1 | 0 | 20 | 0 | 21 | 36 | 52 | 0 | 0 | 88 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 4 | 0 | 41 | 150 |
| 04:30 PM | 6 | 0 | 16 | 0 | 22 | 33 | 61 | 0 | 0 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 5 | 0 | 43 | 159 |
| 04:45 PM | 3 | 0 | 15 | 0 | 18 | 27 | 67 | 0 | 0 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 3 | 0 | 40 | 152 |
| Total | 14 | 0 | 65 | 0 | 79 | 135 | 231 | 0 | 0 | 366 | 0 | 0 | 0 | 0 | 0 | 0 | 164 | 17 | 0 | 181 | 626 |
| 05:00 PM | 0 | 0 | 17 | 0 | 17 | 39 | 60 | 0 | 0 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 2 | 0 | 36 | 152 |
| 05:15 PM | 1 | 0 | 12 | 0 | 13 | 25 | 57 | 0 | 0 | 82 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 0 | 0 | 41 | 136 |
| 05:30 PM | 3 | 0 | 21 | 0 | 24 | 21 | 63 | 0 | 0 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 3 | 0 | 38 | 146 |
| 05:45 PM | 2 | 0 | 24 | 0 | 26 | 35 | 70 | 0 | 0 | 105 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 4 | 0 | 38 | 169 |
| Total | 6 | 0 | 74 | 0 | 80 | 120 | 250 | 0 | 0 | 370 | 0 | 0 | 0 | 0 | 0 | 0 | 144 | 9 | 0 | 153 | 603 |
| Grand Total | 131 | 0 | 1038 | 0 | 1169 | 1044 | 1896 | 0 | 1 | 2941 | 0 | 0 | 0 | 0 | 0 | 0 | 1882 | 95 | 0 | 1977 | 6087 |
| Apprch % | 11.2 | 0 | 88.8 | 0 | | 35.5 | 64.5 | 0 | 0 | | 0 | 0 | 0 | 0 | | 0 | 95.2 | 4.8 | 0 | | |
| Total % | 2.2 | 0 | 17.1 | 0 | 19.2 | 17.2 | 31.1 | 0 | 0 | 48.3 | 0 | 0 | 0 | 0 | 0 | 0 | 30.9 | 1.6 | 0 | 32.5 | |
| Passenger Veh | 122 | 0 | 1024 | 0 | 1146 | 1034 | 1819 | 0 | 1 | 2854 | 0 | 0 | 0 | 0 | 0 | 0 | 1827 | 90 | 0 | 1917 | 5917 |
| % Passenger Veh | 93.1 | 0 | 98.7 | 0 | 98 | 99 | 95.9 | 0 | 100 | 97 | 0 | 0 | 0 | 0 | 0 | 0 | 97.1 | 94.7 | 0 | 97 | 97.2 |
| Trucks | 9 | 0 | 14 | 0 | 23 | 10 | 77 | 0 | 0 | 87 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 5 | 0 | 60 | 170 |
| % Trucks | 6.9 | 0 | 1.3 | 0 | 2 | 1 | 4.1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2.9 | 5.3 | 0 | 3 | 2.8 |

# Data Collection Group
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File Name : News and Firestone
Site Code : 00681114
Start Date : 6/8/2017
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| | Firestone From North | | | | | News From East | | | | | From South | | | | | News From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 06:00 AM to 09:45 AM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 08:15 AM | | | | | | | | | | | | | | | | | | | | | |
| 08:15 AM | **7** | 0 | 19 | 0 | 26 | 12 | 35 | 0 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | **5** | 0 | 50 | 123 |
| 08:30 AM | 1 | 0 | **30** | 0 | **31** | 9 | 25 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 58 | 4 | 0 | 62 | 127 |
| 08:45 AM | 2 | 0 | 18 | 0 | 20 | 11 | 40 | 0 | 0 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 61 | 1 | 0 | 62 | 133 |
| 09:00 AM | 3 | 0 | 25 | 0 | 28 | **13** | **46** | 0 | 0 | **59** | 0 | 0 | 0 | 0 | 0 | 0 | **66** | 0 | 0 | **66** | **153** |
| Total Volume | 13 | 0 | 92 | 0 | 105 | 45 | 146 | 0 | 0 | 191 | 0 | 0 | 0 | 0 | 0 | 0 | 230 | 10 | 0 | 240 | 536 |
| % App. Total | 12.4 | 0 | 87.6 | 0 | | 23.6 | 76.4 | 0 | 0 | | 0 | 0 | 0 | 0 | | 0 | 95.8 | 4.2 | 0 | | |
| PHF | .464 | .000 | .767 | .000 | .847 | .865 | .793 | .000 | .000 | .809 | .000 | .000 | .000 | .000 | .000 | .000 | .871 | .500 | .000 | .909 | .876 |
| Passenger Veh | 12 | 0 | 91 | 0 | 103 | 44 | 131 | 0 | 0 | 175 | 0 | 0 | 0 | 0 | 0 | 0 | 221 | 10 | 0 | 231 | 509 |
| % Passenger Veh | 92.3 | 0 | 98.9 | 0 | 98.1 | 97.8 | 89.7 | 0 | 0 | 91.6 | 0 | 0 | 0 | 0 | 0 | 0 | 96.1 | 100 | 0 | 96.3 | 95.0 |
| Trucks | 1 | 0 | 1 | 0 | 2 | 1 | 15 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 9 | 27 |
| % Trucks | 7.7 | 0 | 1.1 | 0 | 1.9 | 2.2 | 10.3 | 0 | 0 | 8.4 | 0 | 0 | 0 | 0 | 0 | 0 | 3.9 | 0 | 0 | 3.8 | 5.0 |

# Data Collection Group
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File Name : News and Firestone
Site Code : 00681114
Start Date : 6/8/2017
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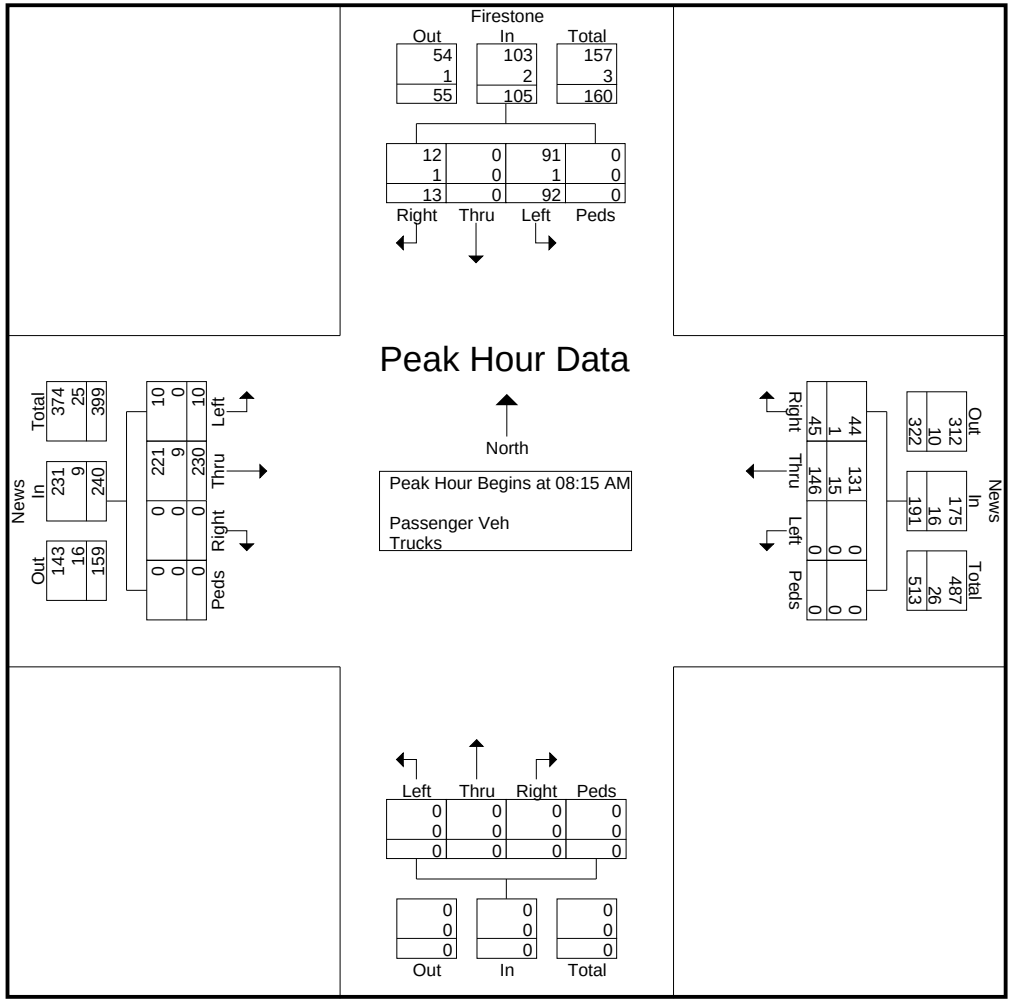

# Data Collection Group
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File Name : News and Firestone
Site Code : 00681114
Start Date : 6/8/2017
Page No : 5

| | Firestone From North | | | | | News From East | | | | | From South | | | | | News From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 12:15 PM | | | | | | | | | | | | | | | | | | | | | |
| 12:15 PM | 3 | 0 | 26 | 0 | 29 | 33 | 40 | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 2 | 0 | 38 | 140 |
| 12:30 PM | 0 | 0 | 21 | 0 | 21 | 29 | 44 | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 2 | 0 | 35 | 129 |
| 12:45 PM | **6** | 0 | 17 | 0 | 23 | **35** | **65** | 0 | 0 | **100** | 0 | 0 | 0 | 0 | 0 | 0 | 41 | **4** | 0 | 45 | **168** |
| 01:00 PM | 6 | 0 | **32** | 0 | **38** | 28 | 39 | 0 | 0 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | **47** | 0 | 0 | **47** | 152 |
| Total Volume | 15 | 0 | 96 | 0 | 111 | 125 | 188 | 0 | 0 | 313 | 0 | 0 | 0 | 0 | 0 | 0 | 157 | 8 | 0 | 165 | 589 |
| % App. Total | 13.5 | 0 | 86.5 | 0 | | 39.9 | 60.1 | 0 | 0 | | 0 | 0 | 0 | 0 | | 0 | 95.2 | 4.8 | 0 | | |
| PHF | .625 | .000 | .750 | .000 | .730 | .893 | .723 | .000 | .000 | .783 | .000 | .000 | .000 | .000 | .000 | .000 | .835 | .500 | .000 | .878 | .876 |
| Passenger Veh | 12 | 0 | 92 | 0 | 104 | 121 | 181 | 0 | 0 | 302 | 0 | 0 | 0 | 0 | 0 | 0 | 153 | 8 | 0 | 161 | 567 |
| % Passenger Veh | 80.0 | 0 | 95.8 | 0 | 93.7 | 96.8 | 96.3 | 0 | 0 | 96.5 | 0 | 0 | 0 | 0 | 0 | 0 | 97.5 | 100 | 0 | 97.6 | 96.3 |
| Trucks | 3 | 0 | 4 | 0 | 7 | 4 | 7 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 | 22 |
| % Trucks | 20.0 | 0 | 4.2 | 0 | 6.3 | 3.2 | 3.7 | 0 | 0 | 3.5 | 0 | 0 | 0 | 0 | 0 | 0 | 2.5 | 0 | 0 | 2.4 | 3.7 |

# Data Collection Group
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File Name : News and Firestone
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Start Date : 6/8/2017
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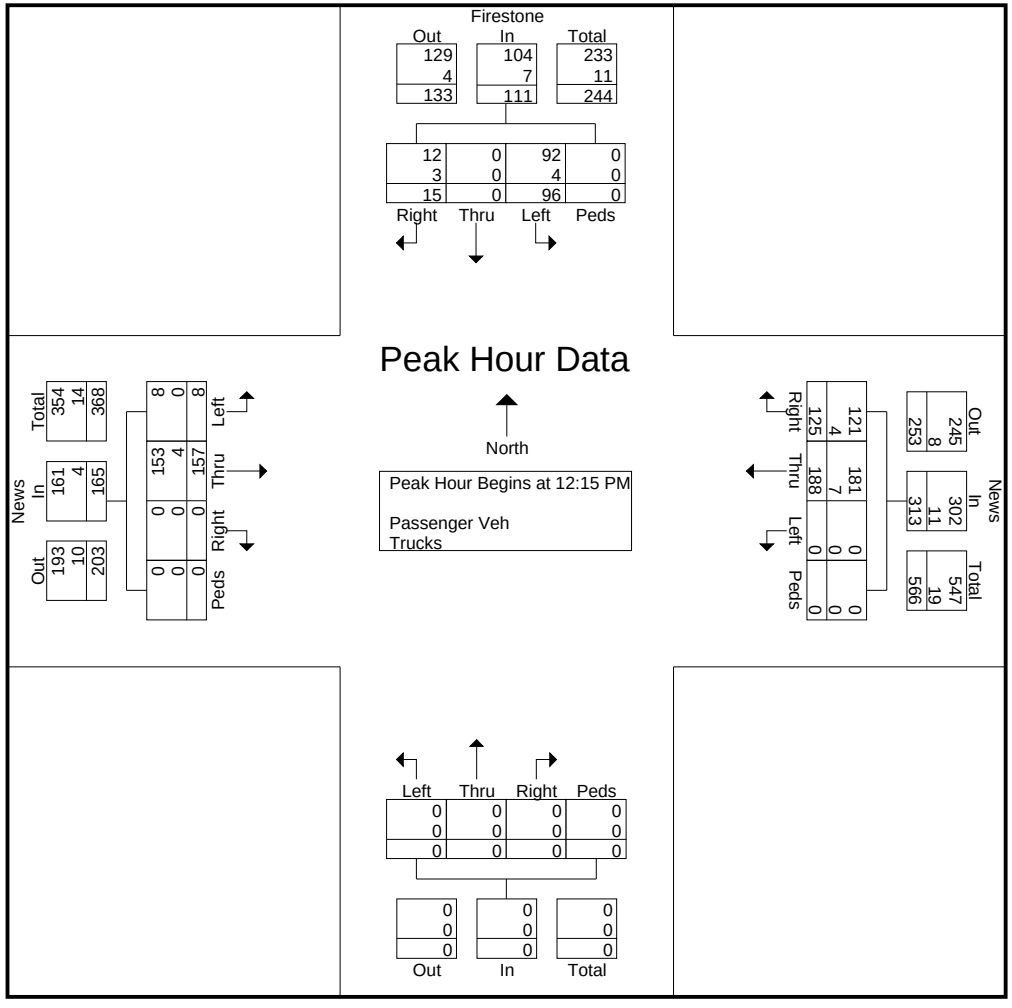

# Data Collection Group
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File Name : News and Firestone
Site Code : 00681114
Start Date : 6/8/2017
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| | Firestone From North | | | | | News From East | | | | | From South | | | | | News From West | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Start Time | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Right | Thru | Left | Peds | App. Total | Int. Total |
| Peak Hour Analysis From 02:00 PM to 05:45 PM - Peak 1 of 1 | | | | | | | | | | | | | | | | | | | | | |
| Peak Hour for Entire Intersection Begins at 03:15 PM | | | | | | | | | | | | | | | | | | | | | |
| 03:15 PM | 1 | 0 | **24** | 0 | **25** | 38 | 56 | 0 | 0 | **94** | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 35 | 154 |
| 03:30 PM | 2 | 0 | 19 | 0 | 21 | 34 | **60** | 0 | 0 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | **64** | **8** | 0 | **72** | **187** |
| 03:45 PM | 3 | 0 | 20 | 0 | 23 | 24 | 56 | 0 | 0 | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 3 | 0 | 47 | 150 |
| 04:00 PM | **4** | 0 | 14 | 0 | 18 | **39** | 51 | 0 | 0 | 90 | 0 | 0 | 0 | 0 | 0 | 0 | 52 | 5 | 0 | 57 | 165 |
| Total Volume | 10 | 0 | 77 | 0 | 87 | 135 | 223 | 0 | 0 | 358 | 0 | 0 | 0 | 0 | 0 | 0 | 195 | 16 | 0 | 211 | 656 |
| % App. Total | 11.5 | 0 | 88.5 | 0 | | 37.7 | 62.3 | 0 | 0 | | 0 | 0 | 0 | 0 | | 0 | 92.4 | 7.6 | 0 | | |
| PHF | .625 | .000 | .802 | .000 | .870 | .865 | .929 | .000 | .000 | .952 | .000 | .000 | .000 | .000 | .000 | .000 | .762 | .500 | .000 | .733 | .877 |
| Passenger Veh | 10 | 0 | 76 | 0 | 86 | 135 | 218 | 0 | 0 | 353 | 0 | 0 | 0 | 0 | 0 | 0 | 184 | 14 | 0 | 198 | 637 |
| % Passenger Veh | 100 | 0 | 98.7 | 0 | 98.9 | 100 | 97.8 | 0 | 0 | 98.6 | 0 | 0 | 0 | 0 | 0 | 0 | 94.4 | 87.5 | 0 | 93.8 | 97.1 |
| Trucks | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 2 | 0 | 13 | 19 |
| % Trucks | 0 | 0 | 1.3 | 0 | 1.1 | 0 | 2.2 | 0 | 0 | 1.4 | 0 | 0 | 0 | 0 | 0 | 0 | 5.6 | 12.5 | 0 | 6.2 | 2.9 |

# Data Collection Group
# LSmith@DataCollectionGroup.net

File Name : News and Firestone
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Start Date : 6/8/2017
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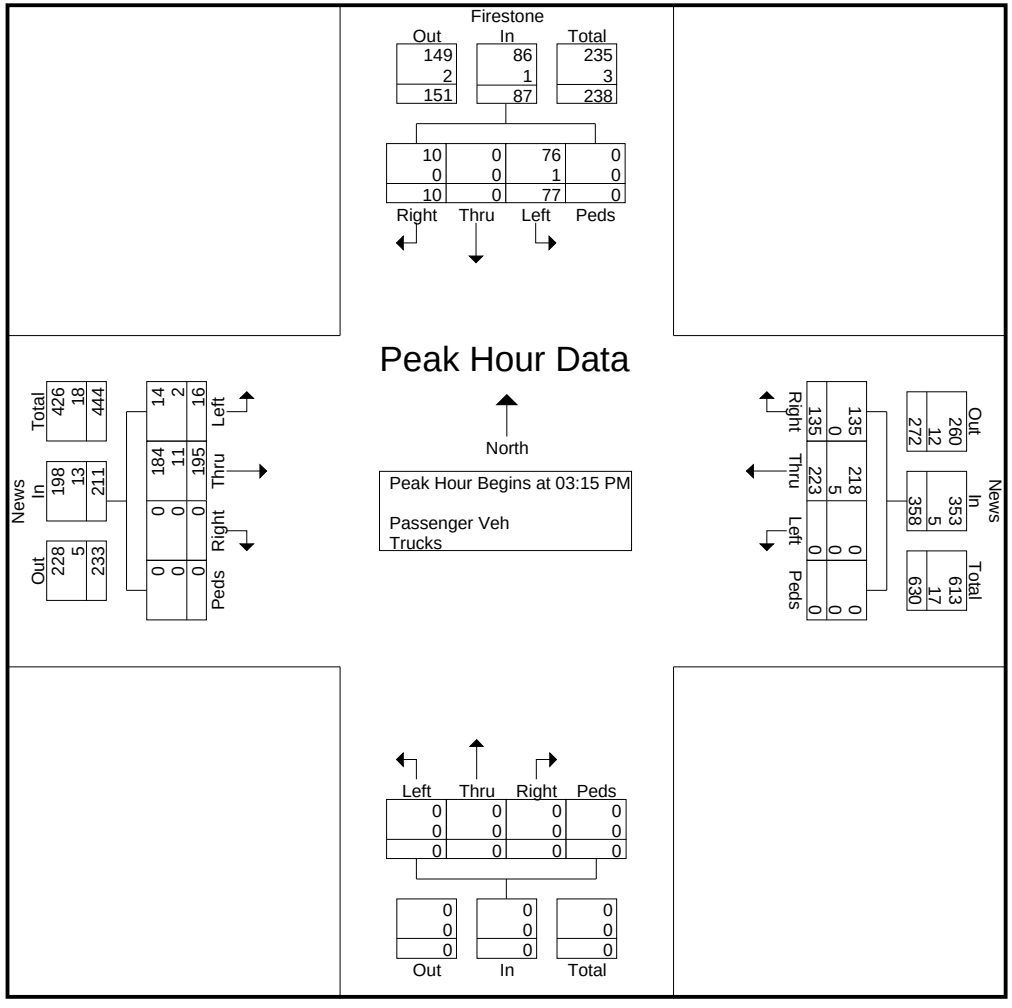


# Appendix C: Volume Worksheets

# VOLUME DEVELOPMENT SHEET

## Longhill Road at Williamsburg W. Drive/Lane Place Drive
## AM Peak Hour
## (7:30 AM to 8:30 AM)

| Description | Longhill Road Eastbound | | | Longhill Road Westbound | | | Williamsburg W. Drive Northbound | | | Lane Place Drive Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| **2017 Counts** | | | | | | | | | | | | |
| Cars | 3 | 727 | 21 | 41 | 449 | 15 | 39 | 2 | 223 | 54 | 1 | 16 |
| Trucks | 0 | 15 | 0 | 2 | 18 | 3 | 3 | 1 | 1 | 2 | 0 | 2 |
| **Total Existing 2017 Traffic** | 3 | 742 | 21 | 43 | 467 | 18 | 42 | 3 | 224 | 56 | 1 | 18 |
| Truck % | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| PHF | 0.88 | | | | | | | | | | | |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Existing** | | | | | | | | | | | | |
| **2019 Existing** | 3 | 772 | 22 | 45 | 486 | 19 | 44 | 3 | 233 | 58 | 1 | 19 |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Background Traffic** | | | | | | | | | | | | |
| **Westport** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 26% | | | | | | | |
| Exiting Distribution | | 25% | | | | | | | | | | |
| *Entering Assignment* | | | | | 2 | | | | | | | |
| Exiting Assignment | | 7 | | | | | | | | | | |
| **Windsor** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 60% | | | | | | | |
| Exiting Distribution | | 60% | | | | | | | | | | |
| *Entering Assignment* | | | | | 2 | | | | | | | |
| Exiting Assignment | | 7 | | | | | | | | | | |
| **The Village** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 8% | | | | | | | |
| Exiting Distribution | | 4% | | | | | | | | | | |
| *Entering Assignment* | | | | | 4 | | | | | | | |
| Exiting Assignment | | 2 | | | | | | | | | | |
| **2021 No Build** | 3 | 819 | 23 | 47 | 514 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| **2027 No Build** | 4 | 920 | 26 | 53 | 577 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| **Proposed Trips** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 60% | | | | | | | |
| Exiting Distribution | | 60% | | | | | | | | | | |
| *Entering Assignment* | | | | | 4 | | | | | | | |
| Exiting Assignment | | 13 | | | | | | | | | | |
| **Proposed + Background** | | | | | | | | | | | | |
| **2021 Total Traffic** | 3 | 832 | 23 | 47 | 518 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| **2027 Total Traffic** | 4 | 933 | 26 | 53 | 581 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |

## PM Peak Hour
## (4:45 PM to 5:45 PM)

| Description | Longhill Road Eastbound | | | Longhill Road Westbound | | | Williamsburg W. Drive Northbound | | | Lane Place Drive Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| **2017 Counts** | | | | | | | | | | | | |
| Cars | 17 | 716 | 35 | 206 | 967 | 38 | 49 | 0 | 132 | 23 | 0 | 13 |
| Trucks | 0 | 19 | 0 | 0 | 10 | 0 | 1 | 0 | 4 | 0 | 0 | 1 |
| **Total Existing 2017 Traffic** | 17 | 735 | 35 | 206 | 977 | 38 | 50 | 0 | 136 | 23 | 0 | 14 |
| Truck % | 0% | 3% | 0% | 0% | 1% | 0% | 2% | - | 3% | 0% | - | 7% |
| PHF | 0.95 | | | | | | | | | | | |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Existing** | | | | | | | | | | | | |
| **2019 Existing** | 18 | 765 | 36 | 214 | 1,016 | 40 | 52 | 0 | 141 | 24 | 0 | 15 |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Background Traffic** | | | | | | | | | | | | |
| **Westport** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 25% | | | | | | | |
| Exiting Distribution | | 28% | | | | | | | | | | |
| *Entering Assignment* | | | | | 7 | | | | | | | |
| Exiting Assignment | | 5 | | | | | | | | | | |
| **Windsor** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 55% | | | | | | | |
| Exiting Distribution | | 55% | | | | | | | | | | |
| *Entering Assignment* | | | | | 7 | | | | | | | |
| Exiting Assignment | | 4 | | | | | | | | | | |
| **The Village** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 5% | | | | | | | |
| Exiting Distribution | | 5% | | | | | | | | | | |
| *Entering Assignment* | | | | | 4 | | | | | | | |
| Exiting Assignment | | 4 | | | | | | | | | | |
| **2021 No Build** | 19 | 809 | 37 | 223 | 1,075 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| **2027 No Build** | 21 | 909 | 42 | 251 | 1,209 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| **Proposed Trips** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 55% | | | | | | | |
| Exiting Distribution | | 55% | | | | | | | | | | |
| *Entering Assignment* | | | | | 13 | | | | | | | |
| Exiting Assignment | | 8 | | | | | | | | | | |
| **Proposed + Background** | | | | | | | | | | | | |
| **2021 Total Traffic** | 19 | 817 | 37 | 223 | 1,088 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| **2027 Total Traffic** | 21 | 917 | 42 | 251 | 1,222 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |

# VOLUME DEVELOPMENT SHEET

## Longhill Road at Ford's Colony Drive
## AM Peak Hour
## (7:30 AM to 8:30 AM)

| Description | Longhill Road Eastbound | | | Longhill Road Westbound | | | Fords Colony Drive Northbound | | | Dominion Village Entrance Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| **2017 Counts** | | | | | | | | | | | | |
| Cars | 3 | 277 | 34 | 103 | 247 | 1 | 63 | 1 | 130 | 0 | 1 | 0 |
| Trucks | 0 | 16 | 2 | 3 | 19 | 0 | 7 | 0 | 0 | 0 | 0 | 0 |
| **Total Existing 2017 Traffic** | 3 | 293 | 36 | 106 | 266 | 1 | 70 | 1 | 130 | 0 | 1 | 0 |
| Truck % | 0% | 5% | 6% | 3% | 7% | 0% | 10% | 0% | 0% | - | 0% | - |
| PHF | 0.83 | | | | | | | | | | | |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Existing** | | | | | | | | | | | | |
| **2019 Existing** | 3 | 305 | 37 | 110 | 277 | 1 | 73 | 1 | 135 | 0 | 1 | 0 |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Background Traffic** | | | | | | | | | | | | |
| **Westport** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 26% | | | | | | | |
| Exiting Distribution | | 25% | | | | | | | | | | |
| *Entering Assignment* | | | | | 2 | | | | | | | |
| Exiting Assignment | | 7 | | | | | | | | | | |
| **Windsor** | | | | | | | | | | | | |
| *Entering Distribution* | | | 20% | 60% | | | | | | | | |
| Exiting Distribution | | | | | | | 20% | | 60% | | | |
| *Entering Assignment* | | | 1 | 2 | | | | | | | | |
| Exiting Assignment | | | | | | | 2 | | 7 | | | |
| **The Village** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 8% | | | | | | | |
| Exiting Distribution | | 4% | | | | | | | | | | |
| *Entering Assignment* | | | | | 4 | | | | | | | |
| Exiting Assignment | | 2 | | | | | | | | | | |
| **2021 No Build** | 3 | 326 | 39 | 116 | 294 | 1 | 78 | 1 | 148 | 0 | 1 | 0 |
| **2027 No Build** | 4 | 366 | 44 | 131 | 331 | 1 | 88 | 1 | 165 | 0 | 1 | 0 |
| **Proposed Trips** | | | | | | | | | | | | |
| *Entering Distribution* | | | 20% | 60% | | | | | | | | |
| Exiting Distribution | | | | | | | 20% | | 60% | | | |
| *Entering Assignment* | | | 1 | 4 | | | | | | | | |
| Exiting Assignment | | | | | | | 4 | | 13 | | | |
| **Proposed + Background** | | | | | | | | | | | | |
| **2021 Total Traffic** | 3 | 326 | 40 | 120 | 294 | 1 | 82 | 1 | 161 | 0 | 1 | 0 |
| **2027 Total Traffic** | 4 | 366 | 45 | 135 | 331 | 1 | 92 | 1 | 178 | 0 | 1 | 0 |

## PM Peak Hour
## (4:45 PM to 5:45 PM)

| Description | Longhill Road Eastbound | | | Longhill Road Westbound | | | Fords Colony Drive Northbound | | | Dominion Village Entrance Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| **2017 Counts** | | | | | | | | | | | | |
| Cars | 0 | 337 | 53 | 192 | 277 | 2 | 45 | 2 | 119 | 4 | 0 | 5 |
| Trucks | 0 | 3 | 0 | 0 | 5 | 0 | 0 | 1 | 2 | 0 | 0 | 0 |
| **Total Existing 2017 Traffic** | 0 | 340 | 53 | 192 | 282 | 2 | 45 | 3 | 121 | 4 | 0 | 5 |
| Truck % | - | 1% | 0% | 0% | 2% | 0% | 0% | 33% | 2% | 0% | - | 0% |
| PHF | 0.94 | | | | | | | | | | | |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Existing** | | | | | | | | | | | | |
| **2019 Existing** | 0 | 354 | 55 | 200 | 293 | 2 | 47 | 3 | 126 | 4 | 0 | 5 |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Background Traffic** | | | | | | | | | | | | |
| **Westport** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 25% | | | | | | | |
| Exiting Distribution | | 28% | | | | | | | | | | |
| *Entering Assignment* | | | | | 7 | | | | | | | |
| Exiting Assignment | | 5 | | | | | | | | | | |
| **Windsor** | | | | | | | | | | | | |
| *Entering Distribution* | | | 15% | 55% | | | | | | | | |
| Exiting Distribution | | | | | | | 15% | | 55% | | | |
| *Entering Assignment* | | | 2 | 7 | | | | | | | | |
| Exiting Assignment | | | | | | | 1 | | 4 | | | |
| **The Village** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | 5% | | | | | | | |
| Exiting Distribution | | 5% | | | | | | | | | | |
| *Entering Assignment* | | | | | 4 | | | | | | | |
| Exiting Assignment | | 4 | | | | | | | | | | |
| **2021 No Build** | 0 | 377 | 59 | 215 | 316 | 2 | 50 | 3 | 135 | 4 | 0 | 5 |
| **2027 No Build** | 0 | 424 | 66 | 242 | 354 | 2 | 56 | 4 | 152 | 5 | 0 | 6 |
| **Proposed Trips** | | | | | | | | | | | | |
| *Entering Distribution* | | | 15% | 55% | | | | | | | | |
| Exiting Distribution | | | | | | | 15% | | 55% | | | |
| *Entering Assignment* | | | 4 | 13 | | | | | | | | |
| Exiting Assignment | | | | | | | 2 | | 8 | | | |
| **Proposed + Background** | | | | | | | | | | | | |
| **2021 Total Traffic** | 0 | 377 | 63 | 228 | 316 | 2 | 52 | 3 | 143 | 4 | 0 | 5 |
| **2027 Total Traffic** | 0 | 424 | 70 | 255 | 354 | 2 | 58 | 4 | 160 | 5 | 0 | 6 |

# VOLUME DEVELOPMENT SHEET

## Centerville Road at Manchester Drive
## AM Peak Hour
## (7:30 AM to 8:30 AM)

| Description | Westport Eastbound | | | Manchester Drive Westbound | | | Centerville Road Northbound | | | Centerville Road Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| **2017 Counts** | | | | | | | | | | | | |
| Cars | 4 | 1 | 2 | 52 | 0 | 45 | 2 | 310 | 32 | 42 | 193 | 1 |
| Trucks | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 27 | 11 | 8 | 17 | 2 |
| **Total Existing 2017 Traffic** | 4 | 1 | 2 | 54 | 0 | 47 | 2 | 337 | 43 | 50 | 210 | 3 |
| Truck % | 0% | 0% | 0% | 4% | - | 4% | 0% | 8% | 26% | 16% | 8% | 67% |
| PHF | 0.91 | | | | | | | | | | | |
| Growth Rate | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% |
| **Existing** | | | | | | | | | | | | |
| **2019 Existing** | 4 | 1 | 2 | 57 | 0 | 49 | 2 | 354 | 45 | 53 | 221 | 3 |
| Growth Rate | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% |
| **Background Traffic** | | | | | | | | | | | | |
| **Westport** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | | | *25%* | | | | | *75%* |
| Exiting Distribution | 72% | | 28% | | | | | | | | | |
| *Entering Assignment* | | | | | | | *2* | | | | | *7* |
| Exiting Assignment | 19 | | 7 | | | | | | | | | |
| **Windsor** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | | | | | *15%* | *5%* | | |
| Exiting Distribution | | | | 15% | | 5% | | | | | | |
| *Entering Assignment* | | | | | | | | | *1* | *0* | | |
| Exiting Assignment | | | | 2 | | 1 | | | | | | |
| **The Village** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | | | | | | | *22%* | |
| Exiting Distribution | | | | | | | | 12% | | | | |
| *Entering Assignment* | | | | | | | | | | | *11* | |
| Exiting Assignment | | | | | | | | 6 | | | | |
| **2021 No Build** | 23 | 1 | 9 | 62 | 0 | 52 | 4 | 378 | 48 | 56 | 243 | 10 |
| **2027 No Build** | 24 | 1 | 10 | 71 | 0 | 61 | 4 | 437 | 55 | 65 | 280 | 11 |
| **Proposed Trips** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | | | | | *15%* | *5%* | | |
| Exiting Distribution | | | | 15% | | 5% | | | | | | |
| *Entering Assignment* | | | | | | | | | *1* | *0* | | |
| Exiting Assignment | | | | 3 | | 1 | | | | | | |
| **Proposed + Background** | | | | | | | | | | | | |
| **2021 Total Traffic** | 23 | 1 | 9 | 65 | 0 | 53 | 4 | 378 | 49 | 56 | 243 | 10 |
| **2027 Total Traffic** | 24 | 1 | 10 | 74 | 0 | 62 | 4 | 437 | 56 | 65 | 280 | 11 |

## PM Peak Hour
## (4:45 PM to 5:45 PM)

| Description | Westport Eastbound | | | Manchester Drive Westbound | | | Centerville Road Northbound | | | Centerville Road Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| **2017 Counts** | | | | | | | | | | | | |
| Cars | 3 | 1 | 2 | 47 | 0 | 27 | 2 | 281 | 62 | 23 | 233 | 2 |
| Trucks | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 | 2 | 0 | 4 | 0 |
| **Total Existing 2017 Traffic** | 3 | 1 | 2 | 47 | 0 | 28 | 2 | 290 | 64 | 23 | 237 | 2 |
| Truck % | 0% | 0% | 0% | 0% | - | 4% | 0% | 3% | 3% | 0% | 2% | 0% |
| PHF | 0.95 | | | | | | | | | | | |
| Growth Rate | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% |
| **Existing** | | | | | | | | | | | | |
| **2019 Existing** | 3 | 1 | 2 | 49 | 0 | 29 | 2 | 305 | 67 | 24 | 249 | 2 |
| Growth Rate | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% |
| **Background Traffic** | | | | | | | | | | | | |
| **Westport** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | | | *29%* | | | | | *71%* |
| Exiting Distribution | 79% | | 21% | | | | | | | | | |
| *Entering Assignment* | | | | | | | *8* | | | | | *20* |
| Exiting Assignment | 13 | | 4 | | | | | | | | | |
| **Windsor** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | | | | | *30%* | | | |
| Exiting Distribution | | | | 30% | | | | | | | | |
| *Entering Assignment* | | | | | | | | | *4* | | | |
| Exiting Assignment | | | | 5 | | | | | | | | |
| **The Village** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | | | | | | | *13%* | |
| Exiting Distribution | | | | | | | | 14% | | | | |
| *Entering Assignment* | | | | | | | | | | | *11* | |
| Exiting Assignment | | | | | | | | 11 | | | | |
| **2021 No Build** | 16 | 1 | 6 | 56 | 0 | 30 | 10 | 331 | 74 | 25 | 273 | 22 |
| **2027 No Build** | 17 | 1 | 6 | 64 | 0 | 35 | 10 | 383 | 86 | 29 | 314 | 22 |
| **Proposed Trips** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | | | | | *30%* | | | |
| Exiting Distribution | | | | 30% | | | | | | | | |
| *Entering Assignment* | | | | | | | | | *7* | | | |
| Exiting Assignment | | | | 4 | | | | | | | | |
| **Proposed + Background** | | | | | | | | | | | | |
| **2021 Total Traffic** | 16 | 1 | 6 | 60 | 0 | 30 | 10 | 331 | 81 | 25 | 273 | 22 |
| **2027 Total Traffic** | 17 | 1 | 6 | 68 | 0 | 35 | 10 | 383 | 93 | 29 | 314 | 22 |

# VOLUME DEVELOPMENT SHEET

## Firestone Drive at News Road
## AM Peak Hour
## (7:30 AM to 8:30 AM)

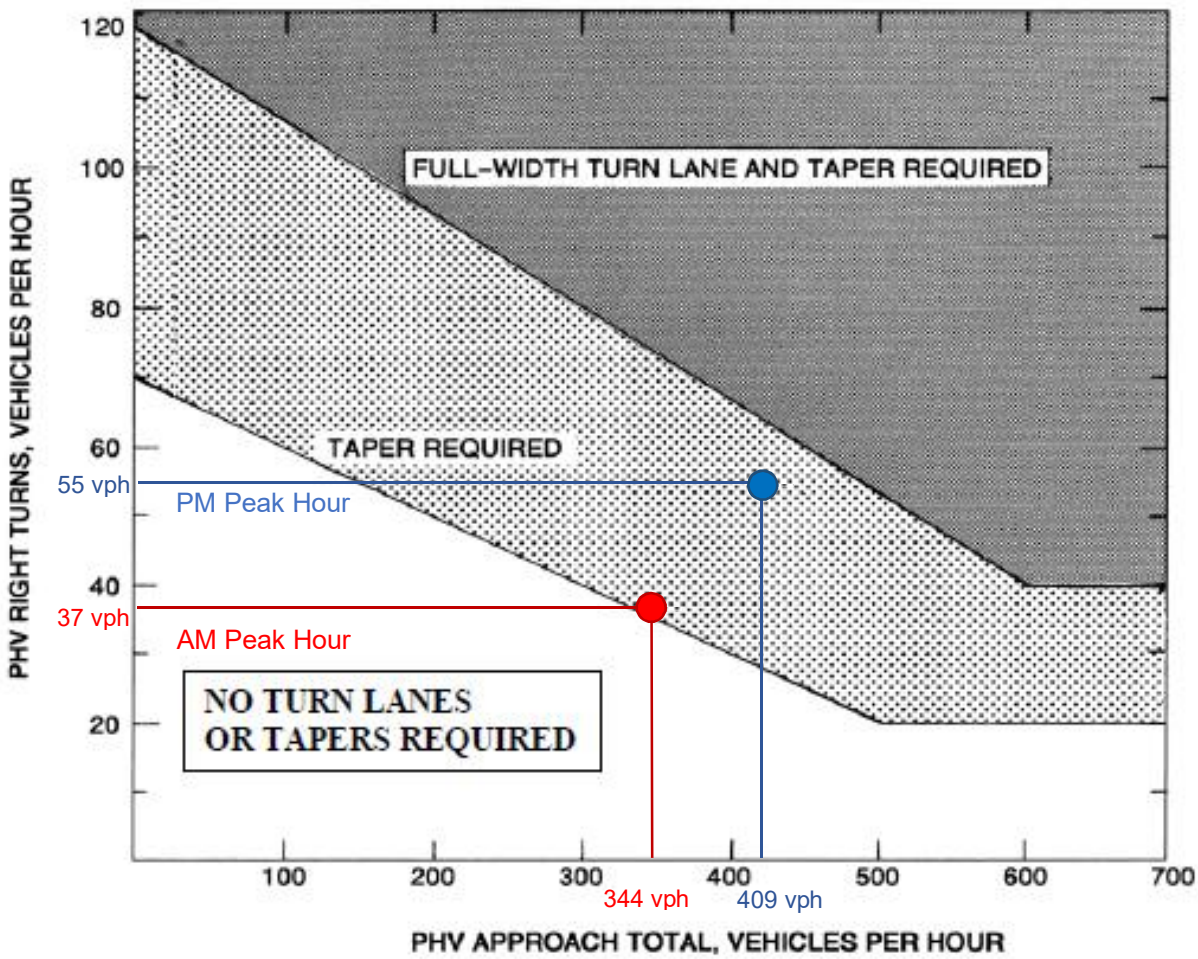
| Description | News Road Eastbound | | | News Road Westbound | | | Proposed Entrance Northbound | | | Firestone Drive Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| **2017 Counts** | | | | | | | | | | | | |
| Cars | 8 | 182 | 0 | 0 | 109 | 42 | - | - | - | 85 | 0 | 17 |
| Trucks | 2 | 6 | 0 | 0 | 16 | 1 | - | - | - | 0 | 0 | 0 |
| **Total Existing 2017 Traffic** | 10 | 188 | 0 | 0 | 125 | 43 | 0 | 0 | 0 | 85 | 0 | 17 |
| Truck % | 20% | 3% | - | - | 13% | 2% | - | - | - | 0% | - | 0% |
| PHF | 0.95 | | | | | | | | | | | |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Existing** | | | | | | | | | | | | |
| **2019 Existing** | 10 | 196 | 0 | 0 | 130 | 45 | 0 | 0 | 0 | 88 | 0 | 18 |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Background Traffic** | | | | | | | | | | | | |
| **Westport** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | *20%* | | | | | | | |
| Exiting Distribution | | 25% | | | | | | | | | | |
| *Entering Assignment* | | | | | *2* | | | | | | | |
| Exiting Assignment | | 7 | | | | | | | | | | |
| **Windsor** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | *10%* | | | | | | | |
| Exiting Distribution | | 10% | | | | | | | | | | |
| *Entering Assignment* | | | | | *0* | | | | | | | |
| Exiting Assignment | | 1 | | | | | | | | | | |
| **The Village** | | | | | | | | | | | | |
| *Entering Distribution* | | | *37%* | *63%* | | | | | | | | |
| Exiting Distribution | | | | | | | 27% | | 73% | | | |
| *Entering Assignment* | | | *18* | *31* | | | | | | | | |
| Exiting Assignment | | | | | | | 14 | | 38 | | | |
| **2021 No Build** | 10 | 212 | 18 | 31 | 137 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| **2027 No Build** | 12 | 237 | 18 | 31 | 154 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| **Proposed Trips** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | *10%* | | | | | | | |
| Exiting Distribution | | 10% | | | | | | | | | | |
| *Entering Assignment* | | | | | *1* | | | | | | | |
| Exiting Assignment | | 2 | | | | | | | | | | |
| **Proposed + Background** | | | | | | | | | | | | |
| **2021 Total Traffic** | 10 | 214 | 18 | 31 | 138 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| **2027 Total Traffic** | 12 | 239 | 18 | 31 | 155 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |

## PM Peak Hour
## (4:45 PM to 5:45 PM)

| Description | News Road Eastbound | | | News Road Westbound | | | Proposed Entrance Northbound | | | Firestone Drive Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right |
| **2017 Counts** | | | | | | | | | | | | |
| Cars | 8 | 144 | 0 | 0 | 243 | 112 | - | - | - | 64 | 0 | 7 |
| Trucks | 0 | 3 | 0 | 0 | 4 | 0 | - | - | - | 1 | 0 | 0 |
| **Total Existing 2017 Traffic** | 8 | 147 | 0 | 0 | 247 | 112 | 0 | 0 | 0 | 65 | 0 | 7 |
| Truck % | 0% | 2% | - | - | 2% | 0% | - | - | - | 2% | - | 0% |
| PHF | 0.96 | | | | | | | | | | | |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Existing** | | | | | | | | | | | | |
| **2019 Existing** | 8 | 153 | 0 | 0 | 257 | 117 | 0 | 0 | 0 | 68 | 0 | 7 |
| Growth Rate | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| **Background Traffic** | | | | | | | | | | | | |
| **Westport** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | *25%* | | | | | | | |
| Exiting Distribution | | 20% | | | | | | | | | | |
| *Entering Assignment* | | | | | *7* | | | | | | | |
| Exiting Assignment | | 3 | | | | | | | | | | |
| **Windsor** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | *30%* | | | | | | | |
| Exiting Distribution | | 30% | | | | | | | | | | |
| *Entering Assignment* | | | | | *4* | | | | | | | |
| Exiting Assignment | | 2 | | | | | | | | | | |
| **The Village** | | | | | | | | | | | | |
| *Entering Distribution* | | | *28%* | *72%* | | | | | | | | |
| Exiting Distribution | | | | | | | 29% | | 71% | | | |
| *Entering Assignment* | | | *23* | *59* | | | | | | | | |
| Exiting Assignment | | | | | | | 23 | | 56 | | | |
| **2021 No Build** | 8 | 164 | 23 | 59 | 278 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| **2027 No Build** | 9 | 182 | 23 | 59 | 308 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| **Proposed Trips** | | | | | | | | | | | | |
| *Entering Distribution* | | | | | *30%* | | | | | | | |
| Exiting Distribution | | 30% | | | | | | | | | | |
| *Entering Assignment* | | | | | *7* | | | | | | | |
| Exiting Assignment | | 4 | | | | | | | | | | |
| **Proposed + Background** | | | | | | | | | | | | |
| **2021 Total Traffic** | 8 | 168 | 23 | 59 | 285 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| **2027 Total Traffic** | 9 | 186 | 23 | 59 | 315 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |

# Appendix D: Turn Lane and Signal Warrant Worksheets

# 2019 Existing Conditions – Longhill Road EBRT




Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

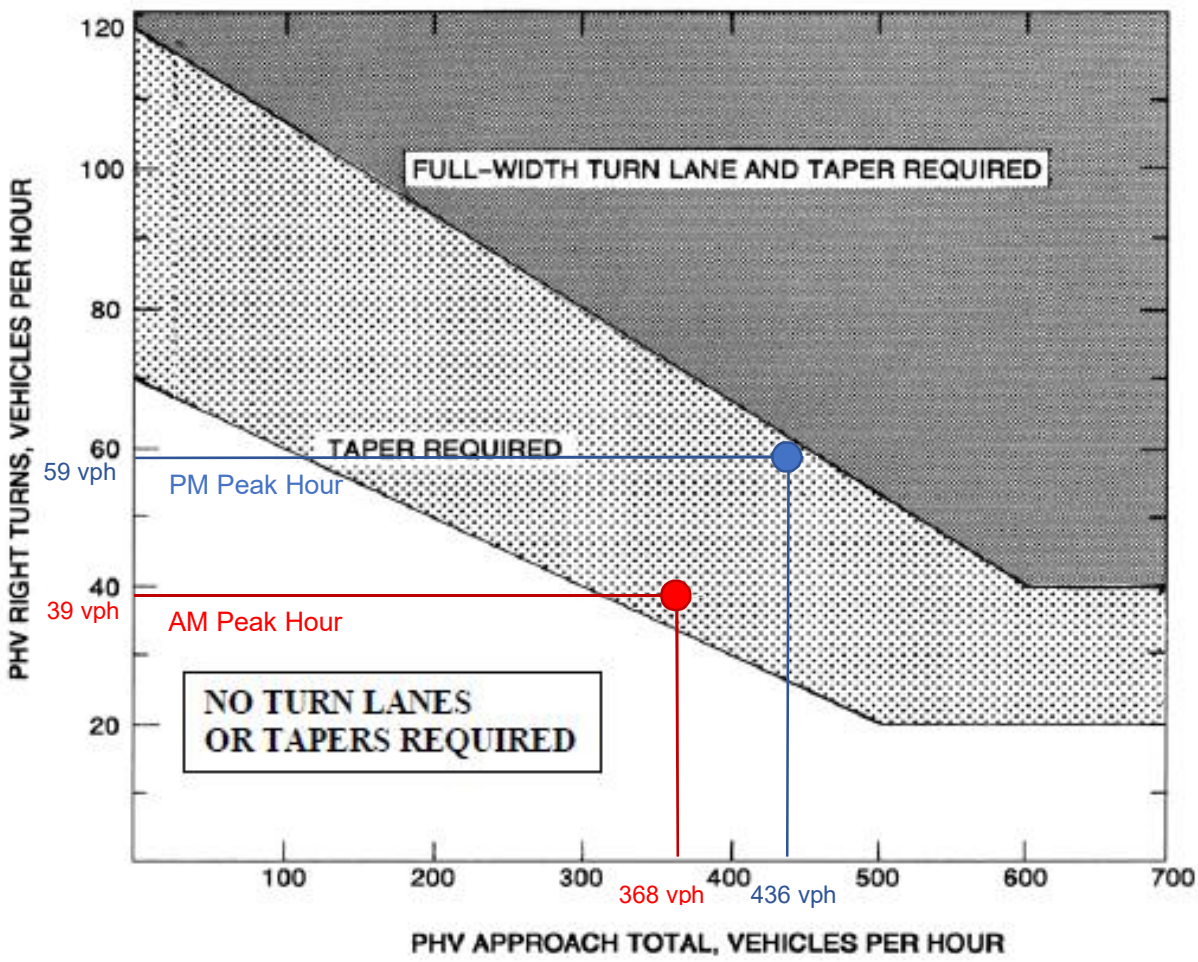
Note: An average of 11% for K x D will suffice.

When right turn facilities are warranted, see Figure 3-1 for design criteria.*

**FIGURE 3-26 WARRANTS FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

* Rev. 1/15

# 2021 No Build Conditions – Longhill Road EBRT




Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

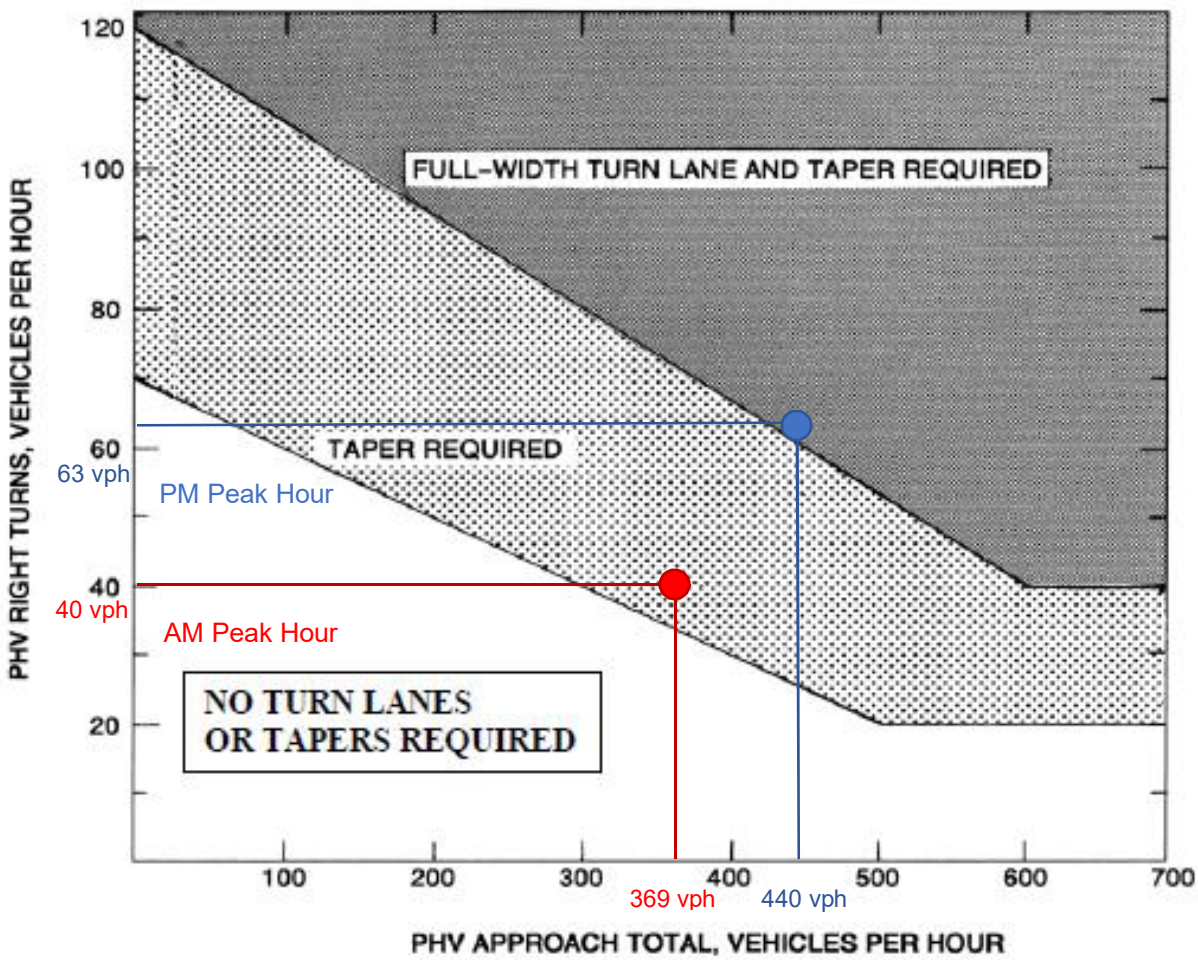
Note: An average of 11% for K x D will suffice.

When right turn facilities are warranted, see Figure 3-1 for design criteria.*

**FIGURE 3-26 WARRANTS FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

* Rev. 1/15

# 2021 Build Conditions – Longhill Road EBRT




Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

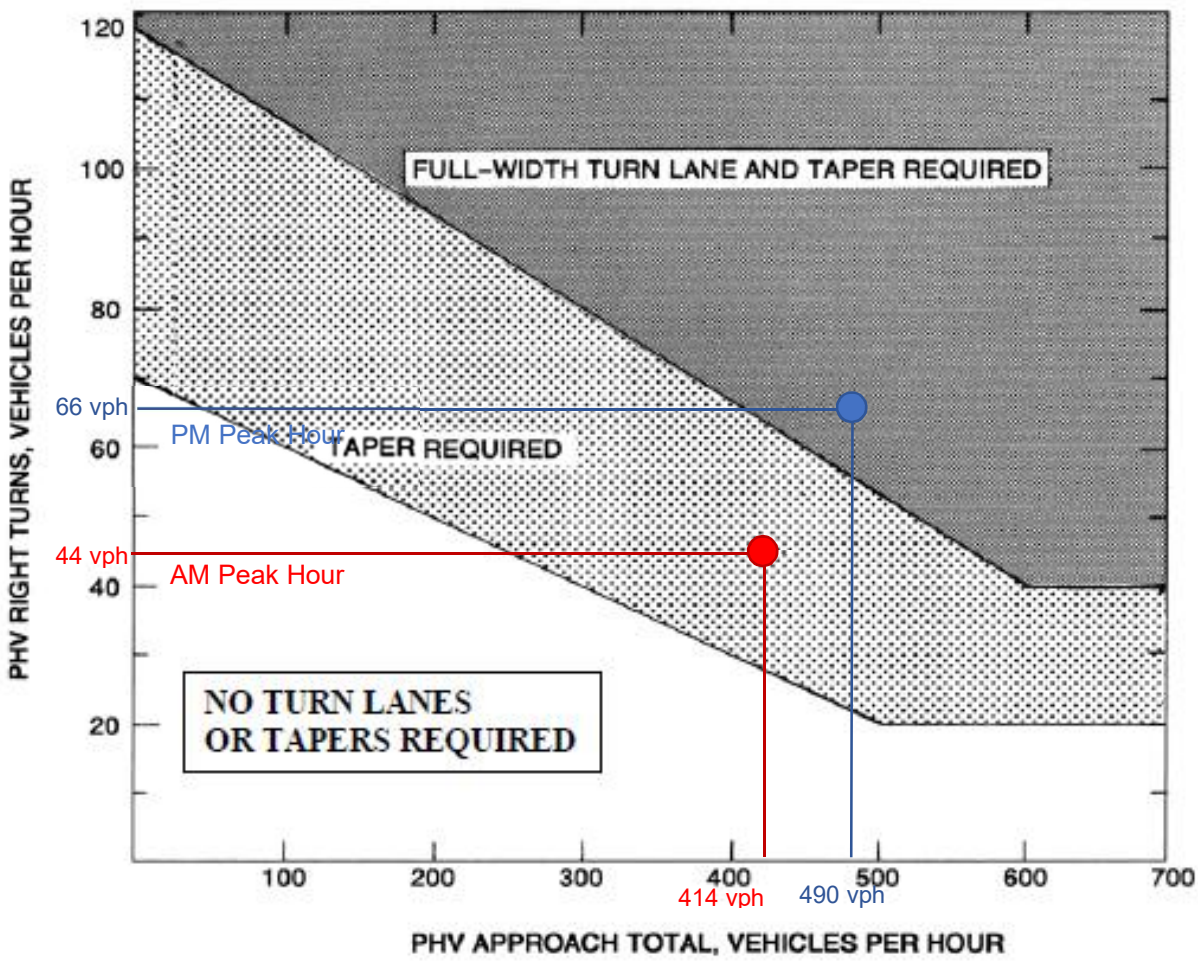
Note: An average of 11% for K x D will suffice.

When right turn facilities are warranted, see Figure 3-1 for design criteria.*

**FIGURE 3-26 WARRANTS FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

* Rev. 1/15

# 2027 No Build Conditions – Longhill Road EBRT




Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

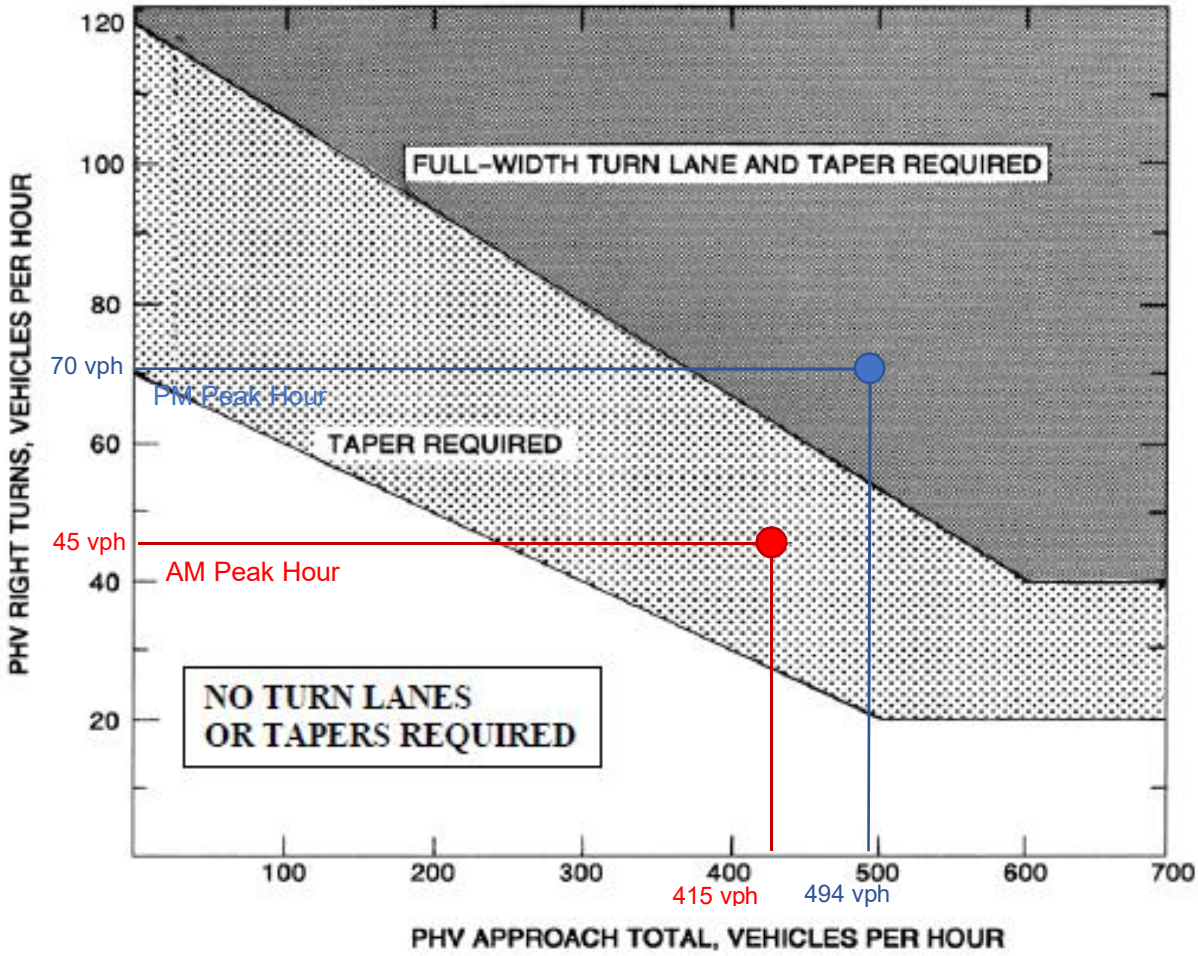
Note: An average of 11% for K x D will suffice.

When right turn facilities are warranted, see Figure 3-1 for design criteria.*

**FIGURE 3-26 WARRANTS FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

* Rev. 1/15

# 2027 Build Conditions – Longhill Road EBRT




Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

**LEGEND**

**PHV** - Peak Hour Volume (also Design Hourly Volume equivalent)

**Adjustment for Right Turns**

For posted speeds at or under 45 mph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

When right turn facilities are warranted, see Figure 3-1 for design criteria.*

**FIGURE 3-26 WARRANTS FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)**

* Rev. 1/15

# Firestone Drive at News Road

# Firestone Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Firestone Drive at News Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2019 Existing (No SBR or WBR)

MAJOR STREET: News Road — # OF APPROACH LANES: 2

MINOR STREET: Firestone Drive — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | SB | NB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 125 | **42** | 0 | | | | | | | | | | | Y | | | |
| 07:00 AM TO 08:00 AM | 304 | **72** | 0 | | | | | Y | | | | | | Y | | | |
| 08:00 AM TO 09:00 AM | 360 | **94** | 0 | | | | | Y | | Y | Y | **Y** | | Y | | | |
| 09:00 AM TO 10:00 AM | 311 | **87** | 0 | | | | | Y | | | Y | | | Y | | | |
| 10:00 AM TO 11:00 AM | 285 | **110** | 0 | | Y | | | Y | | | Y | | | Y | | | |
| 11:00 AM TO 12:00 AM | 316 | **104** | 0 | | | | | Y | | | Y | | | Y | | | |
| 12:00 PM TO 01:00 PM | 338 | **83** | 0 | | | | | Y | | Y | | | | Y | | | |
| 01:00 PM TO 02:00 PM | 321 | **114** | 0 | | Y | | | Y | | | Y | | | Y | | | |
| 02:00 PM TO 03:00 PM | 394 | **112** | 0 | | Y | | | Y | | Y | Y | **Y** | | Y | | | |
| 03:00 PM TO 04:00 PM | 425 | **81** | 0 | Y | | | | Y | | Y | | | | Y | | | |
| 04:00 PM TO 05:00 PM | 428 | **65** | 0 | Y | | | | Y | | Y | | | | Y | | | |
| 05:00 PM TO 06:00 PM | 419 | **74** | 0 | | | | | Y | | Y | | | | Y | | | |
| | **0** | **0** | **0** | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 4,026 | 1,038 | 0 | | | **0** | | | **0** | | | **2** | | | **0** | **0** | **0** |
| | | | | 8 HOURS NEEDED **NOT SATISFIED** | | | 8 HOURS NEEDED **NOT SATISFIED** | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED **NOT SATISFIED** | | | | | | 4 HRS NEEDED **NOT SATISFIED** | 1 HR NEEDED **NOT SATISFIED** |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Firestone Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Firestone Drive at News Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2021 No Build (No SBR, WBR, or NBR)

MAJOR STREET: News Road — # OF APPROACH LANES: 2

MINOR STREET: Firestone Drive/The Villages Driveway — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | SB | NB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 151 | **42** | 32 | | | | | | | | | | | Y | | | |
| 07:00 AM TO 08:00 AM | 348 | **72** | 50 | | | | | Y | | Y | | | | Y | | | |
| 08:00 AM TO 09:00 AM | 417 | **94** | 51 | | | | | Y | | Y | Y | **Y** | | Y | | | |
| 09:00 AM TO 10:00 AM | 363 | **87** | 36 | | | | | Y | | Y | Y | **Y** | | Y | | | |
| 10:00 AM TO 11:00 AM | 338 | **110** | 31 | | Y | | | Y | | Y | Y | **Y** | | Y | | | |
| 11:00 AM TO 12:00 AM | 374 | **104** | 32 | | | | | Y | | Y | Y | **Y** | | Y | | | |
| 12:00 PM TO 01:00 PM | 393 | **83** | 32 | | | | | Y | | Y | | | | Y | | | |
| 01:00 PM TO 02:00 PM | 377 | **114** | 34 | | Y | | | Y | | Y | Y | **Y** | | Y | | | |
| 02:00 PM TO 03:00 PM | 462 | **112** | 36 | Y | Y | **Y** | | Y | | Y | Y | **Y** | | Y | | | |
| 03:00 PM TO 04:00 PM | 504 | **81** | 38 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| 04:00 PM TO 05:00 PM | 520 | **65** | 38 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| 05:00 PM TO 06:00 PM | 518 | **74** | 39 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| | **0** | **0** | **0** | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 4,765 | 1,038 | 449 | | | **1** | | | **0** | | | **6** | | | **3** | **0** | **0** |
| | | | | 8 HOURS NEEDED **NOT SATISFIED** | | | 8 HOURS NEEDED **NOT SATISFIED** | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED **NOT SATISFIED** | | | | | | 4 HRS NEEDED **NOT SATISFIED** | 1 HR NEEDED **NOT SATISFIED** |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Firestone Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Firestone Drive at News Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2021 Build (No SBR, WBR,or NBR)

MAJOR STREET: News Road — # OF APPROACH LANES: 2

MINOR STREET: Firestone Drive/The Villages Driveway — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | SB | NB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 151 | **43** | 32 | | | | | | | | | | | Y | | | |
| 07:00 AM TO 08:00 AM | 348 | **74** | 50 | | | | | Y | | Y | | | | Y | | | |
| 08:00 AM TO 09:00 AM | 417 | **96** | 51 | | | | | Y | | Y | Y | **Y** | | Y | | | |
| 09:00 AM TO 10:00 AM | 363 | **88** | 36 | | | | | Y | | Y | Y | **Y** | | Y | | | |
| 10:00 AM TO 11:00 AM | 338 | **111** | 31 | | Y | | | Y | | Y | Y | **Y** | | Y | | | |
| 11:00 AM TO 12:00 AM | 374 | **105** | 32 | | Y | | | Y | | Y | Y | **Y** | | Y | | | |
| 12:00 PM TO 01:00 PM | 393 | **84** | 32 | | | | | Y | | Y | Y | **Y** | | Y | | | |
| 01:00 PM TO 02:00 PM | 377 | **115** | 34 | | Y | | | Y | | Y | Y | **Y** | | Y | | | |
| 02:00 PM TO 03:00 PM | 462 | **113** | 36 | Y | Y | **Y** | | Y | | Y | Y | **Y** | | Y | | | |
| 03:00 PM TO 04:00 PM | 504 | **82** | 38 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| 04:00 PM TO 05:00 PM | 520 | **66** | 38 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| 05:00 PM TO 06:00 PM | 518 | **75** | 39 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| | **0** | **0** | **0** | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 4,765 | 1,052 | 449 | | | **1** | | | **0** | | | **7** | | | **3** | **0** | **0** |
| | | | | 8 HOURS NEEDED | | | 8 HOURS NEEDED | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED | | | | | | 4 HRS NEEDED | 1 HR NEEDED |
| | | | | **NOT SATISFIED** | | | **NOT SATISFIED** | | | **NOT SATISFIED** | | | | | | **NOT SATISFIED** | **NOT SATISFIED** |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Firestone Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Firestone Drive at News Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2027 No Build (No SBR, WBR, or NBR)

MAJOR STREET: News Road — # OF APPROACH LANES: 2

MINOR STREET: Firestone Drive/The Villages Driveway — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | SB | NB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 188 | **42** | 32 | | | | | | | | | | | Y | | | |
| 07:00 AM TO 08:00 AM | 420 | **72** | 50 | Y | | | | Y | | Y | | | | Y | | | |
| 08:00 AM TO 09:00 AM | 511 | **94** | 51 | Y | | | | Y | | Y | Y | **Y** | Y | Y | **Y** | | |
| 09:00 AM TO 10:00 AM | 453 | **87** | 36 | Y | | | | Y | | Y | Y | **Y** | | Y | | | |
| 10:00 AM TO 11:00 AM | 429 | **110** | 31 | Y | Y | **Y** | | Y | | Y | Y | **Y** | | Y | | | |
| 11:00 AM TO 12:00 AM | 474 | **104** | 32 | Y | | | | Y | | Y | Y | **Y** | | Y | | | |
| 12:00 PM TO 01:00 PM | 515 | **83** | 32 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| 01:00 PM TO 02:00 PM | 499 | **114** | 34 | Y | Y | **Y** | | Y | | Y | Y | **Y** | | Y | | | |
| 02:00 PM TO 03:00 PM | 609 | **112** | 36 | Y | Y | **Y** | | Y | | Y | Y | **Y** | Y | Y | **Y** | | |
| 03:00 PM TO 04:00 PM | 679 | **81** | 38 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 04:00 PM TO 05:00 PM | 720 | **65** | 38 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 05:00 PM TO 06:00 PM | 733 | **74** | 39 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| | **0** | **0** | **0** | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 6,230 | 1,038 | 449 | | | **3** | | | **3** | | | **6** | | | **6** | **0** | **0** |
| | | | | 8 HOURS NEEDED **NOT SATISFIED** | | | 8 HOURS NEEDED **NOT SATISFIED** | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED **NOT SATISFIED** | | | | | | 4 HRS NEEDED **NOT SATISFIED** | 1 HR NEEDED **NOT SATISFIED** |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Firestone Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Firestone Drive at News Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2027 Build (No SBR, WBR, or NBR)

MAJOR STREET: News Road — # OF APPROACH LANES: 2

MINOR STREET: Firestone Drive/The Villages Driveway — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | SB | NB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 188 | **43** | 32 | | | | | | | | | | | Y | | | |
| 07:00 AM TO 08:00 AM | 420 | **74** | 50 | Y | | | | Y | | Y | | | | Y | | | |
| 08:00 AM TO 09:00 AM | 511 | **96** | 51 | Y | | | | Y | | Y | Y | **Y** | Y | Y | **Y** | | |
| 09:00 AM TO 10:00 AM | 453 | **88** | 36 | Y | | | | Y | | Y | Y | **Y** | | Y | | | |
| 10:00 AM TO 11:00 AM | 429 | **111** | 31 | Y | Y | **Y** | | Y | | Y | Y | **Y** | | Y | | | |
| 11:00 AM TO 12:00 AM | 474 | **105** | 32 | Y | Y | **Y** | | Y | | Y | Y | **Y** | | Y | | | |
| 12:00 PM TO 01:00 PM | 515 | **84** | 32 | Y | | | | Y | | Y | Y | **Y** | Y | Y | **Y** | | |
| 01:00 PM TO 02:00 PM | 499 | **115** | 34 | Y | Y | **Y** | | Y | | Y | Y | **Y** | | Y | | | |
| 02:00 PM TO 03:00 PM | 609 | **113** | 36 | Y | Y | **Y** | | Y | | Y | Y | **Y** | Y | Y | **Y** | | |
| 03:00 PM TO 04:00 PM | 679 | **82** | 38 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 04:00 PM TO 05:00 PM | 720 | **66** | 38 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 05:00 PM TO 06:00 PM | 733 | **75** | 39 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| | **0** | **0** | **0** | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 6,230 | 1,052 | 449 | | | **4** | | | **3** | | | **7** | | | **6** | **0** | **0** |
| | | | | 8 HOURS NEEDED | | | 8 HOURS NEEDED | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED | | | | | | 4 HRS NEEDED | 1 HR NEEDED |
| | | | | **NOT SATISFIED** | | | **NOT SATISFIED** | | | **NOT SATISFIED** | | | | | | **NOT SATISFIED** | **NOT SATISFIED** |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Fords Colony Drive at Longhill Road

# Fords Colony Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Fords Colony Drive at Longhill Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2019 Existing (No WBR or NBR)

MAJOR STREET: Longhill Road — # OF APPROACH LANES: 2

MINOR STREET: Fords Colony Drive — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | NB | SB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 234 | 15 | 2 | | | | | | | | | | | | | | |
| 07:00 AM TO 08:00 AM | 604 | 52 | 2 | Y | | | | | | Y | | | Y | Y | Y | | |
| 08:00 AM TO 09:00 AM | 771 | 63 | 2 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | | |
| 09:00 AM TO 10:00 AM | 617 | 44 | 1 | Y | | | | | | Y | | | Y | Y | Y | | |
| 10:00 AM TO 11:00 AM | 507 | 66 | 5 | Y | | | | Y | | Y | | | Y | Y | Y | | |
| 11:00 AM TO 12:00 AM | 573 | 45 | 6 | Y | | | | | | Y | | | Y | Y | Y | | |
| 12:00 PM TO 01:00 PM | 598 | 50 | 5 | Y | | | | | | Y | | | Y | Y | Y | | |
| 01:00 PM TO 02:00 PM | 551 | 44 | 12 | Y | | | | | | Y | | | Y | Y | Y | | |
| 02:00 PM TO 03:00 PM | 763 | 55 | 8 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | | |
| 03:00 PM TO 04:00 PM | 833 | 75 | 13 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | Y | |
| 04:00 PM TO 05:00 PM | 850 | 56 | 4 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | | |
| 05:00 PM TO 06:00 PM | 865 | 39 | 8 | Y | | | Y | | | Y | | | Y | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 7,766 | 604 | 68 | | | 0 | | | 4 | | | 0 | | | 10 | 1 | 0 |
| | | | | 8 HOURS NEEDED | | | 8 HOURS NEEDED | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED | | | | | | 4 HRS NEEDED | 1 HR NEEDED |
| | | | | NOT SATISFIED | | | NOT SATISFIED | | | NOT SATISFIED | | | | | | NOT SATISFIED | NOT SATISFIED |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Fords Colony Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Fords Colony Drive at Longhill Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2021 No Build (No WBR or NBR)

MAJOR STREET: Longhill Road — # OF APPROACH LANES: 2

MINOR STREET: Fords Colony Drive — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | NB | SB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 268 | 18 | 2 | | | | | | | | | | | | | | |
| 07:00 AM TO 08:00 AM | 665 | 57 | 2 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | | |
| 08:00 AM TO 09:00 AM | 843 | 69 | 2 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | | |
| 09:00 AM TO 10:00 AM | 674 | 48 | 1 | Y | | | Y | | | Y | | | Y | Y | Y | | |
| 10:00 AM TO 11:00 AM | 560 | 71 | 5 | Y | | | | Y | | Y | | | Y | Y | Y | | |
| 11:00 AM TO 12:00 AM | 631 | 49 | 6 | Y | | | Y | | | Y | | | Y | Y | Y | | |
| 12:00 PM TO 01:00 PM | 656 | 54 | 5 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | | |
| 01:00 PM TO 02:00 PM | 608 | 48 | 12 | Y | | | | | | Y | | | Y | Y | Y | | |
| 02:00 PM TO 03:00 PM | 831 | 59 | 8 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | | |
| 03:00 PM TO 04:00 PM | 909 | 80 | 14 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | Y | |
| 04:00 PM TO 05:00 PM | 932 | 60 | 4 | Y | | | Y | Y | Y | Y | | | Y | Y | Y | Y | |
| 05:00 PM TO 06:00 PM | 950 | 43 | 8 | Y | | | Y | | | Y | | | Y | Y | Y | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 8,527 | 656 | 69 | | | 0 | | | 6 | | | 0 | | | 11 | 2 | 0 |
| | | | | 8 HOURS NEEDED | | | 8 HOURS NEEDED | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED | | | | | | 4 HRS NEEDED | 1 HR NEEDED |
| | | | | NOT SATISFIED | | | NOT SATISFIED | | | NOT SATISFIED | | | | | | NOT SATISFIED | NOT SATISFIED |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Fords Colony Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Fords Colony Drive at Longhill Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2021 Build (No WBR or NBR)

MAJOR STREET: Longhill Road — # OF APPROACH LANES: 2

MINOR STREET: Fords Colony Drive — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | NB | SB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 273 | **23** | 2 | | | | | | | | | | | | | | |
| 07:00 AM TO 08:00 AM | 673 | **64** | 2 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 08:00 AM TO 09:00 AM | 855 | **77** | 2 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | **Y** | |
| 09:00 AM TO 10:00 AM | 686 | **53** | 1 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 10:00 AM TO 11:00 AM | 573 | **76** | 5 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| 11:00 AM TO 12:00 AM | 646 | **54** | 6 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 12:00 PM TO 01:00 PM | 671 | **57** | 5 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 01:00 PM TO 02:00 PM | 623 | **52** | 12 | Y | | | | | | Y | | | Y | Y | **Y** | | |
| 02:00 PM TO 03:00 PM | 850 | **63** | 8 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 03:00 PM TO 04:00 PM | 932 | **84** | 14 | Y | | | Y | Y | **Y** | Y | Y | **Y** | Y | Y | **Y** | **Y** | |
| 04:00 PM TO 05:00 PM | 960 | **64** | 4 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | **Y** | |
| 05:00 PM TO 06:00 PM | 982 | **47** | 8 | Y | | | Y | | | Y | | | Y | Y | **Y** | | |
| | **0** | **0** | **0** | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 8,724 | 714 | 69 | | | **0** | | | **8** | | | **1** | | | **11** | **3** | **0** |
| | | | | 8 HOURS NEEDED **NOT SATISFIED** | | | 8 HOURS NEEDED **SATISFIED** | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED **NOT SATISFIED** | | | | | | 4 HRS NEEDED **NOT SATISFIED** | 1 HR NEEDED **NOT SATISFIED** |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Fords Colony Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Fords Colony Drive at Longhill Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2027 No Build (No WBR or NBR)

MAJOR STREET: Longhill Road — # OF APPROACH LANES: 2

MINOR STREET: Fords Colony Drive — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | NB | SB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 300 | **20** | 2 | | | | | | | | | | | | | | |
| 07:00 AM TO 08:00 AM | 743 | **64** | 2 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 08:00 AM TO 09:00 AM | 944 | **77** | 2 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | **Y** | |
| 09:00 AM TO 10:00 AM | 755 | **54** | 1 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 10:00 AM TO 11:00 AM | 626 | **79** | 6 | Y | | | | Y | | Y | | | Y | Y | **Y** | | |
| 11:00 AM TO 12:00 AM | 706 | **55** | 7 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 12:00 PM TO 01:00 PM | 734 | **61** | 6 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 01:00 PM TO 02:00 PM | 680 | **54** | 14 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 02:00 PM TO 03:00 PM | 931 | **66** | 9 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | **Y** | |
| 03:00 PM TO 04:00 PM | 1,018 | **90** | 15 | Y | | | Y | Y | **Y** | Y | Y | **Y** | Y | Y | **Y** | **Y** | |
| 04:00 PM TO 05:00 PM | 1,043 | **68** | 5 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | **Y** | |
| 05:00 PM TO 06:00 PM | 1,064 | **48** | 9 | Y | | | Y | | | Y | | | Y | Y | **Y** | | |
| | **0** | | | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 9,544 | 736 | 78 | | | **0** | | | **9** | | | **1** | | | **11** | **4** | **0** |
| | | | | 8 HOURS NEEDED | | | 8 HOURS NEEDED | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED | | | | | | 4 HRS NEEDED | 1 HR NEEDED |
| | | | | **NOT SATISFIED** | | | **SATISFIED** | | | **NOT SATISFIED** | | | | | | **SATISFIED** | **NOT SATISFIED** |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

WARRANT 3 -- Peak Hour Warrant

# Fords Colony Drive Traffic Signal Warrant Analysis

## TRAFFIC SIGNAL VOLUME WARRANT ANALYSIS

INTERSECTION NAME: Fords Colony Drive at Longhill Road

COUNT DATE: 6/8/2017

INTERSECTION CONDITION: 2027 Build (No WBR or NBR)

MAJOR STREET: Longhill Road — # OF APPROACH LANES: 2

MINOR STREET: Fords Colony Drive — # OF APPROACH LANES: 1

ISOLATED COMMUNITY WITH POPULATION LESS THAN 10,000 (Y OR N): N

85TH PERCENTILE SPEED GREATER THAN 40 MPH ON MAJOR STREET (Y OR N): Y

| | MAJOR ST | MINOR ST | | WARRANT 1, Condition A | | | WARRANT 1, Condition B | | | WARRANT 1, Combination Warrant | | | | | | WARRANT 2 | WARRANT 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CONDITION A | | | CONDITION B | | | | |
| | BOTH APPROACHES | HIGHEST APPROACH | | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | MAJOR STREET | MINOR STREET | BOTH MET | | |
| THRESHOLD VALUES | EB/WB | NB | SB | 420 | 105 | | 630 | 53 | | 336 | 84 | | 504 | 42 | | | |
| 06:00 AM TO 07:00 AM | 305 | **25** | 2 | | | | | | | | | | | | | | |
| 07:00 AM TO 08:00 AM | 751 | **71** | 2 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 08:00 AM TO 09:00 AM | 956 | **85** | 2 | Y | | | Y | Y | **Y** | Y | Y | **Y** | Y | Y | **Y** | **Y** | |
| 09:00 AM TO 10:00 AM | 767 | **59** | 1 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 10:00 AM TO 11:00 AM | 639 | **84** | 6 | Y | | | Y | Y | **Y** | Y | Y | **Y** | Y | Y | **Y** | | |
| 11:00 AM TO 12:00 AM | 721 | **60** | 7 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 12:00 PM TO 01:00 PM | 749 | **64** | 6 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 01:00 PM TO 02:00 PM | 695 | **58** | 14 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | | |
| 02:00 PM TO 03:00 PM | 950 | **70** | 9 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | **Y** | |
| 03:00 PM TO 04:00 PM | 1,041 | **94** | 15 | Y | | | Y | Y | **Y** | Y | Y | **Y** | Y | Y | **Y** | **Y** | |
| 04:00 PM TO 05:00 PM | 1,071 | **72** | 5 | Y | | | Y | Y | **Y** | Y | | | Y | Y | **Y** | **Y** | |
| 05:00 PM TO 06:00 PM | 1,096 | **52** | 9 | Y | | | Y | | | Y | | | Y | Y | **Y** | | |
| | **0** | **0** | **0** | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | 9,741 | 794 | 78 | | | **0** | | | **10** | | | **3** | | | **11** | **4** | **0** |
| | | | | 8 HOURS NEEDED | | | 8 HOURS NEEDED | | | 8 HOURS OF BOTH COND. A AND COND. B NEEDED | | | | | | 4 HRS NEEDED | 1 HR NEEDED |
| | | | | **NOT SATISFIED** | | | **SATISFIED** | | | **NOT SATISFIED** | | | | | | **SATISFIED** | **NOT SATISFIED** |

WARRANT 1 -- Eight-Hour Vehicular Volume Warrant
- Condition A : Minimum Vehicular Volume
- Condition B : Interruption of Continuous Traffic
- Combination : Combination of Condition A and Condition B

WARRANT 2 -- Four-Hour Vehicular Volume Warrant

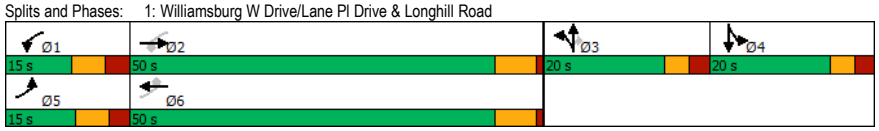
WARRANT 3 -- Peak Hour Warrant

# Appendix E: Synchro and SimTraffic Reports

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 772 | 22 | 45 | 486 | 19 | 44 | 3 | 233 | 58 | 1 | 19 |
| Future Volume (vph) | 3 | 772 | 22 | 45 | 486 | 19 | 44 | 3 | 233 | 58 | 1 | 19 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.967 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | 0 | 1673 | 1615 | 0 | 1676 | 0 |
| Flt Permitted | 0.346 | | | 0.084 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (perm) | 657 | 1863 | 1615 | 152 | 1827 | 1380 | 0 | 1673 | 1615 | 0 | 1676 | 0 |
| Satd. Flow (RTOR) | | | 156 | | | 156 | | | 265 | | 13 | |
| Adj. Flow (vph) | 3 | 877 | 25 | 51 | 552 | 22 | 50 | 3 | 265 | 66 | 1 | 22 |
| Lane Group Flow (vph) | 3 | 877 | 25 | 51 | 552 | 22 | 0 | 53 | 265 | 0 | 89 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 15.0 | 50.0 | 50.0 | 15.0 | 50.0 | 50.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 51.1 | 45.5 | 45.5 | 47.9 | 50.8 | 50.8 | | 9.2 | 9.2 | | 9.9 | |
| Actuated g/C Ratio | 0.59 | 0.53 | 0.53 | 0.56 | 0.59 | 0.59 | | 0.11 | 0.11 | | 0.12 | |
| v/c Ratio | 0.01 | 0.89 | 0.03 | 0.27 | 0.51 | 0.03 | | 0.30 | 0.65 | | 0.44 | |
| Control Delay | 9.3 | 35.7 | 0.0 | 13.1 | 15.4 | 0.1 | | 43.8 | 13.5 | | 41.3 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 9.3 | 35.7 | 0.0 | 13.1 | 15.4 | 0.1 | | 43.8 | 13.5 | | 41.3 | |
| LOS | A | D | A | B | B | A | | D | B | | D | |
| Approach Delay | | 34.6 | | | 14.7 | | | 18.5 | | | 41.3 | |
| Approach LOS | | C | | | B | | | B | | | D | |

| Intersection Summary | |
|---|---|
| Cycle Length: 105 | |
| Actuated Cycle Length: 85.9 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.89 | |
| Intersection Signal Delay: 25.8 | Intersection LOS: C |
| Intersection Capacity Utilization 75.1% | ICU Level of Service D |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 772 | 22 | 45 | 486 | 19 | 44 | 3 | 233 | 58 | 1 | 19 |
| Future Volume (vph) | 3 | 772 | 22 | 45 | 486 | 19 | 44 | 3 | 233 | 58 | 1 | 19 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | | 1673 | 1615 | | 1676 | |
| Flt Permitted | 0.35 | 1.00 | 1.00 | 0.08 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (perm) | 658 | 1863 | 1615 | 152 | 1827 | 1380 | | 1673 | 1615 | | 1676 | |
| Peak-hour factor, PHF | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Adj. Flow (vph) | 3 | 877 | 25 | 51 | 552 | 22 | 50 | 3 | 265 | 66 | 1 | 22 |
| RTOR Reduction (vph) | 0 | 0 | 12 | 0 | 0 | 10 | 0 | 0 | 239 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 3 | 877 | 13 | 51 | 552 | 12 | 0 | 53 | 26 | 0 | 77 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 51.5 | 47.6 | 47.6 | 51.0 | 50.7 | 50.7 | | 9.2 | 9.2 | | 8.0 | |
| Effective Green, g (s) | 51.5 | 47.6 | 47.6 | 51.0 | 50.7 | 50.7 | | 9.2 | 9.2 | | 8.0 | |
| Actuated g/C Ratio | 0.56 | 0.52 | 0.52 | 0.55 | 0.55 | 0.55 | | 0.10 | 0.10 | | 0.09 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 377 | 961 | 833 | 141 | 1004 | 758 | | 166 | 161 | | 145 | |
| v/s Ratio Prot | 0.00 | c0.47 | | c0.01 | c0.30 | | | c0.03 | | | c0.05 | |
| v/s Ratio Perm | 0.00 | | 0.01 | 0.19 | | 0.01 | | | 0.02 | | | |
| v/c Ratio | 0.01 | 0.91 | 0.02 | 0.36 | 0.55 | 0.02 | | 0.32 | 0.16 | | 0.53 | |
| Uniform Delay, d1 | 9.8 | 20.4 | 10.9 | 17.3 | 13.4 | 9.4 | | 38.6 | 38.0 | | 40.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.0 | 13.3 | 0.0 | 0.6 | 1.1 | 0.0 | | 1.1 | 0.5 | | 3.7 | |
| Delay (s) | 9.8 | 33.7 | 10.9 | 17.9 | 14.5 | 9.4 | | 39.7 | 38.5 | | 44.0 | |
| Level of Service | A | C | B | B | B | A | | D | D | | D | |
| Approach Delay (s) | | 33.0 | | | 14.6 | | | 38.7 | | | 44.0 | |
| Approach LOS | | C | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 92.2 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 75.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 305 | 37 | 110 | 277 | 1 | 73 | 1 | 135 | 0 | 1 | 0 |
| Future Volume (vph) | 3 | 305 | 37 | 110 | 277 | 1 | 73 | 1 | 135 | 0 | 1 | 0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.984 | | | | 0.850 | | 0.913 | | | | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.983 | | | | |
| Satd. Flow (prot) | 1805 | 1779 | 0 | 1752 | 1776 | 1615 | 0 | 1648 | 0 | 0 | 1900 | 0 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.983 | | | | |
| Satd. Flow (perm) | 1805 | 1779 | 0 | 1752 | 1776 | 1615 | 0 | 1648 | 0 | 0 | 1900 | 0 |
| Adj. Flow (vph) | 4 | 367 | 45 | 133 | 334 | 1 | 88 | 1 | 163 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 4 | 412 | 0 | 133 | 334 | 1 | 0 | 252 | 0 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 53.5% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 3 | 305 | 37 | 110 | 277 | 1 | 73 | 1 | 135 | 0 | 1 | 0 |
| Future Volume (Veh/h) | 3 | 305 | 37 | 110 | 277 | 1 | 73 | 1 | 135 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 |
| Hourly flow rate (vph) | 4 | 367 | 45 | 133 | 334 | 1 | 88 | 1 | 163 | 0 | 1 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 335 | | | 412 | | | 998 | 998 | 390 | 1138 | 1020 | 334 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 335 | | | 412 | | | 998 | 998 | 390 | 1138 | 1020 | 334 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 88 | | | 55 | 100 | 75 | 100 | 100 | 100 |
| cM capacity (veh/h) | 1236 | | | 1142 | | | 195 | 216 | 663 | 123 | 210 | 712 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 4 | 412 | 133 | 334 | 1 | 252 | 1 |
| Volume Left | 4 | 0 | 133 | 0 | 0 | 88 | 0 |
| Volume Right | 0 | 45 | 0 | 0 | 1 | 163 | 0 |
| cSH | 1236 | 1700 | 1142 | 1700 | 1700 | 359 | 210 |
| Volume to Capacity | 0.00 | 0.24 | 0.12 | 0.20 | 0.00 | 0.70 | 0.00 |
| Queue Length 95th (ft) | 0 | 0 | 10 | 0 | 0 | 128 | 0 |
| Control Delay (s) | 7.9 | 0.0 | 8.6 | 0.0 | 0.0 | 35.5 | 22.2 |
| Lane LOS | A | | A | | | E | C |
| Approach Delay (s) | 0.1 | | 2.4 | | | 35.5 | 22.2 |
| Approach LOS | | | | | | E | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.9 | | |
| Intersection Capacity Utilization | 53.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 1 | 2 | 57 | 0 | 49 | 2 | 354 | 45 | 53 | 221 | 3 |
| Future Volume (vph) | 4 | 1 | 2 | 57 | 0 | 49 | 2 | 354 | 45 | 53 | 221 | 3 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.961 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.972 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1775 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.972 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1775 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 4 | 1 | 2 | 63 | 0 | 54 | 2 | 389 | 49 | 58 | 243 | 3 |
| Lane Group Flow (vph) | 0 | 7 | 0 | 63 | 54 | 0 | 2 | 389 | 49 | 58 | 243 | 3 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 36.9% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 1 | 2 | 57 | 0 | 49 | 2 | 354 | 45 | 53 | 221 | 3 |
| Future Volume (Veh/h) | 4 | 1 | 2 | 57 | 0 | 49 | 2 | 354 | 45 | 53 | 221 | 3 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Hourly flow rate (vph) | 4 | 1 | 2 | 63 | 0 | 54 | 2 | 389 | 49 | 58 | 243 | 3 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 806 | 801 | 243 | 754 | 755 | 389 | 246 | | | 438 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 806 | 801 | 243 | 754 | 755 | 389 | 246 | | | 438 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 98 | 100 | 100 | 79 | 100 | 92 | 100 | | | 94 | | |
| cM capacity (veh/h) | 266 | 302 | 801 | 307 | 321 | 655 | 1332 | | | 1051 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 7 | 63 | 54 | 2 | 389 | 49 | 58 | 243 | 3 |
| Volume Left | 4 | 63 | 0 | 2 | 0 | 0 | 58 | 0 | 0 |
| Volume Right | 2 | 0 | 54 | 0 | 0 | 49 | 0 | 0 | 3 |
| cSH | 336 | 307 | 655 | 1332 | 1700 | 1700 | 1051 | 1700 | 1700 |
| Volume to Capacity | 0.02 | 0.21 | 0.08 | 0.00 | 0.23 | 0.03 | 0.06 | 0.14 | 0.00 |
| Queue Length 95th (ft) | 2 | 19 | 7 | 0 | 0 | 0 | 4 | 0 | 0 |
| Control Delay (s) | 16.0 | 19.7 | 11.0 | 7.7 | 0.0 | 0.0 | 8.6 | 0.0 | 0.0 |
| Lane LOS | C | C | B | A | | | A | | |
| Approach Delay (s) | 16.0 | 15.7 | | 0.0 | | | 1.6 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.8 | | |
| Intersection Capacity Utilization | 36.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 10 | 196 | 130 | 45 | 88 | 18 |
| Future Volume (vph) | 10 | 196 | 130 | 45 | 88 | 18 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | | 0.850 |
| Flt Protected | 0.950 | | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1845 | 1681 | 1583 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1845 | 1681 | 1583 | 1805 | 1615 |
| Adj. Flow (vph) | 11 | 206 | 137 | 47 | 93 | 19 |
| Lane Group Flow (vph) | 11 | 206 | 137 | 47 | 93 | 19 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 21.9% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 10 | 196 | 130 | 45 | 88 | 18 |
| Future Volume (Veh/h) | 10 | 196 | 130 | 45 | 88 | 18 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 11 | 206 | 137 | 47 | 93 | 19 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | 6 |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 184 | | | | 365 | 137 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 184 | | | | 365 | 137 |
| tC, single (s) | 4.3 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.4 | | | | 3.5 | 3.3 |
| p0 queue free % | 99 | | | | 85 | 98 |
| cM capacity (veh/h) | 1290 | | | | 633 | 917 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 |
|---|---|---|---|---|---|
| Volume Total | 11 | 206 | 137 | 47 | 112 |
| Volume Left | 11 | 0 | 0 | 0 | 93 |
| Volume Right | 0 | 0 | 0 | 47 | 19 |
| cSH | 1290 | 1700 | 1700 | 1700 | 762 |
| Volume to Capacity | 0.01 | 0.12 | 0.08 | 0.03 | 0.15 |
| Queue Length 95th (ft) | 1 | 0 | 0 | 0 | 13 |
| Control Delay (s) | 7.8 | 0.0 | 0.0 | 0.0 | 11.2 |
| Lane LOS | A | | | | B |
| Approach Delay (s) | 0.4 | | 0.0 | | 11.2 |
| Approach LOS | | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.6 | | |
| Intersection Capacity Utilization | 21.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | R | L | T | R | LT | R | LTR |
| Maximum Queue (ft) | 69 | 479 | 164 | 81 | 230 | 41 | 92 | 120 | 112 |
| Average Queue (ft) | 3 | 197 | 13 | 24 | 93 | 6 | 35 | 61 | 43 |
| 95th Queue (ft) | 39 | 398 | 82 | 62 | 182 | 26 | 76 | 101 | 88 |
| Link Distance (ft) | | 1007 | | | 741 | 741 | 405 | | 475 |
| Upstream Blk Time (%) | | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | | |
| Storage Bay Dist (ft) | 250 | | 225 | 250 | | | | 225 | |
| Storage Blk Time (%) | 0 | 6 | 0 | 0 | 0 | | | | |
| Queuing Penalty (veh) | 0 | 1 | 0 | 0 | 0 | | | | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | EB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | L | TR | L | LTR | LTR |
| Maximum Queue (ft) | 14 | 10 | 70 | 192 | 6 |
| Average Queue (ft) | 1 | 0 | 21 | 69 | 0 |
| 95th Queue (ft) | 7 | 6 | 51 | 148 | 4 |
| Link Distance (ft) | | 2032 | | 736 | 278 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | 200 | | 225 | | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | L |
| Maximum Queue (ft) | 30 | 60 | 54 | 8 | 64 |
| Average Queue (ft) | 5 | 23 | 19 | 0 | 14 |
| 95th Queue (ft) | 22 | 48 | 41 | 5 | 45 |
| Link Distance (ft) | 247 | 762 | | | |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | 190 |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |





## Intersection: 4: News Road & Firestone Drive

| Movement | EB | WB | SB | SB |
|---|---|---|---|---|
| Directions Served | L | T | L | R |
| Maximum Queue (ft) | 40 | 4 | 69 | 31 |
| Average Queue (ft) | 2 | 0 | 34 | 14 |
| 95th Queue (ft) | 18 | 4 | 57 | 39 |
| Link Distance (ft) | | 493 | 375 | |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | 225 | | | 150 |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

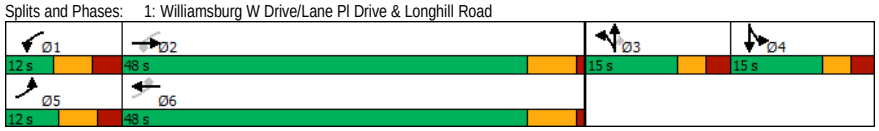
## Network Summary

Network wide Queuing Penalty: 2

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 819 | 23 | 47 | 514 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| Future Volume (vph) | 3 | 819 | 23 | 47 | 514 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.966 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | 0 | 1673 | 1615 | 0 | 1674 | 0 |
| Flt Permitted | 0.342 | | | 0.088 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (perm) | 650 | 1863 | 1615 | 159 | 1827 | 1380 | 0 | 1673 | 1615 | 0 | 1674 | 0 |
| Satd. Flow (RTOR) | | | 182 | | | 182 | | | 244 | | 15 | |
| Adj. Flow (vph) | 3 | 890 | 25 | 51 | 559 | 22 | 50 | 3 | 263 | 65 | 1 | 22 |
| Lane Group Flow (vph) | 3 | 890 | 25 | 51 | 559 | 22 | 0 | 53 | 263 | 0 | 88 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 12.0 | 48.0 | 48.0 | 12.0 | 48.0 | 48.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 47.8 | 43.0 | 43.0 | 44.7 | 47.5 | 47.5 | | 8.3 | 8.3 | | 8.5 | |
| Actuated g/C Ratio | 0.59 | 0.53 | 0.53 | 0.56 | 0.59 | 0.59 | | 0.10 | 0.10 | | 0.11 | |
| v/c Ratio | 0.01 | 0.89 | 0.03 | 0.27 | 0.52 | 0.02 | | 0.31 | 0.68 | | 0.46 | |
| Control Delay | 7.7 | 34.1 | 0.0 | 12.0 | 14.1 | 0.1 | | 41.9 | 17.0 | | 40.3 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 7.7 | 34.1 | 0.0 | 12.0 | 14.1 | 0.1 | | 41.9 | 17.0 | | 40.3 | |
| LOS | A | C | A | B | B | A | | D | B | | D | |
| Approach Delay | | 33.1 | | | 13.4 | | | 21.2 | | | 40.3 | |
| Approach LOS | | C | | | B | | | C | | | D | |

| Intersection Summary | |
|---|---|
| Cycle Length: 90 | |
| Actuated Cycle Length: 80.4 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.89 | |
| Intersection Signal Delay: 25.1 | Intersection LOS: C |
| Intersection Capacity Utilization 78.1% | ICU Level of Service D |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 819 | 23 | 47 | 514 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| Future Volume (vph) | 3 | 819 | 23 | 47 | 514 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | | 1673 | 1615 | | 1675 | |
| Flt Permitted | 0.34 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (perm) | 650 | 1863 | 1615 | 160 | 1827 | 1380 | | 1673 | 1615 | | 1675 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 3 | 890 | 25 | 51 | 559 | 22 | 50 | 3 | 263 | 65 | 1 | 22 |
| RTOR Reduction (vph) | 0 | 0 | 12 | 0 | 0 | 10 | 0 | 0 | 221 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 3 | 890 | 13 | 51 | 559 | 12 | 0 | 53 | 42 | 0 | 74 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 48.4 | 45.2 | 45.2 | 47.9 | 47.5 | 47.5 | | 8.3 | 8.3 | | 6.7 | |
| Effective Green, g (s) | 48.4 | 45.2 | 45.2 | 47.9 | 47.5 | 47.5 | | 8.3 | 8.3 | | 6.7 | |
| Actuated g/C Ratio | 0.56 | 0.52 | 0.52 | 0.55 | 0.55 | 0.55 | | 0.10 | 0.10 | | 0.08 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 373 | 969 | 840 | 136 | 998 | 754 | | 159 | 154 | | 129 | |
| v/s Ratio Prot | 0.00 | c0.48 | | c0.01 | 0.31 | | | c0.03 | | | c0.04 | |
| v/s Ratio Perm | 0.00 | | 0.01 | 0.19 | | 0.01 | | | 0.03 | | | |
| v/c Ratio | 0.01 | 0.92 | 0.02 | 0.38 | 0.56 | 0.02 | | 0.33 | 0.27 | | 0.57 | |
| Uniform Delay, d1 | 9.3 | 19.2 | 10.1 | 16.5 | 12.9 | 9.0 | | 36.7 | 36.5 | | 38.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.0 | 13.8 | 0.0 | 0.6 | 1.2 | 0.0 | | 1.2 | 1.0 | | 6.1 | |
| Delay (s) | 9.3 | 33.0 | 10.1 | 17.2 | 14.1 | 9.0 | | 38.0 | 37.5 | | 44.8 | |
| Level of Service | A | C | B | B | B | A | | D | D | | D | |
| Approach Delay (s) | | 32.3 | | | 14.1 | | | 37.6 | | | 44.8 | |
| Approach LOS | | C | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 27.8 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.78 | | |
| Actuated Cycle Length (s) | 86.9 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 78.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 326 | 39 | 116 | 294 | 1 | 78 | 1 | 148 | 0 | 1 | 0 |
| Future Volume (vph) | 3 | 326 | 39 | 116 | 294 | 1 | 78 | 1 | 148 | 0 | 1 | 0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.984 | | | | 0.850 | | 0.912 | | | | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.983 | | | | |
| Satd. Flow (prot) | 1805 | 1779 | 0 | 1752 | 1776 | 1615 | 0 | 1647 | 0 | 0 | 1900 | 0 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.983 | | | | |
| Satd. Flow (perm) | 1805 | 1779 | 0 | 1752 | 1776 | 1615 | 0 | 1647 | 0 | 0 | 1900 | 0 |
| Adj. Flow (vph) | 3 | 354 | 42 | 126 | 320 | 1 | 85 | 1 | 161 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 3 | 396 | 0 | 126 | 320 | 1 | 0 | 247 | 0 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 56.1% | ICU Level of Service B | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 3 | 326 | 39 | 116 | 294 | 1 | 78 | 1 | 148 | 0 | 1 | 0 |
| Future Volume (Veh/h) | 3 | 326 | 39 | 116 | 294 | 1 | 78 | 1 | 148 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 3 | 354 | 42 | 126 | 320 | 1 | 85 | 1 | 161 | 0 | 1 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 321 | | | 396 | | | 954 | 954 | 375 | 1094 | 974 | 320 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 321 | | | 396 | | | 954 | 954 | 375 | 1094 | 974 | 320 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 89 | | | 60 | 100 | 76 | 100 | 100 | 100 |
| cM capacity (veh/h) | 1250 | | | 1157 | | | 210 | 232 | 676 | 134 | 226 | 725 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 3 | 396 | 126 | 320 | 1 | 247 | 1 |
| Volume Left | 3 | 0 | 126 | 0 | 0 | 85 | 0 |
| Volume Right | 0 | 42 | 0 | 0 | 1 | 161 | 0 |
| cSH | 1250 | 1700 | 1157 | 1700 | 1700 | 382 | 226 |
| Volume to Capacity | 0.00 | 0.23 | 0.11 | 0.19 | 0.00 | 0.65 | 0.00 |
| Queue Length 95th (ft) | 0 | 0 | 9 | 0 | 0 | 109 | 0 |
| Control Delay (s) | 7.9 | 0.0 | 8.5 | 0.0 | 0.0 | 30.1 | 21.0 |
| Lane LOS | A | | A | | | D | C |
| Approach Delay (s) | 0.1 | | 2.4 | | | 30.1 | 21.0 |
| Approach LOS | | | | | | D | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 7.8 | | |
| Intersection Capacity Utilization | 56.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 23 | 1 | 9 | 62 | 0 | 52 | 4 | 378 | 48 | 56 | 243 | 10 |
| Future Volume (vph) | 23 | 1 | 9 | 62 | 0 | 52 | 4 | 378 | 48 | 56 | 243 | 10 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.962 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.966 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1766 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.966 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1766 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 25 | 1 | 10 | 67 | 0 | 57 | 4 | 411 | 52 | 61 | 264 | 11 |
| Lane Group Flow (vph) | 0 | 36 | 0 | 67 | 57 | 0 | 4 | 411 | 52 | 61 | 264 | 11 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 41.8% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 23 | 1 | 9 | 62 | 0 | 52 | 4 | 378 | 48 | 56 | 243 | 10 |
| Future Volume (Veh/h) | 23 | 1 | 9 | 62 | 0 | 52 | 4 | 378 | 48 | 56 | 243 | 10 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 25 | 1 | 10 | 67 | 0 | 57 | 4 | 411 | 52 | 61 | 264 | 11 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 862 | 857 | 264 | 816 | 816 | 411 | 275 | | | 463 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 862 | 857 | 264 | 816 | 816 | 411 | 275 | | | 463 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 90 | 100 | 99 | 76 | 100 | 91 | 100 | | | 94 | | |
| cM capacity (veh/h) | 241 | 279 | 780 | 275 | 294 | 636 | 1300 | | | 1029 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 36 | 67 | 57 | 4 | 411 | 52 | 61 | 264 | 11 |
| Volume Left | 25 | 67 | 0 | 4 | 0 | 0 | 61 | 0 | 0 |
| Volume Right | 10 | 0 | 57 | 0 | 0 | 52 | 0 | 0 | 11 |
| cSH | 299 | 275 | 636 | 1300 | 1700 | 1700 | 1029 | 1700 | 1700 |
| Volume to Capacity | 0.12 | 0.24 | 0.09 | 0.00 | 0.24 | 0.03 | 0.06 | 0.16 | 0.01 |
| Queue Length 95th (ft) | 10 | 23 | 7 | 0 | 0 | 0 | 5 | 0 | 0 |
| Control Delay (s) | 18.7 | 22.2 | 11.2 | 7.8 | 0.0 | 0.0 | 8.7 | 0.0 | 0.0 |
| Lane LOS | C | C | B | A | | | A | | |
| Approach Delay (s) | 18.7 | 17.2 | | 0.1 | | | 1.6 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.5 | | |
| Intersection Capacity Utilization | 41.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 212 | 18 | 31 | 137 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| Future Volume (vph) | 10 | 212 | 18 | 31 | 137 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.988 | | | 0.962 | | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1824 | 0 | 1770 | 1659 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1824 | 0 | 1770 | 1659 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Adj. Flow (vph) | 11 | 223 | 19 | 33 | 144 | 49 | 15 | 0 | 40 | 97 | 0 | 20 |
| Lane Group Flow (vph) | 11 | 242 | 0 | 33 | 193 | 0 | 0 | 15 | 40 | 0 | 97 | 20 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 37.3% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 10 | 212 | 18 | 31 | 137 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| Future Volume (Veh/h) | 10 | 212 | 18 | 31 | 137 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 11 | 223 | 19 | 33 | 144 | 49 | 15 | 0 | 40 | 97 | 0 | 20 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 6 | | | 6 |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 193 | | | 242 | | | 474 | 514 | 232 | 500 | 498 | 168 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 193 | | | 242 | | | 474 | 514 | 232 | 500 | 498 | 168 |
| tC, single (s) | 4.3 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 98 | | | 97 | 100 | 95 | 78 | 100 | 98 |
| cM capacity (veh/h) | 1279 | | | 1324 | | | 477 | 449 | 807 | 449 | 458 | 881 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 11 | 242 | 33 | 193 | 55 | 117 |
| Volume Left | 11 | 0 | 33 | 0 | 15 | 97 |
| Volume Right | 0 | 19 | 0 | 49 | 40 | 20 |
| cSH | 1279 | 1700 | 1324 | 1700 | 1109 | 542 |
| Volume to Capacity | 0.01 | 0.14 | 0.02 | 0.11 | 0.05 | 0.22 |
| Queue Length 95th (ft) | 1 | 0 | 2 | 0 | 4 | 20 |
| Control Delay (s) | 7.8 | 0.0 | 7.8 | 0.0 | 10.5 | 14.2 |
| Lane LOS | A | | A | | B | B |
| Approach Delay (s) | 0.3 | | 1.1 | | 10.5 | 14.2 |
| Approach LOS | | | | | B | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.0 | | |
| Intersection Capacity Utilization | 37.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | R | L | T | R | LT | R | LTR |
| Maximum Queue (ft) | 46 | 563 | 205 | 67 | 206 | 51 | 93 | 133 | 115 |
| Average Queue (ft) | 2 | 241 | 18 | 30 | 94 | 7 | 38 | 63 | 46 |
| 95th Queue (ft) | 28 | 465 | 106 | 58 | 179 | 30 | 80 | 105 | 94 |
| Link Distance (ft) | | 1007 | | | 741 | 741 | 405 | | 475 |
| Upstream Blk Time (%) | | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | | |
| Storage Bay Dist (ft) | 250 | | 225 | 250 | | | | 225 | |
| Storage Blk Time (%) | | 10 | 0 | | 0 | | | | |
| Queuing Penalty (veh) | | 3 | 0 | | 0 | | | | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | EB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | L | TR | L | LTR | LTR |
| Maximum Queue (ft) | 5 | 22 | 77 | 209 | 14 |
| Average Queue (ft) | 0 | 1 | 23 | 72 | 1 |
| 95th Queue (ft) | 4 | 9 | 56 | 151 | 6 |
| Link Distance (ft) | | 2032 | | 736 | 278 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | 200 | | 225 | | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | L |
| Maximum Queue (ft) | 45 | 72 | 52 | 9 | 60 |
| Average Queue (ft) | 19 | 25 | 19 | 0 | 15 |
| 95th Queue (ft) | 41 | 50 | 40 | 4 | 45 |
| Link Distance (ft) | 247 | 762 | | | |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | 190 |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | WB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|
| Directions Served | L | L | LT | R | LT | R |
| Maximum Queue (ft) | 28 | 31 | 40 | 54 | 82 | 33 |
| Average Queue (ft) | 2 | 6 | 12 | 24 | 35 | 14 |
| 95th Queue (ft) | 15 | 23 | 37 | 49 | 63 | 39 |
| Link Distance (ft) | | | 372 | | 374 | |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | 225 | 225 | | 150 | | 150 |
| Storage Blk Time (%) | | | | | 0 | |
| Queuing Penalty (veh) | | | | | 0 | |

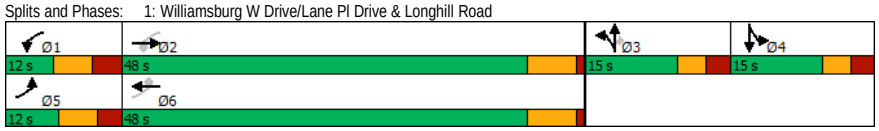
## Network Summary

Network wide Queuing Penalty: 3

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 832 | 23 | 47 | 518 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| Future Volume (vph) | 3 | 832 | 23 | 47 | 518 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.966 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | 0 | 1673 | 1615 | 0 | 1674 | 0 |
| Flt Permitted | 0.339 | | | 0.088 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (perm) | 644 | 1863 | 1615 | 159 | 1827 | 1380 | 0 | 1673 | 1615 | 0 | 1674 | 0 |
| Satd. Flow (RTOR) | | | 182 | | | 182 | | | 241 | | 15 | |
| Adj. Flow (vph) | 3 | 904 | 25 | 51 | 563 | 22 | 50 | 3 | 263 | 65 | 1 | 22 |
| Lane Group Flow (vph) | 3 | 904 | 25 | 51 | 563 | 22 | 0 | 53 | 263 | 0 | 88 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 12.0 | 48.0 | 48.0 | 12.0 | 48.0 | 48.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 47.8 | 43.0 | 43.0 | 44.7 | 47.5 | 47.5 | | 8.3 | 8.3 | | 8.5 | |
| Actuated g/C Ratio | 0.59 | 0.53 | 0.53 | 0.56 | 0.59 | 0.59 | | 0.10 | 0.10 | | 0.11 | |
| v/c Ratio | 0.01 | 0.91 | 0.03 | 0.27 | 0.52 | 0.02 | | 0.31 | 0.69 | | 0.46 | |
| Control Delay | 7.7 | 35.8 | 0.0 | 12.0 | 14.1 | 0.1 | | 41.9 | 17.5 | | 40.3 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 7.7 | 35.8 | 0.0 | 12.0 | 14.1 | 0.1 | | 41.9 | 17.5 | | 40.3 | |
| LOS | A | D | A | B | B | A | | D | B | | D | |
| Approach Delay | | 34.7 | | | 13.5 | | | 21.6 | | | 40.3 | |
| Approach LOS | | C | | | B | | | C | | | D | |

| Intersection Summary | |
|---|---|
| Cycle Length: 90 | |
| Actuated Cycle Length: 80.4 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.91 | |
| Intersection Signal Delay: 26.0 | Intersection LOS: C |
| Intersection Capacity Utilization 78.8% | ICU Level of Service D |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 832 | 23 | 47 | 518 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| Future Volume (vph) | 3 | 832 | 23 | 47 | 518 | 20 | 46 | 3 | 242 | 60 | 1 | 20 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | | 1673 | 1615 | | 1675 | |
| Flt Permitted | 0.34 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.96 | |
| Satd. Flow (perm) | 645 | 1863 | 1615 | 160 | 1827 | 1380 | | 1673 | 1615 | | 1675 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 3 | 904 | 25 | 51 | 563 | 22 | 50 | 3 | 263 | 65 | 1 | 22 |
| RTOR Reduction (vph) | 0 | 0 | 12 | 0 | 0 | 10 | 0 | 0 | 218 | 0 | 14 | 0 |
| Lane Group Flow (vph) | 3 | 904 | 13 | 51 | 563 | 12 | 0 | 53 | 45 | 0 | 74 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 48.4 | 45.2 | 45.2 | 47.9 | 47.5 | 47.5 | | 8.3 | 8.3 | | 6.7 | |
| Effective Green, g (s) | 48.4 | 45.2 | 45.2 | 47.9 | 47.5 | 47.5 | | 8.3 | 8.3 | | 6.7 | |
| Actuated g/C Ratio | 0.56 | 0.52 | 0.52 | 0.55 | 0.55 | 0.55 | | 0.10 | 0.10 | | 0.08 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 371 | 969 | 840 | 136 | 998 | 754 | | 159 | 154 | | 129 | |
| v/s Ratio Prot | 0.00 | c0.49 | | c0.01 | 0.31 | | | c0.03 | | | c0.04 | |
| v/s Ratio Perm | 0.00 | | 0.01 | 0.19 | | 0.01 | | | 0.03 | | | |
| v/c Ratio | 0.01 | 0.93 | 0.02 | 0.38 | 0.56 | 0.02 | | 0.33 | 0.29 | | 0.57 | |
| Uniform Delay, d1 | 9.4 | 19.4 | 10.1 | 17.0 | 12.9 | 9.0 | | 36.7 | 36.6 | | 38.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.0 | 15.8 | 0.0 | 0.6 | 1.2 | 0.0 | | 1.2 | 1.1 | | 6.1 | |
| Delay (s) | 9.4 | 35.2 | 10.1 | 17.7 | 14.1 | 9.0 | | 38.0 | 37.6 | | 44.8 | |
| Level of Service | A | D | B | B | B | A | | D | D | | D | |
| Approach Delay (s) | | 34.5 | | | 14.2 | | | 37.7 | | | 44.8 | |
| Approach LOS | | C | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 28.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 86.9 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 78.8% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 326 | 40 | 120 | 294 | 1 | 82 | 1 | 161 | 0 | 1 | 0 |
| Future Volume (vph) | 3 | 326 | 40 | 120 | 294 | 1 | 82 | 1 | 161 | 0 | 1 | 0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | | |
| Satd. Flow (prot) | 1805 | 1810 | 1524 | 1752 | 1776 | 1615 | 0 | 1648 | 1615 | 0 | 1900 | 0 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.953 | | | | |
| Satd. Flow (perm) | 1805 | 1810 | 1524 | 1752 | 1776 | 1615 | 0 | 1648 | 1615 | 0 | 1900 | 0 |
| Adj. Flow (vph) | 3 | 354 | 43 | 130 | 320 | 1 | 89 | 1 | 175 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 3 | 354 | 43 | 130 | 320 | 1 | 0 | 90 | 175 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 45.1% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 3 | 326 | 40 | 120 | 294 | 1 | 82 | 1 | 161 | 0 | 1 | 0 |
| Future Volume (Veh/h) | 3 | 326 | 40 | 120 | 294 | 1 | 82 | 1 | 161 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 3 | 354 | 43 | 130 | 320 | 1 | 89 | 1 | 175 | 0 | 1 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 7 | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 321 | | | 397 | | | 940 | 941 | 354 | 1028 | 983 | 320 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 321 | | | 397 | | | 940 | 941 | 354 | 1028 | 983 | 320 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 89 | | | 58 | 100 | 75 | 100 | 100 | 100 |
| cM capacity (veh/h) | 1250 | | | 1156 | | | 214 | 235 | 694 | 146 | 222 | 725 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 3 | 354 | 43 | 130 | 320 | 1 | 265 | 1 |
| Volume Left | 3 | 0 | 0 | 130 | 0 | 0 | 89 | 0 |
| Volume Right | 0 | 0 | 43 | 0 | 0 | 1 | 175 | 0 |
| cSH | 1250 | 1700 | 1700 | 1156 | 1700 | 1700 | 631 | 222 |
| Volume to Capacity | 0.00 | 0.21 | 0.03 | 0.11 | 0.19 | 0.00 | 0.42 | 0.00 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 9 | 0 | 0 | 52 | 0 |
| Control Delay (s) | 7.9 | 0.0 | 0.0 | 8.5 | 0.0 | 0.0 | 19.2 | 21.3 |
| Lane LOS | A | | | A | | | C | C |
| Approach Delay (s) | 0.1 | | | 2.5 | | | 19.2 | 21.3 |
| Approach LOS | | | | | | | C | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 5.6 | | |
| Intersection Capacity Utilization | 45.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 23 | 1 | 9 | 65 | 0 | 53 | 4 | 378 | 49 | 56 | 243 | 10 |
| Future Volume (vph) | 23 | 1 | 9 | 65 | 0 | 53 | 4 | 378 | 49 | 56 | 243 | 10 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.962 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.966 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1766 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.966 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1766 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 25 | 1 | 10 | 71 | 0 | 58 | 4 | 411 | 53 | 61 | 264 | 11 |
| Lane Group Flow (vph) | 0 | 36 | 0 | 71 | 58 | 0 | 4 | 411 | 53 | 61 | 264 | 11 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 41.8% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 23 | 1 | 9 | 65 | 0 | 53 | 4 | 378 | 49 | 56 | 243 | 10 |
| Future Volume (Veh/h) | 23 | 1 | 9 | 65 | 0 | 53 | 4 | 378 | 49 | 56 | 243 | 10 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 25 | 1 | 10 | 71 | 0 | 58 | 4 | 411 | 53 | 61 | 264 | 11 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 863 | 858 | 264 | 816 | 816 | 411 | 275 | | | 464 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 863 | 858 | 264 | 816 | 816 | 411 | 275 | | | 464 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 90 | 100 | 99 | 74 | 100 | 91 | 100 | | | 94 | | |
| cM capacity (veh/h) | 240 | 278 | 780 | 275 | 294 | 636 | 1300 | | | 1028 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 36 | 71 | 58 | 4 | 411 | 53 | 61 | 264 | 11 |
| Volume Left | 25 | 71 | 0 | 4 | 0 | 0 | 61 | 0 | 0 |
| Volume Right | 10 | 0 | 58 | 0 | 0 | 53 | 0 | 0 | 11 |
| cSH | 298 | 275 | 636 | 1300 | 1700 | 1700 | 1028 | 1700 | 1700 |
| Volume to Capacity | 0.12 | 0.26 | 0.09 | 0.00 | 0.24 | 0.03 | 0.06 | 0.16 | 0.01 |
| Queue Length 95th (ft) | 10 | 25 | 7 | 0 | 0 | 0 | 5 | 0 | 0 |
| Control Delay (s) | 18.7 | 22.6 | 11.2 | 7.8 | 0.0 | 0.0 | 8.7 | 0.0 | 0.0 |
| Lane LOS | C | C | B | A | | | A | | |
| Approach Delay (s) | 18.7 | 17.5 | | 0.1 | | | 1.6 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.6 | | |
| Intersection Capacity Utilization | 41.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 10 | 214 | 18 | 31 | 138 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| Future Volume (vph) | 10 | 214 | 18 | 31 | 138 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.988 | | | 0.962 | | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1824 | 0 | 1770 | 1658 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1824 | 0 | 1770 | 1658 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Adj. Flow (vph) | 11 | 225 | 19 | 33 | 145 | 49 | 15 | 0 | 40 | 97 | 0 | 20 |
| Lane Group Flow (vph) | 11 | 244 | 0 | 33 | 194 | 0 | 0 | 15 | 40 | 0 | 97 | 20 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 37.5% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 10 | 214 | 18 | 31 | 138 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| Future Volume (Veh/h) | 10 | 214 | 18 | 31 | 138 | 47 | 14 | 0 | 38 | 92 | 0 | 19 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 11 | 225 | 19 | 33 | 145 | 49 | 15 | 0 | 40 | 97 | 0 | 20 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 6 | | | 6 |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 194 | | | 244 | | | 478 | 516 | 234 | 502 | 502 | 170 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 194 | | | 244 | | | 478 | 516 | 234 | 502 | 502 | 170 |
| tC, single (s) | 4.3 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 98 | | | 97 | 100 | 95 | 78 | 100 | 98 |
| cM capacity (veh/h) | 1278 | | | 1322 | | | 474 | 447 | 805 | 447 | 456 | 880 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 11 | 244 | 33 | 194 | 55 | 117 |
| Volume Left | 11 | 0 | 33 | 0 | 15 | 97 |
| Volume Right | 0 | 19 | 0 | 49 | 40 | 20 |
| cSH | 1278 | 1700 | 1322 | 1700 | 1106 | 539 |
| Volume to Capacity | 0.01 | 0.14 | 0.02 | 0.11 | 0.05 | 0.22 |
| Queue Length 95th (ft) | 1 | 0 | 2 | 0 | 4 | 20 |
| Control Delay (s) | 7.8 | 0.0 | 7.8 | 0.0 | 10.6 | 14.2 |
| Lane LOS | A | | A | | B | B |
| Approach Delay (s) | 0.3 | | 1.1 | | 10.6 | 14.2 |
| Approach LOS | | | | | B | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.0 | | |
| Intersection Capacity Utilization | 37.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | R | L | T | R | LT | R | LTR |
| Maximum Queue (ft) | 66 | 561 | 187 | 65 | 217 | 49 | 92 | 141 | 124 |
| Average Queue (ft) | 3 | 255 | 19 | 28 | 93 | 7 | 36 | 65 | 46 |
| 95th Queue (ft) | 38 | 499 | 106 | 57 | 181 | 31 | 75 | 108 | 96 |
| Link Distance (ft) | | 1007 | | | 741 | 741 | 405 | | 475 |
| Upstream Blk Time (%) | | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | | |
| Storage Bay Dist (ft) | 250 | | 225 | 250 | | | | 225 | |
| Storage Blk Time (%) | | 11 | 0 | | 0 | | | | |
| Queuing Penalty (veh) | | 3 | 1 | | 0 | | | | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | EB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|
| Directions Served | L | R | L | LT | R | LTR |
| Maximum Queue (ft) | 9 | 8 | 103 | 115 | 93 | 14 |
| Average Queue (ft) | 1 | 0 | 32 | 42 | 35 | 1 |
| 95th Queue (ft) | 6 | 5 | 72 | 90 | 67 | 6 |
| Link Distance (ft) | | | | 723 | | 278 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | 200 | 300 | 225 | | 175 | |
| Storage Blk Time (%) | | | | 0 | 0 | |
| Queuing Penalty (veh) | | | | 0 | 0 | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | T | L |
| Maximum Queue (ft) | 47 | 68 | 55 | 7 | 2 | 64 |
| Average Queue (ft) | 18 | 27 | 19 | 0 | 0 | 15 |
| 95th Queue (ft) | 41 | 54 | 40 | 4 | 2 | 47 |
| Link Distance (ft) | 247 | 762 | | | 622 | |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | | 190 |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | WB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|
| Directions Served | L | L | LT | R | LT | R |
| Maximum Queue (ft) | 30 | 28 | 40 | 54 | 71 | 33 |
| Average Queue (ft) | 3 | 5 | 12 | 24 | 35 | 14 |
| 95th Queue (ft) | 17 | 21 | 37 | 49 | 59 | 39 |
| Link Distance (ft) | | | 372 | | 374 | |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | 225 | 225 | | 150 | | 150 |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

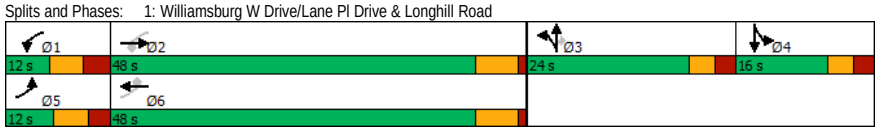
## Network Summary

Network wide Queuing Penalty: 4

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 920 | 26 | 53 | 577 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| Future Volume (vph) | 4 | 920 | 26 | 53 | 577 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.967 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (prot) | 1805 | 3539 | 1615 | 1719 | 3471 | 1380 | 0 | 1669 | 1615 | 0 | 1676 | 0 |
| Flt Permitted | 0.377 | | | 0.186 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (perm) | 716 | 3539 | 1615 | 337 | 3471 | 1380 | 0 | 1669 | 1615 | 0 | 1676 | 0 |
| Satd. Flow (RTOR) | | | 164 | | | 164 | | | 207 | | 13 | |
| Adj. Flow (vph) | 4 | 1000 | 28 | 58 | 627 | 24 | 57 | 4 | 297 | 74 | 1 | 24 |
| Lane Group Flow (vph) | 4 | 1000 | 28 | 58 | 627 | 24 | 0 | 61 | 297 | 0 | 99 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 12.0 | 48.0 | 48.0 | 12.0 | 48.0 | 48.0 | 24.0 | 24.0 | 24.0 | 16.0 | 16.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 40.9 | 34.0 | 34.0 | 36.4 | 40.7 | 40.7 | | 12.0 | 12.0 | | 9.8 | |
| Actuated g/C Ratio | 0.52 | 0.43 | 0.43 | 0.46 | 0.52 | 0.52 | | 0.15 | 0.15 | | 0.12 | |
| v/c Ratio | 0.01 | 0.65 | 0.04 | 0.23 | 0.35 | 0.03 | | 0.24 | 0.71 | | 0.45 | |
| Control Delay | 10.5 | 22.1 | 0.1 | 12.9 | 13.4 | 0.1 | | 37.2 | 22.6 | | 42.3 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 10.5 | 22.1 | 0.1 | 12.9 | 13.4 | 0.1 | | 37.2 | 22.6 | | 42.3 | |
| LOS | B | C | A | B | B | A | | D | C | | D | |
| Approach Delay | | 21.5 | | | 12.9 | | | 25.1 | | | 42.3 | |
| Approach LOS | | C | | | B | | | C | | | D | |

| Intersection Summary | |
|---|---|
| Cycle Length: 100 | |
| Actuated Cycle Length: 78.6 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.71 | |
| Intersection Signal Delay: 20.3 | Intersection LOS: C |
| Intersection Capacity Utilization 61.9% | ICU Level of Service B |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 920 | 26 | 53 | 577 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| Future Volume (vph) | 4 | 920 | 26 | 53 | 577 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1805 | 3539 | 1615 | 1719 | 3471 | 1380 | | 1670 | 1615 | | 1677 | |
| Flt Permitted | 0.38 | 1.00 | 1.00 | 0.19 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.96 | |
| Satd. Flow (perm) | 716 | 3539 | 1615 | 336 | 3471 | 1380 | | 1670 | 1615 | | 1677 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 4 | 1000 | 28 | 58 | 627 | 24 | 57 | 4 | 297 | 74 | 1 | 24 |
| RTOR Reduction (vph) | 0 | 0 | 16 | 0 | 0 | 12 | 0 | 0 | 177 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 4 | 1000 | 12 | 58 | 627 | 12 | 0 | 61 | 120 | 0 | 87 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 41.5 | 37.4 | 37.4 | 41.0 | 40.7 | 40.7 | | 12.0 | 12.0 | | 6.8 | |
| Effective Green, g (s) | 41.5 | 37.4 | 37.4 | 41.0 | 40.7 | 40.7 | | 12.0 | 12.0 | | 6.8 | |
| Actuated g/C Ratio | 0.50 | 0.45 | 0.45 | 0.49 | 0.49 | 0.49 | | 0.14 | 0.14 | | 0.08 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 364 | 1579 | 720 | 223 | 1685 | 670 | | 239 | 231 | | 136 | |
| v/s Ratio Prot | 0.00 | c0.28 | | c0.01 | c0.18 | | | 0.04 | | | c0.05 | |
| v/s Ratio Perm | 0.01 | | 0.01 | 0.12 | | 0.01 | | | c0.07 | | | |
| v/c Ratio | 0.01 | 0.63 | 0.02 | 0.26 | 0.37 | 0.02 | | 0.26 | 0.52 | | 0.64 | |
| Uniform Delay, d1 | 10.8 | 17.9 | 12.9 | 12.5 | 13.5 | 11.2 | | 31.9 | 33.2 | | 37.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.0 | 1.2 | 0.0 | 0.2 | 0.3 | 0.0 | | 0.6 | 2.0 | | 9.9 | |
| Delay (s) | 10.8 | 19.1 | 13.0 | 12.7 | 13.8 | 11.2 | | 32.5 | 35.2 | | 47.2 | |
| Level of Service | B | B | B | B | B | B | | C | D | | D | |
| Approach Delay (s) | | 18.9 | | | 13.6 | | | 34.7 | | | 47.2 | |
| Approach LOS | | B | | | B | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.0 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 83.8 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 61.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 366 | 44 | 131 | 331 | 1 | 88 | 1 | 165 | 0 | 1 | 0 |
| Future Volume (vph) | 4 | 366 | 44 | 131 | 331 | 1 | 88 | 1 | 165 | 0 | 1 | 0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.984 | | | | 0.850 | | 0.912 | | | | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.983 | | | | |
| Satd. Flow (prot) | 1805 | 1779 | 0 | 1752 | 1776 | 1615 | 0 | 1646 | 0 | 0 | 1900 | 0 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.983 | | | | |
| Satd. Flow (perm) | 1805 | 1779 | 0 | 1752 | 1776 | 1615 | 0 | 1646 | 0 | 0 | 1900 | 0 |
| Adj. Flow (vph) | 4 | 398 | 48 | 142 | 360 | 1 | 96 | 1 | 179 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 4 | 446 | 0 | 142 | 360 | 1 | 0 | 276 | 0 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 60.9% | ICU Level of Service B | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 366 | 44 | 131 | 331 | 1 | 88 | 1 | 165 | 0 | 1 | 0 |
| Future Volume (Veh/h) | 4 | 366 | 44 | 131 | 331 | 1 | 88 | 1 | 165 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 4 | 398 | 48 | 142 | 360 | 1 | 96 | 1 | 179 | 0 | 1 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 361 | | | 446 | | | 1074 | 1075 | 422 | 1230 | 1098 | 360 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 361 | | | 446 | | | 1074 | 1075 | 422 | 1230 | 1098 | 360 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 87 | | | 44 | 99 | 72 | 100 | 99 | 100 |
| cM capacity (veh/h) | 1209 | | | 1109 | | | 171 | 192 | 636 | 100 | 186 | 689 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 4 | 446 | 142 | 360 | 1 | 276 | 1 |
| Volume Left | 4 | 0 | 142 | 0 | 0 | 96 | 0 |
| Volume Right | 0 | 48 | 0 | 0 | 1 | 179 | 0 |
| cSH | 1209 | 1700 | 1109 | 1700 | 1700 | 325 | 186 |
| Volume to Capacity | 0.00 | 0.26 | 0.13 | 0.21 | 0.00 | 0.85 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 11 | 0 | 0 | 189 | 0 |
| Control Delay (s) | 8.0 | 0.0 | 8.7 | 0.0 | 0.0 | 55.5 | 24.4 |
| Lane LOS | A | | A | | | F | C |
| Approach Delay (s) | 0.1 | | 2.5 | | | 55.5 | 24.4 |
| Approach LOS | | | | | | F | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 13.5 | | |
| Intersection Capacity Utilization | 60.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 1 | 10 | 71 | 0 | 61 | 4 | 437 | 55 | 65 | 280 | 11 |
| Future Volume (vph) | 24 | 1 | 10 | 71 | 0 | 61 | 4 | 437 | 55 | 65 | 280 | 11 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.961 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.967 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1766 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.967 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1766 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 26 | 1 | 11 | 77 | 0 | 66 | 4 | 475 | 60 | 71 | 304 | 12 |
| Lane Group Flow (vph) | 0 | 38 | 0 | 77 | 66 | 0 | 4 | 475 | 60 | 71 | 304 | 12 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 45.3% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 24 | 1 | 10 | 71 | 0 | 61 | 4 | 437 | 55 | 65 | 280 | 11 |
| Future Volume (Veh/h) | 24 | 1 | 10 | 71 | 0 | 61 | 4 | 437 | 55 | 65 | 280 | 11 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 26 | 1 | 11 | 77 | 0 | 66 | 4 | 475 | 60 | 71 | 304 | 12 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 995 | 989 | 304 | 940 | 941 | 475 | 316 | | | 535 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 995 | 989 | 304 | 940 | 941 | 475 | 316 | | | 535 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 86 | 100 | 99 | 66 | 100 | 89 | 100 | | | 93 | | |
| cM capacity (veh/h) | 188 | 230 | 740 | 223 | 245 | 586 | 1256 | | | 966 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 38 | 77 | 66 | 4 | 475 | 60 | 71 | 304 | 12 |
| Volume Left | 26 | 77 | 0 | 4 | 0 | 0 | 71 | 0 | 0 |
| Volume Right | 11 | 0 | 66 | 0 | 0 | 60 | 0 | 0 | 12 |
| cSH | 242 | 223 | 586 | 1256 | 1700 | 1700 | 966 | 1700 | 1700 |
| Volume to Capacity | 0.16 | 0.34 | 0.11 | 0.00 | 0.28 | 0.04 | 0.07 | 0.18 | 0.01 |
| Queue Length 95th (ft) | 14 | 37 | 9 | 0 | 0 | 0 | 6 | 0 | 0 |
| Control Delay (s) | 22.6 | 29.4 | 11.9 | 7.9 | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 |
| Lane LOS | C | D | B | A | | | A | | |
| Approach Delay (s) | 22.6 | 21.3 | | 0.1 | | | 1.7 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.1 | | |
| Intersection Capacity Utilization | 45.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 237 | 18 | 31 | 154 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| Future Volume (vph) | 12 | 237 | 18 | 31 | 154 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.989 | | | 0.961 | | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1826 | 0 | 1770 | 1657 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1826 | 0 | 1770 | 1657 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Adj. Flow (vph) | 13 | 249 | 19 | 33 | 162 | 56 | 15 | 0 | 40 | 108 | 0 | 22 |
| Lane Group Flow (vph) | 13 | 268 | 0 | 33 | 218 | 0 | 0 | 15 | 40 | 0 | 108 | 22 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 39.3% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 12 | 237 | 18 | 31 | 154 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| Future Volume (Veh/h) | 12 | 237 | 18 | 31 | 154 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 13 | 249 | 19 | 33 | 162 | 56 | 15 | 0 | 40 | 108 | 0 | 22 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 6 | | | 6 |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 218 | | | 268 | | | 524 | 568 | 258 | 551 | 550 | 190 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 218 | | | 268 | | | 524 | 568 | 258 | 551 | 550 | 190 |
| tC, single (s) | 4.3 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 97 | | | 97 | 100 | 95 | 74 | 100 | 97 |
| cM capacity (veh/h) | 1252 | | | 1296 | | | 440 | 417 | 780 | 414 | 427 | 857 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 13 | 268 | 33 | 218 | 55 | 130 |
| Volume Left | 13 | 0 | 33 | 0 | 15 | 108 |
| Volume Right | 0 | 19 | 0 | 56 | 40 | 22 |
| cSH | 1252 | 1700 | 1296 | 1700 | 1073 | 498 |
| Volume to Capacity | 0.01 | 0.16 | 0.03 | 0.13 | 0.05 | 0.26 |
| Queue Length 95th (ft) | 1 | 0 | 2 | 0 | 4 | 26 |
| Control Delay (s) | 7.9 | 0.0 | 7.9 | 0.0 | 10.8 | 15.5 |
| Lane LOS | A | | A | | B | C |
| Approach Delay (s) | 0.4 | | 1.0 | | 10.8 | 15.5 |
| Approach LOS | | | | | B | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.1 | | |
| Intersection Capacity Utilization | 39.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | EB | WB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | L | T | T | R | LT | R | LTR |
| Maximum Queue (ft) | 27 | 233 | 229 | 67 | 78 | 157 | 132 | 55 | 94 | 168 | 132 |
| Average Queue (ft) | 2 | 114 | 107 | 8 | 28 | 84 | 39 | 10 | 37 | 73 | 49 |
| 95th Queue (ft) | 14 | 197 | 189 | 43 | 61 | 143 | 92 | 38 | 79 | 133 | 101 |
| Link Distance (ft) | | 1006 | 1006 | | | 738 | 738 | | 392 | | 461 |
| Upstream Blk Time (%) | | | | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | | | | |
| Storage Bay Dist (ft) | 250 | | | 225 | 250 | | | 250 | | 225 | |
| Storage Blk Time (%) | | 0 | 0 | 0 | | | | | | 0 | |
| Queuing Penalty (veh) | | 0 | 0 | 0 | | | | | | 0 | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | EB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | L | TR | L | LTR | LTR |
| Maximum Queue (ft) | 7 | 19 | 84 | 291 | 5 |
| Average Queue (ft) | 1 | 1 | 26 | 106 | 0 |
| 95th Queue (ft) | 6 | 11 | 60 | 233 | 3 |
| Link Distance (ft) | | 2032 | | 736 | 278 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | 200 | | 225 | | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | NB | NB | SB |
|---|---|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | T | R | L |
| Maximum Queue (ft) | 47 | 69 | 58 | 10 | 2 | 5 | 72 |
| Average Queue (ft) | 20 | 28 | 20 | 1 | 0 | 0 | 19 |
| 95th Queue (ft) | 42 | 56 | 41 | 6 | 2 | 5 | 52 |
| Link Distance (ft) | 247 | 762 | | | 622 | | |
| Upstream Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | | 325 | 190 |
| Storage Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | WB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|
| Directions Served | L | L | LT | R | LT | R |
| Maximum Queue (ft) | 28 | 26 | 38 | 54 | 79 | 33 |
| Average Queue (ft) | 3 | 5 | 12 | 24 | 40 | 16 |
| 95th Queue (ft) | 16 | 20 | 37 | 51 | 67 | 40 |
| Link Distance (ft) | | | 372 | | 374 | |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | 225 | 225 | | 150 | | 150 |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

## Network Summary

Network wide Queuing Penalty: 0

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 933 | 26 | 53 | 581 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| Future Volume (vph) | 4 | 933 | 26 | 53 | 581 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.967 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (prot) | 1805 | 3539 | 1615 | 1719 | 3471 | 1380 | 0 | 1669 | 1615 | 0 | 1676 | 0 |
| Flt Permitted | 0.374 | | | 0.181 | | | | 0.955 | | | 0.964 | |
| Satd. Flow (perm) | 711 | 3539 | 1615 | 328 | 3471 | 1380 | 0 | 1669 | 1615 | 0 | 1676 | 0 |
| Satd. Flow (RTOR) | | | 164 | | | 164 | | | 206 | | 13 | |
| Adj. Flow (vph) | 4 | 1014 | 28 | 58 | 632 | 24 | 57 | 4 | 297 | 74 | 1 | 24 |
| Lane Group Flow (vph) | 4 | 1014 | 28 | 58 | 632 | 24 | 0 | 61 | 297 | 0 | 99 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 12.0 | 48.0 | 48.0 | 12.0 | 48.0 | 48.0 | 24.0 | 24.0 | 24.0 | 16.0 | 16.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 41.1 | 34.1 | 34.1 | 36.5 | 40.9 | 40.9 | | 12.0 | 12.0 | | 9.8 | |
| Actuated g/C Ratio | 0.52 | 0.43 | 0.43 | 0.46 | 0.52 | 0.52 | | 0.15 | 0.15 | | 0.12 | |
| v/c Ratio | 0.01 | 0.66 | 0.04 | 0.23 | 0.35 | 0.03 | | 0.24 | 0.71 | | 0.45 | |
| Control Delay | 10.5 | 22.3 | 0.1 | 12.9 | 13.5 | 0.1 | | 37.2 | 22.8 | | 42.5 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 10.5 | 22.3 | 0.1 | 12.9 | 13.5 | 0.1 | | 37.2 | 22.8 | | 42.5 | |
| LOS | B | C | A | B | B | A | | D | C | | D | |
| Approach Delay | | 21.7 | | | 13.0 | | | 25.2 | | | 42.5 | |
| Approach LOS | | C | | | B | | | C | | | D | |

| Intersection Summary | |
|---|---|
| Cycle Length: 100 | |
| Actuated Cycle Length: 78.8 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.71 | |
| Intersection Signal Delay: 20.4 | Intersection LOS: C |
| Intersection Capacity Utilization 62.3% | ICU Level of Service B |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 933 | 26 | 53 | 581 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| Future Volume (vph) | 4 | 933 | 26 | 53 | 581 | 22 | 52 | 4 | 273 | 68 | 1 | 22 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.97 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.96 | |
| Satd. Flow (prot) | 1805 | 3539 | 1615 | 1719 | 3471 | 1380 | | 1670 | 1615 | | 1677 | |
| Flt Permitted | 0.37 | 1.00 | 1.00 | 0.18 | 1.00 | 1.00 | | 0.96 | 1.00 | | 0.96 | |
| Satd. Flow (perm) | 711 | 3539 | 1615 | 327 | 3471 | 1380 | | 1670 | 1615 | | 1677 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 4 | 1014 | 28 | 58 | 632 | 24 | 57 | 4 | 297 | 74 | 1 | 24 |
| RTOR Reduction (vph) | 0 | 0 | 15 | 0 | 0 | 12 | 0 | 0 | 177 | 0 | 12 | 0 |
| Lane Group Flow (vph) | 4 | 1014 | 13 | 58 | 632 | 12 | 0 | 61 | 120 | 0 | 87 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 41.7 | 37.6 | 37.6 | 41.2 | 40.9 | 40.9 | | 12.0 | 12.0 | | 6.8 | |
| Effective Green, g (s) | 41.7 | 37.6 | 37.6 | 41.2 | 40.9 | 40.9 | | 12.0 | 12.0 | | 6.8 | |
| Actuated g/C Ratio | 0.50 | 0.45 | 0.45 | 0.49 | 0.49 | 0.49 | | 0.14 | 0.14 | | 0.08 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 363 | 1584 | 722 | 220 | 1690 | 671 | | 238 | 230 | | 135 | |
| v/s Ratio Prot | 0.00 | c0.29 | | c0.01 | c0.18 | | | 0.04 | | | c0.05 | |
| v/s Ratio Perm | 0.01 | | 0.01 | 0.12 | | 0.01 | | | c0.07 | | | |
| v/c Ratio | 0.01 | 0.64 | 0.02 | 0.26 | 0.37 | 0.02 | | 0.26 | 0.52 | | 0.64 | |
| Uniform Delay, d1 | 10.8 | 18.0 | 12.9 | 12.5 | 13.5 | 11.2 | | 32.0 | 33.4 | | 37.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.0 | 1.2 | 0.0 | 0.2 | 0.3 | 0.0 | | 0.6 | 2.1 | | 10.1 | |
| Delay (s) | 10.8 | 19.2 | 12.9 | 12.8 | 13.8 | 11.2 | | 32.6 | 35.5 | | 47.5 | |
| Level of Service | B | B | B | B | B | B | | C | D | | D | |
| Approach Delay (s) | | 19.0 | | | 13.6 | | | 35.0 | | | 47.5 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 21.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 84.0 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 62.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 4 | 366 | 45 | 135 | 331 | 1 | 92 | 1 | 178 | 0 | 1 | 0 |
| Future Volume (vph) | 4 | 366 | 45 | 135 | 331 | 1 | 92 | 1 | 178 | 0 | 1 | 0 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.953 | | | | |
| Satd. Flow (prot) | 1805 | 1810 | 1524 | 1752 | 1776 | 1615 | 0 | 1648 | 1615 | 0 | 1900 | 0 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.953 | | | | |
| Satd. Flow (perm) | 1805 | 1810 | 1524 | 1752 | 1776 | 1615 | 0 | 1648 | 1615 | 0 | 1900 | 0 |
| Adj. Flow (vph) | 4 | 398 | 49 | 147 | 360 | 1 | 100 | 1 | 193 | 0 | 1 | 0 |
| Lane Group Flow (vph) | 4 | 398 | 49 | 147 | 360 | 1 | 0 | 101 | 193 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 48.6% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 4 | 366 | 45 | 135 | 331 | 1 | 92 | 1 | 178 | 0 | 1 | 0 |
| Future Volume (Veh/h) | 4 | 366 | 45 | 135 | 331 | 1 | 92 | 1 | 178 | 0 | 1 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 4 | 398 | 49 | 147 | 360 | 1 | 100 | 1 | 193 | 0 | 1 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 7 | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 361 | | | 447 | | | 1060 | 1061 | 398 | 1157 | 1109 | 360 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 361 | | | 447 | | | 1060 | 1061 | 398 | 1157 | 1109 | 360 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 87 | | | 42 | 99 | 71 | 100 | 99 | 100 |
| cM capacity (veh/h) | 1209 | | | 1108 | | | 174 | 195 | 656 | 110 | 183 | 689 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 4 | 398 | 49 | 147 | 360 | 1 | 294 | 1 |
| Volume Left | 4 | 0 | 0 | 147 | 0 | 0 | 100 | 0 |
| Volume Right | 0 | 0 | 49 | 0 | 0 | 1 | 193 | 0 |
| cSH | 1209 | 1700 | 1700 | 1108 | 1700 | 1700 | 507 | 183 |
| Volume to Capacity | 0.00 | 0.23 | 0.03 | 0.13 | 0.21 | 0.00 | 0.58 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 11 | 0 | 0 | 91 | 0 |
| Control Delay (s) | 8.0 | 0.0 | 0.0 | 8.7 | 0.0 | 0.0 | 25.9 | 24.8 |
| Lane LOS | A | | | A | | | D | C |
| Approach Delay (s) | 0.1 | | | 2.5 | | | 25.9 | 24.8 |
| Approach LOS | | | | | | | D | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 7.1 | | |
| Intersection Capacity Utilization | 48.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 24 | 1 | 10 | 74 | 0 | 62 | 4 | 437 | 56 | 65 | 280 | 11 |
| Future Volume (vph) | 24 | 1 | 10 | 74 | 0 | 62 | 4 | 437 | 56 | 65 | 280 | 11 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.961 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.967 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1766 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.967 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1766 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 26 | 1 | 11 | 80 | 0 | 67 | 4 | 475 | 61 | 71 | 304 | 12 |
| Lane Group Flow (vph) | 0 | 38 | 0 | 80 | 67 | 0 | 4 | 475 | 61 | 71 | 304 | 12 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 45.3% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 24 | 1 | 10 | 74 | 0 | 62 | 4 | 437 | 56 | 65 | 280 | 11 |
| Future Volume (Veh/h) | 24 | 1 | 10 | 74 | 0 | 62 | 4 | 437 | 56 | 65 | 280 | 11 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 26 | 1 | 11 | 80 | 0 | 67 | 4 | 475 | 61 | 71 | 304 | 12 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 996 | 990 | 304 | 940 | 941 | 475 | 316 | | | 536 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 996 | 990 | 304 | 940 | 941 | 475 | 316 | | | 536 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 86 | 100 | 99 | 64 | 100 | 89 | 100 | | | 93 | | |
| cM capacity (veh/h) | 188 | 229 | 740 | 223 | 245 | 586 | 1256 | | | 965 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 38 | 80 | 67 | 4 | 475 | 61 | 71 | 304 | 12 |
| Volume Left | 26 | 80 | 0 | 4 | 0 | 0 | 71 | 0 | 0 |
| Volume Right | 11 | 0 | 67 | 0 | 0 | 61 | 0 | 0 | 12 |
| cSH | 241 | 223 | 586 | 1256 | 1700 | 1700 | 965 | 1700 | 1700 |
| Volume to Capacity | 0.16 | 0.36 | 0.11 | 0.00 | 0.28 | 0.04 | 0.07 | 0.18 | 0.01 |
| Queue Length 95th (ft) | 14 | 39 | 10 | 0 | 0 | 0 | 6 | 0 | 0 |
| Control Delay (s) | 22.7 | 29.9 | 11.9 | 7.9 | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 |
| Lane LOS | C | D | B | A | | | A | | |
| Approach Delay (s) | 22.7 | 21.7 | | 0.1 | | | 1.7 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.2 | | |
| Intersection Capacity Utilization | 45.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 12 | 239 | 18 | 31 | 155 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| Future Volume (vph) | 12 | 239 | 18 | 31 | 155 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.989 | | | 0.962 | | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1826 | 0 | 1770 | 1659 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1826 | 0 | 1770 | 1659 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Adj. Flow (vph) | 13 | 252 | 19 | 33 | 163 | 56 | 15 | 0 | 40 | 108 | 0 | 22 |
| Lane Group Flow (vph) | 13 | 271 | 0 | 33 | 219 | 0 | 0 | 15 | 40 | 0 | 108 | 22 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 39.4% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 12 | 239 | 18 | 31 | 155 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| Future Volume (Veh/h) | 12 | 239 | 18 | 31 | 155 | 53 | 14 | 0 | 38 | 103 | 0 | 21 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 13 | 252 | 19 | 33 | 163 | 56 | 15 | 0 | 40 | 108 | 0 | 22 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 6 | | | 6 |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 219 | | | 271 | | | 528 | 572 | 262 | 555 | 554 | 191 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 219 | | | 271 | | | 528 | 572 | 262 | 555 | 554 | 191 |
| tC, single (s) | 4.3 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 97 | | | 97 | 100 | 95 | 74 | 100 | 97 |
| cM capacity (veh/h) | 1251 | | | 1292 | | | 437 | 415 | 777 | 411 | 425 | 856 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 13 | 271 | 33 | 219 | 55 | 130 |
| Volume Left | 13 | 0 | 33 | 0 | 15 | 108 |
| Volume Right | 0 | 19 | 0 | 56 | 40 | 22 |
| cSH | 1251 | 1700 | 1292 | 1700 | 1069 | 495 |
| Volume to Capacity | 0.01 | 0.16 | 0.03 | 0.13 | 0.05 | 0.26 |
| Queue Length 95th (ft) | 1 | 0 | 2 | 0 | 4 | 26 |
| Control Delay (s) | 7.9 | 0.0 | 7.9 | 0.0 | 10.9 | 15.6 |
| Lane LOS | A | | A | | B | C |
| Approach Delay (s) | 0.4 | | 1.0 | | 10.9 | 15.6 |
| Approach LOS | | | | | B | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.1 | | |
| Intersection Capacity Utilization | 39.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | EB | WB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | L | T | T | R | LT | R | LTR |
| Maximum Queue (ft) | 49 | 250 | 264 | 29 | 67 | 166 | 140 | 44 | 98 | 167 | 124 |
| Average Queue (ft) | 4 | 122 | 118 | 7 | 26 | 80 | 44 | 8 | 35 | 77 | 52 |
| 95th Queue (ft) | 32 | 211 | 211 | 24 | 55 | 141 | 101 | 32 | 76 | 138 | 99 |
| Link Distance (ft) | | 1006 | 1006 | | | 738 | 738 | | 392 | | 461 |
| Upstream Blk Time (%) | | | | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | | | | |
| Storage Bay Dist (ft) | 250 | | | 225 | 250 | | | 250 | | 225 | |
| Storage Blk Time (%) | 0 | 0 | 0 | | | | | | | 0 | |
| Queuing Penalty (veh) | 0 | 0 | 0 | | | | | | | 0 | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | EB | EB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|
| Directions Served | L | T | R | L | LT | R | LTR |
| Maximum Queue (ft) | 16 | 4 | 8 | 87 | 196 | 132 | 9 |
| Average Queue (ft) | 1 | 0 | 0 | 34 | 58 | 44 | 0 |
| 95th Queue (ft) | 9 | 4 | 6 | 69 | 146 | 102 | 5 |
| Link Distance (ft) | | 2030 | | | 723 | | 278 |
| Upstream Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |
| Storage Bay Dist (ft) | 200 | | 300 | 225 | | 175 | |
| Storage Blk Time (%) | | | | | 1 | 0 | |
| Queuing Penalty (veh) | | | | | 3 | 0 | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | NB | NB | SB |
|---|---|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | T | R | L |
| Maximum Queue (ft) | 51 | 77 | 56 | 8 | 2 | 4 | 69 |
| Average Queue (ft) | 19 | 30 | 20 | 1 | 0 | 0 | 20 |
| 95th Queue (ft) | 44 | 61 | 42 | 7 | 2 | 5 | 53 |
| Link Distance (ft) | 247 | 762 | | | 622 | | |
| Upstream Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | | 325 | 190 |
| Storage Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | WB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|
| Directions Served | L | L | LT | R | LT | R |
| Maximum Queue (ft) | 37 | 26 | 36 | 52 | 82 | 37 |
| Average Queue (ft) | 3 | 4 | 13 | 24 | 40 | 17 |
| 95th Queue (ft) | 17 | 18 | 38 | 48 | 68 | 42 |
| Link Distance (ft) | | | 372 | | 374 | |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | 225 | 225 | | 150 | | 150 |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

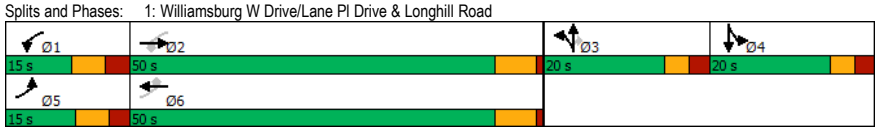
## Network Summary

Network wide Queuing Penalty: 3

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 18 | 765 | 36 | 214 | 1016 | 40 | 52 | 0 | 141 | 24 | 0 | 15 |
| Future Volume (vph) | 18 | 765 | 36 | 214 | 1016 | 40 | 52 | 0 | 141 | 24 | 0 | 15 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.947 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.970 | |
| Satd. Flow (prot) | 1805 | 1845 | 1615 | 1805 | 1881 | 1615 | 0 | 1770 | 1568 | 0 | 1699 | 0 |
| Flt Permitted | 0.073 | | | 0.138 | | | | 0.950 | | | 0.970 | |
| Satd. Flow (perm) | 139 | 1845 | 1615 | 262 | 1881 | 1615 | 0 | 1770 | 1568 | 0 | 1699 | 0 |
| Satd. Flow (RTOR) | | | 156 | | | 156 | | | 161 | | 161 | |
| Adj. Flow (vph) | 19 | 805 | 38 | 225 | 1069 | 42 | 55 | 0 | 148 | 25 | 0 | 16 |
| Lane Group Flow (vph) | 19 | 805 | 38 | 225 | 1069 | 42 | 0 | 55 | 148 | 0 | 41 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 15.0 | 50.0 | 50.0 | 15.0 | 50.0 | 50.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 56.6 | 44.4 | 44.4 | 51.4 | 55.1 | 55.1 | | 8.5 | 8.5 | | 7.1 | |
| Actuated g/C Ratio | 0.65 | 0.51 | 0.51 | 0.59 | 0.64 | 0.64 | | 0.10 | 0.10 | | 0.08 | |
| v/c Ratio | 0.10 | 0.85 | 0.04 | 0.75 | 0.89 | 0.04 | | 0.32 | 0.49 | | 0.14 | |
| Control Delay | 7.8 | 31.0 | 0.1 | 30.3 | 29.5 | 0.1 | | 43.1 | 11.6 | | 1.1 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 7.8 | 31.0 | 0.1 | 30.3 | 29.5 | 0.1 | | 43.1 | 11.6 | | 1.1 | |
| LOS | A | C | A | C | C | A | | D | B | | A | |
| Approach Delay | | 29.2 | | | 28.7 | | | 20.1 | | | 1.1 | |
| Approach LOS | | C | | | C | | | C | | | A | |

| Intersection Summary | |
|---|---|
| Cycle Length: 105 | |
| Actuated Cycle Length: 86.6 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.89 | |
| Intersection Signal Delay: 27.7 | Intersection LOS: C |
| Intersection Capacity Utilization 81.6% | ICU Level of Service D |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 18 | 765 | 36 | 214 | 1016 | 40 | 52 | 0 | 141 | 24 | 0 | 15 |
| Future Volume (vph) | 18 | 765 | 36 | 214 | 1016 | 40 | 52 | 0 | 141 | 24 | 0 | 15 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (prot) | 1805 | 1845 | 1615 | 1805 | 1881 | 1615 | | 1770 | 1568 | | 1700 | |
| Flt Permitted | 0.07 | 1.00 | 1.00 | 0.14 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (perm) | 138 | 1845 | 1615 | 262 | 1881 | 1615 | | 1770 | 1568 | | 1700 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 19 | 805 | 38 | 225 | 1069 | 42 | 55 | 0 | 148 | 25 | 0 | 16 |
| RTOR Reduction (vph) | 0 | 0 | 18 | 0 | 0 | 17 | 0 | 0 | 134 | 0 | 39 | 0 |
| Lane Group Flow (vph) | 19 | 805 | 20 | 225 | 1069 | 25 | 0 | 55 | 14 | 0 | 2 | 0 |
| Heavy Vehicles (%) | 0% | 3% | 0% | 0% | 1% | 0% | 2% | 0% | 3% | 0% | 0% | 7% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 57.1 | 48.5 | 48.5 | 56.6 | 55.1 | 55.1 | | 8.5 | 8.5 | | 3.9 | |
| Effective Green, g (s) | 57.1 | 48.5 | 48.5 | 56.6 | 55.1 | 55.1 | | 8.5 | 8.5 | | 3.9 | |
| Actuated g/C Ratio | 0.61 | 0.52 | 0.52 | 0.61 | 0.59 | 0.59 | | 0.09 | 0.09 | | 0.04 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 120 | 962 | 842 | 293 | 1114 | 956 | | 161 | 143 | | 71 | |
| v/s Ratio Prot | 0.00 | 0.44 | | c0.07 | c0.57 | | | c0.03 | | | c0.00 | |
| v/s Ratio Perm | 0.09 | | 0.01 | 0.40 | | 0.02 | | | 0.01 | | | |
| v/c Ratio | 0.16 | 0.84 | 0.02 | 0.77 | 0.96 | 0.03 | | 0.34 | 0.09 | | 0.02 | |
| Uniform Delay, d1 | 20.3 | 18.9 | 10.8 | 15.3 | 17.9 | 7.8 | | 39.6 | 38.7 | | 42.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.2 | 7.1 | 0.0 | 10.4 | 18.2 | 0.0 | | 1.3 | 0.3 | | 0.1 | |
| Delay (s) | 20.6 | 26.0 | 10.8 | 25.7 | 36.1 | 7.9 | | 40.9 | 39.0 | | 42.9 | |
| Level of Service | C | C | B | C | D | A | | D | D | | D | |
| Approach Delay (s) | | 25.2 | | | 33.5 | | | 39.5 | | | 42.9 | |
| Approach LOS | | C | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 31.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.88 | | |
| Actuated Cycle Length (s) | 93.0 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 81.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 354 | 55 | 200 | 293 | 2 | 47 | 3 | 126 | 4 | 0 | 5 |
| Future Volume (vph) | 0 | 354 | 55 | 200 | 293 | 2 | 47 | 3 | 126 | 4 | 0 | 5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.980 | | | | 0.850 | | 0.903 | | | 0.925 | |
| Flt Protected | | | | 0.950 | | | | 0.987 | | | 0.978 | |
| Satd. Flow (prot) | 1900 | 1846 | 0 | 1805 | 1863 | 1615 | 0 | 1661 | 0 | 0 | 1719 | 0 |
| Flt Permitted | | | | 0.950 | | | | 0.987 | | | 0.978 | |
| Satd. Flow (perm) | 1900 | 1846 | 0 | 1805 | 1863 | 1615 | 0 | 1661 | 0 | 0 | 1719 | 0 |
| Adj. Flow (vph) | 0 | 377 | 59 | 213 | 312 | 2 | 50 | 3 | 134 | 4 | 0 | 5 |
| Lane Group Flow (vph) | 0 | 436 | 0 | 213 | 312 | 2 | 0 | 187 | 0 | 0 | 9 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 54.8% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 354 | 55 | 200 | 293 | 2 | 47 | 3 | 126 | 4 | 0 | 5 |
| Future Volume (Veh/h) | 0 | 354 | 55 | 200 | 293 | 2 | 47 | 3 | 126 | 4 | 0 | 5 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 377 | 59 | 213 | 312 | 2 | 50 | 3 | 134 | 4 | 0 | 5 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 314 | | | 436 | | | 1150 | 1146 | 406 | 1250 | 1174 | 312 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 314 | | | 436 | | | 1150 | 1146 | 406 | 1250 | 1174 | 312 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.8 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.3 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 81 | | | 67 | 98 | 79 | 96 | 100 | 99 |
| cM capacity (veh/h) | 1258 | | | 1134 | | | 150 | 142 | 644 | 101 | 157 | 733 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 0 | 436 | 213 | 312 | 2 | 187 | 9 |
| Volume Left | 0 | 0 | 213 | 0 | 0 | 50 | 4 |
| Volume Right | 0 | 59 | 0 | 0 | 2 | 134 | 5 |
| cSH | 1700 | 1700 | 1134 | 1700 | 1700 | 333 | 193 |
| Volume to Capacity | 0.00 | 0.26 | 0.19 | 0.18 | 0.00 | 0.56 | 0.05 |
| Queue Length 95th (ft) | 0 | 0 | 17 | 0 | 0 | 81 | 4 |
| Control Delay (s) | 0.0 | 0.0 | 8.9 | 0.0 | 0.0 | 28.8 | 24.5 |
| Lane LOS | | | A | | | D | C |
| Approach Delay (s) | 0.0 | | 3.6 | | | 28.8 | 24.5 |
| Approach LOS | | | | | | D | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 6.5 | | |
| Intersection Capacity Utilization | 54.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 3 | 1 | 2 | 49 | 0 | 29 | 2 | 305 | 67 | 24 | 249 | 2 |
| Future Volume (vph) | 3 | 1 | 2 | 49 | 0 | 29 | 2 | 305 | 67 | 24 | 249 | 2 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.955 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.976 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1771 | 0 | 1805 | 1553 | 0 | 1805 | 1845 | 1568 | 1805 | 1863 | 1615 |
| Flt Permitted | | 0.976 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1771 | 0 | 1805 | 1553 | 0 | 1805 | 1845 | 1568 | 1805 | 1863 | 1615 |
| Adj. Flow (vph) | 3 | 1 | 2 | 52 | 0 | 31 | 2 | 321 | 71 | 25 | 262 | 2 |
| Lane Group Flow (vph) | 0 | 6 | 0 | 52 | 31 | 0 | 2 | 321 | 71 | 25 | 262 | 2 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 31.4% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 3 | 1 | 2 | 49 | 0 | 29 | 2 | 305 | 67 | 24 | 249 | 2 |
| Future Volume (Veh/h) | 3 | 1 | 2 | 49 | 0 | 29 | 2 | 305 | 67 | 24 | 249 | 2 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 3 | 1 | 2 | 52 | 0 | 31 | 2 | 321 | 71 | 25 | 262 | 2 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 668 | 708 | 262 | 640 | 639 | 321 | 264 | | | 392 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 668 | 708 | 262 | 640 | 639 | 321 | 264 | | | 392 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 99 | 100 | 100 | 86 | 100 | 96 | 100 | | | 98 | | |
| cM capacity (veh/h) | 352 | 354 | 782 | 383 | 388 | 715 | 1312 | | | 1178 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 6 | 52 | 31 | 2 | 321 | 71 | 25 | 262 | 2 |
| Volume Left | 3 | 52 | 0 | 2 | 0 | 0 | 25 | 0 | 0 |
| Volume Right | 2 | 0 | 31 | 0 | 0 | 71 | 0 | 0 | 2 |
| cSH | 431 | 383 | 715 | 1312 | 1700 | 1700 | 1178 | 1700 | 1700 |
| Volume to Capacity | 0.01 | 0.14 | 0.04 | 0.00 | 0.19 | 0.04 | 0.02 | 0.15 | 0.00 |
| Queue Length 95th (ft) | 1 | 12 | 3 | 0 | 0 | 0 | 2 | 0 | 0 |
| Control Delay (s) | 13.5 | 15.9 | 10.3 | 7.7 | 0.0 | 0.0 | 8.1 | 0.0 | 0.0 |
| Lane LOS | B | C | B | A | | | A | | |
| Approach Delay (s) | 13.5 | 13.8 | | 0.0 | | | 0.7 | | |
| Approach LOS | B | B | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.9 | | |
| Intersection Capacity Utilization | 31.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 8 | 153 | 257 | 117 | 68 | 7 |
| Future Volume (vph) | 8 | 153 | 257 | 117 | 68 | 7 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | | 0.850 |
| Flt Protected | 0.950 | | | | 0.950 | |
| Satd. Flow (prot) | 1805 | 1863 | 1863 | 1615 | 1770 | 1615 |
| Flt Permitted | 0.950 | | | | 0.950 | |
| Satd. Flow (perm) | 1805 | 1863 | 1863 | 1615 | 1770 | 1615 |
| Adj. Flow (vph) | 8 | 159 | 268 | 122 | 71 | 7 |
| Lane Group Flow (vph) | 8 | 159 | 268 | 122 | 71 | 7 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 24.0% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 8 | 153 | 257 | 117 | 68 | 7 |
| Future Volume (Veh/h) | 8 | 153 | 257 | 117 | 68 | 7 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 8 | 159 | 268 | 122 | 71 | 7 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | 6 |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 390 | | | | 443 | 268 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 390 | | | | 443 | 268 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 99 | | | | 88 | 99 |
| cM capacity (veh/h) | 1180 | | | | 568 | 776 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 |
|---|---|---|---|---|---|
| Volume Total | 8 | 159 | 268 | 122 | 78 |
| Volume Left | 8 | 0 | 0 | 0 | 71 |
| Volume Right | 0 | 0 | 0 | 122 | 7 |
| cSH | 1180 | 1700 | 1700 | 1700 | 624 |
| Volume to Capacity | 0.01 | 0.09 | 0.16 | 0.07 | 0.12 |
| Queue Length 95th (ft) | 1 | 0 | 0 | 0 | 11 |
| Control Delay (s) | 8.1 | 0.0 | 0.0 | 0.0 | 12.0 |
| Lane LOS | A | | | | B |
| Approach Delay (s) | 0.4 | | 0.0 | | 12.0 |
| Approach LOS | | | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.6 | | |
| Intersection Capacity Utilization | 24.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | R | L | T | R | LT | R | LTR |
| Maximum Queue (ft) | 148 | 519 | 206 | 250 | 763 | 690 | 97 | 109 | 81 |
| Average Queue (ft) | 16 | 228 | 25 | 124 | 330 | 110 | 39 | 47 | 26 |
| 95th Queue (ft) | 74 | 445 | 120 | 248 | 758 | 532 | 78 | 81 | 61 |
| Link Distance (ft) | | 1007 | | | 741 | 741 | 405 | | 475 |
| Upstream Blk Time (%) | | | | | 7 | 3 | | | |
| Queuing Penalty (veh) | | | | | 0 | 0 | | | |
| Storage Bay Dist (ft) | 250 | | 225 | 250 | | | | 225 | |
| Storage Blk Time (%) | 0 | 9 | 0 | 1 | 7 | | | | |
| Queuing Penalty (veh) | 0 | 5 | 1 | 7 | 15 | | | | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | WB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | TR | L | T | LTR | LTR |
| Maximum Queue (ft) | 21 | 88 | 4 | 156 | 17 |
| Average Queue (ft) | 2 | 34 | 0 | 58 | 4 |
| 95th Queue (ft) | 11 | 71 | 4 | 118 | 14 |
| Link Distance (ft) | 2032 | | 1469 | 736 | 278 |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | 225 | | | |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | L |
| Maximum Queue (ft) | 28 | 42 | 46 | 4 | 30 |
| Average Queue (ft) | 6 | 20 | 13 | 0 | 6 |
| 95th Queue (ft) | 23 | 37 | 34 | 3 | 23 |
| Link Distance (ft) | 247 | 762 | | | |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | 190 |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | WB | SB | SB |
|---|---|---|---|---|
| Directions Served | L | R | L | R |
| Maximum Queue (ft) | 27 | 5 | 71 | 31 |
| Average Queue (ft) | 3 | 0 | 34 | 6 |
| 95th Queue (ft) | 16 | 5 | 60 | 26 |
| Link Distance (ft) | | | 375 | |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | 225 | 300 | | 150 |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

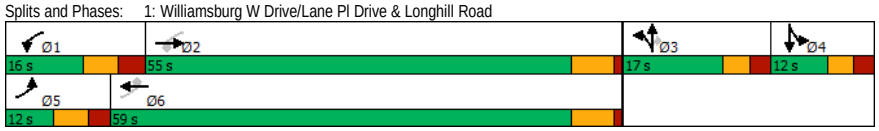
## Network Summary

Network wide Queuing Penalty: 28

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 19 | 809 | 37 | 223 | 1075 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| Future Volume (vph) | 19 | 809 | 37 | 223 | 1075 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.947 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.971 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | 0 | 1687 | 1615 | 0 | 1636 | 0 |
| Flt Permitted | 0.069 | | | 0.106 | | | | 0.950 | | | 0.971 | |
| Satd. Flow (perm) | 131 | 1863 | 1615 | 192 | 1827 | 1380 | 0 | 1687 | 1615 | 0 | 1636 | 0 |
| Satd. Flow (RTOR) | | | 158 | | | 158 | | | 164 | | 164 | |
| Adj. Flow (vph) | 20 | 852 | 39 | 235 | 1132 | 44 | 57 | 0 | 155 | 26 | 0 | 17 |
| Lane Group Flow (vph) | 20 | 852 | 39 | 235 | 1132 | 44 | 0 | 57 | 155 | 0 | 43 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 12.0 | 55.0 | 55.0 | 16.0 | 59.0 | 59.0 | 17.0 | 17.0 | 17.0 | 12.0 | 12.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 59.2 | 45.7 | 45.7 | 53.9 | 57.8 | 57.8 | | 8.6 | 8.6 | | 6.6 | |
| Actuated g/C Ratio | 0.67 | 0.51 | 0.51 | 0.61 | 0.65 | 0.65 | | 0.10 | 0.10 | | 0.07 | |
| v/c Ratio | 0.11 | 0.89 | 0.04 | 0.86 | 0.95 | 0.05 | | 0.35 | 0.51 | | 0.16 | |
| Control Delay | 7.4 | 34.2 | 0.1 | 49.7 | 36.6 | 0.1 | | 46.6 | 12.4 | | 1.2 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 7.4 | 34.2 | 0.1 | 49.7 | 36.6 | 0.1 | | 46.6 | 12.4 | | 1.2 | |
| LOS | A | C | A | D | D | A | | D | B | | A | |
| Approach Delay | | 32.1 | | | 37.7 | | | 21.6 | | | 1.2 | |
| Approach LOS | | C | | | D | | | C | | | A | |

| Intersection Summary | |
|---|---|
| Cycle Length: 100 | |
| Actuated Cycle Length: 88.9 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.95 | |
| Intersection Signal Delay: 33.8 | Intersection LOS: C |
| Intersection Capacity Utilization 84.8% | ICU Level of Service E |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 19 | 809 | 37 | 223 | 1075 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| Future Volume (vph) | 19 | 809 | 37 | 223 | 1075 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | | 1687 | 1615 | | 1635 | |
| Flt Permitted | 0.07 | 1.00 | 1.00 | 0.11 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (perm) | 131 | 1863 | 1615 | 192 | 1827 | 1380 | | 1687 | 1615 | | 1635 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 20 | 852 | 39 | 235 | 1132 | 44 | 57 | 0 | 155 | 26 | 0 | 17 |
| RTOR Reduction (vph) | 0 | 0 | 19 | 0 | 0 | 17 | 0 | 0 | 141 | 0 | 41 | 0 |
| Lane Group Flow (vph) | 20 | 852 | 20 | 235 | 1132 | 27 | 0 | 57 | 14 | 0 | 2 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 59.7 | 50.0 | 50.0 | 59.2 | 57.8 | 57.8 | | 8.6 | 8.6 | | 3.5 | |
| Effective Green, g (s) | 59.7 | 50.0 | 50.0 | 59.2 | 57.8 | 57.8 | | 8.6 | 8.6 | | 3.5 | |
| Actuated g/C Ratio | 0.63 | 0.52 | 0.52 | 0.62 | 0.61 | 0.61 | | 0.09 | 0.09 | | 0.04 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 115 | 977 | 847 | 266 | 1108 | 836 | | 152 | 145 | | 60 | |
| v/s Ratio Prot | 0.00 | 0.46 | | c0.09 | c0.62 | | | c0.03 | | | c0.00 | |
| v/s Ratio Perm | 0.10 | | 0.01 | 0.46 | | 0.02 | | | 0.01 | | | |
| v/c Ratio | 0.17 | 0.87 | 0.02 | 0.88 | 1.02 | 0.03 | | 0.38 | 0.10 | | 0.03 | |
| Uniform Delay, d1 | 22.1 | 19.8 | 10.9 | 21.9 | 18.8 | 7.5 | | 40.8 | 39.8 | | 44.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.3 | 9.3 | 0.0 | 26.7 | 32.6 | 0.0 | | 1.6 | 0.3 | | 0.2 | |
| Delay (s) | 22.3 | 29.2 | 10.9 | 48.6 | 51.4 | 7.6 | | 42.4 | 40.1 | | 44.4 | |
| Level of Service | C | C | B | D | D | A | | D | D | | D | |
| Approach Delay (s) | | 28.3 | | | 49.5 | | | 40.7 | | | 44.4 | |
| Approach LOS | | C | | | D | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 41.2 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.95 | | |
| Actuated Cycle Length (s) | 95.3 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 84.8% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 377 | 59 | 215 | 316 | 2 | 50 | 3 | 135 | 4 | 0 | 5 |
| Future Volume (vph) | 0 | 377 | 59 | 215 | 316 | 2 | 50 | 3 | 135 | 4 | 0 | 5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.980 | | | | 0.850 | | 0.903 | | | 0.925 | |
| Flt Protected | | | | 0.950 | | | | 0.987 | | | 0.978 | |
| Satd. Flow (prot) | 1900 | 1771 | 0 | 1752 | 1776 | 1615 | 0 | 1650 | 0 | 0 | 1719 | 0 |
| Flt Permitted | | | | 0.950 | | | | 0.987 | | | 0.978 | |
| Satd. Flow (perm) | 1900 | 1771 | 0 | 1752 | 1776 | 1615 | 0 | 1650 | 0 | 0 | 1719 | 0 |
| Adj. Flow (vph) | 0 | 401 | 63 | 229 | 336 | 2 | 53 | 3 | 144 | 4 | 0 | 5 |
| Lane Group Flow (vph) | 0 | 464 | 0 | 229 | 336 | 2 | 0 | 200 | 0 | 0 | 9 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 57.8% | ICU Level of Service B | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 377 | 59 | 215 | 316 | 2 | 50 | 3 | 135 | 4 | 0 | 5 |
| Future Volume (Veh/h) | 0 | 377 | 59 | 215 | 316 | 2 | 50 | 3 | 135 | 4 | 0 | 5 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 401 | 63 | 229 | 336 | 2 | 53 | 3 | 144 | 4 | 0 | 5 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 338 | | | 464 | | | 1232 | 1228 | 432 | 1340 | 1258 | 336 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 338 | | | 464 | | | 1232 | 1228 | 432 | 1340 | 1258 | 336 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 79 | | | 57 | 98 | 77 | 95 | 100 | 99 |
| cM capacity (veh/h) | 1232 | | | 1092 | | | 124 | 142 | 627 | 83 | 136 | 711 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 0 | 464 | 229 | 336 | 2 | 200 | 9 |
| Volume Left | 0 | 0 | 229 | 0 | 0 | 53 | 4 |
| Volume Right | 0 | 63 | 0 | 0 | 2 | 144 | 5 |
| cSH | 1700 | 1700 | 1092 | 1700 | 1700 | 294 | 163 |
| Volume to Capacity | 0.00 | 0.27 | 0.21 | 0.20 | 0.00 | 0.68 | 0.06 |
| Queue Length 95th (ft) | 0 | 0 | 20 | 0 | 0 | 115 | 4 |
| Control Delay (s) | 0.0 | 0.0 | 9.2 | 0.0 | 0.0 | 39.7 | 28.3 |
| Lane LOS | | | A | | | E | D |
| Approach Delay (s) | 0.0 | | 3.7 | | | 39.7 | 28.3 |
| Approach LOS | | | | | | E | D |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.3 | | |
| Intersection Capacity Utilization | 57.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 16 | 1 | 6 | 56 | 0 | 30 | 10 | 331 | 74 | 25 | 273 | 22 |
| Future Volume (vph) | 16 | 1 | 6 | 56 | 0 | 30 | 10 | 331 | 74 | 25 | 273 | 22 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.966 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.966 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1773 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.966 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1773 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 17 | 1 | 6 | 59 | 0 | 32 | 11 | 348 | 78 | 26 | 287 | 23 |
| Lane Group Flow (vph) | 0 | 24 | 0 | 59 | 32 | 0 | 11 | 348 | 78 | 26 | 287 | 23 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 35.4% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 16 | 1 | 6 | 56 | 0 | 30 | 10 | 331 | 74 | 25 | 273 | 22 |
| Future Volume (Veh/h) | 16 | 1 | 6 | 56 | 0 | 30 | 10 | 331 | 74 | 25 | 273 | 22 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 17 | 1 | 6 | 59 | 0 | 32 | 11 | 348 | 78 | 26 | 287 | 23 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 741 | 787 | 287 | 716 | 732 | 348 | 310 | | | 426 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 741 | 787 | 287 | 716 | 732 | 348 | 310 | | | 426 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 95 | 100 | 99 | 82 | 100 | 95 | 99 | | | 98 | | |
| cM capacity (veh/h) | 311 | 315 | 757 | 331 | 339 | 691 | 1262 | | | 1062 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 24 | 59 | 32 | 11 | 348 | 78 | 26 | 287 | 23 |
| Volume Left | 17 | 59 | 0 | 11 | 0 | 0 | 26 | 0 | 0 |
| Volume Right | 6 | 0 | 32 | 0 | 0 | 78 | 0 | 0 | 23 |
| cSH | 365 | 331 | 691 | 1262 | 1700 | 1700 | 1062 | 1700 | 1700 |
| Volume to Capacity | 0.07 | 0.18 | 0.05 | 0.01 | 0.20 | 0.05 | 0.02 | 0.17 | 0.01 |
| Queue Length 95th (ft) | 5 | 16 | 4 | 1 | 0 | 0 | 2 | 0 | 0 |
| Control Delay (s) | 15.6 | 18.2 | 10.5 | 7.9 | 0.0 | 0.0 | 8.5 | 0.0 | 0.0 |
| Lane LOS | C | C | B | A | | | A | | |
| Approach Delay (s) | 15.6 | 15.5 | | 0.2 | | | 0.7 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.4 | | |
| Intersection Capacity Utilization | 35.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 8 | 164 | 23 | 59 | 278 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| Future Volume (vph) | 8 | 164 | 23 | 59 | 278 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.982 | | | 0.954 | | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1814 | 0 | 1770 | 1653 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1814 | 0 | 1770 | 1653 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Adj. Flow (vph) | 8 | 171 | 24 | 61 | 290 | 127 | 24 | 0 | 58 | 74 | 0 | 7 |
| Lane Group Flow (vph) | 8 | 195 | 0 | 61 | 417 | 0 | 0 | 24 | 58 | 0 | 74 | 7 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 46.0% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 8 | 164 | 23 | 59 | 278 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| Future Volume (Veh/h) | 8 | 164 | 23 | 59 | 278 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 8 | 171 | 24 | 61 | 290 | 127 | 24 | 0 | 58 | 74 | 0 | 7 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 6 | | | 6 |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 417 | | | 195 | | | 614 | 738 | 183 | 692 | 686 | 354 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 417 | | | 195 | | | 614 | 738 | 183 | 692 | 686 | 354 |
| tC, single (s) | 4.3 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 96 | | | 94 | 100 | 93 | 77 | 100 | 99 |
| cM capacity (veh/h) | 1052 | | | 1378 | | | 384 | 328 | 859 | 324 | 351 | 695 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 8 | 195 | 61 | 417 | 82 | 81 |
| Volume Left | 8 | 0 | 61 | 0 | 24 | 74 |
| Volume Right | 0 | 24 | 0 | 127 | 58 | 7 |
| cSH | 1052 | 1700 | 1378 | 1700 | 1215 | 354 |
| Volume to Capacity | 0.01 | 0.11 | 0.04 | 0.25 | 0.07 | 0.23 |
| Queue Length 95th (ft) | 1 | 0 | 3 | 0 | 5 | 22 |
| Control Delay (s) | 8.4 | 0.0 | 7.7 | 0.0 | 11.1 | 18.6 |
| Lane LOS | A | | A | | B | C |
| Approach Delay (s) | 0.3 | | 1.0 | | 11.1 | 18.6 |
| Approach LOS | | | | | B | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.5 | | |
| Intersection Capacity Utilization | 46.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | R | L | T | R | LT | R | LTR |
| Maximum Queue (ft) | 167 | 562 | 224 | 250 | 772 | 777 | 115 | 83 | 88 |
| Average Queue (ft) | 19 | 251 | 25 | 145 | 397 | 204 | 45 | 45 | 30 |
| 95th Queue (ft) | 85 | 474 | 120 | 271 | 843 | 748 | 93 | 74 | 68 |
| Link Distance (ft) | | 1007 | | | 741 | 741 | 405 | | 475 |
| Upstream Blk Time (%) | | | | | 13 | 7 | | | |
| Queuing Penalty (veh) | | | | | 0 | 0 | | | |
| Storage Bay Dist (ft) | 250 | | 225 | 250 | | | | 225 | |
| Storage Blk Time (%) | 0 | 10 | 0 | 1 | 9 | | | | |
| Queuing Penalty (veh) | 0 | 6 | 1 | 6 | 19 | | | | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | WB | NB | SB |
|---|---|---|---|---|
| Directions Served | TR | L | LTR | LTR |
| Maximum Queue (ft) | 33 | 105 | 246 | 22 |
| Average Queue (ft) | 3 | 39 | 84 | 4 |
| 95th Queue (ft) | 18 | 79 | 193 | 16 |
| Link Distance (ft) | 2032 | | 736 | 278 |
| Upstream Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |
| Storage Bay Dist (ft) | | 225 | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | L |
| Maximum Queue (ft) | 40 | 56 | 46 | 16 | 50 |
| Average Queue (ft) | 14 | 24 | 13 | 1 | 6 |
| 95th Queue (ft) | 37 | 47 | 32 | 8 | 30 |
| Link Distance (ft) | 247 | 762 | | | |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | 190 |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | EB | WB | WB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|---|
| Directions Served | L | TR | L | TR | LT | R | LT | R |
| Maximum Queue (ft) | 35 | 1 | 34 | 4 | 57 | 68 | 76 | 33 |
| Average Queue (ft) | 2 | 0 | 7 | 0 | 18 | 31 | 34 | 6 |
| 95th Queue (ft) | 16 | 0 | 26 | 3 | 47 | 55 | 61 | 25 |
| Link Distance (ft) | | 1230 | | 492 | 372 | | 374 | |
| Upstream Blk Time (%) | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | |
| Storage Bay Dist (ft) | 225 | | 225 | | | 150 | | 150 |
| Storage Blk Time (%) | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | |

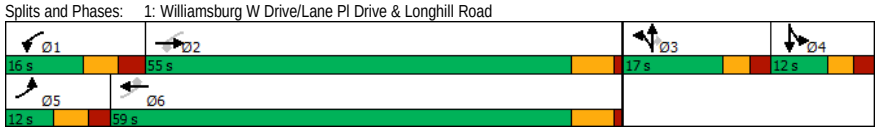
## Network Summary

Network wide Queuing Penalty: 32

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 19 | 817 | 37 | 223 | 1088 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| Future Volume (vph) | 19 | 817 | 37 | 223 | 1088 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.947 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.971 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | 0 | 1687 | 1615 | 0 | 1636 | 0 |
| Flt Permitted | 0.069 | | | 0.101 | | | | 0.950 | | | 0.971 | |
| Satd. Flow (perm) | 131 | 1863 | 1615 | 183 | 1827 | 1380 | 0 | 1687 | 1615 | 0 | 1636 | 0 |
| Satd. Flow (RTOR) | | | 158 | | | 158 | | | 164 | | 164 | |
| Adj. Flow (vph) | 20 | 860 | 39 | 235 | 1145 | 44 | 57 | 0 | 155 | 26 | 0 | 17 |
| Lane Group Flow (vph) | 20 | 860 | 39 | 235 | 1145 | 44 | 0 | 57 | 155 | 0 | 43 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 12.0 | 55.0 | 55.0 | 16.0 | 59.0 | 59.0 | 17.0 | 17.0 | 17.0 | 12.0 | 12.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 59.5 | 46.0 | 46.0 | 54.2 | 58.1 | 58.1 | | 8.6 | 8.6 | | 6.6 | |
| Actuated g/C Ratio | 0.67 | 0.52 | 0.52 | 0.61 | 0.65 | 0.65 | | 0.10 | 0.10 | | 0.07 | |
| v/c Ratio | 0.11 | 0.90 | 0.04 | 0.88 | 0.96 | 0.05 | | 0.35 | 0.51 | | 0.16 | |
| Control Delay | 7.4 | 34.7 | 0.1 | 53.4 | 38.3 | 0.1 | | 46.8 | 12.5 | | 1.2 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 7.4 | 34.7 | 0.1 | 53.4 | 38.3 | 0.1 | | 46.8 | 12.5 | | 1.2 | |
| LOS | A | C | A | D | D | A | | D | B | | A | |
| Approach Delay | | 32.7 | | | 39.6 | | | 21.7 | | | 1.2 | |
| Approach LOS | | C | | | D | | | C | | | A | |

| Intersection Summary | |
|---|---|
| Cycle Length: 100 | |
| Actuated Cycle Length: 89.2 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.96 | |
| Intersection Signal Delay: 35.1 | Intersection LOS: D |
| Intersection Capacity Utilization 85.5% | ICU Level of Service E |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 19 | 817 | 37 | 223 | 1088 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| Future Volume (vph) | 19 | 817 | 37 | 223 | 1088 | 42 | 54 | 0 | 147 | 25 | 0 | 16 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (prot) | 1805 | 1863 | 1615 | 1719 | 1827 | 1380 | | 1687 | 1615 | | 1635 | |
| Flt Permitted | 0.07 | 1.00 | 1.00 | 0.10 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (perm) | 131 | 1863 | 1615 | 184 | 1827 | 1380 | | 1687 | 1615 | | 1635 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 20 | 860 | 39 | 235 | 1145 | 44 | 57 | 0 | 155 | 26 | 0 | 17 |
| RTOR Reduction (vph) | 0 | 0 | 18 | 0 | 0 | 17 | 0 | 0 | 141 | 0 | 41 | 0 |
| Lane Group Flow (vph) | 20 | 860 | 21 | 235 | 1145 | 27 | 0 | 57 | 14 | 0 | 2 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 60.0 | 50.3 | 50.3 | 59.5 | 58.1 | 58.1 | | 8.6 | 8.6 | | 3.5 | |
| Effective Green, g (s) | 60.0 | 50.3 | 50.3 | 59.5 | 58.1 | 58.1 | | 8.6 | 8.6 | | 3.5 | |
| Actuated g/C Ratio | 0.63 | 0.53 | 0.53 | 0.62 | 0.61 | 0.61 | | 0.09 | 0.09 | | 0.04 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 115 | 980 | 849 | 262 | 1110 | 838 | | 151 | 145 | | 59 | |
| v/s Ratio Prot | 0.00 | 0.46 | | c0.09 | c0.63 | | | c0.03 | | | c0.00 | |
| v/s Ratio Perm | 0.11 | | 0.01 | 0.47 | | 0.02 | | | 0.01 | | | |
| v/c Ratio | 0.17 | 0.88 | 0.02 | 0.90 | 1.03 | 0.03 | | 0.38 | 0.10 | | 0.03 | |
| Uniform Delay, d1 | 22.2 | 19.9 | 10.9 | 23.0 | 18.7 | 7.5 | | 41.0 | 39.9 | | 44.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.3 | 9.7 | 0.0 | 29.4 | 35.4 | 0.0 | | 1.6 | 0.3 | | 0.2 | |
| Delay (s) | 22.4 | 29.6 | 10.9 | 52.4 | 54.2 | 7.5 | | 42.6 | 40.2 | | 44.6 | |
| Level of Service | C | C | B | D | D | A | | D | D | | D | |
| Approach Delay (s) | | 28.7 | | | 52.4 | | | 40.9 | | | 44.6 | |
| Approach LOS | | C | | | D | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 43.0 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 0.96 | | |
| Actuated Cycle Length (s) | 95.6 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 85.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 377 | 63 | 228 | 316 | 2 | 52 | 3 | 143 | 4 | 0 | 5 |
| Future Volume (vph) | 0 | 377 | 63 | 228 | 316 | 2 | 52 | 3 | 143 | 4 | 0 | 5 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.925 | |
| Flt Protected | | | | 0.950 | | | | 0.955 | | | 0.978 | |
| Satd. Flow (prot) | 1900 | 1810 | 1524 | 1752 | 1776 | 1615 | 0 | 1657 | 1615 | 0 | 1719 | 0 |
| Flt Permitted | | | | 0.950 | | | | 0.955 | | | 0.978 | |
| Satd. Flow (perm) | 1900 | 1810 | 1524 | 1752 | 1776 | 1615 | 0 | 1657 | 1615 | 0 | 1719 | 0 |
| Adj. Flow (vph) | 0 | 401 | 67 | 243 | 336 | 2 | 55 | 3 | 152 | 4 | 0 | 5 |
| Lane Group Flow (vph) | 0 | 401 | 67 | 243 | 336 | 2 | 0 | 58 | 152 | 0 | 9 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 48.2% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 377 | 63 | 228 | 316 | 2 | 52 | 3 | 143 | 4 | 0 | 5 |
| Future Volume (Veh/h) | 0 | 377 | 63 | 228 | 316 | 2 | 52 | 3 | 143 | 4 | 0 | 5 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 401 | 67 | 243 | 336 | 2 | 55 | 3 | 152 | 4 | 0 | 5 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 7 | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 338 | | | 468 | | | 1228 | 1225 | 401 | 1300 | 1290 | 336 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 338 | | | 468 | | | 1228 | 1225 | 401 | 1300 | 1290 | 336 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 78 | | | 55 | 98 | 77 | 95 | 100 | 99 |
| cM capacity (veh/h) | 1232 | | | 1088 | | | 123 | 140 | 653 | 87 | 128 | 711 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 0 | 401 | 67 | 243 | 336 | 2 | 210 | 9 |
| Volume Left | 0 | 0 | 0 | 243 | 0 | 0 | 55 | 4 |
| Volume Right | 0 | 0 | 67 | 0 | 0 | 2 | 152 | 5 |
| cSH | 1700 | 1700 | 1700 | 1088 | 1700 | 1700 | 447 | 170 |
| Volume to Capacity | 0.00 | 0.24 | 0.04 | 0.22 | 0.20 | 0.00 | 0.47 | 0.05 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 21 | 0 | 0 | 61 | 4 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 9.3 | 0.0 | 0.0 | 24.7 | 27.3 |
| Lane LOS | | | | A | | | C | D |
| Approach Delay (s) | 0.0 | | | 3.9 | | | 24.7 | 27.3 |
| Approach LOS | | | | | | | C | D |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 6.1 | | |
| Intersection Capacity Utilization | 48.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 16 | 1 | 6 | 60 | 0 | 30 | 10 | 331 | 81 | 25 | 273 | 22 |
| Future Volume (vph) | 16 | 1 | 6 | 60 | 0 | 30 | 10 | 331 | 81 | 25 | 273 | 22 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.966 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.966 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1773 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.966 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1773 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 17 | 1 | 6 | 63 | 0 | 32 | 11 | 348 | 85 | 26 | 287 | 23 |
| Lane Group Flow (vph) | 0 | 24 | 0 | 63 | 32 | 0 | 11 | 348 | 85 | 26 | 287 | 23 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 35.4% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 16 | 1 | 6 | 60 | 0 | 30 | 10 | 331 | 81 | 25 | 273 | 22 |
| Future Volume (Veh/h) | 16 | 1 | 6 | 60 | 0 | 30 | 10 | 331 | 81 | 25 | 273 | 22 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 17 | 1 | 6 | 63 | 0 | 32 | 11 | 348 | 85 | 26 | 287 | 23 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 741 | 794 | 287 | 716 | 732 | 348 | 310 | | | 433 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 741 | 794 | 287 | 716 | 732 | 348 | 310 | | | 433 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 95 | 100 | 99 | 81 | 100 | 95 | 99 | | | 98 | | |
| cM capacity (veh/h) | 311 | 312 | 757 | 331 | 339 | 691 | 1262 | | | 1056 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 24 | 63 | 32 | 11 | 348 | 85 | 26 | 287 | 23 |
| Volume Left | 17 | 63 | 0 | 11 | 0 | 0 | 26 | 0 | 0 |
| Volume Right | 6 | 0 | 32 | 0 | 0 | 85 | 0 | 0 | 23 |
| cSH | 365 | 331 | 691 | 1262 | 1700 | 1700 | 1056 | 1700 | 1700 |
| Volume to Capacity | 0.07 | 0.19 | 0.05 | 0.01 | 0.20 | 0.05 | 0.02 | 0.17 | 0.01 |
| Queue Length 95th (ft) | 5 | 17 | 4 | 1 | 0 | 0 | 2 | 0 | 0 |
| Control Delay (s) | 15.6 | 18.4 | 10.5 | 7.9 | 0.0 | 0.0 | 8.5 | 0.0 | 0.0 |
| Lane LOS | C | C | B | A | | | A | | |
| Approach Delay (s) | 15.6 | 15.7 | | 0.2 | | | 0.7 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.4 | | |
| Intersection Capacity Utilization | 35.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 8 | 168 | 23 | 59 | 285 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| Future Volume (vph) | 8 | 168 | 23 | 59 | 285 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.982 | | | 0.955 | | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1814 | 0 | 1770 | 1654 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1814 | 0 | 1770 | 1654 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Adj. Flow (vph) | 8 | 175 | 24 | 61 | 297 | 127 | 24 | 0 | 58 | 74 | 0 | 7 |
| Lane Group Flow (vph) | 8 | 199 | 0 | 61 | 424 | 0 | 0 | 24 | 58 | 0 | 74 | 7 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 46.4% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 8 | 168 | 23 | 59 | 285 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| Future Volume (Veh/h) | 8 | 168 | 23 | 59 | 285 | 122 | 23 | 0 | 56 | 71 | 0 | 7 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 8 | 175 | 24 | 61 | 297 | 127 | 24 | 0 | 58 | 74 | 0 | 7 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 6 | | | 6 |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 424 | | | 199 | | | 626 | 749 | 187 | 702 | 698 | 360 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 424 | | | 199 | | | 626 | 749 | 187 | 702 | 698 | 360 |
| tC, single (s) | 4.3 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 96 | | | 94 | 100 | 93 | 77 | 100 | 99 |
| cM capacity (veh/h) | 1045 | | | 1373 | | | 377 | 323 | 855 | 318 | 346 | 689 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 8 | 199 | 61 | 424 | 82 | 81 |
| Volume Left | 8 | 0 | 61 | 0 | 24 | 74 |
| Volume Right | 0 | 24 | 0 | 127 | 58 | 7 |
| cSH | 1045 | 1700 | 1373 | 1700 | 1209 | 348 |
| Volume to Capacity | 0.01 | 0.12 | 0.04 | 0.25 | 0.07 | 0.23 |
| Queue Length 95th (ft) | 1 | 0 | 3 | 0 | 5 | 22 |
| Control Delay (s) | 8.5 | 0.0 | 7.7 | 0.0 | 11.2 | 18.9 |
| Lane LOS | A | | A | | B | C |
| Approach Delay (s) | 0.3 | | 1.0 | | 11.2 | 18.9 |
| Approach LOS | | | | | B | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.5 | | |
| Intersection Capacity Utilization | 46.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | R | L | T | R | LT | R | LTR |
| Maximum Queue (ft) | 209 | 553 | 204 | 250 | 784 | 777 | 140 | 87 | 83 |
| Average Queue (ft) | 23 | 266 | 23 | 144 | 454 | 253 | 45 | 47 | 28 |
| 95th Queue (ft) | 105 | 491 | 111 | 270 | 929 | 835 | 98 | 74 | 63 |
| Link Distance (ft) | | 1007 | | | 741 | 741 | 405 | | 475 |
| Upstream Blk Time (%) | | | | | 18 | 10 | | | |
| Queuing Penalty (veh) | | | | | 0 | 0 | | | |
| Storage Bay Dist (ft) | 250 | | 225 | 250 | | | | 225 | |
| Storage Blk Time (%) | 0 | 12 | 0 | 1 | 10 | | | | |
| Queuing Penalty (veh) | 0 | 7 | 0 | 8 | 22 | | | | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | EB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|
| Directions Served | T | R | L | LT | R | LTR |
| Maximum Queue (ft) | 2 | 17 | 125 | 155 | 106 | 26 |
| Average Queue (ft) | 0 | 1 | 53 | 45 | 34 | 5 |
| 95th Queue (ft) | 2 | 9 | 98 | 110 | 74 | 18 |
| Link Distance (ft) | 2030 | | | 723 | | 278 |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | 300 | 225 | | 175 | |
| Storage Blk Time (%) | | | | 0 | 0 | |
| Queuing Penalty (veh) | | | | 0 | 0 | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | L |
| Maximum Queue (ft) | 39 | 58 | 47 | 16 | 53 |
| Average Queue (ft) | 15 | 24 | 14 | 1 | 6 |
| 95th Queue (ft) | 37 | 49 | 33 | 9 | 29 |
| Link Distance (ft) | 247 | 762 | | | |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | 190 |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | EB | WB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|
| Directions Served | L | TR | L | LT | R | LT | R |
| Maximum Queue (ft) | 33 | 1 | 34 | 49 | 59 | 87 | 32 |
| Average Queue (ft) | 3 | 0 | 8 | 18 | 30 | 35 | 6 |
| 95th Queue (ft) | 17 | 0 | 28 | 46 | 52 | 67 | 26 |
| Link Distance (ft) | | 1230 | | 372 | | 374 | |
| Upstream Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |
| Storage Bay Dist (ft) | 225 | | 225 | | 150 | | 150 |
| Storage Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |

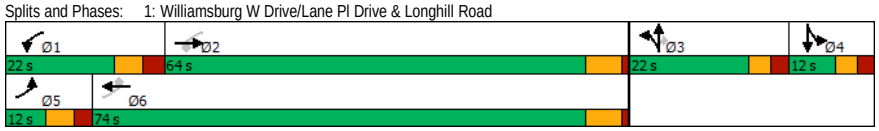
## Network Summary

Network wide Queuing Penalty: 37

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 21 | 909 | 42 | 251 | 1209 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| Future Volume (vph) | 21 | 909 | 42 | 251 | 1209 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.947 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.971 | |
| Satd. Flow (prot) | 1805 | 3539 | 1615 | 1719 | 3471 | 1380 | 0 | 1687 | 1615 | 0 | 1636 | 0 |
| Flt Permitted | 0.151 | | | 0.214 | | | | 0.950 | | | 0.971 | |
| Satd. Flow (perm) | 287 | 3539 | 1615 | 387 | 3471 | 1380 | 0 | 1687 | 1615 | 0 | 1636 | 0 |
| Satd. Flow (RTOR) | | | 195 | | | 132 | | | 200 | | 200 | |
| Adj. Flow (vph) | 22 | 957 | 44 | 264 | 1273 | 49 | 64 | 0 | 174 | 29 | 0 | 19 |
| Lane Group Flow (vph) | 22 | 957 | 44 | 264 | 1273 | 49 | 0 | 64 | 174 | 0 | 48 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 12.0 | 64.0 | 64.0 | 22.0 | 74.0 | 74.0 | 22.0 | 22.0 | 22.0 | 12.0 | 12.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 54.4 | 38.6 | 38.6 | 48.2 | 53.4 | 53.4 | | 9.6 | 9.6 | | 7.1 | |
| Actuated g/C Ratio | 0.64 | 0.45 | 0.45 | 0.57 | 0.63 | 0.63 | | 0.11 | 0.11 | | 0.08 | |
| v/c Ratio | 0.08 | 0.60 | 0.05 | 0.68 | 0.59 | 0.05 | | 0.34 | 0.48 | | 0.15 | |
| Control Delay | 6.8 | 19.6 | 0.1 | 18.5 | 12.7 | 0.1 | | 47.4 | 9.4 | | 1.0 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 6.8 | 19.6 | 0.1 | 18.5 | 12.7 | 0.1 | | 47.4 | 9.4 | | 1.0 | |
| LOS | A | B | A | B | B | A | | D | A | | A | |
| Approach Delay | | 18.5 | | | 13.3 | | | 19.6 | | | 1.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 85.2 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.68 | |
| Intersection Signal Delay: 15.4 | Intersection LOS: B |
| Intersection Capacity Utilization 63.8% | ICU Level of Service B |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 21 | 909 | 42 | 251 | 1209 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| Future Volume (vph) | 21 | 909 | 42 | 251 | 1209 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (prot) | 1805 | 3539 | 1615 | 1719 | 3471 | 1380 | | 1687 | 1615 | | 1635 | |
| Flt Permitted | 0.15 | 1.00 | 1.00 | 0.21 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (perm) | 286 | 3539 | 1615 | 387 | 3471 | 1380 | | 1687 | 1615 | | 1635 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 22 | 957 | 44 | 264 | 1273 | 49 | 64 | 0 | 174 | 29 | 0 | 19 |
| RTOR Reduction (vph) | 0 | 0 | 23 | 0 | 0 | 20 | 0 | 0 | 156 | 0 | 46 | 0 |
| Lane Group Flow (vph) | 22 | 957 | 21 | 264 | 1273 | 29 | 0 | 64 | 18 | 0 | 2 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 55.0 | 43.8 | 43.8 | 54.5 | 53.4 | 53.4 | | 9.6 | 9.6 | | 3.3 | |
| Effective Green, g (s) | 55.0 | 43.8 | 43.8 | 54.5 | 53.4 | 53.4 | | 9.6 | 9.6 | | 3.3 | |
| Actuated g/C Ratio | 0.60 | 0.48 | 0.48 | 0.60 | 0.58 | 0.58 | | 0.11 | 0.11 | | 0.04 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 198 | 1695 | 773 | 386 | 2027 | 806 | | 177 | 169 | | 59 | |
| v/s Ratio Prot | 0.00 | 0.27 | | c0.08 | c0.37 | | | c0.04 | | | c0.00 | |
| v/s Ratio Perm | 0.06 | | 0.01 | c0.33 | | 0.02 | | | 0.01 | | | |
| v/c Ratio | 0.11 | 0.56 | 0.03 | 0.68 | 0.63 | 0.04 | | 0.36 | 0.11 | | 0.03 | |
| Uniform Delay, d1 | 8.9 | 17.0 | 12.6 | 10.5 | 12.5 | 8.1 | | 38.0 | 37.0 | | 42.5 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.1 | 0.7 | 0.0 | 4.0 | 0.9 | 0.0 | | 1.3 | 0.3 | | 0.2 | |
| Delay (s) | 9.0 | 17.7 | 12.6 | 14.4 | 13.3 | 8.1 | | 39.3 | 37.3 | | 42.7 | |
| Level of Service | A | B | B | B | B | A | | D | D | | D | |
| Approach Delay (s) | | 17.3 | | | 13.4 | | | 37.8 | | | 42.7 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 91.4 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 63.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 424 | 66 | 242 | 354 | 2 | 56 | 4 | 152 | 5 | 0 | 6 |
| Future Volume (vph) | 0 | 424 | 66 | 242 | 354 | 2 | 56 | 4 | 152 | 5 | 0 | 6 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.980 | | | | 0.850 | | 0.903 | | | 0.926 | |
| Flt Protected | | | | 0.950 | | | | 0.987 | | | 0.978 | |
| Satd. Flow (prot) | 1900 | 1771 | 0 | 1752 | 1776 | 1615 | 0 | 1650 | 0 | 0 | 1721 | 0 |
| Flt Permitted | | | | 0.950 | | | | 0.987 | | | 0.978 | |
| Satd. Flow (perm) | 1900 | 1771 | 0 | 1752 | 1776 | 1615 | 0 | 1650 | 0 | 0 | 1721 | 0 |
| Adj. Flow (vph) | 0 | 451 | 70 | 257 | 377 | 2 | 60 | 4 | 162 | 5 | 0 | 6 |
| Lane Group Flow (vph) | 0 | 521 | 0 | 257 | 377 | 2 | 0 | 226 | 0 | 0 | 11 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 63.7% | ICU Level of Service B | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 424 | 66 | 242 | 354 | 2 | 56 | 4 | 152 | 5 | 0 | 6 |
| Future Volume (Veh/h) | 0 | 424 | 66 | 242 | 354 | 2 | 56 | 4 | 152 | 5 | 0 | 6 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 451 | 70 | 257 | 377 | 2 | 60 | 4 | 162 | 5 | 0 | 6 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 379 | | | 521 | | | 1383 | 1379 | 486 | 1506 | 1412 | 377 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 379 | | | 521 | | | 1383 | 1379 | 486 | 1506 | 1412 | 377 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 75 | | | 36 | 96 | 72 | 91 | 100 | 99 |
| cM capacity (veh/h) | 1191 | | | 1040 | | | 93 | 110 | 585 | 57 | 105 | 674 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|
| Volume Total | 0 | 521 | 257 | 377 | 2 | 226 | 11 |
| Volume Left | 0 | 0 | 257 | 0 | 0 | 60 | 5 |
| Volume Right | 0 | 70 | 0 | 0 | 2 | 162 | 6 |
| cSH | 1700 | 1700 | 1040 | 1700 | 1700 | 236 | 114 |
| Volume to Capacity | 0.00 | 0.31 | 0.25 | 0.22 | 0.00 | 0.96 | 0.10 |
| Queue Length 95th (ft) | 0 | 0 | 24 | 0 | 0 | 215 | 8 |
| Control Delay (s) | 0.0 | 0.0 | 9.6 | 0.0 | 0.0 | 92.0 | 39.8 |
| Lane LOS | | | A | | | F | E |
| Approach Delay (s) | 0.0 | | 3.9 | | | 92.0 | 39.8 |
| Approach LOS | | | | | | F | E |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 17.0 | | |
| Intersection Capacity Utilization | 63.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 17 | 1 | 6 | 64 | 0 | 35 | 10 | 383 | 86 | 29 | 314 | 22 |
| Future Volume (vph) | 17 | 1 | 6 | 64 | 0 | 35 | 10 | 383 | 86 | 29 | 314 | 22 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.968 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.965 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1775 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.965 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1775 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 18 | 1 | 6 | 67 | 0 | 37 | 11 | 403 | 91 | 31 | 331 | 23 |
| Lane Group Flow (vph) | 0 | 25 | 0 | 67 | 37 | 0 | 11 | 403 | 91 | 31 | 331 | 23 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 38.8% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 17 | 1 | 6 | 64 | 0 | 35 | 10 | 383 | 86 | 29 | 314 | 22 |
| Future Volume (Veh/h) | 17 | 1 | 6 | 64 | 0 | 35 | 10 | 383 | 86 | 29 | 314 | 22 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 18 | 1 | 6 | 67 | 0 | 37 | 11 | 403 | 91 | 31 | 331 | 23 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 855 | 909 | 331 | 824 | 841 | 403 | 354 | | | 494 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 855 | 909 | 331 | 824 | 841 | 403 | 354 | | | 494 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 93 | 100 | 99 | 76 | 100 | 94 | 99 | | | 97 | | |
| cM capacity (veh/h) | 256 | 266 | 715 | 278 | 291 | 643 | 1216 | | | 1001 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 25 | 67 | 37 | 11 | 403 | 91 | 31 | 331 | 23 |
| Volume Left | 18 | 67 | 0 | 11 | 0 | 0 | 31 | 0 | 0 |
| Volume Right | 6 | 0 | 37 | 0 | 0 | 91 | 0 | 0 | 23 |
| cSH | 304 | 278 | 643 | 1216 | 1700 | 1700 | 1001 | 1700 | 1700 |
| Volume to Capacity | 0.08 | 0.24 | 0.06 | 0.01 | 0.24 | 0.05 | 0.03 | 0.19 | 0.01 |
| Queue Length 95th (ft) | 7 | 23 | 5 | 1 | 0 | 0 | 2 | 0 | 0 |
| Control Delay (s) | 17.9 | 22.0 | 10.9 | 8.0 | 0.0 | 0.0 | 8.7 | 0.0 | 0.0 |
| Lane LOS | C | C | B | A | | | A | | |
| Approach Delay (s) | 17.9 | 18.1 | | 0.2 | | | 0.7 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.6 | | |
| Intersection Capacity Utilization | 38.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 9 | 182 | 23 | 59 | 308 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| Future Volume (vph) | 9 | 182 | 23 | 59 | 308 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.983 | | | 0.954 | | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1815 | 0 | 1770 | 1654 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1815 | 0 | 1770 | 1654 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Adj. Flow (vph) | 9 | 190 | 24 | 61 | 321 | 143 | 24 | 0 | 58 | 83 | 0 | 8 |
| Lane Group Flow (vph) | 9 | 214 | 0 | 61 | 464 | 0 | 0 | 24 | 58 | 0 | 83 | 8 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 49.0% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 9 | 182 | 23 | 59 | 308 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| Future Volume (Veh/h) | 9 | 182 | 23 | 59 | 308 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 9 | 190 | 24 | 61 | 321 | 143 | 24 | 0 | 58 | 83 | 0 | 8 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 6 | | | 6 |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 464 | | | 214 | | | 667 | 806 | 202 | 752 | 746 | 392 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 464 | | | 214 | | | 667 | 806 | 202 | 752 | 746 | 392 |
| tC, single (s) | 4.3 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 96 | | | 93 | 100 | 93 | 72 | 100 | 99 |
| cM capacity (veh/h) | 1009 | | | 1356 | | | 353 | 299 | 839 | 294 | 323 | 661 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 9 | 214 | 61 | 464 | 82 | 91 |
| Volume Left | 9 | 0 | 61 | 0 | 24 | 83 |
| Volume Right | 0 | 24 | 0 | 143 | 58 | 8 |
| cSH | 1009 | 1700 | 1356 | 1700 | 1186 | 322 |
| Volume to Capacity | 0.01 | 0.13 | 0.04 | 0.27 | 0.07 | 0.28 |
| Queue Length 95th (ft) | 1 | 0 | 4 | 0 | 6 | 28 |
| Control Delay (s) | 8.6 | 0.0 | 7.8 | 0.0 | 11.5 | 21.0 |
| Lane LOS | A | | A | | B | C |
| Approach Delay (s) | 0.3 | | 0.9 | | 11.5 | 21.0 |
| Approach LOS | | | | | B | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.7 | | |
| Intersection Capacity Utilization | 49.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | EB | WB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | L | T | T | R | LT | R | LTR |
| Maximum Queue (ft) | 59 | 238 | 228 | 33 | 211 | 251 | 230 | 73 | 109 | 110 | 90 |
| Average Queue (ft) | 15 | 123 | 113 | 9 | 93 | 110 | 93 | 12 | 45 | 47 | 31 |
| 95th Queue (ft) | 48 | 203 | 204 | 29 | 170 | 212 | 185 | 49 | 91 | 87 | 66 |
| Link Distance (ft) | | 1006 | 1006 | | | 738 | 738 | | 390 | | 461 |
| Upstream Blk Time (%) | | | | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | | | | |
| Storage Bay Dist (ft) | 250 | | | 225 | 250 | | | 250 | | 225 | |
| Storage Blk Time (%) | | 0 | 0 | | 0 | 0 | 0 | 0 | | | |
| Queuing Penalty (veh) | | 0 | 0 | | 1 | 1 | 0 | 0 | | | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | WB | NB | SB |
|---|---|---|---|---|
| Directions Served | TR | L | LTR | LTR |
| Maximum Queue (ft) | 32 | 138 | 500 | 26 |
| Average Queue (ft) | 4 | 52 | 216 | 5 |
| 95th Queue (ft) | 19 | 102 | 508 | 18 |
| Link Distance (ft) | 2032 | | 736 | 278 |
| Upstream Blk Time (%) | | | 0 | |
| Queuing Penalty (veh) | | | 0 | |
| Storage Bay Dist (ft) | | 225 | | |
| Storage Blk Time (%) | | | | |
| Queuing Penalty (veh) | | | | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | SB |
|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | L |
| Maximum Queue (ft) | 38 | 70 | 46 | 14 | 54 |
| Average Queue (ft) | 15 | 27 | 15 | 1 | 8 |
| 95th Queue (ft) | 38 | 57 | 35 | 10 | 33 |
| Link Distance (ft) | 247 | 762 | | | |
| Upstream Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | 190 |
| Storage Blk Time (%) | | | | | |
| Queuing Penalty (veh) | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | WB | WB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|
| Directions Served | L | L | TR | LT | R | LT | R |
| Maximum Queue (ft) | 37 | 32 | 2 | 52 | 67 | 99 | 33 |
| Average Queue (ft) | 4 | 8 | 0 | 18 | 30 | 40 | 7 |
| 95th Queue (ft) | 20 | 27 | 2 | 46 | 56 | 76 | 29 |
| Link Distance (ft) | | | 492 | 372 | | 374 | |
| Upstream Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |
| Storage Bay Dist (ft) | 225 | 225 | | | 150 | | 150 |
| Storage Blk Time (%) | | | | | | 0 | |
| Queuing Penalty (veh) | | | | | | 0 | |

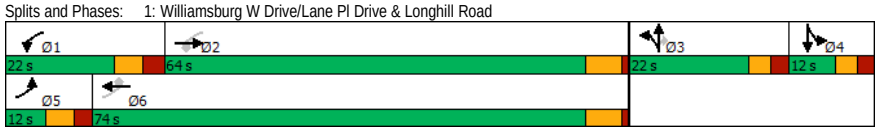
## Network Summary

Network wide Queuing Penalty: 1

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 21 | 917 | 42 | 251 | 1222 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| Future Volume (vph) | 21 | 917 | 42 | 251 | 1222 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.947 | |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.971 | |
| Satd. Flow (prot) | 1805 | 3539 | 1615 | 1719 | 3471 | 1380 | 0 | 1687 | 1615 | 0 | 1636 | 0 |
| Flt Permitted | 0.147 | | | 0.211 | | | | 0.950 | | | 0.971 | |
| Satd. Flow (perm) | 279 | 3539 | 1615 | 382 | 3471 | 1380 | 0 | 1687 | 1615 | 0 | 1636 | 0 |
| Satd. Flow (RTOR) | | | 195 | | | 132 | | | 200 | | 200 | |
| Adj. Flow (vph) | 22 | 965 | 44 | 264 | 1286 | 49 | 64 | 0 | 174 | 29 | 0 | 19 |
| Lane Group Flow (vph) | 22 | 965 | 44 | 264 | 1286 | 49 | 0 | 64 | 174 | 0 | 48 | 0 |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Total Split (s) | 12.0 | 64.0 | 64.0 | 22.0 | 74.0 | 74.0 | 22.0 | 22.0 | 22.0 | 12.0 | 12.0 | |
| Total Lost Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Act Effct Green (s) | 54.7 | 38.9 | 38.9 | 48.5 | 53.6 | 53.6 | | 9.6 | 9.6 | | 7.1 | |
| Actuated g/C Ratio | 0.64 | 0.45 | 0.45 | 0.57 | 0.63 | 0.63 | | 0.11 | 0.11 | | 0.08 | |
| v/c Ratio | 0.08 | 0.60 | 0.05 | 0.69 | 0.59 | 0.05 | | 0.34 | 0.48 | | 0.15 | |
| Control Delay | 6.8 | 19.6 | 0.1 | 18.9 | 12.8 | 0.1 | | 47.5 | 9.4 | | 1.0 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | |
| Total Delay | 6.8 | 19.6 | 0.1 | 18.9 | 12.8 | 0.1 | | 47.5 | 9.4 | | 1.0 | |
| LOS | A | B | A | B | B | A | | D | A | | A | |
| Approach Delay | | 18.5 | | | 13.4 | | | 19.6 | | | 1.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 85.5 | |
| Control Type: Actuated-Uncoordinated | |
| Maximum v/c Ratio: 0.69 | |
| Intersection Signal Delay: 15.5 | Intersection LOS: B |
| Intersection Capacity Utilization 64.0% | ICU Level of Service B |
| Analysis Period (min) 15 | |

Splits and Phases: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road








| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 21 | 917 | 42 | 251 | 1222 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| Future Volume (vph) | 21 | 917 | 42 | 251 | 1222 | 47 | 61 | 0 | 165 | 28 | 0 | 18 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 | | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (prot) | 1805 | 3539 | 1615 | 1719 | 3471 | 1380 | | 1687 | 1615 | | 1635 | |
| Flt Permitted | 0.15 | 1.00 | 1.00 | 0.21 | 1.00 | 1.00 | | 0.95 | 1.00 | | 0.97 | |
| Satd. Flow (perm) | 280 | 3539 | 1615 | 382 | 3471 | 1380 | | 1687 | 1615 | | 1635 | |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 22 | 965 | 44 | 264 | 1286 | 49 | 64 | 0 | 174 | 29 | 0 | 19 |
| RTOR Reduction (vph) | 0 | 0 | 23 | 0 | 0 | 20 | 0 | 0 | 156 | 0 | 46 | 0 |
| Lane Group Flow (vph) | 22 | 965 | 21 | 264 | 1286 | 29 | 0 | 64 | 18 | 0 | 2 | 0 |
| Heavy Vehicles (%) | 0% | 2% | 0% | 5% | 4% | 17% | 7% | 33% | 0% | 4% | 0% | 11% |
| Turn Type | D.P+P | NA | Perm | D.P+P | NA | Perm | Split | NA | Perm | Split | NA | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 3 | | 4 | 4 | |
| Permitted Phases | 6 | | 2 | 2 | | 6 | | | 3 | | | |
| Actuated Green, G (s) | 55.2 | 44.0 | 44.0 | 54.7 | 53.6 | 53.6 | | 9.6 | 9.6 | | 3.3 | |
| Effective Green, g (s) | 55.2 | 44.0 | 44.0 | 54.7 | 53.6 | 53.6 | | 9.6 | 9.6 | | 3.3 | |
| Actuated g/C Ratio | 0.60 | 0.48 | 0.48 | 0.60 | 0.59 | 0.59 | | 0.10 | 0.10 | | 0.04 | |
| Clearance Time (s) | 6.5 | 6.0 | 6.0 | 7.0 | 6.0 | 6.0 | | 5.5 | 5.5 | | 5.5 | |
| Vehicle Extension (s) | 2.0 | 5.0 | 5.0 | 2.0 | 5.0 | 5.0 | | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 195 | 1699 | 775 | 384 | 2031 | 807 | | 176 | 169 | | 58 | |
| v/s Ratio Prot | 0.00 | 0.27 | | c0.08 | c0.37 | | | c0.04 | | | c0.00 | |
| v/s Ratio Perm | 0.07 | | 0.01 | c0.33 | | 0.02 | | | 0.01 | | | |
| v/c Ratio | 0.11 | 0.57 | 0.03 | 0.69 | 0.63 | 0.04 | | 0.36 | 0.11 | | 0.03 | |
| Uniform Delay, d1 | 9.0 | 17.0 | 12.5 | 10.5 | 12.5 | 8.0 | | 38.2 | 37.1 | | 42.6 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 0.1 | 0.7 | 0.0 | 4.0 | 0.9 | 0.0 | | 1.3 | 0.3 | | 0.2 | |
| Delay (s) | 9.1 | 17.7 | 12.6 | 14.6 | 13.4 | 8.1 | | 39.4 | 37.4 | | 42.8 | |
| Level of Service | A | B | B | B | B | A | | D | D | | D | |
| Approach Delay (s) | | 17.3 | | | 13.5 | | | 38.0 | | | 42.8 | |
| Approach LOS | | B | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 17.3 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.62 | | |
| Actuated Cycle Length (s) | 91.6 | Sum of lost time (s) | 24.0 |
| Intersection Capacity Utilization | 64.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 0 | 424 | 70 | 255 | 354 | 2 | 58 | 4 | 160 | 5 | 0 | 6 |
| Future Volume (vph) | 0 | 424 | 70 | 255 | 354 | 2 | 58 | 4 | 160 | 5 | 0 | 6 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.850 | | | 0.850 | | | 0.850 | | 0.926 | |
| Flt Protected | | | | 0.950 | | | | 0.955 | | | 0.978 | |
| Satd. Flow (prot) | 1900 | 1810 | 1524 | 1752 | 1776 | 1615 | 0 | 1659 | 1615 | 0 | 1721 | 0 |
| Flt Permitted | | | | 0.950 | | | | 0.955 | | | 0.978 | |
| Satd. Flow (perm) | 1900 | 1810 | 1524 | 1752 | 1776 | 1615 | 0 | 1659 | 1615 | 0 | 1721 | 0 |
| Adj. Flow (vph) | 0 | 451 | 74 | 271 | 377 | 2 | 62 | 4 | 170 | 5 | 0 | 6 |
| Lane Group Flow (vph) | 0 | 451 | 74 | 271 | 377 | 2 | 0 | 66 | 170 | 0 | 11 | 0 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 52.7% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 424 | 70 | 255 | 354 | 2 | 58 | 4 | 160 | 5 | 0 | 6 |
| Future Volume (Veh/h) | 0 | 424 | 70 | 255 | 354 | 2 | 58 | 4 | 160 | 5 | 0 | 6 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| Hourly flow rate (vph) | 0 | 451 | 74 | 271 | 377 | 2 | 62 | 4 | 170 | 5 | 0 | 6 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 7 | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 379 | | | 525 | | | 1376 | 1372 | 451 | 1457 | 1444 | 377 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 379 | | | 525 | | | 1376 | 1372 | 451 | 1457 | 1444 | 377 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.2 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.6 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 74 | | | 33 | 96 | 72 | 92 | 100 | 99 |
| cM capacity (veh/h) | 1191 | | | 1037 | | | 93 | 109 | 613 | 61 | 98 | 674 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|
| Volume Total | 0 | 451 | 74 | 271 | 377 | 2 | 236 | 11 |
| Volume Left | 0 | 0 | 0 | 271 | 0 | 0 | 62 | 5 |
| Volume Right | 0 | 0 | 74 | 0 | 0 | 2 | 170 | 6 |
| cSH | 1700 | 1700 | 1700 | 1037 | 1700 | 1700 | 336 | 121 |
| Volume to Capacity | 0.00 | 0.27 | 0.04 | 0.26 | 0.22 | 0.00 | 0.70 | 0.09 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 26 | 0 | 0 | 126 | 7 |
| Control Delay (s) | 0.0 | 0.0 | 0.0 | 9.7 | 0.0 | 0.0 | 38.8 | 37.7 |
| Lane LOS | | | | A | | | E | E |
| Approach Delay (s) | 0.0 | | | 4.0 | | | 38.8 | 37.7 |
| Approach LOS | | | | | | | E | E |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.6 | | |
| Intersection Capacity Utilization | 52.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 17 | 1 | 6 | 68 | 0 | 35 | 10 | 383 | 93 | 29 | 314 | 22 |
| Future Volume (vph) | 17 | 1 | 6 | 68 | 0 | 35 | 10 | 383 | 93 | 29 | 314 | 22 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.968 | | | 0.850 | | | | 0.850 | | | 0.850 |
| Flt Protected | | 0.965 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1775 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Flt Permitted | | 0.965 | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 1775 | 0 | 1736 | 1553 | 0 | 1805 | 1759 | 1282 | 1556 | 1759 | 967 |
| Adj. Flow (vph) | 18 | 1 | 6 | 72 | 0 | 37 | 11 | 403 | 98 | 31 | 331 | 23 |
| Lane Group Flow (vph) | 0 | 25 | 0 | 72 | 37 | 0 | 11 | 403 | 98 | 31 | 331 | 23 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 38.8% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 17 | 1 | 6 | 68 | 0 | 35 | 10 | 383 | 93 | 29 | 314 | 22 |
| Future Volume (Veh/h) | 17 | 1 | 6 | 68 | 0 | 35 | 10 | 383 | 93 | 29 | 314 | 22 |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Hourly flow rate (vph) | 18 | 1 | 6 | 72 | 0 | 37 | 11 | 403 | 98 | 31 | 331 | 23 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 855 | 916 | 331 | 824 | 841 | 403 | 354 | | | 501 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 855 | 916 | 331 | 824 | 841 | 403 | 354 | | | 501 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.3 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.3 | | |
| p0 queue free % | 93 | 100 | 99 | 74 | 100 | 94 | 99 | | | 97 | | |
| cM capacity (veh/h) | 256 | 263 | 715 | 278 | 291 | 643 | 1216 | | | 995 | | |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | NB 3 | SB 1 | SB 2 | SB 3 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 25 | 72 | 37 | 11 | 403 | 98 | 31 | 331 | 23 |
| Volume Left | 18 | 72 | 0 | 11 | 0 | 0 | 31 | 0 | 0 |
| Volume Right | 6 | 0 | 37 | 0 | 0 | 98 | 0 | 0 | 23 |
| cSH | 303 | 278 | 643 | 1216 | 1700 | 1700 | 995 | 1700 | 1700 |
| Volume to Capacity | 0.08 | 0.26 | 0.06 | 0.01 | 0.24 | 0.06 | 0.03 | 0.19 | 0.01 |
| Queue Length 95th (ft) | 7 | 25 | 5 | 1 | 0 | 0 | 2 | 0 | 0 |
| Control Delay (s) | 17.9 | 22.5 | 10.9 | 8.0 | 0.0 | 0.0 | 8.7 | 0.0 | 0.0 |
| Lane LOS | C | C | B | A | | | A | | |
| Approach Delay (s) | 17.9 | 18.5 | | 0.2 | | | 0.7 | | |
| Approach LOS | C | C | | | | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.7 | | |
| Intersection Capacity Utilization | 38.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 9 | 186 | 23 | 59 | 315 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| Future Volume (vph) | 9 | 186 | 23 | 59 | 315 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.983 | | | 0.954 | | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (prot) | 1504 | 1815 | 0 | 1770 | 1653 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Flt Permitted | 0.950 | | | 0.950 | | | | 0.950 | | | 0.950 | |
| Satd. Flow (perm) | 1504 | 1815 | 0 | 1770 | 1653 | 0 | 0 | 1770 | 1583 | 0 | 1805 | 1615 |
| Adj. Flow (vph) | 9 | 194 | 24 | 61 | 328 | 143 | 24 | 0 | 58 | 83 | 0 | 8 |
| Lane Group Flow (vph) | 9 | 218 | 0 | 61 | 471 | 0 | 0 | 24 | 58 | 0 | 83 | 8 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | |
|---|---|---|
| Control Type: Unsignalized | | |
| Intersection Capacity Utilization 49.4% | ICU Level of Service A | |
| Analysis Period (min) 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 9 | 186 | 23 | 59 | 315 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| Future Volume (Veh/h) | 9 | 186 | 23 | 59 | 315 | 137 | 23 | 0 | 56 | 80 | 0 | 8 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Hourly flow rate (vph) | 9 | 194 | 24 | 61 | 328 | 143 | 24 | 0 | 58 | 83 | 0 | 8 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | 6 | | | 6 |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 471 | | | 218 | | | 678 | 817 | 206 | 762 | 758 | 400 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 471 | | | 218 | | | 678 | 817 | 206 | 762 | 758 | 400 |
| tC, single (s) | 4.3 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 95 | | | 93 | 100 | 93 | 71 | 100 | 99 |
| cM capacity (veh/h) | 1003 | | | 1352 | | | 347 | 294 | 835 | 289 | 319 | 655 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 9 | 218 | 61 | 471 | 82 | 91 |
| Volume Left | 9 | 0 | 61 | 0 | 24 | 83 |
| Volume Right | 0 | 24 | 0 | 143 | 58 | 8 |
| cSH | 1003 | 1700 | 1352 | 1700 | 1180 | 317 |
| Volume to Capacity | 0.01 | 0.13 | 0.05 | 0.28 | 0.07 | 0.29 |
| Queue Length 95th (ft) | 1 | 0 | 4 | 0 | 6 | 29 |
| Control Delay (s) | 8.6 | 0.0 | 7.8 | 0.0 | 11.5 | 21.4 |
| Lane LOS | A | | A | | B | C |
| Approach Delay (s) | 0.3 | | 0.9 | | 11.5 | 21.4 |
| Approach LOS | | | | | B | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.7 | | |
| Intersection Capacity Utilization | 49.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

## Intersection: 1: Williamsburg W Drive/Lane Pl Drive & Longhill Road

| Movement | EB | EB | EB | EB | WB | WB | WB | WB | NB | NB | SB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Directions Served | L | T | T | R | L | T | T | R | LT | R | LTR |
| Maximum Queue (ft) | 69 | 262 | 253 | 53 | 215 | 242 | 244 | 115 | 128 | 103 | 88 |
| Average Queue (ft) | 15 | 129 | 120 | 11 | 94 | 108 | 96 | 12 | 45 | 42 | 32 |
| 95th Queue (ft) | 50 | 229 | 219 | 40 | 166 | 203 | 189 | 59 | 97 | 80 | 69 |
| Link Distance (ft) | | 1006 | 1006 | | | 738 | 738 | | 390 | | 461 |
| Upstream Blk Time (%) | | | | | | | | | | | |
| Queuing Penalty (veh) | | | | | | | | | | | |
| Storage Bay Dist (ft) | 250 | | | 225 | 250 | | | 250 | | 225 | |
| Storage Blk Time (%) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | | | |
| Queuing Penalty (veh) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |

## Intersection: 2: Fords Colony Drive/Dominon Village & Longhill Road

| Movement | EB | EB | WB | B11 | NB | NB | SB |
|---|---|---|---|---|---|---|---|
| Directions Served | T | R | L | T | LT | R | LTR |
| Maximum Queue (ft) | 5 | 19 | 134 | 54 | 357 | 156 | 24 |
| Average Queue (ft) | 0 | 1 | 62 | 2 | 107 | 56 | 5 |
| 95th Queue (ft) | 5 | 8 | 112 | 55 | 362 | 145 | 18 |
| Link Distance (ft) | 2030 | | | 2988 | 723 | | 278 |
| Upstream Blk Time (%) | | | | | 1 | | |
| Queuing Penalty (veh) | | | | | 0 | | |
| Storage Bay Dist (ft) | | 300 | 225 | | | 175 | |
| Storage Blk Time (%) | | | | | 10 | 1 | |
| Queuing Penalty (veh) | | | | | 16 | 0 | |

## Intersection: 3: Centerville Road & Westport/Manchester Drive

| Movement | EB | WB | WB | NB | SB | SB |
|---|---|---|---|---|---|---|
| Directions Served | LTR | L | TR | L | L | R |
| Maximum Queue (ft) | 42 | 63 | 49 | 19 | 49 | 2 |
| Average Queue (ft) | 15 | 27 | 16 | 2 | 9 | 0 |
| 95th Queue (ft) | 39 | 52 | 36 | 11 | 33 | 0 |
| Link Distance (ft) | 247 | 762 | | | | |
| Upstream Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |
| Storage Bay Dist (ft) | | | 140 | 190 | 190 | 325 |
| Storage Blk Time (%) | | | | | | |
| Queuing Penalty (veh) | | | | | | |

## Intersection: 4: News Road & Firestone Drive

| Movement | EB | WB | WB | NB | NB | SB | SB |
|---|---|---|---|---|---|---|---|
| Directions Served | L | L | TR | LT | R | LT | R |
| Maximum Queue (ft) | 44 | 37 | 6 | 54 | 54 | 94 | 33 |
| Average Queue (ft) | 4 | 10 | 0 | 18 | 28 | 40 | 7 |
| 95th Queue (ft) | 23 | 31 | 3 | 46 | 50 | 76 | 29 |
| Link Distance (ft) | | | 492 | 372 | | 374 | |
| Upstream Blk Time (%) | | | | | | | |
| Queuing Penalty (veh) | | | | | | | |
| Storage Bay Dist (ft) | 225 | 225 | | | 150 | | 150 |
| Storage Blk Time (%) | | | | | | 0 | |
| Queuing Penalty (veh) | | | | | | 0 | |

## Network Summary

Network wide Queuing Penalty: 18

# News Road Corridor Traffic Forecast And Analysis

**JAMES CITY COUNTY, VIRGINIA**

***For:***
**REALTEC, INC.**

***By:***
**DRW Consultants, LLC**
**Midlothian, VA**

**April 22, 2008**

# News Road Corridor Traffic Forecast And Analysis

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**Midlothian, VA**

**April 22, 2008**

COMMONWEALTH OF VIRGINIA
DEXTER R. WILLIAMS
Lic. No. 031163
4-24-08
PROFESSIONAL ENGINEER

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# REPORT TEXT

# EXECUTIVE SUMMARY

This traffic study was prepared in response to comments received at the February 27, 2008 meeting of the James City County Planning Commission regarding the proposed rezoning of The Village At Ford's Colony (The Village). The primary principle discussed at the meeting was that a traffic study for the News Road corridor should be prepared based on an accounting of traffic from approved development to date as well as the proposed development of The Village At Ford's Colony and other likely proposals for development. This approach to accounting for other anticipated development traffic in the area is a corridor build out approach to traffic forecasting as opposed to the previous July 12, 2007 "Traffic Analysis For Ford's Colony CRCC". The July 12, 2007 used a forecast year with growth factor approach to traffic forecasting, which does not account for other development directly.

The July 12, 2007 report focused only on the The Village (CCRC) connection to the News Road/Firestone Drive intersection. As discussed at the Planning Commission meeting, counts were available for the News Road intersections at Centerville Road, Old News Road and Monticello Avenue and thus were available to be included in a News Road corridor study. This corridor study includes traffic forecasts for the News Road intersections at Centerville Road, Firestone Drive, Old News Road and Monticello Avenue.

The Village is a retirement community with various types of housing for seniors. These include:

1. Townhomes. 32 units are included in this report. (Note: the number of planned townhome units has been reduced to 24 since the completion of traffic analysis in this report).
2. Independent Living Units. 332 units included in this report.
3. Congregate Case Apartments. 290 units included in this report.
4. Assisted Living/Skill Care. 118 beds included in this report.
5. Nursing Home. 180 beds included in this report.

The existing two lane sections of News Road have adequate capacity for traffic to be generated by all approved and proposed development (including The Village) in the News Road corridor. Ford's Colony, the developer The Village will include turn lanes on News Road at Firestone Drive for access to The Village as well as cash contributions and/or construction for turn lanes on News Road at Powhatan Village, general improvements to News Road, and to the West Monticello Avenue plan which includes improvements at the Monticello Avenue/News Road intersection.

## INTRODUCTION

Exhibit 1a shows the News Road corridor from Centerville Road on the west to Monticello Avenue on the east. Centerville Road is the periphery of the Primary Service Area and primarily serves a radial route connection between residential uses in the adjacent area and the Williamsburg region. As such, a forecast for residential development in the adjacent area can be an effective tool for forecasting future traffic on News Road.

Exhibit 1b shows the development area and inventory used in this traffic study (the Exhibit 1b development area map frame is shown on Exhibit 1a). There are 10 identified developments in the area.

There are four AM and PM peak hour traffic analysis scenarios presented in this study:

1. 2007/2008 counts.
2. All Approved Development: Addition of Ford's Colony, Powhatan Secondary north of News Road, Springhill, Westport and Liberty Ridge traffic to counts.
3. The Village: Addition of The Village traffic to all approved development traffic.
4. Proposed Development: Addition of Nixon/Graves, Richardson and Beamer traffic to The Village traffic.

Exhibit 1c shows intersections on the News Road corridor from Centerville Road to Monticello Avenue. Traffic forecasts and analysis for these intersections are addressed as follows:

1. Traffic counts and forecasts are included for the Centerville Road, Firestone Drive, Old News Road and Monticello Avenue intersections. These were the counts that were available for creation of forecasts and inclusion in this study.
2. Traffic analysis is included for the Centerville Road, Firestone Drive, Old News Road and Monticello Avenue intersections. A more thorough traffic analysis for the Monticello Avenue corridor, including the News Road intersection, is included in the March 1, 2008 traffic study for Section 12 of New Town for the 2015 PM peak hour. The March 1, 2008 traffic study includes traffic growth from sources other than News Road area development, and includes recommendations for improvements for West Monticello Avenue (including the News Road intersection) that were originally developed in conjunction with the 2006 rezoning of Section 9 of New Town.
3. Recommendations for turn lane additions at intersections are included for all unsignalized intersections. (See March 1, 2008 report for signalized intersection at Monticello Avenue).

## 2007/2008 AM AND PM PEAK HOUR TRAFFIC COUNTS

Exhibit 3 shows AM and PM peak hour counts for the News Road corridor. The Centerville Road intersection turning movement counts are tabulated on Appendix Exhibit A series and shown graphically on the upper row of Exhibit 3. These counts were conducted in April 2007, but have not been published before.

The Firestone Drive intersection turning movement counts are tabulated on Appendix Exhibit B series and shown graphically on the second row of Exhibit 3. These counts were conducted in April 2007 and were used in the July 12, 2007 traffic study for The Village.

The Old News Road intersection turning movement counts are tabulated on Appendix Exhibit C series and shown graphically on the third row of Exhibit 3. These counts were conducted in January 2008 by LandMark Design Group and haven not been published before.

The Old News Road intersection turning movement counts are tabulated on Appendix Exhibit D series and shown graphically on the bottom row of Exhibit 3. The PM counts were conducted in April 2007 and were used in the March 1, 2008 traffic study for Section 12 of New Town. The AM counts were conducted on March 11, 2008 and have not been published before. (Note: the Appendix Exhibit D exhibit uses a north/south orientation for News Road; all other areas of this report use an east/west orientation for News Road).

Peak hour intersection levels of service are calculated using Synchro. Synchro reports are presented in the technical appendix. Following are peak hour LOS for 2007/2008 counts on the News Road corridor:

1. Centerville Road (Appendix Exhibits G1 and G2). There are no auxiliary lanes at this three-way, unsignalized intersection, with single lane approaches in all three directions and a stop sign for the westbound approach on News Road. News Road westbound approach: LOS B for AM and PM, Centerville Road southbound approach: LOS A for AM and PM. Right turn and left turn lane warrants are included in the technical appendix for existing counts (Appendix Exhibits J1 and J2 for AM and PM peak hour right turn lane warrants on northbound Centerville Road, and Appendix Exhibit K for left turn lanes warrants on southbound Centerville Road). A right turn taper is warranted for existing counts, and a left turn lane is warranted on southbound Centerville Road for 2007 PM peak hour counts.
2. Firestone Drive (Appendix Exhibits H1 and H2). There are auxiliary lanes on all approaches at this three-way, unsignalized intersection, with an eastbound left turn lane and a westbound right turn lane on News Road, and separate right and left turn lanes and a stop sign for the southbound approach on Firestone Drive. Firestone Drive southbound approach: LOS B AM and PM, News Road eastbound left turn: LOS A AM and PM.
3. Old News Road (Appendix Exhibits I1 and I2). This is a four-way, unsignalized intersection with stop signs on the northbound and southbound approaches. Southbound Old News Road and northbound Lake Powhatan have single approach lanes to the stop signs. Westbound News Road has two through lanes with a left turn

lane and a right turn lane. Eastbound News Road has two through lanes with a separate left turn lane. Old News Road southbound approach: LOS B AM and PM, Lake Powhatan northbound approach: LOS B AM and LOS C PM, News Road eastbound left turn: LOS A AM and PM, News Road westbound left turn: LOS A AM and PM.

4. Monticello Avenue (Appendix Exhibit P1 and P2). This is a signalized intersection with overall LOS C and LOS D or better for all turning movements for AM and PM peak hours.

Traffic on News Road progressively increases from west to east. The lowest traffic volumes are on News Road east of Centerville Road. The peak hour two-way two lane highway segment LOS is B in the AM and PM peak hours. The highest traffic on the two lane sections of News Road is from Powhatan Secondary to Old News Road. The peak hour two-way two lane highway segment LOS is C in the AM peak hour and LOS D in the PM peak hour.

## FORD'S COLONY TRIP DISTRIBUTION

Peak hour traffic counts were conducted at all access points to Ford's Colony in 2003 with results reported in a traffic study dated February 28, 2004 by DRW Consultants, Inc. The 2004 report was an update of previous reports in 1993 and 1998. The report documented that Ford's Colony peak hour trip generation in 1998 and 2003 varied from 54% to 64% of values in Trip Generation, 6th Edition by the Institute of Transportation Engineers (ITE). The traffic forecast for Ford's Colony in the 2004 study used a percentage of ITE values for trip generation. The percentage of ITE values was the average of 1998 and 2003 peak hour entering and exiting traffic.

The 2003 counts also provide a basis for determining trip distribution for Ford's Colony for use as a basis for other development trip distribution. The upper sections of Exhibits 2a and 2b respectively show the 2003 AM and PM peak hour counts for traffic entering and existing Ford's Colony four points of access. The lower sections of Exhibits 2a and 2b respectively

show the percentages of total entering and exiting traffic for the AM and PM peak hours at the four points of access.

There are four points of access to Ford's Colony:

1. Williamsburg West Drive on Longhill Road: This access also provides access to Williamsburg West subdivision. Ford's Colony access is via a card-operated gate.
2. Ford's Colony Drive on Longhill Road: This access is open in Ford's Colony for about 1,000 feet, with manned and card-operated gates thereafter for access to Ford's Colony.
3. Firestone Drive on News Road: This access is a card-operated gate.
4. Manchester Drive on Centerville Road: This is a manned gate access, and is the designated access for construction and outside service traffic.

To determine east-west trip distribution splits for new development traffic with access on News Road, Ford's Colony traffic on Longhill Road and News Road (direct east-west access roads) is aggregated. These access points include Ford's Colony Drive and Williamsburg West Drive on Longhill Road and Firestone Drive on News Road. The east-west split delineation of traffic at these three points of access is shown on Exhibit 2c (east in blue arrows, west in red arrows).

East-west splits using these three points of access are calculated for the AM and PM peak hours on Exhibits 2a and 2b. The following table summarizes the results for the east-west directional split of Ford's Colony traffic:

TABLE ONE: FORD'S COLONY EAST-WEST DIRECTIONAL SPLIT

| | EAST | WEST |
|---|---|---|
| AM ENTERING | 73% | 27% |
| AM EXITING | 83% | 17% |
| PM ENTERING | 82% | 18% |
| PM EXITING | 81% | 19% |

To determine north-south trip distribution splits for new development traffic with access on Centerville Road, all Ford's Colony traffic is aggregated. The north-south split delineation of traffic at these three points of access is shown on Exhibit 2d (north in blue arrows, south in red arrows).

North-south splits using these three points of access are calculated for the AM and PM peak hours using the three access points. The following table summarizes the results for the north-south directional split of Ford's Colony traffic:

TABLE TWO: FORD'S COLONY NORTH-SOUTH DIRECTIONAL SPLIT

| | NORTH | SOUTH |
|---|---|---|
| AM ENTERING | 75% | 25% |
| AM EXITING | 72% | 28% |
| PM ENTERING | 71% | 29% |
| PM EXITING | 79% | 21% |

The Table One results for the east-west split are remarkably consistent for the AM exiting, PM entering and PM exiting traffic, with 2% or less difference between any of the three conditions. The AM entering traffic has a higher west split which may be related to relatively higher trip generation for Ford's Colony service-oriented, AM entering traffic.

The Table Two results for the north-south split are also relatively consistent, with 8% or less difference between any of the four conditions. These results are applied to new developments in this study.

## APPROVED DEVELOPMENT TRAFFIC FORECAST

Ford's Colony has access to News Road directly at Firestone Drive only. Traffic studies in 1993, 1998 and 2003 have shown Ford's Colony trip generation to vary substantially from conventional trip generate equations and average rates in Trip Generation, 5$^{th}$, 6$^{th}$ and 7$^{th}$ Editions (TG5 through TG7), published by the Institute of Transportation Engineers (ITE).

The approach to forecasting build out traffic from Ford's Colony on News Road is to calculate the percentage increase in TG7 traffic values between April 2007 development and build out, and apply the percentage increase to Ford's Colony traffic counts at Firestone Drive.

Table One on Exhibit 4 shows Ford's Colony trip generation for 2007 and build out using TG7. Percentage increases for build out over 2007 development are in the 32% range. These percentages have been applied to Ford's Colony traffic on Firestone Drive. The increase in Firestone Drive traffic is assigned to the four News Road intersections on Appendix Exhibit E1.

For the 30 unbuilt single family housing units in Powhatan Secondary north of News Road, 100% of TG7 values are assigned as new traffic onto News Road at Powhatan Secondary. Trip generation and distribution for these units are shown on Table 2 on Exhibit 4. Trip assignments to the four News Road intersections are shown on Appendix Exhibit E2.

For the 74 unbuilt units in Greensprings, these are assumed to be the Exhibit 2 Greensprings area with access to Centerville Road south of News Road as shown on Exhibit 2. Table 3 on Exhibit 4 shows trip generation for these 74 units, and trip distribution from these units north on Centerville Road. 60% of traffic is assigned to the north, with 40% assigned to News Road. Trip assignments to the four News Road intersections are shown on Appendix Exhibit E3. The Ford's Colony trip distribution was not applied completely to Greensprings because of the relative ease of access to Monticello Avenue at Centerville Road.

For the 108 unbuilt units in Westport, Ford's Colony trip generation factors are used and results are assigned as new traffic. Westport has access to Centerville Road north of News Road. Table 1 on Exhibit 5 shows trip generation using the Ford's Colony north-south trip distribution split. Trip assignments to the four News Road intersections are shown on Appendix Exhibit E4.

For the 138 unbuilt units in Liberty Ridge, 100% of TG7 values are assigned as new traffic. Liberty Ridge has access to Centerville Road north of Westport. Table 2 on Exhibit 5 shows trip generation using the Ford's Colony north-south trip distribution split. Trip assignments to the four News Road intersections are shown on Appendix Exhibit E5.

Exhibit 8 shows the traffic forecast on News Road for all approved development. Traffic assignment for unbuilt units in Ford's Colony, Powhatan Secondary, Greensprings, Westport and Liberty Ridge have been added to the 2007/2008 counts.

Following are peak hour LOS for traffic forecast with all approved development on the News Road corridor:

1. Centerville Road (Appendix Exhibits G3 and G4). With existing lane configuration, News Road westbound approach: LOS B for AM and LOS C PM, Centerville Road southbound approach: LOS A for AM and PM. Right turn warrants are included in the technical appendix for the approved development forecast (Appendix Exhibits J1 and J2 for AM and PM peak hour right turn lane warrants on northbound Centerville Road). A right turn taper is warranted for the approved development forecast, and a left turn lane was warranted on southbound Centerville Road for 2007 PM peak hour counts.
2. Firestone Drive (Appendix Exhibits H3 and H4). With existing lane configuration, Firestone Drive southbound approach: LOS B AM and LOS B PM, News Road eastbound left turn: LOS A AM and PM.
3. Old News Road (Appendix Exhibits I3 and I4). With existing lane configuration, Old News Road southbound approach: LOS B AM and LOS C PM, Lake Powhatan northbound approach: LOS B AM and LOS C PM, News Road eastbound left turn: LOS A AM and PM, News Road westbound left turn: LOS A AM and PM.
4. Monticello Avenue (Appendix Exhibit P3 and P4). This is a signalized intersection with overall LOS D for the AM peak hour and LOS C for the PM peak hour and LOS D or better for all turning movements for AM and PM peak hours.

On News Road east of Centerville Road, the peak hour two-way two lane highway segment LOS is C in the AM and PM peak hours. On News Road from Powhatan Secondary to Old News Road, the peak hour two-way two lane highway segment LOS is C in the AM peak hour and LOS D in the PM peak hour.

## THE VILLAGE AT FORD'S COLONY TRAFFIC FORECAST

Trip generation for The Village is shown in Table 1 on Exhibit 6 using Trip Generation, 7th Edition (TG7), by the Institute of Transportation Engineers (ITE). Trip generation has increased from the July 12, 2007 report by the addition of 180 nursing home beds which were not included in the development inventory provided for that report.

Trip distribution for The Village is also shown on Exhibit 6. The Ford's Colony east-west trip distribution split is used. Trip assignments to the four News Road intersections are shown on Appendix Exhibit E6.

Exhibit 9 shows the traffic forecast on News Road for The Village. Traffic assignment for The Village has been added to the approved development forecast.

Following are peak hour LOS for traffic forecast with all approved development on the News Road corridor:

1. Centerville Road (Appendix Exhibits G5 and G6). With existing lane configuration, News Road westbound approach: LOS B for AM and LOS C PM, Centerville Road southbound approach: LOS A for AM and PM.
2. Firestone Drive (Appendix Exhibits H5 and H6). Firestone Drive southbound approach: LOS C AM and LOS B PM, The Village northbound approach: LOS B AM and LOS C PM, News Road eastbound left turn: LOS A AM and PM, News Road westbound left turn: LOS A AM and PM.
3. Old News Road (Appendix Exhibits I5 and I6). With existing lane configuration, Old News Road southbound approach: LOS B AM and LOS C PM, Lake Powhatan

northbound approach: LOS B AM and LOS C PM, News Road eastbound left turn: LOS A AM and PM, News Road westbound left turn: LOS A AM and PM.

4. Monticello Avenue (Appendix Exhibit P5 and P6). This is a signalized intersection with overall LOS D for the AM peak hour and LOS C for the PM peak hour and LOS D or better for all turning movements for AM and PM peak hours.

On News Road east of Centerville Road, the peak hour two-way two lane highway segment LOS is C in the AM and PM peak hours. On News Road from Powhatan Secondary to Old News Road, the peak hour two-way two lane highway segment LOS is C in the AM peak hour and LOS D in the PM peak hour.

## PROPOSED DEVELOPMENT TRAFFIC FORECAST

The Nixon/Graves property lies west of The Village with access via News Road. There is no specific development plan for this property. Development density at one single family unit per acre is used, yielding 60 units. Trip generation for the 60 units is shown on Table 1 on Exhibit 7. The Ford's Colony east-west trip distribution split is used. Trip assignments to the four News Road intersections are shown on Appendix Exhibit E7.

The Richardson property lies west of the Nixon/Graves property. There is no specific development plan for this property. Development density at one single family unit per three acres is used, yielding 39 units. Trip generation for the 39 units is shown on Table 2 on Exhibit 7. The Ford's Colony east-west trip distribution split is used. Trip assignments to the four News Road intersections are shown on Appendix Exhibit E8.

The Beamer property is adjacent to Powhatan Secondary north of News Road. 70 townhouses are proposed for this property. Trip generation for the 39 units is shown on Table 3 on Exhibit 7. All access is via Jester Lane to Old News Road, traffic to Centerville Road, News Road east and Monticello Avenue south is assigned to News Road at Old News Road. Trip assignments to the four News Road intersections are shown on Appendix Exhibit E8.

Exhibit 10 shows the traffic forecast on News Road for proposed development. Traffic assignment for the three proposed developments has been added to The Village forecast.

Following are peak hour LOS for traffic forecast with all approved development on the News Road corridor:

1. Centerville Road (Appendix Exhibits G7 and G8). With existing lane configuration, News Road westbound approach: LOS B for AM and LOS C PM, Centerville Road southbound approach: LOS A for AM and PM. Right turn warrants are included in the technical appendix for the proposed development forecast (Appendix Exhibits J1 and J2 for AM and PM peak hour right turn lane warrants on northbound Centerville Road). A right turn taper is warranted for the proposed development forecast, and a left turn lane was warranted on southbound Centerville Road for 2007 PM peak hour counts.
2. Firestone Drive (Appendix Exhibits H7 and H8). With westbound left turn lane, Firestone Drive southbound approach: LOS C AM and LOS D PM , The Village northbound approach: LOS B AM and PM, News Road eastbound left turn: LOS A AM and PM, News Road westbound left turn: LOS A AM and PM.
3. Old News Road (Appendix Exhibits I7 and I8). With existing lane configuration, Old News Road southbound approach: LOS B AM and LOS D PM, Lake Powhatan northbound approach: LOS B AM and LOS D PM, News Road eastbound left turn: LOS A AM and PM, News Road westbound left turn: LOS A AM and PM.
4. Monticello Avenue (Appendix Exhibit P7 and P8). This is a signalized intersection with overall LOS D for the AM and PM peak hours and LOS D or better for all turning movements for AM peak hour and LOS E or better for PM peak hour.

On News Road east of Centerville Road, the peak hour two-way two lane highway segment LOS is C in the AM and PM peak hours. On News Road from Powhatan Secondary to Old News Road, the peak hour two-way two lane highway segment LOS is D in the AM and PM peak hours.

## SUMMARY AND CONCLUSIONS

At the News Road/Centerville Road intersection, existing counts warrant a southbound left turn lane on Centerville Road. For all scenarios, a right turn lane taper is warranted on northbound Centerville Road at the intersection. The proposed development forecast shows traffic very nearly warranting a full right turn lane. The westbound single lane on News Road at the stop sign show LOS C or better for all scenarios, but the volumes are such that widening to provide two lanes on the stop approach is desirable. The following table shows the intersection LOS for all scenarios:

TABLE THREE
UNSIGNALIZED INTERSECTION LOS AT
CENTERVILLE ROAD/NEWS ROAD

| CONDITION | AM PEAK HOUR LOS | | PM PEAK HOUR LOS | |
|---|---|---|---|---|
| | Westbound Left/Right | Southbound Left/Thru | Westbound Left/Right | Southbound Left/Thru |
| 2007/2008 | B – 12.1 | A – 2.5 | B – 13.6 | A – 2.5 |
| Approved | B – 13.5 | A – 3.4 | C – 16.7 | A – 3.1 |
| The Village | B – 14.1 | A – 3.7 | C – 17.9 | A – 3.4 |
| Proposed | B – 14.6 | A – 3.9 | C – 19.2 | A – 3.7 |

Notes: Numeric values in seconds delay, with increasing value for decreasing LOS.

At the News Road/Springhill Drive intersection, counts were not available. There is a right turn lane on westbound News Road and there is no eastbound left turn lane on News Road. The proposed development forecast is a 58% increase over existing counts on News Road west of Firestone and the potential for a left turn lane warrant increases with increasing traffic.

At the News Road/Firestone Drive, the progressive increase in traffic from existing counts to the proposed development forecast shows a corresponding increase in delay for the southbound Firestone Drive approach. There is an existing left turn lane on westbound News Road to serve the access connection of The Village at this intersection. An eastbound right turn lane on News Road is not warranted (Appendix Exhibit J3). The following table shows the intersection LOS for all scenarios:

TABLE FOUR
UNSIGNALIZED INTERSECTION LOS AT
FIRESTONE DRIVE/NEWS ROAD

| CONDITION | AM PEAK HOUR LOS | | | | PM PEAK HOUR LOS | | | |
|---|---|---|---|---|---|---|---|---|
| | SB Left | NB Left | EB Left | WB Left | SB Left | NB Left | EB Left | WB Left |
| 2007/2008 | B – 11.3 | n/a | A – 7.5 | n/a | B – 12.2 | n/a | A – 8.1 | n/a |
| Approved | B – 12.7 | n/a | A – 7.5 | n/a | B – 14.0 | n/a | A – 8.4 | n/a |
| The Village | C – 17.9 | B – 13.5 | A – 7.6 | A – 7.9 | D – 26.1 | C – 17.2 | A – 8.4 | A – 7.8 |
| Proposed | C – 20.3 | B – 14.5 | A – 7.7 | A – 8.0 | D – 33.0 | C – 19.7 | A – 8.6 | A – 7.9 |

Notes: Numeric values in seconds delay, with increasing value for decreasing LOS.

At the News Road/Powhatan Parkway intersection, there is a westbound right turn lane. There is no eastbound right turn lane or left turn lanes in either direction. While counts were not available for this intersection, the 2008 counts on News Road west of Old News Road probably warrant a westbound left turn lane, and the proposed development forecast almost certainly will warrant a left turn lane. A full eastbound right turn lane may not be warranted under any condition due to the trend towards most trip distribution to and from the east on News Road.

At the News Road/Old News Road, the progressive increase in traffic from existing counts to the proposed development forecast shows a corresponding decline in LOS for the southbound Old News Road approach. There are existing eastbound and westbound left turn lanes on News Road, and a westbound right turn lane. An eastbound right turn lane on News Road is not warranted (right turn volume of 2 vph less than 10 vph minimum to warrant a right turn taper on a four lane road). The addition of a second southbound lane on Old News Road may not show a LOS improvement, but the volumes are such that improvements to provide two lanes on the stop approach are desirable. The following table shows the intersection LOS for all scenarios:

TABLE FIVE
UNSIGNALIZED INTERSECTION LOS AT
OLD NEWS ROAD/NEWS ROAD

| CONDITION | AM PEAK HOUR LOS | | | | PM PEAK HOUR LOS | | | |
|---|---|---|---|---|---|---|---|---|
| | SB App. | NB App. | EB Left | WB Left | SB App. | NB App. | EB Left | WB Left |
| 2007/2008 | B – 10.3 | B – 10.8 | A – 7.7 | A – 8.1 | B – 15.0 | C – 15.2 | A – 8.5 | A – 0.0 |
| Approved | B – 10.7 | B – 11.8 | A – 7.8 | A – 8.4 | C – 18.3 | C – 18.7 | A – 8.8 | A – 0.0 |
| The Village | B – 11.0 | B – 12.4 | A – 7.9 | A – 8.5 | C – 22.6 | C – 23.1 | A – 9.1 | A – 0.0 |
| Proposed | B – 11.7 | B – 13.1 | A – 7.9 | A – 8.7 | D – 28.6 | D – 27.5 | A – 9.4 | A – 0.0 |

Notes: Numeric values in seconds delay, with increasing value for decreasing LOS.

The following table shows the two-way two lane highway segment traffic LOS and volume/capacity (v/c) ratios for New Road east of Centerville Road (lowest volumes) and from Powhatan Secondary to Old News Road (highest volumes):

TABLE SIX
TWO-WAY TWO LANE HIGHWAY SEGMENT LOS ON NEWS ROAD

| CONDITION | EAST OF CENTERVILLE | | POW. SEC. TO OLD NEWS | |
|---|---|---|---|---|
| | AM PEAK HOUR | PM PEAK HOUR | AM PEAK HOUR | PM PEAK HOUR |
| 2007/2008 | B – 0.12 | B – 0.15 | C – 0.23 | D – 0.32 |
| Approved | C – 0.16 | C – 0.15 | C – 0.28 | D – 0.35 |
| The Village | C – 0.18 | C – 0.17 | C – 0.31 | D – 0.40 |
| Proposed | C – 0.19 | C – 0.18 | D – 0.34 | D – 0.44 |

Notes: Numeric values in volume capacity ratios (v/c), with increasing value for decreasing LOS.

Needed improvements for News Road at Monticello Avenue were addressed with the West Monticello Plan prepared in 2006 and included in the March 1, 2008 traffic study for Section 12 of New Town. The March 1, 2008 traffic study includes a traffic forecast beyond the News Road corridor with resulting large volumes. Any changes needed for the Monticello Marketplace driveway on News Road should be addressed with the design for the West Monticello Plan. For the purposes of comparison, the following table presents signalized intersection LOS results for the traffic counts and forecasts presented in this report:

TABLE SEVEN
SIGNALIZED INTERSECTION LOS AT
NEWS ROAD/MONTICELLO AVENUE

| CONDITION | AM PEAK HOUR LOS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Overall | EB Left | EB Thru | WB Left | WB Thru | NB Left | NB Thru | NB Right | SB Left | SB L/T/R |
| 2007/2008 | C – 34.0 | D – 45.4 | D – 36.9 | C – 25.0 | B – 12.3 | D– 41.2 | D – 42.2 | D – 42.2 | D – 45.3 | D – 39.8 |
| Approved | D – 35.2 | D – 45.4 | D – 38.9 | C – 25.0 | B – 13.1 | D– 41.2 | D – 42.5 | D – 42.2 | D – 47.4 | D – 39.5 |
| The Village | D – 35.9 | D – 45.4 | D – 39.9 | C – 24.9 | B – 13.5 | D– 40.9 | D – 42.6 | D – 41.8 | D – 49.3 | D – 40.1 |
| Proposed | D – 36.8 | D – 45.4 | D – 41.3 | C – 24.9 | B – 14.0 | D– 40.7 | D – 42.7 | D – 41.7 | D – 51.3 | D – 41.0 |
| CONDITION | PM PEAK HOUR LOS | | | | | | | | | |
| | Overall | EB Left | EB Thru | WB Left | WB Thru | NB Left | NB Thru | NB Right | SB Left | SB L/T/R |
| 2007/2008 | C – 32.1 | D – 44.5 | D – 38.0 | C – 28.0 | B – 17.3 | D– 40.1 | D – 45.9 | D – 39.7 | D – 46.4 | D – 43.2 |
| Approved | C – 33.1 | D – 44.8 | D – 39.1 | C – 27.9 | B – 18.0 | D– 39.7 | D – 50.0 | D – 39.3 | D – 48.6 | D – 44.7 |
| The Village | C – 34.7 | D – 43.3 | D – 38.0 | C – 29.5 | B – 19.4 | D– 39.4 | D – 54.5 | D – 39.1 | D – 53.9 | D – 47.4 |
| Proposed | D – 35.9 | D – 43.7 | D – 38.5 | C – 29.5 | B – 19.8 | D– 39.2 | E – 60.0 | D – 38.9 | E – 57.1 | D – 49.1 |

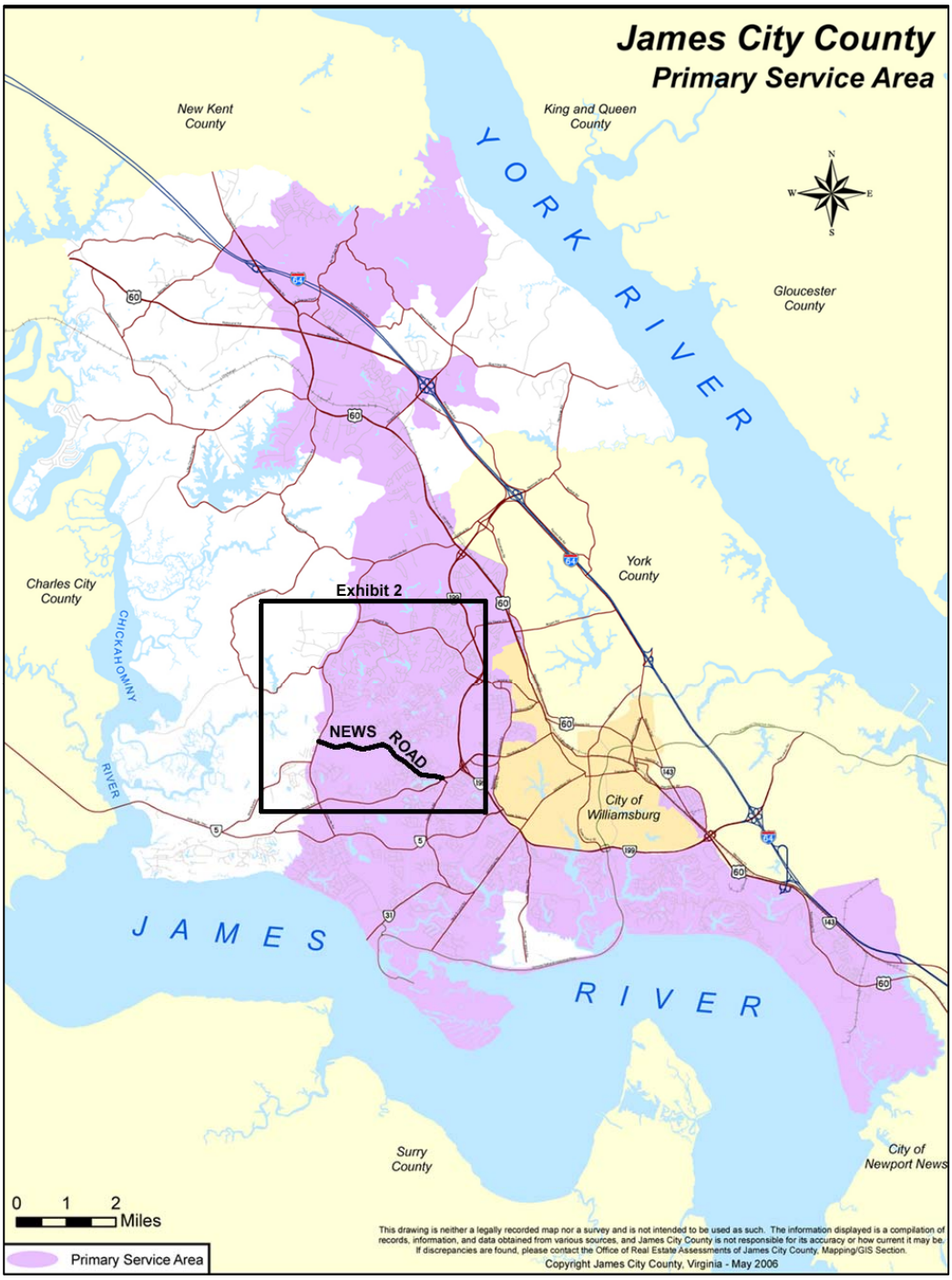
Notes: Numeric values in seconds delay, with increasing value for decreasing LOS.

Overall, the total traffic forecast on News Road will be within the capacity of two lane News Road. Stop-sign controlled traffic will experience LOS B through D, with LOS D occurring only in the PM peak hour.

At Firestone Drive, Ford's Colony will include an eastbound right turn lane for The Village development as well as a westbound left turn lane. Ford's Colony previously proffered the installation of a traffic signal at News Road/Firestone Drive at such time that traffic at the intersection warrants the traffic signal.

Ford's Colony also intends to provide a westbound left turn lane on News Road at Powhatan Secondary. This westbound left turn lane will provide improved convenience to the residents of Powhatan Secondary and reduced delay for all westbound traffic on News Road.

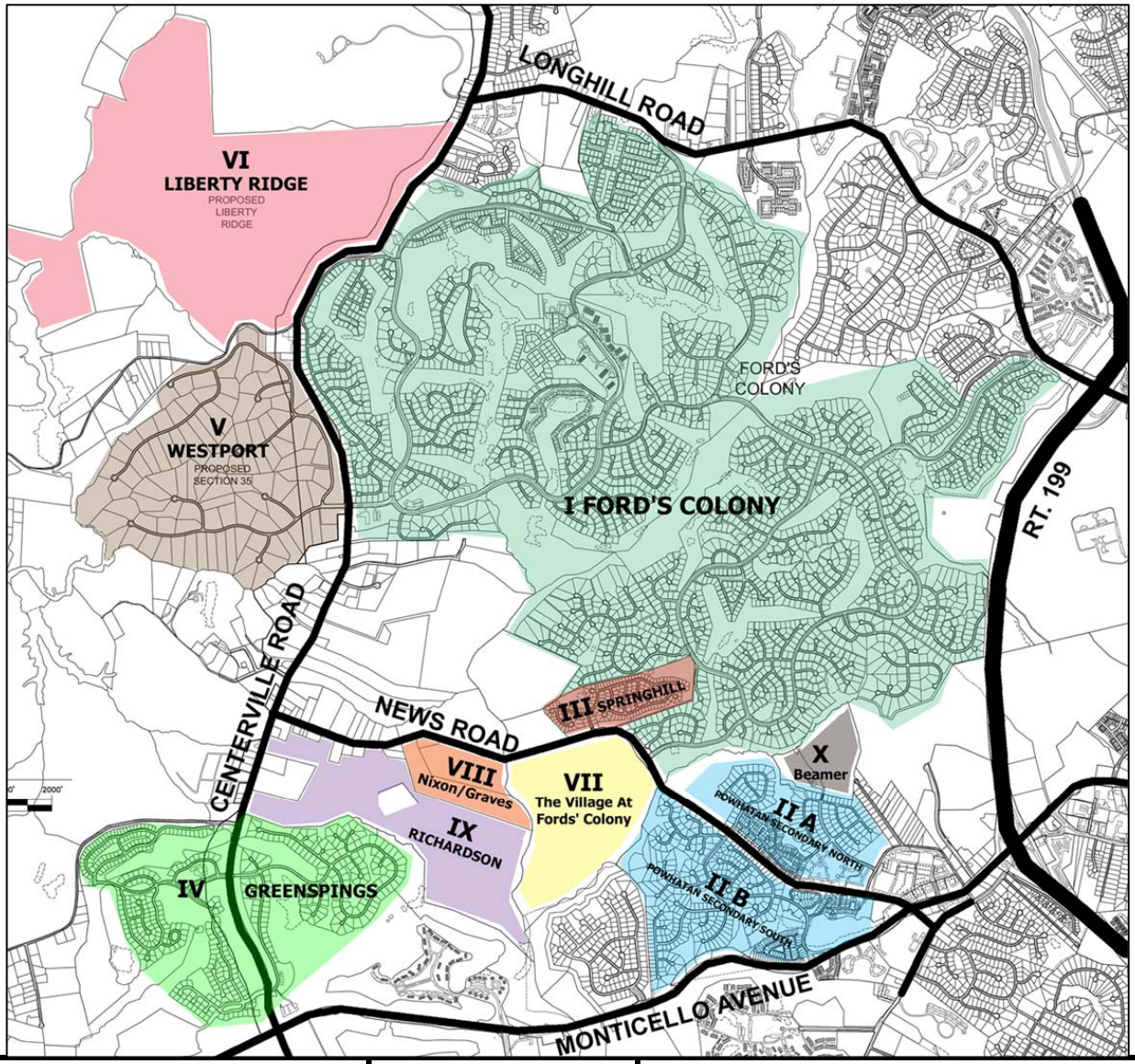
# REPORT EXHIBITS




NEWS ROAD CORRIDOR
REGIONAL LOCATION

***DRW Consultants, LLC***
***804-794-7312***

Exhibit 1a

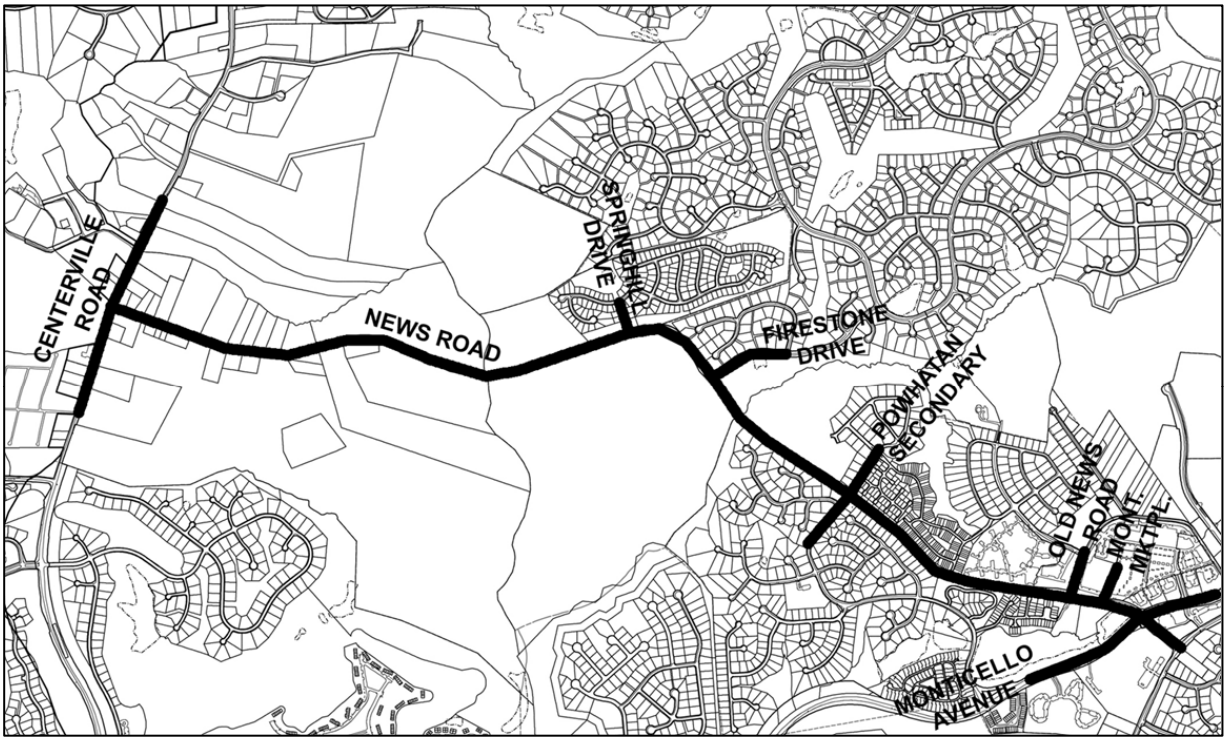



| Development | | Inventory Source | Forecast Technique |
|---|---|---|---|
| Map # | Name | | |
| I | Ford's Colony | Ford's Colony | Increase News Road/Firestone counts by buildout (3050 units)/April 07 (2272 units) ratio |
| IIA | Powhatan Secondary North of News Road | Ford's Colony | Assign trips for 30 unbuilt units |
| IIB | Powhatan Secondary South of News Road | Ford's Colony | Built out; no assignment |
| III | Springhill | Ford's Colony | Built out; no assignment |
| IV | Greensprings | AES | Assign trips for 74 unbuilt units |
| V | Westport | Ford's Colony | Assign trips for 108 unbuilt units |
| VI | Liberty Ridge | Ford's Colony | Assign trips for 139 unbuilt units |
| VII | The Village At Ford's Colony | Ford's Colony | Assign proposed development trips |
| VIII | Nixon/Graves (Realtec) | Ford's Colony | Assign trips for one SF unit per 3 ac. (60 units) |
| IX | Richardson | Ford's Colony | Assign trips for one SF unit per 1 ac. (20 units) |
| X | Beamer | Ford's Colony | Assign trips for 70 new units |

NEWS ROAD CORRIDOR
DEVELOPMENT INVENTORY

***DRW Consultants, LLC***
***804-794-7312***

Exhibit 1b

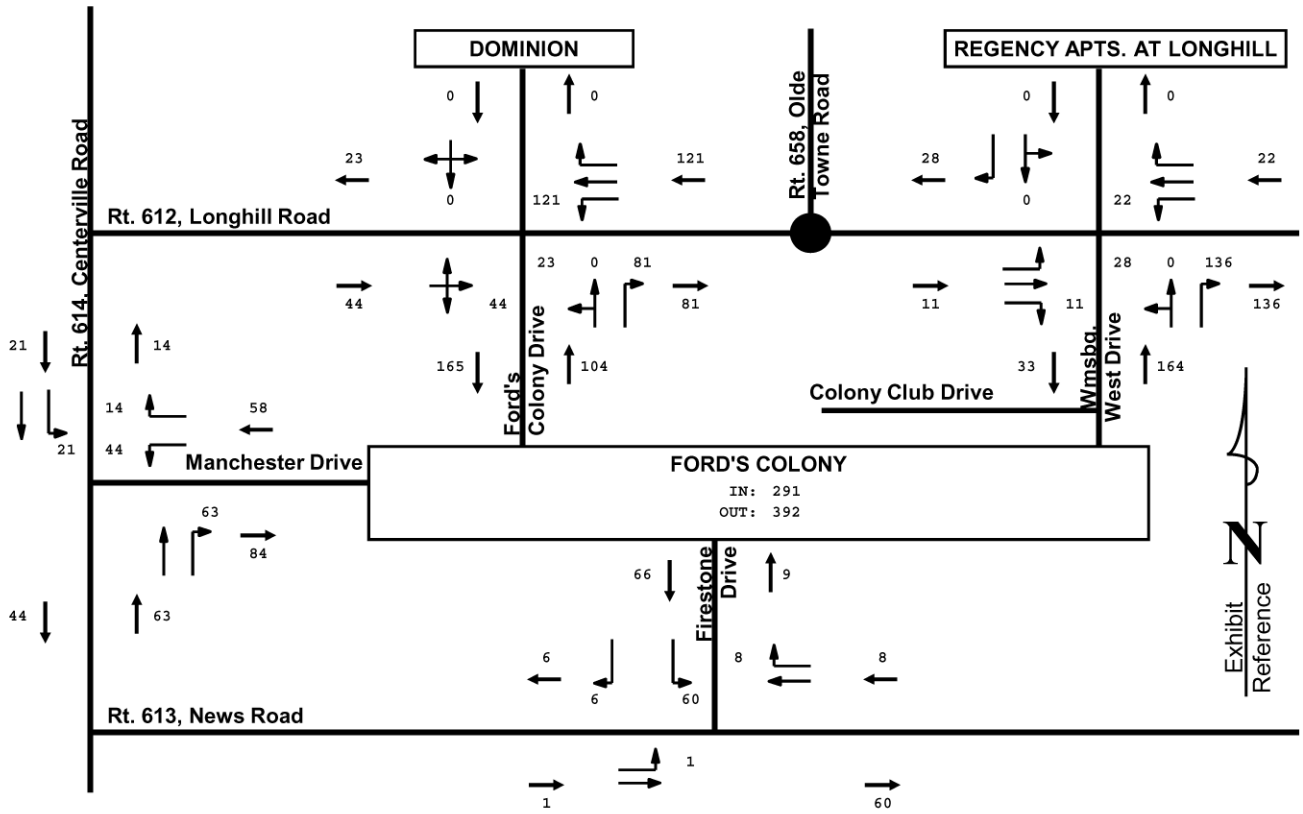



NEWS ROAD CORRIDOR
INTERSECTIONS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 1c

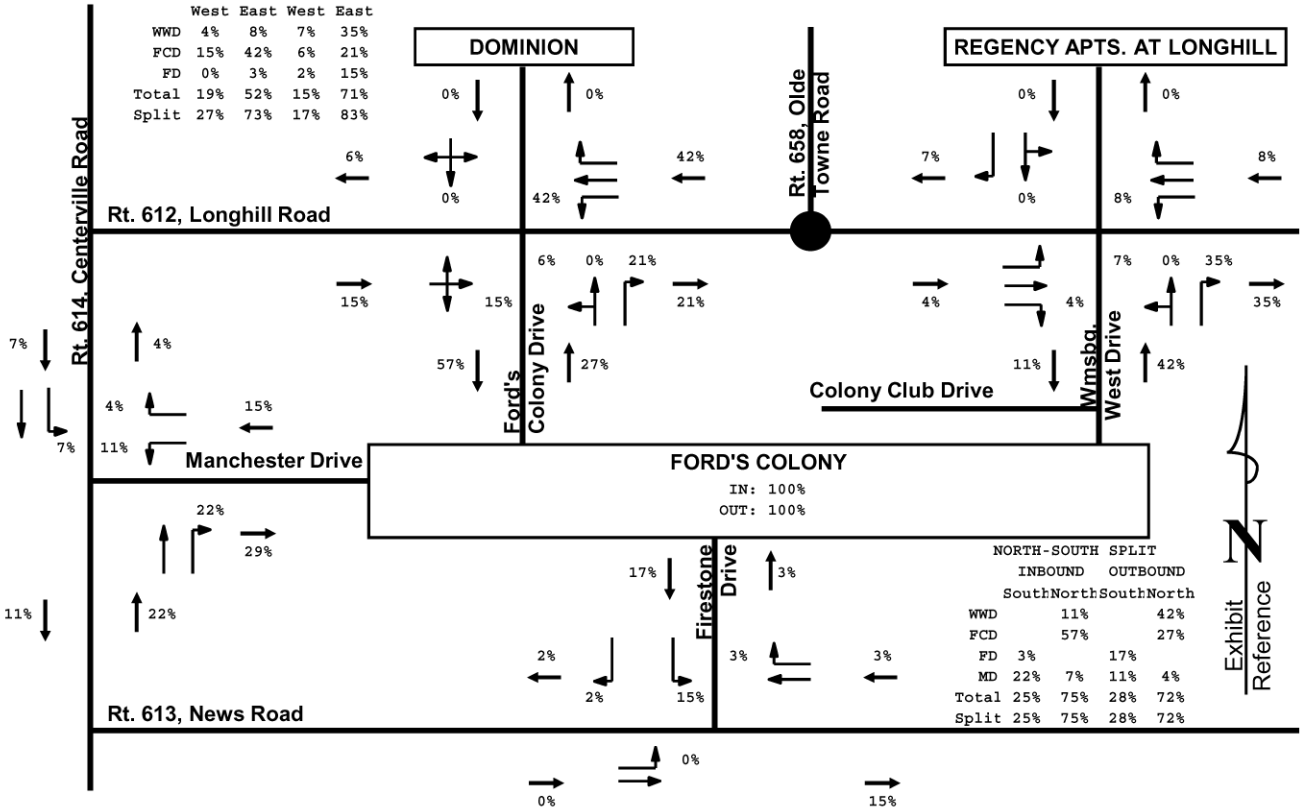
## 2003 AM Peak Hour Counts




## 2003 AM PEAK HOUR DISTRIBUTION

EAST-WEST SPLIT

| | INBOUND | | OUTBOUND | |
|---|---|---|---|---|
| | West | East | West | East |
| WWD | 4% | 8% | 7% | 35% |
| FCD | 15% | 42% | 6% | 21% |
| FD | 0% | 3% | 2% | 15% |
| Total | 19% | 52% | 15% | 71% |
| Split | 27% | 73% | 17% | 83% |




NORTH-SOUTH SPLIT

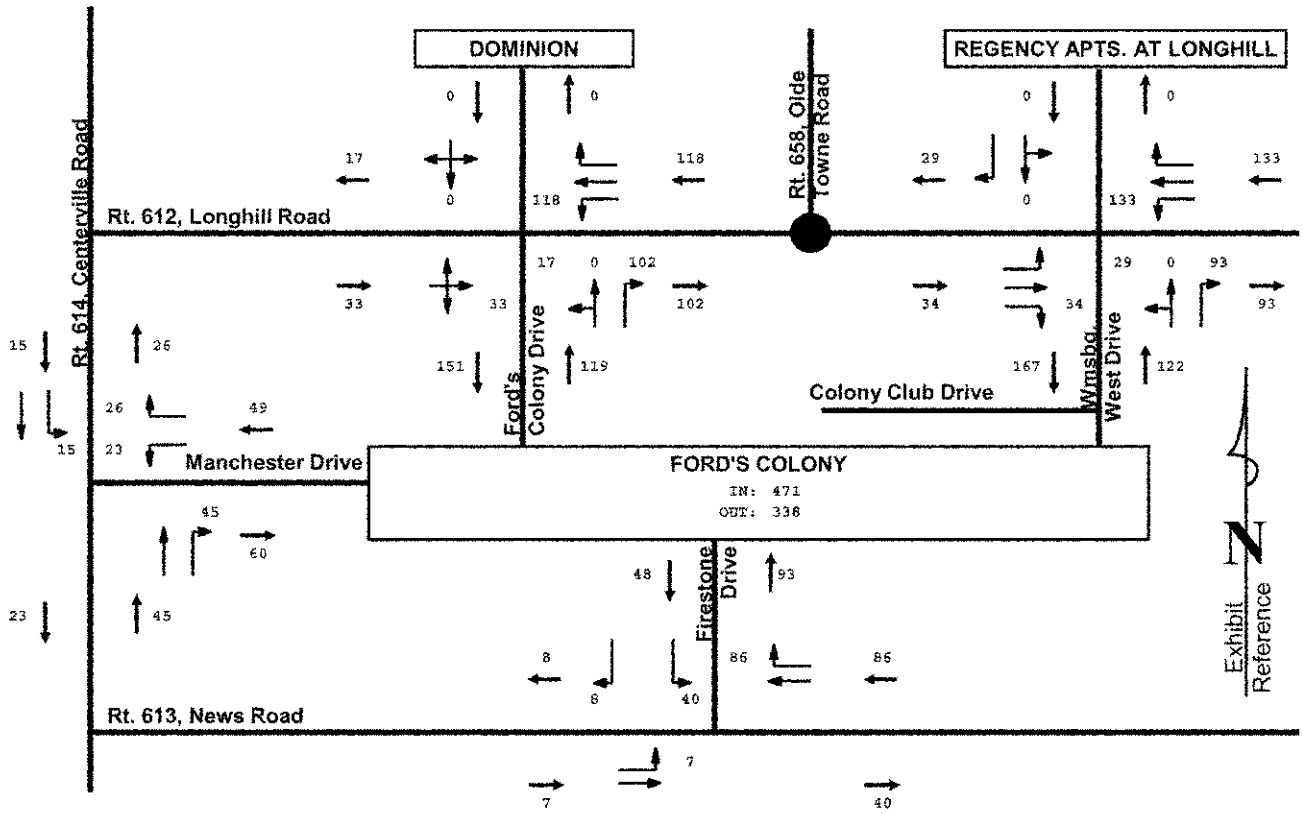
| | INBOUND | | OUTBOUND | |
|---|---|---|---|---|
| | South | North | South | North |
| WWD | | 11% | | 42% |
| FCD | | 57% | | 27% |
| FD | 3% | | 17% | |
| MD | 22% | 7% | 11% | 4% |
| Total | 25% | 75% | 28% | 72% |
| Split | 25% | 75% | 28% | 72% |

FORD'S COLONY 2003 AM PEAK HOUR DISTRIBUTION

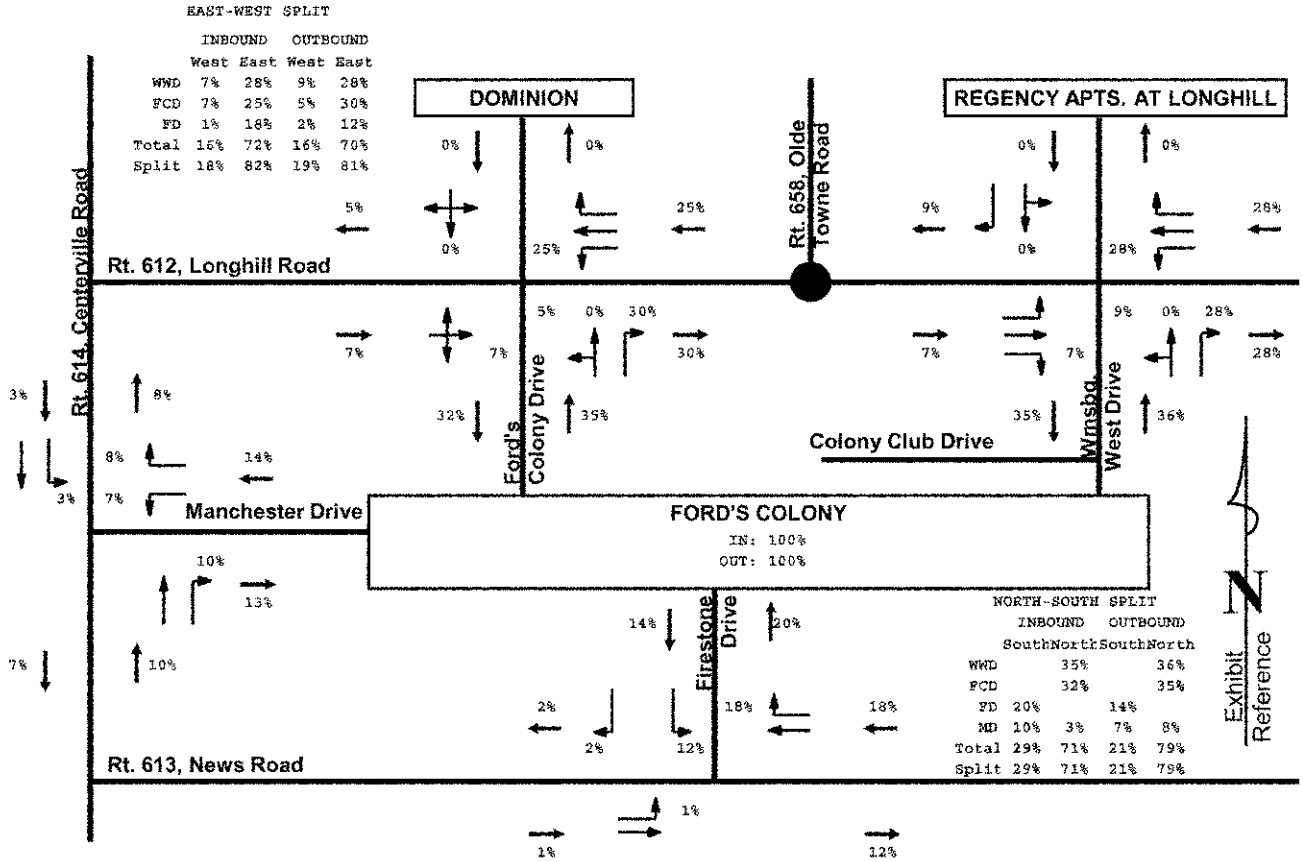
*DRW Consultants, LLC*
*804-794-7312*

**Exhibit 2a**

## 2003 PM Peak Hour Counts




## 2003 PM PEAK HOUR DISTRIBUTION




FORD'S COLONY 2003 PM PEAK HOUR DISTRIBUTION

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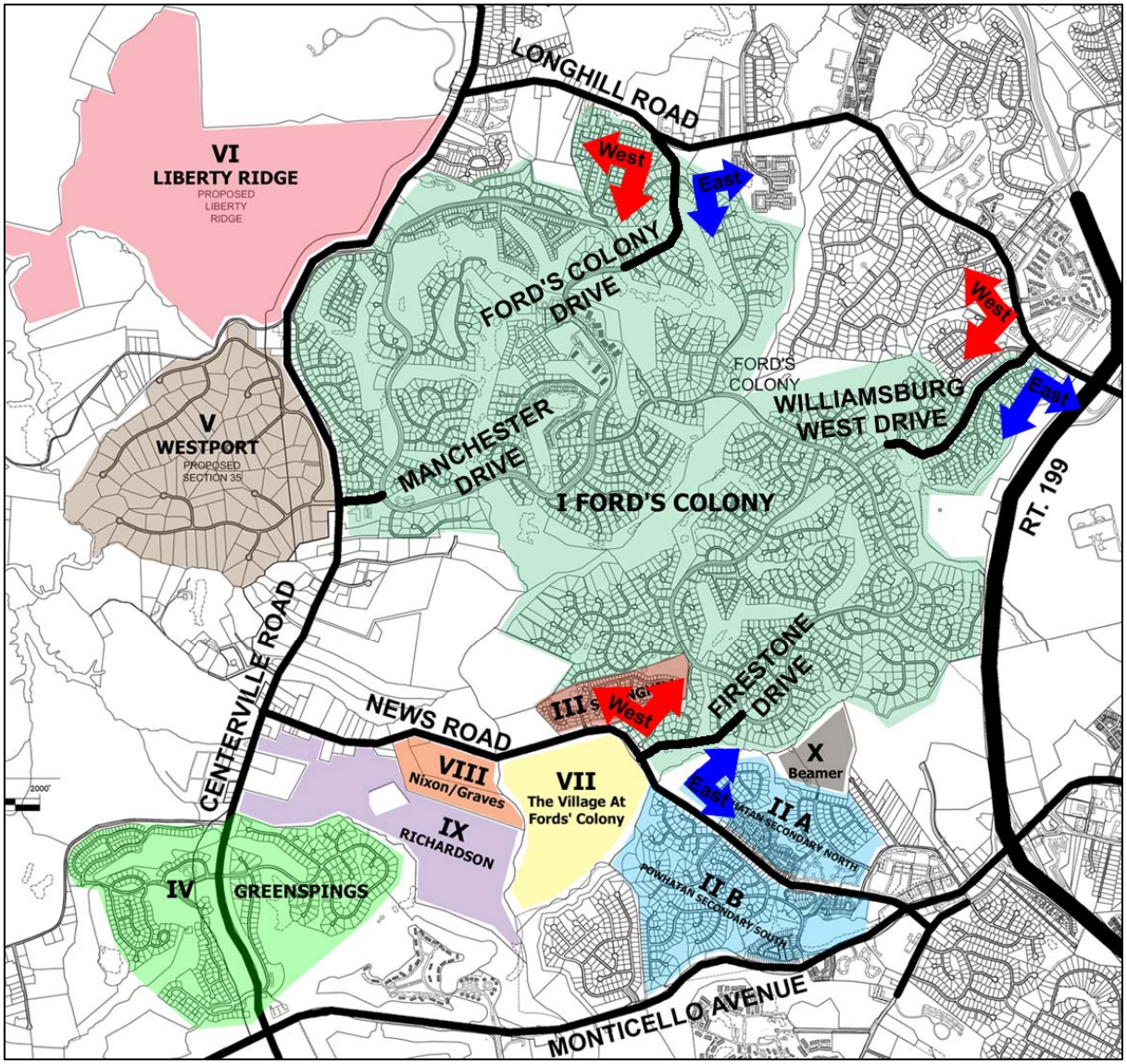
*804-794-7312*

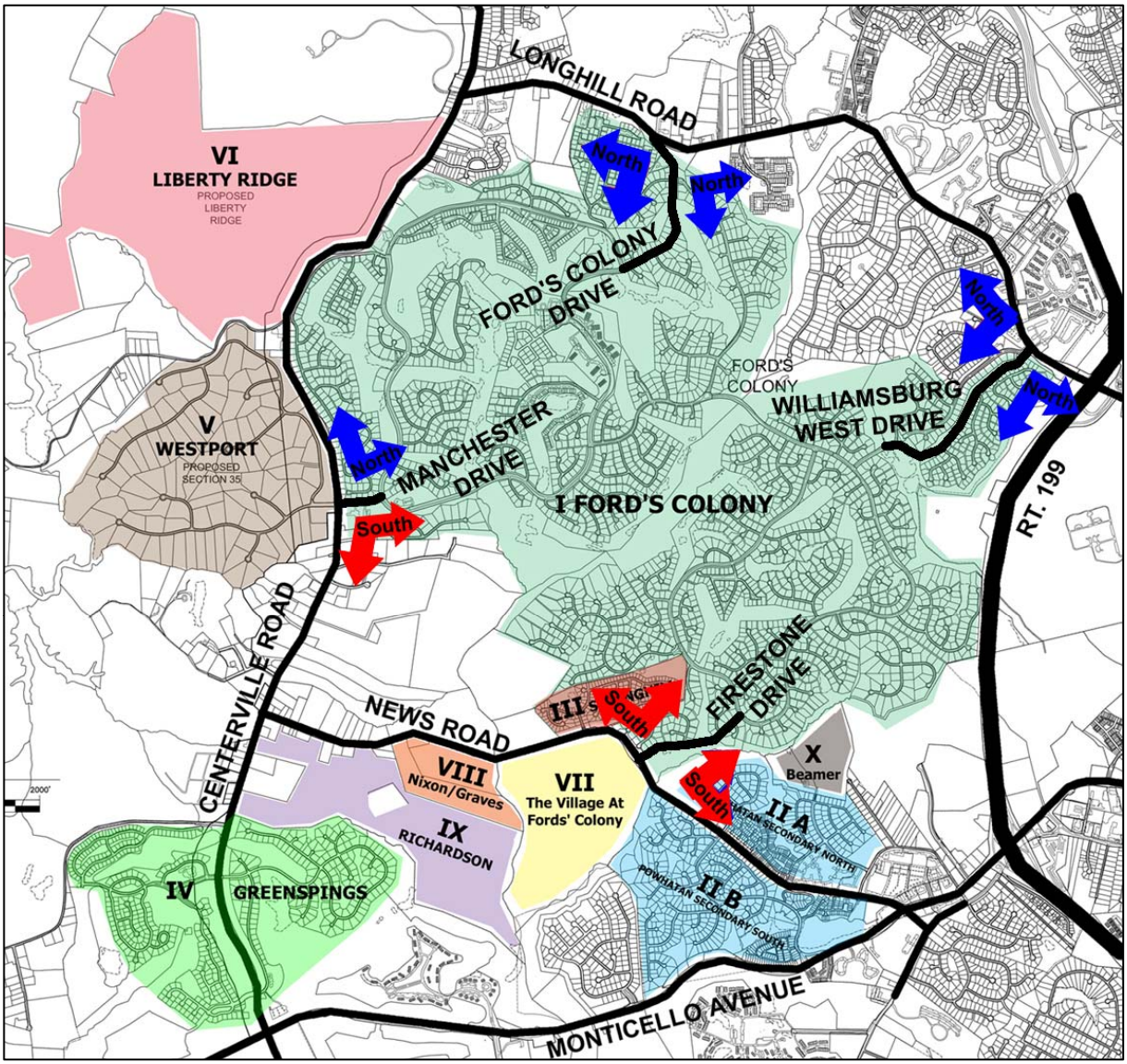
Exhibit 2b




FORD'S COLONY EAST- WEST DISTRIBUTION SPLIT
TRAFFIC LOCATIONS

***DRW Consultants, LLC***
***804-794-7312***

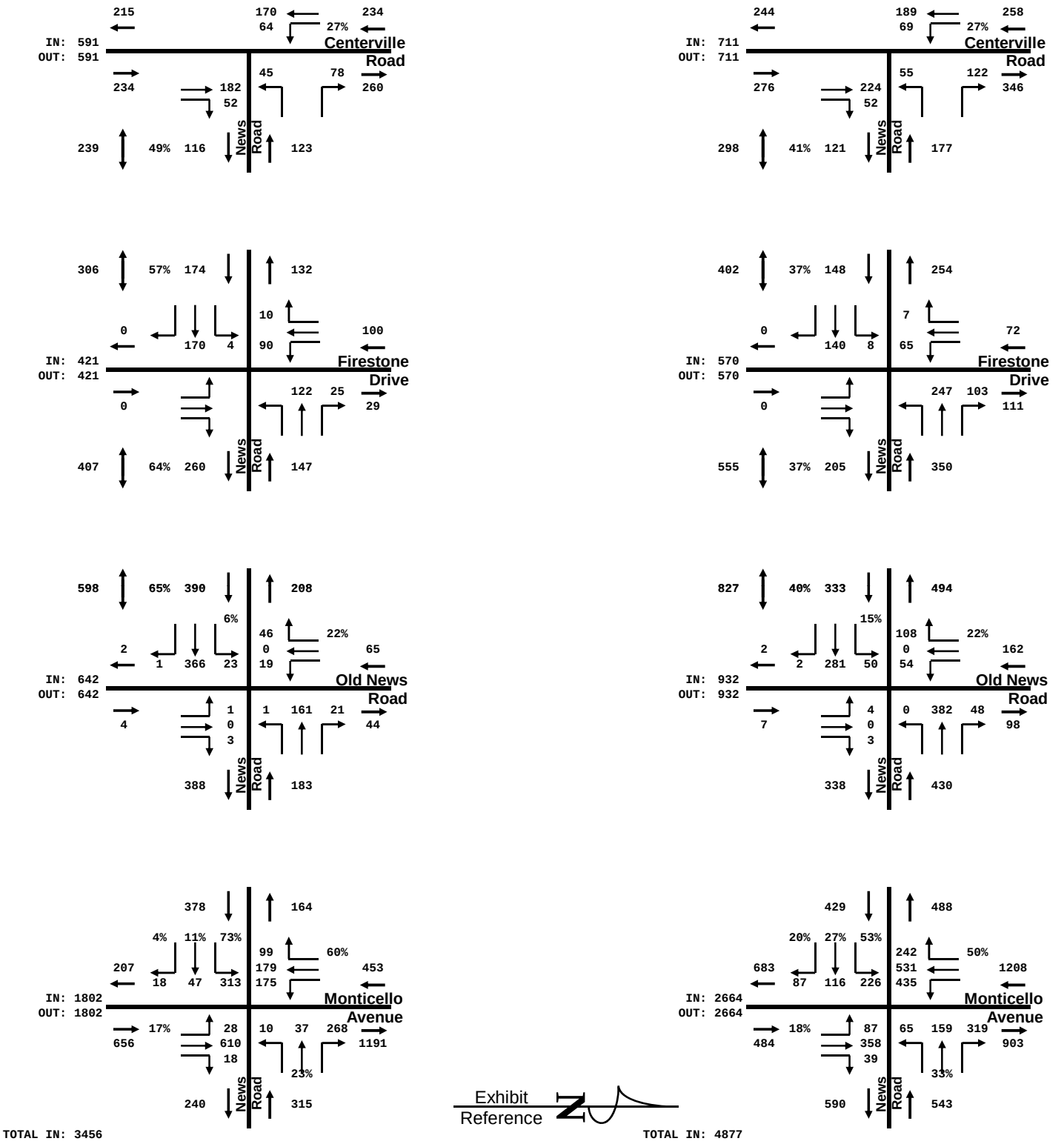
Exhibit 2c




FORD'S COLONY NORTH-SOUTH DISTRIBUTION SPLIT
TRAFFIC LOCATIONS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 2d




**AM PEAK HOUR**

**PM PEAK HOUR**

2007/2008 PEAK HOUR COUNTS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 3

| TRACT | LAND USE | LAND USE CODE | SQ.FT., OTHER UNITS | WEEKDAY TRIP GENERATION AM PEAK HOUR Enter | Exit | Total | PM PEAK HOUR Enter | Exit | Total | DAILY |
|---|---|---|---|---|---|---|---|---|---|---|

**TABLE 1 - FORD'S COLONY TRIP GENERATION (I)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **2007** | | | | | | | | | | |
| avg. rate-adj. st. | Single-Family | 210 | 2,180 units | 409 | 1226 | 1635 | 1387 | 815 | 2202 | 20863 |
| eq.-adj. st. | Condo/Townhouse | 230 | 92 units | 8 | 40 | 48 | 38 | 18 | 56 | 598 |
| | | 2007 TOTAL | 2272 units | 417 | 1266 | 1683 | 1425 | 833 | 2258 | 21461 |
| **BUILD OUT** | | | | | | | | | | |
| avg. rate-adj. st. | Single-Family | 210 | 2,862 units | 537 | 1610 | 2147 | 1821 | 1070 | 2891 | 27389 |
| eq.-adj. st. | Condo/Townhouse | 230 | 188 units | 15 | 71 | 86 | 68 | 33 | 101 | 1098 |
| | | BUILDOUT TOTAL | 3050 units | 552 | 1681 | 2233 | 1889 | 1103 | 2992 | 28487 |
| | | | % INCREASE | 32.4% | 32.8% | 32.7% | 32.6% | 32.4% | 32.5% | 32.7% |

**TABLE 2 - POWHATAN SECONDARY NORTH (IIA) - East West Split**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| eq.-adj. st. | Single-Family | 210 | 30 units | 8 | 22 | 30 | 23 | 13 | 36 | 343 |

| | AM Peak Hour | | | | PM Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|
| | Entering Traffic | | Exiting Traffic | | Entering Traffic | | Exiting Traffic | |
| Direction | % Dist. | Trips | % Dist. | Trips | % Dist. | Trips | % Dist. | Trips |
| Centerville North | 22% | 2 | 12% | 3 | 13% | 3 | 14% | 2 |
| Centerville South | 5% | 0 | 5% | 1 | 5% | 1 | 5% | 1 |
| Old News North | 20% | 2 | 5% | 1 | 20% | 5 | 15% | 2 |
| Monticello North | 20% | 2 | 45% | 10 | 30% | 7 | 35% | 5 |
| News East | 23% | 2 | 23% | 5 | 22% | 5 | 21% | 3 |
| Monticello South | 10% | 1 | 10% | 2 | 10% | 2 | 10% | 1 |
| | 100% | 9 | 100% | 22 | 100% | 23 | 100% | 14 |

NOTE: ALL TRAFFIC ASSIGNED TO NEWS ROAD VIA POWHATAN SECONDARY

**TABLE 3 - GREENSPRINGS (IV) - 40% To News Road**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| eq.-adj. st. | Single-Family | 210 | 74 units | 15 | 46 | 61 | 52 | 30 | 82 | 788 |

| | AM Peak Hour | | | | PM Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|
| | Entering Traffic | | Exiting Traffic | | Entering Traffic | | Exiting Traffic | |
| Direction | % Dist. | Trips | % Dist. | Trips | % Dist. | Trips | % Dist. | Trips |
| Centerville South | 40% | 6 | 40% | 18 | 40% | 21 | 40% | 12 |
| Centerville North | 20% | 3 | 20% | 9 | 20% | 10 | 20% | 6 |
| Old News North | 10% | 2 | 10% | 5 | 10% | 5 | 10% | 3 |
| Monticello North | 20% | 3 | 20% | 9 | 20% | 10 | 20% | 6 |
| News East | 10% | 2 | 10% | 5 | 10% | 5 | 10% | 3 |
| | 100% | 16 | 100% | 46 | 100% | 51 | 100% | 30 |

NOTE: TRAFFIC ASSIGNED TO NEWS ROAD VIA CENTERVILLE ROAD

Trip generation rates from Trip Generation, 7th Edition (TG7) by the Institute of Transportation Engineers (ITE)

FORD'S COLONY, POWHATAN SECONDARY, GREENSPRINGS
TRIP GENERATION AND DISTRIBUTION

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 4

| TRACT | LAND USE | LAND USE CODE | SQ.FT., OTHER UNITS | WEEKDAY TRIP GENERATION | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | AM PEAK HOUR | | | PM PEAK HOUR | | | DAILY |
| | | | | Enter | Exit | Total | Enter | Exit | Total | |

**TABLE 1 - WESTPORT (V) - North-South Split**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| eq.-adj. st. | Single-Family | 210 | 108 units | 21 | 64 | 85 | 72 | 43 | 115 | 1116 |
| Average of % ITE avg. trip rate for 1998 and 2003 - Ford's Colony | | | | 95% | 46% | 58% | 49% | 74% | 58% | |
| Ford's Colony Trip Generation Rates | | | 108 units | 20 | 30 | 49 | 35 | 32 | 67 | |

| | AM Peak Hour | | | | PM Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|
| | Entering Traffic | | Exiting Traffic | | Entering Traffic | | Exiting Traffic | |
| Direction | % Dist. | Trips | % Dist. | Trips | % Dist. | Trips | % Dist. | Trips |
| Centerville North | 75% | 15 | 72% | 22 | 71% | 25 | 79% | 25 |
| Centerville South | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 0 |
| Old News North | 5% | 1 | 5% | 2 | 5% | 2 | 5% | 2 |
| Monticello North | 10% | 2 | 15% | 5 | 15% | 5 | 10% | 3 |
| News East | 5% | 1 | 5% | 2 | 5% | 2 | 5% | 2 |
| Monticello South | 5% | 1 | 3% | 1 | 4% | 1 | 1% | 0 |
| | 100% | 20 | 100% | 32 | 100% | 35 | 100% | 32 |

NOTE: TRAFFIC ASSIGNED TO NEWS ROAD VIA CENTERVILLE ROAD

**TABLE 2 - LIBERTY RIDGE (VI) - North-South Split**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| eq.-adj. st. | Single-Family | 210 | 138 units | 27 | 79 | 106 | 90 | 53 | 143 | 1398 |

| | AM Peak Hour | | | | PM Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|
| | Entering Traffic | | Exiting Traffic | | Entering Traffic | | Exiting Traffic | |
| Direction | % Dist. | Trips | % Dist. | Trips | % Dist. | Trips | % Dist. | Trips |
| Centerville North | 75% | 20 | 72% | 57 | 71% | 64 | 79% | 42 |
| Centerville South | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 0 |
| Old News North | 5% | 1 | 5% | 4 | 5% | 5 | 5% | 3 |
| Monticello North | 10% | 3 | 15% | 12 | 15% | 14 | 10% | 5 |
| News East | 5% | 1 | 5% | 4 | 5% | 5 | 5% | 3 |
| Monticello South | 5% | 1 | 3% | 2 | 4% | 4 | 1% | 1 |
| | 100% | 26 | 100% | 79 | 100% | 92 | 100% | 54 |

NOTE: TRAFFIC ASSIGNED TO NEWS ROAD VIA CENTERVILLE ROAD

Trip generation rates from Trip Generation, 7th Edition (TG7) by the Institute of Transportation Engineers (ITE)

WESTPORT, LIBERTY RIDGE
TRIP GENERATION AND DISTRIBUTION

***DRW Consultants, LLC***
***804-794-7312***

Exhibit 5

**TABLE 1 - THE VILLAGE TRIP GENERATION**

| TRACT | LAND USE | LAND USE CODE | SQ.FT., OTHER UNITS | WEEKDAY TRIP GENERATION | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | AM PEAK HOUR | | | PM PEAK HOUR | | | DAILY |
| | | | | Enter | Exit | Total | Enter | Exit | Total | |
| | Elderly Detached | 251 | 32 units | 4 | 6 | 10 | 13 | 9 | 22 | 206 |
| | Elderly Attached | 252 | 332 units | 12 | 15 | 27 | 23 | 14 | 37 | 1155 |
| | Congregate Care | 253 | 290 units | 10 | 7 | 17 | 27 | 22 | 49 | 586 |
| | Assisted Living | 254 | 118 occ.bed | 15 | 5 | 20 | 18 | 16 | 34 | 323 |
| rate/adj. st. | Nursing Home | 620 | 180 beds | 21 | 10 | 31 | 13 | 27 | 40 | 427 |
| | | TOTAL | 952 units | 62 | 43 | 105 | 94 | 88 | 182 | 2697 |

| | | | |
|---|---|---|---|
| **TG 7 Definitions** | Elderly Detached | 251 | may have recreation, but not central dining or health care |
| | Elderly Attached | 252 | apartment-like residential units |
| | Congregate Care | 253 | centralized amenities: dining, house keeping, trans., social/rec |
| | Assisted Living | 254 | protective oversight, ALS and Alzheimers may be included |

| ITE USE CODE | 253 | 254 | | | 251 | 252 | | |
|---|---|---|---|---|---|---|---|---|
| FORD'S COLONY CCRC DEFINITIONS | CCRC Apt | Asst. Liv. Skill Care | CCRC Total | | Town Homes | Ind. L.U. | Non CCRC | |
| Community 1 | 154 | 18 | 172 | | 6 | | | |
| Community 2 | | 100 | 100 | | 26 | 214 | | |
| Community 3 | 136 | | 136 | | | 118 | | |
| | 290 | 118 | 408 | | 32 | 332 | 364 | |

**TABLE 2 - THE VILLAGE SITE TRIP DISTRIBUTION - East West Split**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 62 | 43 | 105 | 94 | 88 | 182 |
| | AM Peak Hour | | | | | | PM Peak Hour | | |
| | Entering Traffic | | Exiting Traffic | | | | Entering Traffic | | Exiting Traffic |
| Direction | % Dist. | Trips | % Dist. | Trips | | | % Dist. | Trips | % Dist. | Trips |
| Centerville North | 22% | 14 | 12% | 5 | | | 13% | 12 | 14% | 12 |
| Centerville South | 5% | 3 | 5% | 2 | | | 5% | 5 | 5% | 4 |
| Old News North | 20% | 12 | 5% | 2 | | | 20% | 19 | 15% | 13 |
| Monticello North | 20% | 12 | 45% | 19 | | | 30% | 28 | 35% | 31 |
| News East | 23% | 14 | 23% | 10 | | | 22% | 21 | 21% | 18 |
| Monticello South | 10% | 6 | 10% | 4 | | | 10% | 9 | 10% | 9 |
| | 100% | 61 | 100% | 42 | | | 100% | 94 | 100% | 87 |

Trip generation rates from Trip Generation, 7th Edition (TG7) by the Institute of Transportation Engineers (ITE)

THE VILLAGE AT FORD'S COLONY (VII)
TRIP GENERATION AND DISTRIBUTION

***DRW Consultants, LLC***
***804-794-7312***

Exhibit 6

| TRACT | LAND USE | LAND USE CODE | SQ.FT., OTHER UNITS | WEEKDAY TRIP GENERATION | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | AM PEAK HOUR | | | PM PEAK HOUR | | | DAILY |
| | | | | Enter | Exit | Total | Enter | Exit | Total | |

**TABLE 1 - NIXON-GRAVES (VIII) - East-West Split**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| eq.-adj. st. | Single-Family | 210 | 60 units | 13 | 38 | 51 | 43 | 25 | 68 | 650 |
| | | AM Peak Hour | | | | | PM Peak Hour | | | |
| | | Entering Traffic | | Exiting Traffic | | | Entering Traffic | | Exiting Traffic | |
| | Direction | % Dist. | Trips | % Dist. | Trips | | % Dist. | Trips | % Dist. | Trips |
| | Centerville North | 22% | 3 | 12% | 5 | | 13% | 6 | 14% | 4 |
| | Centerville South | 5% | 1 | 5% | 2 | | 5% | 2 | 5% | 1 |
| | Old News North | 20% | 3 | 5% | 2 | | 20% | 9 | 15% | 4 |
| | Monticello North | 20% | 3 | 45% | 17 | | 30% | 13 | 35% | 9 |
| | News East | 23% | 3 | 23% | 9 | | 22% | 9 | 21% | 5 |
| | Monticello South | 10% | 1 | 10% | 4 | | 10% | 4 | 10% | 3 |
| | | 100% | 14 | 100% | 39 | | 100% | 43 | 100% | 26 |

NOTE: ALL TRAFFIC ASSIGNED TO NEWS ROAD

**TABLE 2 - RICHARDSON (IX) - East-West Split**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| eq.-adj. st. | Single-Family | 210 | 39 units | 9 | 28 | 37 | 29 | 17 | 46 | 437 |
| | | AM Peak Hour | | | | | PM Peak Hour | | | |
| | | Entering Traffic | | Exiting Traffic | | | Entering Traffic | | Exiting Traffic | |
| | Direction | % Dist. | Trips | % Dist. | Trips | | % Dist. | Trips | % Dist. | Trips |
| | Centerville North | 22% | 2 | 12% | 3 | | 13% | 4 | 14% | 2 |
| | Centerville South | 5% | 0 | 5% | 1 | | 5% | 1 | 5% | 1 |
| | Old News North | 20% | 2 | 5% | 1 | | 20% | 6 | 15% | 3 |
| | Monticello North | 20% | 2 | 45% | 13 | | 30% | 9 | 35% | 6 |
| | News East | 23% | 2 | 23% | 6 | | 22% | 6 | 21% | 4 |
| | Monticello South | 10% | 1 | 10% | 3 | | 10% | 3 | 10% | 2 |
| | | 100% | 9 | 100% | 27 | | 100% | 29 | 100% | 18 |

NOTE: ALL TRAFFIC ASSIGNED TO NEWS ROAD

**TABLE 3 - BEAMER (X) - North-South Split**

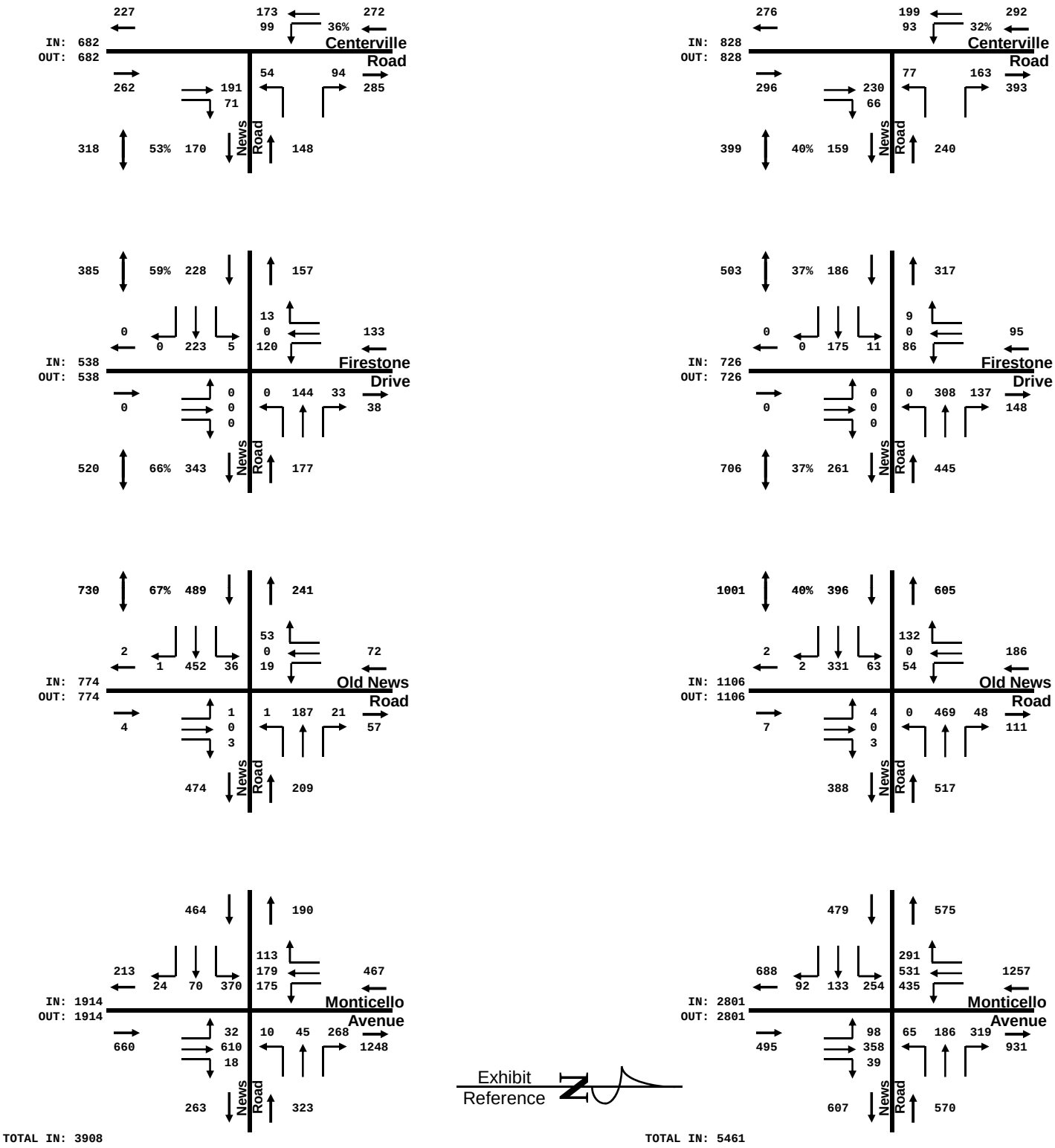
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| eq.-adj. st. | Condo/Townhouse | 230 | 70 units | 7 | 32 | 39 | 30 | 15 | 45 | 474 |
| | | AM Peak Hour | | | | | PM Peak Hour | | | |
| | | Entering Traffic | | Exiting Traffic | | | Entering Traffic | | Exiting Traffic | |
| | Direction | % Dist. | Trips | % Dist. | Trips | | % Dist. | Trips | % Dist. | Trips |
| | Centerville North | 5% | 0 | 5% | 2 | | 5% | 2 | 5% | 1 |
| | Centerville South | 5% | 0 | 5% | 2 | | 5% | 2 | 5% | 1 |
| | Old News North | 75% | 5 | 72% | 23 | | 71% | 21 | 79% | 12 |
| | Monticello North | 0% | 0 | 0% | 0 | | 0% | 0 | 0% | 0 |
| | News East | 10% | 1 | 13% | 4 | | 10% | 3 | 10% | 2 |
| | Monticello South | 5% | 0 | 5% | 2 | | 9% | 3 | 1% | 0 |
| | | 100% | 6 | 100% | 33 | | 100% | 31 | 100% | 16 |

Trip generation rates from Trip Generation, 7th Edition (TG7) by the Institute of Transportation Engineers (ITE)

NIXON-GRAVES, RICHARDSON, BEAMER
TRIP GENERATION AND DISTRIBUTION

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 7



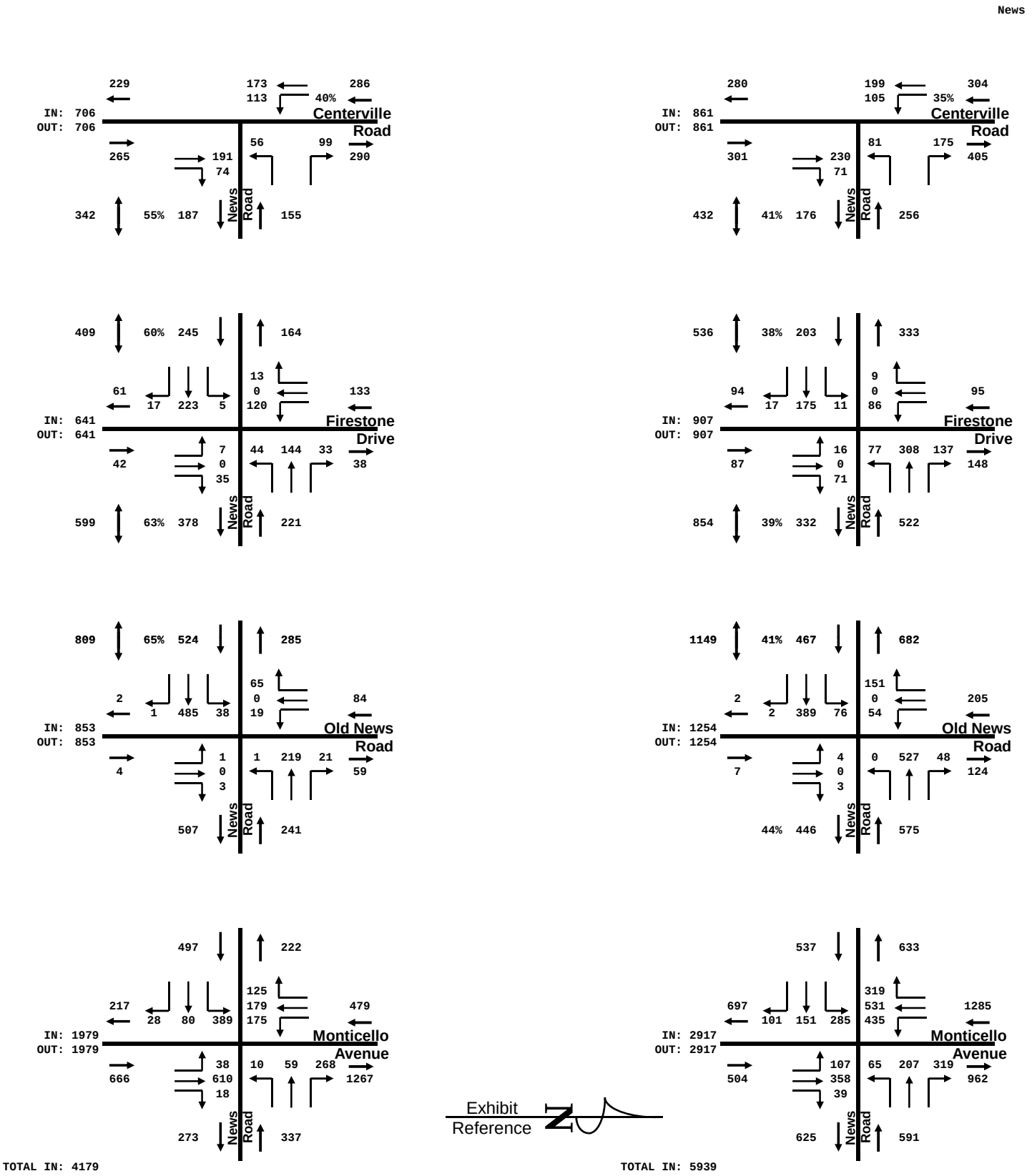

**AM PEAK HOUR**

**PM PEAK HOUR**

APPROVED DEVELOPMENT TRAFFIC FORECAST (I THRU VI)
(2007/2008 Counts And All Approved Development Traffic)

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 8



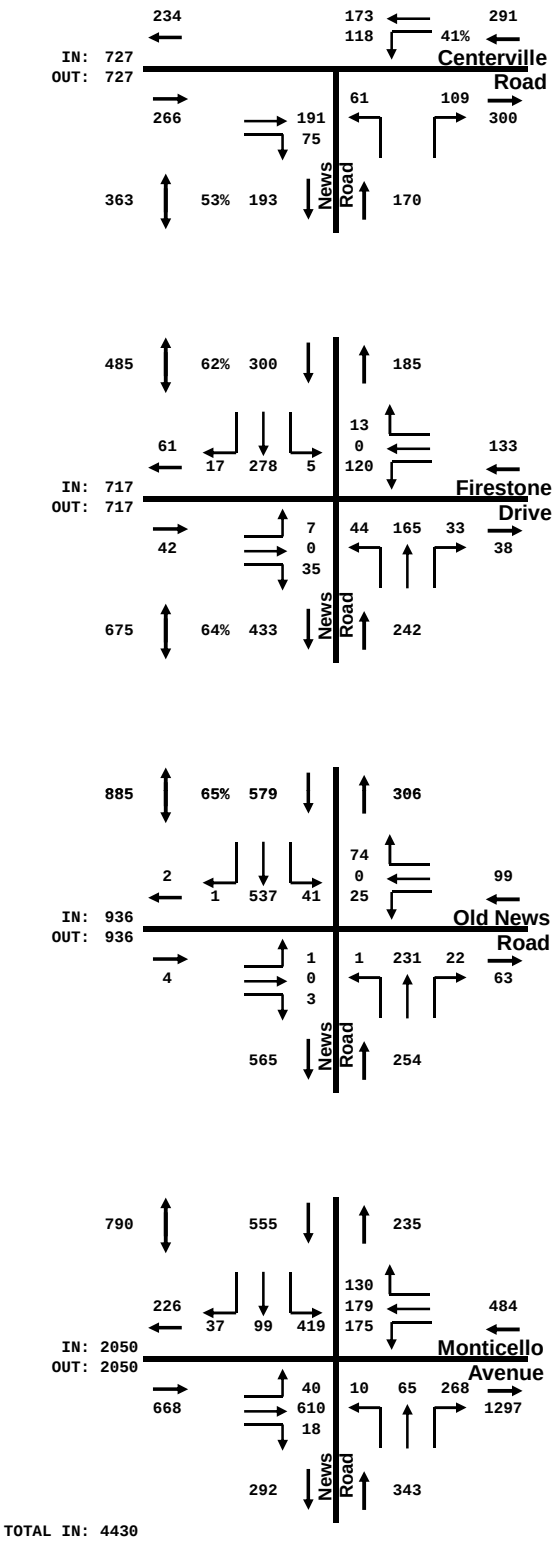

**AM PEAK HOUR**

**PM PEAK HOUR**

THE VILLAGE AT FORD'S COLONY TRAFFIC FORECAST (I THRU VII)
(Approved Development Forecast And The Village Traffic)

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 9



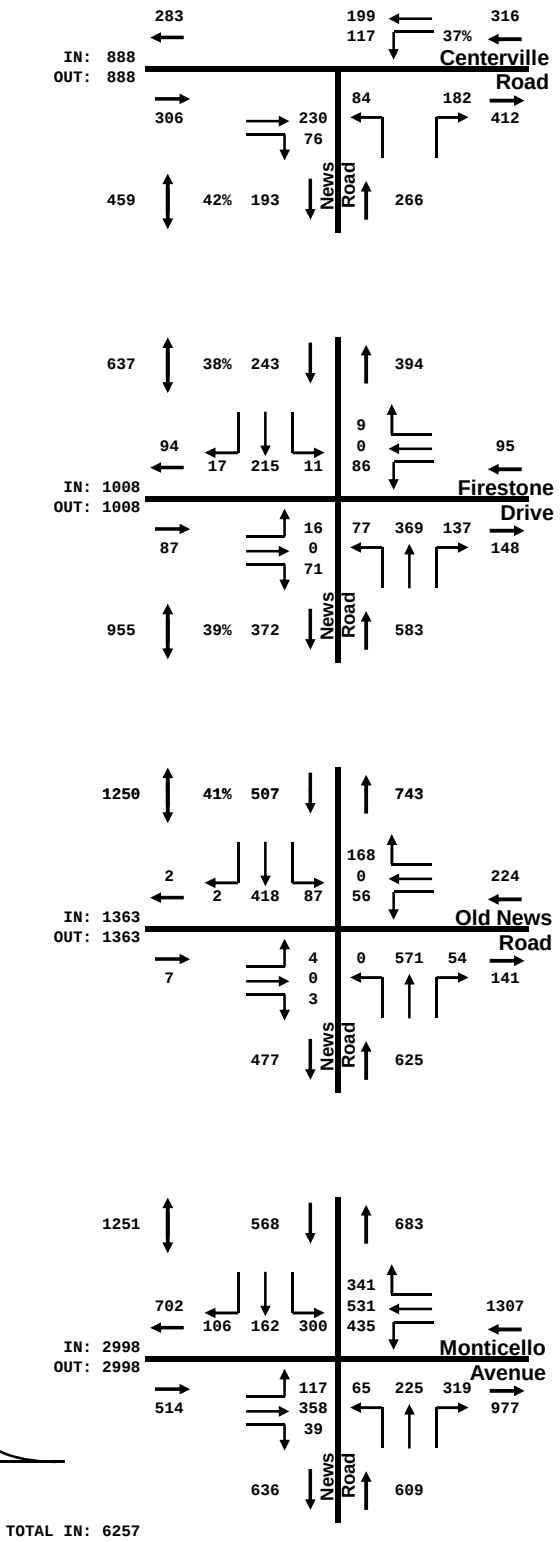




Exhibit Reference

**AM PEAK HOUR**

**PM PEAK HOUR**

PROPOSED DEVELOPMENT TRAFFIC FORECAST (I THRU X)
(The Village Forecast With Proposed Development Traffic)

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 10

# APPENDIX
# EXHIBITS

# APPENDIX
# TABLE OF CONTENTS


APPENDIX EXHIBITS — Number

**Peak Hour Traffic Count ..... AM PM**
News Road/Centerville Road ..... A1 ..... A2
News Road/Firestone Drive ..... B1 ..... B2
News Road/Old News Road ..... C1 ..... C2
News Road/Monticello Avenue ..... D1 ..... D2

**Development Trip Assignments**
Ford's Colony Build Out Trips ..... E1
Powhatan Secondary North Trip Assignments ..... E2
Greensprings Trip Assignments ..... E3
Westport Trip Assignments ..... E4
Liberty Ridge Trip Assignments ..... E5
The Village At Ford's Colony Trip Assignments ..... E6
Nixon-Graves Trip Assignments ..... E7
Richardson Trip Assignments ..... E8
Beamer Trip Assignments ..... E9

**Synchro Unsignalized Intersection LOS (HCM) ..... AM PM**
**News Road/Centerville Road**
2007/2008 Counts ..... G1 ..... G2
Approved Development Forecast ..... G3 ..... G4
The Village Forecast ..... G5 ..... G6
Proposed Development Forecast ..... G7 ..... G8
**News Road/Firestone Drive**
2007/2008 Counts ..... H1 ..... H2
Approved Development Forecast ..... H3 ..... H4
The Village Forecast ..... H5 ..... H6
Proposed Development Forecast ..... H7 ..... H8
**News Road/Old News Road**
2007/2008 Counts ..... I1 ..... I2
Approved Development Forecast ..... I3 ..... I4
The Village Forecast ..... I5 ..... I6
Proposed Development Forecast ..... I7 ..... I8

**Right Turn Lane Warrants ..... AM PM**
News Road/Centerville Road (Counts And All Forecasts) ..... J1 ..... J2
News Road/Firestone Drive (Counts And All Forecasts) ..... J3 ..... J3

**Left Turn Lane Warrants**
News Road/Centerville Road (2007) ..... K

**News Road Two Lane Highway LOS ..... AM PM**
**East Of Centerville Road**
2007/2008 Counts ..... L1 ..... L2
Approved Development Forecast ..... L3 ..... L4
The Village Forecast ..... L5 ..... L6
Proposed Development Forecast ..... L7 ..... L8
**Powhatan Secondary to Old News Road**
2007/2008 Counts ..... O1 ..... O2
Approved Development Forecast ..... O3 ..... O4
The Village Forecast ..... O5 ..... O6
Proposed Development Forecast ..... O7 ..... O8

**Synchro Signalized Intersection LOS (HCM) ..... AM PM**
**News Road/Monticello Avenue**
2007/2008 Counts ..... P1 ..... P2
Approved Development Forecast ..... P3 ..... P4
The Village Forecast ..... P5 ..... P6
Proposed Development Forecast ..... P7 ..... P8

**AM PEAK HOUR** Date: Thu, 4/26/07

LOCATION: Centerville Road/News Road

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | | 34 | 10 | 19 | 44 | | | | | 14 | | 20 | 141 |
| 7:15 to 7:30 | | 91 | 19 | 35 | 83 | | | | | 26 | | 33 | 287 |
| 7:30 to 7:45 | | 133 | 36 | 46 | 128 | | | | | 38 | | 60 | 441 |
| 7:45 to 8:00 | | 182 | 52 | 64 | 170 | | | | | 45 | | 78 | 591 |
| 8:00 to 8:15 | | 216 | 66 | 79 | 195 | | | | | 54 | | 87 | 697 |
| 8:15 to 8:30 | | 267 | 70 | 103 | 228 | | | | | 61 | | 117 | 846 |
| 8:30 to 8:45 | | 308 | 80 | 120 | 262 | | | | | 66 | | 139 | 975 |
| 8:45 to 9:00 | | 357 | 90 | 134 | 296 | | | | | 73 | | 157 | 1107 |
| Count Sheet | | F | E | B | A | | | | | D | | C | |

15 MINUTE INTERVAL COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | 0 | 34 | 10 | 19 | 44 | 0 | 0 | 0 | 0 | 14 | 0 | 20 | 141 |
| 7:15 to 7:30 | 0 | 57 | 9 | 16 | 39 | 0 | 0 | 0 | 0 | 12 | 0 | 13 | 146 |
| 7:30 to 7:45 | 0 | 42 | 17 | 11 | 45 | 0 | 0 | 0 | 0 | 12 | 0 | 27 | 154 |
| 7:45 to 8:00 | 0 | 49 | 16 | 18 | 42 | 0 | 0 | 0 | 0 | 7 | 0 | 18 | 150 |
| 8:00 to 8:15 | 0 | 34 | 14 | 15 | 25 | 0 | 0 | 0 | 0 | 9 | 0 | 9 | 106 |
| 8:15 to 8:30 | 0 | 51 | 4 | 24 | 33 | 0 | 0 | 0 | 0 | 7 | 0 | 30 | 149 |
| 8:30 to 8:45 | 0 | 41 | 10 | 17 | 34 | 0 | 0 | 0 | 0 | 5 | 0 | 22 | 129 |
| 8:45 to 9:00 | 0 | 49 | 10 | 14 | 34 | 0 | 0 | 0 | 0 | 7 | 0 | 18 | 132 |

HOUR INTERVAL

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 8:00 | 0 | 182 | 52 | 64 | 170 | 0 | 0 | 0 | 0 | 45 | 0 | 78 | 591 |
| 7:15 to 8:15 | 0 | 182 | 56 | 60 | 151 | 0 | 0 | 0 | 0 | 40 | 0 | 67 | 556 |
| 7:30 to 8:30 | 0 | 176 | 51 | 68 | 145 | 0 | 0 | 0 | 0 | 35 | 0 | 84 | 559 |
| 7:45 to 8:45 | 0 | 175 | 44 | 74 | 134 | 0 | 0 | 0 | 0 | 28 | 0 | 79 | 534 |
| 8:00 to 9:00 | 0 | 175 | 38 | 70 | 126 | 0 | 0 | 0 | 0 | 28 | 0 | 79 | 516 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 8:00 | 0 | 182 | 52 | 64 | 170 | 0 | 0 | 0 | 0 | 45 | 0 | 78 | 591 |
| 8:00 to 9:00 | 0 | 175 | 38 | 70 | 126 | 0 | 0 | 0 | 0 | 28 | 0 | 79 | 516 |

Exhibit A1

**PM PEAK HOUR** Date: Wed, 4/25/07

LOCATION: Centerville Road/News Road

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3:45 to 4:00 | | | | | | | | | | | | | |
| 4:00 to 4:15 | | 46 | 15 | 12 | 44 | | | | | 18 | | 22 | 157 |
| 4:15 to 4:30 | | 112 | 28 | 28 | 97 | | | | | 30 | | 50 | 345 |
| 4:30 to 4:45 | | 160 | 35 | 45 | 133 | | | | | 48 | | 78 | 499 |
| 4:45 to 5:00 | | 212 | 44 | 67 | 174 | | | | | 64 | | 106 | 667 |
| 5:00 to 5:15 | | 274 | 62 | 84 | 227 | | | | | 79 | | 140 | 866 |
| 5:15 to 5:30 | | 337 | 75 | 96 | 277 | | | | | 90 | | 172 | 1047 |
| 5:30 to 5:45 | | 384 | 87 | 114 | 322 | | | | | 103 | | 200 | 1210 |
| 5:45 to 6:00 | | 425 | 96 | 121 | 371 | | | | | 112 | | 221 | 1346 |
| Count Sheet | | F | E | B | A | | | | | D | | C | |

15 MINUTE INTERVAL COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 4:15 | 0 | 46 | 15 | 12 | 44 | 0 | 0 | 0 | 0 | 18 | 0 | 22 | 157 |
| 4:15 to 4:30 | 0 | 66 | 13 | 16 | 53 | 0 | 0 | 0 | 0 | 12 | 0 | 28 | 188 |
| 4:30 to 4:45 | 0 | 48 | 7 | 17 | 36 | 0 | 0 | 0 | 0 | 18 | 0 | 28 | 154 |
| 4:45 to 5:00 | 0 | 52 | 9 | 22 | 41 | 0 | 0 | 0 | 0 | 16 | 0 | 28 | 168 |
| 5:00 to 5:15 | 0 | 62 | 18 | 17 | 53 | 0 | 0 | 0 | 0 | 15 | 0 | 34 | 199 |
| 5:15 to 5:30 | 0 | 63 | 13 | 12 | 50 | 0 | 0 | 0 | 0 | 11 | 0 | 32 | 181 |
| 5:30 to 5:45 | 0 | 47 | 12 | 18 | 45 | 0 | 0 | 0 | 0 | 13 | 0 | 28 | 163 |
| 5:45 to 6:00 | 0 | 41 | 9 | 7 | 49 | 0 | 0 | 0 | 0 | 9 | 0 | 21 | 136 |

HOUR INTERVAL

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 5:00 | 0 | 212 | 44 | 67 | 174 | 0 | 0 | 0 | 0 | 64 | 0 | 106 | 667 |
| 4:15 to 5:15 | 0 | 228 | 47 | 72 | 183 | 0 | 0 | 0 | 0 | 61 | 0 | 118 | 709 |
| 4:30 to 5:30 | 0 | 225 | 47 | 68 | 180 | 0 | 0 | 0 | 0 | 60 | 0 | 122 | 702 |
| 4:45 to 5:45 | 0 | 224 | 52 | 69 | 189 | 0 | 0 | 0 | 0 | 55 | 0 | 122 | 711 |
| 5:00 to 6:00 | 0 | 213 | 52 | 54 | 197 | 0 | 0 | 0 | 0 | 48 | 0 | 115 | 679 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:45 to 5:45 | 0 | 224 | 52 | 69 | 189 | 0 | 0 | 0 | 0 | 55 | 0 | 122 | 711 |

Exhibit A2

**AM PEAK HOUR**

LOCATION: News Road/Firestone Drive

DATE:
Thu, 4/26/07

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | | | | 10 | | 1 | 0 | 54 | | | 29 | 3 | 97 |
| 7:15 to 7:30 | | | | 23 | | 2 | 1 | 109 | | | 53 | 6 | 194 |
| 7:30 to 7:45 | | | | 37 | | 6 | 1 | 142 | | | 89 | 10 | 285 |
| 7:45 to 8:00 | | | | 55 | | 6 | 2 | 197 | | | 113 | 17 | 390 |
| 8:00 to 8:15 | | | | 72 | | 9 | 3 | 244 | | | 140 | 26 | 494 |
| 8:15 to 8:30 | | | | 88 | | 12 | 4 | 252 | | | 180 | 30 | 566 |
| 8:30 to 8:45 | | | | 119 | | 14 | 4 | 320 | | | 209 | 36 | 702 |
| 8:45 to 9:00 | | | | 145 | | 16 | 6 | 367 | | | 235 | 42 | 811 |
| Count Sheet | | | | C | | D | E | F | | | A | B | |

15 MINUTE INCREMENT COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | 0 | 0 | 0 | 10 | 0 | 1 | 0 | 54 | 0 | 0 | 29 | 3 | 97 |
| 7:15 to 7:30 | 0 | 0 | 0 | 13 | 0 | 1 | 1 | 55 | 0 | 0 | 24 | 3 | 97 |
| 7:30 to 7:45 | 0 | 0 | 0 | 14 | 0 | 4 | 0 | 33 | 0 | 0 | 36 | 4 | 91 |
| 7:45 to 8:00 | 0 | 0 | 0 | 18 | 0 | 0 | 1 | 55 | 0 | 0 | 24 | 7 | 105 |
| 8:00 to 8:15 | 0 | 0 | 0 | 17 | 0 | 3 | 1 | 47 | 0 | 0 | 27 | 9 | 104 |
| 8:15 to 8:30 | 0 | 0 | 0 | 16 | 0 | 3 | 1 | 8 | 0 | 0 | 40 | 4 | 72 |
| 8:30 to 8:45 | 0 | 0 | 0 | 31 | 0 | 2 | 0 | 68 | 0 | 0 | 29 | 6 | 136 |
| 8:45 to 9:00 | 0 | 0 | 0 | 26 | 0 | 2 | 2 | 47 | 0 | 0 | 26 | 6 | 109 |

HOUR INCREMENT

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 8:00 | 0 | 0 | 0 | 55 | 0 | 6 | 2 | 197 | 0 | 0 | 113 | 17 | 390 |
| 7:15 to 8:15 | 0 | 0 | 0 | 62 | 0 | 8 | 3 | 190 | 0 | 0 | 111 | 23 | 397 |
| 7:30 to 8:30 | 0 | 0 | 0 | 65 | 0 | 10 | 3 | 143 | 0 | 0 | 127 | 24 | 372 |
| 7:45 to 8:45 | 0 | 0 | 0 | 82 | 0 | 8 | 3 | 178 | 0 | 0 | 120 | 26 | 417 |
| 8:00 to 9:00 | 0 | 0 | 0 | 90 | 0 | 10 | 4 | 170 | 0 | 0 | 122 | 25 | 421 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8:00 to 9:00 | 0 | 0 | 0 | 90 | 0 | 10 | 4 | 170 | 0 | 0 | 122 | 25 | 421 |

Exhibit B1

**PM PEAK HOUR**

LOCATION: News Road/Firestone Drive

DATE:
Wed, 4/25/07

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 4:15 | | | | 19 | | 4 | 3 | 27 | | | 53 | 24 | 130 |
| 4:15 to 4:30 | | | | 36 | | 7 | 3 | 58 | | | 91 | 49 | 244 |
| 4:30 to 4:45 | | | | 47 | | 7 | 5 | 91 | | | 148 | 80 | 378 |
| 4:45 to 5:00 | | | | 69 | | 13 | 7 | 127 | | | 202 | 101 | 519 |
| 5:00 to 5:15 | | | | 84 | | 14 | 8 | 166 | | | 274 | 130 | 676 |
| 5:15 to 5:30 | | | | 101 | | 14 | 11 | 198 | | | 338 | 152 | 814 |
| 5:30 to 5:45 | | | | 111 | | 18 | 14 | 230 | | | 393 | 173 | 939 |
| 5:45 to 6:00 | | | | 122 | | 20 | 16 | 259 | | | 438 | 191 | 1046 |
| Count Sheet | | | | C | | D | E | F | | | A | B | |

15 MINUTE INCREMENT COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 4:15 | 0 | 0 | 0 | 19 | 0 | 4 | 3 | 27 | 0 | 0 | 53 | 24 | 130 |
| 4:15 to 4:30 | 0 | 0 | 0 | 17 | 0 | 3 | 0 | 31 | 0 | 0 | 38 | 25 | 114 |
| 4:30 to 4:45 | 0 | 0 | 0 | 11 | 0 | 0 | 2 | 33 | 0 | 0 | 57 | 31 | 134 |
| 4:45 to 5:00 | 0 | 0 | 0 | 22 | 0 | 6 | 2 | 36 | 0 | 0 | 54 | 21 | 141 |
| 5:00 to 5:15 | 0 | 0 | 0 | 15 | 0 | 1 | 1 | 39 | 0 | 0 | 72 | 29 | 157 |
| 5:15 to 5:30 | 0 | 0 | 0 | 17 | 0 | 0 | 3 | 32 | 0 | 0 | 64 | 22 | 138 |
| 5:30 to 5:45 | 0 | 0 | 0 | 10 | 0 | 4 | 3 | 32 | 0 | 0 | 55 | 21 | 125 |
| 5:45 to 6:00 | 0 | 0 | 0 | 11 | 0 | 2 | 2 | 29 | 0 | 0 | 45 | 18 | 107 |

HOUR INCREMENT

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 5:00 | 0 | 0 | 0 | 69 | 0 | 13 | 7 | 127 | 0 | 0 | 202 | 101 | 519 |
| 4:15 to 5:15 | 0 | 0 | 0 | 65 | 0 | 10 | 5 | 139 | 0 | 0 | 221 | 106 | 546 |
| 4:30 to 5:30 | 0 | 0 | 0 | 65 | 0 | 7 | 8 | 140 | 0 | 0 | 247 | 103 | 570 |
| 4:45 to 5:45 | 0 | 0 | 0 | 64 | 0 | 11 | 9 | 139 | 0 | 0 | 245 | 93 | 561 |
| 5:00 to 6:00 | 0 | 0 | 0 | 53 | 0 | 7 | 9 | 132 | 0 | 0 | 236 | 90 | 527 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:30 to 5:30 | 0 | 0 | 0 | 65 | 0 | 7 | 8 | 140 | 0 | 0 | 247 | 103 | 570 |

Exhibit B2

**AM PEAK HOUR** Date: Tue, 1/29/08

LOCATION: News Road/Old News Road

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | | | | | | | | | | | | | 0 |
| 7:15 to 7:30 | | | | | | | | | | | | | 0 |
| 7:30 to 7:45 | | | | | | | | | | | | | 0 |
| 7:45 to 8:00 | | | | | | | | | | | | | 0 |
| 8:00 to 8:15 | | | | | | | | | | | | | 0 |
| 8:15 to 8:30 | | | | | | | | | | | | | 0 |
| 8:30 to 8:45 | | | | | | | | | | | | | 0 |
| 8:45 to 9:00 | | | | | | | | | | | | | 0 |

Count Sheet

15 MINUTE INTERVAL COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 46 | 0 | 0 | 12 | 7 | 71 |
| 7:15 to 7:30 | 0 | 0 | 0 | 2 | 0 | 5 | 4 | 91 | 0 | 0 | 37 | 2 | 141 |
| 7:30 to 7:45 | 0 | 0 | 0 | 14 | 0 | 13 | 4 | 84 | 0 | 0 | 18 | 1 | 134 |
| 7:45 to 8:00 | 0 | 0 | 0 | 2 | 0 | 8 | 7 | 108 | 0 | 0 | 34 | 2 | 161 |
| 8:00 to 8:15 | 0 | 0 | 0 | 5 | 0 | 16 | 9 | 104 | 0 | 0 | 65 | 7 | 206 |
| 8:15 to 8:30 | 1 | 0 | 0 | 2 | 0 | 8 | 2 | 54 | 0 | 0 | 34 | 6 | 107 |
| 8:30 to 8:45 | 0 | 0 | 0 | 4 | 0 | 14 | 3 | 87 | 0 | 0 | 32 | 3 | 143 |
| 8:45 to 9:00 | 0 | 0 | 3 | 8 | 0 | 8 | 9 | 121 | 1 | 1 | 30 | 5 | 186 |

HOUR INTERVAL

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 8:00 | 0 | 0 | 0 | 18 | 0 | 30 | 17 | 329 | 0 | 0 | 101 | 12 | 507 |
| 7:15 to 8:15 | 0 | 0 | 0 | 23 | 0 | 42 | 24 | 387 | 0 | 0 | 154 | 12 | 642 |
| 7:30 to 8:30 | 1 | 0 | 0 | 23 | 0 | 45 | 22 | 350 | 0 | 0 | 151 | 16 | 608 |
| 7:45 to 8:45 | 1 | 0 | 0 | 13 | 0 | 46 | 21 | 353 | 0 | 0 | 165 | 18 | 617 |
| 8:00 to 9:00 | 1 | 0 | 3 | 19 | 0 | 46 | 23 | 366 | 1 | 1 | 161 | 21 | 642 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:15 to 8:15 | 0 | 0 | 0 | 23 | 0 | 42 | 24 | 387 | 0 | 0 | 154 | 12 | 642 |
| 8:00 to 9:00 | 1 | 0 | 3 | 19 | 0 | 46 | 23 | 366 | 1 | 1 | 161 | 21 | 642 |

Exhibit C1

**PM PEAK HOUR** Date: Tue, 1/29/08

LOCATION: News Road/Old News Road

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3:45 to 4:00 | | | | | | | | | | | | | |
| 4:00 to 4:15 | | | | | | | | | | | | | 0 |
| 4:15 to 4:30 | | | | | | | | | | | | | 0 |
| 4:30 to 4:45 | | | | | | | | | | | | | 0 |
| 4:45 to 5:00 | | | | | | | | | | | | | 0 |
| 5:00 to 5:15 | | | | | | | | | | | | | 0 |
| 5:15 to 5:30 | | | | | | | | | | | | | 0 |
| 5:30 to 5:45 | | | | | | | | | | | | | 0 |
| 5:45 to 6:00 | | | | | | | | | | | | | 0 |

Count Sheet

15 MINUTE INTERVAL COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 4:15 | 0 | 0 | 0 | 5 | 0 | 19 | 11 | 47 | 1 | 0 | 53 | 8 | 144 |
| 4:15 to 4:30 | 1 | 0 | 0 | 8 | 0 | 26 | 9 | 56 | 0 | 1 | 99 | 11 | 211 |
| 4:30 to 4:45 | 0 | 0 | 0 | 25 | 0 | 29 | 14 | 81 | 2 | 0 | 112 | 19 | 282 |
| 4:45 to 5:00 | 0 | 0 | 0 | 8 | 0 | 13 | 11 | 66 | 0 | 0 | 77 | 2 | 177 |
| 5:00 to 5:15 | 0 | 0 | 2 | 7 | 0 | 31 | 12 | 71 | 0 | 0 | 86 | 11 | 220 |
| 5:15 to 5:30 | 4 | 0 | 1 | 14 | 0 | 35 | 13 | 63 | 0 | 0 | 107 | 16 | 253 |
| 5:30 to 5:45 | 1 | 0 | 0 | 6 | 0 | 26 | 8 | 82 | 0 | 0 | 106 | 16 | 245 |
| 5:45 to 6:00 | 0 | 0 | 1 | 9 | 0 | 29 | 8 | 66 | 4 | 0 | 80 | 10 | 207 |

HOUR INTERVAL

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 5:00 | 1 | 0 | 0 | 46 | 0 | 87 | 45 | 250 | 3 | 1 | 341 | 40 | 814 |
| 4:15 to 5:15 | 1 | 0 | 2 | 48 | 0 | 99 | 46 | 274 | 2 | 1 | 374 | 43 | 890 |
| 4:30 to 5:30 | 4 | 0 | 3 | 54 | 0 | 108 | 50 | 281 | 2 | 0 | 382 | 48 | 932 |
| 4:45 to 5:45 | 5 | 0 | 3 | 35 | 0 | 105 | 44 | 282 | 0 | 0 | 376 | 45 | 895 |
| 5:00 to 6:00 | 5 | 0 | 4 | 36 | 0 | 121 | 41 | 282 | 4 | 0 | 379 | 53 | 925 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:30 to 5:30 | 4 | 0 | 3 | 54 | 0 | 108 | 50 | 281 | 2 | 0 | 382 | 48 | 932 |

Exhibit C2

**AM PEAK HOUR** Date: Tue, 3/11/08

LOCATION: MONTICELLO AVENUE/NEWS ROAD

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | 5 | 12 | 44 | 59 | 14 | 9 | 9 | 112 | 5 | 37 | 49 | 14 | 369 |
| 7:15 to 7:30 | 8 | 24 | 112 | 143 | 24 | 11 | 21 | 237 | 6 | 72 | 89 | 29 | 776 |
| 7:30 to 7:45 | 11 | 35 | 175 | 217 | 32 | 17 | 23 | 398 | 13 | 111 | 134 | 44 | 1210 |
| 7:45 to 8:00 | 11 | 41 | 251 | 316 | 45 | 20 | 29 | 586 | 19 | 160 | 176 | 74 | 1728 |
| 8:00 to 8:15 | 15 | 49 | 312 | 372 | 61 | 27 | 37 | 722 | 23 | 212 | 228 | 113 | 2171 |
| 8:15 to 8:30 | 19 | 60 | 375 | 428 | 75 | 32 | 41 | 838 | 26 | 258 | 281 | 143 | 2576 |
| 8:30 to 8:45 | 27 | 75 | 428 | 489 | 95 | 37 | 48 | 921 | 31 | 309 | 324 | 172 | 2956 |
| 8:45 to 9:00 | 33 | 86 | 486 | 569 | 126 | 46 | 55 | 1039 | 42 | 373 | 380 | 193 | 3428 |
| Count Sheet | J | K | L | G | H | I | A | B | C | D | E | F | |

15 MINUTE INTERVAL COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | 5 | 12 | 44 | 59 | 14 | 9 | 9 | 112 | 5 | 37 | 49 | 14 | 369 |
| 7:15 to 7:30 | 3 | 12 | 68 | 84 | 10 | 2 | 12 | 125 | 1 | 35 | 40 | 15 | 407 |
| 7:30 to 7:45 | 3 | 11 | 63 | 74 | 8 | 6 | 2 | 161 | 7 | 39 | 45 | 15 | 434 |
| 7:45 to 8:00 | 0 | 6 | 76 | 99 | 13 | 3 | 6 | 188 | 6 | 49 | 42 | 30 | 518 |
| 8:00 to 8:15 | 4 | 8 | 61 | 56 | 16 | 7 | 8 | 136 | 4 | 52 | 52 | 39 | 443 |
| 8:15 to 8:30 | 4 | 11 | 63 | 56 | 14 | 5 | 4 | 116 | 3 | 46 | 53 | 30 | 405 |
| 8:30 to 8:45 | 8 | 15 | 53 | 61 | 20 | 5 | 7 | 83 | 5 | 51 | 43 | 29 | 380 |
| 8:45 to 9:00 | 6 | 11 | 58 | 80 | 31 | 9 | 7 | 118 | 11 | 64 | 56 | 21 | 472 |

HOUR INTERVAL

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 8:00 | 11 | 41 | 251 | 316 | 45 | 20 | 29 | 586 | 19 | 160 | 176 | 74 | 1728 |
| 7:15 to 8:15 | 10 | 37 | 268 | 313 | 47 | 18 | 28 | 610 | 18 | 175 | 179 | 99 | 1802 |
| 7:30 to 8:30 | 11 | 36 | 263 | 285 | 51 | 21 | 20 | 601 | 20 | 186 | 192 | 114 | 1800 |
| 7:45 to 8:45 | 16 | 40 | 253 | 272 | 63 | 20 | 25 | 523 | 18 | 198 | 190 | 128 | 1746 |
| 8:00 to 9:00 | 22 | 45 | 235 | 253 | 81 | 26 | 26 | 453 | 23 | 213 | 204 | 119 | 1700 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:15 to 8:15 | 10 | 37 | 268 | 313 | 47 | 18 | 28 | 610 | 18 | 175 | 179 | 99 | 1802 |

Exhibit D1

**PM PEAK HOUR** Date: Thu, 4/19/07

LOCATION: MONTICELLO AVENUE/NEWS ROAD

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3:45 to 4:00 | | | | | | | | | | | | | |
| 4:00 to 4:15 | 8 | 40 | 57 | 34 | 20 | 15 | 8 | 60 | 7 | 107 | 101 | 39 | 496 |
| 4:15 to 4:30 | 16 | 88 | 141 | 72 | 49 | 29 | 25 | 148 | 17 | 221 | 206 | 93 | 1105 |
| 4:30 to 4:45 | 24 | 122 | 211 | 115 | 81 | 42 | 37 | 218 | 27 | 304 | 318 | 133 | 1632 |
| 4:45 to 5:00 | 35 | 162 | 291 | 165 | 116 | 56 | 52 | 319 | 32 | 406 | 437 | 190 | 2261 |
| 5:00 to 5:15 | 47 | 208 | 384 | 233 | 152 | 71 | 73 | 393 | 45 | 520 | 564 | 251 | 2941 |
| 5:15 to 5:30 | 69 | 259 | 448 | 291 | 183 | 84 | 93 | 505 | 55 | 646 | 702 | 321 | 3656 |
| 5:30 to 5:45 | 83 | 287 | 528 | 339 | 205 | 107 | 120 | 584 | 61 | 738 | 819 | 372 | 4243 |
| 5:45 to 6:00 | 100 | 321 | 607 | 388 | 232 | 133 | 139 | 675 | 71 | 823 | 952 | 423 | 4864 |
| Count Sheet | D | E | F | A | B | C | J | K | L | G | H | I | |

15 MINUTE INTERVAL COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 4:15 | 8 | 40 | 57 | 34 | 20 | 15 | 8 | 60 | 7 | 107 | 101 | 39 | 496 |
| 4:15 to 4:30 | 8 | 48 | 84 | 38 | 29 | 14 | 17 | 88 | 10 | 114 | 105 | 54 | 609 |
| 4:30 to 4:45 | 8 | 34 | 70 | 43 | 32 | 13 | 12 | 70 | 10 | 83 | 112 | 40 | 527 |
| 4:45 to 5:00 | 11 | 40 | 80 | 50 | 35 | 14 | 15 | 101 | 5 | 102 | 119 | 57 | 629 |
| 5:00 to 5:15 | 12 | 46 | 93 | 68 | 36 | 15 | 21 | 74 | 13 | 114 | 127 | 61 | 680 |
| 5:15 to 5:30 | 22 | 51 | 64 | 58 | 31 | 13 | 20 | 112 | 10 | 126 | 138 | 70 | 715 |
| 5:30 to 5:45 | 14 | 28 | 80 | 48 | 22 | 23 | 27 | 79 | 6 | 92 | 117 | 51 | 587 |
| 5:45 to 6:00 | 17 | 34 | 79 | 49 | 27 | 26 | 19 | 91 | 10 | 85 | 133 | 51 | 621 |

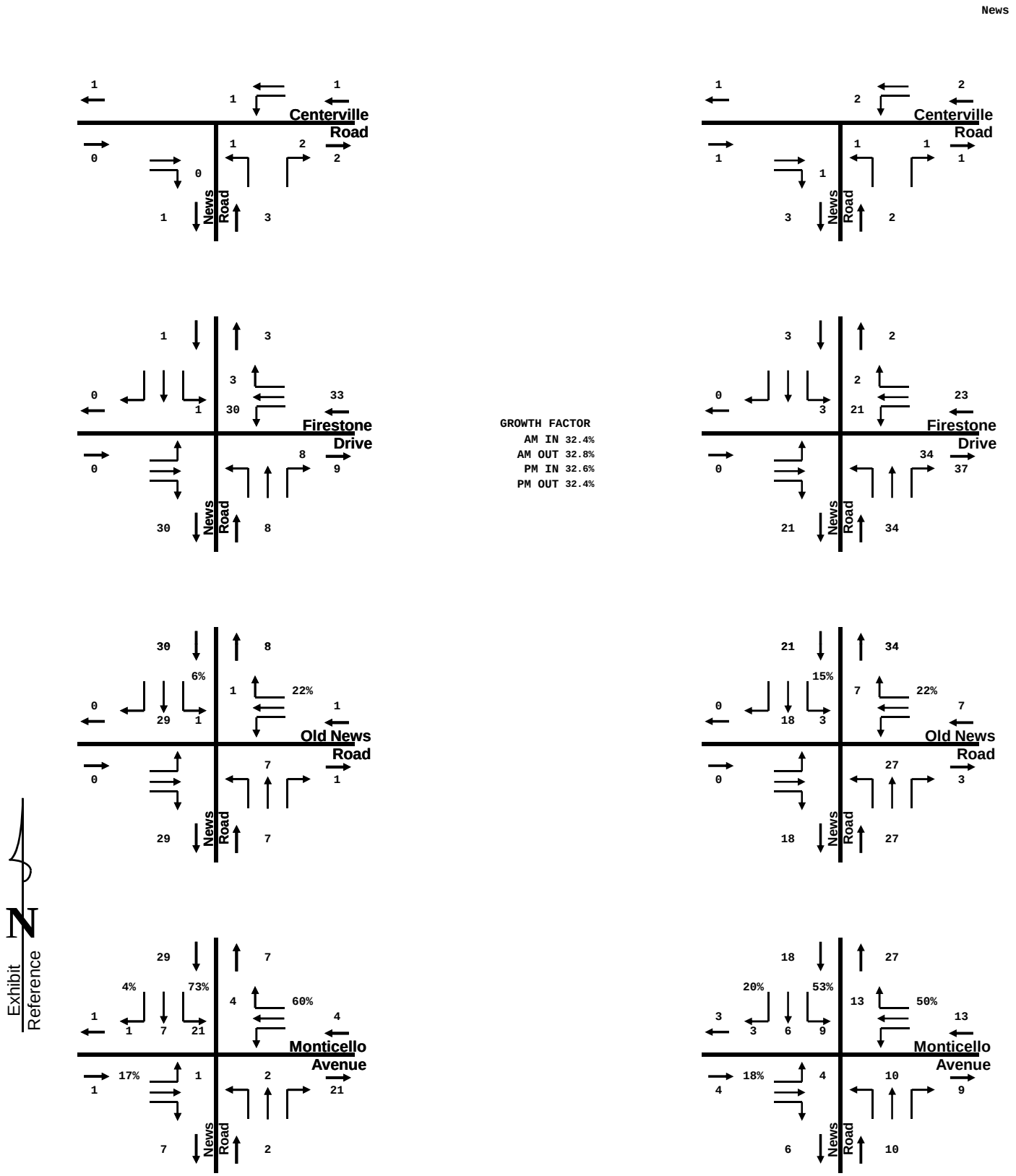
HOUR INTERVAL

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 5:00 | 35 | 162 | 291 | 165 | 116 | 56 | 52 | 319 | 32 | 406 | 437 | 190 | 2261 |
| 4:15 to 5:15 | 39 | 168 | 327 | 199 | 132 | 56 | 65 | 333 | 38 | 413 | 463 | 212 | 2445 |
| 4:30 to 5:30 | 53 | 171 | 307 | 219 | 134 | 55 | 68 | 357 | 38 | 425 | 496 | 228 | 2551 |
| 4:45 to 5:45 | 59 | 165 | 317 | 224 | 124 | 65 | 83 | 366 | 34 | 434 | 501 | 239 | 2611 |
| 5:00 to 6:00 | 65 | 159 | 316 | 223 | 116 | 77 | 87 | 356 | 39 | 417 | 515 | 233 | 2603 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:45 to 5:45 | 59 | 165 | 317 | 224 | 124 | 65 | 83 | 366 | 34 | 434 | 501 | 239 | 2611 |

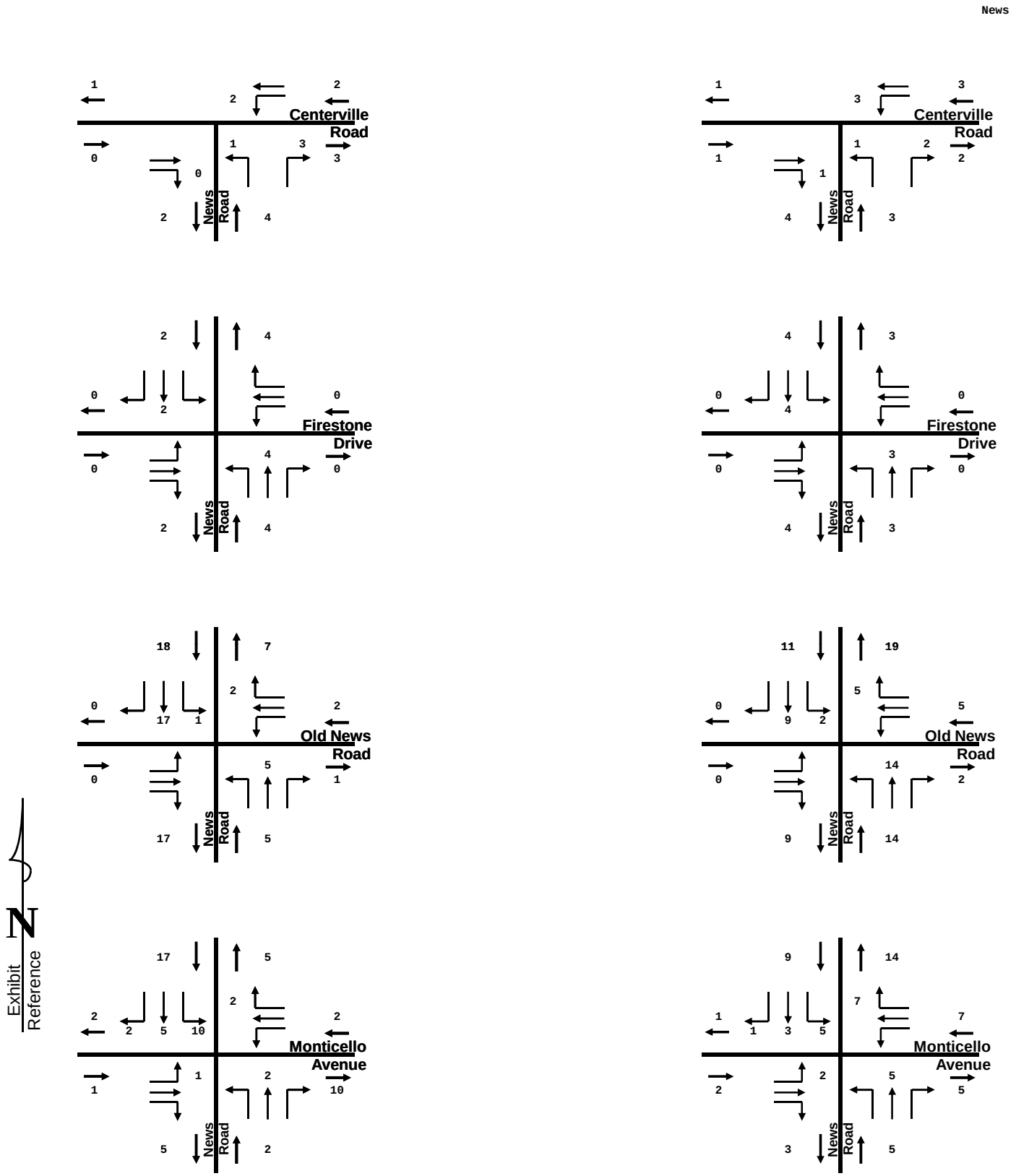
Exhibit D2




FORD'S COLONY BUILD OUT TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

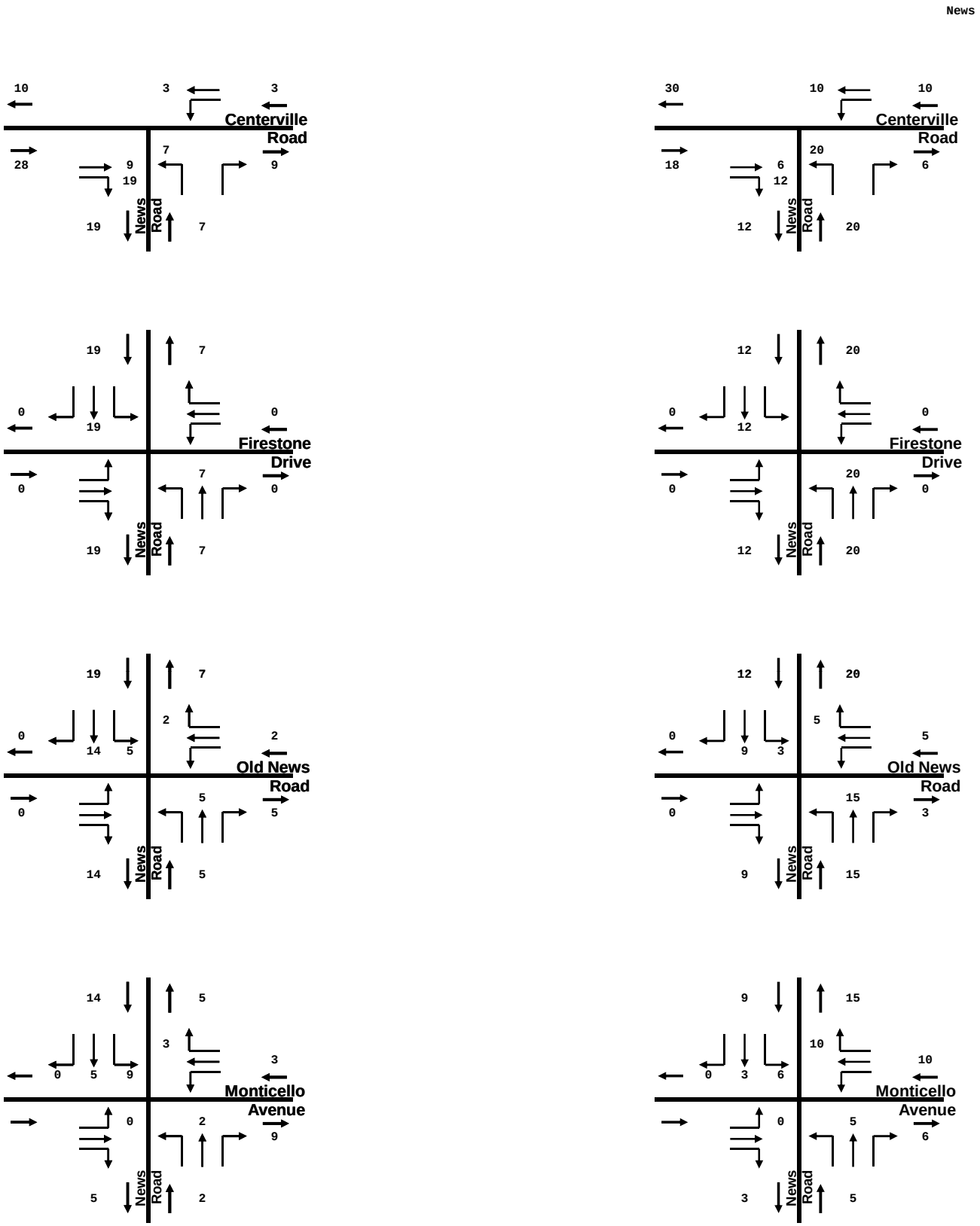
Exhibit E1




POWHATAN SECONDARY NORTH TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

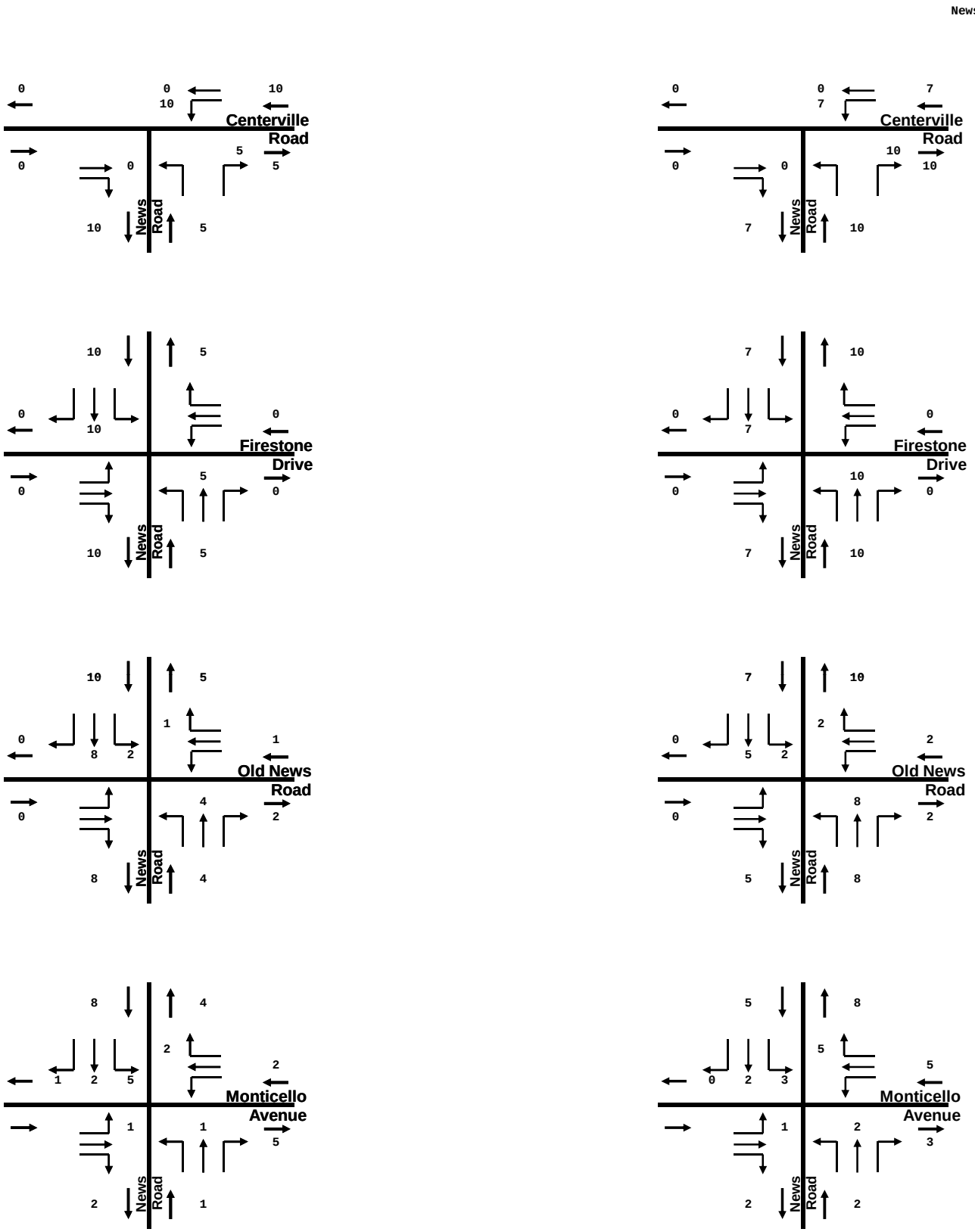
Exhibit E2




GREENSPRINGS TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit E3



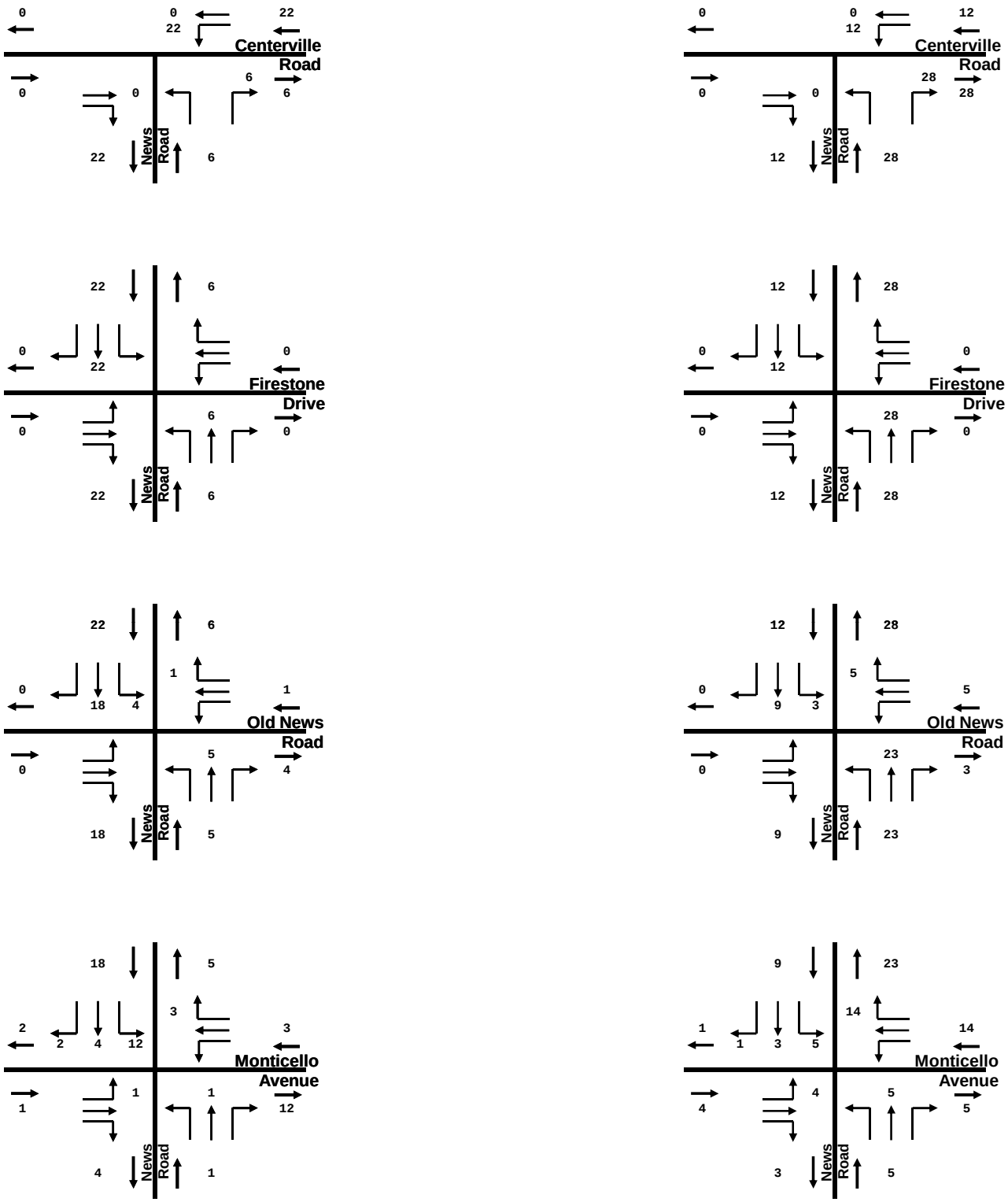

**AM PEAK HOUR**

**PM PEAK HOUR**

WESTPORT TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit E4




N

Exhibit Reference

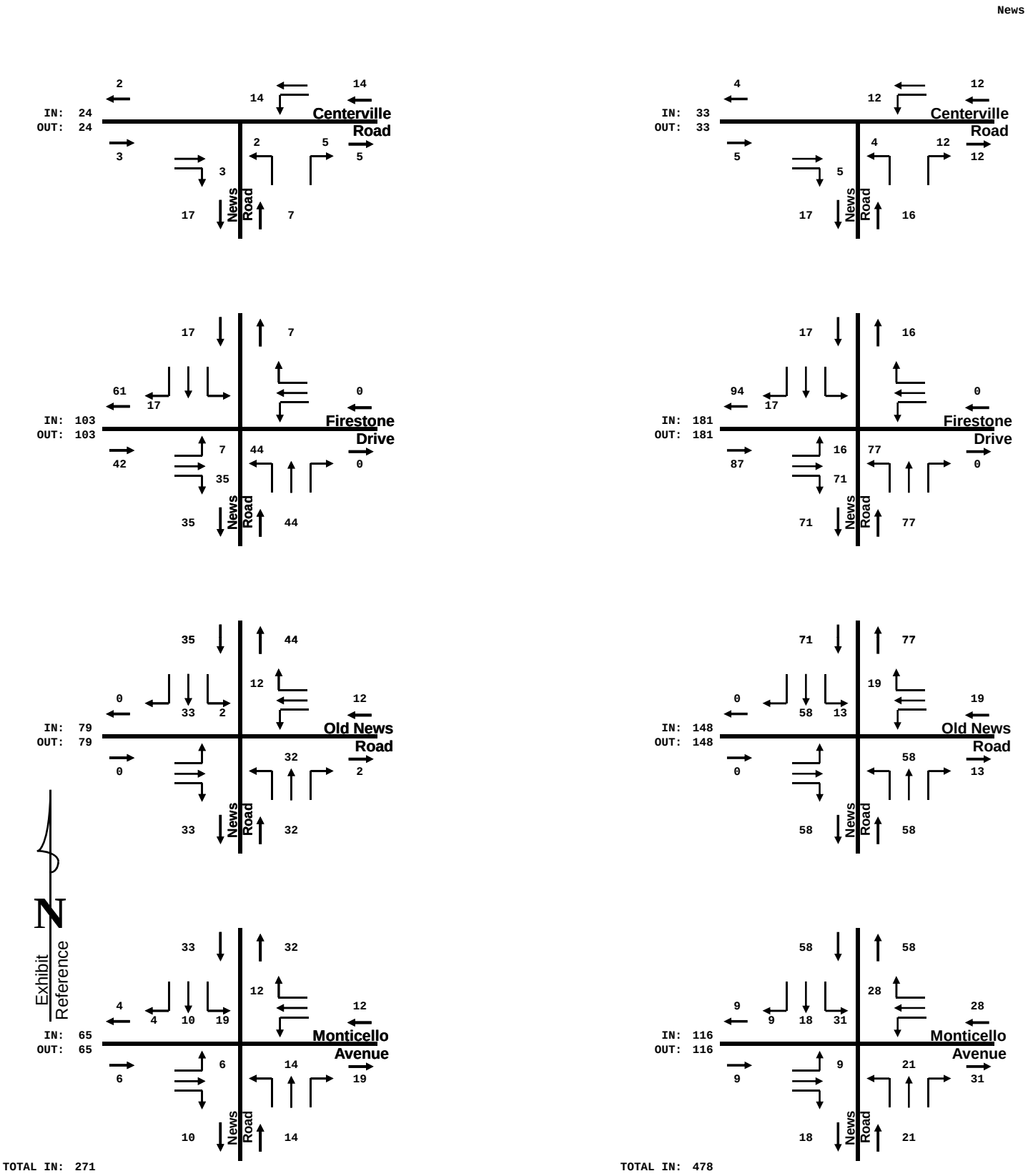
**AM PEAK HOUR**

**PM PEAK HOUR**

LIBERTY RIDGE TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit E5



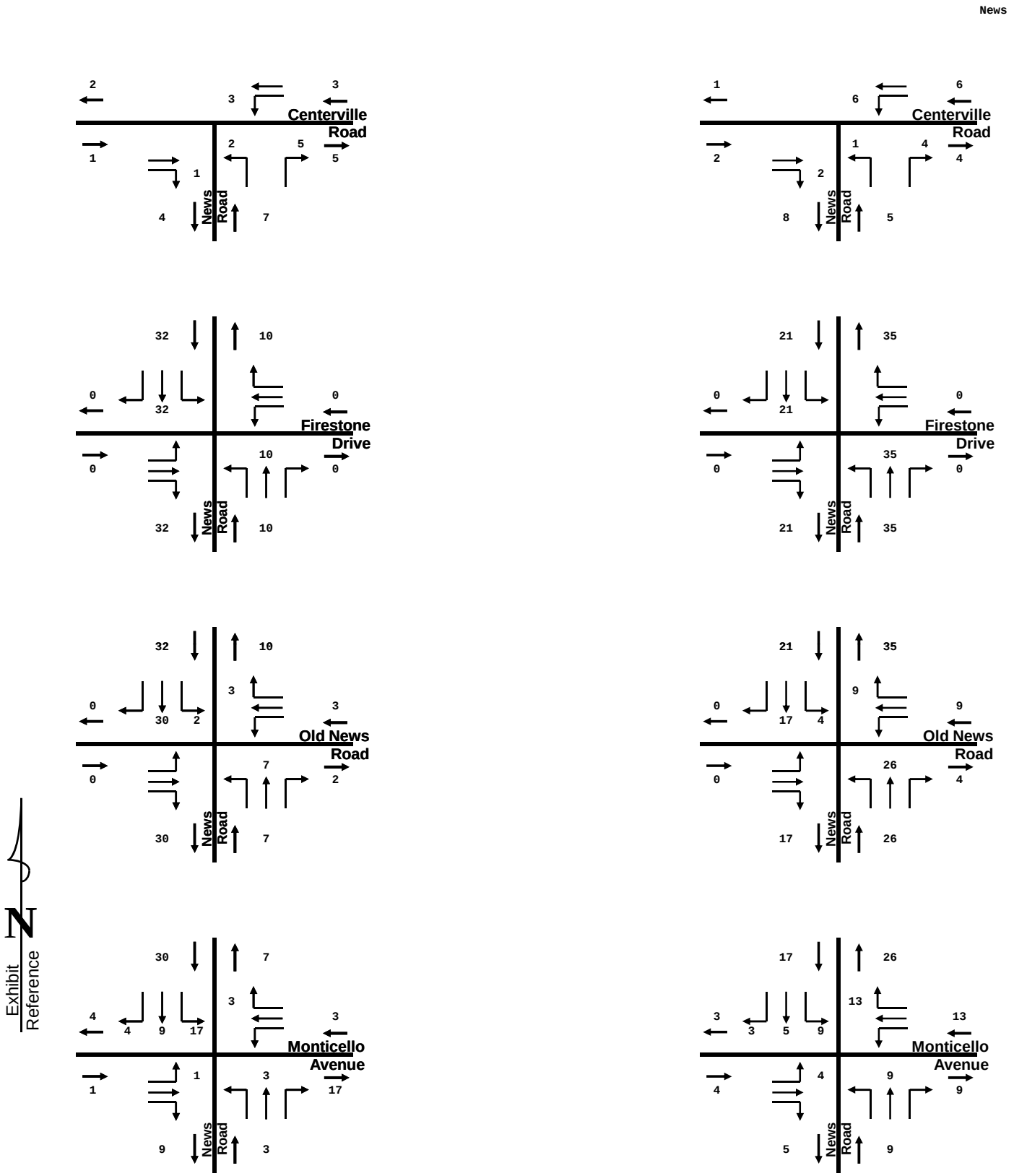

**AM PEAK HOUR**

**PM PEAK HOUR**

THE VILLAGE AT FORD'S COLONY TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

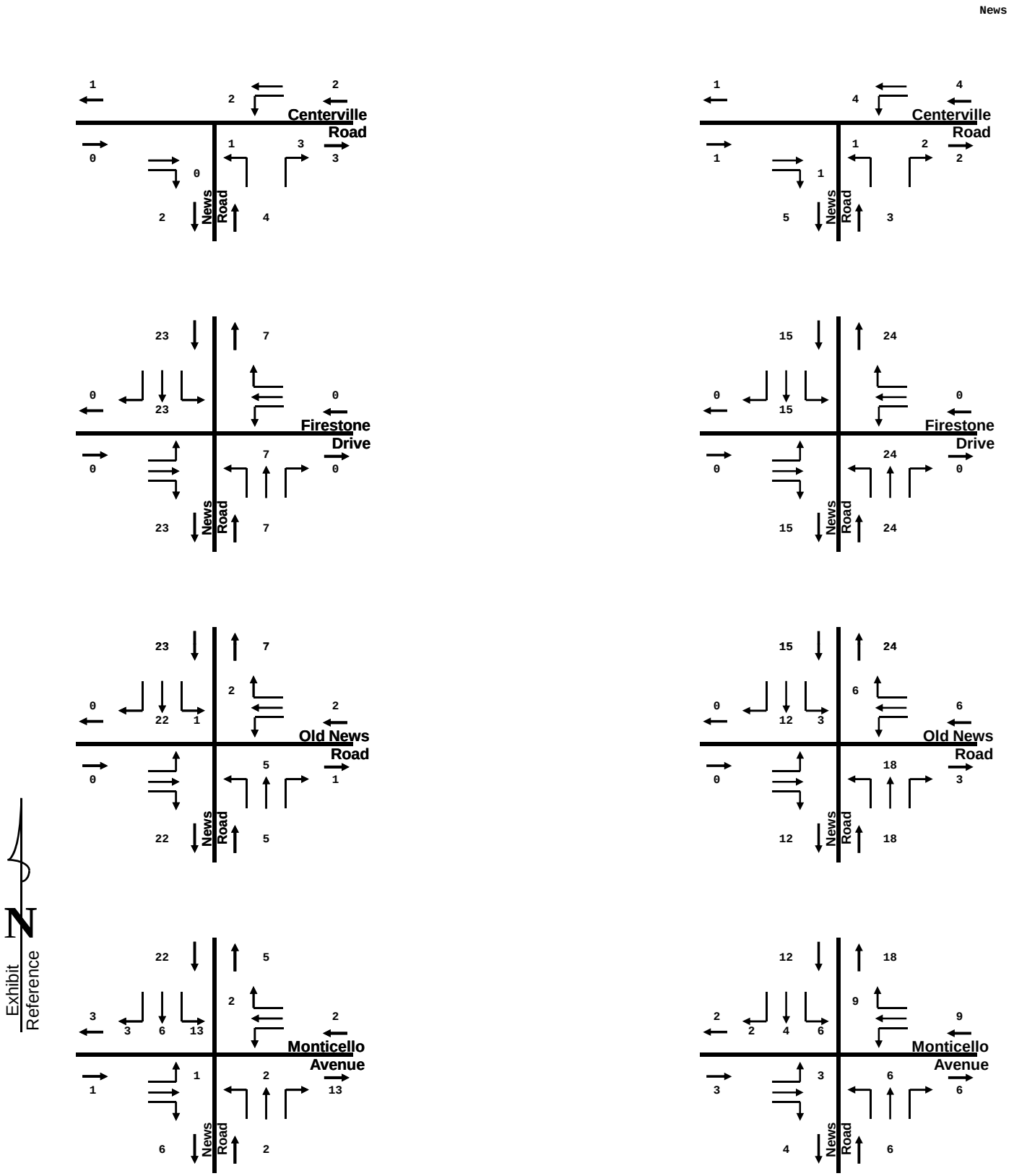
Exhibit E6




NIXON-GRAVES TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit E7



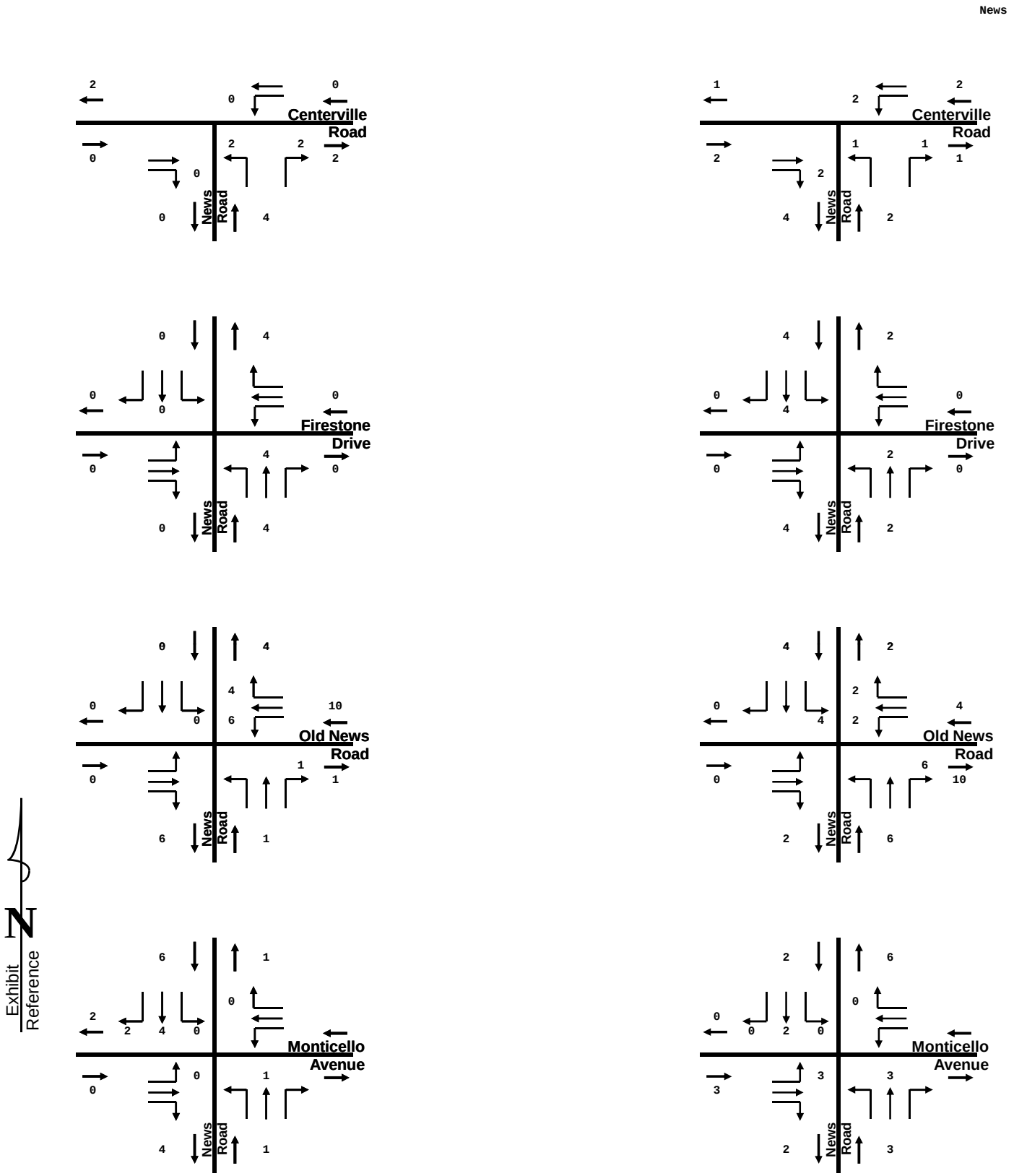

**AM PEAK HOUR**

**PM PEAK HOUR**

RICHARDSON TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit E8




BEAMER TRIP ASSIGNMENTS

*DRW Consultants, LLC*
*804-794-7312*

Exhibit E9

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 45 | 78 | 182 | 52 | 64 | 170 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 49 | 85 | 198 | 57 | 70 | 185 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 550 | 226 | | | 254 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 550 | 226 | | | 254 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 90 | 90 | | | 95 | |
| cM capacity (veh/h) | 470 | 813 | | | 1311 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 134 | 254 | 254 |
| Volume Left | 49 | 0 | 70 |
| Volume Right | 85 | 57 | 0 |
| cSH | 642 | 1700 | 1311 |
| Volume to Capacity | 0.21 | 0.15 | 0.05 |
| Queue Length (ft) | 20 | 0 | 4 |
| Control Delay (s) | 12.1 | 0.0 | 2.5 |
| Lane LOS | B | | A |
| Approach Delay (s) | 12.1 | 0.0 | 2.5 |
| Approach LOS | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.5 | | |
| Intersection Capacity Utilization | 42.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 55 | 122 | 224 | 52 | 69 | 189 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 60 | 133 | 243 | 57 | 75 | 205 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 627 | 272 | | | 300 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 627 | 272 | | | 300 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 86 | 83 | | | 94 | |
| cM capacity (veh/h) | 421 | 767 | | | 1261 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 192 | 300 | 280 |
| Volume Left | 60 | 0 | 75 |
| Volume Right | 133 | 57 | 0 |
| cSH | 611 | 1700 | 1261 |
| Volume to Capacity | 0.32 | 0.18 | 0.06 |
| Queue Length (ft) | 34 | 0 | 5 |
| Control Delay (s) | 13.6 | 0.0 | 2.5 |
| Lane LOS | B | | A |
| Approach Delay (s) | 13.6 | 0.0 | 2.5 |
| Approach LOS | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.3 | | |
| Intersection Capacity Utilization | 49.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 54 | 94 | 191 | 71 | 99 | 173 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 59 | 102 | 208 | 77 | 108 | 188 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 649 | 246 | | | 285 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 649 | 246 | | | 285 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 85 | 87 | | | 92 | |
| cM capacity (veh/h) | 398 | 793 | | | 1277 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 161 | 285 | 296 |
| Volume Left | 59 | 0 | 108 |
| Volume Right | 102 | 77 | 0 |
| cSH | 582 | 1700 | 1277 |
| Volume to Capacity | 0.28 | 0.17 | 0.08 |
| Queue Length (ft) | 28 | 0 | 7 |
| Control Delay (s) | 13.5 | 0.0 | 3.4 |
| Lane LOS | B | | A |
| Approach Delay (s) | 13.5 | 0.0 | 3.4 |
| Approach LOS | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.3 | | |
| Intersection Capacity Utilization | 47.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 77 | 163 | 230 | 66 | 93 | 199 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 84 | 177 | 250 | 72 | 101 | 216 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 704 | 286 | | | 322 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 704 | 286 | | | 322 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 77 | 76 | | | 92 | |
| cM capacity (veh/h) | 370 | 753 | | | 1238 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 261 | 322 | 317 |
| Volume Left | 84 | 0 | 101 |
| Volume Right | 177 | 72 | 0 |
| cSH | 565 | 1700 | 1238 |
| Volume to Capacity | 0.46 | 0.19 | 0.08 |
| Queue Length (ft) | 60 | 0 | 7 |
| Control Delay (s) | 16.7 | 0.0 | 3.1 |
| Lane LOS | C | | A |
| Approach Delay (s) | 16.7 | 0.0 | 3.1 |
| Approach LOS | C | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 5.9 | | |
| Intersection Capacity Utilization | 56.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 56 | 99 | 191 | 74 | 113 | 173 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 61 | 108 | 208 | 80 | 123 | 188 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 682 | 248 | | | 288 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 682 | 248 | | | 288 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 84 | 86 | | | 90 | |
| cM capacity (veh/h) | 376 | 791 | | | 1274 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 168 | 288 | 311 |
| Volume Left | 61 | 0 | 123 |
| Volume Right | 108 | 80 | 0 |
| cSH | 565 | 1700 | 1274 |
| Volume to Capacity | 0.30 | 0.17 | 0.10 |
| Queue Length (ft) | 31 | 0 | 8 |
| Control Delay (s) | 14.1 | 0.0 | 3.7 |
| Lane LOS | B | | A |
| Approach Delay (s) | 14.1 | 0.0 | 3.7 |
| Approach LOS | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.6 | | |
| Intersection Capacity Utilization | 49.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 81 | 175 | 230 | 71 | 105 | 199 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 88 | 190 | 250 | 77 | 114 | 216 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 733 | 289 | | | 327 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 733 | 289 | | | 327 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 75 | 75 | | | 91 | |
| cM capacity (veh/h) | 352 | 751 | | | 1232 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 278 | 327 | 330 |
| Volume Left | 88 | 0 | 114 |
| Volume Right | 190 | 77 | 0 |
| cSH | 552 | 1700 | 1232 |
| Volume to Capacity | 0.50 | 0.19 | 0.09 |
| Queue Length (ft) | 70 | 0 | 8 |
| Control Delay (s) | 17.9 | 0.0 | 3.4 |
| Lane LOS | C | | A |
| Approach Delay (s) | 17.9 | 0.0 | 3.4 |
| Approach LOS | C | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 6.5 | | |
| Intersection Capacity Utilization | 58.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 61 | 109 | 191 | 75 | 118 | 173 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 66 | 118 | 208 | 82 | 128 | 188 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 693 | 248 | | | 289 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 693 | 248 | | | 289 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 82 | 85 | | | 90 | |
| cM capacity (veh/h) | 368 | 790 | | | 1273 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 185 | 289 | 316 |
| Volume Left | 66 | 0 | 128 |
| Volume Right | 118 | 82 | 0 |
| cSH | 560 | 1700 | 1273 |
| Volume to Capacity | 0.33 | 0.17 | 0.10 |
| Queue Length (ft) | 36 | 0 | 8 |
| Control Delay (s) | 14.6 | 0.0 | 3.9 |
| Lane LOS | B | | A |
| Approach Delay (s) | 14.6 | 0.0 | 3.9 |
| Approach LOS | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.9 | | |
| Intersection Capacity Utilization | 50.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Volume (veh/h) | 84 | 182 | 230 | 76 | 117 | 199 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 91 | 198 | 250 | 83 | 127 | 216 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | None | | | | | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 762 | 291 | | | 333 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 762 | 291 | | | 333 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 73 | 74 | | | 90 | |
| cM capacity (veh/h) | 334 | 748 | | | 1227 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 289 | 333 | 343 |
| Volume Left | 91 | 0 | 127 |
| Volume Right | 198 | 83 | 0 |
| cSH | 538 | 1700 | 1227 |
| Volume to Capacity | 0.54 | 0.20 | 0.10 |
| Queue Length (ft) | 79 | 0 | 9 |
| Control Delay (s) | 19.2 | 0.0 | 3.7 |
| Lane LOS | C | | A |
| Approach Delay (s) | 19.2 | 0.0 | 3.7 |
| Approach LOS | C | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 7.1 | | |
| Intersection Capacity Utilization | 59.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 4 | 170 | 122 | 25 | 90 | 10 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 4 | 185 | 133 | 27 | 98 | 11 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 160 | | | | 326 | 133 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 160 | | | | 326 | 133 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 85 | 99 |
| cM capacity (veh/h) | 1419 | | | | 666 | 917 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 4 | 185 | 133 | 27 | 98 | 11 |
| Volume Left | 4 | 0 | 0 | 0 | 98 | 0 |
| Volume Right | 0 | 0 | 0 | 27 | 0 | 11 |
| cSH | 1419 | 1700 | 1700 | 1700 | 666 | 917 |
| Volume to Capacity | 0.00 | 0.11 | 0.08 | 0.02 | 0.15 | 0.01 |
| Queue Length (ft) | 0 | 0 | 0 | 0 | 13 | 1 |
| Control Delay (s) | 7.5 | 0.0 | 0.0 | 0.0 | 11.3 | 9.0 |
| Lane LOS | A | | | | B | A |
| Approach Delay (s) | 0.2 | | 0.0 | | 11.1 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.7 | | |
| Intersection Capacity Utilization | 20.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 8 | 140 | 247 | 103 | 65 | 7 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 9 | 152 | 268 | 112 | 71 | 8 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 380 | | | | 438 | 268 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 380 | | | | 438 | 268 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 99 | | | | 88 | 99 |
| cM capacity (veh/h) | 1178 | | | | 572 | 770 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 9 | 152 | 268 | 112 | 71 | 8 |
| Volume Left | 9 | 0 | 0 | 0 | 71 | 0 |
| Volume Right | 0 | 0 | 0 | 112 | 0 | 8 |
| cSH | 1178 | 1700 | 1700 | 1700 | 572 | 770 |
| Volume to Capacity | 0.01 | 0.09 | 0.16 | 0.07 | 0.12 | 0.01 |
| Queue Length (ft) | 1 | 0 | 0 | 0 | 11 | 1 |
| Control Delay (s) | 8.1 | 0.0 | 0.0 | 0.0 | 12.2 | 9.7 |
| Lane LOS | A | | | | B | A |
| Approach Delay (s) | 0.4 | | 0.0 | | 11.9 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.6 | | |
| Intersection Capacity Utilization | 23.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 5 | 223 | 144 | 33 | 120 | 13 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 5 | 242 | 157 | 36 | 130 | 14 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 192 | | | | 410 | 157 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 192 | | | | 410 | 157 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 78 | 98 |
| cM capacity (veh/h) | 1381 | | | | 596 | 889 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 5 | 242 | 157 | 36 | 130 | 14 |
| Volume Left | 5 | 0 | 0 | 0 | 130 | 0 |
| Volume Right | 0 | 0 | 0 | 36 | 0 | 14 |
| cSH | 1381 | 1700 | 1700 | 1700 | 596 | 889 |
| Volume to Capacity | 0.00 | 0.14 | 0.09 | 0.02 | 0.22 | 0.02 |
| Queue Length (ft) | 0 | 0 | 0 | 0 | 21 | 1 |
| Control Delay (s) | 7.6 | 0.0 | 0.0 | 0.0 | 12.7 | 9.1 |
| Lane LOS | A | | | | B | A |
| Approach Delay (s) | 0.2 | | 0.0 | | 12.4 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.1 | | |
| Intersection Capacity Utilization | 25.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 11 | 175 | 308 | 137 | 86 | 9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 12 | 190 | 335 | 149 | 93 | 10 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 484 | | | | 549 | 335 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 484 | | | | 549 | 335 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 99 | | | | 81 | 99 |
| cM capacity (veh/h) | 1079 | | | | 491 | 707 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 12 | 190 | 335 | 149 | 93 | 10 |
| Volume Left | 12 | 0 | 0 | 0 | 93 | 0 |
| Volume Right | 0 | 0 | 0 | 149 | 0 | 10 |
| cSH | 1079 | 1700 | 1700 | 1700 | 491 | 707 |
| Volume to Capacity | 0.01 | 0.11 | 0.20 | 0.09 | 0.19 | 0.01 |
| Queue Length (ft) | 1 | 0 | 0 | 0 | 17 | 1 |
| Control Delay (s) | 8.4 | 0.0 | 0.0 | 0.0 | 14.0 | 10.2 |
| Lane LOS | A | | | | B | B |
| Approach Delay (s) | 0.5 | | 0.0 | | 13.7 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.9 | | |
| Intersection Capacity Utilization | 27.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 5 | 223 | 17 | 44 | 155 | 33 | 7 | 0 | 35 | 120 | 0 | 13 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 5 | 242 | 18 | 48 | 168 | 36 | 8 | 0 | 38 | 130 | 0 | 14 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 204 | | | 261 | | | 541 | 562 | 252 | 555 | 536 | 168 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 204 | | | 261 | | | 541 | 562 | 252 | 555 | 536 | 168 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 96 | | | 98 | 100 | 95 | 68 | 100 | 98 |
| cM capacity (veh/h) | 1367 | | | 1304 | | | 431 | 418 | 787 | 408 | 433 | 876 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 5 | 261 | 48 | 168 | 36 | 8 | 38 | 130 | 14 |
| Volume Left | 5 | 0 | 48 | 0 | 0 | 8 | 0 | 130 | 0 |
| Volume Right | 0 | 18 | 0 | 0 | 36 | 0 | 38 | 0 | 14 |
| cSH | 1367 | 1700 | 1304 | 1700 | 1700 | 431 | 787 | 408 | 876 |
| Volume to Capacity | 0.00 | 0.15 | 0.04 | 0.10 | 0.02 | 0.02 | 0.05 | 0.32 | 0.02 |
| Queue Length (ft) | 0 | 0 | 3 | 0 | 0 | 1 | 4 | 34 | 1 |
| Control Delay (s) | 7.6 | 0.0 | 7.9 | 0.0 | 0.0 | 13.5 | 9.8 | 17.9 | 9.2 |
| Lane LOS | A | | A | | | B | A | C | A |
| Approach Delay (s) | 0.2 | | 1.5 | | | 10.4 | | 17.1 | |
| Approach LOS | | | | | | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.7 | | |
| Intersection Capacity Utilization | 39.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 11 | 175 | 17 | 77 | 308 | 137 | 16 | 0 | 71 | 86 | 0 | 9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 12 | 190 | 18 | 84 | 335 | 149 | 17 | 0 | 77 | 93 | 0 | 10 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 484 | | | 209 | | | 735 | 874 | 199 | 793 | 735 | 335 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 484 | | | 209 | | | 735 | 874 | 199 | 793 | 735 | 335 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 94 | | | 94 | 100 | 91 | 64 | 100 | 99 |
| cM capacity (veh/h) | 1079 | | | 1362 | | | 312 | 267 | 842 | 263 | 322 | 707 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 12 | 209 | 84 | 335 | 149 | 17 | 77 | 93 | 10 |
| Volume Left | 12 | 0 | 84 | 0 | 0 | 17 | 0 | 93 | 0 |
| Volume Right | 0 | 18 | 0 | 0 | 149 | 0 | 77 | 0 | 10 |
| cSH | 1079 | 1700 | 1362 | 1700 | 1700 | 312 | 842 | 263 | 707 |
| Volume to Capacity | 0.01 | 0.12 | 0.06 | 0.20 | 0.09 | 0.06 | 0.09 | 0.36 | 0.01 |
| Queue Length (ft) | 1 | 0 | 5 | 0 | 0 | 4 | 8 | 39 | 1 |
| Control Delay (s) | 8.4 | 0.0 | 7.8 | 0.0 | 0.0 | 17.2 | 9.7 | 26.1 | 10.2 |
| Lane LOS | A | | A | | | C | A | D | B |
| Approach Delay (s) | 0.5 | | 1.2 | | | 11.1 | | 24.6 | |
| Approach LOS | | | | | | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.4 | | |
| Intersection Capacity Utilization | 41.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 5 | 278 | 17 | 44 | 165 | 33 | 7 | 0 | 35 | 120 | 0 | 13 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 5 | 302 | 18 | 48 | 179 | 36 | 8 | 0 | 38 | 130 | 0 | 14 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 215 | | | 321 | | | 611 | 633 | 311 | 626 | 607 | 179 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 215 | | | 321 | | | 611 | 633 | 311 | 626 | 607 | 179 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 96 | | | 98 | 100 | 95 | 64 | 100 | 98 |
| cM capacity (veh/h) | 1355 | | | 1239 | | | 386 | 380 | 729 | 364 | 394 | 863 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 5 | 321 | 48 | 179 | 36 | 8 | 38 | 130 | 14 |
| Volume Left | 5 | 0 | 48 | 0 | 0 | 8 | 0 | 130 | 0 |
| Volume Right | 0 | 18 | 0 | 0 | 36 | 0 | 38 | 0 | 14 |
| cSH | 1355 | 1700 | 1239 | 1700 | 1700 | 386 | 729 | 364 | 863 |
| Volume to Capacity | 0.00 | 0.19 | 0.04 | 0.11 | 0.02 | 0.02 | 0.05 | 0.36 | 0.02 |
| Queue Length (ft) | 0 | 0 | 3 | 0 | 0 | 2 | 4 | 40 | 1 |
| Control Delay (s) | 7.7 | 0.0 | 8.0 | 0.0 | 0.0 | 14.5 | 10.2 | 20.3 | 9.2 |
| Lane LOS | A | | A | | | B | B | C | A |
| Approach Delay (s) | 0.1 | | 1.5 | | | 10.9 | | 19.2 | |
| Approach LOS | | | | | | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.8 | | |
| Intersection Capacity Utilization | 42.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 11 | 215 | 17 | 77 | 369 | 137 | 16 | 0 | 71 | 86 | 0 | 9 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 12 | 234 | 18 | 84 | 401 | 149 | 17 | 0 | 77 | 93 | 0 | 10 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 550 | | | 252 | | | 845 | 984 | 243 | 903 | 845 | 401 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 550 | | | 252 | | | 845 | 984 | 243 | 903 | 845 | 401 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 94 | | | 93 | 100 | 90 | 57 | 100 | 98 |
| cM capacity (veh/h) | 1020 | | | 1313 | | | 262 | 230 | 796 | 220 | 277 | 649 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 12 | 252 | 84 | 401 | 149 | 17 | 77 | 93 | 10 |
| Volume Left | 12 | 0 | 84 | 0 | 0 | 17 | 0 | 93 | 0 |
| Volume Right | 0 | 18 | 0 | 0 | 149 | 0 | 77 | 0 | 10 |
| cSH | 1020 | 1700 | 1313 | 1700 | 1700 | 262 | 796 | 220 | 649 |
| Volume to Capacity | 0.01 | 0.15 | 0.06 | 0.24 | 0.09 | 0.07 | 0.10 | 0.43 | 0.02 |
| Queue Length (ft) | 1 | 0 | 5 | 0 | 0 | 5 | 8 | 49 | 1 |
| Control Delay (s) | 8.6 | 0.0 | 7.9 | 0.0 | 0.0 | 19.7 | 10.0 | 33.0 | 10.6 |
| Lane LOS | A | | A | | | C | B | D | B |
| Approach Delay (s) | 0.4 | | 1.0 | | | 11.8 | | 30.9 | |
| Approach LOS | | | | | | B | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.6 | | |
| Intersection Capacity Utilization | 44.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 23 | 366 | 1 | 1 | 161 | 21 | 1 | 0 | 3 | 19 | 0 | 46 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 25 | 398 | 1 | 1 | 175 | 23 | 1 | 0 | 3 | 21 | 0 | 50 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 198 | | | 399 | | | 588 | 648 | 199 | 429 | 626 | 88 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 198 | | | 399 | | | 588 | 648 | 199 | 429 | 626 | 88 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 98 | | | 100 | | | 100 | 100 | 100 | 96 | 100 | 95 |
| cM capacity (veh/h) | 1372 | | | 1156 | | | 366 | 380 | 808 | 500 | 391 | 953 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | WB 4 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 25 | 265 | 134 | 1 | 88 | 88 | 23 | 4 | 71 |
| Volume Left | 25 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 21 |
| Volume Right | 0 | 0 | 1 | 0 | 0 | 0 | 23 | 3 | 50 |
| cSH | 1372 | 1700 | 1700 | 1156 | 1700 | 1700 | 1700 | 621 | 754 |
| Volume to Capacity | 0.02 | 0.16 | 0.08 | 0.00 | 0.05 | 0.05 | 0.01 | 0.01 | 0.09 |
| Queue Length (ft) | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 |
| Control Delay (s) | 7.7 | 0.0 | 0.0 | 8.1 | 0.0 | 0.0 | 0.0 | 10.8 | 10.3 |
| Lane LOS | A | | | A | | | | B | B |
| Approach Delay (s) | 0.5 | | | 0.0 | | | | 10.8 | 10.3 |
| Approach LOS | | | | | | | | B | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.4 | | |
| Intersection Capacity Utilization | 29.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 50 | 281 | 2 | 0 | 382 | 48 | 4 | 0 | 3 | 54 | 0 | 108 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 54 | 305 | 2 | 0 | 415 | 52 | 4 | 0 | 3 | 59 | 0 | 117 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 467 | | | 308 | | | 740 | 883 | 154 | 680 | 832 | 208 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 467 | | | 308 | | | 740 | 883 | 154 | 680 | 832 | 208 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 95 | | | 100 | | | 98 | 100 | 100 | 82 | 100 | 85 |
| cM capacity (veh/h) | 1090 | | | 1250 | | | 250 | 269 | 865 | 323 | 288 | 798 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | WB 4 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 54 | 204 | 104 | 0 | 208 | 208 | 52 | 8 | 176 |
| Volume Left | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 59 |
| Volume Right | 0 | 0 | 2 | 0 | 0 | 0 | 52 | 3 | 117 |
| cSH | 1090 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 360 | 536 |
| Volume to Capacity | 0.05 | 0.12 | 0.06 | 0.00 | 0.12 | 0.12 | 0.03 | 0.02 | 0.33 |
| Queue Length (ft) | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 36 |
| Control Delay (s) | 8.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.2 | 15.0 |
| Lane LOS | A | | | | | | | C | B |
| Approach Delay (s) | 1.3 | | | 0.0 | | | | 15.2 | 15.0 |
| Approach LOS | | | | | | | | C | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.2 | | |
| Intersection Capacity Utilization | 34.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 36 | 452 | 1 | 1 | 187 | 21 | 1 | 0 | 3 | 19 | 0 | 53 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 39 | 491 | 1 | 1 | 203 | 23 | 1 | 0 | 3 | 21 | 0 | 58 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 226 | | | 492 | | | 732 | 798 | 246 | 533 | 776 | 102 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 226 | | | 492 | | | 732 | 798 | 246 | 533 | 776 | 102 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 97 | | | 100 | | | 100 | 100 | 100 | 95 | 100 | 94 |
| cM capacity (veh/h) | 1340 | | | 1067 | | | 284 | 308 | 754 | 418 | 317 | 934 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | WB 4 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 39 | 328 | 165 | 1 | 102 | 102 | 23 | 4 | 78 |
| Volume Left | 39 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 21 |
| Volume Right | 0 | 0 | 1 | 0 | 0 | 0 | 23 | 3 | 58 |
| cSH | 1340 | 1700 | 1700 | 1067 | 1700 | 1700 | 1700 | 533 | 705 |
| Volume to Capacity | 0.03 | 0.19 | 0.10 | 0.00 | 0.06 | 0.06 | 0.01 | 0.01 | 0.11 |
| Queue Length (ft) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 |
| Control Delay (s) | 7.8 | 0.0 | 0.0 | 8.4 | 0.0 | 0.0 | 0.0 | 11.8 | 10.7 |
| Lane LOS | A | | | A | | | | B | B |
| Approach Delay (s) | 0.6 | | | 0.0 | | | | 11.8 | 10.7 |
| Approach LOS | | | | | | | | B | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.4 | | |
| Intersection Capacity Utilization | 31.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 63 | 331 | 2 | 0 | 469 | 48 | 4 | 0 | 3 | 54 | 0 | 132 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 68 | 360 | 2 | 0 | 510 | 52 | 4 | 0 | 3 | 59 | 0 | 143 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 562 | | | 362 | | | 896 | 1060 | 181 | 830 | 1009 | 255 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 562 | | | 362 | | | 896 | 1060 | 181 | 830 | 1009 | 255 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 93 | | | 100 | | | 98 | 100 | 100 | 76 | 100 | 81 |
| cM capacity (veh/h) | 1005 | | | 1193 | | | 180 | 208 | 831 | 248 | 223 | 744 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | WB 4 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 68 | 240 | 122 | 0 | 255 | 255 | 52 | 8 | 202 |
| Volume Left | 68 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 59 |
| Volume Right | 0 | 0 | 2 | 0 | 0 | 0 | 52 | 3 | 143 |
| cSH | 1005 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 271 | 471 |
| Volume to Capacity | 0.07 | 0.14 | 0.07 | 0.00 | 0.15 | 0.15 | 0.03 | 0.03 | 0.43 |
| Queue Length (ft) | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 53 |
| Control Delay (s) | 8.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18.7 | 18.3 |
| Lane LOS | A | | | | | | | C | C |
| Approach Delay (s) | 1.4 | | | 0.0 | | | | 18.7 | 18.3 |
| Approach LOS | | | | | | | | C | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.7 | | |
| Intersection Capacity Utilization | 38.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 38 | 485 | 1 | 1 | 219 | 21 | 1 | 0 | 3 | 19 | 0 | 65 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 41 | 527 | 1 | 1 | 238 | 23 | 1 | 0 | 3 | 21 | 0 | 71 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 261 | | | 528 | | | 802 | 873 | 264 | 590 | 851 | 119 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 261 | | | 528 | | | 802 | 873 | 264 | 590 | 851 | 119 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 97 | | | 100 | | | 100 | 100 | 100 | 95 | 100 | 92 |
| cM capacity (veh/h) | 1301 | | | 1035 | | | 247 | 277 | 734 | 380 | 286 | 910 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | WB 4 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 41 | 351 | 177 | 1 | 119 | 119 | 23 | 4 | 91 |
| Volume Left | 41 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 21 |
| Volume Right | 0 | 0 | 1 | 0 | 0 | 0 | 23 | 3 | 71 |
| cSH | 1301 | 1700 | 1700 | 1035 | 1700 | 1700 | 1700 | 492 | 692 |
| Volume to Capacity | 0.03 | 0.21 | 0.10 | 0.00 | 0.07 | 0.07 | 0.01 | 0.01 | 0.13 |
| Queue Length (ft) | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 11 |
| Control Delay (s) | 7.9 | 0.0 | 0.0 | 8.5 | 0.0 | 0.0 | 0.0 | 12.4 | 11.0 |
| Lane LOS | A | | | A | | | | B | B |
| Approach Delay (s) | 0.6 | | | 0.0 | | | | 12.4 | 11.0 |
| Approach LOS | | | | | | | | B | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.5 | | |
| Intersection Capacity Utilization | 33.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 76 | 389 | 2 | 0 | 527 | 48 | 4 | 0 | 3 | 54 | 0 | 151 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 83 | 423 | 2 | 0 | 573 | 52 | 4 | 0 | 3 | 59 | 0 | 164 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 625 | | | 425 | | | 1040 | 1214 | 212 | 953 | 1163 | 286 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 625 | | | 425 | | | 1040 | 1214 | 212 | 953 | 1163 | 286 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 91 | | | 100 | | | 97 | 100 | 100 | 70 | 100 | 77 |
| cM capacity (veh/h) | 952 | | | 1131 | | | 133 | 165 | 793 | 199 | 177 | 710 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | WB 4 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 83 | 282 | 143 | 0 | 286 | 286 | 52 | 8 | 223 |
| Volume Left | 83 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 59 |
| Volume Right | 0 | 0 | 2 | 0 | 0 | 0 | 52 | 3 | 164 |
| cSH | 952 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 206 | 423 |
| Volume to Capacity | 0.09 | 0.17 | 0.08 | 0.00 | 0.17 | 0.17 | 0.03 | 0.04 | 0.53 |
| Queue Length (ft) | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 75 |
| Control Delay (s) | 9.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.1 | 22.6 |
| Lane LOS | A | | | | | | | C | C |
| Approach Delay (s) | 1.5 | | | 0.0 | | | | 23.1 | 22.6 |
| Approach LOS | | | | | | | | C | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.4 | | |
| Intersection Capacity Utilization | 41.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 41 | 537 | 1 | 1 | 231 | 22 | 1 | 0 | 3 | 25 | 0 | 74 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 45 | 584 | 1 | 1 | 251 | 24 | 1 | 0 | 3 | 27 | 0 | 80 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 275 | | | 585 | | | 882 | 951 | 292 | 638 | 927 | 126 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 275 | | | 585 | | | 882 | 951 | 292 | 638 | 927 | 126 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 97 | | | 100 | | | 99 | 100 | 100 | 92 | 100 | 91 |
| cM capacity (veh/h) | 1285 | | | 986 | | | 213 | 249 | 704 | 350 | 257 | 901 |

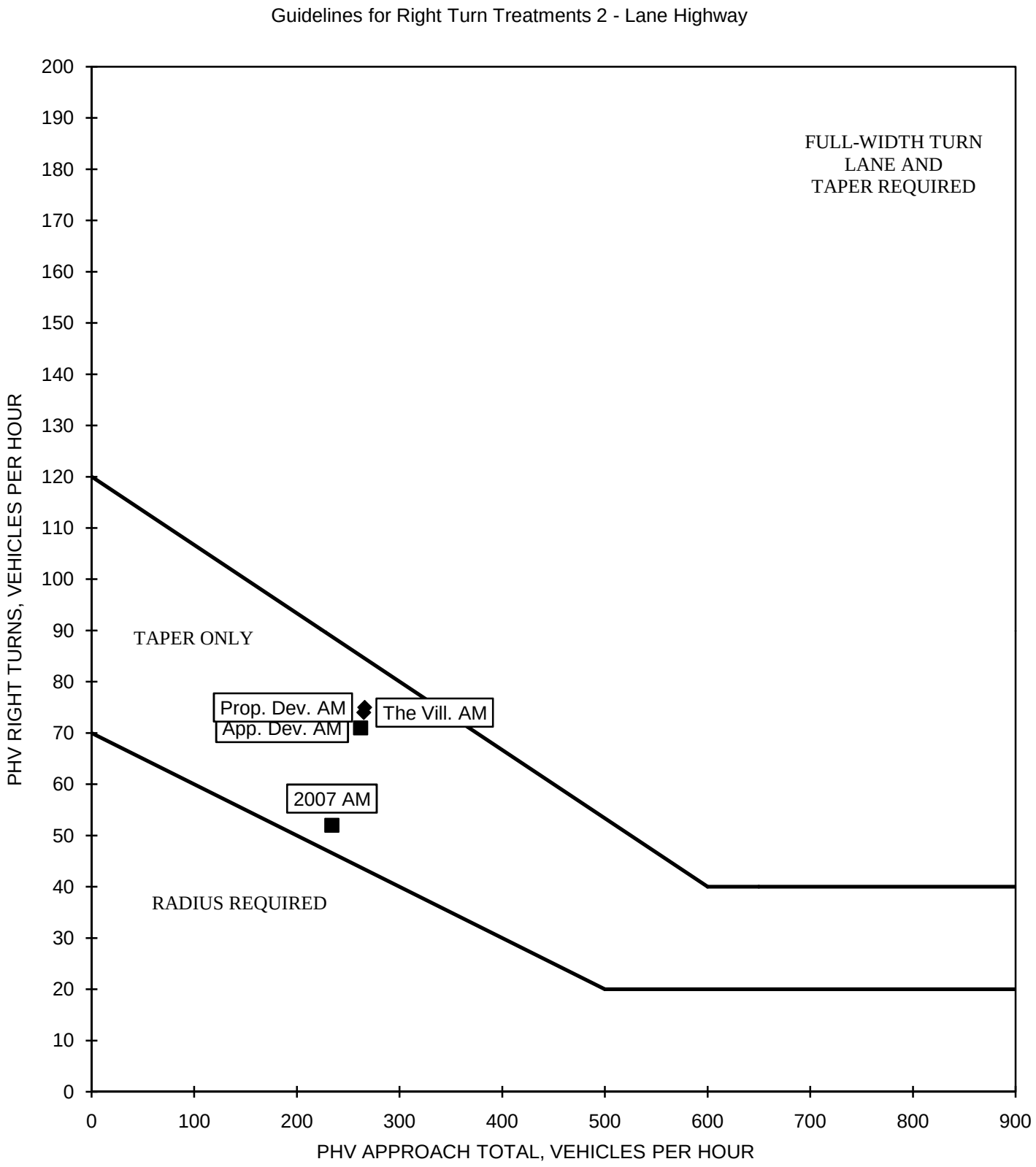
| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | WB 4 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 45 | 389 | 196 | 1 | 126 | 126 | 24 | 4 | 108 |
| Volume Left | 45 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 27 |
| Volume Right | 0 | 0 | 1 | 0 | 0 | 0 | 24 | 3 | 80 |
| cSH | 1285 | 1700 | 1700 | 986 | 1700 | 1700 | 1700 | 447 | 645 |
| Volume to Capacity | 0.03 | 0.23 | 0.12 | 0.00 | 0.07 | 0.07 | 0.01 | 0.01 | 0.17 |
| Queue Length (ft) | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 15 |
| Control Delay (s) | 7.9 | 0.0 | 0.0 | 8.7 | 0.0 | 0.0 | 0.0 | 13.1 | 11.7 |
| Lane LOS | A | | | A | | | | B | B |
| Approach Delay (s) | 0.6 | | | 0.0 | | | | 13.1 | 11.7 |
| Approach LOS | | | | | | | | B | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.6 | | |
| Intersection Capacity Utilization | 36.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 87 | 418 | 2 | 0 | 571 | 54 | 4 | 0 | 3 | 56 | 0 | 168 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 95 | 454 | 2 | 0 | 621 | 59 | 4 | 0 | 3 | 61 | 0 | 183 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 679 | | | 457 | | | 1138 | 1324 | 228 | 1040 | 1266 | 310 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 679 | | | 457 | | | 1138 | 1324 | 228 | 1040 | 1266 | 310 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 90 | | | 100 | | | 96 | 100 | 100 | 64 | 100 | 73 |
| cM capacity (veh/h) | 909 | | | 1101 | | | 106 | 139 | 774 | 169 | 150 | 686 |

| Direction, Lane # | EB 1 | EB 2 | EB 3 | WB 1 | WB 2 | WB 3 | WB 4 | NB 1 | SB 1 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 95 | 303 | 154 | 0 | 310 | 310 | 59 | 8 | 243 |
| Volume Left | 95 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 61 |
| Volume Right | 0 | 0 | 2 | 0 | 0 | 0 | 59 | 3 | 183 |
| cSH | 909 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 168 | 389 |
| Volume to Capacity | 0.10 | 0.18 | 0.09 | 0.00 | 0.18 | 0.18 | 0.03 | 0.05 | 0.63 |
| Queue Length (ft) | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 103 |
| Control Delay (s) | 9.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.5 | 28.6 |
| Lane LOS | A | | | | | | | D | D |
| Approach Delay (s) | 1.6 | | | 0.0 | | | | 27.5 | 28.6 |
| Approach LOS | | | | | | | | D | D |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 5.4 | | |
| Intersection Capacity Utilization | 44.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

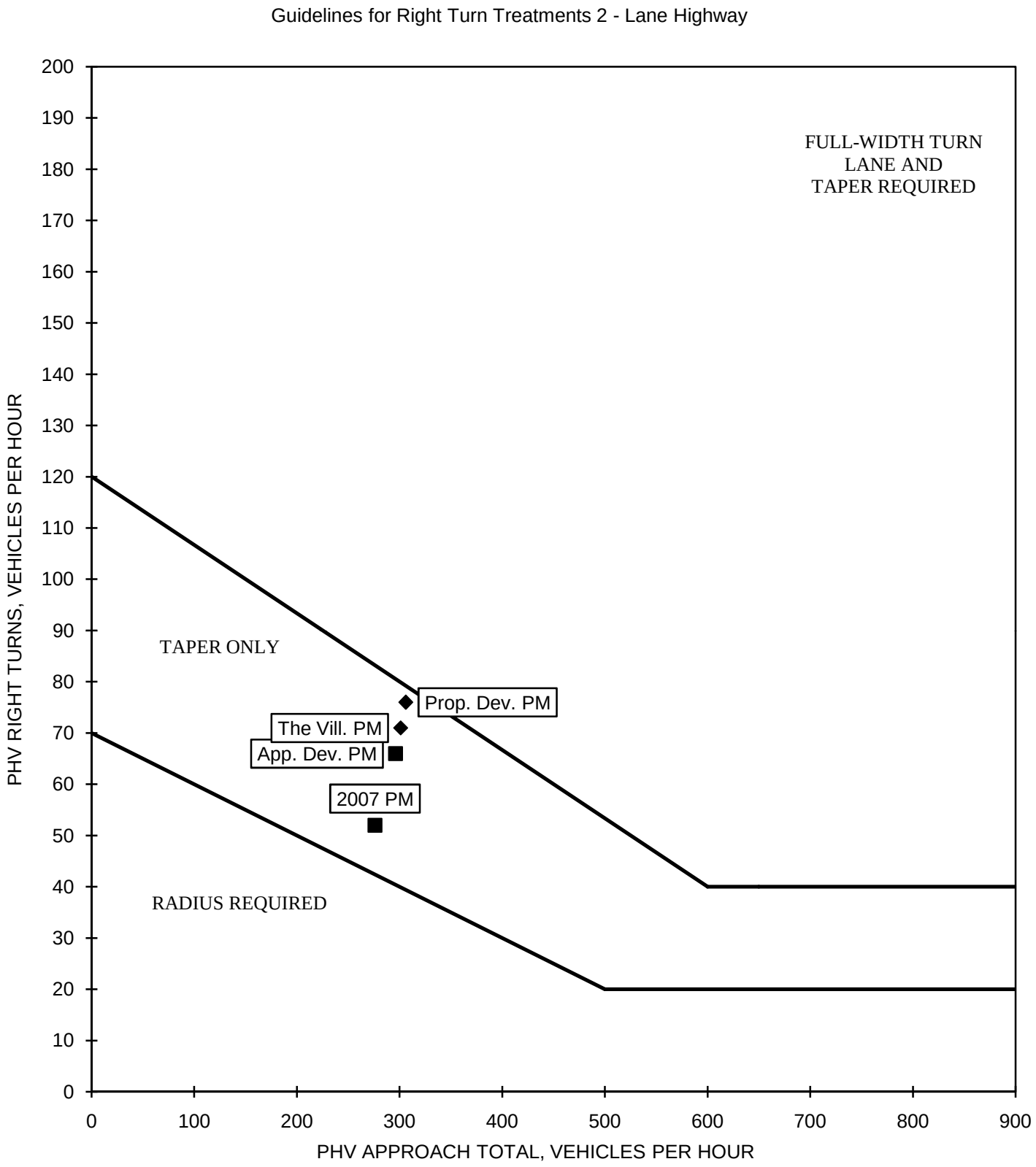



Source: VDOT Road Design Manual, Vol. 1, Page C-15, Figure C-1-8

VDOT RIGHT TURN LANE WARRANT
NORTHBOUND CENTERVILLE ROAD AT NEWS ROAD
AM PEAK HOUR COUNTS AND FORECAST

***DRW Consultants, LLC***
***804-794-7312***

Exhibit J1

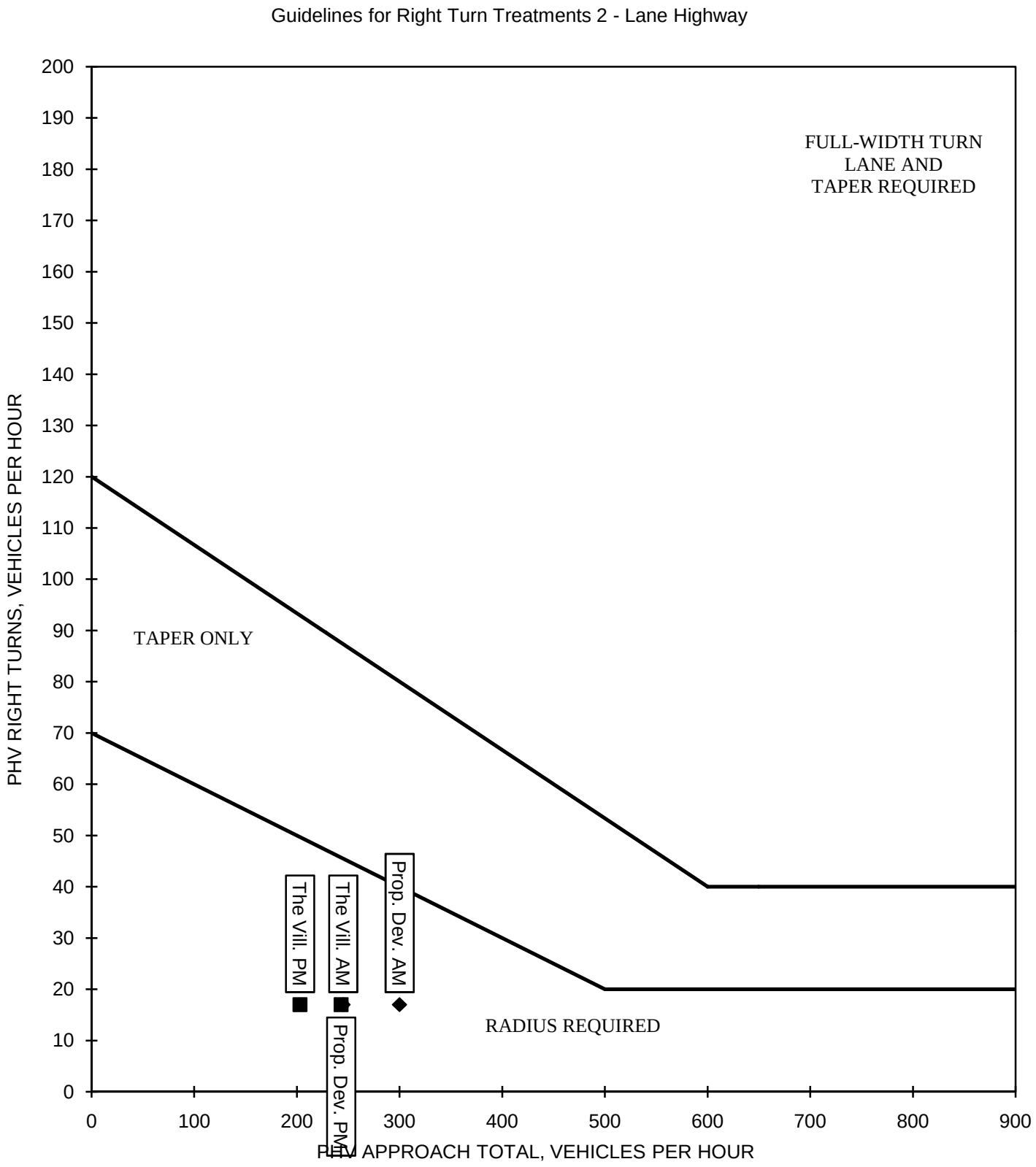



Source: VDOT Road Design Manual, Vol. 1, Page C-15, Figure C-1-8

VDOT RIGHT TURN LANE WARRANT
NORTHBOUND CENTERVILLE ROAD AT NEWS ROAD
PM PEAK HOUR COUNTS AND FORECAST

***DRW Consultants, LLC***
***804-794-7312***

Exhibit J2

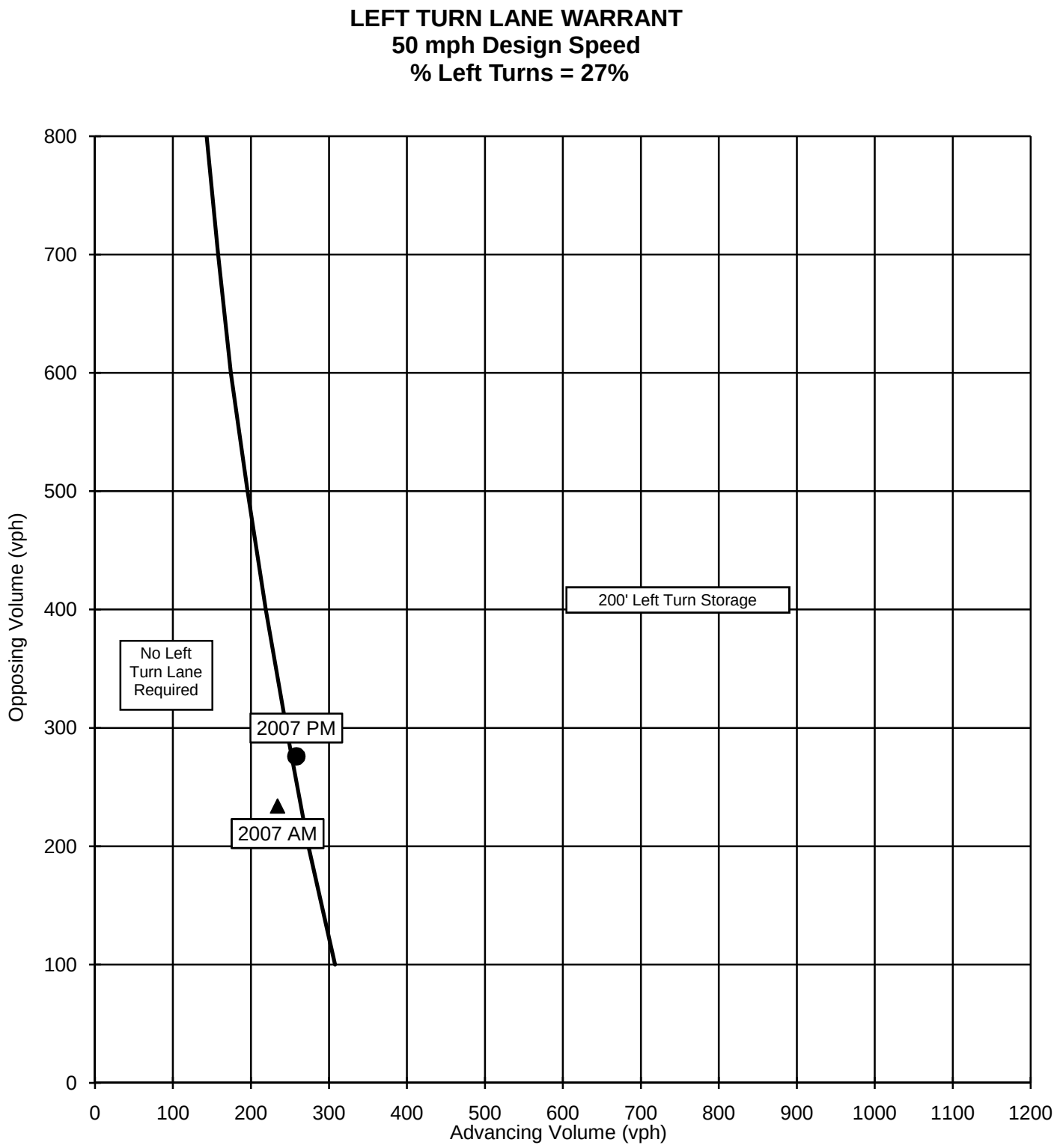



Source: VDOT Road Design Manual, Vol. 1, Page C-15, Figure C-1-8

VDOT RIGHT TURN LANE WARRANT
EASTBOUND NEWS ROAD AT FIRESTONE DRIVE

***DRW Consultants, LLC***
***804-794-7312***

Exhibit J3




Source: Interpolated from VDOT Road Design Manual, Appendix C, derived from Highway Research Record Number 211

VDOT LEFT TURN LANE WARRANTS
NORTHBOUND CENTERVILLE ROAD AT NEWS ROAD
AM AND PM PEAK HOUR COUNTS

*DRW Consultants, LLC*
*804-794-7312*

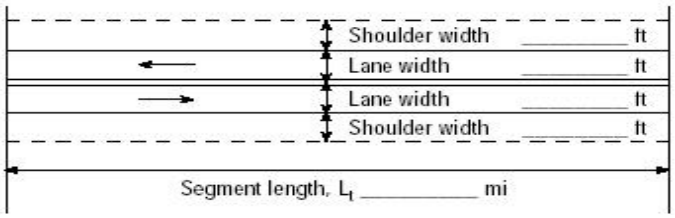
Exhibit K

# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *East of Centerville* |
| Date Performed | *4/3/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *2007/2008 COUNTS AM* | Analysis Year | *Exhibit L1* |

Project Description: *News Road Corridor Study - Exhibit L1*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *239* veh/h |
| Directional split | *51 / 49* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *10* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.71* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *2.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.930* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *393* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *200* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *2.5 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *44.5 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *4.5* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *37.0* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.77* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.8* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.962* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *351* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *179* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *26.5* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *23.9* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *50.5* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *B* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.12* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *91* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *335* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *2.5* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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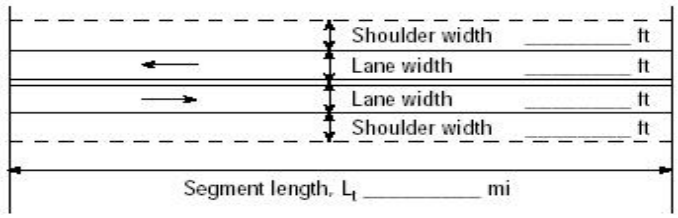
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *East of Centerville* |
| Date Performed | *4/3/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *2007/2008 COUNTS PM* | Analysis Year | *Exhibit L2* |

Project Description: *News Road Corridor Study - Exhibit L2*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *298* veh/h |
| Directional split | *59 / 41* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *10* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.71* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *2.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.930* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *490* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *289* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *2.5 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *44.5 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *4.2* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.5* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.77* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.8* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.962* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *437* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *258* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *31.9* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *22.1* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *54.0* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *B* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.15* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *113* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *417* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *3.1* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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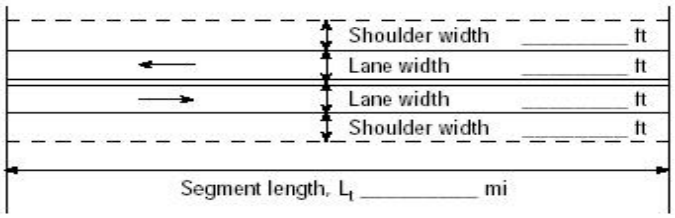
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *East of Centerville* |
| Date Performed | *4/3/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *APPROVED DEVELOPMENT AM* | Analysis Year | *Exhibit L3* |

Project Description: *News Road Corridor Study - Exhibit L3*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *318* veh/h |
| Directional split | *53 / 47* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *10* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.71* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *2.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.930* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *523* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *277* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *2.5 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *44.5 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *4.1* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.3* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.77* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.8* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.962* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *467* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *248* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *33.7* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *22.9* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *56.5* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.16* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *121* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *445* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *3.3* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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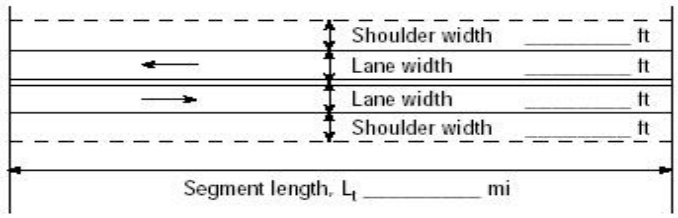
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *East of Centerville* |
| Date Performed | *4/3/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *Approved Development PM* | Analysis Year | *Exhibit L4* |

Project Description: *News Road Corridor Study - Exhibit L4*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *399* veh/h |
| Directional split | *60 / 40* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *10* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.93* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.9* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.957* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *487* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *292* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *2.5 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *44.5 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *4.2* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.5* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.77* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.8* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.962* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *586* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *352* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *40.3* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *20.8* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *61.1* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.15* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *152* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *559* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *4.2* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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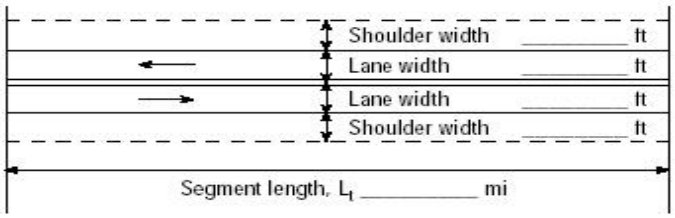
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *East of Centerville* |
| Date Performed | *4/3/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *The Village DEVELOPMENT AM* | Analysis Year | *Exhibit L5* |

Project Description: *News Road Corridor Study - Exhibit L5*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *342* veh/h |
| Directional split | *55 / 45* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *10* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.71* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *2.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.930* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *563* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *310* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *2.5 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *44.5 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *4.0* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.1* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.77* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.8* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.962* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *502* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *276* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *35.7* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *22.0* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *57.7* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.18* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *130* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *479* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *3.6* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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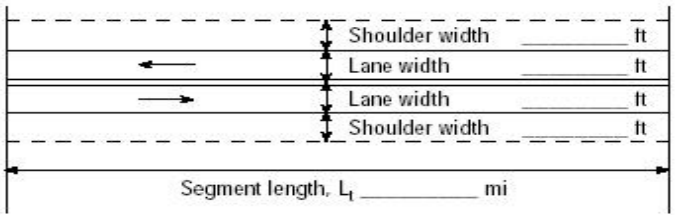
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *East of Centerville* |
| Date Performed | *4/3/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *The Village DEVELOPMENT PM* | Analysis Year | *Exhibit L6* |

Project Description: *News Road Corridor Study - Exhibit L6*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *432* veh/h |
| Directional split | *59 / 41* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *10* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.93* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.9* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.957* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *528* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *312* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *2.5 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *44.5 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *4.1* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.3* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.94* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *512* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *302* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *36.2* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *21.5* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *57.7* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.17* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *164* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *605* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *4.5* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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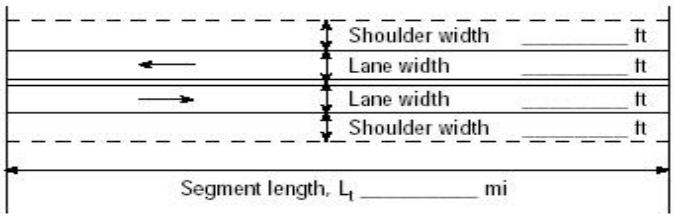
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *East of Centerville* |
| Date Performed | *4/3/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *PROPOSED DEVELOPMENT AM* | Analysis Year | *Exhibit L7* |

Project Description: *News Road Corridor Study - Exhibit L7*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *363* veh/h |
| Directional split | *53 / 47* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *10* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.71* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *2.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.930* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *597* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *316* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *2.5 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *44.5 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *3.9* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.0* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.77* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.8* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.962* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *533* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *282* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *37.4* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *21.7* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *59.1* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.19* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *138* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *508* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *3.8* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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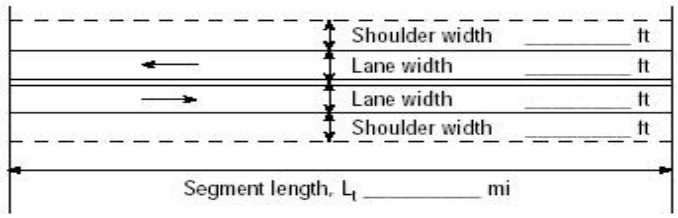
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *East of Centerville* |
| Date Performed | *4/3/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *PROPOSED DEVELOPMENT PM* | Analysis Year | *Exhibit L8* |

Project Description: *News Road Corridor Study - Exhibit L8*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *459* veh/h |
| Directional split | *58 / 42* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *10* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.93* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.9* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.957* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *561* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *325* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *2.5 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *44.5 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *4.0* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.1* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.94* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *544* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *316* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *38.0* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *21.2* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *59.2* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.18* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *175* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *643* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *4.8* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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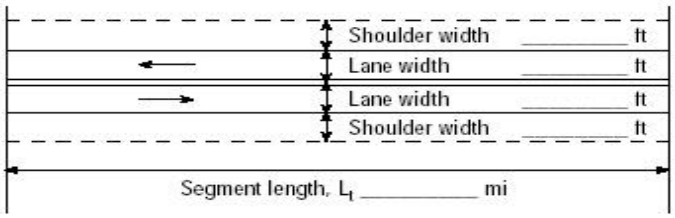
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *Old News Road/Powhatan Seconda* |
| Date Performed | *3/12/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *2007/2008 COUNTS AM* | Analysis Year | *Exhibit O1* |

Project Description: *News Road Corridor Study - Exhibit O1*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *598* veh/h |
| Directional split | *65 / 35* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *1* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.93* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.9* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.957* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *730* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *475* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *0.3 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *46.8 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *3.3* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *37.8* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.94* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *709* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *461* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *46.4* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *17.4* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *63.7* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.23* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *98* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *359* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *2.6* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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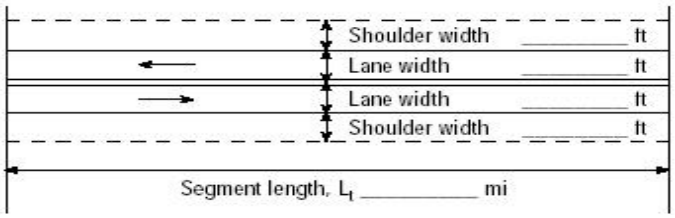
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *Old News Road/Powhatan Seconda* |
| Date Performed | *3/12/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *2007/2008 COUNTS PM* | Analysis Year | *Exhibit O2* |

Project Description: *News Road Corridor Study - Exhibit O2*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *827* veh/h |
| Directional split | *60 / 40* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *1* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.93* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.9* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.957* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1010* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *606* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *4.8 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *0.3 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *45.0 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *2.6* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *34.5* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.94* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *980* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *588* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *57.7* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *12.5* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *70.3* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *D* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.32* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *135* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *496* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *3.9* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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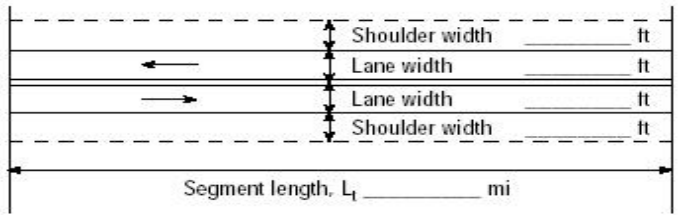
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *Old News Road/Powhatan Seconda* |
| Date Performed | *3/12/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *Approved Development AM* | Analysis Year | *Exhibit O3* |

Project Description: *News Road Corridor Study - Exhibit O3*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *730* veh/h |
| Directional split | *67 / 33* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *1* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.93* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.9* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.957* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *892* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *598* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *0.3 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *46.8 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *2.8* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *37.0* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.94* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *865* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *580* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *53.2* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *13.9* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *67.1* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.28* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *119* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *438* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *3.2* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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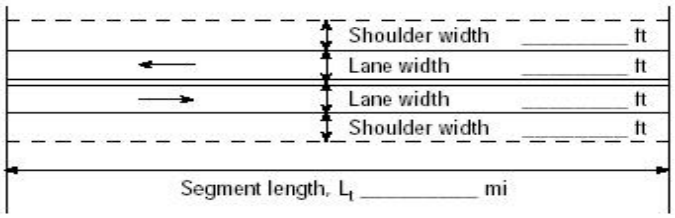
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *Old News Road/Powhatan Seconda* |
| Date Performed | *3/12/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *Approved Development PM* | Analysis Year | *Exhibit O4* |

Project Description: *News Road Corridor Study - Exhibit O4*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *1001* veh/h |
| Directional split | *60 / 40* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *1* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.99* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1127* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *676* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *0.3 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *46.8 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *2.3* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *35.7* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.94* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1186* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *712* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *64.7* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *10.3* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *75.1* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *D* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.35* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *163* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *601* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *4.6* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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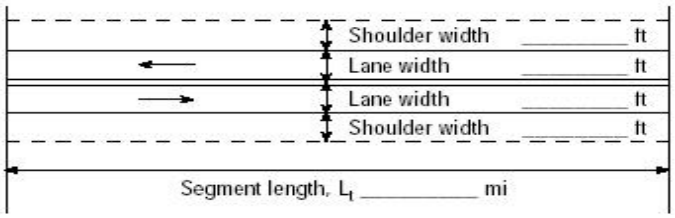
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *Old News Road/Powhatan Seconda* |
| Date Performed | *3/12/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *The Village Development AM* | Analysis Year | *Exhibit O5* |

Project Description: *News Road Corridor Study - Exhibit O5*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *809* veh/h |
| Directional split | *65 / 35* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *1* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.93* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.9* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.957* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *988* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *642* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *0.3 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *46.8 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *2.6* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.5* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.94* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *959* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *623* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *57.0* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *12.8* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *69.8* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *C* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.31* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *132* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *485* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *3.6* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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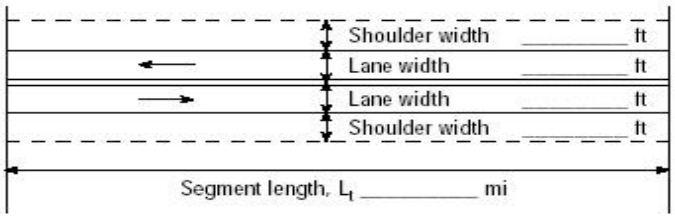
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *Old News Road/Powhatan Seconda* |
| Date Performed | *3/12/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *The Village Development PM* | Analysis Year | *Exhibit O6* |

Project Description: *News Road Corridor Study - Exhibit O6*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *1149* veh/h |
| Directional split | *59 / 41* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *1* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.99* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1293* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *763* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *0.3 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *46.8 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *1.9* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *34.8* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *1.00* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.0* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *1.000* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1249* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *737* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *66.6* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *9.7* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *76.3* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *D* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.40* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *187* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *689* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *5.4* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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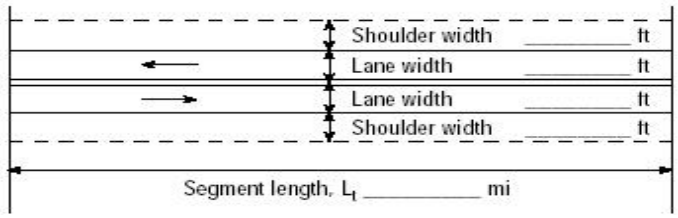
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *Old News Road/Powhatan Seconda* |
| Date Performed | *3/12/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *Proposed Development AM* | Analysis Year | *Exhibit O7* |

Project Description: *News Road Corridor Study - Exhibit O7*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *885* veh/h |
| Directional split | *65 / 35* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *1* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.93* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.9* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.957* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1081* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *703* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *0.3 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *46.8 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *2.4* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *36.0* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *0.94* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1049* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *682* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *60.2* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *11.9* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *72.1* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *D* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.34* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *144* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *531* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *4.0* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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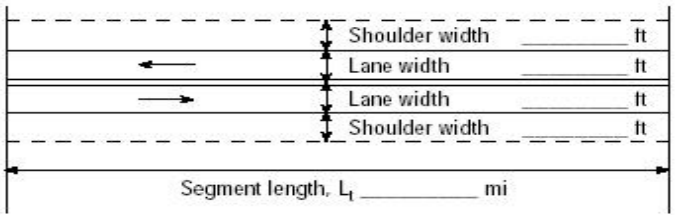
# TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

| ***General Information*** | | ***Site Information*** | |
|---|---|---|---|
| Analyst | *DRW* | Highway | *News Road* |
| Agency or Company | *DRW Consultants, LLC* | From/To | *Old News Road/Powhatan Seconda* |
| Date Performed | *3/12/2008* | Jurisdiction | *JCC* |
| Analysis Time Period | *Proposed Development PM* | Analysis Year | *Exhibit O8* |

Project Description: *News Road Corridor Study - Exhibit O8*

***Input Data***



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

| | |
|---|---|
| Two-way hourly volume | *1250* veh/h |
| Directional split | *59 / 41* |
| Peak-hour factor, PHF | *0.92* |
| No-passing zone | *100* |
| % Trucks and Buses , $P_T$ | *5 %* |
| % Recreational vehicles, $P_R$ | *0%* |
| Access points/ *mi* | *1* |

***Average Travel Speed***

| | |
|---|---|
| Grade adjustment factor, $f_G$ (Exhibit 20-7) | *0.99* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9) | *1.5* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9) | *1.1* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *0.976* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1407* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *830* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field Measured speed, $S_{FM}$ | *mi/h* | Base free-flow speed, $BFFS_{FM}$ | *50.0 mi/h* |
| Observed volume, $V_f$ | *veh/h* | Adj. for lane width and shoulder width[3], $f_{LS}$ (Exhibit 20-5) | *3.0 mi/h* |
| Free-flow speed, FFS FFS=$S_{FM}$+0.00776($V_f$/ $f_{HV}$ ) | *mi/h* | Adj. for access points, $f_A$ (Exhibit 20-6) | *0.3 mi/h* |
| | | Free-flow speed, FFS (FSS=BFFS-$f_{LS}$-$f_A$) | *46.8 mi/h* |

| | |
|---|---|
| Adj. for no-passing zones, $f_{np}$ ( *mi/h*) (Exhibit 20-11) | *1.7* |
| Average travel speed, ATS ( *mi/h*) ATS=FFS-0.00776$v_p$-$f_{np}$ | *34.1* |

***Percent Time-Spent-Following***

| | |
|---|---|
| Grade Adjustment factor, $f_G$ (Exhibit 20-8) | *1.00* |
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-10) | *1.0* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10) | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}$=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$ ) | *1.000* |
| Two-way flow rate[1], $v_p$ (pc/h)=V/ (PHF * $f_G$ * $f_{HV}$) | *1359* |
| $v_p$ * highest directional split proportion[2] (pc/h) | *802* |
| Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$) | *69.7* |
| Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12) | *8.5* |
| Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$ | *78.2* |

***Level of Service and Other Performance Measures***

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II) | *D* |
| Volume to capacity ratio, v/c=$V_p$/ 3,200 | *0.44* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)= 0.25$L_t$(V/PHF) | *204* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)=V*$L_t$ | *750* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)= $VMT_{15}$/ATS | *6.0* |

***Notes***

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3234 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3234 | |
| Volume (vph) | 28 | 610 | 18 | 175 | 179 | 99 | 10 | 37 | 268 | 313 | 47 | 18 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 29 | 642 | 19 | 184 | 188 | 104 | 11 | 39 | 282 | 329 | 49 | 19 |
| RTOR Reduction (vph) | 0 | 0 | 14 | 0 | 0 | 49 | 0 | 0 | 250 | 0 | 6 | 0 |
| Lane Group Flow (vph) | 29 | 642 | 5 | 184 | 188 | 55 | 11 | 39 | 32 | 165 | 226 | 0 |
| Turn Type | Prot | | Perm | Prot | | Perm | Split | | Perm | Split | | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 2 | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 4.9 | 23.7 | 23.7 | 32.6 | 51.4 | 51.4 | 8.8 | 8.8 | 8.8 | 13.9 | 13.9 | |
| Effective Green, g (s) | 8.4 | 27.2 | 27.2 | 36.1 | 54.9 | 54.9 | 11.8 | 11.8 | 11.8 | 16.9 | 16.9 | |
| Actuated g/C Ratio | 0.08 | 0.26 | 0.26 | 0.35 | 0.53 | 0.53 | 0.11 | 0.11 | 0.11 | 0.16 | 0.16 | |
| Clearance Time (s) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 143 | 926 | 414 | 614 | 1868 | 836 | 201 | 211 | 180 | 262 | 526 | |
| v/s Ratio Prot | 0.02 | c0.18 | | c0.10 | 0.05 | | 0.01 | 0.02 | | c0.10 | 0.07 | |
| v/s Ratio Perm | | | 0.01 | | | 0.07 | | | 0.18 | | | |
| v/c Ratio | 0.20 | 0.69 | 0.01 | 0.30 | 0.10 | 0.07 | 0.05 | 0.18 | 0.18 | 0.63 | 0.43 | |
| Uniform Delay, d1 | 44.7 | 34.6 | 28.4 | 24.7 | 12.2 | 12.0 | 41.1 | 41.7 | 41.7 | 40.6 | 39.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.7 | 2.3 | 0.0 | 0.3 | 0.1 | 0.2 | 0.1 | 0.4 | 0.5 | 4.7 | 0.6 | |
| Delay (s) | 45.4 | 36.9 | 28.5 | 25.0 | 12.3 | 12.2 | 41.2 | 42.2 | 42.2 | 45.3 | 39.8 | |
| Level of Service | D | D | C | C | B | B | D | D | D | D | D | |
| Approach Delay (s) | | 37.0 | | | 17.2 | | | 42.2 | | | 42.1 | |
| Approach LOS | | D | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 34.0 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 52.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3190 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3190 | |
| Volume (vph) | 87 | 358 | 39 | 435 | 531 | 242 | 65 | 159 | 319 | 226 | 116 | 87 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 92 | 377 | 41 | 458 | 559 | 255 | 68 | 167 | 336 | 238 | 122 | 92 |
| RTOR Reduction (vph) | 0 | 0 | 33 | 0 | 0 | 133 | 0 | 0 | 287 | 0 | 41 | 0 |
| Lane Group Flow (vph) | 92 | 377 | 8 | 458 | 559 | 122 | 68 | 167 | 49 | 143 | 268 | 0 |
| Turn Type | Prot | | Perm | Prot | | Perm | Split | | Perm | Split | | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 2 | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 8.5 | 17.3 | 17.3 | 37.5 | 46.3 | 46.3 | 12.1 | 12.1 | 12.1 | 12.1 | 12.1 | |
| Effective Green, g (s) | 12.0 | 20.8 | 20.8 | 41.0 | 49.8 | 49.8 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | |
| Actuated g/C Ratio | 0.12 | 0.20 | 0.20 | 0.39 | 0.48 | 0.48 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| Clearance Time (s) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 204 | 708 | 317 | 698 | 1695 | 758 | 257 | 270 | 230 | 234 | 463 | |
| v/s Ratio Prot | 0.05 | c0.11 | | c0.26 | 0.16 | | 0.04 | 0.09 | | 0.09 | c0.10 | |
| v/s Ratio Perm | | | 0.03 | | | 0.16 | | | 0.21 | | | |
| v/c Ratio | 0.45 | 0.53 | 0.03 | 0.66 | 0.33 | 0.16 | 0.26 | 0.62 | 0.21 | 0.61 | 0.58 | |
| Uniform Delay, d1 | 42.9 | 37.2 | 33.5 | 25.7 | 16.8 | 15.3 | 39.5 | 41.7 | 39.2 | 41.7 | 41.5 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.6 | 0.8 | 0.0 | 2.2 | 0.5 | 0.5 | 0.6 | 4.2 | 0.5 | 4.7 | 1.8 | |
| Delay (s) | 44.5 | 38.0 | 33.5 | 28.0 | 17.3 | 15.8 | 40.1 | 45.9 | 39.7 | 46.4 | 43.2 | |
| Level of Service | D | D | C | C | B | B | D | D | D | D | D | |
| Approach Delay (s) | | 38.8 | | | 20.8 | | | 41.5 | | | 44.2 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 32.1 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.76 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 66.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3240 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3240 | |
| Volume (vph) | 32 | 610 | 18 | 175 | 179 | 113 | 10 | 45 | 268 | 370 | 70 | 24 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 34 | 642 | 19 | 184 | 188 | 119 | 11 | 47 | 282 | 389 | 74 | 25 |
| RTOR Reduction (vph) | 0 | 0 | 14 | 0 | 0 | 58 | 0 | 0 | 250 | 0 | 7 | 0 |
| Lane Group Flow (vph) | 34 | 642 | 5 | 184 | 188 | 61 | 11 | 47 | 32 | 195 | 286 | 0 |
| Turn Type | Prot | | Perm | Prot | | Perm | Split | | Perm | Split | | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 2 | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 5.1 | 22.4 | 22.4 | 32.6 | 49.9 | 49.9 | 8.8 | 8.8 | 8.8 | 15.2 | 15.2 | |
| Effective Green, g (s) | 8.6 | 25.9 | 25.9 | 36.1 | 53.4 | 53.4 | 11.8 | 11.8 | 11.8 | 18.2 | 18.2 | |
| Actuated g/C Ratio | 0.08 | 0.25 | 0.25 | 0.35 | 0.51 | 0.51 | 0.11 | 0.11 | 0.11 | 0.17 | 0.17 | |
| Clearance Time (s) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 146 | 881 | 394 | 614 | 1817 | 813 | 201 | 211 | 180 | 282 | 567 | |
| v/s Ratio Prot | 0.02 | c0.18 | | c0.10 | 0.05 | | 0.01 | 0.03 | | c0.12 | 0.09 | |
| v/s Ratio Perm | | | 0.01 | | | 0.08 | | | 0.18 | | | |
| v/c Ratio | 0.23 | 0.73 | 0.01 | 0.30 | 0.10 | 0.08 | 0.05 | 0.22 | 0.18 | 0.69 | 0.51 | |
| Uniform Delay, d1 | 44.6 | 35.8 | 29.4 | 24.7 | 13.0 | 12.8 | 41.1 | 41.9 | 41.7 | 40.3 | 38.8 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.8 | 3.0 | 0.0 | 0.3 | 0.1 | 0.2 | 0.1 | 0.5 | 0.5 | 7.1 | 0.7 | |
| Delay (s) | 45.4 | 38.9 | 29.4 | 25.0 | 13.1 | 13.0 | 41.2 | 42.5 | 42.2 | 47.4 | 39.5 | |
| Level of Service | D | D | C | C | B | B | D | D | D | D | D | |
| Approach Delay (s) | | 38.9 | | | 17.5 | | | 42.2 | | | 42.7 | |
| Approach LOS | | D | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 35.2 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 53.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3197 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3197 | |
| Volume (vph) | 98 | 358 | 39 | 435 | 531 | 291 | 65 | 186 | 319 | 254 | 133 | 92 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 103 | 377 | 41 | 458 | 559 | 306 | 68 | 196 | 336 | 267 | 140 | 97 |
| RTOR Reduction (vph) | 0 | 0 | 33 | 0 | 0 | 163 | 0 | 0 | 286 | 0 | 37 | 0 |
| Lane Group Flow (vph) | 103 | 377 | 8 | 458 | 559 | 143 | 68 | 196 | 50 | 160 | 307 | 0 |
| Turn Type | Prot | | Perm | Prot | | Perm | Split | | Perm | Split | | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 2 | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 8.8 | 16.4 | 16.4 | 37.6 | 45.2 | 45.2 | 12.5 | 12.5 | 12.5 | 12.5 | 12.5 | |
| Effective Green, g (s) | 12.3 | 19.9 | 19.9 | 41.1 | 48.7 | 48.7 | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | |
| Actuated g/C Ratio | 0.12 | 0.19 | 0.19 | 0.40 | 0.47 | 0.47 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| Clearance Time (s) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 209 | 677 | 303 | 699 | 1657 | 741 | 264 | 278 | 236 | 240 | 476 | |
| v/s Ratio Prot | 0.06 | c0.11 | | c0.26 | 0.16 | | 0.04 | 0.11 | | 0.10 | c0.11 | |
| v/s Ratio Perm | | | 0.03 | | | 0.19 | | | 0.21 | | | |
| v/c Ratio | 0.49 | 0.56 | 0.03 | 0.66 | 0.34 | 0.19 | 0.26 | 0.71 | 0.21 | 0.67 | 0.65 | |
| Uniform Delay, d1 | 42.9 | 38.1 | 34.2 | 25.7 | 17.5 | 16.2 | 39.2 | 42.1 | 38.9 | 41.8 | 41.7 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.8 | 1.0 | 0.0 | 2.2 | 0.6 | 0.6 | 0.5 | 7.9 | 0.5 | 6.8 | 3.0 | |
| Delay (s) | 44.8 | 39.1 | 34.2 | 27.9 | 18.0 | 16.7 | 39.7 | 50.0 | 39.3 | 48.6 | 44.7 | |
| Level of Service | D | D | C | C | B | B | D | D | D | D | D | |
| Approach Delay (s) | | 39.8 | | | 21.1 | | | 42.8 | | | 45.9 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 33.1 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.77 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 69.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3239 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3239 | |
| Volume (vph) | 38 | 610 | 18 | 175 | 179 | 125 | 10 | 59 | 268 | 389 | 80 | 28 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 40 | 642 | 19 | 184 | 188 | 132 | 11 | 62 | 282 | 409 | 84 | 29 |
| RTOR Reduction (vph) | 0 | 0 | 14 | 0 | 0 | 65 | 0 | 0 | 249 | 0 | 7 | 0 |
| Lane Group Flow (vph) | 40 | 642 | 5 | 184 | 188 | 67 | 11 | 62 | 33 | 205 | 310 | 0 |
| Turn Type | Prot | | Perm | Prot | | Perm | Split | | Perm | Split | | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 2 | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 5.4 | 21.8 | 21.8 | 32.7 | 49.1 | 49.1 | 9.2 | 9.2 | 9.2 | 15.3 | 15.3 | |
| Effective Green, g (s) | 8.9 | 25.3 | 25.3 | 36.2 | 52.6 | 52.6 | 12.2 | 12.2 | 12.2 | 18.3 | 18.3 | |
| Actuated g/C Ratio | 0.09 | 0.24 | 0.24 | 0.35 | 0.51 | 0.51 | 0.12 | 0.12 | 0.12 | 0.18 | 0.18 | |
| Clearance Time (s) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 151 | 861 | 385 | 616 | 1790 | 801 | 208 | 219 | 186 | 283 | 570 | |
| v/s Ratio Prot | 0.02 | c0.18 | | c0.10 | 0.05 | | 0.01 | 0.03 | | c0.13 | 0.10 | |
| v/s Ratio Perm | | | 0.01 | | | 0.08 | | | 0.18 | | | |
| v/c Ratio | 0.26 | 0.75 | 0.01 | 0.30 | 0.11 | 0.08 | 0.05 | 0.28 | 0.18 | 0.72 | 0.54 | |
| Uniform Delay, d1 | 44.5 | 36.4 | 29.9 | 24.7 | 13.4 | 13.3 | 40.8 | 41.9 | 41.4 | 40.5 | 39.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.9 | 3.5 | 0.0 | 0.3 | 0.1 | 0.2 | 0.1 | 0.7 | 0.5 | 8.9 | 1.1 | |
| Delay (s) | 45.4 | 39.9 | 29.9 | 24.9 | 13.5 | 13.5 | 40.9 | 42.6 | 41.8 | 49.3 | 40.1 | |
| Level of Service | D | D | C | C | B | B | D | D | D | D | D | |
| Approach Delay (s) | | 40.0 | | | 17.7 | | | 41.9 | | | 43.7 | |
| Approach LOS | | D | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 35.9 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 54.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3200 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3200 | |
| Volume (vph) | 107 | 358 | 39 | 435 | 531 | 319 | 65 | 207 | 319 | 285 | 151 | 101 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 113 | 377 | 41 | 458 | 559 | 336 | 68 | 218 | 336 | 300 | 159 | 106 |
| RTOR Reduction (vph) | 0 | 0 | 33 | 0 | 0 | 185 | 0 | 0 | 285 | 0 | 35 | 0 |
| Lane Group Flow (vph) | 113 | 377 | 8 | 458 | 559 | 151 | 68 | 218 | 51 | 181 | 349 | 0 |
| Turn Type | Prot | | Perm | Prot | | Perm | Split | | Perm | Split | | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 2 | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 10.3 | 17.3 | 17.3 | 36.2 | 43.2 | 43.2 | 12.8 | 12.8 | 12.8 | 12.7 | 12.7 | |
| Effective Green, g (s) | 13.8 | 20.8 | 20.8 | 39.7 | 46.7 | 46.7 | 15.8 | 15.8 | 15.8 | 15.7 | 15.7 | |
| Actuated g/C Ratio | 0.13 | 0.20 | 0.20 | 0.38 | 0.45 | 0.45 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| Clearance Time (s) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 235 | 708 | 317 | 676 | 1589 | 711 | 269 | 283 | 240 | 243 | 483 | |
| v/s Ratio Prot | 0.06 | c0.11 | | c0.26 | 0.16 | | 0.04 | 0.12 | | 0.11 | c0.12 | |
| v/s Ratio Perm | | | 0.03 | | | 0.21 | | | 0.21 | | | |
| v/c Ratio | 0.48 | 0.53 | 0.03 | 0.68 | 0.35 | 0.21 | 0.25 | 0.77 | 0.21 | 0.74 | 0.72 | |
| Uniform Delay, d1 | 41.8 | 37.2 | 33.5 | 26.8 | 18.7 | 17.4 | 38.9 | 42.4 | 38.6 | 42.2 | 42.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.6 | 0.8 | 0.0 | 2.7 | 0.6 | 0.7 | 0.5 | 12.2 | 0.4 | 11.7 | 5.3 | |
| Delay (s) | 43.3 | 38.0 | 33.5 | 29.5 | 19.4 | 18.1 | 39.4 | 54.5 | 39.1 | 53.9 | 47.4 | |
| Level of Service | D | D | C | C | B | B | D | D | D | D | D | |
| Approach Delay (s) | | 38.8 | | | 22.5 | | | 44.5 | | | 49.5 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 34.7 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 71.3% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3237 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.97 | |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3237 | |
| Volume (vph) | 40 | 610 | 18 | 175 | 179 | 130 | 10 | 65 | 268 | 419 | 99 | 37 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 42 | 642 | 19 | 184 | 188 | 137 | 11 | 68 | 282 | 441 | 104 | 39 |
| RTOR Reduction (vph) | 0 | 0 | 15 | 0 | 0 | 69 | 0 | 0 | 248 | 0 | 8 | 0 |
| Lane Group Flow (vph) | 42 | 642 | 4 | 184 | 188 | 68 | 11 | 68 | 34 | 221 | 355 | 0 |
| Turn Type | Prot | | Perm | Prot | | Perm | Split | | Perm | Split | | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 2 | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 5.5 | 21.1 | 21.1 | 32.7 | 48.3 | 48.3 | 9.4 | 9.4 | 9.4 | 15.8 | 15.8 | |
| Effective Green, g (s) | 9.0 | 24.6 | 24.6 | 36.2 | 51.8 | 51.8 | 12.4 | 12.4 | 12.4 | 18.8 | 18.8 | |
| Actuated g/C Ratio | 0.09 | 0.24 | 0.24 | 0.35 | 0.50 | 0.50 | 0.12 | 0.12 | 0.12 | 0.18 | 0.18 | |
| Clearance Time (s) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 153 | 837 | 374 | 616 | 1763 | 788 | 211 | 222 | 189 | 291 | 585 | |
| v/s Ratio Prot | 0.02 | c0.18 | | c0.10 | 0.05 | | 0.01 | 0.04 | | c0.14 | 0.11 | |
| v/s Ratio Perm | | | 0.01 | | | 0.09 | | | 0.18 | | | |
| v/c Ratio | 0.27 | 0.77 | 0.01 | 0.30 | 0.11 | 0.09 | 0.05 | 0.31 | 0.18 | 0.76 | 0.61 | |
| Uniform Delay, d1 | 44.4 | 37.0 | 30.4 | 24.7 | 13.8 | 13.7 | 40.6 | 41.9 | 41.2 | 40.5 | 39.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 4.2 | 0.0 | 0.3 | 0.1 | 0.2 | 0.1 | 0.8 | 0.5 | 10.8 | 1.8 | |
| Delay (s) | 45.4 | 41.3 | 30.4 | 24.9 | 14.0 | 13.9 | 40.7 | 42.7 | 41.7 | 51.3 | 41.0 | |
| Level of Service | D | D | C | C | B | B | D | D | D | D | D | |
| Approach Delay (s) | | 41.2 | | | 17.9 | | | 41.8 | | | 44.9 | |
| Approach LOS | | D | | | B | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 36.8 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 55.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 0.91 | |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (prot) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3201 | |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.98 | |
| Satd. Flow (perm) | 1770 | 3539 | 1583 | 1770 | 3539 | 1583 | 1770 | 1863 | 1583 | 1610 | 3201 | |
| Volume (vph) | 117 | 358 | 39 | 435 | 531 | 341 | 65 | 225 | 319 | 300 | 162 | 106 |
| Peak-hour factor, PHF | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |
| Adj. Flow (vph) | 123 | 377 | 41 | 458 | 559 | 359 | 68 | 237 | 336 | 316 | 171 | 112 |
| RTOR Reduction (vph) | 0 | 0 | 33 | 0 | 0 | 200 | 0 | 0 | 284 | 0 | 35 | 0 |
| Lane Group Flow (vph) | 123 | 377 | 8 | 458 | 559 | 159 | 68 | 237 | 52 | 192 | 372 | 0 |
| Turn Type | Prot | | Perm | Prot | | Perm | Split | | Perm | Split | | |
| Protected Phases | 5 | 2 | | 1 | 6 | | 4 | 4 | | 3 | 3 | |
| Permitted Phases | | | 2 | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 10.5 | 16.9 | 16.9 | 36.2 | 42.6 | 42.6 | 13.0 | 13.0 | 13.0 | 12.9 | 12.9 | |
| Effective Green, g (s) | 14.0 | 20.4 | 20.4 | 39.7 | 46.1 | 46.1 | 16.0 | 16.0 | 16.0 | 15.9 | 15.9 | |
| Actuated g/C Ratio | 0.13 | 0.20 | 0.20 | 0.38 | 0.44 | 0.44 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| Clearance Time (s) | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 238 | 694 | 311 | 676 | 1569 | 702 | 272 | 287 | 244 | 246 | 489 | |
| v/s Ratio Prot | 0.07 | c0.11 | | c0.26 | 0.16 | | 0.04 | 0.13 | | 0.12 | c0.13 | |
| v/s Ratio Perm | | | 0.03 | | | 0.23 | | | 0.21 | | | |
| v/c Ratio | 0.52 | 0.54 | 0.03 | 0.68 | 0.36 | 0.23 | 0.25 | 0.83 | 0.21 | 0.78 | 0.76 | |
| Uniform Delay, d1 | 41.9 | 37.6 | 33.8 | 26.8 | 19.1 | 17.9 | 38.7 | 42.6 | 38.5 | 42.4 | 42.2 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.9 | 0.9 | 0.0 | 2.7 | 0.6 | 0.8 | 0.5 | 17.3 | 0.4 | 14.8 | 6.9 | |
| Delay (s) | 43.7 | 38.5 | 33.8 | 29.5 | 19.8 | 18.7 | 39.2 | 60.0 | 38.9 | 57.1 | 49.1 | |
| Level of Service | D | D | C | C | B | B | D | E | D | E | D | |
| Approach Delay (s) | | 39.3 | | | 22.7 | | | 46.7 | | | 51.7 | |
| Approach LOS | | D | | | C | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 35.9 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.80 | | |
| Actuated Cycle Length (s) | 104.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 72.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

# Traffic Analysis For Ford's Colony CCRC

**JAMES CITY COUNTY, VIRGINIA**

***For:***
**Realtec, Inc.**

***By:***
**DRW Consultants, LLC**
**Midlothian, VA**

**July 12, 2007**

# Traffic Analysis For Ford's Colony CCRC

JAMES CITY COUNTY, VIRGINIA

*For:*
Realtec, Inc.

*By:*
DRW Consultants, LLC
Midlothian, VA

July 12, 2007

COMMONWEALTH OF VIRGINIA
DEXTER R. WILLIAMS
Lic. No. 031163
7-12-07
PROFESSIONAL ENGINEER

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# REPORT TEXT

## INTRODUCTION

Realtec, Inc. (Fords' Colony) proposes to build a Continuing Care Retirement Community (CCRC) on News Road across from the existing Firestone Drive access to Ford's Colony. This report has been prepared for review by James City County (JCC) and VDOT concurrent with the proposed rezoning of the development.

The Ford's Colony CCRC development location in the Williamsburg region is shown on Exhibit 1. The Ford's Colony CCRC development location in the local area is shown on Exhibit 2. The property is located on the south side of News Road.

Access to the Ford's Colony CCRC will be on News Road across from Firestone Drive. This traffic study addresses existing and future traffic conditions at the News Road/Firestone Drive intersection.

## EXISTING PEAK HOUR TRAFFIC

Peak hour turning movement counts were conducted at the News Road/Firestone Drive intersection. The counts were conducted from 7 to 9 AM on Thursday, April 26, 2007 and from 4 to 6 PM on Wednesday, April 25, 2007. The peak hour counts are tabulated on Appendix Exhibit A series.

The April 2007 peak hour turning movement volumes are shown on the intersection diagram on the top row of Exhibit 5. There is an existing eastbound left turn and westbound right turn on News Road serving Firestone Drive. There is also an existing westbound left turn that will serve the Ford's Colony CCRC.

2007 peak hour level of service (LOS) calculations are shown on Appendix Exhibits D1 and D2 for the AM and PM peak hours, respectively. Synchro is used for LOS calculations in this study, and Exhibits D1 and D2 are SYNCHRO HCM (Highway Capacity Manual) unsignalized intersection reports. There is LOS A overall (ICU LOS basis) and LOS B or better for all turning movements in both peak hours for 2007 conditions.

## 2012 PEAK HOUR BACKGROUND TRAFFIC

Exhibit 3 shows JCC daily traffic counts and the resulting trends on two sections of News Road. The section of News Road from Centerville Road to Springhill Subdivision has a 1.00 growth factor from 2007 to 2012, or 0% per year average increase. The section of News Road from Springhill Subdivision to Powhatan Secondary has a 1.13 growth factor from 2007 to 2012, or 2.6% per year average increase.

A 3% annual traffic growth rate is used in this study. The second row on Exhibit 5 shows 2012 peak hour background traffic at the News Road/Firestone Drive intersection with a 1.15 growth factor applied to existing peak hour counts.

2012 peak hour background traffic level of service (LOS) calculations are shown on Appendix Exhibits D3 and D4 for the AM and PM peak hours, respectively. There is LOS A overall (ICU LOS basis) and LOS B or better for all turning movements in both peak hours for 2012 background traffic.

## FORD'S COLONY CCRC TRIP GENERATION, DISTRIBUTION AND ASSIGNMENT

The Ford's Colony CCRC development includes a range of senior living accommodations. Trip generation for the Ford's Colony CCRC has been calculated using Trip Generation, 7th Edition (TG7), published by the Institute of Transportation Engineers (ITE). The terminology used in the project description of the Ford's Colony CCRC has been translated to TG7 categories as follows:

1. 32 Townhomes. For trip generation purposes, TG7 Elderly Detached, Land Use Code (LUC) 251 is used in this study. These units are not attached but LUC 251 distinguishes these units from the independent living units (apartments).
2. 332 Independent Living Units. These are described as apartments, and TG7 Elderly Attached, Land Use Code 252 is characterized as apartment-like units.

3. 290 CCRC Apartments. These units translate directly to TG7 Congregate Care, Land Use Code 253.
4. 118 Assisted Living/Skill Care. These units translate directly to TG7 Assisted Living, Land Use Code 254.

Trip generation and distribution for the Ford's Colony CCRC is shown on Exhibit 4, Table 1. Site trip distribution is shown in Table 2 on Exhibit 4. The third row on Exhibit 5 shows the assignment of Ford's Colony CCRC traffic to the News Road/Firestone Drive intersection.

## 2012 TOTAL TRAFFIC FORECAST

The bottom row on Exhibit 5 shows total 2012 peak hour traffic at the News Road/Firestone Drive intersection.

Exhibits 6a and 6b respectively show the peak hour left turn lane warrants for the westbound left turn at News Road/Firestone Drive intersection. A left turn lane is warranted in the PM peak hour.

Exhibit 7 shows the peak hour right turn lane turn lane warrants for the eastbound right turn at News Road/Firestone Drive intersection. Only a right turn radius is warranted for AM or PM peak hour traffic.

2012 peak hour total traffic level of service (LOS) calculations are shown on Appendix Exhibits D5 and D6 for the AM and PM peak hours, respectively. There is LOS A overall (ICU LOS basis) and LOS C or better for all turning movements in both peak hours.

## SUMMARY AND CONCLUSIONS

The collective effect of background traffic growth and the Ford's Colony CCRC in 2012 produces LOS C or better for all turning movements. The following table compares LOS results:

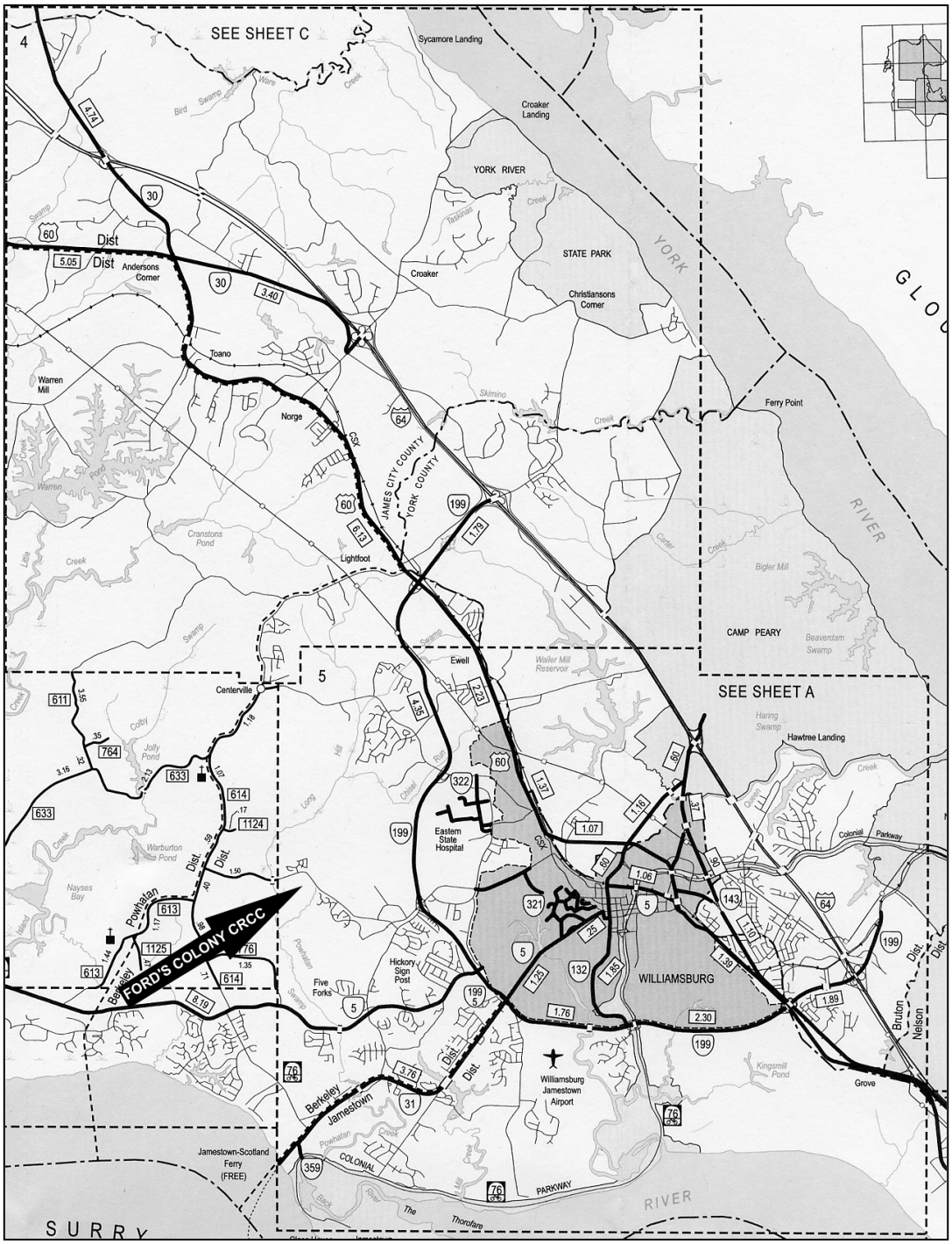
TABLE 1: NEWS ROAD/FIRESTONE DRIVE
UNSIGNALIZED INTERSECTION LOS RESULTS

| | AM PEAK HOUR | | | | | | PM PEAK HOUR | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2007 | | 2012 Bkgd | | 2012 Total | | 2007 | | 2012 Bkgd | | 2012 Total | |
| Overall | A | 21% | A | 23% | A | 36% | A | 23% | A | 26% | A | 39% |
| EBL | A | 8 | A | 8 | A | 8 | A | 8 | A | 8 | A | 8 |
| EBT | n/a | | n/a | | n/a | | n/a | | n/a | | n/a | |
| EBR | n/a | | n/a | | n/a | | n/a | | n/a | | n/a | |
| WBL | n/a | | n/a | | A | 8 | n/a | | n/a | | A | 8 |
| WBT | n/a | | n/a | | n/a | | n/a | | n/a | | n/a | |
| WBR | n/a | | n/a | | n/a | | n/a | | n/a | | n/a | |
| NBL | n/a | | n/a | | n/a | | n/a | | n/a | | n/a | |
| NBT | n/a | | n/a | | B | 13 | n/a | | n/a | | C | 16 |
| NBR | n/a | | n/a | | A | 10 | n/a | | n/a | | A | 10 |
| SBL | B | 11 | B | 12 | n/a | | B | 12 | B | 13 | n/a | |
| SBT | n/a | | n/a | | C | 15 | n/a | | n/a | | C | 21 |
| SBR | A | 9 | A | 9 | A | 9 | A | 10 | A | 10 | A | 9 |

Notes: For overall intersection, numeric values in % Intersection Capacity Utilization, with increasing value for decreasing LOS. For individual movements, numeric values in seconds delay, with increasing value for decreasing LOS.

The addition of the Ford's Colony CCRC access to align on News Road at Firestone Drive produces LOS C or better for all turning movements and does not require any additional turn lanes. The existing southbound left turn lane on Firestone Drive at News Road will be restriped to a shared left and through lane. The only other improvement at the intersection will be the connection of Ford's Colony CCRC access.

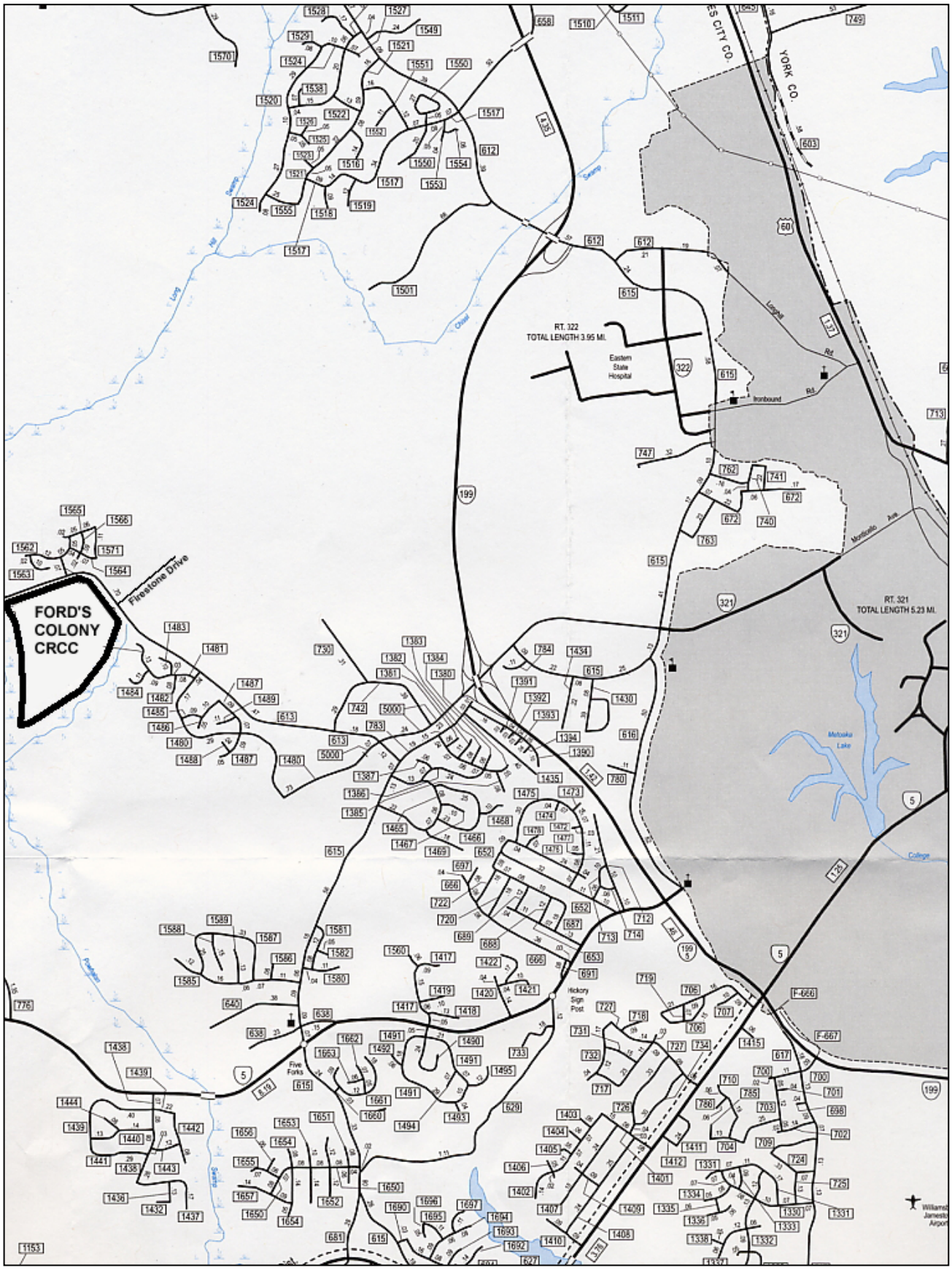
# REPORT EXHIBITS




REGIONAL LOCATION MAP
FORD'S COLONY CCRC

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 1




AREA LOCATION MAP
FORD'S COLONY CRCC

*DRW Consultants, LLC*
*804-794-7312*

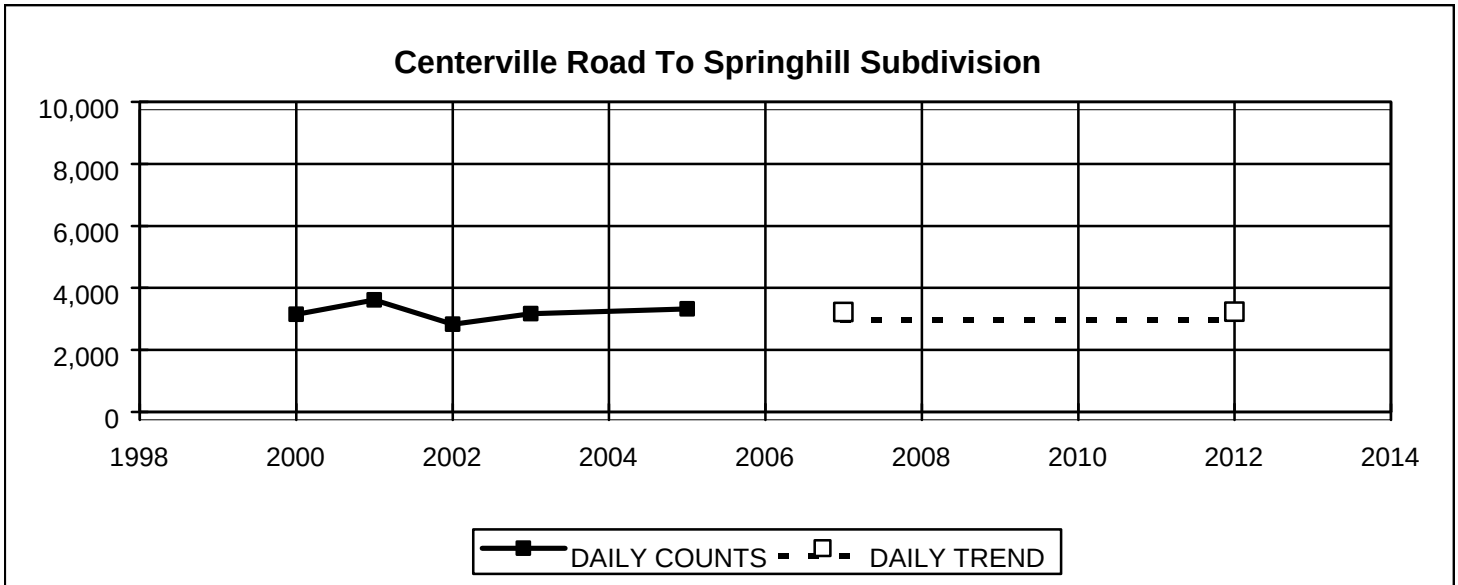
Exhibit 2

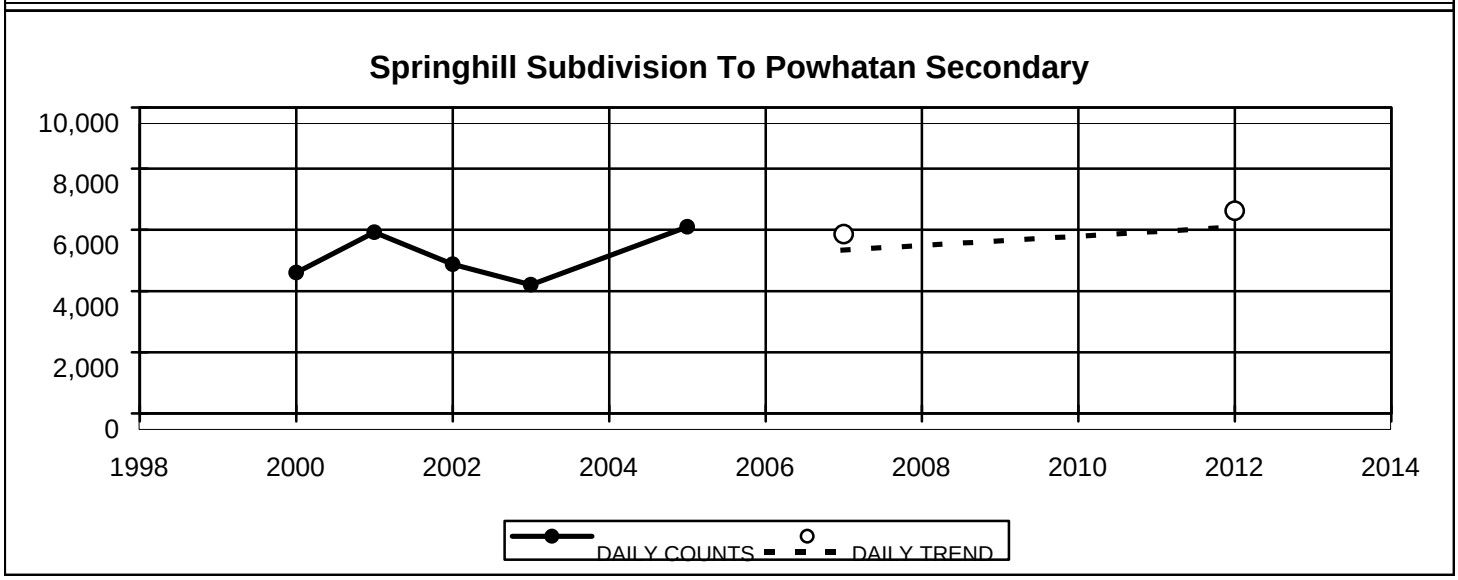
Street: News Road, Rt. 613
From: Centerville Road
To: Springhill Subdivision
Station: 36

| Year | DAILY COUNTS | |
|---|---|---|
| 2000 | 3,147 | |
| 2001 | 3,611 | |
| 2002 | 2,830 | |
| 2003 | 3,168 | |
| 2005 | 3,323 | |
| Year | DAILY TREND | |
| 2007 | 3,221 | Δ07 |
| 2012 | 3,227 | 1.00 |

Street: News Road, Rt. 613
From: Springhill Subdivision
To: Powhatan Secondary
Station: 37

| Year | DAILY COUNTS | |
|---|---|---|
| 2000 | 4,603 | |
| 2001 | 5,918 | |
| 2002 | 4,871 | |
| 2003 | 4,207 | |
| 2005 | 6,096 | |
| Year | DAILY TREND | |
| 2007 | 5,863 | Δ07 |
| 2012 | 6,617 | 1.13 |




Traffic counts published by James City County Planning Division.

NEWS ROAD DAILY TRAFFIC COUNTS AND TRENDS


***DRW Consultants, LLC***
***804-794-7312***


Exhibit 3

**TABLE 1 - Total Units Trip Generation**

| TRACT | LAND USE | LAND USE CODE | SQ.FT., OTHER UNITS | WEEKDAY TRIP GENERATION AM PEAK HOUR Enter | Exit | Total | PM PEAK HOUR Enter | Exit | Total | DAILY |
|---|---|---|---|---|---|---|---|---|---|---|
| | Elderly Detached | 251 | 32 units | 4 | 6 | 10 | 13 | 9 | 22 | 206 |
| | Elderly Attached | 252 | 332 units | 12 | 15 | 27 | 23 | 14 | 37 | 1155 |
| | Congregate Care | 253 | 290 units | 10 | 7 | 17 | 27 | 22 | 49 | 586 |
| | Assisted Living | 254 | 118 occ.bed | 15 | 5 | 20 | 18 | 16 | 34 | 323 |
| | | TOTAL | 772 units | 41 | 33 | 74 | 81 | 61 | 142 | 2270 |
| **TG 7 Definitions** | Elderly Detached | 251 | may have recreation, but not central dining or health care | | | | | | | |
| | Elderly Attached | 252 | apartment-like residential units | | | | | | | |
| | Congregate Care | 253 | centralized amenities: dining, house keeping, trans., social/rec | | | | | | | |
| | Assisted Living | 254 | protective oversight, ALS and Alzheimers may be included | | | | | | | |

| ITE USE CODE | 253 | 254 | | | 251 | 252 | | |
|---|---|---|---|---|---|---|---|---|
| FORD'S COLONY CCRC DEFINITIONS | CCRC Apt | Asst. Liv. Skill Care | CCRC Total | | Town Homes | Ind. L.U. | Non CCRC | |
| Community 1 | 154 | 18 | 172 | | 6 | | | |
| Community 2 | | 100 | 100 | | 26 | 214 | | |
| Community 3 | 136 | | 136 | | | 118 | | |
| | 290 | 118 | 408 | | 32 | 332 | 364 | |

**TABLE 2 - SITE TRIP DISTRIBUTION**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 41 | 33 | 74 | 81 | 61 | 142 |
| | AM Peak Hour | | | | | PM Peak Hour | | | |
| | Entering Traffic | | Exiting Traffic | | | Entering Traffic | | Exiting Traffic | |
| Direction | % Dist. | Trips | % Dist. | Trips | | % Dist. | Trips | % Dist. | Trips |
| East | 85% | 35 | 85% | 28 | | 85% | 69 | 85% | 52 |
| North | 5% | 2 | 5% | 2 | | 5% | 4 | 5% | 3 |
| West | 10% | 4 | 10% | 3 | | 10% | 8 | 10% | 6 |
| | 100% | 41 | 100% | 33 | | 100% | 81 | 100% | 61 |

Trip generation rates from Trip Generation, 7th Edition (TG7) by the Institute of Transportation Engineers (ITE)

FORD'S COLONY CCRC
TRIP GENERATION AND DISTRIBUTION

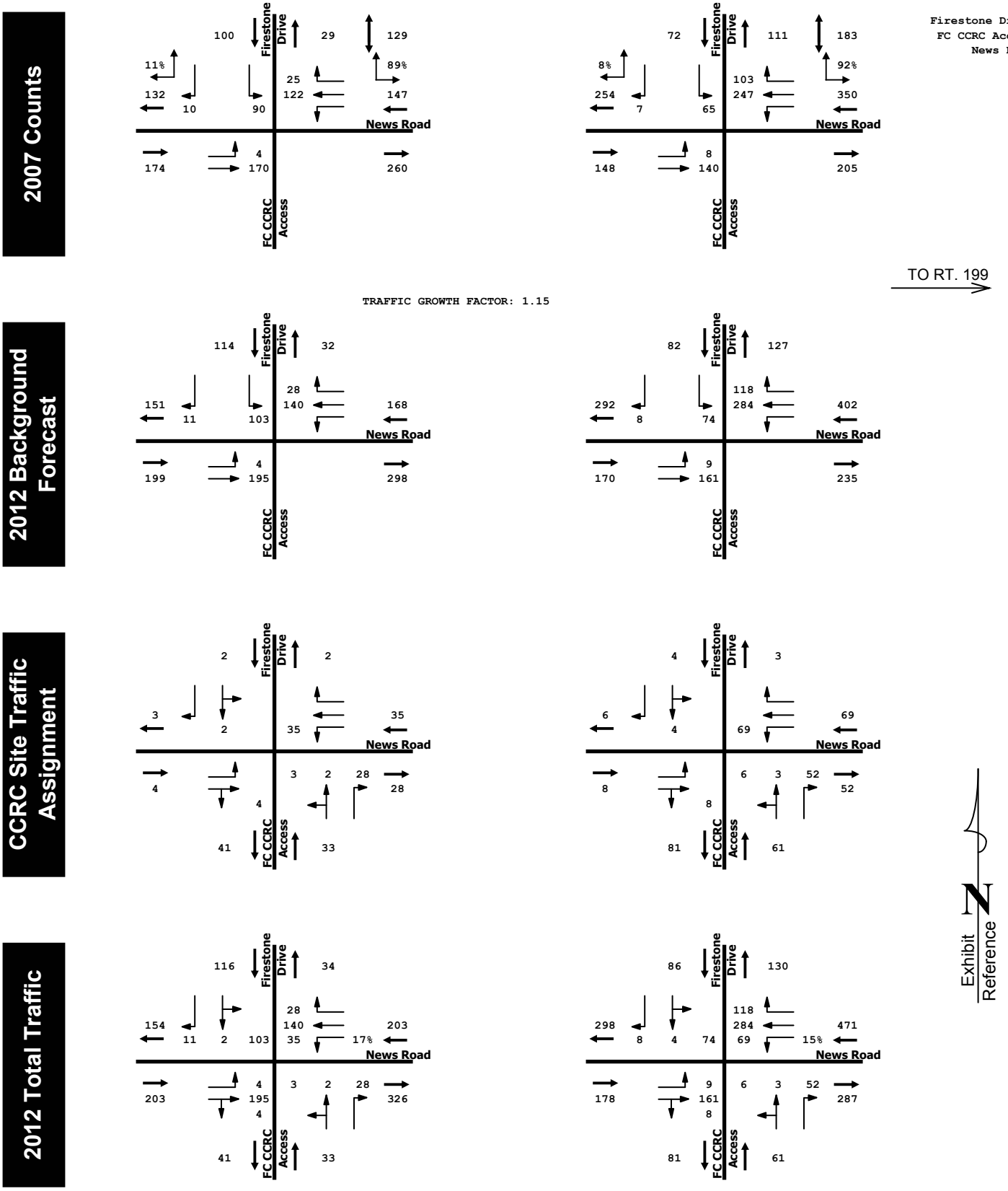
*DRW Consultants, LLC*
*804-794-7312*

Exhibit 4

Firestone Drive
FC CCRC Access
News Road

TO RT. 199

TRAFFIC GROWTH FACTOR: 1.15

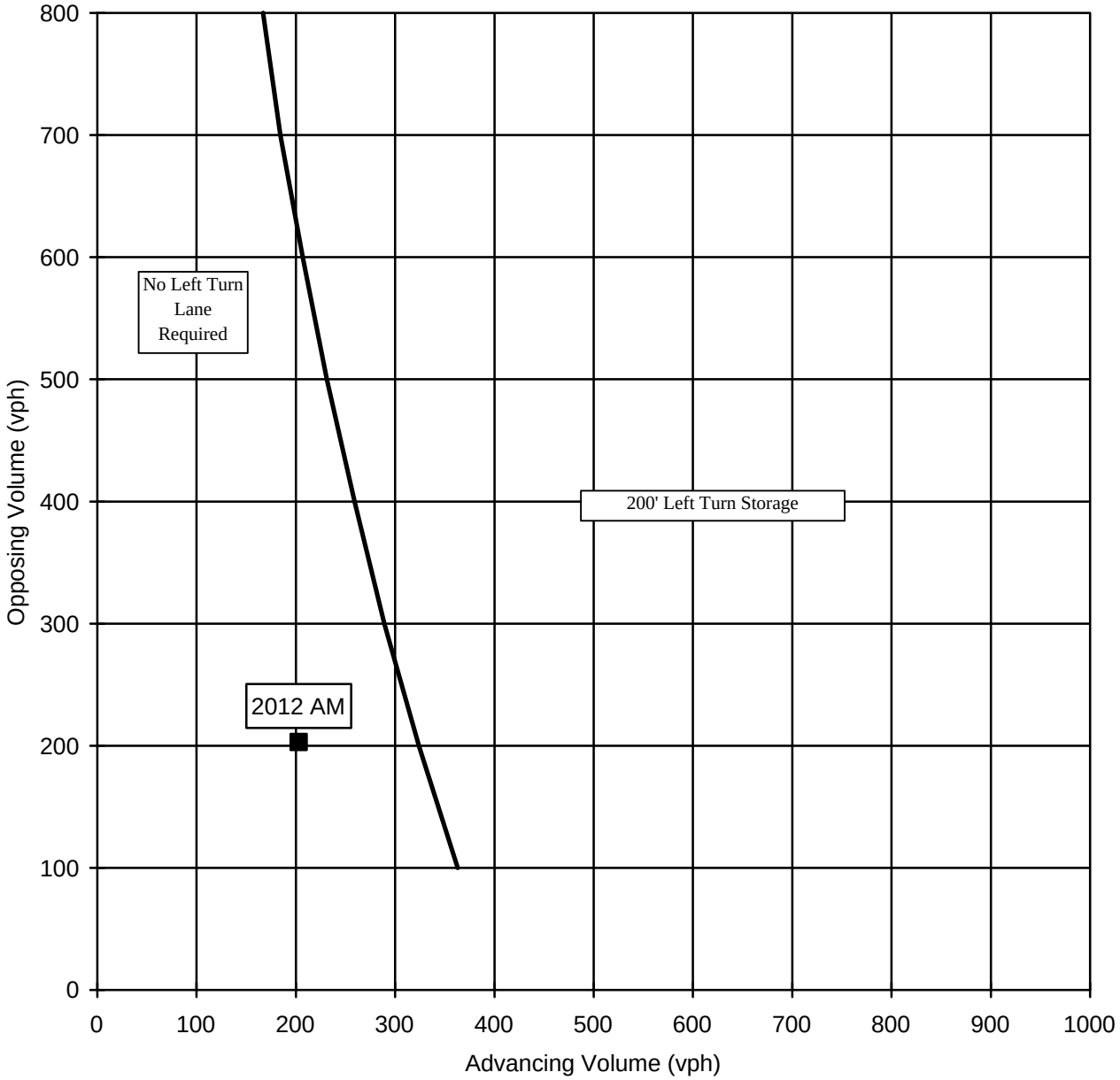



EXISTING PEAK HOUR TRAFFIC COUNTS AND 2012 FORECAST

*DRW Consultants, LLC*
*804-794-7312*

Exhibit 5

**LEFT TURN LANE WARRANT**
**50 mph Design Speed**
**% Left Turns = 17%**



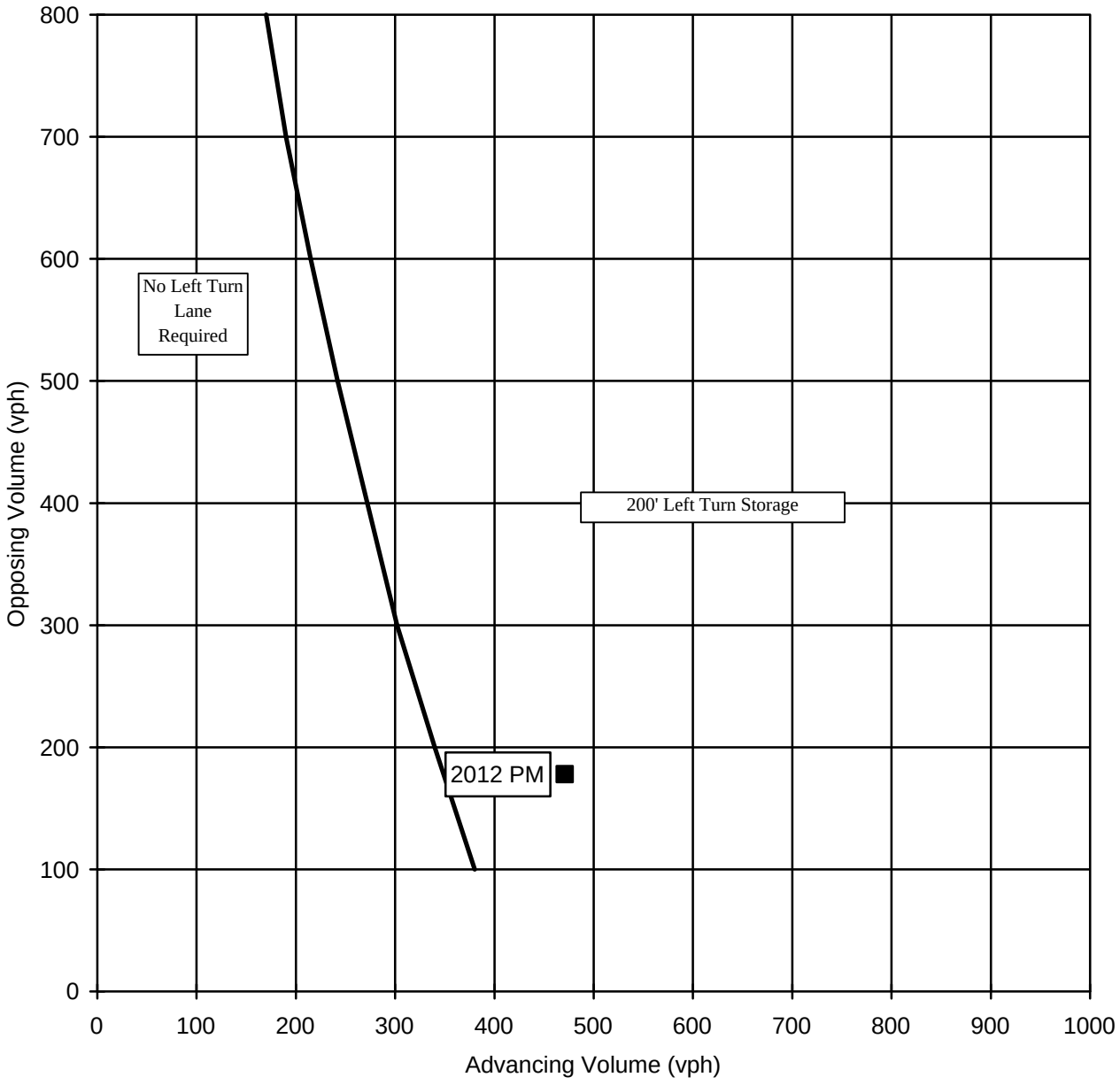

Source: Interpolated from VDOT Road Design Manual, Appendix C, derived from Highway Research Record Number 211

2012 AM PEAK HOUR
LEFT TURN LANE WARRANT
WESTBOUND NEWS ROAD AT FORDS'S COLONY CCRC

***DRW Consultants, LLC***
***804-794-7312***

Exhibit 6a

**LEFT TURN LANE WARRANT**
**50 mph Design Speed**
**% Left Turns = 15%**

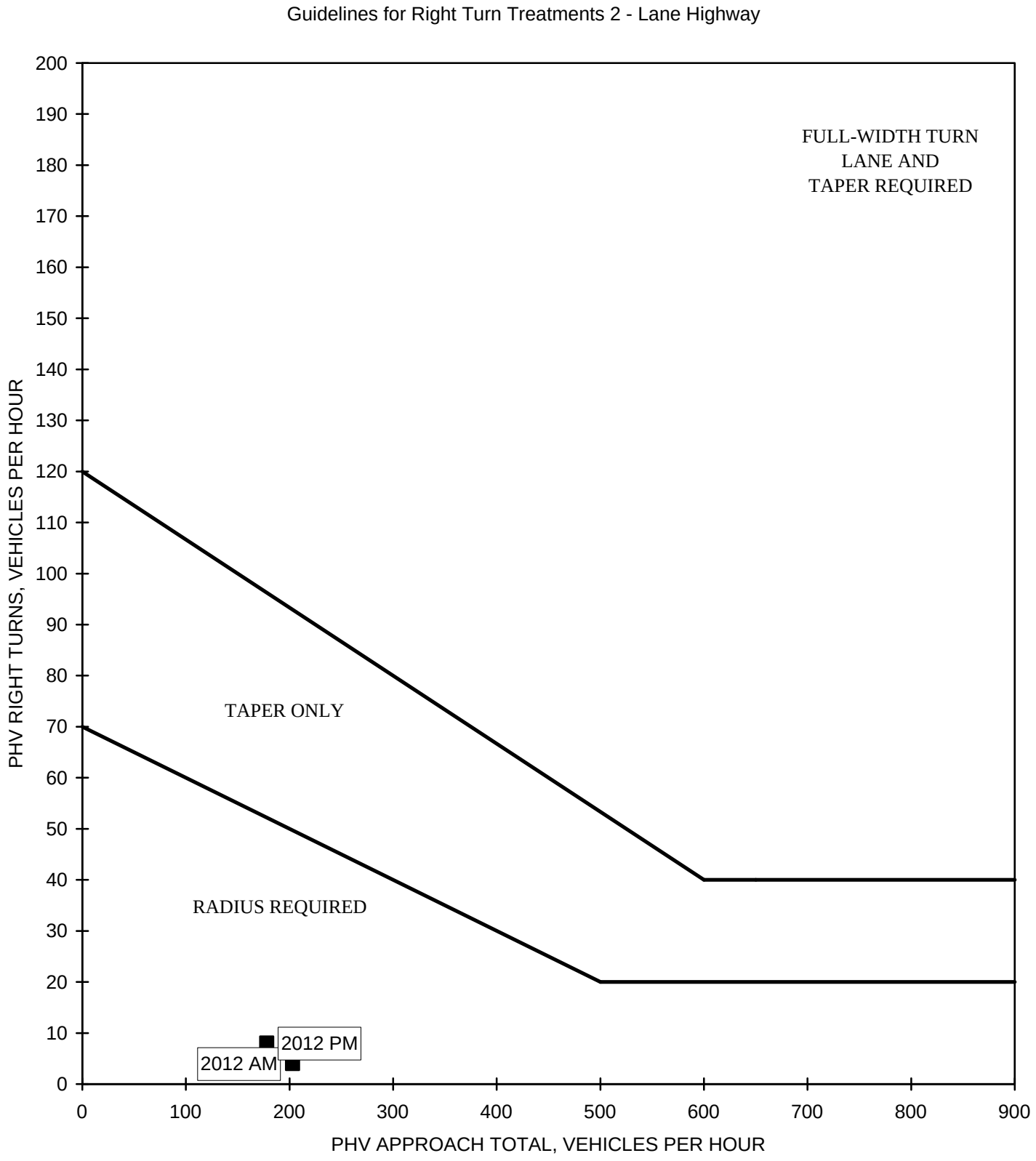



Source: Interpolated from VDOT Road Design Manual, Appendix C, derived from Highway Research Record Number 211

2012 PM PEAK HOUR
LEFT TURN LANE WARRANT
WESTBOUND NEWS ROAD AT FORDS'S COLONY CCRC


***DRW Consultants, LLC***
***804-794-7312***


Exhibit 6b




Source: VDOT Road Design Manual, Vol. 1, Page C-15, Figure C-1-8

2012 PEAK HOUR
RIGHT TURN LANE WARRANT
EASTBOUND NEWS ROAD AT FORD'S COLONY CCRC

***DRW Consultants, LLC***
***804-794-7312***

Exhibit 7

# APPENDIX
# EXHIBITS

# APPENDIX
# TABLE OF CONTENTS


| APPENDIX EXHIBITS | Number |
|---|---|
| **Peak Hour Traffic Count** | **AM PM** |
| News Road/Firestone Drive | A1..... A2 |
| **News Road/Firestone Drive Unsignalized Intersection LOS** | **AM PM** |
| 2007 Peak Hour Traffic Counts | D1..... D2 |
| 2012 Background Traffic | D3..... D4 |
| 2012 Total Traffic (With Ford's Colony CCRC) | D5..... D6 |

**AM PEAK HOUR**

LOCATION: News Road/Firestone Drive

DATE:
Thu, 4/26/07

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | | | | 10 | | 1 | 0 | 54 | | | 29 | 3 | 97 |
| 7:15 to 7:30 | | | | 23 | | 2 | 1 | 109 | | | 53 | 6 | 194 |
| 7:30 to 7:45 | | | | 37 | | 6 | 1 | 142 | | | 89 | 10 | 285 |
| 7:45 to 8:00 | | | | 55 | | 6 | 2 | 197 | | | 113 | 17 | 390 |
| 8:00 to 8:15 | | | | 72 | | 9 | 3 | 244 | | | 140 | 26 | 494 |
| 8:15 to 8:30 | | | | 88 | | 12 | 4 | 252 | | | 180 | 30 | 566 |
| 8:30 to 8:45 | | | | 119 | | 14 | 4 | 320 | | | 209 | 36 | 702 |
| 8:45 to 9:00 | | | | 145 | | 16 | 6 | 367 | | | 235 | 42 | 811 |
| Count Sheet | | | | C | | D | E | F | | | A | B | |

15 MINUTE INCREMENT COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 7:15 | 0 | 0 | 0 | 10 | 0 | 1 | 0 | 54 | 0 | 0 | 29 | 3 | 97 |
| 7:15 to 7:30 | 0 | 0 | 0 | 13 | 0 | 1 | 1 | 55 | 0 | 0 | 24 | 3 | 97 |
| 7:30 to 7:45 | 0 | 0 | 0 | 14 | 0 | 4 | 0 | 33 | 0 | 0 | 36 | 4 | 91 |
| 7:45 to 8:00 | 0 | 0 | 0 | 18 | 0 | 0 | 1 | 55 | 0 | 0 | 24 | 7 | 105 |
| 8:00 to 8:15 | 0 | 0 | 0 | 17 | 0 | 3 | 1 | 47 | 0 | 0 | 27 | 9 | 104 |
| 8:15 to 8:30 | 0 | 0 | 0 | 16 | 0 | 3 | 1 | 8 | 0 | 0 | 40 | 4 | 72 |
| 8:30 to 8:45 | 0 | 0 | 0 | 31 | 0 | 2 | 0 | 68 | 0 | 0 | 29 | 6 | 136 |
| 8:45 to 9:00 | 0 | 0 | 0 | 26 | 0 | 2 | 2 | 47 | 0 | 0 | 26 | 6 | 109 |

HOUR INCREMENT

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7:00 to 8:00 | 0 | 0 | 0 | 55 | 0 | 6 | 2 | 197 | 0 | 0 | 113 | 17 | 390 |
| 7:15 to 8:15 | 0 | 0 | 0 | 62 | 0 | 8 | 3 | 190 | 0 | 0 | 111 | 23 | 397 |
| 7:30 to 8:30 | 0 | 0 | 0 | 65 | 0 | 10 | 3 | 143 | 0 | 0 | 127 | 24 | 372 |
| 7:45 to 8:45 | 0 | 0 | 0 | 82 | 0 | 8 | 3 | 178 | 0 | 0 | 120 | 26 | 417 |
| 8:00 to 9:00 | 0 | 0 | 0 | 90 | 0 | 10 | 4 | 170 | 0 | 0 | 122 | 25 | 421 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8:00 to 9:00 | 0 | 0 | 0 | 90 | 0 | 10 | 4 | 170 | 0 | 0 | 122 | 25 | 421 |

Exhibit A1

**PM PEAK HOUR**

LOCATION: News Road/Firestone Drive

DATE:
Wed, 4/25/07

CUMULATIVE 15 MINUTE COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 4:15 | | | | 19 | | 4 | 3 | 27 | | | 53 | 24 | 130 |
| 4:15 to 4:30 | | | | 36 | | 7 | 3 | 58 | | | 91 | 49 | 244 |
| 4:30 to 4:45 | | | | 47 | | 7 | 5 | 91 | | | 148 | 80 | 378 |
| 4:45 to 5:00 | | | | 69 | | 13 | 7 | 127 | | | 202 | 101 | 519 |
| 5:00 to 5:15 | | | | 84 | | 14 | 8 | 166 | | | 274 | 130 | 676 |
| 5:15 to 5:30 | | | | 101 | | 14 | 11 | 198 | | | 338 | 152 | 814 |
| 5:30 to 5:45 | | | | 111 | | 18 | 14 | 230 | | | 393 | 173 | 939 |
| 5:45 to 6:00 | | | | 122 | | 20 | 16 | 259 | | | 438 | 191 | 1046 |
| Count Sheet | | | | C | | D | E | F | | | A | B | |

15 MINUTE INCREMENT COUNTS

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 4:15 | 0 | 0 | 0 | 19 | 0 | 4 | 3 | 27 | 0 | 0 | 53 | 24 | 130 |
| 4:15 to 4:30 | 0 | 0 | 0 | 17 | 0 | 3 | 0 | 31 | 0 | 0 | 38 | 25 | 114 |
| 4:30 to 4:45 | 0 | 0 | 0 | 11 | 0 | 0 | 2 | 33 | 0 | 0 | 57 | 31 | 134 |
| 4:45 to 5:00 | 0 | 0 | 0 | 22 | 0 | 6 | 2 | 36 | 0 | 0 | 54 | 21 | 141 |
| 5:00 to 5:15 | 0 | 0 | 0 | 15 | 0 | 1 | 1 | 39 | 0 | 0 | 72 | 29 | 157 |
| 5:15 to 5:30 | 0 | 0 | 0 | 17 | 0 | 0 | 3 | 32 | 0 | 0 | 64 | 22 | 138 |
| 5:30 to 5:45 | 0 | 0 | 0 | 10 | 0 | 4 | 3 | 32 | 0 | 0 | 55 | 21 | 125 |
| 5:45 to 6:00 | 0 | 0 | 0 | 11 | 0 | 2 | 2 | 29 | 0 | 0 | 45 | 18 | 107 |

HOUR INCREMENT

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:00 to 5:00 | 0 | 0 | 0 | 69 | 0 | 13 | 7 | 127 | 0 | 0 | 202 | 101 | 519 |
| 4:15 to 5:15 | 0 | 0 | 0 | 65 | 0 | 10 | 5 | 139 | 0 | 0 | 221 | 106 | 546 |
| 4:30 to 5:30 | 0 | 0 | 0 | 65 | 0 | 7 | 8 | 140 | 0 | 0 | 247 | 103 | 570 |
| 4:45 to 5:45 | 0 | 0 | 0 | 64 | 0 | 11 | 9 | 139 | 0 | 0 | 245 | 93 | 561 |
| 5:00 to 6:00 | 0 | 0 | 0 | 53 | 0 | 7 | 9 | 132 | 0 | 0 | 236 | 90 | 527 |

PEAK HOUR TURNING MOVEMENT VOLUMES

| TIME | NB Left | NB Thru | NB Right | SB Left | SB Thru | SB Right | EB Left | EB Thru | EB Right | WB Left | WB Thru | WB Right | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:30 to 5:30 | 0 | 0 | 0 | 65 | 0 | 7 | 8 | 140 | 0 | 0 | 247 | 103 | 570 |

Exhibit A2

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 4 | 170 | 122 | 25 | 90 | 10 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 4 | 185 | 133 | 27 | 98 | 11 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 160 | | | | 326 | 133 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 160 | | | | 326 | 133 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 85 | 99 |
| cM capacity (veh/h) | 1419 | | | | 666 | 917 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 4 | 185 | 133 | 27 | 98 | 11 |
| Volume Left | 4 | 0 | 0 | 0 | 98 | 0 |
| Volume Right | 0 | 0 | 0 | 27 | 0 | 11 |
| cSH | 1419 | 1700 | 1700 | 1700 | 666 | 917 |
| Volume to Capacity | 0.00 | 0.11 | 0.08 | 0.02 | 0.15 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 13 | 1 |
| Control Delay (s) | 7.5 | 0.0 | 0.0 | 0.0 | 11.3 | 9.0 |
| Lane LOS | A | | | | B | A |
| Approach Delay (s) | 0.2 | | 0.0 | | 11.1 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.7 | | |
| Intersection Capacity Utilization | 20.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 8 | 140 | 247 | 103 | 65 | 7 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 9 | 152 | 268 | 112 | 71 | 8 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 380 | | | | 438 | 268 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 380 | | | | 438 | 268 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 99 | | | | 88 | 99 |
| cM capacity (veh/h) | 1178 | | | | 572 | 770 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 9 | 152 | 268 | 112 | 71 | 8 |
| Volume Left | 9 | 0 | 0 | 0 | 71 | 0 |
| Volume Right | 0 | 0 | 0 | 112 | 0 | 8 |
| cSH | 1178 | 1700 | 1700 | 1700 | 572 | 770 |
| Volume to Capacity | 0.01 | 0.09 | 0.16 | 0.07 | 0.12 | 0.01 |
| Queue Length 95th (ft) | 1 | 0 | 0 | 0 | 11 | 1 |
| Control Delay (s) | 8.1 | 0.0 | 0.0 | 0.0 | 12.2 | 9.7 |
| Lane LOS | A | | | | B | A |
| Approach Delay (s) | 0.4 | | 0.0 | | 11.9 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.6 | | |
| Intersection Capacity Utilization | 23.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 4 | 195 | 140 | 28 | 103 | 11 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 4 | 212 | 152 | 30 | 112 | 12 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 183 | | | | 373 | 152 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 183 | | | | 373 | 152 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 82 | 99 |
| cM capacity (veh/h) | 1392 | | | | 626 | 894 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 4 | 212 | 152 | 30 | 112 | 12 |
| Volume Left | 4 | 0 | 0 | 0 | 112 | 0 |
| Volume Right | 0 | 0 | 0 | 30 | 0 | 12 |
| cSH | 1392 | 1700 | 1700 | 1700 | 626 | 894 |
| Volume to Capacity | 0.00 | 0.12 | 0.09 | 0.02 | 0.18 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 16 | 1 |
| Control Delay (s) | 7.6 | 0.0 | 0.0 | 0.0 | 12.0 | 9.1 |
| Lane LOS | A | | | | B | A |
| Approach Delay (s) | 0.2 | | 0.0 | | 11.7 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.8 | | |
| Intersection Capacity Utilization | 22.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 9 | 161 | 284 | 118 | 74 | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 10 | 175 | 309 | 128 | 80 | 9 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 437 | | | | 503 | 309 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 437 | | | | 503 | 309 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 99 | | | | 85 | 99 |
| cM capacity (veh/h) | 1123 | | | | 523 | 731 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 10 | 175 | 309 | 128 | 80 | 9 |
| Volume Left | 10 | 0 | 0 | 0 | 80 | 0 |
| Volume Right | 0 | 0 | 0 | 128 | 0 | 9 |
| cSH | 1123 | 1700 | 1700 | 1700 | 523 | 731 |
| Volume to Capacity | 0.01 | 0.10 | 0.18 | 0.08 | 0.15 | 0.01 |
| Queue Length 95th (ft) | 1 | 0 | 0 | 0 | 13 | 1 |
| Control Delay (s) | 8.2 | 0.0 | 0.0 | 0.0 | 13.1 | 10.0 |
| Lane LOS | A | | | | B | A |
| Approach Delay (s) | 0.4 | | 0.0 | | 12.8 | |
| Approach LOS | | | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.7 | | |
| Intersection Capacity Utilization | 25.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 4 | 195 | 4 | 35 | 140 | 28 | 3 | 2 | 28 | 103 | 2 | 11 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 4 | 212 | 4 | 38 | 152 | 30 | 3 | 2 | 30 | 112 | 2 | 12 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 183 | | | 216 | | | 464 | 482 | 214 | 480 | 453 | 152 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 183 | | | 216 | | | 464 | 482 | 214 | 480 | 453 | 152 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 97 | | | 99 | 100 | 96 | 76 | 100 | 99 |
| cM capacity (veh/h) | 1392 | | | 1353 | | | 488 | 469 | 826 | 465 | 487 | 894 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 4 | 216 | 38 | 152 | 30 | 5 | 30 | 114 | 12 |
| Volume Left | 4 | 0 | 38 | 0 | 0 | 3 | 0 | 112 | 0 |
| Volume Right | 0 | 4 | 0 | 0 | 30 | 0 | 30 | 0 | 12 |
| cSH | 1392 | 1700 | 1353 | 1700 | 1700 | 480 | 826 | 465 | 894 |
| Volume to Capacity | 0.00 | 0.13 | 0.03 | 0.09 | 0.02 | 0.01 | 0.04 | 0.25 | 0.01 |
| Queue Length 95th (ft) | 0 | 0 | 2 | 0 | 0 | 1 | 3 | 24 | 1 |
| Control Delay (s) | 7.6 | 0.0 | 7.7 | 0.0 | 0.0 | 12.6 | 9.5 | 15.2 | 9.1 |
| Lane LOS | A | | A | | | B | A | C | A |
| Approach Delay (s) | 0.1 | | 1.3 | | | 10.0 | | 14.7 | |
| Approach LOS | | | | | | A | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 4.2 | | |
| Intersection Capacity Utilization | 36.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 9 | 161 | 8 | 69 | 284 | 118 | 6 | 3 | 52 | 74 | 4 | 8 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Hourly flow rate (vph) | 10 | 175 | 9 | 75 | 309 | 128 | 7 | 3 | 57 | 80 | 4 | 9 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 437 | | | 184 | | | 668 | 786 | 179 | 711 | 662 | 309 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 437 | | | 184 | | | 668 | 786 | 179 | 711 | 662 | 309 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 95 | | | 98 | 99 | 93 | 74 | 99 | 99 |
| cM capacity (veh/h) | 1123 | | | 1391 | | | 346 | 304 | 863 | 307 | 358 | 731 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | WB 3 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|---|---|
| Volume Total | 10 | 184 | 75 | 309 | 128 | 10 | 57 | 85 | 9 |
| Volume Left | 10 | 0 | 75 | 0 | 0 | 7 | 0 | 80 | 0 |
| Volume Right | 0 | 9 | 0 | 0 | 128 | 0 | 57 | 0 | 9 |
| cSH | 1123 | 1700 | 1391 | 1700 | 1700 | 331 | 863 | 309 | 731 |
| Volume to Capacity | 0.01 | 0.11 | 0.05 | 0.18 | 0.08 | 0.03 | 0.07 | 0.27 | 0.01 |
| Queue Length 95th (ft) | 1 | 0 | 4 | 0 | 0 | 2 | 5 | 27 | 1 |
| Control Delay (s) | 8.2 | 0.0 | 7.7 | 0.0 | 0.0 | 16.2 | 9.5 | 21.0 | 10.0 |
| Lane LOS | A | | A | | | C | A | C | A |
| Approach Delay (s) | 0.4 | | 1.1 | | | 10.5 | | 20.0 | |
| Approach LOS | | | | | | B | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.7 | | |
| Intersection Capacity Utilization | 39.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

**GEDDY, HARRIS, FRANCK & HICKMAN, L.L.P.**

ATTORNEYS AT LAW
1177 JAMESTOWN ROAD
WILLIAMSBURG, VIRGINIA 23185
TELEPHONE: (757) 220-6500
FAX: (757) 229-5342

MAILING ADDRESS:
POST OFFICE BOX 379
WILLIAMSBURG, VIRGINIA 23187-0379

VERNON M. GEDDY, JR. (1926-2005)
STEPHEN D. HARRIS
SHELDON M. FRANCK
VERNON M. GEDDY, III
SUSANNA B. HICKMAN
ANDREW M. FRANCK

SHERRI L. NELSON

November 22, 2021

Mr. Paul Holt
Director of Community Development
James City County
101-A Mounts Bay Road
Williamsburg, Virginia 23185

Re: Ford's Village – Z-21-0012 and MP-21-0003

Dear Mr. Holt:

I write on behalf of the applicant to request an exception to the James City County Recreational Facility Development Guidelines for the referenced applications. Such an exception may be granted by the Board of Supervisors with recommendations from the Planning Director and Director of Parks and Recreation.

Ford's Village is a large-campus, continuing care retirement community. The applicants have proffered extensive age-appropriate recreation facilities designed for older adults pursuant to Proffer 13 of the Amendment to Amended and Restated Ford's Colony Proffers submitted with the applications, a copy of which is pasted below:

> **13.** **Recreation**. The portion of the Property designated as CCRC-D on the Master Plan shall include, but shall not be limited to, the following amenities: main lobby and living room; dining room; activities/card room; fitness center; beauty/barber salon; library; multipurpose room and landscaped grounds and courtyards generally as shown on the Master Plan. CCRC-D may also include, but shall not be limited to, the following additional amenities: a bar/lounge; café/coffee shop; education room, spa and wellness center; physical therapy and/or physician's office(s), home health, and pharmacy. The amenities listed above are intended for residents and employees of Ford's Village and their guests and not the general public. The portions of the Property designated as CCRC-A, CCRC-B and CCRC-C on the Master Plan shall include the following amenities: a clubhouse with studio room for classes, and a recreation room; an outdoor pool; pocket parks; pickleball courts and walking and biking paths all generally as shown on the Master Plan. The exact recreational facilities provided in portions of the Property designated as CCRC-A, CCRC-B and CCRC-C on the Master

Plan and their location may be changed with the prior approval of the Development Review Committee.

All residents of Ford's Village will have access to all amenities within the development. As discussed with staff, there are ample recreational facilities proffered but the proffered facilities do not meet the letter of the Guidelines due to the lack of an athletic field and playground. We submit the proffered facilities more than meet the goals of the Guidelines and that strict application of the Guidelines is not appropriate in this case.

Thank you for your consideration of this request and please let me know if you need anything further from us.

Sincerely,

Vernon M. Geddy, III

Mr. Rock Bell
Mr. Jason Grimes
Ms. Doris-Ellie Sullivan

## Thomas Wysong

**From:** Thomas Wysong
**Sent:** Wednesday, November 3, 2021 3:23 PM
**To:** Paul Holt
**Subject:** RE: [External] [External]New Development on News Rd

Got it, thanks.

---

**From:** Paul Holt <Paul.Holt@jamescitycountyva.gov>
**Sent:** Wednesday, November 3, 2021 3:09 PM
**To:** Thomas Wysong <Thomas.Wysong@jamescitycountyva.gov>
**Subject:** FW: [External] [External]New Development on News Rd

For Dec. packet

---

**From:** Richard Krapf <Richard.Krapf@jamescitycountyva.gov>
**Sent:** Wednesday, November 3, 2021 3:07 PM
**To:** Jamie Shannon <jamieshannonrealty@gmail.com>
**Cc:** PlanComm <PlanComm@jamescitycountyva.gov>
**Subject:** Re: [External] [External]New Development on News Rd

Dear Ms. Shannon -

Thank you for taking the time to write, outlining your views on this land use case. Citizen feedback is an important part of our review process and will be considered along with other elements such as the Comprehensive Plan and staff report. Please note that the applicant has requested a deferral until our December 1st planning commission meeting.

Sincerely,

Rich Krapf

---

**From:** Jamie Shannon <jamieshannonrealty@gmail.com>
**Sent:** Wednesday, November 3, 2021 1:19 PM
**To:** Richard Krapf
**Subject:** [External] [External]New Development on News Rd

Mr. Krapf,

I'm a local business owner and resident. I work, live and worship here locally in Williamsburg, Virginia.

I'm opposed to the new mega-development being considered on News Road. That being said I understand that those services may be necessary for our area but feel like the area being considered isn't a good location due to the impact it will have on both the local residents, traffic patterns and lack of space to accommodate that with a major infrastructure change to the local roadways and utilities. Not to mention as a local real

estate agent I'm privy to the understanding that this could greatly affect local neighborhood values now as well as future values.

I personally live and have clients that live in neighborhoods to include Ford's Colony, Powhatan Secondary and Powhatan Woods.

I urge you to vote NO against this new development!

Jamie Shannon
Keller Williams Realty Williamsburg
4084 Courthouse St #3B
Williamsburg, VA 23188
Licensed agent in Virginia

## Thomas Wysong

**From:** Sharon Paulson <spaul7137@gmail.com>
**Sent:** Wednesday, November 10, 2021 9:08 AM
**To:** Thomas Wysong
**Subject:** [External]Input regarding proposed Ford's Village on News Road

To all members of James City County Planning Commission:

It was with great consternation that my husband and I found out this morning for the first time that there is a huge plan afoot to build a high density housing/retirement/assisted living facility off of News Road in the middle of the Powhatan Creek watershed.

While we have confidence in the wisdom of our planning council and Board of Supervisors to make the correct decision, we would have felt remiss if we did not go on record as opposing this proposed project. The list of reasons for this stance is large, but we will just highlight a few in this email as follows:

1. News Road is already a safety hazard for many drivers who venture there. It is almost unthinkable to imagine hundreds (or thousands) if you count staff, more drivers navigating that dangerous 2-lane, curvy road. This is perhaps the single most salient point against building any new construction that has an outlet to News Road.
2. The potential damage to the watershed here is immense. This location is special and we have a huge custodial responsibility for this treasure.
3. Traffic on Centerville Road, already high, would also increase due to its intersection with News Road.
4.Construction noise and traffic would impact surrounding communities directly.
5. A sudden addition of so many residents demands that an assessment of availability of both medical staff and facilities be carried out. It is already difficult to secure necessary medical appointments, and this is an extremely important, often overlooked aspect of new development, particularly of the high-density kind.
6. A study of the impact on local law enforcement would also need to be undertaken.

We would like to be informed of any information with regard to forthcoming decisions and would definitely want time to gather community support against this.

There is a feeling in the community that nobody can fight big money projects when they get set in motion. We don't believe that. We trust that the decision to accept or reject this project will be done in a thoughtful, patient way, allowing for all voices to be heard.

Thanks so much for your service.

Sincerely,
Sharon & John Paulson

Carol A Burtis
4509 Basswood Way
Williamsburg VA 23188
Burtisca@gmail.com

November 30, 2021

Re: Fords Colony Fords Village

Michael Woolson
James City County, Virginia

Via e-mail: Michael.Woolson @jamescitycountyva.gov

Dear Mr. Woolson:

I have been a homeowner in the Powhatan Villages in Williamsburg VA for the past two years. I chose to move from the Midwest to Williamsburg, VA and selected my home based on affordability with my budget. My home backs up to News Road.

Any impact to News Road will affect my home and the homes of my neighbors. I noted the last traffic study to support the Fords Colony Fords Village project was done five years ago. In the past two years I have noted not only an increase in traffic on News Road, but a significant increase in traffic noise, to the point it can awaken me from sleep despite double honeycomb blinds AND sound blocking thermal drapes on my bedroom windows. At times, drivers hit the accelerator forcefully and do not have adequate mufflers on their vehicles, creating a noise nuisance. A current traffic study needs to be done to adequately forecast future traffic, and consideration as to reducing the speed limit and increasing police presence along News Road would be appropriate with yet another destination added to the street. It is not logical to project decreased traffic at the same time as adding yet another destination adjacent to News Road. Increasing buffers to offset additional noise along the North Side of News Road behind the Powhatan Villages homes would also be appropriate, and assurances that News Road will not be widened in the proximity of Powhatan Villages need to be addressed.

I also noted that the flood-plane measure is based on the current one-hundred year flood-plane criteria. Please be advised that this measure is being revised as one-hundred year flood-plane criteria are no longer dependable due to climate change. Until the method of measure's revision is complete, using a higher number year flood-plane criteria would be a more adequate measure. JCSA Engineer Dion Walsh's comments regarding the water main, revision of sewer manholes & uphill flow, minimizing grinder pump lots, & connection to sewer along the creek by Monticello Woods did not appear to be addressed in your project, and corrections need to be made to insure the best and safest alternatives for the area. It would also be beneficial to list prohibited chemicals that homeowners should not allow to seep into storm sewers.

My final area of concern is a possible increased real estate tax base due to this project, which will affect my Powhatan Villages community and anyone on a fixed income budget, including myself. Many of my neighbors are also retired and on fixed incomes. With inflation, any real estate property tax increase caused by the development of Ford Villages will negatively impact many Powhatan Village residents.

Mr. Woolson, if writing and presenting this letter of concern is adequate to have the issues I mentioned addressed, please so advise. If it does not, please inform me of the time and address of the meeting tonight so I may bring my concerns publicly. With the continued covid threat and an inability to see well to drive at night, I would prefer this letter meet the criteria to address the concerns. In any case, please respond via return e-mail: Burtisca@gmail.com

Thank you for your attention to these matters.

Sincerely,
Carol A. Burtis

**Unapproved Minutes of the December 1, 2021**
**Planning Commission Regular Meeting**

**Z-21-0012 and MP-21-0003. Proffer and Master Plan Amendment for the Continuing Care Retirement Facility at Ford's Colony (Ford's Village)**

Mr. Thomas Wysong, Senior Planner, stated that Mr. Vernon Geddy has applied on behalf of Frye Development to amend the adopted Master Plan and Proffers for the Continuing Care Retirement Community (CCRC) at Ford's Colony. Mr. Wysong stated that the subject parcel is zoned R-4, Residential Planned Community, is inside the Primary Service Area (PSA). and designated Low Density Residential in the Comprehensive Plan, which recommends this use.

Mr. Wysong stated that in 2008, this parcel was rezoned from R-8, Rural Residential to R-4, Residential Planned Community with Proffers to permit a CCRC known as the Village at Ford's Colony. Mr. Wysong further stated that this currently approved Master Plan for this property permits up to 741 units, rooms and beds and is accompanied by Proffers intended to mitigate community impacts.

Mr. Wysong stated that this proposal would amend the approved Master Plan and Proffers by reducing the total number of units, rooms, and beds from 741 to 516 and changing the layout of the site. Mr. Wysong stated that the applicant is proposing up to 286 residential units comprised of single-family dwellings and multifamily dwellings with an additional 230 assisted living/memory care rooms/skilled nursing beds to be located in the facility portion of the property. Mr. Wysong further stated that this development would include accessory amenities intended for the residents and employees of the development.

Mr. Wysong stated that the Proffers have been updated to include a unit mixture cap on the facility portion of the property of up to 75 apartments in this facility portion, no more than 155 assisted living rooms/memory care rooms, and no more than 40 skilled nursing beds. Mr. Wysong stated that the major changes to the proffers include the updating of the current contribution amount for community impacts, the addition of a proffer requiring a traffic signal warrant analysis for the proposed main entrance to the development, and the revision of stormwater commitments. Mr. Wysong further stated that the applicant is also proposing to remove certain proffers, including the completion of the Cold Spring Swamp Drainage Analysis and the Greenway Trail Proffer. Mr. Wysong stated that if approved, this amendment would reduce the density on the subject parcel from 3.59 units per acre to 2.17 dwelling units per acre and would also result in a marginal decrease within the overall density of Ford's Colony from 1.25 unit per acre to 1.13 units per acre.

Mr. Wysong stated that staff finds the proposal to be compatible with the Comprehensive Plan, Zoning Ordinance, and surrounding development, and recommends that the Planning Commission recommend approval of this application, subject to the amended proffers.

Mr. Polster inquired if the Stormwater Division took into account the removal of two proffers related to Stormwater mitigation when they reviewed the proposal.

Mr. Wysong stated that Stormwater staff did review the proposal and did not raise any concerns over the removal of the two proffers; however, they may not have fully considered the upstream issues, the culvert, and the flooding issues.

Mr. Krapf inquired whether the height limitation from previously approved proffers would remain in effect for new buildings.

Mr. Wysong stated that a new building not shown on the Master Plan would require a Master Plan Amendment.

Mr. Haldeman stated that there is an approved Master Plan for a CCRC on the property. Mr. Haldeman inquired if the developer could build out the CCRC according to the existing plan should this amended plan not be approved.

Mr. Wysong stated that the developer could build out the existing plan without any legislative action.

Mr. Haldeman noted that the Public Hearing remains open from the November 3, 2021 meeting.

Mr. Vernon Geddy, Geddy, Harris, Franck, & Hickman, LLP, 1177 Jamestown Road, representing the applicant, made a presentation to the Commission on the project.

Mr. Krapf inquired if there are any measures under consideration to mitigate the prolonged impact of construction vehicles on News Road.

Mr. Jason Grimes, AES Consulting Engineers, stated that nothing has been put in place; however, the most intense development will occur at the outset with the RUI building.

Mr. Krapf noted that his concern lies with the heavy equipment that brings in bulldozers, etc. and the impact on traffic flow. Mr. Krapf stated that since the bulk of the citizen concerns relate to traffic issues, this might be something that the applicant should consider.

Ms. Leverenz inquired if Frye Development has developed any other CCRC properties.

Mr. Geddy stated that this would be the first.

Ms. Leverenz further inquired if the owners of independent living units would also own the lot.

Mr. Geddy stated they would own the lot.

Ms. Leverenz inquired if the homeowners association (HOA) would provide property management services.

Mr. Geddy stated that there would be an HOA which would provide property maintenance services.

Ms. Leverenz inquired if the residents in the independent living section would have priority consideration for the assisted living option.

Mr. Geddy stated that at this time it would be based on availability.

Ms. Null inquired about the price range on the homes.

Mr. Rock Bell, Vice President for Development, Frye Properties, stated that they would be moderately high-end homes; however, it would not be feasible to give a price point at this time.

Ms. Null stated that her question stemmed from wanting to understand who might be living in that community; would it be sufficiently affordable.

Mr. Geddy stated that there would be a mix of housing types from small bungalow to larger single-family residences.

Mr. Rose inquired why there was no planning for construction traffic, given the applicant's experience in developing properties.

Mr. Geddy stated that traffic impacts had been addressed through the secondary construction entrance. Mr. Geddy further stated that the applicant would also look at options for timing of arrivals and departures, as well as what equipment could remain on the property for the duration of construction.

Mr. O'Connor inquired about the difference in intensity between the approved plan and this proposal and the resulting impact on the watershed.

Mr. Grimes stated that the original plan called for large apartment style buildings with large parking fields. Mr. Grimes stated that this proposal was developed to provide one large scale institutional style structure with single-family style development surrounding it. Mr. Grimes further stated that the resulting decrease in impervious covers allows for different stormwater mitigation options. Mr. Grimes noted that the existing proffers were no longer applicable to the proposal.

Mr. O'Connor inquired if the stormwater management would be the traditional curb and gutter with pipe and drop inlets.

Mr. Grimes stated that the current stormwater regulations would require treatment trains that take it through a series of infiltration measures, bioretention measures, and Low Impact Development (LID) swales. Mr. Grimes noted that many of the properties would have rain barrels or rain gardens as part of the stormwater management plan.

Ms. Leverenz inquired if the positive fiscal impact would come from the assisted living facility.

Mr. Geddy stated that the larger impact would come from the RUI facility; however, since there are no school children associated with the single-family dwellings, the independent living units should also have a positive impact.

* Mr. Rose left the meeting at approximately 6:50 p.m.

Mr. Haldeman called for disclosures from the Commission.

Mr. Polster stated that he spoke with Mr. Grimes and Mr. Geddy.

Mr. Krapf, Mr. O'Connor, Mr. Haldeman, and Ms. Null each stated that they spoke with Mr. Geddy.

Ms. Susan Tisdale, 209 Governor Edward Nott Court, addressed the Commission in opposition to the application.

Ms. Leanne Sutton, 201 Old Carriage Way, addressed the Commission in opposition to the application.

Ms. Kay Krapfl, 3833 Cluster Way, addressed the Commission in opposition to the application.

Mr. David Banks, 215 Charter House Lane, addressed the Commission in opposition to the application.

Mr. Kevin Fleming, 228 Old Carriage Way, addressed the Commission in opposition to the application.

Ms. Lisa Schmidt, 108 Powhatan Overlook, addressed the Commission in opposition to the application.

Ms. Regina Walsh, 4599 Beacon Hill Drive, addressed the Commission in opposition to the application.

Mr. Jason Smith, 124 Old Carriage Way, addressed the Commission in opposition to the application.

Mr. Bob Meyers, 143 Waters Edge Drive, addressed the Commission in opposition to the application.

Mr. Eric Ganzer, 4280 Beamer's Ridge, addressed the Commission in opposition to the application.

Ms. Debbie Wright, 450 Thompson Lane, addressed the Commission in opposition to the application.

Ms. Beth Emerson, 4052 Powhatan Secondary, addressed the Commission in opposition to the application.

As no one else wished to speak, Mr. Haldeman closed the Public Hearing.

Mr. Haldeman opened the floor for discussion by the Commission.

Mr. Polster stated that he was trying to understand whether the Stormwater Division concurs with the ramifications of removing these proffers for the upstream portion of the property and what, if any, consequences might occur. Mr. Polster stated that he would like to see the Stormwater Division come to the Board of Supervisors meeting prepared to discuss any potential consequences.

Mr. Krapf stated that the initial approved plan for this property included a CCRC that could still be built out by-right if this application is not approved. Mr. Krapf stated that he considered this application with an eye toward whether it was a better design or would mitigate any impacts of the development. Mr. Krapf noted that this plan reduces the number of residential units by 40% over the adopted Master Plan. Mr. Krapf further noted that the fiscal impact of this proposal is positive. Mr. Krapf stated that the proposed design is more appealing and leaves more open space giving it the appearance of a neighborhood.

Mr. Krapf stated that he does have significant concerns about the ability of News Road to accommodate the additional traffic.

Mr. Krapf requested that Mr. Holt clarify the Virginia Department of Transportation's (VDOT) role in the construction of the proffered traffic improvements.

Mr. Holt noted that the improvements and associated warrants are in the proffers and would rely on private versus public funding. Mr. Holt stated that the developer would be responsible for constructing the improvements. Mr. Holt further stated that VDOT's approval would be for the geometric design of the improvements in an engineering level document at the site plan stage.

Ms. Leverenz stated that she is pleased with the proposed design; however, it appears that this project is something slightly different from the traditional CCRC. Ms. Leverenz stated that this proposal has two distinct components with the Assisted Living facility being one and the Independent Living Units, essentially a 55 + retirement community, the second. Ms. Leverenz stated that contrary to the most CCRCs, there is no guarantee that residents in the Independent Living Units would be given priority for space in the Assisted Living, when the need arises. Ms. Leverenz noted that if this were just an age-restricted retirement community, the Commission would not be inclined to support it.

The Commission discussed several CCRC facilities that are adjacent to, but separate from a neighboring retirement community that do not guarantee access to the Assisted Living Units.

Mr. O'Connor stated that the decision point is whether to allow the possibility that the more intense development would be built out by-right or accept a proposal that would reduce the number of units, reduce the traffic and improve stormwater mitigation.

Mr. Haldeman stated that he plans to support the application. Mr. Haldeman stated that he shares the public's concerns and those of his fellow Commissioners. Mr. Haldeman stated that the location is not well suited to this type of development; however, there is an existing plan in place and this amendment is a substantial improvement.

Ms. Null noted that she would like to see a second gate or access point to ensure that residents can leave in the event of an emergency.

Mr. Polster made a motion to recommend approval of the application.

On a roll call vote, the Commission voted to recommend approval of Z-21-0012 and MP-21-0003. Proffer and Master Plan Amendment for the Continuing Care Retirement Facility at Ford's Colony (Ford's Village) (5-1)

**AGENDA ITEM NO. G.7.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Terry Costello, Senior Planner

SUBJECT: SUP-21-0018. 1403 Jamestown Road Rental of Rooms

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**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Staff Report | Staff Report |
| | Resolution | Resolution |
| | Location Map | Exhibit |
| | Master Plan | Exhibit |
| | Applicant narrative | Backup Material |
| | Emails from adjacent property owners | Backup Material |
| | Unapproved minutes of the December 1, 2021 Planning Commission Meeting | Minutes |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Planning | Holt, Paul | Approved | 12/22/2021 - 3:39 PM |
| Development Management | Holt, Paul | Approved | 12/22/2021 - 3:51 PM |
| Publication Management | Pobiak, Amanda | Approved | 12/22/2021 - 4:28 PM |
| Legal Review | Kinsman, Adam | Approved | 12/28/2021 - 7:34 AM |
| Board Secretary | Saeed, Teresa | Approved | 12/28/2021 - 8:35 AM |
| Board Secretary | Purse, Jason | Approved | 1/4/2022 - 2:13 PM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:47 PM |

## SUMMARY FACTS

| | |
|---|---|
| Applicant: | Mr. Franklin Berggren |
| Land Owner: | Mr. Franklin Berggren |
| Proposal: | To allow for the short-term rental of two bedrooms within a caretaker-occupied single-family home |
| Location: | 1403 Jamestown Road |
| Tax Map/Parcel No.: | 4810400018 |
| Property Acreage: | ± .96 acres |
| Zoning: | R-1, Limited Residential |
| Comprehensive Plan: | Low Density Residential |
| Primary Service Area (PSA): | Inside |
| Staff Contact: | Terry Costello, Deputy Zoning Administrator/Senior Planner |

## PUBLIC HEARING DATES

| | |
|---|---|
| Planning Commission: | December 1, 2021, 6:00 p.m. |
| Board of Supervisors: | January 11, 2022, 5:00 p.m. |

## FACTORS FAVORABLE

1. There is adequate off-street parking.
2. The applicant has acknowledged that, should this application be approved, he will obtain the proper licensing and inspections through the County and will be subject to appropriate use-based taxes.
3. A caretaker will live on-site.
4. Impacts: See Impact Analysis on Pages 3-4.

## FACTORS UNFAVORABLE

1. Staff finds the proposal inconsistent with the *Our County, Our Shared Future: James City County 2045 Comprehensive Plan.*
2. See Impact Analysis on Pages 3-4.
3. See Comprehensive Plan Analysis on Page 5.

## SUMMARY STAFF RECOMMENDATION

Staff finds the proposal to be incompatible with surrounding development and not consistent with the recommendations of the 2045 Comprehensive Plan. Staff therefore does not recommend approval of this application. Should the Board of Supervisors wish to recommend approval, staff has included proposed conditions for consideration (Attachment No. 1).

*This staff report is prepared by the James City County Planning Division to provide information to the Planning Commission and Board of Supervisors to assist them in making a recommendation on this application. It may be useful to members of the general public interested in this application.*

## PLANNING COMMISSION RECOMMENDATION

At its December 1, 2021, meeting, the Planning Commission voted to recommend denial of this application by a vote of 6-0. (Commissioner Rose left due to a prior commitment.)

## PROPOSED CHANGES MADE SINCE THE PLANNING COMMISSION MEETING

None.

## PROJECT DESCRIPTION

Mr. Franklin Berggren has applied for a Special Use Permit (SUP) to allow for a short-term rental of two bedrooms within an existing four-bedroom house. This house is not the owner's primary residence; a caretaker will be present during the time of the rentals. The proposal includes no changes to the size or footprint of the house.

The "Rental of Rooms" use within the R-1 Zoning District limits rentals to a maximum of three bedrooms and requires the homeowner or caretaker to continue residing at the property during the time of the rental. The proposed conditions limit the number of bedrooms available for short-term rental to two bedrooms.

The property has an existing driveway and an existing parking area sufficient to accommodate guests. The two-bedroom home is on public water and sewer. In previous short-term rental applications, staff calculated the number of occupants to be two people per bedroom. Per SUP Condition No. 3, the maximum number of occupants per contract is four.

## PLANNING AND ZONING HISTORY

- There have been no legislative cases associated with this parcel.

## SURROUNDING ZONING AND DEVELOPMENT

- The property is located in the Bozarth and Mahone Subdivision.
- Properties to the north, south, east, and west are zoned R-1, Limited Residential.
- Properties surrounding this parcel are designated Low Density Residential on the 2045 Comprehensive Plan Land Use Map.

| Impacts/Potentially Unfavorable Conditions | Status *(No Mitigation Required/Mitigated/Not Fully Mitigated)* | Considerations/Proposed Mitigation of Potentially Unfavorable Conditions |
|---|---|---|
| Public Transportation: Vehicular | No Mitigation Required | - The proposal is not anticipated to generate traffic exceeding a typical residential use.<br>- The subject property is located on a minor arterial road. |
| Public Transportation: Bicycle/Pedestrian | No Mitigation Required | - There are no changes to the existing footprint of the building and bicycle and pedestrian accommodations are not required per Section 24-35(c)(2) of the Zoning Ordinance. |
| Public Safety | No Mitigation Required | - Fire Station 3 on John Tyler Highway serves this area of the County and is approximately 1.5 miles from the proposed short-term rental.<br>- Staff finds this project does not generate impacts that require mitigation to the County's Fire Department facilities or services. |
| Public Schools | No Mitigation Required | - N/A since no residential dwelling units are proposed. |
| Public Parks and Recreation | No Mitigation Required | - N/A since no residential dwelling units are proposed. |
| Public Libraries and Cultural Centers | No Mitigation Required | - Staff finds this project does not generate impacts that require mitigation. |
| Groundwater and Drinking Water Resources | No Mitigation Required | - The property receives public water and sewer.<br>- The proposal does not generate impacts that require mitigation to groundwater or drinking water resources. |

| **Impacts/Potentially Unfavorable Conditions** | **Status** *(No Mitigation Required/Mitigated/Not Fully Mitigated)* | **Considerations/Proposed Mitigation of Potentially Unfavorable Conditions** |
|---|---|---|
| Watersheds, Streams, and Reservoirs Project is located in the Mill Creek Watershed. | No Mitigation Required | - The Stormwater and Resource Protection Division has reviewed this application and had no objections. No new impervious surface is proposed as part of this SUP request. Should exterior site improvements be made in the future, those improvements would be subject to additional environmental review at that time. |
| Cultural/Historic | No Mitigation Required | - The subject property has been previously disturbed and has no known cultural resources on-site. |
| Nearby and Surrounding Properties | Not Fully Mitigated | - Traffic is anticipated to be typical of a residential home; the subject property must adhere to the County's Noise Ordinance. Although the proposed SUP conditions would mitigate some impacts to neighboring properties, staff finds the location of the subject parcel poses a potential for impact and is not conducive for this use. |
| Community Character | No Mitigation Required | - Jamestown Road is located within a Community Character Corridor. There is adequate vegetation along Jamestown Road and the residence is approximately 100 feet from Jamestown Road. |
| Covenants and Restrictions | No Mitigation Required | - The applicant has verified that he is not aware of any covenants or restrictions on the property that prohibit the proposed use. |

## 2045 COMPREHENSIVE PLAN

The site is designated Low Density Residential on the 2045 Comprehensive Plan Land Use Map. The newly adopted Comprehensive Plan provides recommendations regarding locations for short-term rentals.

Per the adopted Comprehensive Plan, due to the unique impacts that can arise from transient residents in short-term rentals, the County should continue to carefully consider the impacts these uses can have on a community's quality of life. The thriving rural character of James City County continues to offer a variety of agri-tourism opportunities, for which short-term rentals may provide a truly unique opportunity and experience; one that provides economic benefits to rural property owners but does not directly compete with more conventional tourism-based opportunities inside the PSA. If located within a residential context, short-term rentals should serve to complement the residential character of the area rather than altering its nature. Therefore, while every location can be considered uniquely, short-term rentals are most appropriately located subject to the following development standards:

- Be located on lands designated Rural Lands, Neighborhood Commercial, Community Commercial, Mixed Use, or Economic Opportunity.

  *This property is designated Low Density Residential on the adopted 2045 Comprehensive Plan Land Use Map.*

- Be located on the edge or corner of an existing platted subdivision, rather than internal to it.

  *This parcel is located within an existing platted subdivision and fronts on Jamestown Road. It is not internal to the subdivision.*

- Be located on a major road.

  *This property is located on Jamestown Road and is classified by the Virginia Department of Transportation as a minor arterial road. The road appears adequate for the proposed use.*

- Be operated in a manner such that the property owner will continue to live and reside on the property during the rental.

  *The owner of the home will not reside on the same property as the proposed rental; however, a caretaker will be on-site during the times of the rentals.*

Staff finds the proposal inconsistent with the recommendations of the 2045 Comprehensive Plan.

## PROPOSED SUP CONDITIONS

Proposed conditions are provided in Attachment No. 1.

## STAFF RECOMMENDATION

Staff finds the proposal incompatible with surrounding zoning and development and not consistent with the recommendations of the adopted 2045 Comprehensive Plan.

Staff therefore does not recommend approval of the proposed SUP. Should the Board of Supervisors wish to recommend approval, staff has included proposed conditions for consideration.

TC/ap
SUP21-18_1403JmstwnRd

Attachments:
1. Resolution
2. Location Map
3. Master Plan
4. Applicant Narrative
5. Emails from adjacent property owners
6. Unapproved Minutes of the December 1, 2021, Planning Commission Meeting

# **R E S O L U T I O N**

CASE NO. SUP-21-0018. 1403 JAMESTOWN ROAD RENTAL OF ROOMS

WHEREAS, the Board of Supervisors of James City County, Virginia, has adopted by Ordinance specific land uses that shall be subjected to a Special Use Permit (SUP) process; and

WHEREAS, Mr. Franklin Berggren has applied for an SUP to allow for the short-term rental of two bedrooms within a caretaker-occupied single-family dwelling located at 1403 Jamestown Road and further identified as James City County Real Estate Tax Map Parcel No. 4810400018 (the "Property"); and

WHEREAS, the Planning Commission, following its public hearing on December 1, 2021, recommended denial of Case No. SUP-21-0018 by a vote of 6-0; and

WHEREAS, a public hearing was advertised, adjoining property owners notified, and a hearing conducted on Case No. SUP-21-0018; and

WHEREAS, the Board of Supervisors of James City County, Virginia, finds this use to be consistent with the 2045 Comprehensive Plan Land Use Map designation for the Property.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, after consideration of the factors in Section 24-9 of the James City County Code, does hereby approve the issuance of Case No. SUP-21-0018 as described herein with the following conditions:

1. *Master Plan* – This SUP shall permit the rental of rooms on property located at 1403 Jamestown Road and further identified as James City County Real Estate Tax Map Parcel No. 4810400018 (the "Property"). The use and layout of the Property shall be generally as shown on the document entitled "JCC SUP-21-0018, 1403 Jamestown Road Rental of Rooms" and date stamped November 10, 2021 (the "Master Plan"), with any deviations considered per Section 24-23(a)(2) of the Zoning Ordinance, as amended. This condition does not restrict improvements typical of a residential property as determined by the Director of Planning.

2. *Commencement* – Evidence of a business license and updated Certificate of Occupancy shall be provided to the Director of Planning within twelve (12) months from the issuance of the SUP, or this SUP shall automatically be void.

3. *Number of rental room occupants* – There shall be no more than two (2) bedrooms available for rent to visitors and no more than four (4) rental occupants total at any one time.

4. *Contracts per Rental Period* – There shall not, during any period of time, be simultaneous rentals of the Property under separate contracts.

5. *Signage* – No signage related to the use of the short-term rental shall be permitted on the Property.

6. *Parking* – Off-site parking for this use shall be prohibited. No oversized commercial vehicles associated with rental occupants of the short-term rental, such as, but not limited to, buses, commercial trucks, and trailers shall be allowed to park on the Property.

7. *Severance Clause* – This SUP is not severable. Invalidation of any word, phrase, clause, sentence, or paragraph shall invalidate the remainder.

_____
Michael J. Hipple
Chairman, Board of Supervisors

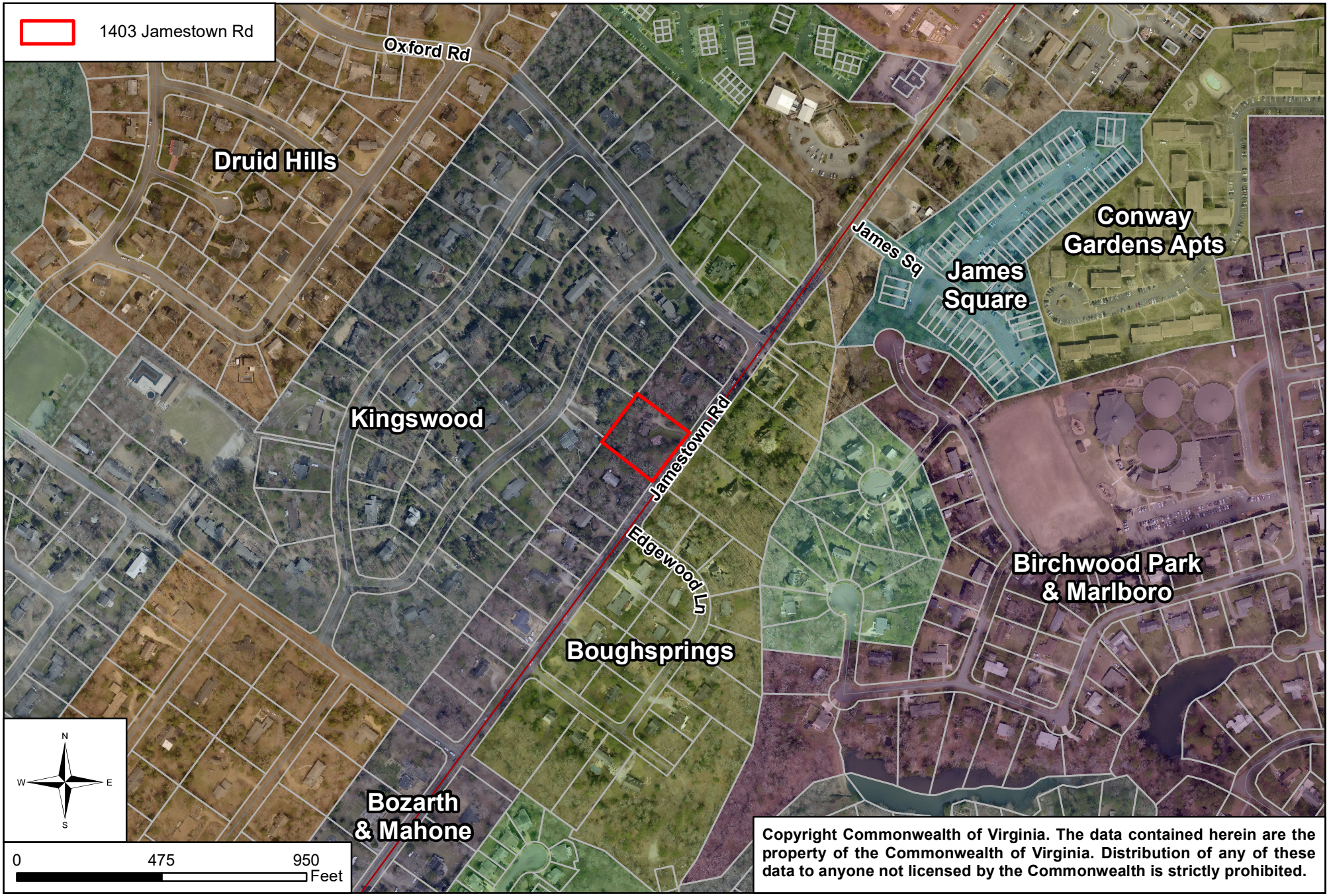
ATTEST:

_____
Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

# JCC SUP-21-0018, 1403 Jamestown Rd
# Rental of Rooms

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# JCC SUP-21-0018, 1403 Jamestown Rd Rental of Rooms

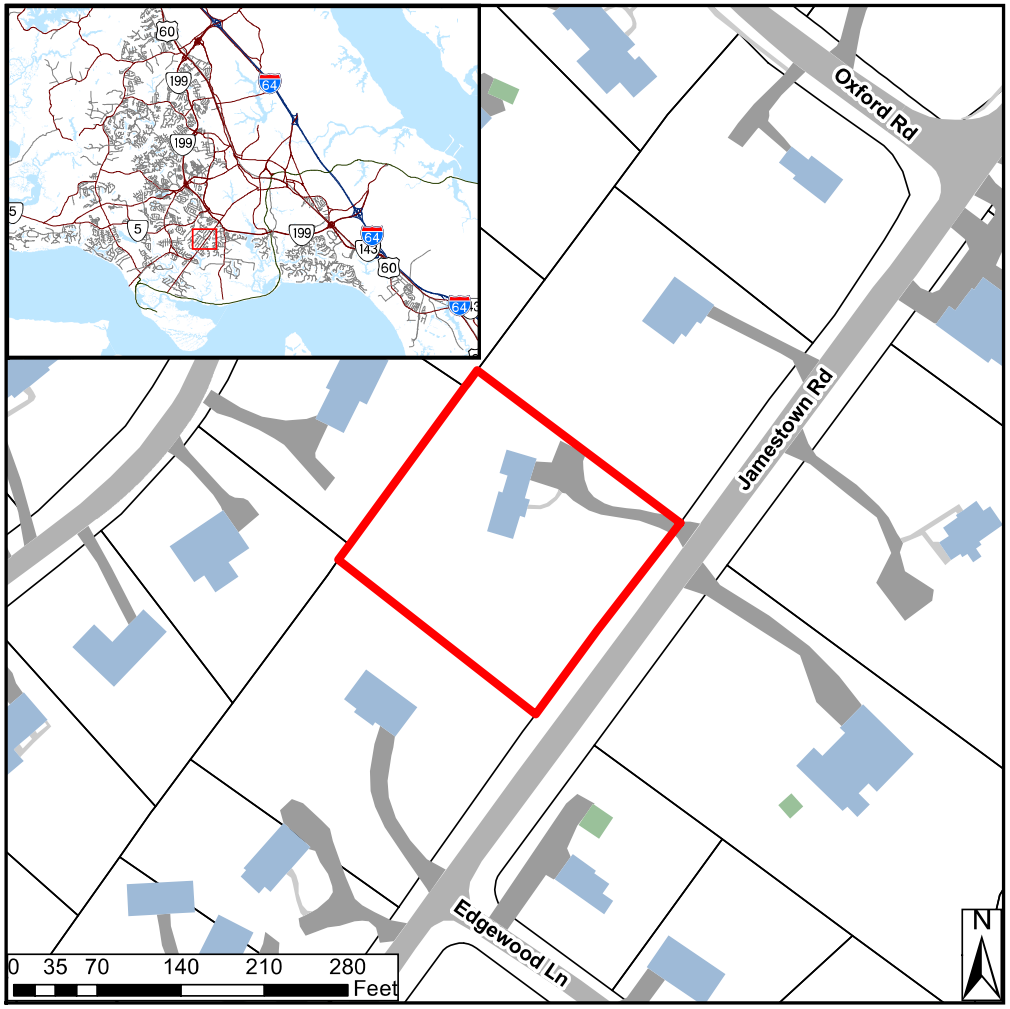
Master Plan Dated November 10, 2021

## Property Information

4810400018
Franklin Scott Berggren
1403 Jamestown Rd
Williamsburg, VA 23185
R1 Limited Residential
Comp Plan: Low Density Residential
Acres: .96

## General Notes

1. Site is served by public water and sewer.
2. Property is not located in a FEMA Flood zone.
3. Property does not contain Resource Protection Area.
4. Property has an existing driveway.
5. A minimum of three parking spots shall be provided (one parking spot per bedroom).




Maps Not To Scale

## Adjacent Properties

4810300034
Robert S & Ann E Buran
108 Dover Rd
Williamsburg, VA 23185
R1 Limited Residential

4810300035
Frank P Trustee & Martha I T Caruso
110 Dover Rd
Williamsburg, VA 23185
R1 Limited Residential

4810300033
Stephen C Nevins
106 Dover Rd
Williamsburg, VA 23185
R1 Limited Residential

4810500025
Daniel D Grove
100 Edgewood Ln
Williamsburg, VA 23185
R1 Limited Residential

4810400017
Alta Vrooman
1405 Jamestown Rd
Williamsburg, VA 23185
R1 Limited Residential

4810400019
Bill D Saunders
1401 Jamestown Rd
Williamsburg, VA 23185
R1 Limited Residential

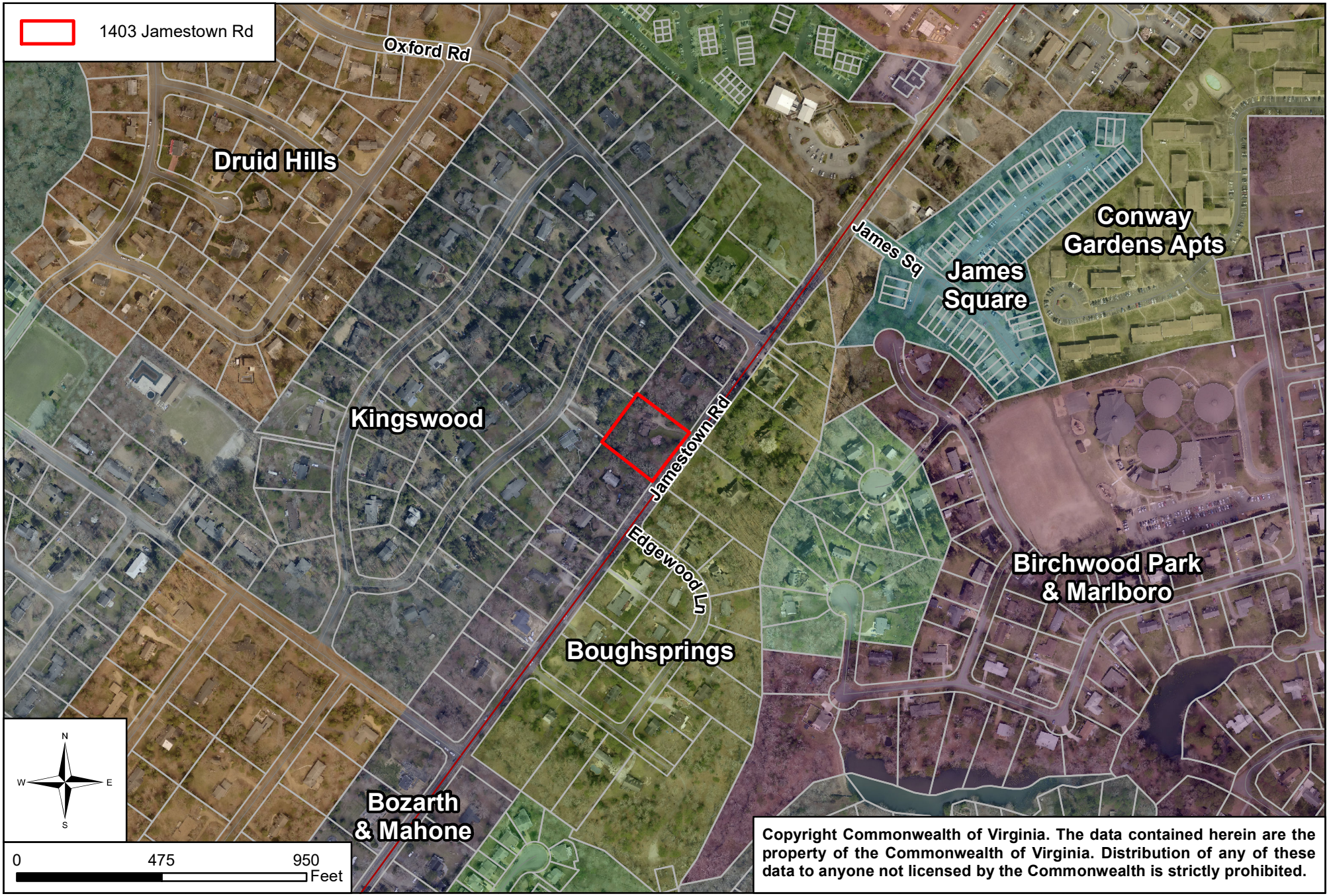
4810500024
Juan & Veronica Gomez
1404 Jamestown Rd
Williamsburg, VA 23185
R1 Limited Residential

4810500023
Gregory P Johnson & Shelley M Hurt
1402 Jamestown Rd
Williamsburg, VA 23185
R1 Limited Residential

## Sheet Index


1. Cover Page
2. Location Map
3. Site Details

# JCC SUP-21-0018, 1403 Jamestown Rd
# Rental of Rooms

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# JCC SUP-21-0018
# 1403 Jamestown Road Rental of Rooms

1403 Jamestown Road Narrative

We are thrilled to be able to share this conveniently located, historically inspired home with visitors to Williamsburg. Our home has 3 bedrooms and 2 ½ baths. We will have a full time tenant/caretaker living on premise. We would be like to rent out 2 additional rooms to visitors. When we are not, ourselves, using our home. We personally, have a family of six and have found booking multiple hotel rooms awkward and inconvenient. And, now that our children have turned into teens, even timeshare rentals have lost their appeal as we all can no longer all fit into the same living room at a given time. We would like to share the conveniences of home and the space to be able to gather while also being able to have personal space, when needed, with other families. Given the home's location on Jamestown Road, surrounded by an acre of wooded property, we cannot expect any noticeable impact to traffic, noise, or disruptions to the surrounding area.

Ann Buran
108 Dover Road
Williamsburg, VA 23185
November 30, 2021

Community Development
101-A Mounts Bay Road
P.O. Box 8784
Williamsburg, VA 23187-8784
community.development@jamescitycountyva.gov

RE: SUP-21-0018. 1403 Jamestown Road Rental of Rooms
To Whom It May Concern:

I am writing regarding the property identified as JCC Real Estate Tax Map No. 4810400018. I am the adjacent property owner; I live at 108 Dover Road and my entire back property line shares that of the residence in question.

Our neighborhood is zoned R-1, Limited Residential, and designated Low Density Residential on the 2045 Comprehensive Plan Land Use Map. The recommended uses include "single-family and multifamily units, accessory units, cluster or cottage homes on small lots, recreation areas, and limited commercial." The most relevant aspect of this code is the following clause: "The regulations for this district are designed to stabilize and protect the essential characteristics of the district".

I, and those in my community I have spoken to, feel that the use of this property as an Airbnb fundamentally contradicts the fact that regulations specifically aim to protect the "essential characteristics of [our] district". This neighborhood is a small, older community of single family homes. Residents gather at the community pool and building, and are largely known to one another. Historically, to my knowledge, these homes have not been used as transient rental properties. In our own experience, as a military family, due to permanent change of station orders, we have had to rent our home. We worked hard to find renters who conformed to the characteristics of our neighborhood, and who would have served as conscientious and stable neighbors in our community. Most often these new tenants signed two to three year leases. This option is available to the new homeowner. It is the preferred option for myself and my neighbors. We have experienced what having a tenant who does not conform to the expectations of the neighborhood entails. My concern is the number of tenants who would pass through this property and the myriad situations that could disrupt the stability and "essential characteristics" of our neighborhood.

Thank you in advance for your attention to this matter. These concerns are based upon a love for our community and the wish to mitigate future issues in what seems to be an easily avoidable situation.

Thank you,
Ann Buran

## Terry Costello

**From:** Beth Klapper
**Sent:** Tuesday, November 30, 2021 11:48 AM
**To:** Terry Costello
**Cc:** Paul Holt; Josh Crump
**Subject:** FW: [External]SUP-21-00818.1403 Jamestown Road rental of rooms

**From:** martha caruso <carusom05@gmail.com>
**Sent:** Monday, November 29, 2021 2:14 PM
**To:** Community Development <community.development@jamescitycountyva.gov>
**Subject:** [External]SUP-21-00818.1403 Jamestown Road rental of rooms

I live on Dover Road behind the proposed AirBnB rental property. I have heard that the property owner lives in California. I am not averse to rental property, but I have a problem with the transient nature of this type of rental. According to the Code of James City County Building uses, this fits the description of a Tourist home, rather than a limited residential. It also does not fit the special permitted limited commercial rental of three rooms, since this is a large home, and the owner would not live on site. I have tried to imagine all possibilities, however remote, since I feel it is better to avoid the problem, rather than try to complain later.

Concerns with a transient rental that is managed through an out of state property manager:

- **Safety** We have had break-ins in the neighborhood, and watch out for each other. We have many walkers, and mostly we recognize each other. Who would be responsible for the safety of Kingswood children and seniors and property? (Since this is a group that can change every day or week throughout the school year, as well as summer.)
- **Safety and Environment** There is an easement that runs from the back of this property to Dover Road which is essentially in my backyard, since it is no more than a path. The previous owner made use of this path to walk her dog through the Kingswood neighborhood. This easement is not a well lit path, and mostly would end up with persons walking on my neighbor's driveway (Who would pick up litter?, or be responsible if someone tripped in this area. Privacy at all hours is also a concern)
- **Noise** Since this is a short term transient rental, in a large home, it can accomodate families, or larger parties. It does not have a lot of frontal parking, but again the easement provides an easy walkway to parking on Dover. (There is the issue of noise, or tree line grass damage from parking)
- 
- Again my concern is that if these or other issues occur, they would be addressed by an out of state owner after- the guilty parties have left... and I would have to wait until the next time it occurs. These are three of the reasons that I believe this purpose of designating 1403 Jamestown Road as an AirBnB, would impair the character of the adjacent neighborhood, of single family low density residential homes, and go against the present codes.

### Sec. 24-231. - Statement of intent.

The Limited Residential District, R-1, is composed of certain quiet, low-density residential areas plus certain open areas where similar residential development is likely to occur. The regulations for this district are designed to

stabilize and protect the essential characteristics of the district, **to limit activities of a commercial nature and to implement the policies and designations of the Comprehensive Plan applicable to low-density residential areas.** To these ends, development is limited to low-density residential and generally permitted uses are limited to single-family dwellings, plus certain additional community-oriented uses that serve the residents of this district.

## Sec. 24-232. - Use list.

| |
|---|
| Rental of rooms to a **maximum of three rooms** |

Tourist home. A dwelling where lodging or lodging and meals are provided for compensation for up to **five rooms which are open to transients.**

**Martha Caruso**
**110 Dover Road**

**Unapproved Minutes of the December 1, 2021**
**Planning Commission Regular Meeting**

**SUP-21-0018. 1403 Jamestown Road Rental of Rooms**

Ms. Terry Costello, Senior Planner, stated that Mr. Franklin Berggren has applied for an SUP to allow the short-term rental of two bedrooms in a caretaker-occupied single-family home located at 1403 Jamestown Road. Ms. Costello stated that the property is zoned R-1, Limited Residential, is designated Low Density Residential on the 2045 Comprehensive Plan Land Use Map, and is located inside the PSA. Ms. Costello further stated that, if granted, this SUP would allow for short-term rentals throughout the year. Ms. Costello stated that no changes to the footprint of the home are proposed.

Ms. Costello stated that staff finds some favorable factors for this application, such as a caretaker being located on-site and the presence of adequate off-street parking; however, the proposal does not meet the recommendations regarding locations for short-term rentals in the 2045 Comprehensive Plan.

Ms. Costello stated that staff finds the proposal incompatible with surrounding zoning and development, and inconsistent with the recommendations of the adopted 2045 Comprehensive Plan; therefore, staff is unable to recommend approval of this application.

Mr. Haldeman inquired if the property qualifies as being on the edge or corner of a major road.

Ms. Costello stated that the property is on the edge of a major road. Ms. Costello further clarified that the requirement is to ensure that the property is not internal to a subdivision.

Mr. Haldeman called for disclosures from the Commission.

There were no disclosures.

Mr. Haldeman opened the Public Hearing.

Mr. Franklin Berggren, 1403 Jamestown Road, Applicant, addressed the Commission in support of the application and short-term rentals in general.

Mr. John Gomez, 1404 Jamestown Road, addressed the Commission in opposition to the application.

Ms. Martha Caruso, 110 Dover Road, addressed the Commission in opposition to the application.

Mr. Vrooman, 1405 Jamestown Road, addressed the Commission in opposition to the application.

Ms. Ann Buran, 108 Dover Road, addressed the Commission in opposition to the application.

Ms. Sharon Dennis, 100 St Georges Boulevard, addressed the Commission in support of the application and short-term rentals in general.

Mr. Wilson Huffman, 2032 Back River Lane, addressed the Commission in support of the application and short-term rentals in general.

Mr. Frank Caruso, 110 Dover Road, addressed the Commission in opposition to the application.

Ms. Shelly Hert, 1402 Jamestown Road, addressed the Commission in opposition to the application.

As no one else wished to speak, Mr. Haldeman closed the Public Hearing.

Mr. Haldeman opened the floor for discussion by the Commission.

Mr. Polster inquired if the applicant had a similar application previously for a different property.

Mr. Berggren stated that he does own two properties but no longer finds the property on Lake Powell Road to meet the family's needs.

Ms. Null stated that she does not agree with short-term rentals in a neighborhood when the property owner does not reside in the home.

Mr. Polster stated that based on the standards developed for the Comprehensive Plan, he intends to support staff's recommendation to recommend denial of the application.

Ms. Leverenz stated that the Commission needs to uphold the new guidelines in the Comprehensive Plan. Ms. Leverenz stated that she concurs with staff's recommendation.

Mr. O'Connor stated that since SUPs are granted in perpetuity, there is no way to ensure that the property owner, now or in the future will use a rental site that vets its users. Mr. O'Connor further stated that the guidelines for short-term rentals was developed to promote long-term rental of housing in areas that were suited to affordable housing and to promote short-term rentals in areas where it would also meet the goals of encouraging agritourism and the protection of rural lands.

Mr. Polster made a motion not to recommend approval of the SUP-21-0018.

On a roll call vote, the Commission voted not to recommend approval of SUP-21-0018. 1403 Jamestown Road Rental of Rooms. (6-0)

**AGENDA ITEM NO. G.8.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Terry Costello, Senior Planner

SUBJECT: SUP-21-0020. 528 Neck-O-Land Road Tourist Home

---

**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Staff Report | Staff Report |
| | Resolution | Resolution |
| | Location Map | Exhibit |
| | Master Plan | Exhibit |
| | Applicant narrative | Backup Material |
| | Lot Development Plan | Exhibit |
| | Unapproved minutes of the December 1, 2021 Planning Commission Meeting | Minutes |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Planning | Holt, Paul | Approved | 12/22/2021 - 3:52 PM |
| Development Management | Holt, Paul | Approved | 12/22/2021 - 3:52 PM |
| Publication Management | Daniel, Martha | Approved | 12/22/2021 - 3:57 PM |
| Legal Review | Kinsman, Adam | Approved | 12/28/2021 - 7:34 AM |
| Board Secretary | Saeed, Teresa | Approved | 12/28/2021 - 8:35 AM |
| Board Secretary | Purse, Jason | Approved | 1/4/2022 - 2:13 PM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:55 PM |

## SUMMARY FACTS

| | |
|---|---|
| Applicant: | Ms. Sharon Dennis, Colonial Cottage Vacation Rentals |
| Land Owner: | Ms. Sharon Dennis |
| Proposal: | To allow for a tourist home rental of an entire two-bedroom residential home as a tourist home. The owner does not live on-site. |
| Location: | 528 Neck-O-Land Road |
| Tax Map/Parcel No.: | 5510200008 |
| Property Acreage: | ± .99 acres |
| Zoning: | R-8, Rural Residential |
| Comprehensive Plan: | Low Density Residential |
| Primary Service Area: (PSA) | Inside |
| Staff Contact: | Terry Costello, Deputy Zoning Administrator/Senior Planner |

## PUBLIC HEARING DATES

| | |
|---|---|
| Planning Commission: | December 1, 2021, 6:00 p.m. |
| Board of Supervisors: | January 11, 2022, 5:00 p.m. |

## FACTORS FAVORABLE

1. There is adequate off-street parking.
2. The applicant has acknowledged that, should this application be approved, she will obtain the proper licensing and inspections through the County and will be subject to appropriate use-based taxes.
3. Impacts: See Impact Analysis on Pages 3-4.

## FACTORS UNFAVORABLE

1. Staff finds the proposal inconsistent with the *Our County, Our Shared Future: James City County 2045 Comprehensive Plan.*
2. See Impact Analysis on Pages 3-4.
3. See Comprehensive Plan Analysis on Page 5.

## SUMMARY STAFF RECOMMENDATION

Staff finds the proposal to be incompatible with surrounding development and not consistent with the recommendations of the 2045 Comprehensive Plan. Staff therefore does not recommend approval of this application. Should the Board of Supervisors wish to recommend approval, staff has included proposed conditions for consideration (Attachment No. 1).

## PLANNING COMMISSION RECOMMENDATION

At its December 1, 2021, meeting, the Planning Commission voted to recommend denial of this application by a vote of 6-0. (Commissioner Rose left due to a prior commitment)

## PROPOSED CHANGES MADE SINCE THE PLANNING COMMISSION MEETING

None.

## PROJECT DESCRIPTION

Ms. Sharon Dennis has applied for a Special Use Permit (SUP) to allow for a short-term rental of an existing two-bedroom house as a tourist home. This house is not the primary residence for Ms. Dennis, who resides elsewhere in James City County. The proposal includes no changes to the size or footprint of the house.

The Zoning Ordinance defines a tourist home as "a dwelling where lodging or lodging and meals are provided for compensation for up to five rooms which are open to transients." The proposed conditions limit the number of bedrooms available for rental to two bedrooms.

The property has an existing driveway and an existing parking area sufficient to accommodate guests. The two-bedroom home is on public water and sewer. In previous tourist home applications, staff calculated the number of occupants to be two people per bedroom. Per SUP Condition No. 3, the maximum number of occupants per contract is four.

## PLANNING AND ZONING HISTORY

- There have been no legislative cases associated with this parcel.

## SURROUNDING ZONING AND DEVELOPMENT

- The property is located in the Neck-O-Land Hundred Subdivision.
- Properties to the north, south, and west are zoned R-8, Rural Residential.
- Properties to the east are zoned R-1, Limited Residential and PL, Public Lands.
- Properties surrounding this parcel are designated Low Density Residential on the 2045 Comprehensive Plan Land Use Map.

| **Impacts/Potentially Unfavorable Conditions** | **Status** *(No Mitigation Required/Mitigated/Not Fully Mitigated)* | **Considerations/Proposed Mitigation of Potentially Unfavorable Conditions** |
|---|---|---|
| Public Transportation: Vehicular | No Mitigation Required | - The proposal is not anticipated to generate traffic exceeding a typical residential use.<br>- The subject property is located on a local road. |
| Public Transportation: Bicycle/Pedestrian | No Mitigation Required | - There are no changes to the existing footprint of the building and bicycle and pedestrian accommodations are not required per Section 24-35(c)(2) of the Zoning Ordinance. |
| Public Safety | No Mitigation Required | - Fire Station 3 on John Tyler Highway serves this area of the County and is approximately 3.9 miles from the proposed tourist home.<br>- Staff finds this project does not generate impacts that require mitigation to the County's Fire Department facilities or services. |
| Public Schools | No Mitigation Required | - N/A since no residential dwelling units are proposed. |
| Public Parks and Recreation | No Mitigation Required | - N/A since no residential dwelling units are proposed. |
| Public Libraries and Cultural Centers | No Mitigation Required | - Staff finds this project does not generate impacts that require mitigation. |
| Groundwater and Drinking Water Resources | No Mitigation Required | - The property receives public water and sewer.<br>- The proposal does not generate impacts that require mitigation to groundwater or drinking water resources. |

| **Impacts/Potentially Unfavorable Conditions** | **Status** *(No Mitigation Required/Mitigated/Not Fully Mitigated)* | **Considerations/Proposed Mitigation of Potentially Unfavorable Conditions** |
|---|---|---|
| Watersheds, Streams, and Reservoirs Project is located in the Mill Creek Watershed. | No Mitigation Required | - The Stormwater and Resource Protection Division has reviewed this application and had no objections. No new impervious surface is proposed as part of this SUP request. Should exterior site improvements be made in the future, those improvements would be subject to additional environmental review at that time. |
| Cultural/Historic | No Mitigation Required | - The subject property has been previously disturbed and has no known cultural resources on-site. |
| Nearby and Surrounding Properties | Not Fully Mitigated | - Traffic is anticipated to be typical of a residential home; the subject property must adhere to the County's Noise Ordinance. Although the proposed SUP conditions would mitigate some impacts to neighboring properties, staff finds the location of the subject parcel poses a potential for impact and is not conducive for this use. |
| Community Character | No Mitigation Required | - Neck-O-Land Road is not a Community Character Corridor; however, this parcel is located within the Jamestown Island - Jamestown Settlement - Greensprings Road Community Character Area. |
| Covenants and Restrictions | No Mitigation Required | - The applicant has verified that she is not aware of any covenants or restrictions on the property that prohibit the proposed use. |

## 2045 COMPREHENSIVE PLAN

The site is designated Low Density Residential on the 2045 Comprehensive Plan Land Use Map. The newly adopted Comprehensive Plan provides recommendations regarding locations for short-term rentals.

Per the adopted Comprehensive Plan, due to the unique impacts that can arise from transient residents in short-term rentals, the County should continue to carefully consider the impacts these uses can have on a community's quality of life. The thriving rural character of James City County continues to offer a variety of agri-tourism opportunities, for which short-term rentals may provide a truly unique opportunity and experience; one that provides economic benefits to rural property owners but does not directly compete with more conventional tourism-based opportunities inside the PSA. If located within a residential context, short-term rentals should serve to complement the residential character of the area rather than altering its nature. Therefore, while every location can be considered uniquely, short-term rentals are most appropriately located subject to the following development standards:

- Be located on lands designated Rural Lands, Neighborhood Commercial, Community Commercial, Mixed Use, or Economic Opportunity.

  *This property is designated Low Density Residential on the adopted 2045 Comprehensive Plan Land Use Map.*

- Be located on the edge or corner of an existing platted subdivision, rather than internal to it.

  *This parcel is located within an existing platted subdivision and fronts on Neck-O-Land Road. It is not internal to the subdivision.*

- Be located on a major road.

  *This property is located on Neck-O-Land Road, which is classified by the Virginia Department of Transportation as a local road; however, the road appears adequate to support the proposed use.*

- Be operated in a manner such that the property owner will continue to live and reside on the property during the rental.

  *The owner of the home will not reside on the same property as the proposed rental. The homeowner resides in a different part of the County.*

Staff finds the proposal is inconsistent with the recommendations of 2045 Comprehensive Plan.

## PROPOSED SUP CONDITIONS

Proposed conditions are provided in Attachment No. 1.

## STAFF RECOMMENDATION

Staff finds the proposal incompatible with surrounding zoning and development and not consistent with the recommendations of the adopted 2045 Comprehensive Plan.

Staff therefore does not recommend approval of the proposed SUP. Should the Board of Supervisors wish to recommend approval, staff has included proposed conditions for consideration.

TC/ap
SUP21-20_528NkOLndRd

Attachments:
1. Resolution
2. Location Map
3. Master Plan
4. Applicant Narrative
5. Lot Development Plan
6. Unapproved minutes from the December 1, 2021, Planning Commission Meeting

# **R E S O L U T I O N**

CASE NO. SUP-21-0020. 528 NECK-O-LAND ROAD TOURIST HOME

WHEREAS, the Board of Supervisors of James City County, Virginia, has adopted by Ordinance specific land uses that shall be subjected to a Special Use Permit (SUP) process; and

WHEREAS, Ms. Sharon Dennis has applied for an SUP to allow for the short-term rental of an entire two-bedroom single-family dwelling located at 528 Neck-O-Land Road and further identified as James City County Real Estate Tax Map Parcel No. 5510200008 (the "Property"); and

WHEREAS, the Planning Commission, following its public hearing on December 1, 2021, recommended denial of Case No. SUP-21-0020 by a vote of 6-0; and

WHEREAS, a public hearing was advertised, adjoining property owners notified, and a hearing conducted on Case No. SUP-21-0020; and

WHEREAS, the Board of Supervisors of James City County, Virginia, finds this use to be consistent with the 2045 Comprehensive Plan Land Use Map designation for the Property.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, after consideration of the factors in Section 24-9 of the James City County Code, does hereby approve the issuance of Case No. SUP-21-0020 as described herein with the following conditions:

1. *Master Plan* - This SUP shall permit a tourist home on property located at 528 Neck-O-Land Road and further identified as James City County (JCC) Real Estate Tax Map Parcel No. 5510200008 (the "Property"). The use and layout of the Property shall be generally as shown on the document entitled "JCC SUP-21-0020, 528 Neck-O-Land Road, Tourist Home" and date stamped November 10, 2021 (the "Master Plan"), with any deviations considered per Section 24-23(a)(2) of the Zoning Ordinance, as amended. This condition does not restrict improvements typical of a residential property as determined by the Director of Planning.

2. *Commencement* - Evidence of a business license and updated Certificate of Occupancy shall be provided to the Director of Planning within twelve (12) months from the issuance of the SUP, or this SUP shall automatically be void.

3. *Number of rental room occupants* - There shall be no more than two (2) bedrooms available for rent to visitors and no more than four (4) rental occupants total at any one time.

4. *Contracts per Rental Period* - There shall not, during any period of time, be simultaneous rentals of the Property under separate contracts.

5. *Signage* - No signage related to the use of the tourist home shall be permitted on the Property.

6. *Parking* - Off-site parking for this use shall be prohibited. No oversized commercial vehicles associated with rental occupants of the tourist home, such as, but not limited to, buses, commercial trucks, and trailers shall be allowed to park on the Property.

7. *Severance Clause* - This SUP is not severable. Invalidation of any word, phrase, clause, sentence, or paragraph shall invalidate the remainder.

_____

Chairman, Board of Supervisors

ATTEST:

_____

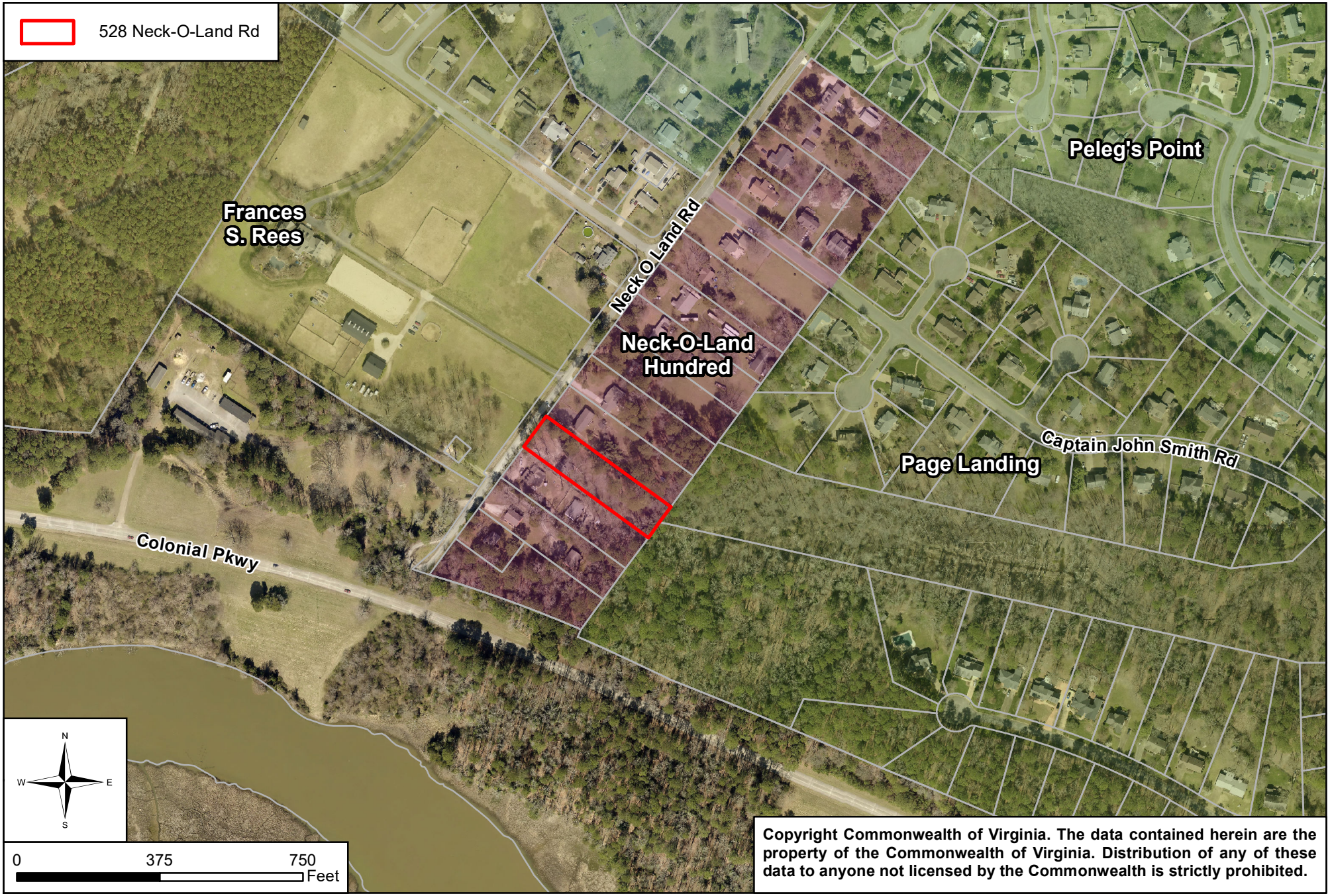
Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

SUP21-20_528NkOLndRd-res

# JCC SUP-21-0020, 528 Neck-O-Land Rd
# Tourist Home

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# JCC SUP-21-0020, 528 Neck-O-Land Rd Tourist Home

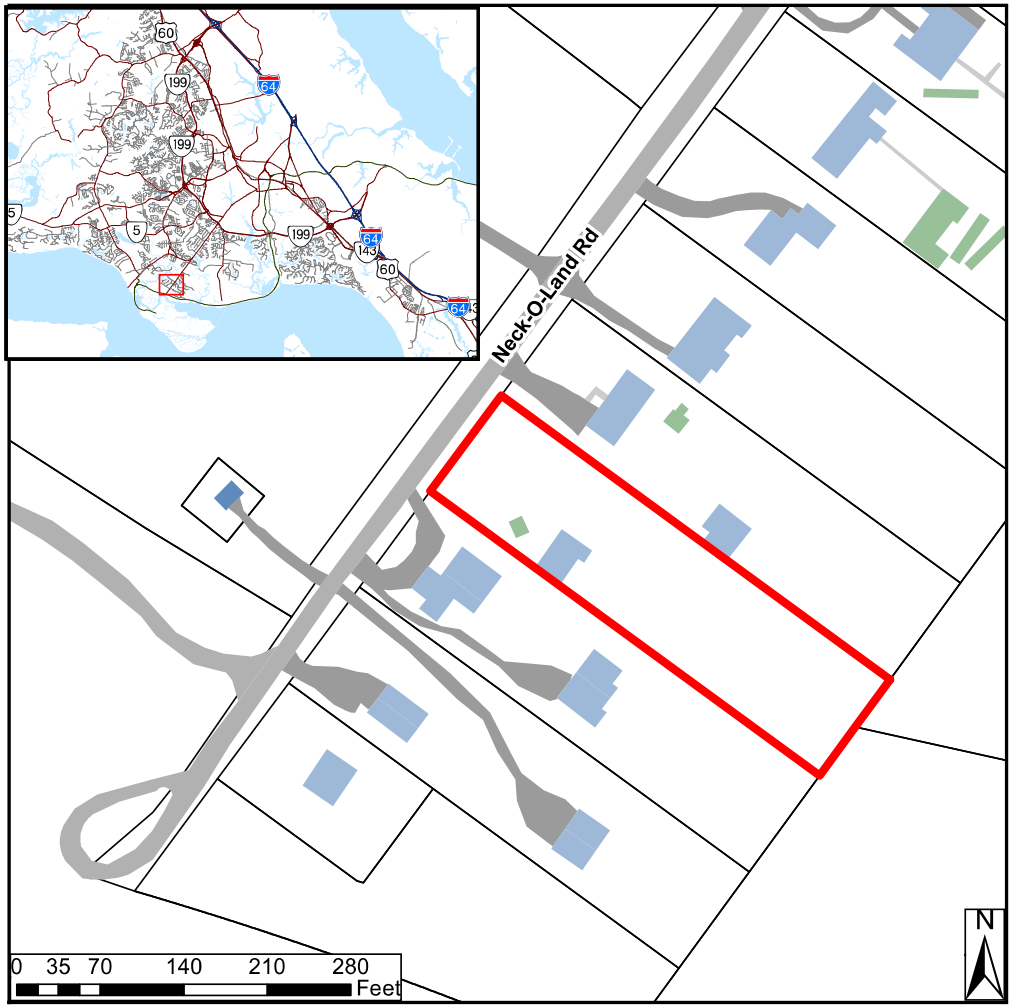
Master Plan Dated November 10, 2021

## Property Information

5510200008
Sharon A Dennis
528 Neck-O-Land Rd
Williamsburg, VA 23185
R8 Rural Residential
Comp Plan: Low Density Residential
Acres: .99

## General Notes

1. Site is served by public water and sewer.
2. Property is not located in a FEMA Flood zone.
3. Property does not contain Resource Protection Area.
4. Property has an existing driveway.
5. A minimum of two parking spots shall be provided (one parking spot per bedroom).




Maps Not To Scale

## Adjacent Properties

5510300049
United States of America
2049 Back River Ln
Williamsburg, VA 23185
PL Public Lands

5510300001C
Page Landing Homes Association
4744 Captain John Smith
Williamsburg, VA 23185
R1 Limited Residential

4732500001
Philip D Trustee
Decamp
105 Constance Ave
Williamsburg, VA 23185
R8 Rural Residential

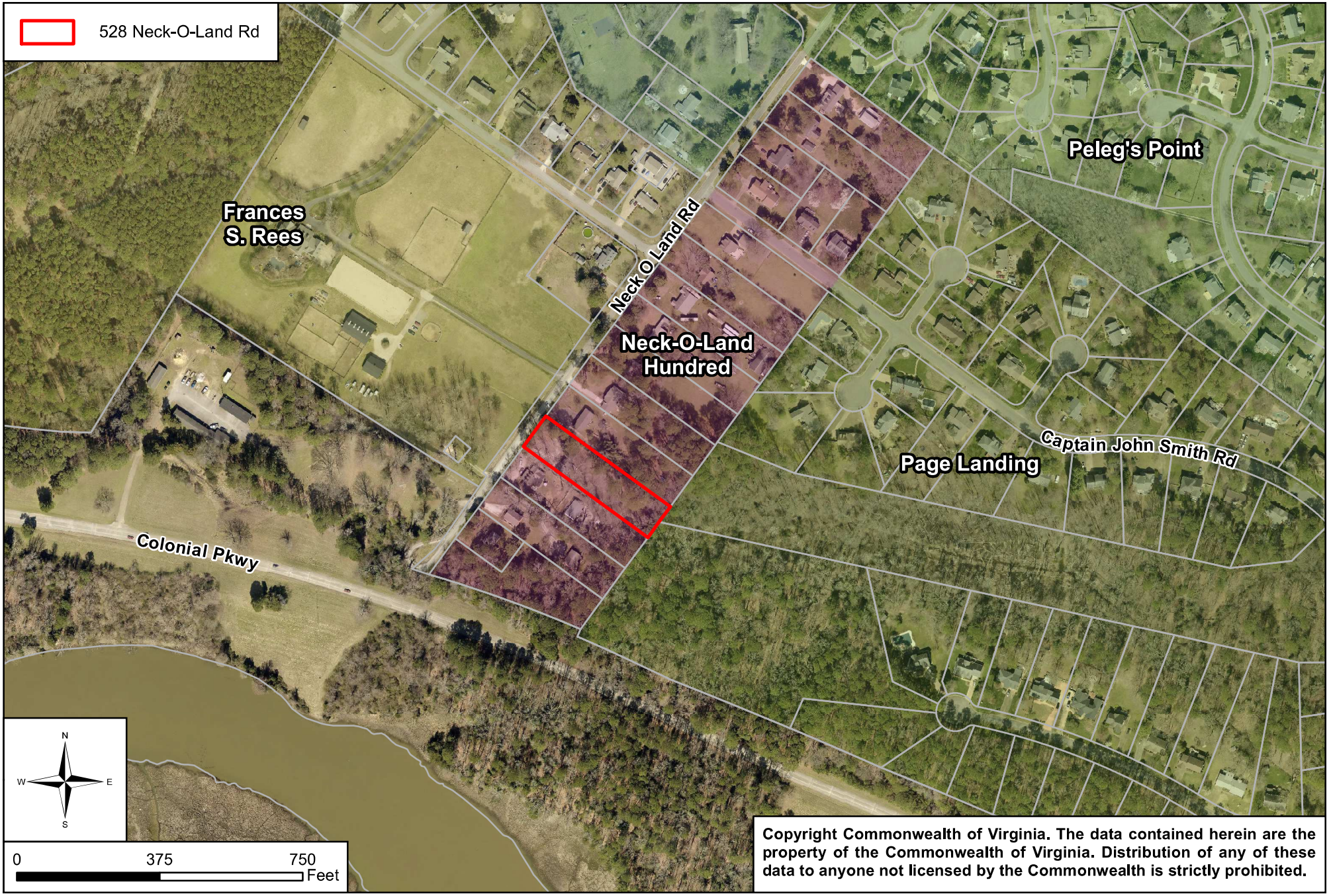
5510200007
Robert M & Karen Y Finnan
526 Neck O Land Rd
Williamsburg, VA 23185
R8 Rural Residential

5510200009
Wilson Huffman
530 Neck O Land Rd
Williamsburg, VA 23185
R8 Rural Residential

## Sheet Index


1. Cover Page
2. Location Map
3. Site Details

# JCC SUP-21-0020, 528 Neck-O-Land Rd
# Tourist Home

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JCC SUP-21-0020
528 Neck-O-Land Road Tourist Home

To whom it may concern,

I have owned my cottage on 528 Neck O Land Road since September 2000. I love the area and my home. I've had to relocate to a larger home to accommodate my new family since that time. I have had renters at this location since Approximately 2008. I am applying for a Special Use Permit to host A short term rental so that I can properly maintain and enhance this beautiful cottage. It would be a pleasure to share the history with those seeking the peace and tranquility of Williamsburg. I don't see any impact on neighbors, particularly, The neighbors on either side of this property. They would be supportive. On one side of my property, I do not have the exact address, I believe they are already operational with an SUP as a short term rental. I've experienced nothing but quiet and pleasant visitors and I see no reason for any concerns on the location having any impact.

Sincerely,
Sharon Dennis

-SCREENED PATIO.....250 SQ.FT.
-LARGE SHEDS.....2,554 SQ.FT.
-PUMP HOUSE.....28 SQ.FT.

TOTAL 2,832 SQ.FT.
7.1 % IMPERVIOUS

PROPOSED IMPERVIOUS:

-SCREENED PATIO.....250 SQ.FT.
-LARGE SHEDS.....2,554 SQ.FT.
-PUMP HOUSE.....28 SQ.FT.
-PROPOSED HOUSE..1,494 SQ.FT.
-GRAVEL.....1,035 SQ.FT.

TOTAL 5,361 SQ.FT.
13.4 % IMPERVIOUS

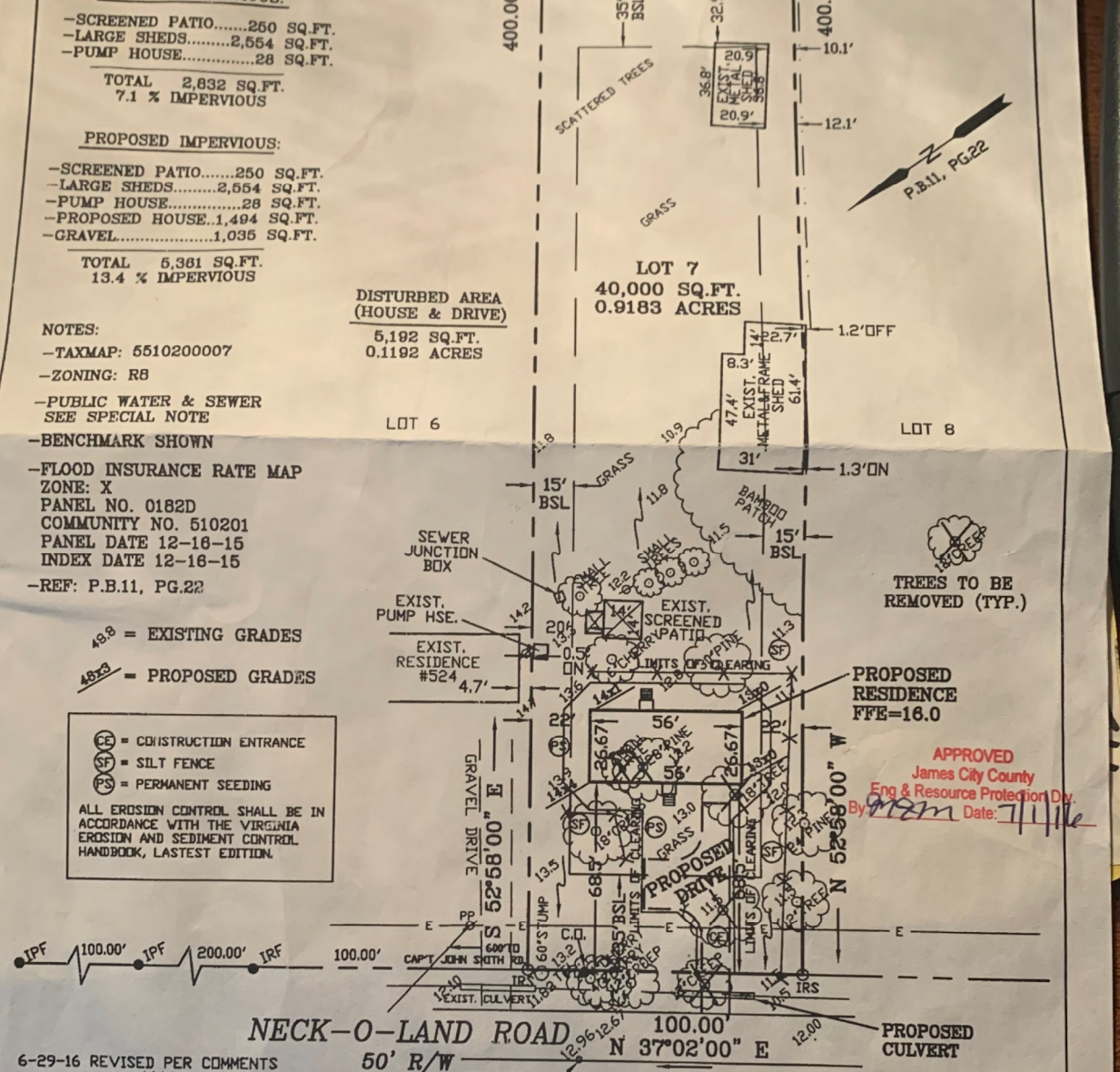
DISTURBED AREA
(HOUSE & DRIVE)
5,192 SQ.FT.
0.1192 ACRES

NOTES:
-TAXMAP: 5510200007
-ZONING: R8
-PUBLIC WATER & SEWER
SEE SPECIAL NOTE
-BENCHMARK SHOWN
-FLOOD INSURANCE RATE MAP
ZONE: X
PANEL NO. 0182D
COMMUNITY NO. 510201
PANEL DATE 12-16-15
INDEX DATE 12-16-15
-REF: P.B.11, PG.22

48.8 = EXISTING GRADES
48x3 = PROPOSED GRADES

CE = CONSTRUCTION ENTRANCE
SF = SILT FENCE
PS = PERMANENT SEEDING

ALL EROSION CONTROL SHALL BE IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK, LASTEST EDITION.




APPROVED
James City County
Eng & Resource Protection Div.
By: MRM Date: 7/1/16

6-29-16 REVISED PER COMMENTS

COMMONWEALTH OF VIRGINIA
RANDALL R. PARKER
LIC.NO. 002376
6-29-16
LAND SURVEYOR

The applicant may need to obtain the following:
X VDOT LUP
VSMP

I, ..... HEREBY CERTIFY THAT THE PROPERTY SHOWN ON THIS PLAT WAS SURVEYED ON THIS DATE AND IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

THERE ARE NO ENCROACHMENTS OF OTHER BUILDINGS EXCEPT AS SHOWN.

PARKER SURVEYING INC.

SPECIAL NOTES:
1) WATER METER NOT FOUND FOR THIS LOT
2) SEWER C.O. FOUND APPEARS TO RUN TO ADJOINNING LOT ADDRESS # 524

# 526 NECK-O-LAND ROAD

# LOT DEVELOPMENT PLAN

LOT 7 BLOCK B

NECK-O-LAND HUNDRED
P.B.11, PG.22
JAMES CITY COUNTY, VIRGINIA

**Unapproved Minutes of the December 1, 2021**
**Planning Commission Regular Meeting**

**SUP-21-0020. 528 Neck-O-Land Road Tourist Home**

Ms. Terry Costello, Senior Planner, stated that Ms. Sharon Dennis has applied for an SUP to allow the short-term rental of a two-bedroom single-family home at 528 Neck O Land Road. Ms. Costello stated that the property is zoned R-8, Rural Residential, is designated Low Density Residential on the 2045 Comprehensive Plan Land Use Map, and is located inside the PSA. Ms. Costello stated that, if granted, this SUP would allow for short-term rentals throughout the year. Ms. Costello stated that no changes to the footprint of the home are proposed.

Ms. Costello stated that staff finds some favorable factors for this application, such as the presence of adequate off-street parking and that the applicant will obtain the proper licensing and inspections; however, the proposal does not meet the recommendations regarding locations for short-term rentals specified in the 2045 Comprehensive Plan.

Ms. Costello stated that staff finds the proposal incompatible with surrounding zoning and development, and inconsistent with the recommendations of the adopted 2045 Comprehensive Plan,; therefore, staff is unable to recommend approval of this application.

Ms. Costello noted that staff received two phone calls and one email from adjacent property owners expressing their concern over this use. Ms. Costello stated that those property owners were not in favor of this application.

Ms. Costello stated that should the Planning Commission recommend approval of this application, staff has included proposed conditions for consideration.

Mr. Haldeman called for disclosures from the Commission.

There were no disclosures.

Mr. Haldeman opened the Public Hearing.

Ms. Dennis, Applicant, addressed the Commission in support of the application and short-term rentals in general.

Mr. Berggren addressed the Commission in support of short-term rentals with regards to possible confusion of the Ordinance conflicting with the Comprehensive Plan.

Mr. Darr Barshis, 532 Neck-O-Land Road, addressed the Commission in support of the application.

As no one else wished to speak, Mr. Haldeman closed the Public Hearing.

Ms. Leverenz stated this was a tough decision for her due to the rural nature of Neck-O-Land Road.

Ms. Leverenz stated that under the circumstances they should consistently support the guidelines in the Comprehensive Plan and that she is concerned with the number of short-term rentals in the area.

Mr. Krapf stated that he agrees with Ms. Leverenz and that there is no guarantee that the next owner of the property will share the same philosophy as the current applicant.

Mr. Polster stated that if an SUP was specific to the applicant and not the property, he would be more inclined to recommend approval on a case-by-case basis.

Mr. Polster made a motion not to recommend approval of SUP-21-0020.

On a roll call vote, the Commission voted not to recommend approval of SUP-21-0020. 528 Neck-O-Land Road Tourist Home. (6-0)

**AGENDA ITEM NO. H.1.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Michael Woolson, Section Chief - Resource Protection

SUBJECT: Appeal of Notice of Violation, 5032 River Drive

---

**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Memorandum | Staff Report |
| | Resolution to Affirm ESC Violation - RA Coleman | Resolution |
| | Resolution to Affirm SWM Violation - Patterson | Resolution |
| | Resolution to Affirm SWM Violation - RA Coleman | Resolution |
| | Resolution to Reverse ESC Violation - RA Coleman | Resolution |
| | Resolution to Reverse ESC VIolation - Patterson | Resolution |
| | Resolution to Affirm ESC Violation - Patters | Resolution |
| | Resolution to Reverse SWM violation - Patterson | Resolution |
| | Resolution to Reverse SWM violation - RA Coleman | Resolution |
| | Figure 1. June 23, 2017 | Backup Material |
| | Figure 2. July 2, 2017 | Backup Material |
| | Figure 3. September 15, 2017 | Backup Material |
| | Figure 4. September 15, 2017 | Backup Material |
| | Figure 6. May 31, 2021 | Backup Material |
| | Figure 5. October 17, 2020 | Backup Material |
| | Figure 7. June 18, 2021 | Backup Material |
| | Figure 8. June 21, 2021 | Backup Material |
| | Figure 9. June 23, 2021 | Backup Material |
| | Figure 10. July 1, 2021 | Backup Material |
| | Figure 11. July 1, 2021 | Backup Material |
| | Exhibit A. Sensitive Area Activity Application, June 28, 2017 | Backup Material |
| | Exhibit B. : The Structures Group, forensic review and structural design of retaining wall, June 19, 2017 | Backup Material |

| | | |
|---|---|---|
| 🗋 | Exhibit C. ECS slope evaluation, August 3, 2001 | Backup Material |
| 🗋 | Exhibit D: Building Permit application, June 21, 2017 | Backup Material |
| 🗋 | Exhibit E: Building Permit Final, December 8, 2017 | Backup Material |
| 🗋 | Exhibit F: Notice of Violation, June 28, 2021 | Backup Material |
| 🗋 | Exhibit G: Notice of Violation, November 17, 2021 | Backup Material |
| 🗋 | Exhibit H: County Code Sections 8-4, 8-5 and 8-22 | Backup Material |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Engineering & Resource Protection | Small, Toni | Approved | 12/22/2021 - 12:02 PM |
| Development Management | Holt, Paul | Approved | 12/22/2021 - 12:32 PM |
| Publication Management | Daniel, Martha | Approved | 12/22/2021 - 1:49 PM |
| Legal Review | Kinsman, Adam | Approved | 12/28/2021 - 7:35 AM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:07 PM |
| Board Secretary | Purse, Jason | Approved | 1/4/2022 - 2:12 PM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:56 PM |

**M E M O R A N D U M**

DATE: January 11, 2022

TO: The Board of Supervisors

FROM: Michael D. Woolson, Section Chief, Resource Protection
Elizabeth Parman, Assistant County Attorney

SUBJECT: Appeal of Notice of Violation for Land Disturbing, Erosion and Sediment Control, and Stormwater Management Ordinance Violations, dated June 28, 2021 and November 17, 2021 - 5032 River Drive

---

Mr. Gregory S. Bean, Esq. filed an appeal to the James City County Board of Supervisors (the "Board") on July 28, 2021, on behalf of Mr. Danny Patterson (the "Owner"). The Owner is appealing the administrative decision that there are violations of County Code Chapter 8 - Erosion and Sediment Control Ordinance ("Ordinance") at 5032 River Drive (the "Property") because the permit requirements outlined in Sections 8-4, 8-5, and 8-22 of the James City County Code have not been met.

Mr. Bean appeared at the September 14, 2021, Board of Supervisors meeting to request a one-month deferral which was granted. Mr. Bean also appeared at the October 12, 2021, Board of Supervisors meeting to request a three-month deferral which was granted.

Mr. J. Stephen Roberts, Esq. filed an appeal to the James City County Board of Supervisors (the "Board") on December 10, 2021, on behalf of R.A. Coleman, Inc. (the "Contractor"). The Contractor is appealing the administrative decision that there are violations of County Code Chapter 8 - Erosion and Sediment Control Ordinance ("Ordinance") at 5032 River Drive (the "Property") because the permit requirements outlined in Sections 8-4, 8-5, and 8-22 of the James City County Code have not been met.

Pursuant to James City County Code Section 8-8 and Section 8-32, the Board of Supervisors shall hear appeals of administrative decisions. In reviewing the County agent's actions, the Board of Supervisors shall consider evidence and opinions presented by the aggrieved appellant and the County agent. After considering the evidence and opinions, the Board of Supervisors may affirm, reverse, or modify the decision of the County agent. The Board of Supervisors' decision shall be final, subject only to review by the Circuit Court of James City County.

**Background Information**

On June 21, 2021, staff received a phone call from the Virginia Marine Resources Commission (VMRC) about a potential navigation hazard in Diascund Creek due to some trees in the water. Staff conducted a field investigation on June 21, 2021 and discovered that the hillside between the existing house located at 5032 River Drive and Diascund Creek had collapsed sending debris into the creek. The hillside collapse appeared to affect 5030, 5032, and 5034 River Drive, an area of approximately 6,000 square feet. In the ensuing office investigation, staff was not able to locate the submittal of any plan or permit showing the work being performed at 5032 River Drive. After talking to neighbors, it was determined that approximately 30 to 50 dump truck loads of dirt were delivered and spread out in the rear yard with the understanding that it was intended to fill in holes from a recently removed deck. The neighbors indicated that the trucks were from Coleman Nursery.

On June 28, 2021, staff sent a Notice of Violation to Mr. Patterson and on November 17, 2021, staff also sent a Notice of Violation to Mr. Randy Coleman, R.A. Coleman, Inc. These notices outlined the nature of the violations on the property. Specifically, the work caused a global rotational slope failure in the Resource Protection Area (RPA). Neither Mr. Patterson nor his contractor, R.A. Coleman, Inc., submitted an Erosion and Sediment Control Plan nor applied for a land disturbing permit as required by County Code Chapter 8.

*History*

In 2017, Mr. Patterson applied for a Chesapeake Bay Preservation Waiver (CBE-17-095) to allow for the construction of a retaining wall to help stabilize the structural integrity of the existing home. He also submitted an Erosion and Sediment Control Plan (E&S-028-17) and received a building permit (B17-2037). The retaining wall received final building approval on December 8, 2017. When E&S-028-17 was approved, it was determined by staff that a land disturbing permit was not required because the extent of the work was less than 2,500 square feet.

In 2001, Mr. Patterson commissioned ECS Consulting Engineers to do a slope stability analysis. The report was supplied to the County on June 28, 2017, as supporting documentation for the justification of a retaining wall in the Chesapeake Bay Preservation Ordinance Sensitive Area Activity Application. The results of this slope stability analysis showed that a rotational slope failure was possible.

The retaining wall built in 2017 was removed at some point in time prior to the slope failure of June 21, 2021. There are no records that Mr. Patterson or any contractor applied for a demolition permit to remove the retaining wall or the deck on the back of the house.

**Staff Findings**

Staff has reviewed the appeal and associated documents and offers the following information for the Board's consideration.

1. Mr. Danny Patterson is the current owner of the Property located at 5032 River Drive.

2. On June 21, 2021, Mr. Patterson's hired contractor, R.A. Coleman, Inc., filled in a portion of his rear yard with dirt, the entirety of which is in the RPA.

3. At approximately 3:30 p.m. on June 21, 2021, the slope collapsed due to the extra weight that had been placed on it over the course of the day. The slope failure affected neighboring properties and resulted in land disturbance of approximately 6,000 square feet. Staff received a call from the VMRC at approximately 4:30 p.m. relaying concerns about navigation hazards in Diascund Creek.

4. Neither Mr. Patterson nor his contractor applied for or received any County approvals for the work that was done. Neither the Owner nor the Contractor submitted an Erosion and Sediment Control Plan as required by County Code Section 8-4 nor for a land disturbing permit as required by County Code Section 8-22. Mr. Patterson previously applied for permits for a retaining wall completed in 2017.

**Issues to be Decided by the Board**

1. Whether Mr. Patterson violated County Code Section 8-4 for failing to submit an Erosion and Sediment Control Plan for land disturbing activity.

2. Whether Mr. Patterson violated County Code Section 8-22 for failing to obtain a stormwater (land disturbing) permit.

3. Whether R.A. Coleman, Inc. violated County Code Section 8-4 for failing to submit an Erosion and Sediment Control Plan for land disturbing activity.

4. Whether R.A. Coleman, Inc. violated County Code Section 8-22 for failing to obtain a stormwater (land disturbing) permit.

MDW/EP/ap
ESCSWMOrdViol_5032RvrRd-mem

Attachments

# **R E S O L U T I O N**

AFFIRMING THE EROSION AND SEDIMENT CONTROL VIOLATION

AT 5032 RIVER DRIVE

WHEREAS, Mr. J. Stephen Roberts, Registered Agent, on behalf of R.A. Coleman, Inc. ("Appellant"), has appeared before the Board of Supervisors of James City County (the "Board") on January 11, 2022, to appeal a Notice of Violation issued on November 17, 2021, to the Appellant for violations of County Code Chapter 8, Erosion and Sediment Control Ordinance, on a parcel of property identified as James City County Real Estate Tax Map Parcel No. 0930300007 and further identified as 5032 River Drive (the "Property"); and

WHEREAS, the Board, pursuant to County Code Section 8-8, has listened to the arguments presented by the Appellant and by the County agent and has carefully considered all evidence entered into the record.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, by a majority vote of its members affirms the Notice of Violation issued to R.A. Coleman, Inc. on November 17, 2021, and finds that R.A. Coleman, Inc. is in violation of County Code, Chapter 8, Article I, Erosion and Sediment Control, sec. 8-4.

NOW, THEREFORE, BE IT FURTHER RESOLVED that the Board of Supervisors of James City County, Virginia, encourages the parties to reach a settlement agreement to abate the violation.

NOW, THEREFORE, BE IT FINALLY RESOLVED that the Board of Supervisors of James City County, Virginia, urges the County Attorney's Office to seek the maximum penalties allowed by the County Code if this matter is brought before the Circuit Court.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

AffESCViolColeman-5032RvrRd-res

# **R E S O L U T I O N**

AFFIRMING THE STORMWATER MANAGEMENT VIOLATION AT 5032 RIVER DRIVE

WHEREAS, Mr. Gregory Bean, Esq., on behalf of Mr. Danny Patterson ("Appellant"), has appeared before the Board of Supervisors of James City County (the "Board") on January 11, 2022, to appeal a Notice of Violation issued on June 28, 2021, to the Appellant for violations of County Code Chapter 8, Erosion and Sediment Control Ordinance, on a parcel of property identified as James City County Real Estate Tax Map Parcel No. 0930300007 and further identified as 5032 River Drive (the "Property"); and

WHEREAS, the Board, pursuant to County Code Section 8-32, has listened to the arguments presented by the Appellant and by the County agent and has carefully considered all evidence entered into the record.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, by a majority vote of its members affirms the Notice of Violation issued to Mr. Danny Patterson on June 28, 2021, and finds that Mr. Danny Patterson is in violation of County Code, Chapter 8, Article II, The Virginia Stormwater Management Program, Section 8-22.

NOW, THEREFORE, BE IT FURTHER RESOLVED that the Board of Supervisors of James City County, Virginia, encourages the parties to reach a settlement agreement to abate the violation.

NOW, THEREFORE, BE IT FINALLY RESOLVED that the Board of Supervisors of James City County, Virginia, urges the County Attorney's Office to seek the maximum penalties allowed by the County Code if this matter is brought before the Circuit Court.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

AffSWMViolPatterson-5032RvrRd-res

# R E S O L U T I O N

AFFIRMING THE STORMWATER MANAGEMENT VIOLATION AT 5032 RIVER DRIVE

WHEREAS, Mr. J. Stephen Roberts, Registered Agent, on behalf of R.A. Coleman, Inc. ("Appellant"), has appeared before the Board of Supervisors of James City County (the "Board") on January 11, 2022, to appeal a Notice of Violation issued on November 17, 2021, to the Appellant for violations of County Code Chapter 8, Erosion and Sediment Control Ordinance, on a parcel of property identified as James City County Real Estate Tax Map Parcel No. 0930300007 and further identified as 5032 River Drive (the "Property"); and

WHEREAS, the Board, pursuant to County Code Section 8-32, has listened to the arguments presented by the Appellant and by the County agent and has carefully considered all evidence entered into the record.; and

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, by a majority vote of its members affirms the Notice of Violation issued to R.A. Coleman, Inc. on November 17, 2021, and finds that R.A. Coleman, Inc. is in violation of County Code, Chapter 8, Article II, The Virginia Stormwater Management Program, Section 8-22.

NOW, THEREFORE, BE IT FURTHER RESOLVED that the Board of Supervisors of James City County, Virginia, encourages the parties to reach a settlement agreement to abate the violation.

NOW, THEREFORE, BE IT FINALLY RESOLVED that the Board of Supervisors of James City County, Virginia, urges the County Attorney's Office to seek the maximum penalties allowed by the County Code if this matter is brought before the Circuit Court.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

AffSWMViolColeman-5032RvrRd-res

# **R E S O L U T I O N**

REVERSING THE EROSION AND SEDIMENT CONTROL VIOLATION

AT 5032 RIVER DRIVE

WHEREAS, Mr. J. Stephen Roberts, Registered Agent, on behalf of R.A. Coleman, Inc. ("Appellant"), has appeared before the Board of Supervisors of James City County (the "Board") on January 11, 2022, to appeal a Notice of Violation issued on November 17, 2021, to the Appellant for violations of County Code Chapter 8, Erosion and Sediment Control Ordinance on a parcel of property identified as James City County Real Estate Tax Map Parcel No. 0930300007 and further identified as 5032 River Drive (the "Property"); and

WHEREAS, the Board, pursuant to County Code Section 8-8, has listened to the arguments presented by the Appellant and by the County agent and has carefully considered all evidence entered into the record.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, by a majority vote of its members reverses the Notice of Violation issued to R.A. Coleman, Inc. on November 17, 2021, and finds that R.A. Coleman, Inc. is not in violation of County Code, Chapter 8, Article I, Erosion and Sediment Control.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

RevESCViolColeman-5032RvrRd-res

# **R E S O L U T I O N**

REVERSING THE EROSION AND SEDIMENT CONTROL VIOLATION

AT 5032 RIVER DRIVE

WHEREAS, Mr. Gregory Bean, Esq., on behalf of Mr. Danny Patterson ("Appellant"), has appeared before the Board of Supervisors of James City County (the "Board") on January 11, 2022, to appeal a Notice of Violation issued on June 28, 2021, to the Appellant for violations of County Code Chapter 8, Erosion and Sediment Control Ordinance, on a parcel of property identified as James City County Real Estate Tax Map Parcel No. 0930300007 and further identified as 5032 River Drive (the "Property"); and

WHEREAS, the Board, pursuant to County Code Section 8-8, has listened to the arguments presented by the Appellant and by the County agent and has carefully considered all evidence entered into the record.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, by a majority vote of its members reverses the Notice of Violation issued to Mr. Danny Patterson on June 28, 2021, and finds that Mr. Danny Patterson is not in violation of County Code, Chapter 8, Article I, Erosion and Sediment Control.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

RevESCViolPatterson-5032RvrRd-res

# **R E S O L U T I O N**

AFFIRMING THE EROSION AND SEDIMENT CONTROL VIOLATION

AT 5032 RIVER DRIVE

WHEREAS, Mr. Gregory Bean, Esq., on behalf of Mr. Danny Patterson ("Appellant"), has appeared before the Board of Supervisors of James City County (the "Board") on January 11, 2022, to appeal a Notice of Violation issued on June 28, 2021, to the Appellant for violations of County Code Chapter 8, Erosion and Sediment Control Ordinance, on a parcel of property identified as James City County Real Estate Tax Map Parcel No. 0930300007 and further identified as 5032 River Drive (the "Property"); and

WHEREAS, the Board, pursuant to County Code Section 8-8, has listened to the arguments presented by the Appellant and by the County agent and has carefully considered all evidence entered into the record.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, by a majority vote of its members affirms the Notice of Violation issued to Mr. Danny Patterson on June 28, 2021, and finds that Mr. Danny Patterson is in violation of County Code, Chapter 8, Article I, Erosion and Sediment Control, Section 8-4.

NOW, THEREFORE, BE IT FURTHER RESOLVED that the Board of Supervisors of James City County, Virginia, encourages the parties to reach a settlement agreement to abate the violation.

NOW, THEREFORE, BE IT FINALLY RESOLVED that the Board of Supervisors of James City County, Virginia, urges the County Attorney's Office to seek the maximum penalties allowed by the County Code if this matter is brought before the Circuit Court.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

AffESCViolPatterson-5032RvrRd-res

# **R E S O L U T I O N**

REVERSING THE STORMWATER MANAGEMENT VIOLATION AT 5032 RIVER DRIVE

WHEREAS, Mr. Gregory Bean, Esq., on behalf of Mr. Danny Patterson ("Appellant"), has appeared before the Board of Supervisors of James City County (the "Board") on January 11, 2022, to appeal a Notice of Violation issued on June 28, 2021, to the Appellant for violations of County Code Chapter 8, Erosion and Sediment Control Ordinance, on a parcel of property identified as James City County Real Estate Tax Map Parcel No. 0930300007 and further identified as 5032 River Drive (the "Property"); and

WHEREAS, the Board, pursuant to County Code Section 8-32, has listened to the arguments presented by the Appellant and by the County agent and has carefully considered all evidence entered into the record.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, by a majority vote of its members reverses the Notice of Violation issued to Mr. Danny Patterson on June 28, 2021, and finds that Mr. Danny Patterson is not in violation of County Code, Chapter 8, Article II, The Virginia Stormwater Management Program.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

RevSWMViolPatterson-5032RvrRd-res

# **R E S O L U T I O N**

REVERSING THE STORMWATER MANAGEMENT VIOLATION AT 5032 RIVER DRIVE

WHEREAS, Mr. J. Stephen Roberts, Registered Agent, on behalf of R.A. Coleman, Inc. ("Appellant"), has appeared before the Board of Supervisors of James City County (the "Board") on January 11, 2022, to appeal a Notice of Violation issued on November 17, 2021, to the Appellant for violations of County Code Chapter 8, Erosion and Sediment Control Ordinance, on a parcel of property identified as James City County Real Estate Tax Map Parcel No. 0930300007 and further identified as 5032 River Drive (the "Property"); and

WHEREAS, the Board, pursuant to County Code Section 8-32, has listened to the arguments presented by the Appellant and by the County agent and has carefully considered all evidence entered into the record.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, by a majority vote of its members reverses the Notice of Violation issued to R.A. Coleman, Inc. on November 17, 2021, and finds that R.A. Coleman, Inc. is not in violation of County Code, Chapter 8, Article II, The Virginia Stormwater Management Program.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

RevSWMViolColeman-5032RvrRd-res

Engineering JUN 28 2017 Protection

# Chesapeake Bay Preservation Ordinance
# Sensitive Area Activity Application

RECEIVED

For Office Use Only CBE 17-095
CB Number CBS 17-028

**Submission Requirements: (Check all applicable)**

- [x] A $25 non-refundable processing fee payable to Treasurer, James City County.
- [x] RPA - landward 50' – Complete Items 1 – 5, and sign on Page 3.
- [ ] RPA - seaward 50' – Complete Items 1 – 5, sign on Page 3 and submit an additional $100 non-refundable fee payable to Treasurer, James City County, for the Chesapeake Bay Board.
- [ ] Conservation Easement – Complete Items 1, 2, 3, and 5, and sign on Page 3.
- [x] Steep Slopes ≥ 25 percent - Complete Items 1, 2, 3, and 5, and sign on Page 3.
- [x] Attach plans as required (see instruction on Page 4, Item 4).
- [ ] Applicable surety as required for mitigation (see **Mitigation Rates Table** on Page 2).

***Upon completion, please return pages 1-3 to the JCC Engineering and Resource Protection Division***

**Property Owner Information:** Date: 6-19-17

Name: Danny E. Patterson
Address: 5032 River Drive; Lanexa, VA 23089
Phone: 757-897-2871 Fax: _____ Email: depatterson@verizon.net

**Contact (if different from above):**

Name: Michael A. Matthews Phone: 757-220-0465
Email: mmatthews@thestructuresgroup.com

**Project Information:**

Project Address: 5032 River Drive; Lanexa, VA 23089
Subdivision Name, Lot, and Section No.: Cyprus Point Subdivision
Parcel Identification No. or Tax Map No.: 0930300007
Date Lot was platted: 7-8-83 Line or Bldg Permit No.: A171119/ E35-28-17

**Activity Location and Impacts (Square Feet - SF):** (check all that apply)

- [x] Steep Slopes ≥ 25 percent 2,197 (SF)
- [ ] Conservation Easement _____ (SF)
- [ ] Trees to be Removed _____ (#)
- [x] RPA - Landward 50' 2,197 (SF)
- [ ] RPA - Seaward 50' _____ (SF)
- [x] Proposed Impervious Cover +122 (SF)

**Activity involves:** (check all that apply)

- [ ] New principal structure construction
- [ ] Permitted buffer modifications:
- [x] Accessory (Detached) Structure or Patio
- [ ] Other: _____
- [ ] Building addition to principal structure
- [ ] Dead/diseased/dying tree removal
- [ ] Invasive/noxious weed removal
- [ ] Redevelopment: _____
- [ ] Attached Deck
- [ ] Sightline
- [ ] Access path/trail



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**For Office Use Only** CBR17-095
CBS
**CB Number** 17-028

1. **Description of requested sensitive area activity and reason for request:**

*(In the description, please indicate the reason for the proposed structure or activity, the location, sizes and dimensions of feature. For decks or expansions, indicate if ground floor, first floor or other levels)*

A timber retaining wall is proposed to be installed approximately 20'-0" down slope from the existing residence to prevent additional erosion and distress to the residence. The retaining wall is proposed to be 122' long and up to 8-0" tall.

2. As per Section 23-9 of the Chesapeake Bay Preservation Ordinance, if there is an on-site sewage disposal system on this property, has it been inspected and/or pumped out is the past five years? ☑ **Yes** ☐ **No**

3. Are permits from other local, State or Federal agencies required for any portion of this project? ☑ **Yes** ☐ **No**
(If yes, please explain) James City County Building Permit

4. **Water Quality Impact Assessment**

The purpose of a water quality impact assessment is to demonstrate that the project will result in the removal of no less than 75 percent of sediments and 40 percent of nutrients from post-development stormwater run-off and that it will retard runoff, prevent accelerated erosion, promote infiltration, and filter non-point source pollution equivalent to the full undisturbed 100-foot buffer.

A. Why is this encroachment necessary? Can it be relocated to avoid RPA impacts?
The existing slope has failed. No, The entire rear portion of the property is completely within the RPA boundary.

B. What measures will be used to minimize impervious area? Examples: pervious pavers, removal of existing impervious surfaces (concrete, pavement, etc.) in the RPA not needed for the project
The proposed retaining wall will be filled and graded with topsoil to minimize the impact of the impervious cover.

5. **Proposed mitigation measures:**

**Note:** All mitigation measures must be shown in detail on a mitigation plan. Show both location of mitigation measures and plant species if applicable. All mitigation plants must be native species and be located in the sensitive area (RPA or Conservation Easement).

**Mitigation Rates Table**

| Impervious Area (SF) | Mitigation Required | Surety |
|---|---|---|
| <400 | 1 tree and 3 shrubs | $250 |
| 400-1,000 | 1 canopy tree, 2 understory trees and 3 shrubs per 400 SF (or fraction thereof) | $1,000 |
| >1,000 | Plant at same rate as 400 – 1,000; or may be determined by Director of Engineering and Resource Protection Division | To be determined |


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**For Office Use Only** CBE 17-095
**CB Number** CBS 17-028

A. Vegetation/ground cover enhancement of buffer (see Mitigation Rates Table on previous page).

- ☐ Number of native canopy trees _____
- ☐ Number of native understory trees _____
- ☐ Number of native shrubs _____
- ☐ Square feet of native ground cover _____
- ☐ Square feet of mulch _____

B. Best Management Practices (BMPs)

- ☐ EC-2 (degradable) erosion control matting
- ☐ Dry Swale
- ☑ Silt fence
- ☐ Turf (Nutrient) Management Plan
- ☐ Bioretention or rain garden practice
- ☐ Infiltration Area/Trench/Drywell
- ☐ Structural BMP (Wet or Dry Pond)
- ☐ Rain Barrel
- ☐ Gravel under deck (3" of gravel over synthetic filter fabric under entire deck area)
- ☐ Other: _____

**I understand that the following are approval conditions:**

1) **Mitigation for the above activity shall follow the approved mitigation plan and be guaranteed with a form of surety acceptable to the County Attorney.**
2) **Limits of disturbance as shown on the approved plan shall not be exceeded.**
3) **This approval shall become null and void if construction has not begun within 12 months of the approval date.**
4) **Surety will be released following the completion and inspection of mitigation plantings.**

Property owner signature _____ Date 6/16/17

Program Administrator _____ Date 7/6/17
Authorized Signature

For Office Use Only

Approval of retaining wall and drainage structures to guarantee the structural integrity of the existing home.

Approval expires 7/6/18

**Surety Amount:** _____
**Date/Rec No.:** _____
**Fee Paid?** ☑ Yes ☐ No
**Amount:** 25.00
**Date/Rec No.:** 6/28/17 #3158


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FLOOD ZONE

**Building Safety & Permits Copy**

The Structures Group, Inc.
Consulting Engineers

June 19, 2017

APPROVED FOR GENERAL CONFORMANCE TO THE 2012 USBC
DATE: 8/9/17 BY: SOM

Danny E. Patterson
5032 River Drive
Lanexa, Virginia 23089

Re: Patterson/5032 River Drive
TSG No. VA17083.FOR

Dear Mr. Patterson:

With your authorization, we performed a cursory forensic review and structural design for the retaining wall structure to resolve the slope failure at the rear of the single family residence located at 5032 River Drive within the Cypress Point section of James City County, Virginia. The purpose of our review was to determine the nature and extent of distress exhibited in the slope.

Our site visit was conducted on Friday, May 26, 2017, in your company as well as Michael Woolson and Ashely Tatge with the James City County Engineering and Resource Protection Division. During our site visit, we reviewed the existing slope failure as well as the foundation of the residence, cataloging areas of distress noted.

The single family residence is a two (2) story timber framed structure, with an attached one (1) car garage located on the front elevation. The exterior of the main residence consists of wood siding. The residence is partially constructed over a slab on grade and partially over a masonry foundation enclosing a vented crawl space. The roof consists of gable framed roofs over the main portion of the residence as well as the garage, with all roof surfaces covered with asphalt shingles. A timber framed deck is located along the rear elevation of the residence. Closer review revealed the exterior finish grade of the property sloped from front to rear.

During our site visit, we noted a global slope failure of the soil approximately 20' behind the rear elevation of the residence resulting in an approximate 5' to 6' vertical drop off. It was noted that the slope failure also led to the collapse of both the dock and the stairwell leading to the dock. Further, it was also noted that the slope failure led to the collapse of the existing timber bulkhead located approximately 10' from the shore of Diascund Creek. Closer inspection of the shoreline revealed that the rip-rap had also been pushed out towards the creek.

Along the foundation of the deck attached to the residence, it was noted that the lattice had been pushed out away from the residence and towards the creek. Further inspection of the foundation of the residence revealed minor cracks in the parged surface of the rear corner of the left and right elevation masonry foundation walls.

1200 Old Colony Lane
Williamsburg, VA 23185
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Phone (757) 220-0465
Fax (757) 220-1546

**SOIL SURVEY AND RESEARCH**

Our research included a review of the Soil Survey of James City and York Counties and the City of Williamsburg Virginia, produced in 2014 by the United States Department of Agriculture. This soil survey revealed that the residence was constructed in an area consisting of primarily Emporia complex soil series with 15 to 25 percent slopes. This soil has a moderate shrink-swell potential.

Based on our research, it seems the residence, while constructed circa 1960, lies within the Chesapeake Bay Resource Preservation Area (RPA) of James City County. It should be noted that James City County, Virginia is one of 84 localities in Virginia subject to the requirements of the Bay Act program because of the County's geographic location in the Tidewater region of Virginia. The Bay Act program is mandated by the Commonwealth of Virginia by Title 62.1, Chapter 3.1, Article 2.5 of the Code of Virginia and Chapter 830, Chesapeake Bay Preservation Designation and Management Regulations, 9VAC25-830-10 et. seq. of Virginia Administrative Code. Construction within the RPA of James City County is governed by an ordinance that controls and regulates runoff towards wetlands, streams, and tributaries to the Chesapeake Bay. Most land use activities in the RPA are generally prohibited or restricted unless an exception or waiver is granted by the Chesapeake Bay Preservation Board.

Upon research of past geotechnical work performed on the property, it was noted that a geotechnical report was prepared by ECS dated August 3, 2001. According to the report, bulkheads were constructed between the house and the creek in 1987 and 1994 and failed along with a significant portion of the slope in August of 2000. While repairs to the rip-rap toe support and slope were performed in October 2000, further settlement and movement of the slope was detected in March/April of 2001. Therefore, in order to stabilize the slope, ECS recommended the installation of a retaining wall along the toe of the slope, just beyond the edge of the rip-rap. ECS recommended piles spaced 5' on center with a minimum embedment depth of at least 15' below the mean low water. This retaining wall system was constructed; however, it has recently failed due to a global slope failure and has overturned towards the creek damaging the adjacent boat dock.

The report by ECS also included soil boring logs from two (2) locations on the property and included an analysis of the existing slope in 2001. The 2001 ECS report and boring logs have been attached to this report.

**CONCLUSIONS**

Our analysis of the existing slope failure and the existing distress to the foundation of the residence revealed that the existing earth on the steep slope of the lot is unstable and has experienced a global failure. It is our opinion that the slope failure, if left unmitigated, will result in future distress and possible failure of the foundation of the residence.

Following our meeting, it was determined that some form of a retaining wall system would be needed to stabilize the slope and protect the foundation and deck of the existing residence. It was determined that due to the severity of the existing global slope failure and its location within the Resource Protection Area, the review of such remedial repair plans will go through the James City County Environmental Department as well as the Building Safety and Permits Division.

A retaining wall site plan has been prepared and two (2) copies of this plan have been submitted to the James City County Engineering and Resource Protection Division with a copy of this letter. It is our

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recommendation that the proposed retaining wall site plan be submitted as part of the application to the Chesapeake Bay Board. Based on our discussions at the site, we feel that this project may go through a brief administrative review process.

Likewise, to facilitate a simultaneous review process, we have submitted the James City County Building Permit Application to the James City County Building Safety and Permits Division along with an additional two (2) copies of the plan. For your reference, we have attached one (1) copy of the drawings and copies of the Chesapeake Bay Board Application and James City County Permit Application which have been submitted.

We appreciate the opportunity to be of service in this matter. If you have any questions, please feel free to contact our office.

Sincerely,
The Structures Group, Inc.

Joseph W. Krallinger, E.I.T.
Staff Engineer

COMMONWEALTH OF VIRGINIA
MICHAEL A. MATTHEWS
Lic. No. 017653
6/19/17
PROFESSIONAL ENGINEER

Michael A. Matthews, P.E.
President

MAM/msv

attachments

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ENGINEERING CONSULTING SERVICES, LTD.
Geotechnical • Construction Materials • Environmental

August 3, 2001

Mr. Danny Patterson
5032 River Drive
Lanexa, VA 23089

ECS Project No. 6521

Reference: Slope Evaluation
Patterson Residence – 5032 River Drive
Lanexa, Virginia

Dear Mr. Patterson:

Engineering Consulting Services, Ltd. is pleased to present the results of the subsurface exploration and geotechnical engineering analysis for the above referenced project.

**Overview:**

It is our understanding that the existing residence was built on a relatively level plateau in 1980. The north side of the property slopes down about 20 feet to Diascund Creek, a tributary of the Chickahominy River that is located about 1,500 feet to the south. Bulkheads were constructed between the house and the creek in 1987 and 1994. These bulkheads (retaining walls) failed, along with a significant portion of the slope in August 2000. Repairs to the slope ("rip-rip" toe support and slope reconstruction) was performed in October 2000; however, settlement/movement of the "rip-rap" and slope cracks were detected in March/April 2001.

**Scope of Work:**

Two (2) soil test borings (extended to depths of 20 and 30 feet) were performed by Scott Drilling on May 11, 2001. The 20 foot boring (B-2) was performed within the front yard of the house and the 30 foot boring (B-1) was performed near the top of the slope at the rear of the house. A slotted PVC-Pipe was installed at each borehole location for groundwater readings. The purpose of the borings was to ascertain the general subsurface conditions (soil type and groundwater), to aid in evaluating the stability of the existing slope. A location diagram and the boring logs are attached with this report.

*2119-D North Hamilton Street, Richmond Virginia 23230 • (804) 353-6333 • Fax (804) 353-9478*
*Offices: Richmond, VA • Washington, D.C. • Norfolk, VA • Williamsburg, VA • Roanoke, VA • Fredericksburg, VA • Danville, VA*
*Baltimore, MD • Frederick, MD • Research Triangle Park, NC • Wilmington, NC • Charlotte, NC • Greensboro, NC • Greenville, SC • Atlanta, GA*

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The test borings were performed with an ATV-mounted drill rig, which utilized continuous flight augers to advance the boreholes. Representative soil samples were obtained from the borings by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2 inch O.D., split barrel sampler is driven into a soil a distance of 24 inches by a 140-pound hammer falling 30 inches. The first 6 inches is considered the seating interval. The number of blows required to drive the sampler through the next two 6-inch intervals is termed the Standard Penetration Test (SPT) value, and is indicated for each sample on the boring logs. A reference notes sheet for the boring logs is attached with this letter.

ECS engineering personnel visually classified representative soil samples that were collected from the borings and returned to our ECS office. The engineering properties of the soil, along with groundwater data collected on various dates (5/13, 5/14, and 6/1/01), were utilized for slope stability analysis.

**Conclusions and Recommendations:**

Based on visual inspection of the existing slope, in it's current condition, it is obvious that the "Rip-Rap" toe reinforcement and slope reconstruction that was performed in or about October 2000 wasn't effective in stabilizing the already weakened slope. Although the concept of reinforcing the toe of the previously failed slope with "Rip-Rap" is considered an acceptable stabilization method (alternative), it is my opinion that prudent engineering design wasn't employed. In this respect, if the base of the slope was mucked-out (including the excavation at the toe), and if a heavy duty geosynthetic fabric and/or geogrid had been used to retain the "Rip-Rap", the additional slope movement may have been prevented. Furthermore, the depth of the excavation and "Rip-Rap" placement should have been extended below the potential failure plane for maximum effectiveness. It should be noted, however, that the actual conditions at the time of "Rip-Rap" placement are not fully known at this time. Reportedly, the base area was very wet and soft, which made construction difficult. Typically under these working conditions, the quality of the work is greatly reduced, and some form of additional failure occurs regardless of the design.

ECS has performed a limited evaluation of the existing slope using PCSTABL software. This evaluation is considered limited since a detailed survey of the slope isn't available. The evaluation was performed based on linear measurements and slope angle approximation. Based on this evaluation the existing slope is approximately 2H (horizontal) to 1V (vertical), and has a calculated Safety Factor of 1.33 against failure. Most slopes are designed with a maximum slope of 2H:1V and a minimum Safety Factor of 1.5. A plot of the slope configuration is included with this report.

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Since the calculated Safety Factor of the existing slope is less than 1.5, consideration should be given to improving the stability of the slope. Typically, flattening the slope is the most common and inexpensive method for slope stability improvement; however, this alternative is not practical due to space restrictions. Reinforcing the toe is also a common alternative; however, the presence of surface water (in this case a tidal condition) and the presence of existing "Rip-Rap" stone makes standard excavation impractical. Installation of a retaining wall supported by a piling system could possibly be the most practical and cost effective alternative. Generally speaking, the pilings could consist of driven timber or concrete piles, or cast-in-place concrete piles. The piles should be installed in a row along the face of the slope, just beyond the edge of the "Rip-Rap" or at the approximate mid-point of the slope (where the current fault line exists). The tip of the piles should extend at least 15 feet below the MLW elevation. Piles should be installed on approximate 5 foot center-to-center spacing. The top of the piles should be extended above the surface as required for pile cap (bracing) or retaining wall construction.

**Closing:**

We have enjoyed being of service to you on this project. If you should have any questions regarding the information and recommendations contained herein or if we can be of further assistance, please do not hesitate to contact us.

Respectfully,

ENGINEERING CONSULTING SERVICES, LTD.

COMMONWEALTH OF VIRGINIA
DAVID E. STINNETTE
NO. 028419
PROFESSIONAL ENGINEER

David E. Stinnette, P.E.
Engineering Services Manager

Attachments: Boring Location Diagram
Boring Logs
PCSTABL Plot (with comments/notes)
Reference Notes Sheet For Boring Logs and USCS Sheet

GEOTECH/REPORTS/6521.doc

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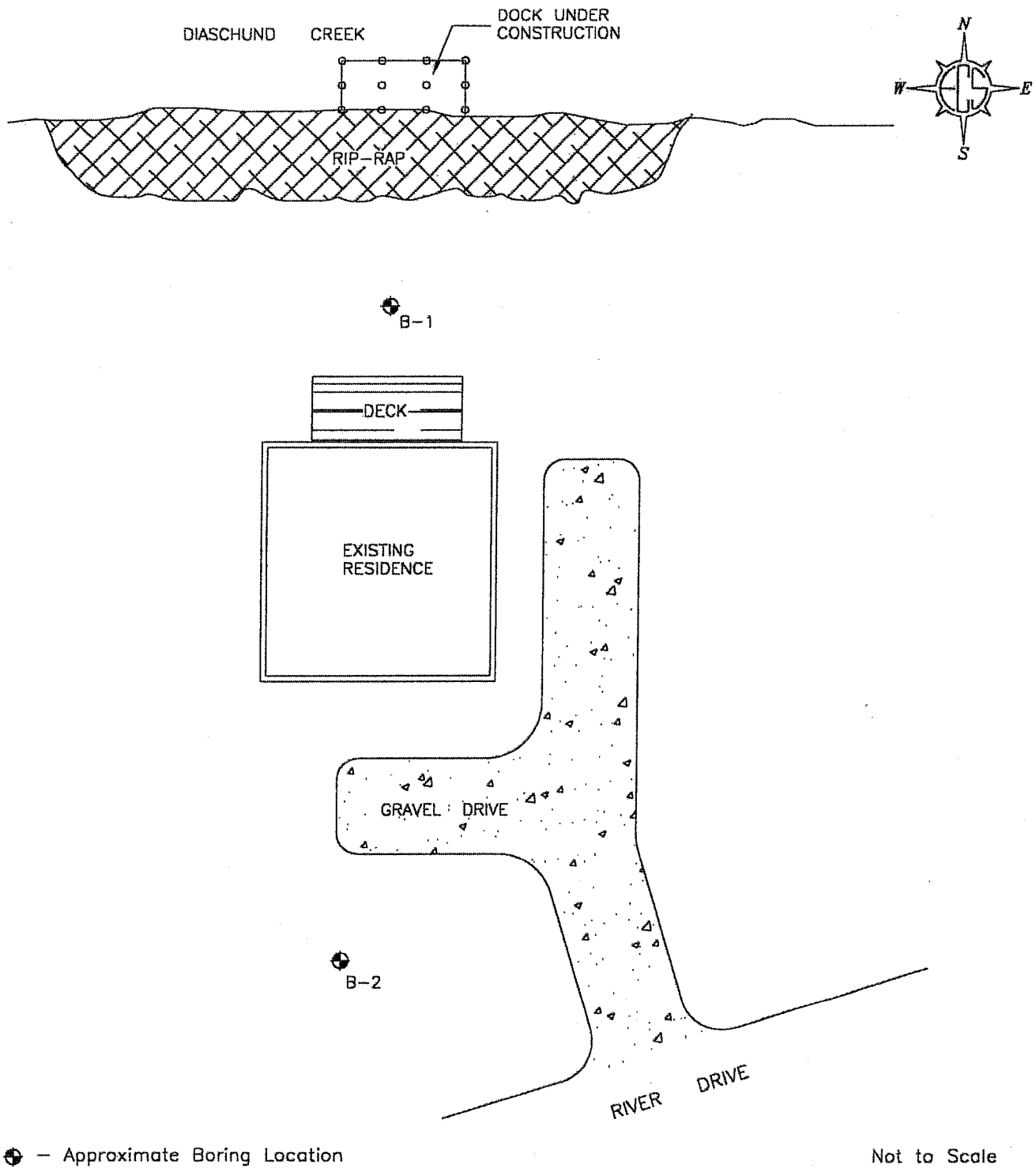


PREPARED FOR:

DANNY E. PATTERSON

ECS LTD
ENGINEERING CONSULTING SERVICES, LTD

BORING LOCATION DIAGRAM

PATTERSON RESIDENCE
SLOPE FAILURE EVALUATION
JAMES CITY CO., VIRGINIA

ECS, LTD. PROJECT NO. 6521

These documents were printed from the official JCC Records Management Imaging site

| CLIENT | JOB # | BORING # | SHEET |
|---|---|---|---|
| DANNY E. PATTERSON | 6521 | B-1 | 1 OF 1 |

PROJECT NAME: PATTERSON RESIDENCE-SLOPE FAILURE EVAL.

ARCHITECT-ENGINEER:

SITE LOCATION: 5032 RIVER DRIVE, JAMES CITY COUNTY, VA

ECS LTD

CALIBRATED PENETROMETER TONS/FT.$^2$ (1, 2, 3, 4, 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ (10, 20, 30, 40, 50+)

STANDARD PENETRATION BLOWS/FT. ⊗ (10, 20, 30, 40, 50+)

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL (ENGLISH UNITS / SURFACE ELEVATION) | STANDARD PENETRATION BLOWS/FT. |
|---|---|---|---|---|---|---|
| 0 | 1 | SS | 24 | 24 | Topsoil | 6 |
| | 2 | SS | 24 | 24 | Silty Fine to Medium SAND, Orangish Brown, Moist, Loose, (SM) [Possible Fill] | 7 |
| 5 | 3 | SS | 24 | 24 | Fine Sandy Lean CLAY, Light Brown and Tan, Moist, Medium Stiff, (CL) | 7 |
| | 4 | SS | 24 | 24 | Lean CLAY, Orange and Light Gray, Dry to Moist, Very Stiff to Medium Stiff, (CH) | 16 |
| | 5 | SS | 24 | 24 | | 7 |
| 10 | | | | | | |
| | 6 | SS | 24 | 24 | | 5 |
| 15 | | | | | | |
| | 7 | SS | 24 | 24 | | 7 |
| 20 | | | | | | |
| | 8 | SS | 24 | 24 | | 7 |
| 25 | | | | | | |
| | 9 | SS | 24 | 24 | | 9 |
| 30 | | | | | | |

WATER LEVELS ELEVATION (FT)

END OF BORING @ 30.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

| | | |
|---|---|---|
| WL 18.0' WS OR WD | BORING STARTED 5-11-01 | TOPSOIL DEPTH 2" |
| WL(AB) WL(AC) | BORING COMPLETED 5-11-01 | CAVE IN DEPTH ● N/A |
| WL 15.9' @ 6-1-01 | RIG ATV FOREMAN SCOTT | DRILLING METHOD HOLLOW STEM AGUER |

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| CLIENT | JOB # | BORING # | SHEET |
|---|---|---|---|
| DANNY E. PATTERSON | 6521 | B-2 | 1 OF 1 |

PROJECT NAME: PATTERSON RESIDENCE-SLOPE FAILURE EVAL.

ARCHITECT-ENGINEER:

SITE LOCATION: 5032 RIVER DRIVE, JAMES CITY COUNTY, VA

ECS LTD

CALIBRATED PENETROMETER TONS/FT.$^2$ (1, 2, 3, 4, 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ (10, 20, 30, 40, 50+)

STANDARD PENETRATION BLOWS/FT. ⊗ (10, 20, 30, 40, 50+)

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL (ENGLISH UNITS / SURFACE ELEVATION) | WATER LEVELS ELEVATION (FT) | STANDARD PENETRATION BLOWS/FT. |
|---|---|---|---|---|---|---|---|
| 0 | 1 | SS | 24 | 24 | Topsoil | | 12 |
| | 2 | SS | 24 | 24 | Lean CLAY, Light Brown, Dry, Stiff, (CL) | | 12 |
| 5 | 3 | SS | 24 | 24 | Lean CLAY With Silt, Orange, Light Gray, and White, Moist, Very Stiff, (CL) | | 29 |
| | 4 | SS | 24 | 24 | | | 19 |
| | 5 | SS | 24 | 24 | | | 20 |
| 10 | 6 | SS | 24 | 24 | Fat CLAY, Orange, Gray, and Dark Red, Dry to Moist, Medium Stiff to Soft, (CH) | | 12 |
| | 7 | SS | 24 | 24 | | | 4 |
| 15 | | | | | | | |
| | 8 | SS | 24 | 24 | | | 4 |
| 20 | | | | | END OF BORING @ 20.0' | | |
| 25 | | | | | | | |
| 30 | | | | | | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

| | | |
|---|---|---|
| WL DRY WS OR WD | BORING STARTED 5-11-01 | TOPSOIL DEPTH 4" |
| WL(AB) WL(AC) | BORING COMPLETED 5-11-01 | CAVE IN DEPTH @ N/A |
| WL 18.2' @ 6-1-01 | RIG ATV FOREMAN SCOTT | DRILLING METHOD HOLLOW STEM AGUER |

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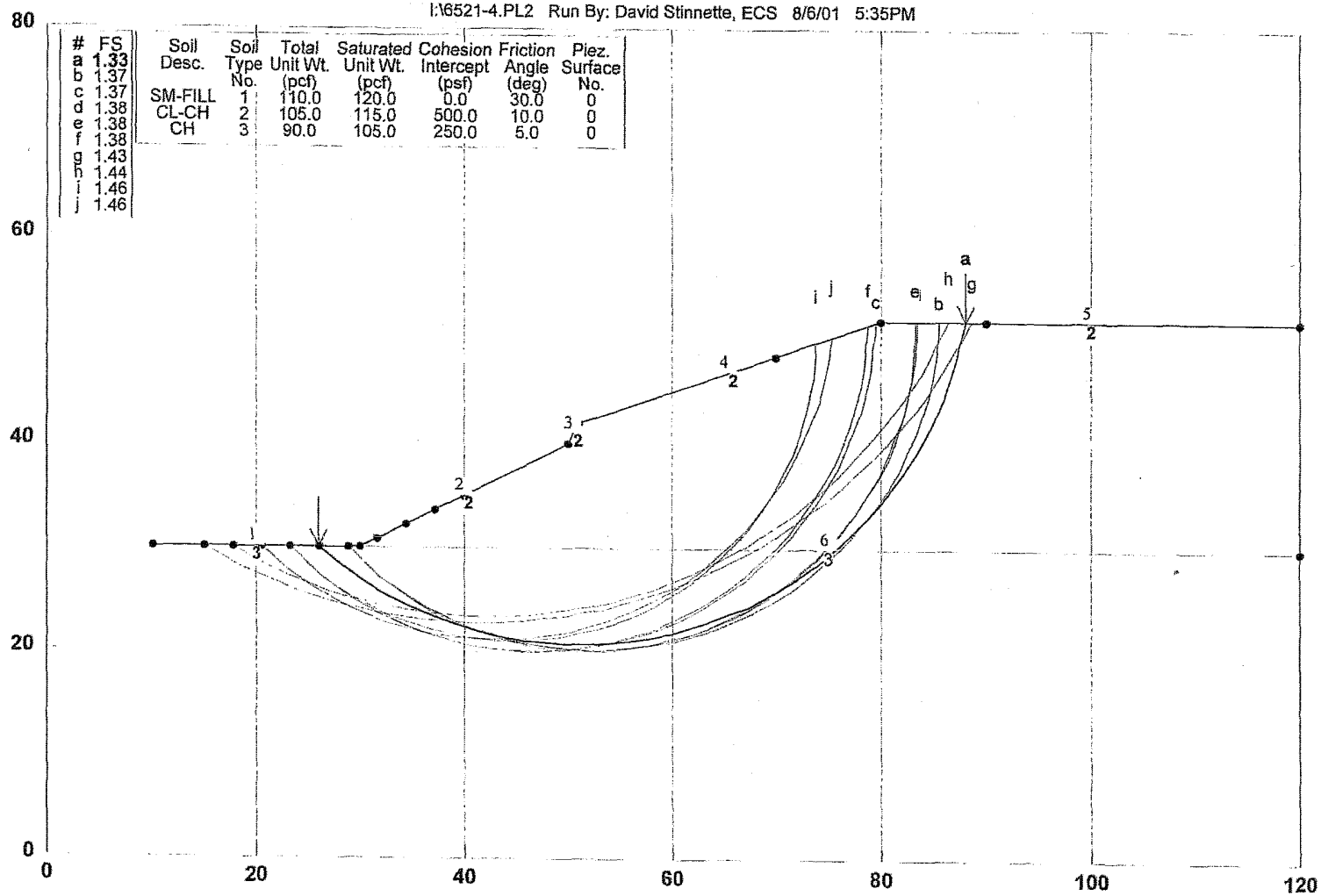
# PATTERSON RESIDENCE - SLOPE EVALUATION /ECS PROJECT NO. 6521

I:\6521-4.PL2 Run By: David Stinnette, ECS 8/6/01 5:35PM

| # | FS |
|---|---|
| a | 1.33 |
| b | 1.37 |
| c | 1.37 |
| d | 1.38 |
| e | 1.38 |
| f | 1.38 |
| g | 1.43 |
| h | 1.44 |
| i | 1.46 |
| j | 1.46 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| SM-FILL | 1 | 110.0 | 120.0 | 0.0 | 30.0 | 0 |
| CL-CH | 2 | 105.0 | 115.0 | 500.0 | 10.0 | 0 |
| CH | 3 | 90.0 | 105.0 | 250.0 | 5.0 | 0 |

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Safety Factors Are Calculated By The Modified Bishop Method

STED

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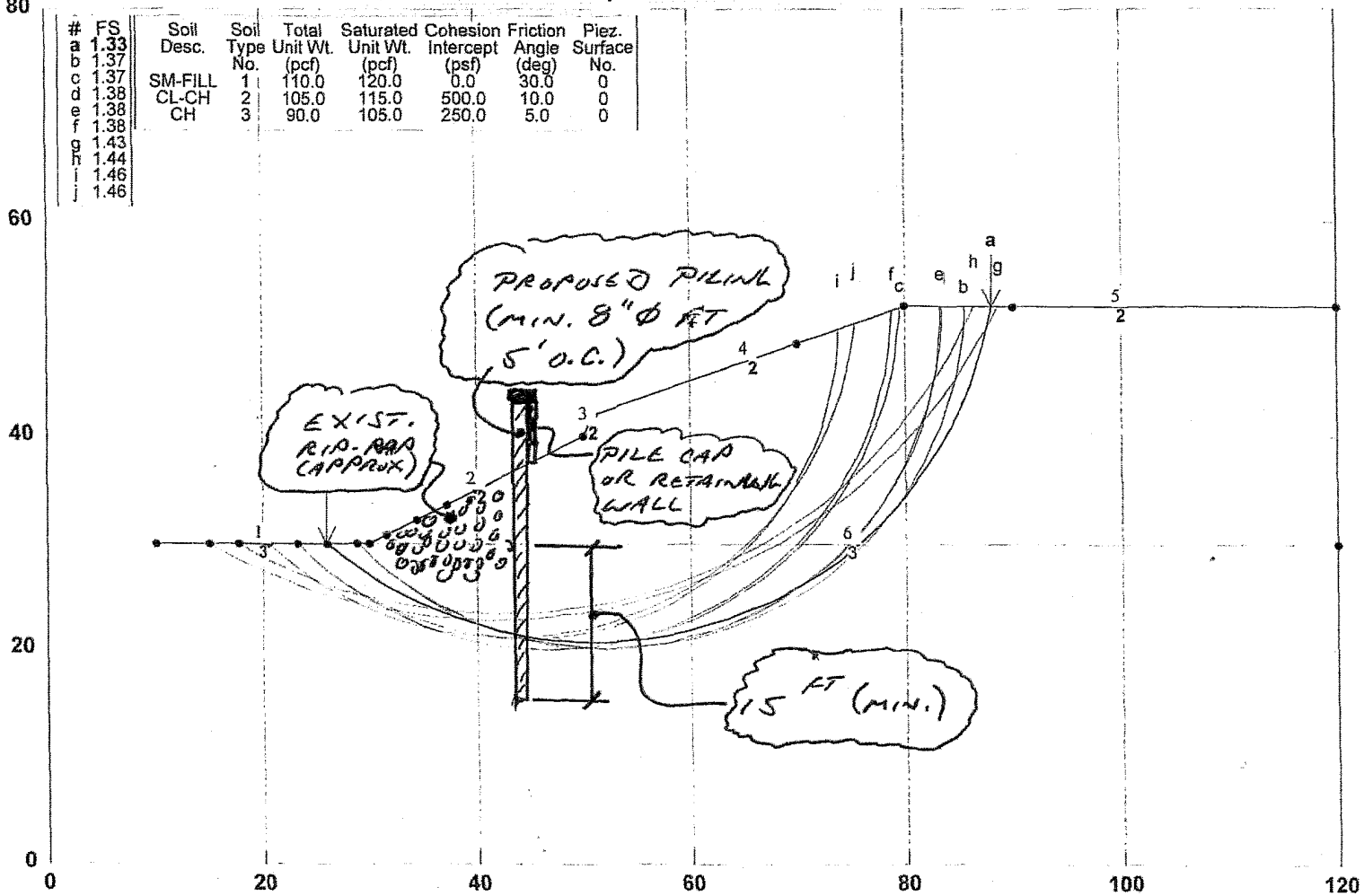
# PATTERSON RESIDENCE - SLOPE EVALUATION /ECS PROJECT NO. 6521

I:\6521-4.PL2 Run By: David Stinnette, ECS 8/6/01 5:35PM

| # | FS |
|---|---|
| a | 1.33 |
| b | 1.37 |
| c | 1.37 |
| d | 1.38 |
| e | 1.38 |
| f | 1.38 |
| g | 1.43 |
| h | 1.44 |
| i | 1.46 |
| j | 1.46 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| SM-FILL | 1 | 110.0 | 120.0 | 0.0 | 30.0 | 0 |
| CL-CH | 2 | 105.0 | 115.0 | 500.0 | 10.0 | 0 |
| CH | 3 | 90.0 | 105.0 | 250.0 | 5.0 | 0 |




PCSTABL5M/si FSmin=1.33

Safety Factors Are Calculated By The Modified Bishop Method

STED

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# REFERENCE NOTES FOR BORING LOGS

## I. Drilling and Sampling Symbols:

SS - Split Spoon Sampler
ST - Shelby Tube Sampler
RC - Rock Core; NX, BX, AX
DC - Dutch Cone Penetrometer
PA - Power Auger (no sample)
HSA - Hollow Stem Auger
PM - Pressuremeter
WS - Wash Sample
BS - Bulk Sample of Cuttings
RB - Rock Bit Drilling

Standard Penetration Test (SPT) refers to the blows per foot of a 140 lb hammer free falling 30 inches on a 2 in. O.D. split-spoon sampler, as specified in ASTM D-1586. The SPT blow count is commonly referred to as the N-value. Typically the split-spoon sampler is driven to depths of 18 to 24 inches. The SPT result, N-value, is commonly determined by summing the second and third 6-inch increments.

## II. Correlation of Penetration Resistances to Soil Properties:

COHESIVE SOILS
(CLAY, SILT and COMBINATIONS)

| CONSISTENCY | SPT, N (Blows/Foot) | UNDRAINED SHEAR STRENGTH C, (PSF) |
|---|---|---|
| VERY SOFT | < 2 | <250 |
| SOFT | 3 - 5 | 250 - 500 |
| MEDIUM STIFF | 6 - 10 | 500 - 1000 |
| STIFF | 11 - 15 | 1000 - 2000 |
| VERY STIFF | 16- 30 | 2000 - 4000 |
| HARD | > 31 | > 4000 |

NON-COHESIVE SOILS
(SAND, GRAVEL, SILT and COMBINATIONS)

| DENSITY | SPT, N (Blows/Foot) | RELATIVE DENSITY (%) |
|---|---|---|
| VERY LOOSE | < 5 | 0 – 15 |
| LOOSE | 6 – 10 | 16 – 35 |
| MEDIUM DENSE | 11 – 30 | 36 – 65 |
| DENSE | 31 – 50 | 66 – 85 |
| VERY DENSE | 51 – 80 | 86 – 98 |
| EXTREMELY DENSE | > 81 | 99 - 100 |

[Particle Size Identification]:

- Boulders: 8 inch diameter or more
- Cobbles: 3 to 8 inch diameter
- Gravel:
  - Coarse: 1 to 3 inch
  - Medium: 1/2 to 1 inch
  - Fine: 1/4 to 1/2 inch
- Sand:
  - Coarse: 2.00 mm to 1/4 inch (diameter of pencil lead)
  - Medium: .42 mm to 2.00 mm (diameter of broom straw)
  - Fine: .074 mm to .42 mm (diameter of human hair)

## III. Water Level Measurement Symbols:

WL - Water Level
WCI - Wet Cave In
WS - While Sampling
DCI - Dry Cave In
WD - While Drilling
BCR - Before Casing Removal
ACR - After Casing Removal

The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding drilling fluids in a granular soil. In clays and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases additional methods of measurement are generally applied.

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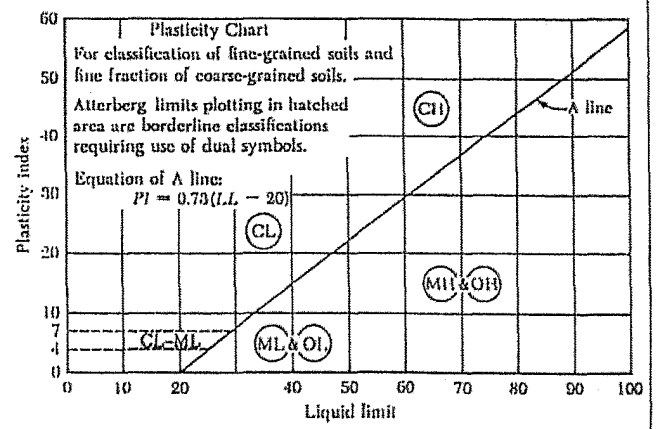
# UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

**Table** Unified System of Classification

| Major divisions | | | Group symbols | Typical names |
|---|---|---|---|---|
| Coarse-Grained Soils More than 50% retained on No. 200 sieve | Gravels 50% or more of coarse fraction retained on No. 4 sieve | Clean Gravels | GW | Well-graded gravels and gravel-sand mixtures, little or no fines |
| | | | GP | Poorly graded gravels and gravel-sand mixtures, little or no fines |
| | | Gravels with Fines | GM | Silty gravels, gravel-sand-silt mixtures |
| | | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | Sands More than 50% of coarse fraction passes No. 4 sieve | Clean Sands | SW | Well-graded sands and gravelly sands, little or no fines |
| | | | SP | Poorly graded sands and gravelly sands, little or no fines |
| | | Sands with Fines | SM | Silty sands, sand-silt mixtures |
| | | | SC | Clayey sands, sand-clay mixtures |
| Fine-Grained Soils 50% or more passes No. 200 sieve | Silts and Clays Liquid limit 50% or less | | ML | Inorganic silts, very fine sands, rock flour, silty or clayey fine sands |
| | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | | OL | Organic silts and organic silty clays of low plasticity |
| | Silts and Clays Liquid limit greater than 50% | | MH | Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts |
| | | | CH | Inorganic clays of high plasticity, fat clays |
| | | | OH | Organic clays of medium to high plasticity |
| Highly Organic Soils | | | PT | Peat, muck, and other highly organic soils |

**Table** (Continued)

| | Classification criteria | |
|---|---|---|
| Classification on basis of percentage of fines<br>Less than 5% pass No. 200 sieve: GW, GP, SW, SP<br>More than 12% pass No. 200 sieve: GM, GC, SM, SC<br>5% to 12% pass No. 200 sieve: Borderline classification requiring use of dual symbols | $C_u = D_{60}/D_{10}$ Greater than 4<br>$C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 | |
| | Not meeting both criteria for GW | |
| | Atterberg limits plot below "A" line or plasticity index less than 4 | Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols |
| | Atterberg limits plot above "A" line and plasticity index greater than 7 | |
| | $C_u = D_{60}/D_{10}$ Greater than 6<br>$C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 | |
| | Not meeting both criteria for SW | |
| | Atterberg limits plot below "A" line or plasticity index less than 4 | Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols |
| | Atterberg limits plot above "A" line and plasticity index greater than 7 | |




Visual-manual identification, see ASTM Designation D2488.

Reprinted from the Annual Book of ASTM Standards

Engineering Consulting Services, Ltd.

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Patterson

# Application for Building Permit

James City County VIRGINIA Jamestown 1607

**Contractor Information**

License No.: 2705156333
Company Name: RA Coleman Inc
Address: 4626 Hickory Signpost Rd
City: Williamsburg State: VA Zip: 23185
Phone No.: (757) 903-4855 Fax No. ( )
Email Address: Randy@RAColemanInc.com
Signature:
Print Name: Randy A Coleman Jr President

**Owner Information**

Name: Danny Patterson
Address: 5032 River Drive
City: Lanexa State: VA Zip: 23089
Phone No.: (757) 897-2871 Fax No. ( )
Email Address: depatterson@verizon.net
Signature:
Print name: Danny Patterson
Agent: The Structures Group, Inc.
Print Name: Michael A. Matthews, P.E.

Building Safety & Permits Received JUN 21 2017 James City County

**Description of Work:** Construction of new timber retaining to be installed to prevent additional slope failure. The retaining wall is approximately 122'-0" long and up to 8'-0" tall

**Location of Work**

Tax Map No.: 0930300007 4070
Street Address: 5032 River Drive
City: Lanexa State: VA Zip: 23089
Zone: A1 Subdivision:

**(For Commercial Projects Only)**

Site Plan No. Date Approved:

**Mechanic's Lien Agent**

Name:
Address:
City: State: Zip:
Phone No.: ( ) Fax No. ( )

**Building Information**

Stories ____ No. Rooms ____ No. Baths ____ No. Bath Fix ____
No. Fireplaces ____ Type:
Exterior Finish: ☐ vinyl ☐ brick ☐ wood ☐ other
Interior Finish: ☐ Gypsum ☐ wallboard ☐ wood ☐ other
Flooring: ☐ carpet ☐ wood ☐ vinyl ☐ other
Roofing: ☐ asphalt ☐ fiberglass ☐ wood ☐ other
Heat Type: ☐ gas ☐ heat pump ☐ electric ☐ other
Air Conditioning Type: ☐ central ☐ window ☐ none
Estimated Construction Value: $50,000.00
(Do not include Lot $)

Floor Area (sq.ft.):
(Do not include Basement, Garage, and Deck/Porch)
Deck (sq.ft.):
Porch (sq.ft.):
Basement Area (sq.ft.):
Garage Area (sq.ft.):
Total Area (sq.ft.):
☐ Public Sewer ☐ Septic ☐ Well ☐ Grinder Pump
☐ Public $H_2O$

sent email to Mr Patterson

**OFFICE USE ONLY**

Special Flood Hazard Area: Yes ☑ No ☐ Zone AE

Lot Width:
Lot Depth:
Front Property Line:
Right Property Line:
Left Property Line:
Rear Property Line:
*PERMIT NO.:* B17-2037
*LINE NO.:* A17-1119
Date/Time In: 6/22/17
Date Plan Reviewed: 8/9/17

Improvement Code: RW
Structure Used As: Retaining Wall
Occupancy Class: R5
Occupancy Load:
Type Construction: VB
Zoning Approved:
Plan Approved: Sum
*PLAN REVIEW FEE:* 15.00
*PERMIT FEE:* 500.00
*ERP FEE:* 10.00
*VSMP FEE:*
*TOTAL:* $525.00

*Notes:* 2012 USBC
taxes are current

FLOOD ZONE



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Notes: CALL RANDY AT 757-342-3316 FOR PLANS AND MEET

# Building Safety and Permits Inspection Request/Report

James City County VIRGINIA Jamestown 1607

Permit No: **B17-2037** **08-Dec-2017**

Address: **5032 RIVER DRIVE**

Ticket 439903

Soil: MODERAT

Tax Map #: **0930300007**

SubDivision: **CYPRESS POINT**

Time Preference (Not Guaranteed)

Owner: DANNY E PATTERSON

| Permit Type | Improvement | Type of Inspection | Contractor | |
|---|---|---|---|---|
| Building | RW | Final | R A COLEMAN LAN | (757) 903-4855 |

Last Inspection (if not approved)

9/20/2017 Building LK 0 Sched: PILINGS RANDY COLEMAN 757-342-3316 Final

RESULT:

12/8/17

☑ Approved ☐ Rejected ☐ Code E Kirkpatrick Inspector ☐ Verified

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**General Services**
107 Tewning Road
Williamsburg, VA 23188
P: 757-259-4080
General.Services@jamescitycountyva.gov

**jamescitycountyva.gov**

**Capital Projects**
107 Tewning Road
Williamsburg, VA 23188
757-259-4080

**Fleet**
103 Tewning Road
Williamsburg, VA 23188
757-259-4122

**Stormwater and Resource Protection**
101-E Mounts Bay Road
Williamsburg, VA 23185
757-253-6670

**Facilities & Grounds**
113 Tewning Road
Williamsburg, VA 23188
757-259-4080

**Solid Waste**
1204 Jolly Pond Road
Williamsburg, VA 23188
757-565-0971

# NOTICE OF VIOLATION

of James City County's Environmental Regulations

June 28, 2021

Mr. Danny Patterson
5032 River Drive
Lanexa, VA 23089

Re: **Chesapeake Bay Preservation Ordinance Violation, Land Disturbing Violation, Erosion and Sediment Control Ordinance Violation, Stormwater Management Ordinance Violation and an Erosion Impact Area.**
**5032 River Drive, James City County PIN 0930300007**
**SRP-21-0005**

Dear Mr. Patterson:

On June 21, 2021, representatives of the James City County Stormwater and Resource Protection Division inspected the properties adjacent to 5032 River Drive after a complaint was received at the County for work occurring within the resource protection area. This work caused a global rotational slope failure to occur affecting property at 5030 River Drive, 5032 River Drive and 5034 River Drive. This work also caused fill and debris to impact a portion of Diascund Creek. The County does not have any active Chesapeake Bay Preservation Exception requests, Wetland Permit applications, Erosion and Sediment Control Plans, or Land Disturbing Permit applications on file for any of these properties.

This activity is a violation of: (1) James City County Code ("County Code") Chapter 23 Chesapeake Bay Preservation Ordinance, (2) County Code Chapter 8, Article I Erosion and Sediment Control Ordinance, and (3) County Code Chapter 8, Article II Stormwater Management Ordinance. Civil penalties can range from $1,000 to $32,500 per day per violation. These civil penalties may be ordered by the James City County Circuit Court upon petition from the County. Civil charges may be agreed upon instead of the County initiating a lawsuit against you. Civil charges can range from $1,000 to $32,500 per violation.

Please be advised that this is an official notification that the filling of the resource protection area and resultant global slope failure of the hillside into Diascund Creek is a Chesapeake Bay Ordinance, Stormwater Management Ordinance and Erosion and Sediment Control Ordinance violation. In order to rectify these violations, please contact our office at your earliest convenience to arrange for a meeting with representatives of the Stormwater and Resource Protection Division staff to discuss

civil penalties, restoring the creek, and restoring the RPA by entering into a Chesapeake Bay Restoration Agreement.

Should you wish to appeal any of these violations, the appeals would be heard by the following entities:

- Chesapeake Bay Preservation Ordinance appeals are heard by the James City County Chesapeake Bay Board (County Code sec. 23-17);
- Stormwater Management Ordinance appeals are heard by the James City County Circuit Court (County Code sec. 8-32) ;
- Erosion and Sediment Control Ordinance appeals are heard by the James City County Board of Supervisors (County Code sec. 8-8).

Please contact our office at 757-253-6670 to discuss this matter within the next 30 days. If you wish to appeal this determination you must initiate an appeal within 30 days After 30 days from the date of this letter, the matter is no longer appealable.

Sincerely,

Michael Woolson
Section Chief, Resource Protection
Stormwater and Resource Protection Division

cc: Toni Small, Stormwater and Resource Protection Division Director, via email
Liz Parman, Assistant County Attorney, via email
Paul Holt, Community Development Director, via email
Christy Parrish, Zoning Administrator, via email

**General Services**
107 Tewning Road
Williamsburg, VA 23188
P: 757-259-4080
General.Services@jamescitycountyva.gov

**jamescitycountyva.gov**

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**Facilities & Grounds**
113 Tewning Road
Williamsburg, VA 23188
757-259-4080

**Solid Waste**
1204 Jolly Pond Road
Williamsburg, VA 23188
757-565-0971

# NOTICE OF VIOLATION

of James City County's Environmental Regulations

November 17, 2021

R.A. Coleman, Inc.
c/o Mr. Randy Coleman
4626 Hickory Signpost Road
Williamsburg, VA 23185

Re: **Chesapeake Bay Preservation Ordinance Violation, Land Disturbing Violation, Erosion and Sediment Control Ordinance Violation, Stormwater Management Ordinance Violation and an Erosion Impact Area.**
**5032 River Drive, James City County PIN 0930300007**
**SRP-21-0006**

Dear Mr. Coleman:

On June 21, 2021, representatives of the James City County Stormwater and Resource Protection Division inspected the properties adjacent to 5032 River Drive after a complaint was received at the County for work occurring within the resource protection area. This work caused a global rotational slope failure to occur affecting property at 5030 River Drive, 5032 River Drive and 5034 River Drive. This work also caused fill and debris to impact a portion of Diascund Creek. The County does not have any active Chesapeake Bay Preservation Exception requests, Wetland Permit applications, Erosion and Sediment Control Plans, or Land Disturbing Permit applications on file for any of these properties.

This activity is a violation of: (1) James City County Code ("County Code") Chapter 23 Chesapeake Bay Preservation Ordinance, (2) County Code Chapter 8, Article I Erosion and Sediment Control Ordinance, and (3) County Code Chapter 8, Article II Stormwater Management Ordinance. Civil penalties can range from $1,000 to $32,500 per day per violation. These civil penalties may be ordered by the James City County Circuit Court upon petition from the County. Civil charges may be agreed upon instead of the County initiating a lawsuit against you. Civil charges can range from $1,000 to $32,500 per violation.

Please be advised that this is an official notification that the filling of the resource protection area and resultant global slope failure of the hillside into Diascund Creek is a Chesapeake Bay Ordinance, Stormwater Management Ordinance and Erosion and Sediment Control Ordinance violation. In order to rectify these violations, please contact our office at your earliest convenience to arrange for

a meeting with representatives of the Stormwater and Resource Protection Division staff to discuss civil penalties, restoring the creek, and restoring the RPA by entering into a Chesapeake Bay Restoration Agreement.

Should you wish to appeal any of these violations, the appeals would be heard by the following entities:

- Chesapeake Bay Preservation Ordinance appeals are heard by the James City County Chesapeake Bay Board (County Code sec. 23-17);
- Stormwater Management Ordinance appeals are heard by the James City County Circuit Court (County Code sec. 8-32) ;
- Erosion and Sediment Control Ordinance appeals are heard by the James City County Board of Supervisors (County Code sec. 8-8).

Please contact our office at 757-253-6670 to discuss this matter within the next 30 days. If you wish to appeal this determination you must initiate an appeal within 30 days After 30 days from the date of this letter, the matter is no longer appealable.

Sincerely,

Michael Woolson, PLA, CFM
Section Chief, Resource Protection
Stormwater and Resource Protection Division

cc: Toni Small, Stormwater and Resource Protection Division Director, via email
Liz Parman, Assistant County Attorney, via email
Paul Holt, Community Development Director, via email
Christy Parrish, Zoning Administrator, via email
J. Stephen Roberts, Registered Agent, R.A. Coleman, Inc., via regular mail

## Sec. 8-4. Regulated land disturbing activities; submission and approval of plans, contents of plans.

(a) Except as provided herein, no person may engage in any land disturbing activity until he has submitted to the engineering and resource protection division for the county an erosion and sediment control plan for the land disturbing activity and such plan has been approved by the plan-approving authority. Where land disturbing activities involve lands under the jurisdiction of more than one local control program, an erosion and sediment control plan, at the option of the applicant, may be submitted to the board for review and approval rather than to each jurisdiction concerned.

Where the land disturbing activity results from the construction of a single-family residence, an "agreement in lieu of a plan" may be substituted for an erosion and sediment control plan if executed by the plan-approving authority.

(b) The standards contained within the Virginia Erosion and Sediment Control Regulations, including the Minimum Standards, the Virginia Erosion and Sediment Control Handbook and the James City County Guidelines for Design and Construction of Stormwater Management BMPs (Guidelines) are to be used by the applicant when making a submittal under the provisions of this chapter and in the preparation of an erosion and sediment control plan. The plan-approving authority, in considering the adequacy of a submitted plan, shall be guided by these same standards, regulations and guidelines. When the standards vary between the publications, the state regulations shall take precedence except for the MS-19 two-year storm criteria, whereas James City County has adopted a one-year storm criteria as specified in the Guidelines.

(c) The plan-approving authority shall, within 45 days from receipt thereof, approve any such plan, if it is determined that the plan meets the requirements of the local control program, and if the person responsible for carrying out the plan certifies that he or she will properly perform the erosion and sediment control measures included in the plan and will conform to the provisions of this chapter. In addition, as a prerequisite to approval of the plan, the person responsible for carrying out the plan shall provide the name of an individual holding a certificate of competence, as provided by the state Department of Conservation and Recreation, who will be in charge of and responsible for carrying out the land disturbing activity. Any disapproval of a plan shall be in writing and any disapproval shall specify the reasons for such disapproval.

When the plan is determined to be inadequate, the plan-approving authority shall specify such modifications, terms and conditions that will permit approval of the plan. If no action is taken within 45 days, the plan shall be deemed approved and the person authorized to proceed with the proposed activity.

(d) An approved plan may be changed by the plan-approving authority when:

(1) The inspection reveals that the plan is inadequate to satisfy applicable regulations; or

(2) The person responsible for carrying out the plan finds that because of changed circumstances or for other reasons the approved plan cannot be effectively carried out, and proposed amendments to the plan, consistent with the requirements of this chapter, are agreed to by the plan-approving authority and the person responsible for carrying out the plans.

(e) In order to prevent further erosion, the county may require approval of a conservation plan for any land identified in the local program as an erosion impact area.

(f) When land disturbing activity will be required of a contractor performing construction work pursuant to a construction contract, the preparation, submission, and approval of an erosion and sediment control plan shall be the responsibility of the owner.

(g) Whenever electric and telephone utility companies, interstate and intrastate natural gas pipeline companies or railroad companies undertake any of the activities included in subparagraphs (1) and (2) of this subsection, they shall be considered exempt from the provisions of this chapter.

(1) Construction, installation and maintenance of electric, natural gas and telephone utility lines and pipelines; and

(2) Construction of the tracks, rights-of-way, bridges, communication facilities and other related structures and facilities of the railroad company.

(3) Projects not included in subparagraphs (1) and (2) of this subsection shall comply with the requirements of the county erosion and sediment control program.

(h) State agency projects are exempt from the provisions of this chapter except as provided for in the Code of Virginia, section 10.1-564.

(Ord. No. 85A-13, 10-26-99; Ord. No. 85A-14, 7-24-01; Ord. No. 85A-19, 7-26-11)

## Sec. 8-5. Permits, fees, bonding, etc.

(a) Agencies authorized under any other law to issue grading, building, or other permits for activities involving land disturbing activities may not issue any such permit unless the applicant submits with his application an approved erosion and sediment control plan and certification that the plan will be followed.

(b) No person may engage in any land disturbing activity until he has acquired a land disturbing permit, unless the proposed land disturbing activity is specifically exempt from the provisions of this chapter, and has paid the fees and posted the required bond.

(c) Fees. The administrative fees set forth in County Code Appendix A—Fee Schedule for Development Related Permits shall be paid to the county.

(1) Payment of any permit fees set forth in County Code Appendix A-Fee Schedule for Development Related Permits shall be waived for the county, any entity created solely by the county and those regional entities to which the county is a party provided that: (i) The other parties to the regional entity similarly waive fees; and (ii) The regional entity has locations in more than one locality.

(d) No land disturbing permit shall be issued until the applicant submits with his application an approved erosion and sediment control plan and certification that the plan will be followed.

(e) Performance surety. All applicants for permits shall provide to the county a performance bond, cash escrow, or an irrevocable letter of credit, any combination thereof, or other legal arrangements as is acceptable to the county attorney, to ensure that measures could be taken by the county at the applicant's expense should the applicant fail, after proper notice, within the time specified to initiate or maintain appropriate conservation measures required of him as a result of his land disturbing activity.

The amount of the performance surety shall not exceed the total of the estimated cost to initiate and maintain appropriate conservation action based on unit price for new public or private sector construction in the locality and a reasonable allowance for estimated administrative costs and inflation which shall not exceed twenty-five percent of the cost of the conservation action. Should it be necessary for the county to take such conservation action, the county may collect from the applicant any costs in excess of the amount of the surety held.

Within 60 days of adequate stabilization, as determined by the engineering and resource protection division, in any project or section of a project, such performance surety, or the unexpended or unobligated portion thereof shall be either refunded to the applicant or terminated, based upon the percentage of stabilization accomplished in the project or project section.

(f) Any land disturbing permit shall contain a right of entry to allow the manager or his designees access to the property until a final inspection determines that the land is adequately stabilized.

(g) These requirements are in addition to all other provisions relating to the issuance of permits and are not intended to otherwise affect the requirements for such permits.

(h) Any approved erosion and sediment control plan shall become null and void one year after the date of issuance of the land disturbing permit, and no further work subject to this chapter shall be allowed unless and until an additional or updated erosion and sediment control plan has been submitted and approved in accordance with the provisions of this chapter or unless all requirements of the approved control plan have been completed in less than one year in accord with such plan and verified by the on-site inspection by the manager.

(Ord. No. 85A-13, 10-26-99; Ord. No. 85A-14, 7-24-01; Ord. No. 85A-15, 4-22-03; Ord. No. 85A-16, 5-11-04; Ord. No. 85A-17, 6-28-05; Ord. No. 85A-19, 7-26-11; Ord. No. 85A-22 , 8-9-11)

## Sec. 8-22. Stormwater permit requirement; exemptions.

(a) Except as provided herein, no person may engage in any land disturbing activity until a VSMP authority permit has been issued by the administrator in accordance with the provisions of this article. VESCP and VSMP authority permits may be combined into a single consolidated permit that is consistent with the provisions of the Virginia Erosion and Sediment Control Law (§ 62.1-44.15:51 et seq. of the Code of Virginia).

(b) After June 30, 2014, and consistent with 9VAC25-870-51, a Chesapeake Bay preservation area land disturbing activity shall not require completion of a registration statement or require coverage under the general VPDES permit for discharges of stormwater from construction activities (VAR10) but shall be subject to erosion and sediment control plan requirements consistent with Virginia erosion and sediment control law and regulations, this article, stormwater management plan requirements as outlined under section 8-25, technical criteria and administrative requirements for land disturbing activities as outlined in section 8-28, and the requirements for control measures for long-term maintenance as outlined in section 8-29.

(c) Notwithstanding any other provisions of this article, the following activities are exempt, upon verification by the administrator, and unless otherwise required by federal law. The administrator is authorized and directed to determine if a particular activity meets or qualifies for a specific exemption. Any appeal of the administrator's decision shall be heard by the board of supervisors.

(1) Minor residential, business, and community landscaping activities such as tilling, adding soil amendments such as compost, and mulching for small scale features such as vegetable, flower or herb gardens, annual or perennial flower beds, ornamental plantings, wildflower plantings, edge borders, and reasonable turfgrass establishment. Exempted work under this provision cannot be situated in RPA and is normally reserved for aesthetic, beautification or scenic purposes and shall not include clearing, grading, placement of impervious cover, or soil disturbance due to placement of earthen fill or deep depths or quantities of topsoil beyond that expected for landscape purposes;

(2) Permitted surface or deep mining operations and projects, or oil and gas operations and projects conducted under the provisions of Title 45.1 of the Code of Virginia;

(3) Clearing of lands specifically for agricultural purposes and the management, tilling, planting, or harvesting of agricultural, horticultural, or forest crops, livestock feedlot operations, or as additionally set forth by the state board in regulations, including engineering operations as follows: construction of terraces, terrace outlets, check dams, desilting basins, dikes, ponds, ditches, strip cropping, lister furrowing, contour cultivating, contour furrowing, land drainage, and land irrigation; however, this exception shall not apply to harvesting of forest crops unless the area on which harvesting occurs is reforested artificially or naturally in accordance with the provisions of Chapter 11 (§ 10.1-1100 et seq.) of Title 10.1 of the Code of Virginia or is converted to bona fide agricultural or improved pasture use as described in Subsection B of § 10.1-1163 of Article 9 of Chapter 11 of Title 10.1 of the Code of Virginia;

(4) Single-family residences separately built and disturbing less than one acre and not part of a larger common plan of development or sale, including additions or modifications to existing single-family

detached residential structures. However, localities subject to the Chesapeake Bay Preservation Act (§ 62.1-44.15:67 et seq.) may regulate these single-family residences where land disturbance exceeds 2,500 square feet;

(5) Land disturbing activities that disturb less than one acre of land except for land disturbing activity exceeding an area of 2,500 square feet in all areas of the county designated as subject to the Chesapeake Bay preservation area designation and management regulations (9VAC25-830) adopted pursuant to the Chesapeake Bay Preservation Act (§ 62.1-44.15:67 et seq.) or activities that are part of a larger common plan of development or sale that is one acre or greater of disturbance; however, the board of supervisors may reduce this exception to a smaller area of disturbed land or qualify the conditions under which this exemption shall apply;

(6) Discharges to a sanitary sewer or a combined sewer system;

(7) Activities under a state or federal reclamation program to return an abandoned property to an agricultural or open land use;

(8) Routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original construction of the previously approved project, including obligated storm drainage and stormwater management or BMP facility maintenance, provided it is performed to maintain proper stormwater function and structural integrity of previously approved and installed systems, does not result in any type of improvement such as new pipes, channels, or the addition of access structures such as inlets or manholes, or results in a change in conveyance method, capacity, slope, size, alignment, material type, area, hydraulic radius, storage volume, or the physical location of any part of the system. The paving of an existing road with a compacted or impervious surface and reestablishment of existing associated ditches and shoulders shall be deemed routine maintenance if performed in accordance with this subsection;

(9) Small scale archaeological and geotechnical or other similar investigative activities, unless the administrator deems that work for access and the investigative activity are of such a scale or magnitude to threaten natural resources or environmental inventory components as outlined in section 23-10 of the county code;

(10) Small scale projects performed by the county pursuant to federal or state grant funds received and of which are solely for educational or demonstration purposes for water quality improvement or nonpoint source pollution control;

(11) Reclamation or stabilization projects in which the county draws on erosion and sediment control, siltation, public improvement, subdivision or other performance surety as secured for a development project in accordance with section 8-35 of this article. Work under this item shall be of sole purpose to immediately stabilize or implement temporary erosion and sediment control measures at a site because of default on the project and to prevent damage or threatening conditions to adjacent or downstream property or water resources. Work under this provision shall be procured, contracted and managed by the VSMP authority or designee in accordance with county and county purchasing department requirements; and

(12) Conducting land disturbing activities in response to a public emergency, declared or otherwise, where the related work requires immediate authorization to avoid imminent endangerment to property, human health or the environment. In such situations, the administrator shall be advised of the disturbance within seven days of commencing the land disturbing activity and compliance with the administrative requirements of subsection (a) is required within 30 days of commencing the land disturbing activity.

(Ord. No. 85A-21, 5-13-14)

**AGENDA ITEM NO. H.2.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Ryan T. Ashe, Fire Chief

SUBJECT: Authorization for Nine Full-Time Firefighter I-IV Positions

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**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| | Memorandum | Cover Memo |
| | Resolution | Resolution |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Fire | Ashe, Ryan | Approved | 12/23/2021 - 9:54 AM |
| Publication Management | Daniel, Martha | Approved | 12/23/2021 - 10:03 AM |
| Legal Review | Kinsman, Adam | Approved | 12/28/2021 - 7:33 AM |
| Board Secretary | Saeed, Teresa | Approved | 12/28/2021 - 8:39 AM |
| Board Secretary | Rinehimer, Bradley | Approved | 1/3/2022 - 8:18 AM |
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 2:07 PM |

**M E M O R A N D U M**

DATE: January 11, 2022

TO: The Board of Supervisors

FROM: Ryan T. Ashe, Fire Chief

SUBJECT: Authorization for Nine Full-Time Firefighter I-IV Positions

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The Fire Department is budgeted for 37 positions on each of the three shifts, which is five more than our minimum daily operational need of 32 per shift. A review of our historical data shows we average five staff on leave per day, which places us at our minimum daily operational need, if all 37 budgeted positions are available to work. However, the Fire Department always has staff unavailable to work due to Recruit training, Family Medical Leave Act (FMLA), military leave, modified/light duty, or vacancies. The Fire Department tracks this data by pay period and a review of the historical data shows an average of nine positions, or three per shift, that are unavailable to work. Accounting for both leave and unavailable positions, each shift starts with only 29 staff scheduled to work. Voluntary or mandatory overtime must be used to fill the unavailable positions in order to simply meet the minimum operational need of 32 staff on duty. Three additional staff per day on overtime has a financial impact of an additional $600,000 annually and creates hardship in work-life balance for our staff who are often working 48-72 hours consecutively.

For several years, the Fire Department benefited from additional positions that were planned for the opening of Fire Station 6 but were ultimately used to address several strategic plan initiatives in Fiscal Year 2021. The temporary cushion of staff were used as over-hires to offset overtime that would have occurred from staff being unavailable to work. Overtime spending during this period was reduced by approximately $600,000 annually and staff were not held on mandatory overtime to meet our daily operational need.

The Fire Department is proposing the addition of nine Firefighter I-IVs to increase the total positions assigned to each shift by three. These additional positions will offset the increase in overtime spending, reduce/eliminate mandatory overtime, and ensure we maintain the minimum operational need to respond to our community. If approved, the Fire Department will begin filling these positions in February to start Emergency Medical training and fill any remaining positions by April 2022 to begin the fire academy. The estimated cost of these positions for the remainder of Fiscal Year 2022 is $209,189, which would be funded by savings in the General Fund.

Staff recommends the adoption of the attached resolution.

RTA/ap
Auth9FllTmeFFpos-mem

Attachment

# **R E S O L U T I O N**

AUTHORIZATION FOR NINE FULL-TIME FIREFIGHTER I-IV POSITIONS

WHEREAS, the James City County Board of Supervisors has the authority to establish County full-time positions; and

WHEREAS, the Fire Department desires to add nine additional Firefighter I-IV positions, effective February 1, 2022, in order to offset overtime spending and prevent mandatory overtime; and

WHEREAS, the estimated cost of these positions for the remainder of Fiscal Year 2022 is $209,189.

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of James City County, Virginia, hereby approves nine full-time Firefighter I-IVs in the Fire Department and authorizes the use of General Fund savings for this purpose.

_____

Chairman, Board of Supervisors

ATTEST:

_____

Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| SADLER | ____ | ____ | ____ | ____ |
| ICENHOUR | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

Auth9FllTmeFFpos-res

**AGENDA ITEM NO. H.3.**

**ITEM SUMMARY**

| | |
|---|---|
| DATE: | 1/11/2022 |
| TO: | The Board of Supervisors |
| FROM: | Richard Bradshaw, Commissioner of the Revenue |
| SUBJECT: | Ordinance to amend James City County Code section 20-45 to allow the Commissioner of the Revenue to assess a penalty for late returns (Action deferred at Nov. 9, 2021 Regular Meeting) |

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**ATTACHMENTS:**

| | Description | Type |
|---|---|---|
| 🗋 | Memorandum | Cover Memo |
| 🗋 | Ordinance (strikethrough version) | Ordinance |
| 🗋 | Ordinance (clean version) | Ordinance |
| 🗋 | Minutes from the Public Hearing | Exhibit |

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 4:18 PM |

**M E M O R A N D U M**

DATE: January 11, 2022

TO: The Board of Supervisors

FROM: Richard W. Bradshaw, Commissioner of the Revenue
Adam R. Kinsman, County Attorney

SUBJECT: Revision of Section 20-45 of the County Code

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The Commissioner of the Revenue desires that Section 20-45 of the James City County Code (the "County Code") be amended to permit his office to impose a 10% penalty for failure to provide a report on the amount of prepared food and beverage tax owed to the County. Currently, the County Code only permits the Treasurer to impose a penalty for such failure.

The public hearing was held on November 9, 2021 and the Board deferred action until the January 11, 2022 Regular Meeting.

RWB/ARK/md
RevCCSec20-45-mem

Attachment

ORDINANCE NO._____

AN ORDINANCE TO AMEND AND REORDAIN CHAPTER 20, TAXATION, OF THE CODE OF THE COUNTY OF JAMES CITY, VIRGINIA, BY AMENDING ARTICLE VII, TAX ON PREPARED FOOD AND BEVERAGES, SECTION 20-45, PENALTY OF LATE REMITTANCE OR FALSE RETURN.

BE IT ORDAINED by the Board of Supervisors of the County of James City, Virginia, that Chapter 20, Taxation, is hereby amended and reordained by amending Article VII, Tax on Prepared Food and Beverages, Section 20-45, Penalty of late remittance or false return.

## Chapter 20. Taxation

### Article VII. Tax on Prepared Food and Beverages

**Sec. 20-45 Penalty of late remittance, ~~or~~ false return, *or failure to file report*.**

*(a)* If any seller whose duty it is to do so shall fail or refuse to file any report required by this article or to remit to the treasurer the tax required to be collected and paid under this article within the time and in the amount specified in this article, there shall be added to such tax by the treasurer a penalty in the amount of ten percent of the tax past due, or $10.00, whichever is greater; provided, however, that the penalty shall in no case exceed the amount of the tax assessable and interest thereon at the rate of ten percent per annum, which shall be computed upon the taxes and penalty from the date such taxes are due and payable.

*(b) If any person shall fail or refuse to file a report required to be filed by this article within the time specified, the commissioner of the revenue shall assess a penalty of ten percent to the tax owed for each such failure or refusal to file a report, which penalty shall become part of the tax owed at the time the penalty is assessed. No such penalty shall exceed the amount of the tax owned.*

_____
John J. McGlennon
Chairman, Board of Supervisors

ATTEST:

_____
Teresa J. Saeed
Deputy Clerk to the Board

| | VOTES | | | |
|---|---|---|---|---|
| | AYE | NAY | ABSTAIN | ABSENT |
| ICENHOUR | ____ | ____ | ____ | ____ |
| HIPPLE | ____ | ____ | ____ | ____ |
| LARSON | ____ | ____ | ____ | ____ |
| SADLER | ____ | ____ | ____ | ____ |
| MCGLENNON | ____ | ____ | ____ | ____ |

Adopted by the Board of Supervisors of James City County, Virginia, this 11th day of January, 2022.

RevCCSec20-45-ord

ORDINANCE NO._____

AN ORDINANCE TO AMEND AND REORDAIN CHAPTER 20, TAXATION, OF THE CODE OF THE COUNTY OF JAMES CITY, VIRGINIA, BY AMENDING ARTICLE VII, TAX ON PREPARED FOOD AND BEVERAGES, SECTION 20-45, PENALTY OF LATE REMITTANCE OR FALSE RETURN.

BE IT ORDAINED by the Board of Supervisors of the County of James City, Virginia, that Chapter 20, Taxation, is hereby amended and reordained by amending Article VII, Tax on Prepared Food and Beverages, Section 20-45, Penalty of late remittance or false return.

## Chapter 20. Taxation

## Article VII. Tax on Prepared Food and Beverages

**Sec. 20-45 Penalty of late remittance, false return, or failure to file report.**

(a) If any seller whose duty it is to do so shall fail or refuse to file any report required by this article or to remit to the treasurer the tax required to be collected and paid under this article within the time and in the amount specified in this article, there shall be added to such tax by the treasurer a penalty in the amount of ten percent of the tax past due, or $10.00, whichever is greater; provided, however, that the penalty shall in no case exceed the amount of the tax assessable and interest thereon at the rate of ten percent per annum, which shall be computed upon the taxes and penalty from the date such taxes are due and payable.

(b) If any person shall fail or refuse to file a report required to be filed by this article within the time specified, the commissioner of the revenue shall assess a penalty of ten percent to the tax owed for each such failure or refusal to file a report, which penalty shall become part of the tax owed at the time the penalty is assessed. No such penalty shall exceed the amount of the tax owned.

RevCCSec20-45-ord-final

**Public Hearing Minutes**

**November 9, 2021**

3. Ordinance to amend James City County Code section 20-45 to allow the Commissioner of the Revenue to assess a penalty for late returns

A motion to Postpone was made by John McGlennon, the motion result was Passed.

AYES: 5 NAYS: 0 ABSTAIN: 0 ABSENT: 0

Ayes: Hipple, Icenhour Jr, Larson, McGlennon, Sadler

Mr. Kinsman addressed the Board as Mr. Bradshaw was not present. Mr. Kinsman remarked on the Commissioner of the Revenue's request to amend the County Code to allow him to assess a 10% penalty upon anyone who failed to file a report predominantly for food and beverage. Mr. Kinsman noted he was available to answer any questions.

Ms. Sadler asked if this pertained mainly to the restaurant industry based on verbiage.

Mr. Kinsman confirmed yes.

Ms. Sadler inquired if the Treasurer's office collected a 10% penalty for late fees.

Mr. Kinsman replied correct.

Ms. Sadler asked if this would be an additional penalty for late paperwork.

Mr. Kinsman replied yes, for failure to file the report.

Ms. Sadler asked if some businesses could potentially get penalized twice.

Mr. Kinsman confirmed yes, two taxes could be incurred.

Mr. Hipple pointed out Mr. Bradshaw entered the boardroom.

Mr. Kinsman noted he would be happy to let Mr. Bradshaw take over the podium.

Mr. Bradshaw addressed the Board to answer any questions.

Ms. Sadler noted Mr. Kinsman had answered the questions she had; however, Ms. Sadler expressed her concern of local businesses potentially getting double hit, adding the many challenges local businesses currently faced. Ms. Sadler acknowledged that other localities were implementing this penalty, but she did not feel this was the right time to execute.

Mr. Bradshaw noted the vast majority of the local businesses who filed late were not a few days late, but three or four months late.

Ms. Sadler suggested revisiting this proposal in another year or so. Ms. Sadler pointed out many local businesses were still struggling because of the COVID-19 pandemic, adding she found it difficult to support something like this right now. Ms. Sadler thanked Mr. Bradshaw for sharing his thoughts.

Mr. Icenhour asked if this was a separate penalty from the Treasurer's late payment fee penalty.

Mr. Bradshaw confirmed yes.

Mr. Icenhour inquired if this penalty was specifically for filing the paperwork.

Mr. Bradshaw confirmed that was correct.

Mr. Icenhour inquired how often local businesses file the report in a timely manner, but do not pay the taxes within the given timeframe.

Mr. Bradshaw commented the vast majority file paperwork and included payment.

Mr. Icenhour replied okay.

Mr. Bradshaw noted there were rare occasions where an individual would submit a form and no payment, adding in that scenario no late filing penalty would be incurred. Mr. Bradshaw further noted as he was telling Ms. Sadler the most common occurrence was not receiving any paperwork until an administrative assessment was made a few months later.

Mr. Icenhour asked what percentage of cases fall under this category.

Mr. Bradshaw replied approximately 5% or 6%.

Mr. Icenhour replied okay.

Mr. Bradshaw pointed out that percentage in most cases were repeat offenders. Mr. Bradshaw stated there were a couple of businesses who file once every six months.

Mr. McGlennon highlighted the concerns Ms. Sadler addressed in regard to the potential double penalty. Mr. McGlennon inquired on a different approach and if the concern was mainly repeat offenders to implement higher penalty rates on those individuals.

Mr. Bradshaw noted it would be a bit more challenging to do, adding if there was a late filing penalty it would apply to any individual who was late filing. Mr. Bradshaw further noted there would be a potential for a waiver for cause; however, it would be determined on a case-by-case basis.

Ms. Larson thanked Mr. Bradshaw. Ms. Larson noted she was not prepared to support this proposal due to the challenging times our local restaurants were under. Ms. Larson further noted she was not opposed to this idea in the future but requested to see more data on the percentage of repeated offenders and if other localities participated, she would like to see the language used.

Mr. Bradshaw noted the language was almost identical to York County's Code.

Ms. Larson replied okay, thank you.

Mr. Bradshaw mentioned the language in peninsula cities varied because the collection process was different, adding all collections and postings were conducted in the Commissioner of the Revenue's Office. Mr. Bradshaw stated in those jurisdictions there was an initial 10% penalty, 30 days later another 5% penalty, followed by 30 days after another 5% penalty, 30 days later another 5% penalty goes in, in addition to the interest accrued over that span of time.

Ms. Larson asked what if the 10% penalty did not work.

Mr. Bradshaw commented if the 10% penalty did not work, he doubts the additional 5% penalty occurrences would be effective either.

Ms. Larson asked if York County had seen success in this process.

Mr. Bradshaw noted York County Code has had this process since adopting the Food and Beverage Tax.

Ms. Larson asked if York County was having success with the additional penalties.

Mr. Bradshaw stated there was no way to tell.

Mr. McGlennon asked what the failure rate was between James City County versus York County.

Mr. Bradshaw stated he had no idea.

Mr. McGlennon mentioned that would be useful information to be obtained as well.

Ms. Larson responded yes.

Mr. McGlennon pointed out if York County had this provision and James City County did not, James City County most likely would have a higher rate for failure to file.

Ms. Sadler requested data on business retention regarding restaurants comparable in another locality. Ms. Sadler reiterated the challenges the service industry had endured. Ms. Sadler noted she understood the County needed to collect what was owed.

Ms. Larson responded absolutely.

Ms. Sadler asked if it was going to negatively impact business retention.

Mr. Bradshaw stated we were not seeing local restaurants closing in James City County.

Ms. Sadler replied local restaurants were having challenges with being understaffed, remaining open, and having to shorten hours of operation. Ms. Sadler noted those concerns were brought to her attention numerous of times, adding it was an ongoing issue. Ms. Sadler expressed her concerns of not putting any additional burdens on our local service industry at this time.

Mr. Hipple asked if not filing on time could permit restriction/suspension of Driver's Licenses.

Mr. Bradshaw replied no.

Mr. Hipple asked the explanation as to why it could not be done.

Mr. Bradshaw explained there was no statutory ability to do so.

Mr. Hipple questioned the ability to revoke a Driver's License.

Mr. Bradshaw noted those were two separate taxes. Mr. Bradshaw remarked that would be like putting an individual's real estate up for foreclosure because personal property tax was not paid.

Mr. Hipple commented after a certain duration of time it would be.

Mr. Bradshaw responded not for personal property tax.

Mr. Hipple replied he was referring to real estate.

Ms. Larson suggested adding the item to the legislative agenda.

Mr. Bradshaw commented on the inability to mix taxes.

Mr. Hipple expressed his concern as a business owner and the number of taxes.

Mr. Bradshaw explained the food and beverage tax was a trust tax and was not reflected in the businesses' gross receipts, adding the tax was paid by the citizen to be turned over to the County. Mr. Bradshaw reiterated the food and beverage tax was collected from the citizen by the local business; however, it would not be included in the local business's income.

Mr. Hipple remarked on the fuel tax that citizens also pay to support and service our roads. Mr. Hipple expressed his concern of double taxing and suggested an alternative approach. Mr. Hipple commented 5% seemed to be a pretty low percentage, adding he would like to see more data in regard to the number of local businesses that were included in that percentage.

Mr. Bradshaw noted there were approximately 600 filers, adding staff were having to conduct administrative assessments on approximately 35 to 40 of them every month.

Mr. McGlennon noted he would like to have more data before making a final decision on this matter. He further noted the staff time and increased costs to the department to process those failures may be justified with implementing the late filing tax. Mr. McGlennon recommended coming back before the Board with additional data to make a more rational decision.

Mr. Bradshaw commented he would provide any pertinent information to the Board.

Mr. Icenhour commented on the 5% of filers appeared to cause a challenge for both the Treasurer's Office and the Commissioner of Revenue's Office.

Mr. Bradshaw confirmed yes.

Mr. Icenhour noted it was a rare case of a local business filing, but not submitting payment.

Mr. Bradshaw noted the challenge of not filing caused a hold in which staff could not invoice the local business nor put the business into the billing system. Mr. Bradshaw further noted that resulted in the administrative assessment and a revision later.

Mr. Icenhour suggested a penalty for delay in filing opposed to a collection fee since it was a rare case in which a business would file and not submit payment, adding an increased penalty on the Commissioner's side if failure to submit payment.

Mr. Bradshaw indicated cities such as Suffolk, Newport News, and Hampton jurisdictions had an initial 10% penalty, 30 days later a 5% penalty for nonpayment, followed by another 5%, and another 5%, adding for a total penalty of 25% including a 10% interest rate.

Mr. Icenhour remarked it would be beneficial to find out the experiences other localities had with the penalties to complete a thorough comparison.

Ms. Sadler reiterated her concerns of implementing this in such a challenging time for our service industry. Ms. Sadler noted she was in agreeance of collecting the pertinent data to further assess this item later; however, did not feel this was the right time to proceed.

Mr. McGlennon noted he understood Ms. Sadler's point. Mr. McGlennon further noted Mr. Bradshaw had made a very valid point, which was the local business was collecting the customers prepared food and beverage tax, adding it was the responsibility of the local business to ensure that monies was passed onto the County.

Ms. Larson agreed.

Mr. McGlennon asked Mr. Bradshaw if he could come back before the Board in a month.

Mr. Bradshaw asked if the Board could provide their questions so he could gather all information and stated he would be more than happy to return in a month.

Ms. Larson recommended Mr. Bradshaw come back before the Board in January. Ms. Larson noted to be on the safe side, adding there were a lot of questions pertaining to this item.

Mr. Hipple clarified that the postponement would be till the January 11, 2022 Meeting.

Mr. Hipple opened the Public Hearing.

Mr. Hipple closed the Public Hearing as there were no speakers.

**AGENDA ITEM NO. K.1.**

**ITEM SUMMARY**

| | |
|---|---|
| DATE: | 1/11/2022 |
| TO: | The Board of Supervisors |
| FROM: | Teresa J. Saeed, Deputy Clerk |
| SUBJECT: | Consideration of a personnel matter, the appointment of individuals to County Boards and/or Commissions pursuant to Section 2.2-3711(A)(1) of the Code of Virginia and pertaining to the Planning Commission |

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**ATTACHMENTS:**

| Description | Type |
|---|---|

**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Board Secretary | Saeed, Teresa | Approved | 1/4/2022 - 3:23 PM |

**AGENDA ITEM NO. L.1.**

**ITEM SUMMARY**

DATE: 1/11/2022

TO: The Board of Supervisors

FROM: Teresa J. Saeed, Deputy Clerk

SUBJECT: Adjourn until 1 p.m. on January 25, 2022

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**REVIEWERS:**

| Department | Reviewer | Action | Date |
|---|---|---|---|
| Board Secretary | Saeed, Teresa | Approved | 1/3/2022 - 9:47 AM |