COUNTY of FREDERICK

Department of Planning and Development
540/ 665-5651
Fax: 540/ 665-6395

MEMORANDUM

TO: Frederick County Board of Supervisors
Frederick County Planning Commission
Comprehensive Plans and Programs Committee (CPPC)

FROM: Candice E. Perkins, AICP, CZA, Assistant Director

RE: **Board of Supervisors/Planning Commission Joint Work Session – Comprehensive Plan Amendments**

DATE: August 3, 2018

The Board of Supervisors will hold a joint work session on **Wednesday, August 15, 2018 at 6:00 p.m. in the Board of Supervisors Meeting Room.**

The following items are proposed for discussion:

AGENDA

1. **Comprehensive Plan Amendment (CPPA) Requests for 2018:**
   a. CPPA #02-18 – Carter Tract Proposal – Clearbrook (Near Brucetown Road)
   b. CPPA #03-18 – Waverly Farm– (south of Hopewell Road and west of Interstate 81)

2. **Other**

Please contact me if you have any questions.

CEP/pd

Attachments

Item #1: 2018 Comprehensive Plan Amendments (CPPA)

The Planning Department received two Comprehensive Plan Amendments (CPPA) requests by this year's June 1, 2018 deadline:

> **CPPA #02-18, for the Carter Tract – Sewer and Water Service Area (SWSA) Inclusion Request and Industrial Land Use Designation Request; Parcels 45-A-2, 45-A-7, 33-A-144 and 33-A-89.** This is a request to expand the boundary of the Sewer and Water Service Area (SWSA) to include 213.8 acres of land and to designate the site for industrial land uses. The properties are currently zoned RA (Rural Areas) and the Northeast Frederick Land Use Plan shows the properties as remaining rural. The properties are located north of the CSX Railroad, south of Brucetown Road, and east/adjacent to the Clearbrook quarry in the Stonewall Magisterial District.
> ***CPPC Recommendation: Consideration for further study***
>
> **CPPA #03-18, for Wavery Farm – Sewer and Water Service Area (SWSA) Inclusion Request; Parcels 33-A-69, 33-A-70, 44-A-80 and 44-A-80A.** This is a request to expand the boundary of the Sewer and Water Service Area (SWSA) to include 145.50 acres of land; currently 51.36 acres of the site is within the SWSA. The properties are currently zoned RA (Rural Areas); however, the Northeast Frederick Land Use Plan designates these parcels for mixed use industrial/office and industrial uses. The properties are located south of Hopewell Road and west of Interstate 81, in the Stonewall Magisterial District.
> ***CPPC Recommendation: Consideration for further study***

The Comprehensive Plans and Programs Committee (CPPC) discussed these requests at their July 2018 meeting. The CPPC discussed the warrants of the requested amendments, transportation concerns for the site and the larger area of the Northeast Land Use Plan, water concerns, and the inclusion of properties adjacent to the requests. Ultimately the CPPC supported further study of the requests.

Attached you will find the applications, maps showing the location of the proposals, maps showing the location of the proposals in the context of the Northeast Land Use Plan, comments from Frederick Water and information provided by the Applicants.

Staff is ultimately seeking the Board's direction as to whether these CPPA's warrant further study and consideration.

315 Tasker Road
Stephens City, Virginia 22655

PH (540) 868-1061
Fax (540) 868-1429
www.FrederickWater.com

Eric R. Lawrence
Executive Director

MEMORANDUM

TO: Candice Perkins, Assistant Director, Frederick County Planning Department

FROM: Eric R. Lawrence, Executive Director

SUBJECT: 2018 Comprehensive Policy Plan Amendment Review

DATE: June 12, 2018

Thank you for the opportunity to provide preliminary comments on the Comprehensive Policy Plan Amendment applications received for the 2018 application period. We understand that Frederick Water's preliminary comments will be shared with the Board of Supervisors and Planning Commission during their CPPA review joint work session later this summer. We welcome the opportunity to participate in a more thorough review of the applications once the Board decides if the application warrant further evaluation.

Our preliminary comments:

Waverly SWSA Expansion, Waverly Farm c/o Michael Stiles – Sewer and Water Service Area (SWSA) Expansion Request; Parcels 33-A-69, 33-A-70, 44-A-80, and 44-A-80A.

These properties are located in the southwest quadrant of I-81 Exit 321, south of Hopewell Road. Frederick Water does presently provide water and sewer services to the VDOT Rest Area, located immediately south of the applicant's land areas, and the only service lines we have in the vicinity of the western side of I-81. The service to the VDOT Rest Area has limited capacities available for use by other users.

There is currently limited sewer conveyance capacity available in the vicinity of the subject parcels. The 2017 Sanitary Sewer Master Plan offers that as the area develops, effluent from the Northern Service Region would be conveyed to the Opequon Water Reclamation Facility (OWRF) through a series of pump stations. The existing Route 11 North sewer system has available capacities reserved by property owners who funded the sewer infrastructure extension to Rest Church Road area over a decade ago, but the system does not currently have excess capacity available for additional land areas such as the subject properties. Sewer conveyance and treatment capacities are currently limited and warrant upgrades to meet long term planned development that is already captured in the current Sewer and Water Service Area (SWSA) boundary. Expansion of the SWSA will introduce additional demands for service and additional conveyance and treatment volumes, simply *adding additional land area that will further share the limited existing conveyance and treatment capacities.*

FCSA does not support further study of the application without consideration of a much larger study area that could collectively contribute to infrastructure improvements that convey the study area sewage directly to the OWRF or to a new WWTP. A study of opportunities, and implementation of results, for expansion of wastewater treatment facilities would also be necessary.

Carter Tract Industrial Land Use Designation and SWSA Expansion, O-N Minerals Company – Sewer and Water Service Area (SWSA) Expansion Request; Parcels 45-A-2, 45-A-8, and 33-A-144.

These properties are located east of the existing SWSA in the Clearbrook area, north of Gun Club Road and south of Brucetown Road. Frederick Water does not presently have water and sewer facilities in the vicinity of the Carter Tract.

There is currently limited sewer conveyance capacity available in the vicinity of the subject parcels. The 2017 Sanitary Sewer Master Plan indicates that as the area develops, effluent from the Northern Service Region would be conveyed to the Opequon Water Reclamation Facility (OWRF) through a series of pump stations. The existing Route 11 North sewer system has available capacities reserved by property owners who funded the sewer infrastructure extension to Rest Church Road area over a decade ago, but the system does not currently have excess capacity available for additional land areas such as the subject properties. Sewer

conveyance and treatment capacities are currently limited and warrant upgrades to meet long term planned development that is reflected in the current Sewer and Water Service Area (SWSA). Expansion of the SWSA will introduce additional demands for service, and additional conveyance and treatment capacities, essentially *adding additional land area to further share the limited existing conveyance and treatment capacities*.

FCSA does not support further study of the application without consideration of a much larger study area that could collectively contribute to infrastructure improvements to convey the study area sewage directly to the OWRF or to a new WWTP. A study of opportunities for expansion of wastewater treatment facilities would also be important.

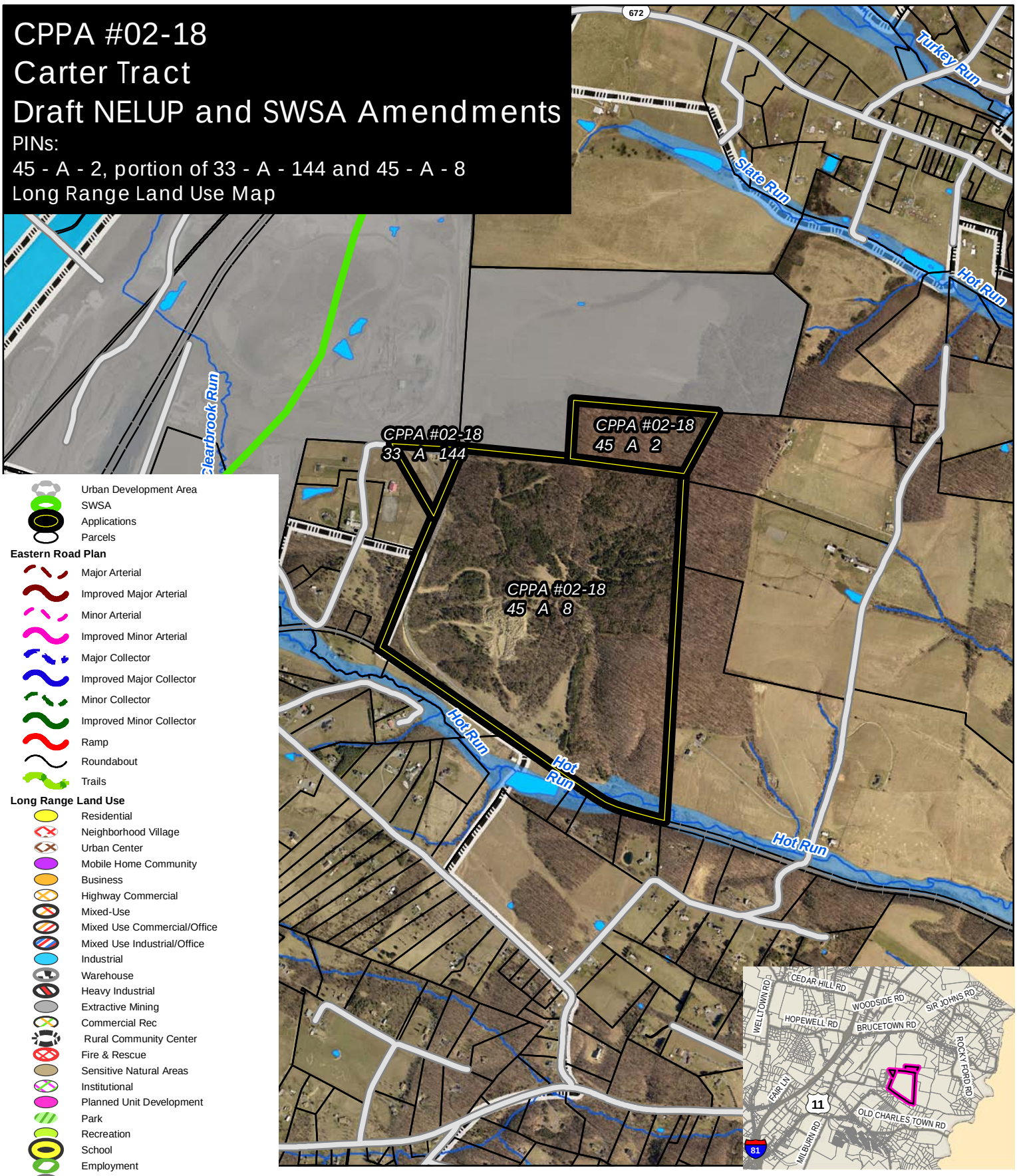
CPPA #02-18

CARTER TRACT

SEWER AND WATER SERVICE AREA (SWSA) INCLUSION REQUEST AND INDUSTRIAL LAND USE DESIGNATION REQUEST

CPPA #02-18
Carter Tract
Draft NELUP and SWSA Amendments

PINs:
45 - A - 2, portion of 33 - A - 144 and 45 - A - 8
Long Range Land Use Map



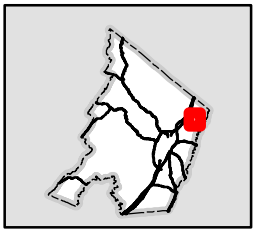
Urban Development Area
SWSA
Applications
Parcels

Eastern Road Plan

Major Arterial
Improved Major Arterial
Minor Arterial
Improved Minor Arterial
Major Collector
Improved Major Collector
Minor Collector
Improved Minor Collector
Ramp
Roundabout
Trails

Long Range Land Use

Residential
Neighborhood Village
Urban Center
Mobile Home Community
Business
Highway Commercial
Mixed-Use
Mixed Use Commercial/Office
Mixed Use Industrial/Office
Industrial
Warehouse
Heavy Industrial
Extractive Mining
Commercial Rec
Rural Community Center
Fire & Rescue
Sensitive Natural Areas
Institutional
Planned Unit Development
Park
Recreation
School
Employment
Airport Support Area
B2 / B3
Residential, 4 u/a
High-Density Residential, 6 u/a
High-Density Residential, 12-16 u/a
Rural Area
Interstate Buffer
Landfill Support Area
Natural Resources & Recreation
Environmental & Recreational Resources



CPPA #02-18
Carter Tract
PINs:
45 - A - 2, portion of 33 - A - 144 and 45 - A - 8
Draft NELUP and SWSA Amendments
Long Range Land Use Map

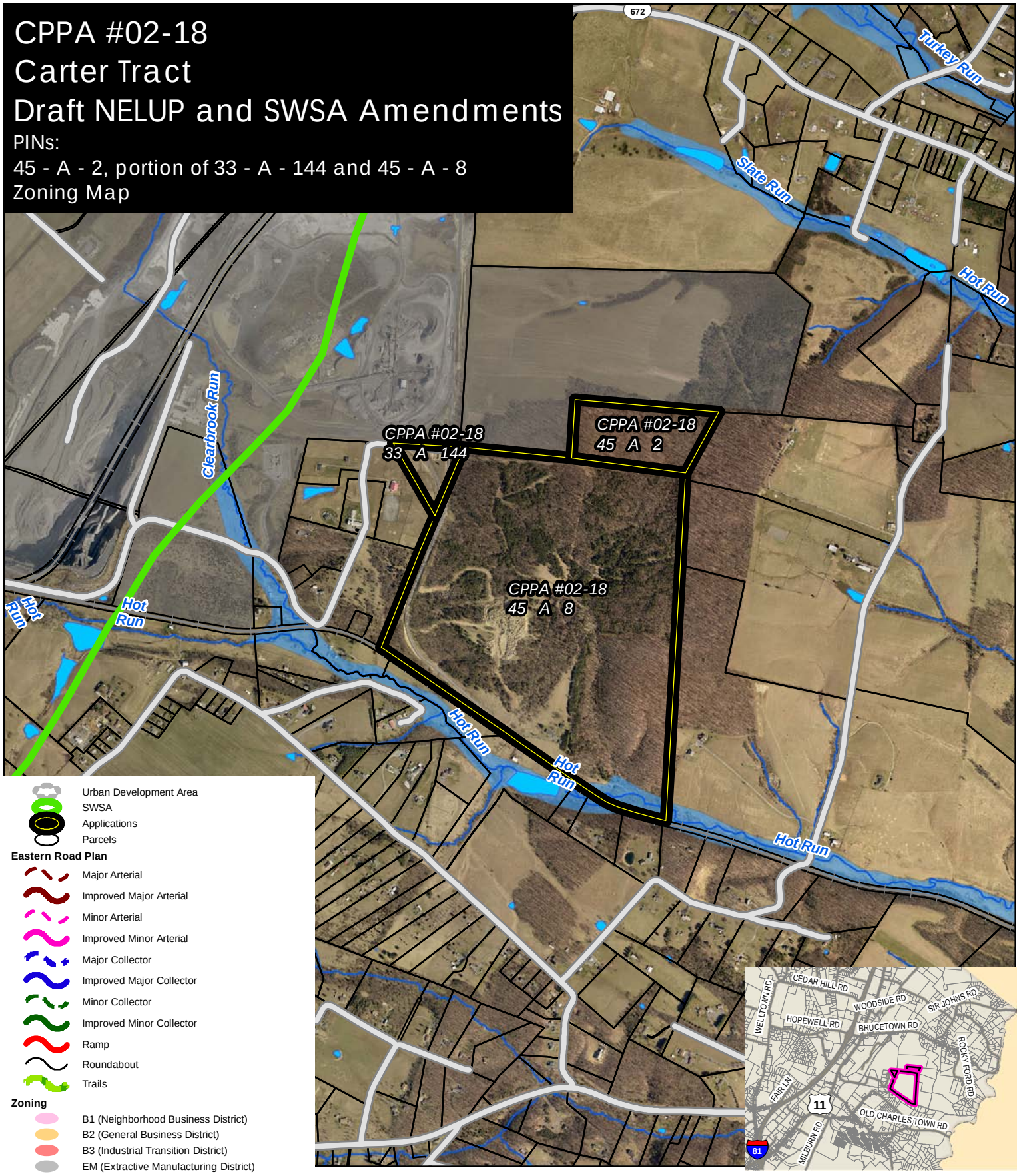
Note:
Frederick County Dept of Planning & Development
107 N Kent St
Suite 202
Winchester, VA 22601
540 - 665 - 5651

Map Created: June 4, 2018
Staff: cperkins

0 0.175 0.35 0.7 Miles

CPPA #02-18
Carter Tract
Draft NELUP and SWSA Amendments

PINs:
45 - A - 2, portion of 33 - A - 144 and 45 - A - 8
Zoning Map



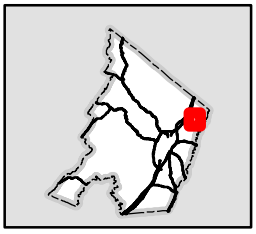
Urban Development Area
SWSA
Applications
Parcels

Eastern Road Plan

- Major Arterial
- Improved Major Arterial
- Minor Arterial
- Improved Minor Arterial
- Major Collector
- Improved Major Collector
- Minor Collector
- Improved Minor Collector
- Ramp
- Roundabout
- Trails

Zoning

- B1 (Neighborhood Business District)
- B2 (General Business District)
- B3 (Industrial Transition District)
- EM (Extractive Manufacturing District)
- HE (Higher Education District)
- M1 (Light Industrial District)
- M2 (Industrial General District)
- MH1 (Mobile Home Community District)
- MS (Medical Support District)
- OM (Office - Manufacturing Park)
- R4 (Residential Planned Community District)
- R5 (Residential Recreational Community District)
- RA (Rural Areas District)
- RP (Residential Performance District)



CPPA #02-18
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Zoning Map

Note:
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107 N Kent St
Suite 202
Winchester, VA 22601
540 - 665 - 5651
Map Created: June 4, 2018
Staff: cperkins

0 0.175 0.35 0.7 Miles

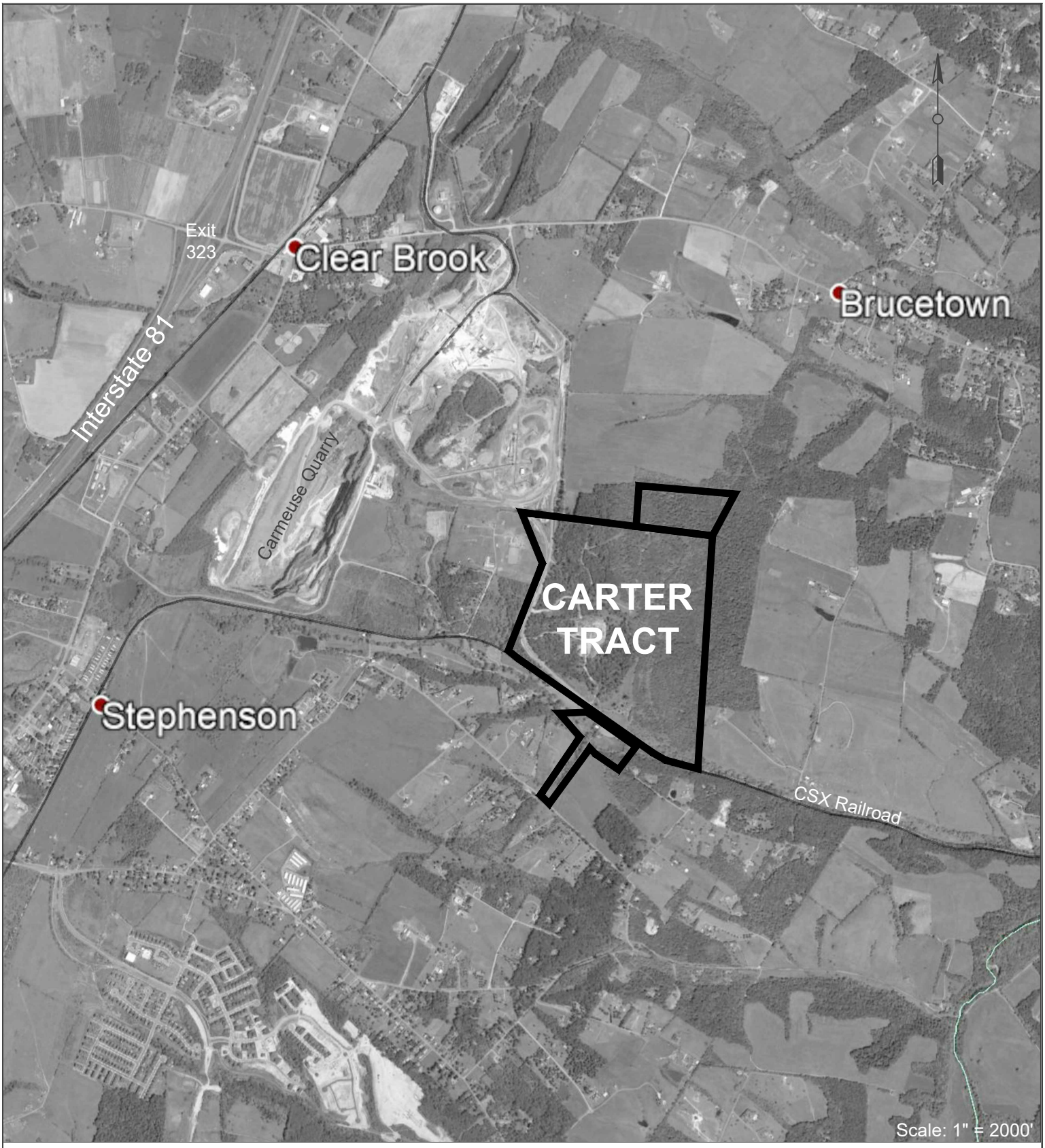
6/1/2018

Comprehensive Policy Plan Amendment

Carter Tract Proposal

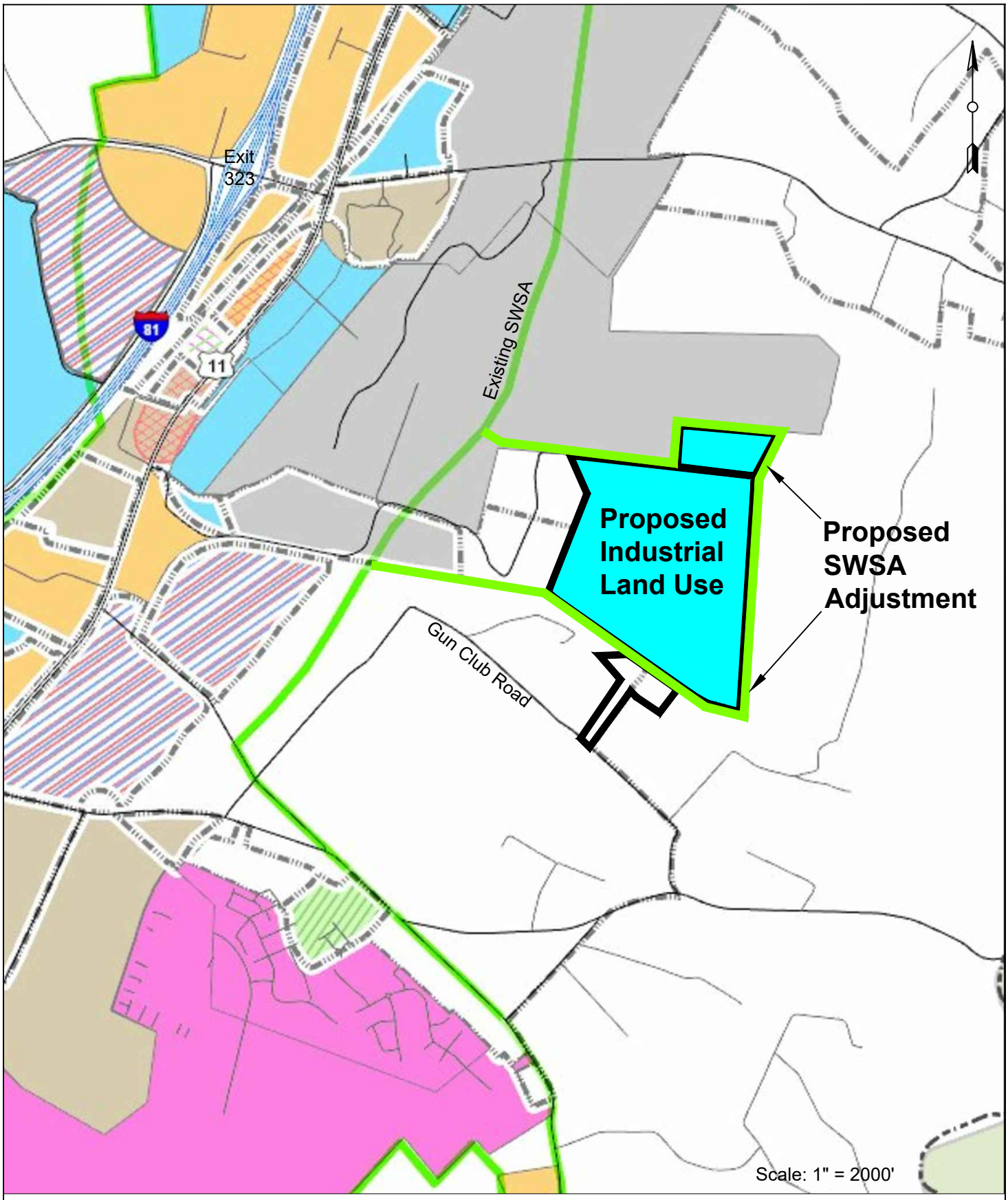
Prepared by

Tim Stowe
STOWE ENGINEERING
103 Heath Court
Winchester, VA 22602



Location Map for Carter Tract

Comprehensive Plan Amendment Proposal



Proposed Changes for Carter Tract

Comprehensive Plan Amendment Proposal

COMPREHENSIVE POLICY PLAN AMENDMENT INITIATION REQUEST FORM

(Please type all information. The application will not be deemed complete unless all items listed below have been submitted.)

A. Owner(s) Information:

1. Name: *O-N Minerals (Chemstone) Company*

2. Project Name: *Project Ferrari*

3. Mailing Address: *O-N Minerals: 11 Stanwix Street – 21st floor, Pittsburgh, PA 15222*
Attn: Kevin Whyte

4. Telephone Number: *O-N Minerals: 412.995.5520*

Authorized Agent Information:

1. Name: *Tim Stowe, Stowe Engineering*

2. Project Name: *Project Ferrari*

3. Mailing Address: *103 Heath Court*
Winchester, VA 22602

4. Telephone Number: *540.686.7373*

B. Legal interest in the property affected or reason for the request:
To facilitate industrial development on the property the owner would like to change the future land use to industrial on the parcel known as the Carter Tract. They would also like to have the Carter Tract included in the SWSA so water and sewer services will be available to support planned industrial use. A map showing the proposed changes is on the following page.

C. Proposed Comprehensive Policy Plan amendment - please provide the following information.

1. FOR A MAP AMENDMENT

a. PIN(s): *,45-A-2, portion of 45-A-8, portion of 33-A-144*
Magisterial District: *Stonewall*

b. Parcel size (approximate acres): *223.35 total; 213.8 in CPP amendment proposal*

2035 Comprehensive Plan
Future Land Use Designations
within 1 Mile

Land Use	Area (ac)
Industrial	55
Park & Recreation	40
Extractive Mining	718
Rural/Agricultural	2721
Total	3534

Exit 323

81

11

Existing SWSA

Proposed Industrial Land Use

Proposed SWSA Adjustment

Gun Club Road

Opequon Creek

WV

Clarke County

Parcels

Long Range Land Use

- Rural Community Center
- Business
- Mixed-Use
- Mixed Use Commercial \ Office
- Highway Commercial
- Warehouse
- Industrial
- Heavy Industrial
- Mixed Use Industrial \ Office
- Extractive Mining
- Residential
- Planned Unit Development
- Mixed Use Age Restricted
- Urban Center
- Neighborhood Village
- Recreation
- Commercial Recreation
- Open Space
- Natural Resources & Recreation
- Park
- Historic \ DSA
- Fire & Rescue
- Institutional
- School

STOWE ENGINEERING, PLC
103 Heath Court
Winchester, VA 22602
(540) 686-7373
fax (540) 301-1100

REVISIONS

NO.	DATE	DESCRIPTION	BY

PROPOSED LAND USE AND SWSA ADJUSTMENT FOR CARTER TRACT

CARTER TRACT
STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE: June 1, 2018
SCALE: 1" = 2000'
DESIGNED BY: TS
DRAWN BY: TS
CHECKED BY: TS
PROJECT #: 1168.0
SHEET 1 OF 1

c. Plat of area proposed for CPPA amendment, including metes and bounds description.

See the tab labeled "PLAT."

d. Existing Comprehensive Plan land use classification(s):

The existing 2035 Comprehensive Plan shows no future land use designation on the Carter tracts.

e. Proposed Comprehensive Plan land use classification(s):

The proposed Comprehensive Plan land use designation for the two tracts is Industrial.

f. Existing zoning and land use of the subject parcel:

The existing zoning of the subject parcels is Rural Agricultural. There is a single-family residence with a life estate on the property near the CSX railroad and Gun Club Road.

g. What use/zoning will be requested if amendment is approved?

M-2 Industrial General District will be requested.

h. Describe, using text and maps as necessary, the existing zoning, Comprehensive Policy Plan designations, and/or approved uses and densities along with other characteristics of properties that are within:

- 1/4 mile from the parcel(s) perimeter if the parcel is less than 20 acres in size;
- ½ mile if 21 - 100 acres in size; or
- 1 mile if more than 100 acres in size.

Note: Colored maps cannot be duplicated in the Planning Department.

The major land uses and zoning surrounding the Carter tracts can be summarized as:

Direction	Land Use/Zoning	Zoning
South	Large lot residential	Rural/Agricultural
East	Agricultural	Rural/Agricultural
North	Agriculture	Extractive Mining & Rural/Agricultural
North West	Parks & Recreation	Rural/Agricultural
West	Extractive Mining and Industrial	Extractive Mining

A small area of MH-1 mobile home zoning (4 ac) is located approximately 1-mile northeast of the property, and a small area of M-1 manufacturing (9 ac) is located south of the site. The site's terrain and mature tree cover provide natural buffers to visual and other impacts. The CSX railroad provides a man-made barrier that will keep the proposed industrial land use an appropriate distance from Gun Club Road and the homes to the south.

Maps showing the existing conditions, Comprehensive Policy Plan future land use designations, and zoning as of April 2018 within 1 mile of the site are included on the following pages.

Exit 323

Clear Brook

Brucetown

Extractive Mining

Agricultural

Carmeuse Quarry

Interstate 81

CARTER TRACT

West Virginia

Wadesville

Agricultural

Stephenson

Agricultural

1 mile

Large Lot Residential

Clarke County

Snowden Bridge

Jordan Springs

STOWE ENGINEERING, PLC

103 Heath Court
Winchester, VA 22602
(540) 686-7373
fax (540) 301-1100

REVISIONS

NO.	DATE	DESCRIPTION	BY

EXISTING CONDITIONS WITHIN 1 MILE

CARTER TRACT
STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE:	June 1, 2018
SCALE:	1" = 2000'
DESIGNED BY:	TS
DRAWN BY:	TS
CHECKED BY:	TS
PROJECT #:	1168.0
SHEET	1 OF 1

2035 Comprehensive Plan
Future Land Use Designations
within 1 Mile

Land Use	Area (ac)
Industrial	55
Park & Recreation	40
Extractive Mining	718
Rural/Agricultural	2721
Total	3534

Exit 323

81

11

Existing SWSA

CARTER TRACT

Gun Club Road

1 mile

Opequon Creek

WV

Clarke County

Parcels

Long Range Land Use

- Rural Community Center
- Business
- Mixed-Use
- Mixed Use Commercial \ Office
- Highway Commercial
- Warehouse
- Industrial
- Heavy Industrial
- Mixed Use Industrial \ Office
- Extractive Mining
- Residential
- Planned Unit Development
- Mixed Use Age Restricted
- Urban Center
- Neighborhood Village
- Recreation
- Commercial Recreation
- Open Space
- Natural Resources & Recreation
- Park
- Historic \ DSA
- Fire & Rescue
- Institutional
- School

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103 Heath Court
Winchester, VA 22602
(540) 686-7373
fax (540) 301-1100

REVISIONS

NO.	DATE	DESCRIPTION	BY

2035 COMPREHENSIVE PLAN
FUTURE LAND USE WITHIN 1 MILE

CARTER TRACT
STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE:	June 1, 2018
SCALE:	1" = 2000'
DESIGNED BY:	TS
DRAWN BY:	TS
CHECKED BY:	TS
PROJECT #:	1168.0
SHEET	1 OF 1

Summary of April 2035 Zoning Map Designations within 1 Mile

Land Use	Area (ac)
M-1	9
MH-1	4
EM	770
Rural/Agricultural	2751
Total	3534

Exit 323

81

11

EM Zoning

MH1 Zoning

CARTER TRACT

RA Zoning

M1 Zoning

1 mile

Opequon Creek

WV

Clarke County

- Future RT 37
- Urban Development Area
- SWSA
- Approved TDR Properties

Zoning

- B1 (Neighborhood Business District)
- B2 (General Business District)
- B3 (Industrial Transition District)
- EM (Extractive Manufacturing District)
- HE (Higher Education District)
- M1 (Light Industrial District)
- M2 (Industrial General District)
- MH1 (Mobile Home Community District)
- MS (Medical Support District)
- OM (Office - Manufacturing Park)
- R4 (Residential Planned Community District)
- R5 (Residential Recreational Community District)
- RA (Rural Areas District)
- RP (Residential Performance District)

Agricultural & Forestal Districts

- Apple Pie Ridge
- Albin
- South Timber Ridge
- South Frederick District
- Double Church District
- Red Bud
- Green Spring
- George Washington National Forest

STOWE ENGINEERING, PLC
103 Heath Court
Winchester, VA 22602
(540) 686-7373
fax (540) 301-1100

REVISIONS

NO.	DATE	DESCRIPTION	BY

APRIL 2018 ZONING WITHIN 1 MILE

CARTER TRACT
STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE:	June 1, 2018
SCALE:	1" = 2000'
DESIGNED BY:	TS
DRAWN BY:	TS
CHECKED BY:	TS
PROJECT #:	1168.0
SHEET	1 OF 1

i. The name, mailing address, and parcel number of all property owners within 200 ft. of the subject parcel(s), with Adjacent Property Owners Affidavit (page 8).

See the tab labeled "Adjoining Property Owners"

2. FOR A TEXT AMENDMENT

a. Purpose and intent of amendment.

To recognize key intersections along Route 11 North and local roads associated with this land use change may need improvements prior to the Route 11 North mainline.

b. Cite Plan chapter, goal, policy and/or action strategy text that is proposed to be amended.

Chapter V Transportation, Needs Assessment, Route 11 North Corridor Widening

c. Proposed new or revised text.

Route 11 North Corridor Widening

Modeling of the expected development along the Route 11 North corridor indicates a need for widening and access management to the entire corridor with the corridor to become 6 lanes to Cedar Hill Road and 4 lanes to the West Virginia State line. The most immediate need is to widen from Route 37 to Old Charlestown Road. Project timing may necessitate that intersections and local roads be improved prior to the Route 11 mainline improvements. Where practical, the use of rail should be encouraged to reduce truck traffic in the corridor.

Note: Please attach and specify text changes with additions underlined and deletions crossed through.

d. Demonstrate how the proposal furthers the goals, policies/objectives, and action strategies set forth in the Comprehensive Policy Plan chapter(s) relative to the amendment request and why proposed revisions to said goals, policies, and action strategies are appropriate.

(reference is made to the corresponding section of the 2035 Comprehensive Plan)

Comprehensive Plan Section IV. Business Development, Introduction, Focus for the Future

To encourage C & I uses to Frederick County has designated certain areas solely for these types of uses such as the **Route 11 North corridor**, Kernstown area, Round Hill, the Route 277 Triangle area, and in the vicinity of the Winchester Regional Airport. Future planning efforts will continue to identify opportunities to align land uses to promote business development.

Policy Appropriateness - In response to this policy, the proposed Comprehensive Plan amendment will establish an additional 213.8 acre of land for industrial development, thereby aligning land uses and business development opportunities.

Comprehensive Plan Section IV. Business Development. Introduction, Community Benefits

Adequate amounts of land must be planned for and designated for both Commercial and Industrial uses and residential developments. Striking a balance of these land uses and ensuring that the tax rates remain low and that services are available to support these initiatives will help make Frederick County an economic engine within the region.

Policy Appropriateness - In response to this policy, the Carter Tract will be designated as industrial land. Its development as such will enable the county to better strike the desired balance between all land uses.

GOAL: Develop a Strategy that Promotes the Expansion of Desirable Business and Industrial Land Uses.

STRATEGIES:

Frederick County Economic Development Authority (EDA) targeted industries: (as of February 2016):

- Light Industrial
- Pharmaceutical & Medicine Manufacturing, Scientific Research & Development, and Lab Services
- Business Services
- Retail

The proposed land use and SWSA change will further the goals, policies, objectives and strategies set forth in the Comprehensive Plan by opening lands for industrial use

adjacent to a neighboring industry and potential raw product supplier. The proposed changes are appropriate because they cluster development, encourage inter-parcel movement of goods and services, provide access to an existing rail line for the movement of raw and finished products, and promote the overall expansion of industrial land uses in the County.

Comprehensive Plan Section IV. Business Development, Office and Industrial, Community Benefits

The continuation of a low residential tax rate is a direct result of the expansion of the commercial and industrial tax. Currently commercial and industrial tax revenue accounts for approximately 13% of the County's tax base. The County's goal indicates this should be around 25% to ensure a balanced fiscal environment. Tax revenue derived from the average single-family residence is approximately fifty percent of the cost of service provided for that same residence. The County's fiscal survival is dependent upon recruiting office and industrial occupants which offset those residential costs.

The proposed land use and SWSA change designates an additional 213.8 acres of land for industrial use, strengthening the county's financial position and offsetting residential costs.

Additional community benefit was realized when O-N Minerals gave Frederick Water an easement almost 2000 feet long on the Carter Tract for Frederick Water's proposed raw water transmission line.

GOAL: Identify and Recognize Areas in the County Most Strategically Suited for Office and Industrial Development

STRATEGIES:

- Complete review of area land use plans to ensure sufficient acreage is designated for office and industrial uses.
- All infrastructure, such as voice and data fiber, electric, water, wastewater and natural gas, should be extended to areas identified for office and industrial uses and non-rural residential areas.
- The rezoning process should be examined and streamlined as appropriate in order to encourage landowners of properties identified in Area Plans (see Appendix I) to proceed with rezoning.

The Carter Tract clearly meets this goal as it is well suited for industrial development. The property is adjacent to an existing rail line and is flanked by a gas transmission line and high capacity fiber optic lines. The property is a short distance from the Anderson Water Treatment plant, and wastewater can be pumped to the Frederick Water system. The property is also heavily wooded which will provide protections to the surrounding residences.

e. Demonstrate how the proposal is internally consistent with other Comprehensive Policy Plan components that are not the subject of the amendment.

The proposed land use will strengthen the county's financial position thereby enabling the county to better offset the impacts of residential land use costs. This amendment dovetails with the intent and direction of the 2035 Comprehensive Plan's Route 11 North recommendations and those for supporting existing industries.

f. What level of service impacts, if any, are associated with the request?

The level of service impact associated with commercial and industrial development is transportation. Rail and inter-parcel connectivity will offset highway impacts. This is a key item that will need to be addressed in any rezoning.

3. FOR ALL AMENDMENTS

a. Justification of proposed Comprehensive Policy Plan amendment (provide attachments if necessary). Describe why the change to the Comprehensive Policy Plan is being proposed.

This amendment is being proposed because the current owner see an opportunity to create new business opportunities while implementing key land use and financial goals of the Comprehensive Plan. It is their desire to see this area develop into a positive economic generator for the County. The presence of an existing rail, natural gas transmission, and high capacity fiber optic lines all make this site well suited to the proposed change. The adjacent limestone product supplier encourages inter-parcel connectivity. The owners will have to work with VDOT and the Frederick Water in order to proceed with a rezoning request.

b. How would the resultant changes impact or benefit Frederick County. Consider, for example, transportation, economic development and public facilities.

- *Positive Impact #1 - The economic benefits to Frederick County through real estate, business property, and Machinery & Tools revenue without the offsetting costs typically associated with residential development.*
- *Positive Impact #2 - The development costs of this land has either been or will be absorbed by the owner.*
- *Positive Impact #3 - The existing infrastructure on the site makes it highly attractive to potential industrial users and has been installed by the utility owner.*
- *Positive Impact #4 - The site has direct rail access to the CSX mainline track with regular service, thus potentially reducing truck traffic.*
- *Positive Impact #5 - The location of this property is in the targeted commercial/industrial growth area.*
- *Positive Impact #5 - Impacts on neighbors will be minimal due to the remote nature of the site, its terrain, its heavy tree cover, and its distance from residences.*
- *Positive Impact #6 – Access to the site will be provided via the existing Carmeuse commercial entrance on Brucetown Road, and private internal roads.*
- *Positive Impact #7 - This site provides a great opportunity to bring more good paying jobs in Frederick County.*

- *Negative Impact - While the use of rail and inter-parcel connectivity will be advocated to reduce new traffic and eliminate some existing traffic, there is still the potential for some congestion at the intersection of Route 11 and Hopewell/Brucetown Roads.*

Other information may be required by the Director of Planning, the Planning Commission, or Board of County Supervisors during the review of the initiation request. The applicant will be notified, in writing, if additional information is required.

All applications must also contain the following items:

1. Special Limited Power of Attorney Affidavit (see page 9 if parcels of land are involved).
2. Non-Refundable Application Review Fee of $3,000 (payable to the *Frederick County Treasurer*).

Applicants should consult the Comprehensive Policy Plan to identify goals, policies or action strategies which are applicable to individual Comprehensive Policy Plan amendment requests.

Signatures:

I (we), the undersigned, do hereby respectfully make application to and petition the Frederick County Board of Supervisors to amend the Comprehensive Plan. I (we) authorize Frederick County officials to enter the property for site inspection purposes.

I (we) hereby certify that this application and its accompanying materials are true and accurate to the best of my (our) knowledge.

Owner(s): _____ Date: 5/21/18

_____ _____

Applicant(s): Timothy Stowe Date: 5/30/18

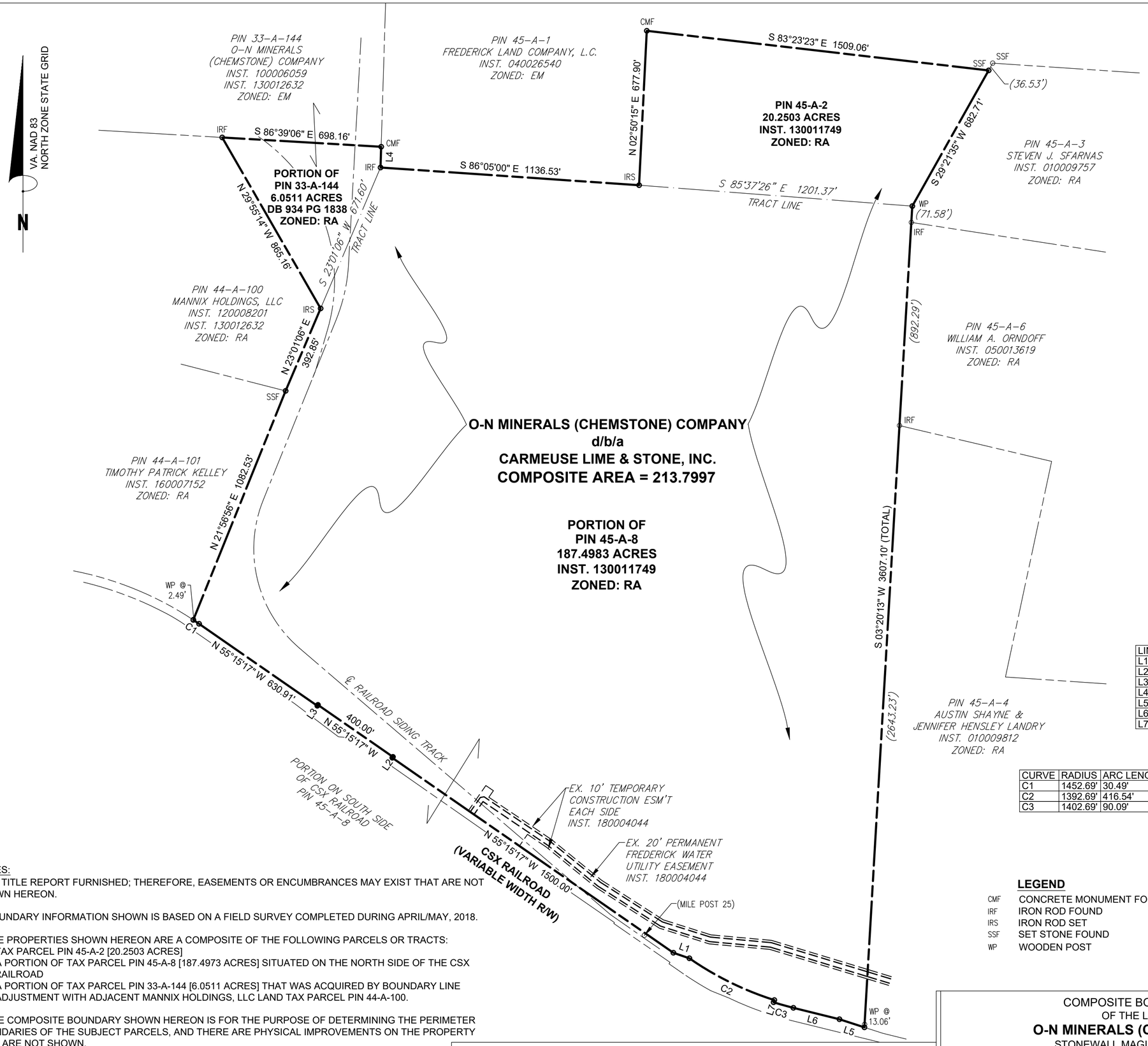
_____ _____

Adjacent Property Owner Listing

Property Owners within 200 ft. of the Carter Tract

Listing compiled on 5/24/18

PIN	Owner's Name	Owner's Name (cont.)	Owner's Address	City	State	Mailing ZIP
45 A 1	FREDERICK LAND COMPANY LLC		893 CLUBHOUSE RD	YORK	PA	17403
44 A 109A	BOHNENKAMP GARY A		214 LITTLER LN	STEPHENSON	VA	22656
45 A 2	O-N MINERALS (CHEMSTONE) COMPANY	ATTN: TAX DEPT	11 STANWIX ST FL 21	PITTSBURGH	PA	15222
44 A 100	MANNIX HOLDINGS LLC		1419 RAMSEUR LN	WINCHESTER	VA	22601
44 A 101	KELLEY TIMOTHY PATRICK	KELLEY MARIA N	5926 WIGTON DR	HOUSTON	TX	77096
44 A 102	KELLEY TIMOTHY PATRICK	KELLEY MARIA N	5926 WIGTON DR	HOUSTON	TX	77096
44 A 108A	RUDOLPH ESTEN O III		PO BOX 87	STEPHENSON	VA	22656
44 A 108C	RUDOLPH ESTEN O III	RUDOLPH DEBORAH L	PO BOX 87	STEPHENSON	VA	22656
45 A 8D	TALADA DONALD D TRUSTEE	TALADA CYNTHIA C TRUSTEE	223 SLATE LN	STEPHENSON	VA	22656
45 A 8B	FIDDLER MATTIE L		227 SLATE LN	STEPHENSON	VA	22656
45 A 8A	FIDDLER THOMAS L	FIDDLER BARBARA J	233 SLATE LN	STEPHENSON	VA	22656
45 A 10U	MILLER KATHLEEN C		2431 WARD RD	WAYLAND	NY	14572
45 A 6	ORNDOFF WILLIAM A		739 SLATE LN	STEPHENSON	VA	22656
45 A 3	SFARNAS STEVEN J		PO BOX 224	STEPHENSON	VA	22656
45 A 4	LANDRY JENNIFER H	LANDRY AUSTIN S	445 SLATE LN	STEPHENSON	VA	22656
45 A 8	O-N MINERALS (CHEMSTONE) COMPANY	ATTN: TAX DEPT	11 STANWIX ST FL 21	PITTSBURGH	PA	15222
33 A 144	O-N MINERALS (CHEMSTONE) COMPANY	ATTN: TAX DEPT	11 STANWIX ST FL 21	PITTSBURGH	PA	15222
44 A 109B	HOBBS CHARLES R	HOBBS TOMMIE J	212 LITTLER LN	STEPHENSON	VA	22656



LINE TABLE

LINE	BEARING	DISTANCE
L1	N 70°51'41" W	74.34'
L2	N 34°44'43" E	5.00'
L3	S 34°44'43" W	5.00'
L4	S 01°46'21" W	90.99'
L5	N 72°04'02" W	115.15'
L6	N 76°04'17" W	208.00'
L7	N 17°36'31" E	10.00'

CURVE TABLE

CURVE	RADIUS	ARC LENGTH	CHORD LENGTH	CHORD BEARING	DELTA ANGLE
C1	1452.69'	30.49'	30.49'	N 55°51'08" W	01°12'09"
C2	1392.69'	416.54'	414.99'	N 63°49'23" W	17°08'12"
C3	1402.69'	90.09'	90.08'	N 74°13'53" W	3°40'48"

NOTES:

1. NO TITLE REPORT FURNISHED; THEREFORE, EASEMENTS OR ENCUMBRANCES MAY EXIST THAT ARE NOT SHOWN HEREON.

2. BOUNDARY INFORMATION SHOWN IS BASED ON A FIELD SURVEY COMPLETED DURING APRIL/MAY, 2018.

3. THE PROPERTIES SHOWN HEREON ARE A COMPOSITE OF THE FOLLOWING PARCELS OR TRACTS:
   a. TAX PARCEL PIN 45-A-2 [20.2503 ACRES]
   b. A PORTION OF TAX PARCEL PIN 45-A-8 [187.4973 ACRES] SITUATED ON THE NORTH SIDE OF THE CSX RAILROAD
   c. A PORTION OF TAX PARCEL PIN 33-A-144 [6.0511 ACRES] THAT WAS ACQUIRED BY BOUNDARY LINE ADJUSTMENT WITH ADJACENT MANNIX HOLDINGS, LLC LAND TAX PARCEL PIN 44-A-100.

4. THE COMPOSITE BOUNDARY SHOWN HEREON IS FOR THE PURPOSE OF DETERMINING THE PERIMETER BOUNDARIES OF THE SUBJECT PARCELS, AND THERE ARE PHYSICAL IMPROVEMENTS ON THE PROPERTY THAT ARE NOT SHOWN.

LEGEND

CMF	CONCRETE MONUMENT FOUND
IRF	IRON ROD FOUND
IRS	IRON ROD SET
SSF	SET STONE FOUND
WP	WOODEN POST

COMMONWEALTH OF VIRGINIA
S. W. Marsh
Lic. No. 001843
5/22/18
LAND SURVEYOR

300 0 300 600
SCALE: 1" = 300'

Marsh & Legge Land Surveyors, P.L.C.
560 NORTH LOUDOUN STREET ~ WINCHESTER, VIRGINIA 22601
PHONE (540) 667-0468 ~ FAX (540) 667-0469 ~ EMAIL office@marshandlegge.com

COMPOSITE BOUNDARY PLAT
OF THE LANDS OF
O-N MINERALS (CHEMSTONE) CO.
STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DRAWING NO.
ID10513
DATE:
MAY 22, 2018
"ID10513-CompositePlat"
SHEET
1
OF 1

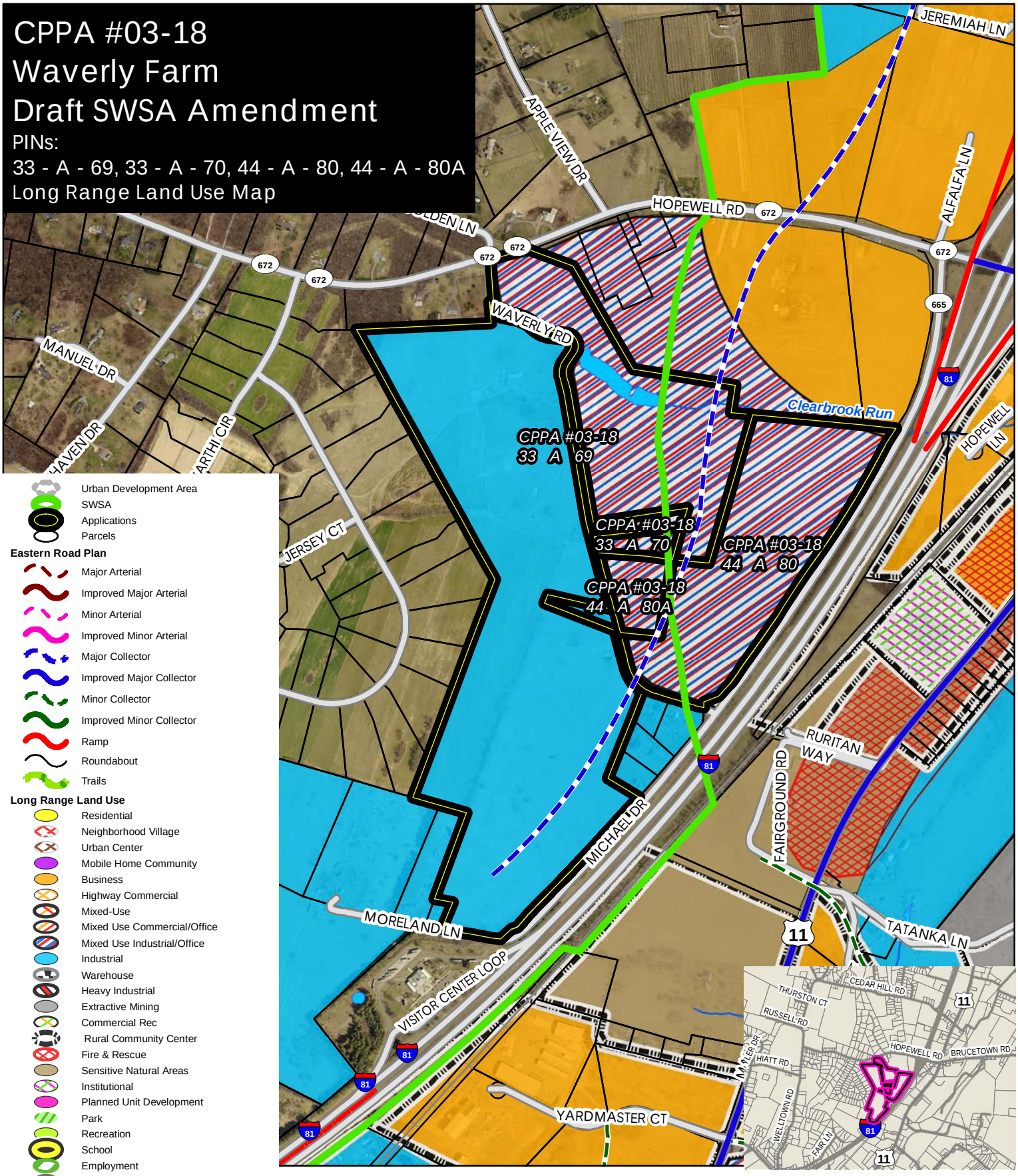
CPPA #03-18

WAVERLY FARM

SEWER AND WATER SERVICE AREA (SWSA) INCLUSION REQUEST

CPPA #03-18
Waverly Farm
Draft SWSA Amendment

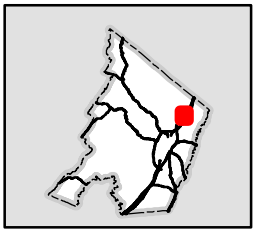
PINs:
33 - A - 69, 33 - A - 70, 44 - A - 80, 44 - A - 80A
Long Range Land Use Map



Urban Development Area
SWSA
Applications
Parcels

Eastern Road Plan
Major Arterial
Improved Major Arterial
Minor Arterial
Improved Minor Arterial
Major Collector
Improved Major Collector
Minor Collector
Improved Minor Collector
Ramp
Roundabout
Trails

Long Range Land Use
Residential
Neighborhood Village
Urban Center
Mobile Home Community
Business
Highway Commercial
Mixed-Use
Mixed Use Commercial/Office
Mixed Use Industrial/Office
Industrial
Warehouse
Heavy Industrial
Extractive Mining
Commercial Rec
Rural Community Center
Fire & Rescue
Sensitive Natural Areas
Institutional
Planned Unit Development
Park
Recreation
School
Employment
Airport Support Area
B2 / B3
Residential, 4 u/a
High-Density Residential, 6 u/a
High-Density Residential, 12-16 u/a
Rural Area
Interstate Buffer
Landfill Support Area
Natural Resources & Recreation
Environmental & Recreational Resources



CPPA #03-18
Waverly Farm
PINs:
33 - A - 69, 33 - A - 70, 44 - A - 80, 44 - A - 80A
Draft SWSA Amendment
Long Range Land Use Map

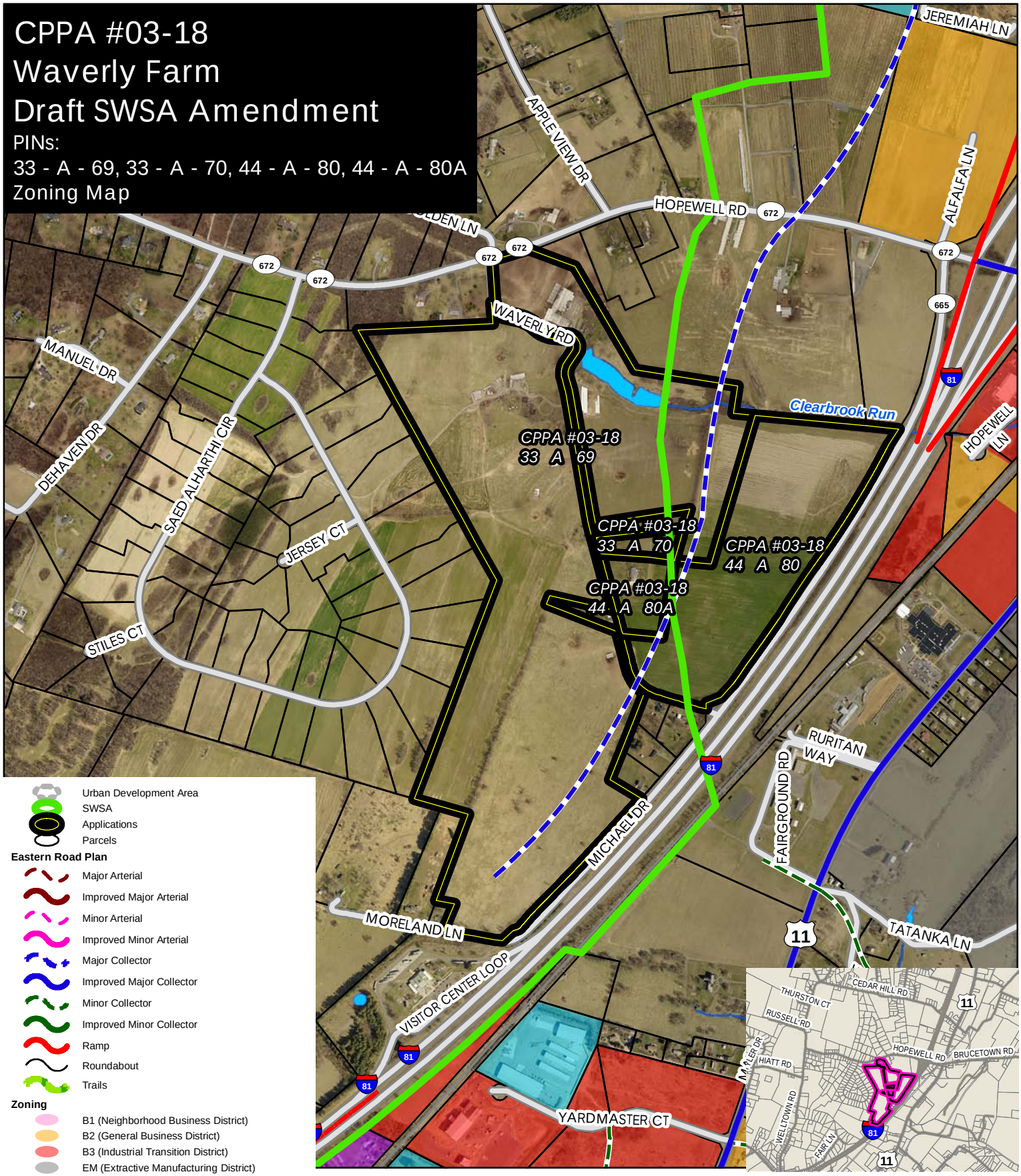
Note:
Frederick County Dept of
Planning & Development
107 N Kent St
Suite 202
Winchester, VA 22601
540 - 665 - 5651

Map Created: June 5, 2018
Staff: cperkins

0 0.125 0.25 0.5 Miles

CPPA #03-18
Waverly Farm
Draft SWSA Amendment

PINs:
33 - A - 69, 33 - A - 70, 44 - A - 80, 44 - A - 80A
Zoning Map



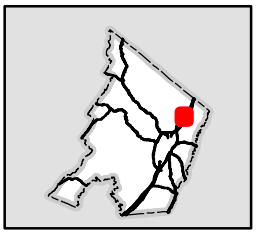
Urban Development Area
SWSA
Applications
Parcels

Eastern Road Plan

- Major Arterial
- Improved Major Arterial
- Minor Arterial
- Improved Minor Arterial
- Major Collector
- Improved Major Collector
- Minor Collector
- Improved Minor Collector
- Ramp
- Roundabout
- Trails

Zoning

- B1 (Neighborhood Business District)
- B2 (General Business District)
- B3 (Industrial Transition District)
- EM (Extractive Manufacturing District)
- HE (Higher Education District)
- M1 (Light Industrial District)
- M2 (Industrial General District)
- MH1 (Mobile Home Community District)
- MS (Medical Support District)
- OM (Office - Manufacturing Park)
- R4 (Residential Planned Community District)
- R5 (Residential Recreational Community District)
- RA (Rural Areas District)
- RP (Residential Performance District)



CPPA #03-18
Waverly Farm
PINs:
33 - A - 69, 33 - A - 70, 44 - A - 80, 44 - A - 80A
Draft SWSA Amendment
Zoning Map

Note:
Frederick County Dept of
Planning & Development
107 N Kent St
Suite 202
Winchester, VA 22601
540 - 665 - 5651

Map Created: June 5, 2018
Staff: cperkins

0 0.125 0.25 0.5 Miles

WAVERLY FARM SWSA EXPANSION

2018 COMPREHENSIVE POLICY PLAN AMENDMENT

June 1, 2018

TM #33-A-69; 33-A-70; 44-A-80 & 44-A-80A
Stonewall Magisterial District
Frederick County, Virginia

Current Owner: **Waverly Farm c/o C. Michael Stiles**

Contact Person: **Evan Wyatt, Director of Land Planning**
Greenway Engineering, Inc.
151 Windy Hill Lane
Winchester, VA 22602

COMPREHENSIVE POLICY PLAN AMENDMENT
2018 INITIATION REQUEST FORM

Owner(s) Information:

Name: Waverly Farm c/o C. Michael Stiles

Project Name: Waverly Farm Sewer & Water Service Area Expansion

Mailing Address: 461 Waverly Road Clear Brook, VA 22624

Telephone Number: (540) 667-8061

Authorized Agent Information:

Name: Greenway Engineering, Inc. – Attn. Evan Wyatt, Director of Land Planning

Project Name: Waverly Farm Sewer & Water Service Area Expansion

Mailing Address: 151 Windy Hill Lane Winchester, VA 22602

Telephone Number: (540) 662-4185

Legal Interest in the Property Affected or Reason for the Request:

Legal Interest: Waverly Farm c/o C. Michael Stiles

Reason for Request: The Frederick County Northeast Frederick Land Use Plan recommends commercial, mixed office and industrial, and industrial land use for parcels located in the southwestern quadrant of I-81 Exit 321. This quadrant consists of an assortment of parcels totaling approximately 425 acres. Waverly Farm comprises approximately 46% of the land area within this quadrant, of which 51.4± acres are currently within the Sewer and Water Service Area (SWSA) and 145.5± acres are adjacent to the SWSA. Waverly Farm is petitioning Frederick County to include the remaining acreage within the SWSA.

SECTION 1 – FOR A MAP AMENDMENT

Proposed Comprehensive Policy Plan Amendment Information:

PIN(s): Waverly Farm: Tax Map Nos. 33-A-69, 33-A-70, 44-A-80, 44-A-80A

Magisterial District: Stonewall District

Parcel Size (approximate acres):

The subject parcels specific to Waverly Farm (Tax Map Nos. 33-A-69, 33-A-70, 44-A-80, 44-A-80A) are approximately 196.86± acres in total size, of which 51.36± acres are currently within the Sewer and Water Service Area (SWSA) and 145.50± acres are adjacent to the SWSA.

Plat of area proposed for CPPA amendment, including metes and bounds description:

Please refer to the recorded Instruments for Waverly Farm that provide the legal descriptions for the subject properties as follows:

Instrument No. 060014297 – Tax Map Parcel 33-A-69
Instrument No. 080003456 – Tax Map Parcel 33-A-70
Instrument No. 060002447 – Tax Map Parcel 44-A-80
Instrument No. 050029700 – Tax Map Parcel 44-A-80A

Existing Comprehensive Plan Land Use Classification(s):

Mixed Use Industrial/Office & Industrial

Proposed Comprehensive Plan Land Use Classification(s):

Mixed Use Industrial/Office & Industrial

Note: The proposed request to expand the Sewer and Water Service Area (SWSA) to incorporate the 145.5± acre portion of Waverly Farm that is adjacent to the SWSA boundary does not modify the future land use designations previously adopted by the Board of Supervisors.

Existing Zoning and Land Use of the Subject Parcel:

The subject properties owned by Waverly Farm that are located partially within and partially outside of the Sewer and Water Service Area are zoned RA, Rural Areas District and are used primarily for agricultural and residential purposes.

What Use/Zoning will be requested if Amendment is approved?

The subject properties owned by Waverly Farm that are located partially within and partially outside of the Sewer and Water Service Area would maintain the Mixed Use Industrial/Office and

Industrial future land use designations adopted by the Board of Supervisors. Future rezoning requests would comply with the recommendations of the Northeast Frederick Land Use Plan, which could include M-1, District and OM District zonings depending on the specific development plans for the 196.86± acre area.

Describe, using Text and Maps as Necessary, the Existing Zoning, Comprehensive Policy Plan Designations, and/or Approved Uses and Densities Along with Other Characteristics of Properties that are Within 1 Mile from the Parcel(s) Perimeter if the Parcel is More than 100 acres in Size:

Please refer to the attached Zoning Map 1-Mile Radius Exhibit that identifies the various properties that meet this distance criteria. The following information describes existing and future land use characteristics within this radius boundary:

- Properties to the north of Waverly Farm located on the west side of Interstate 81 are zoned RA, Rural Areas District, B-2, Business General District, B-3, Industrial Transition District and M-1, Light Industrial District. Properties to the north of Waverly Farm located on the east side of Interstate 81 are zoned RA, Rural Areas District, B-3, Industrial Transition District and EM, Extractive Manufacturing District.

  The Frederick County Northeast Frederick Land Use Plan recommends future Business and Industrial Land Use for properties to the north of Waverly Farm that are within the SWSA, and Rural Areas Land Use for properties to the north of Waverly Farm that are outside of the SWSA.

- Properties to the south of Waverly Farm located on the west side of Interstate 81 are zoned RA, Rural Areas District. Properties to the south of Waverly Farm located on the east side of Interstate 81 are zoned RA, Rural Areas District, RP, Residential Performance District, MH-1, Mobile Home Community District, B-2, Business General District, B-3, Industrial Transition District, OM, Office-Manufacturing District, M-1, Light Industrial District, and M-2, Industrial General District.

  The Frederick County Northeast Frederick Land Use Plan recommends future Business and Industrial Land Use for properties to the south of Waverly Farm that are within and outside of the SWSA.

- Properties to the east of Waverly Farm located on the east side of Interstate 81 are zoned RA, Rural Areas District, B-2, Business General District, B-3, Industrial Transition District and EM, Extractive Manufacturing District.

  The Frederick County Northeast Frederick Land Use Plan recommends future Business, Industrial, and Extractive Mining Land Use for properties to the east of Waverly Farm that are within and outside of the SWSA.

- Properties to the west of Waverly Farm located on the west side of Interstate 81 are zoned RA, Rural Areas District.

  The Frederick County Northeast Frederick Land Use Plan recommends future Office-Manufacturing, Industrial, and Rural Areas Land Use for properties to the west of Waverly Farm that are outside of the SWSA.

The Name, Mailing Address, and Parcel Number of all Property Owners Within 200' of the Subject Parcel(s), with Adjacent Property Owners Affidavit:

Please refer to the attached Adjoining Property Owner Map Exhibit and Adjoining Property Owner Table Exhibit that provides the location and applicable contact information for all properties within 200' of the subject properties.

SECTION 2 – FOR A TEXT AMENDMENT

The Waverly Farm Sewer & Water Service Area Expansion Amendment does not propose to incorporate a Text Amendment for consideration by the Board of Supervisors.

SECTION 3 – FOR ALL AMENDMENTS

Justification of Proposed Comprehensive Policy Plan Amendment (Provide Attachments if Necessary). Describe why the Change to the Comprehensive Policy Plan is Being Proposed:

The Frederick County Northeast Frederick Land Use Plan recommends commercial, mixed office and industrial, and industrial land use for parcels located in the southwestern quadrant of I-81 Exit 321. This quadrant consists of an assortment of parcels totaling approximately 425 acres. Waverly Farm comprises approximately 46% of the land area within this quadrant, of which 51.4± acres are currently within the Sewer and Water Service Area (SWSA) and 145.5± acres are adjacent to the SWSA. The Northeast Frederick Land Use Plan recommends mixed office and industrial, and industrial land use development for the Waverly Farm subject properties.

Frederick County Policy requires properties to be located with the SWSA as a condition of being developed with public water and sewer service. Inclusion of properties within the SWSA is required as the first step in the future land use development process in order to proceed with future rezoning, master development plan and site plan processes. The Waverly Farm SWSA Expansion Amendment includes an evaluation of the existing and proposed water and sewer to determine operational issues and needs required for the 425-acre quadrant area. Complete copies of these reports have been provided to Frederick Water and the Planning Department for review.

How would the Resultant Changes Impact or Benefit Frederick County? Consider, for example, Transportation, Economic Development and Public Facilities:

The Waverly Farm 196.86± acre area is projected to yield 1,110,000 SF of light industrial and warehouse land use and 125,000 SF of office land use specific to the anticipated developable area within the subject properties. The projected land uses are consistent with the recommendations of the Frederick County Northeast Frederick Land Use Plan, which identifies Waverly Farm for future economic development land use. The following information identifies impacts and benefits to Frederick County for future economic development land use consistent with the Comprehensive Policy Plan.

Transportation

The following table provides projected traffic generation rates specific to the anticipated developable area of the Waverly Farm properties. The projected traffic generation rates assume 1,110,000 SF of industrial land use and 125,000 SF of office land use. The values used from this projection were obtained from the Institute of Traffic Engineers (ITE) Trip Generation Manual, 9th Edition, which is the source currently utilized by VDOT and Frederick County for transportation impact analysis. The values used for industrial land use are an average of the ITE for light industrial and warehouse land use.

Weekday Average Daily Traffic Volume Projections				
Land Use	*ITE*	*ADT Rate*	*Unit Numbers*	*Totals*
Industrial	110/150	5.26/1,000 SF	1,110,000 SF	5,838 ADT
Office	710	11.03/1,000 SF	125,000 SF	1,379 ADT

The Frederick County Northeast Frederick Land Use Plan identifies a new major collector road system that provides access for future economic development land use throughout the limits of the Waverly Farm subject properties to Hopewell Road (Route 672). The development of future economic development land use would incorporate the new major collector as a component of the Master Development Plan.

Economic Development

The Northeast Frederick Land Use Plan recommends mixed office and industrial, and industrial land use development for the Waverly Farm subject properties. The future development of these land uses will provide economic development benefit to Frederick County in tax revenues and employment opportunities for residents of the community. These tax revenues will provide a benefit to Frederick County to off-set fiscal impacts specific to residential land use within the community.

Water and Sewer Capacities

The Waverly Farm SWSA Expansion Amendment includes an evaluation of the existing and proposed water and sewer systems to determine operational issues and needs required for the 425-acre quadrant area. It is anticipated the development of the 425-acre area consistent with the land uses recommended by Frederick County Northeast Frederick Land Use Plan will require an eventual water and sewer capacity of 322,233 GPD at buildout. Complete copies of these reports have been provided to Frederick Water and the Planning Department for review in support of the Waverly Farm SWSA Expansion Amendment.

Public Schools

The Waverly Farm Sewer & Water Service Area Expansion Amendment will not impact Frederick County Public Schools Services. Economic Development opportunities specific to the Waverly Farm Sewer & Water Service Area Expansion Amendment will provide revenue to Frederick County in support of local government services.

Fire and Rescue

The development of land uses recommended by Frederick County Northeast Frederick Land Use Plan will create an impact to County Fire and Rescue Services. It is anticipated that future rezoning applications specific to the Waverly Farm Sewer & Water Service Area Expansion Amendment will include monetary contributions calculated on the amount of structural square footage that is developed within the subject properties to assist in the mitigation of this impact.

Parks and Recreation

The Waverly Farm Sewer & Water Service Area Expansion Amendment will not impact Frederick County Parks and Recreation Services. Economic Development opportunities specific to the Waverly Farm Sewer & Water Service Area Expansion Amendment will provide revenue to Frederick County in support of local government services.

2018 Comprehensive Policy Plan Application Information

- Application Signatures Page
- Subject Property Owners Affidavit
- Special Limited Power of Attorney Signature Pages
- Comprehensive Policy Plan Amendment Application Fee
- Adjoining Property Owner Map & Table Exhibits

Signatures:

I (we), the undersigned, do hereby respectfully make application to and petition the Frederick County Board of Supervisors to amend the Comprehensive Plan. I (we) authorize Frederick County officials to enter the property for site inspection purposes.

I (we) hereby certify that this application and its accompanying materials are true and accurate to the best of my (our) knowledge.

Applicant(s): Evan A. Wyatt Date: 5/31/18

Owner(s): _____ Date: _____

Attachment 1

(TO BE COMPLETED BY APPLICANT)

SUBJECT PROPERTY OWNERS AFFIDAVIT
County of Frederick, Virginia
Frederick Planning Web Site: www.fcva.us

Department of Planning & Development, County of Frederick, Virginia
107 North Kent Street, Suite 202 Winchester, Virginia 22601
Phone 540-665-5651 Facsimile 540-665-6395

STATE OF VIRGINIA
COUNTY OF FREDERICK

This 31ST (Day) day of MAY (Month), 2018 (Year),

I, EVAN A. WYATT, GREENWAY ENGINEERING, INC.
(Owner/Contract Purchaser/Authorized Agent)

hereby make oath that the list of property owners of the subject site, as submitted with the application, is a true and accurate list based on the information provided by the Frederick County Commissioner of the Revenue Office as taken from the current real estate assessment records.

Evan A. Wyatt
(Owner/Contract Purchaser/Authorized Agent)
(circle one)

COMMONWEALTH OF VIRGINIA:

County of Frederick

Subscribed and sworn to before me this 31 day of May, 2018 in my County and State aforesaid by the forenamed Principal.

KAYNA F. FLYTHE
NOTARY PUBLIC
REG. #7754086
COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES
MAY 31, 2021

Kayna F. Flythe
NOTARY PUBLIC

My Commission expires: May 31, 2021

Attachment 2

Special Limited Power of Attorney
County of Frederick, Virginia
Frederick Planning Web Site: www.fcva.us

Department of Planning & Development, County of Frederick, Virginia
107 North Kent Street, Suite 202 Winchester, Virginia 22601
Phone 540-665-5651 Facsimile 540-665-6395

Know All Men By Those Present: That I (We)

(Name) Waverly Farm, c/o C. Michael Stiles (Phone) (540) 533-1193

(Address) 461 Waverly Road Clear Brook, VA 22624
the owner(s) of all those tracts or parcels of land ("Property") conveyed to me (us), by deed recorded in the Clerk's Office of the Circuit Court of the County of Frederick, Virginia, by

Instrument No. 060014297 on Page 0515, and is described as

Parcel: 33 Lot: A Block: 69 Section: _____ Subdivision: _____
do hereby make, constitute and appoint:

(Name) Greenway Engineering, Inc. (Phone) (540) 662-4185

(Address) 151 Windy Hill Lane Winchester, VA 22602
To act as my true and lawful attorney-in-fact for and in my (our) name, place, and stead with full power and authority I (we) would have if acting personally to file planning applications for my (our) above described Property, including:

_ **Rezoning (including proffers)**
_ **Conditional Use Permit**
_ **Master Development Plan (Preliminary and Final)**
_ **Subdivision**
_ **Site Plan**
_ **Comprehensive Policy Plan Amendment**
_ **Appeal or Variance**

My attorney-in-fact shall have the authority to offer proffered conditions and to make amendments to previously approved proffered conditions except as follows:

_____

This authorization shall expire one year from the day it is signed, or until it is otherwise rescinded or modified.
In witness thereof, I (we) have hereto set my (our) hand and seal this 29 day of May, 2018,

Signature(s) C. Michael Stiles

RAYNA Y. FLYTHE
NOTARY PUBLIC
REG. #7754086
COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES
MAY 31, 2021

State of Virginia, City/County of Frederick, To-wit:

I, Rayna Y. Flythe, a Notary Public in and for the jurisdiction aforesaid, certify that the person(s) who signed to the foregoing instrument personally appeared before me and has acknowledged the same before me in the jurisdiction aforesaid this 29 day of May, 2018.

Rayna Y Flythe
Notary Public

My Commission Expires: May 31, 2021

Attachment 2

Special Limited Power of Attorney
County of Frederick, Virginia
Frederick Planning Web Site: www.fcva.us

Department of Planning & Development, County of Frederick, Virginia
107 North Kent Street, Suite 202 Winchester, Virginia 22601
Phone 540-665-5651 Facsimile 540-665-6395

Know All Men By Those Present: That I (We)

(Name) Waverly Farm, c/o C. Michael Stiles (Phone) (540) 533-1193

(Address) 461 Waverly Road Clear Brook, VA 22624
the owner(s) of all those tracts or parcels of land ("Property") conveyed to me (us), by deed recorded in the Clerk's Office of the Circuit Court of the County of Frederick, Virginia, by

Instrument No. 08000 3456 on Page 0219, and is described as

Parcel: 33 Lot: A Block: 70 Section: _____ Subdivision: _____
do hereby make, constitute and appoint:

(Name) Greenway Engineering, Inc. (Phone) (540) 662-4185

(Address) 151 Windy Hill Lane Winchester, VA 22602
To act as my true and lawful attorney-in-fact for and in my (our) name, place, and stead with full power and authority I (we) would have if acting personally to file planning applications for my (our) above described Property, including:

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_____

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In witness thereof, I (we) have hereto set my (our) hand and seal this 29 day of May, 2018,

Signature(s) C. Michael Stiles

State of Virginia, City/County of Frederick, To-wit:

I, Rayna Y. Flythe, a Notary Public in and for the jurisdiction aforesaid, certify that the person(s) who signed to the foregoing instrument personally appeared before me and has acknowledged the same before me in the jurisdiction aforesaid this 29 day of May, 2018.

Rayna Y. Flythe
Notary Public

My Commission Expires: May 31, 2021

RAYNA Y. FLYTHE
NOTARY PUBLIC
REG. #7754086
COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES
MAY 31, 2021

Attachment 2

Special Limited Power of Attorney
County of Frederick, Virginia
Frederick Planning Web Site: www.fcva.us

Department of Planning & Development, County of Frederick, Virginia
107 North Kent Street, Suite 202 Winchester, Virginia 22601
Phone 540-665-5651 Facsimile 540-665-6395

Know All Men By Those Present: That I (We)

(Name) Waverly Farm, c/o C. Michael Stiles (Phone) (540) 533-1193

(Address) 461 Waverly Road Clear Brook, VA 22624
the owner(s) of all those tracts or parcels of land ("Property") conveyed to me (us), by deed recorded in the Clerk's Office of the Circuit Court of the County of Frederick, Virginia, by

Deed Book ~~Instrument No~~. 555 on Page 393, and is described as

Parcel: 44 Lot: A Block: 80 Section: _____ Subdivision: _____
do hereby make, constitute and appoint:

(Name) Greenway Engineering, Inc. (Phone) (540) 662-4185

(Address) 151 Windy Hill Lane Winchester, VA 22602
To act as my true and lawful attorney-in-fact for and in my (our) name, place, and stead with full power and authority I (we) would have if acting personally to file planning applications for my (our) above described Property, including:

- _ **Rezoning (including proffers)**
- _ **Conditional Use Permit**
- _ **Master Development Plan (Preliminary and Final)**
- _ **Subdivision**
- _ **Site Plan**
- _ **Comprehensive Policy Plan Amendment**
- _ **Appeal or Variance**

My attorney-in-fact shall have the authority to offer proffered conditions and to make amendments to previously approved proffered conditions except as follows:

_____

This authorization shall expire one year from the day it is signed, or until it is otherwise rescinded or modified.

In witness thereof, I (we) have hereto set my (our) hand and seal this 29 day of May, 2018,

Signature(s) C. Michael Stiles

RAYNA Y. FLYTHE
NOTARY PUBLIC
REG. #7754086
COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES
MAY 31, 2021

State of Virginia, City/County of Frederick, To-wit:

I, Rayna Y. Flythe, a Notary Public in and for the jurisdiction aforesaid, certify that the person(s) who signed to the foregoing instrument personally appeared before me and has acknowledged the same before me in the jurisdiction aforesaid this 29 day of May, 2018.

Rayna Y Flythe
Notary Public

My Commission Expires: May 31, 2021

Attachment 2

Special Limited Power of Attorney
County of Frederick, Virginia
Frederick Planning Web Site: www.fcva.us

Department of Planning & Development, County of Frederick, Virginia
107 North Kent Street, Suite 202 Winchester, Virginia 22601
Phone 540-665-5651 Facsimile 540-665-6395

Know All Men By Those Present: That I (We)

(Name) Waverly Farm, c/o C. Michael Stiles (Phone) (540) 533-1193

(Address) 461 Waverly Road Clear Brook, VA 22624
the owner(s) of all those tracts or parcels of land ("Property") conveyed to me (us), by deed recorded in the Clerk's Office of the Circuit Court of the County of Frederick, Virginia, by

Instrument No. 050029700 on Page 0974, and is described as

Parcel: 44 Lot: A Block: 80A Section: _____ Subdivision: _____
do hereby make, constitute and appoint:

(Name) Greenway Engineering, Inc. (Phone) (540) 662-4185

(Address) 151 Windy Hill Lane Winchester VA 22602
To act as my true and lawful attorney-in-fact for and in my (our) name, place, and stead with full power and authority I (we) would have if acting personally to file planning applications for my (our) above described Property, including:

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My Commission Expires: May 31, 2021

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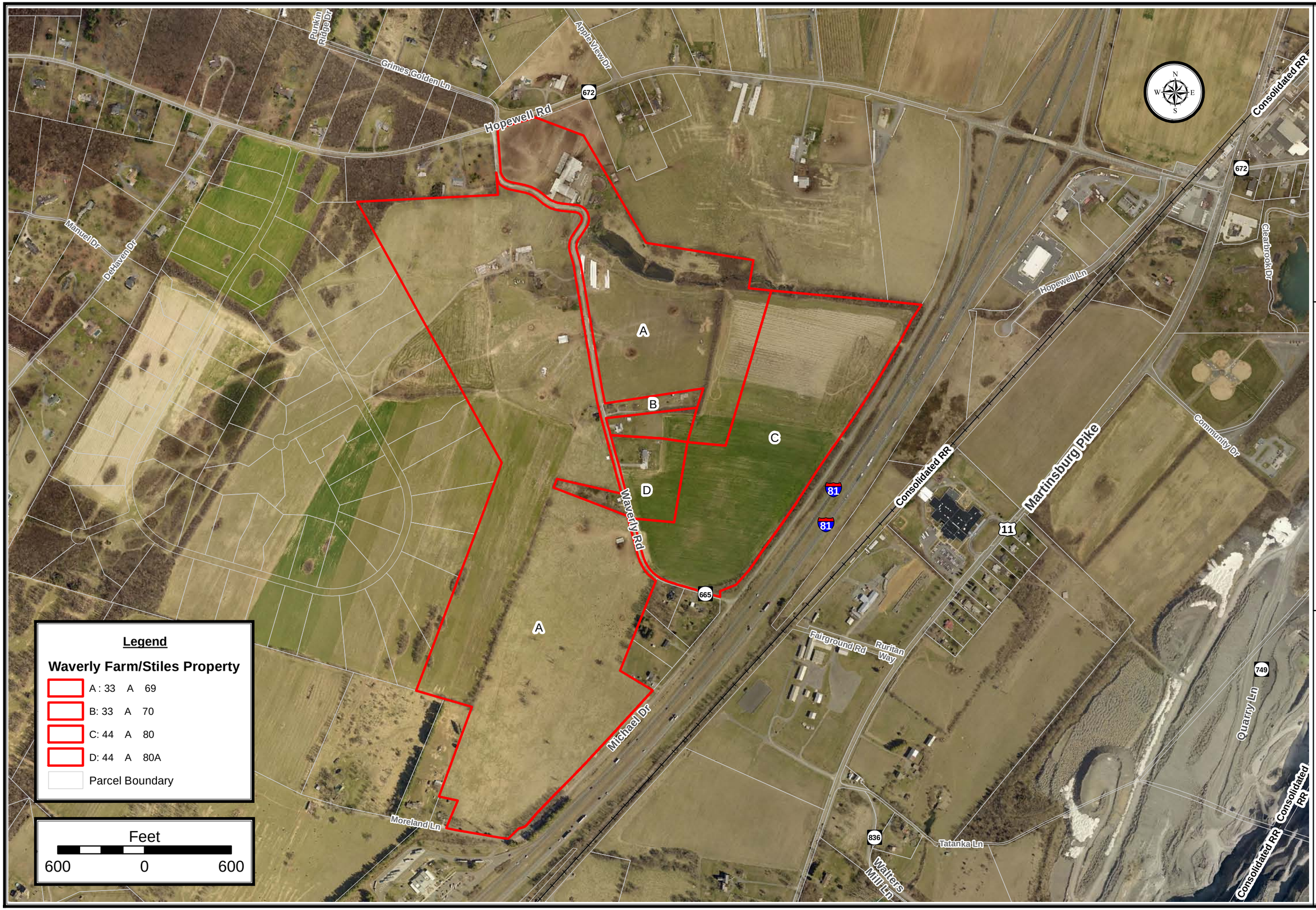
MAY 31, 2021



Map Data Source: Frederick County, Va. GIS Department, 2018 Data. Frederick County Aerial 2017

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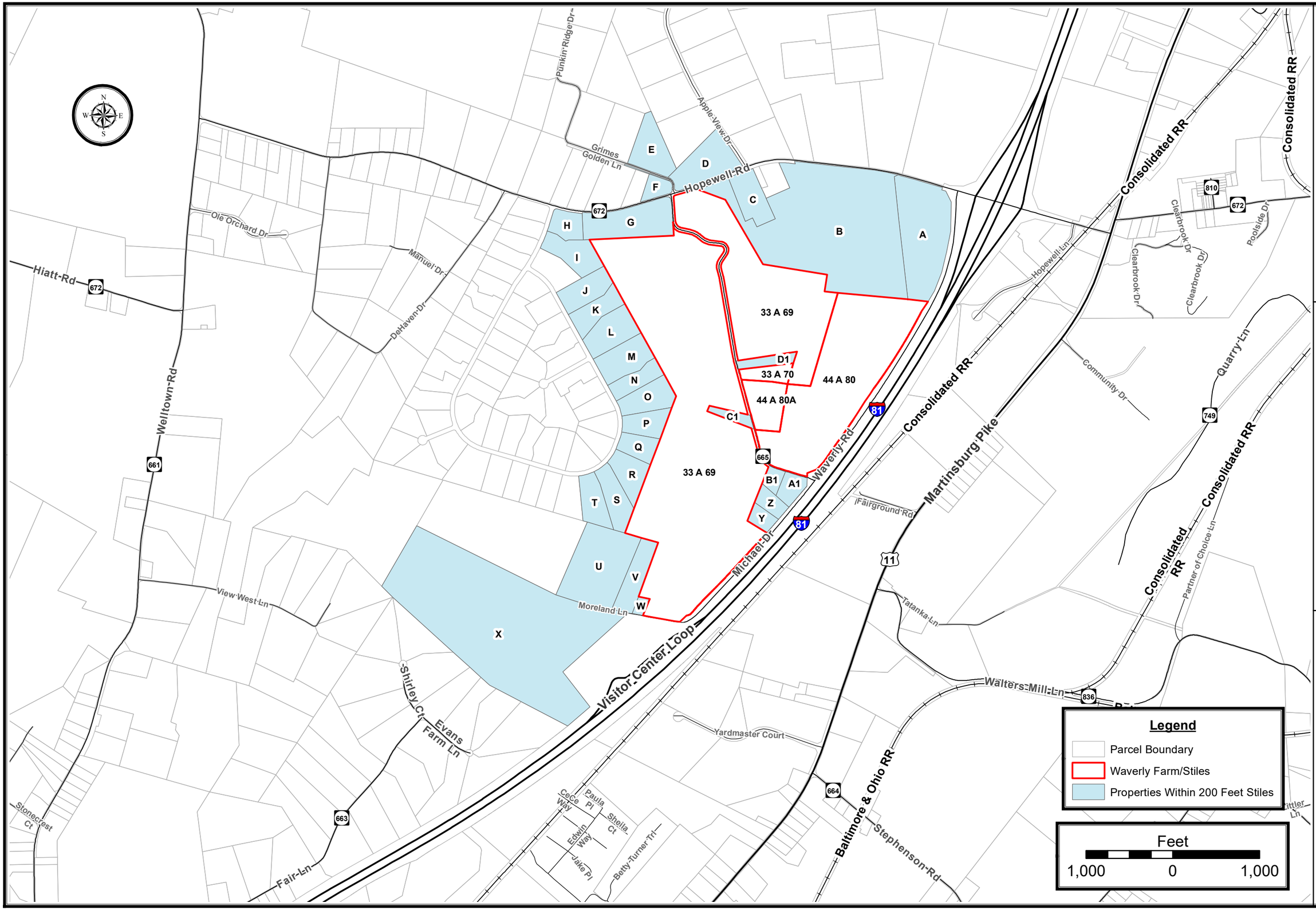
WAVERLY FARM
COMPREHENSIVE POLICY PLAN AMENDMENT
AERIAL OVERVIEW EXHIBIT

STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE: 05-30-2018 | PROJECT ID:4915WG | DESIGNED BY: DWE

SCALE: 1 Inch = 600 Feet

WAVERLY FARM
C.P.P.A. AERIAL OVERVIEW EXHIBIT



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WAVERLY FARM

C.P.P.A. SURROUNDING PROPERTIES WITHIN 200 FEET

STONEWALL MAGISTERIAL DISTRICT

FREDERICK COUNTY, VIRGINIA

DATE: 05-30-2018 | PROJECT ID:4915WG | DESIGNED BY: DWE

SCALE: 1 Inch = 1,000 Feet

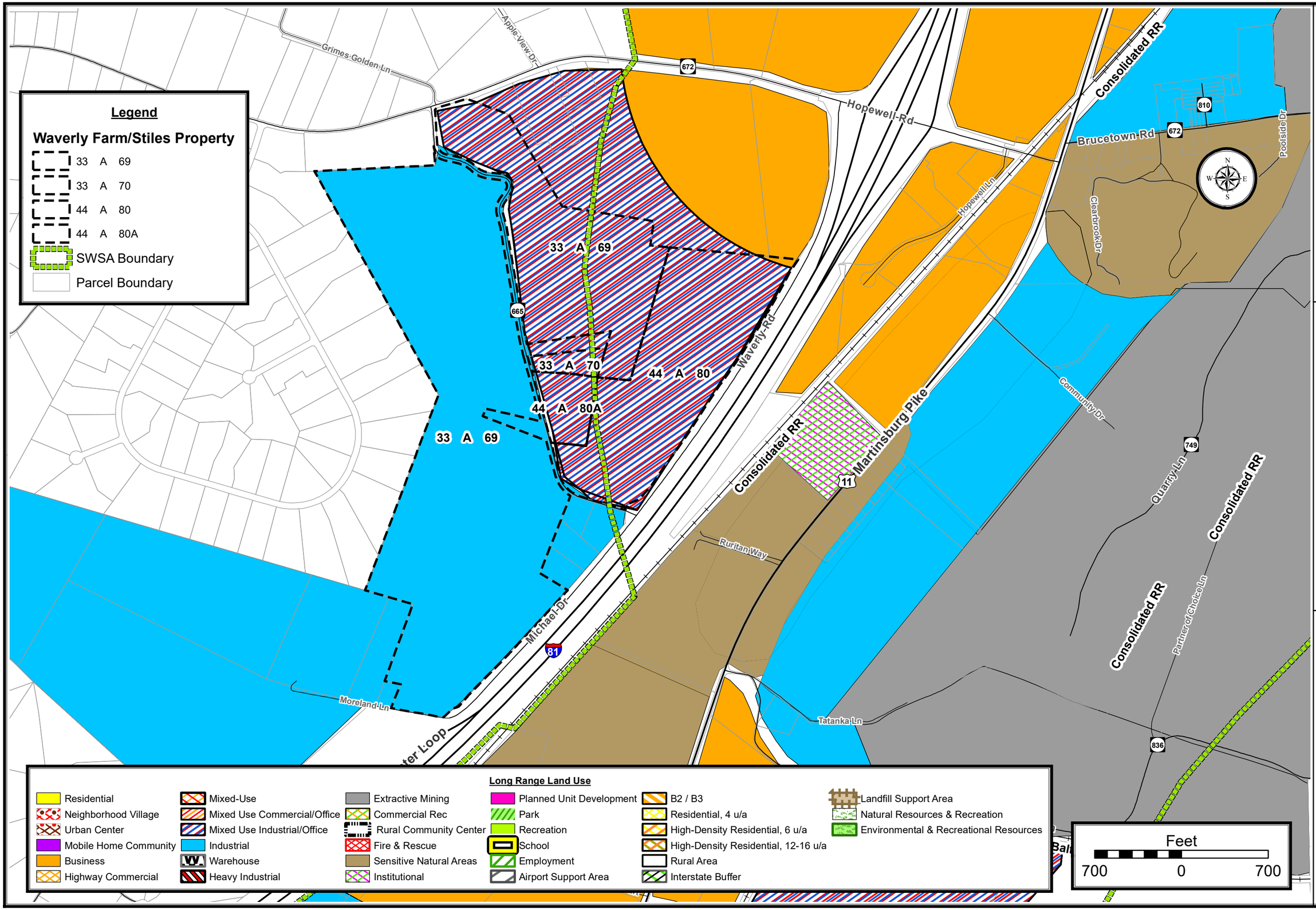
WAVERLY FARM
COMPREHENSIVE POLICY PLAN AMENDMENT
SURROUNDING PROPERTIES
WITHIN 200 FEET

Map Data Source: Frederick County, Va. GIS Department, 2018 Data.

Label	Tax Map Number	Owner	Mailing Address	City and State	ZIP
A	33 A 164A	HMC LP LLP	920 HOPEWELL RD	CLEAR BROOK, VA	22624
B	33 A 78	HMC LP LLP	920 HOPEWELL RD	CLEAR BROOK, VA	22624
C	33 A 73	COOKE RONALD R, COOKE LINDA D	722 HOPEWELL RD	CLEAR BROOK, VA	22624
D	33 6 15	STILES PAUL L	669 HOPEWELL RD	CLEAR BROOK, VA	22624
E	33 6 16	COLLINS MONTE, COLLINS THELMA L	132 GRIMES GOLDEN LN	CLEAR BROOK, VA	22624
F	33 1 11	POOLE LINDA, BRUCE KAREN	2117 HARVEST DR	WINCHESTER, VA	22601
G	33 A 68	HOPEWELL MEETING LOT, C/O JAMES T RILEY	1321 VANCERIGHT CIR	WINCHESTER, VA	22601
H	33 13 1 1	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
I	33 13 1 3	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
J	33 13 1 66	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
K	33 13 1 64	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
L	33 13 1 62	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
M	33 13 1 55	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
N	33 13 1 53	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
O	33 13 1 51	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
P	33 13 1 49	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
Q	33 13 1 47	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
R	33 13 1 45	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
S	33 13 1 44	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
T	33 13 1 43	WAVERLY FARM LLC, ATTN: BIKRM SINGH	11325 RANDOM HILLS RD STE 360	FAIRFAX, VA	22030
U	44 A 3B	PRICE LEANNA MARIE	219 MORELAND LN	CLEAR BROOK, VA	22624
V	44 A 2	MORELAND ROBERT L	162 MORELAND LN	CLEAR BROOK, VA	22624
W	44 A 80B	MORELAND ROBERT LORAIN, SHIRLEY IRENE	162 MORELAND LN	CLEAR BROOK, VA	22624
X	44 A 3	PAYNE GARY L, PAYNE PAMELA L	358 VIEW WEST LN	CLEAR BROOK, VA	22624
Y	44 A 78	PRICE THOMAS FRANKLIN	164 MICHAEL DR	CLEAR BROOK, VA	22624
Z	44 A 78C	SAVILLE BRUCE ELLEN	144 MICHAEL DR	CLEAR BROOK, VA	22624
A1	44 A 78A	KITTS GARY M, KITTS LOUISE L	472 WAVERLY RD	CLEAR BROOK, VA	22624
B1	44 A 78B	MCCORD DANIEL E	456 WAVERLY RD	CLEAR BROOK, VA	22624
C1	44 A 79	TAYLOR RICHARD R	386 WAVERLY RD	CLEAR BROOK, VA	22624
D1	33 A 71	FISHEL DAVID G	323 WAVERLY RD	CLEAR BROOK, VA	22624

2018 Comprehensive Policy Plan Amendments Exhibits

- Current Long Range Land Use Plan Exhibit
- Current Long Range Land Use Plan with SWSA Expansion Exhibit
- Current Long Range Transportation Plan Exhibit
- Current Long Range Transportation Plan with SWSA Expansion Exhibit
- Proposed Water & Sewer Infrastructure with SWSA Expansion Exhibit
- Current Water & Sewer Infrastructure Exhibit – 1 Mile From Subject Parcels
- Current Zoning Map Exhibit – 1 Mile From Subject Parcels



Map Data Source: Frederick County, Va. GIS Department, 2018 Data

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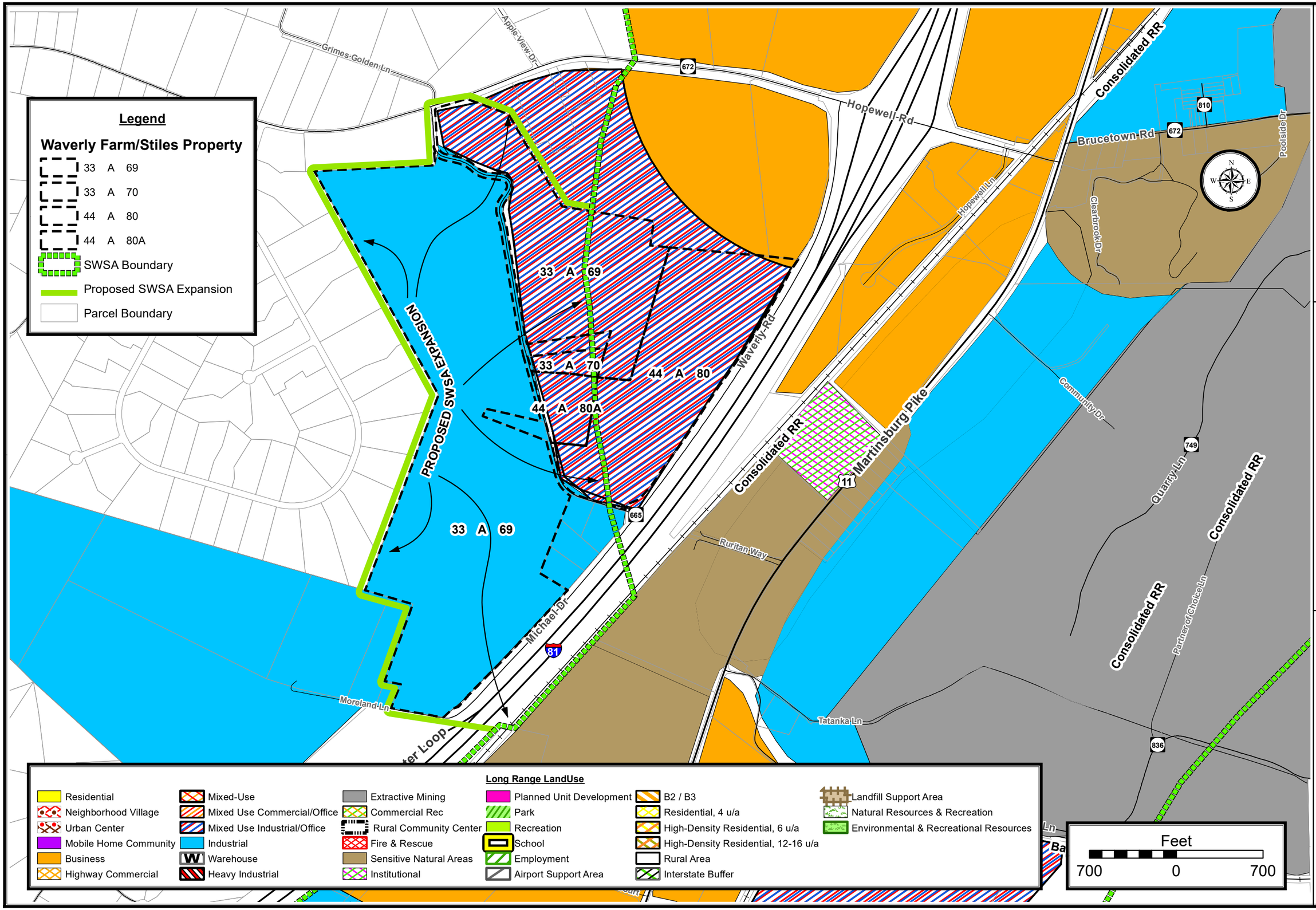
WAVERLY FARM
WAVERLY FARM
C.P.P.A. EXISTING LONG RANGE LAND USE MAP
COMPREHENSIVE POLICY PLAN AMENDMENT
EXISTING
LONG RANGE LAND USE MAP EXHIBIT
EXISTING
STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA
DATE: 05-30-2018 | PROJECT ID:4915WG | DESIGNED BY: DWE
SCALE: 1 Inch = 700 Feet



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WAVERLY FARM
COMPREHENSIVE POLICY PLAN AMENDMENT

LONG RANGE LAND USE MAP EXHIBIT
PROPOSED

WAVERLY FARM
C.P.P.A LONG RANGE LAND USE MAP - PROPOSED

STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE: 05-30-2018 | PROJECT ID:4915WG | DESIGNED BY: DWE

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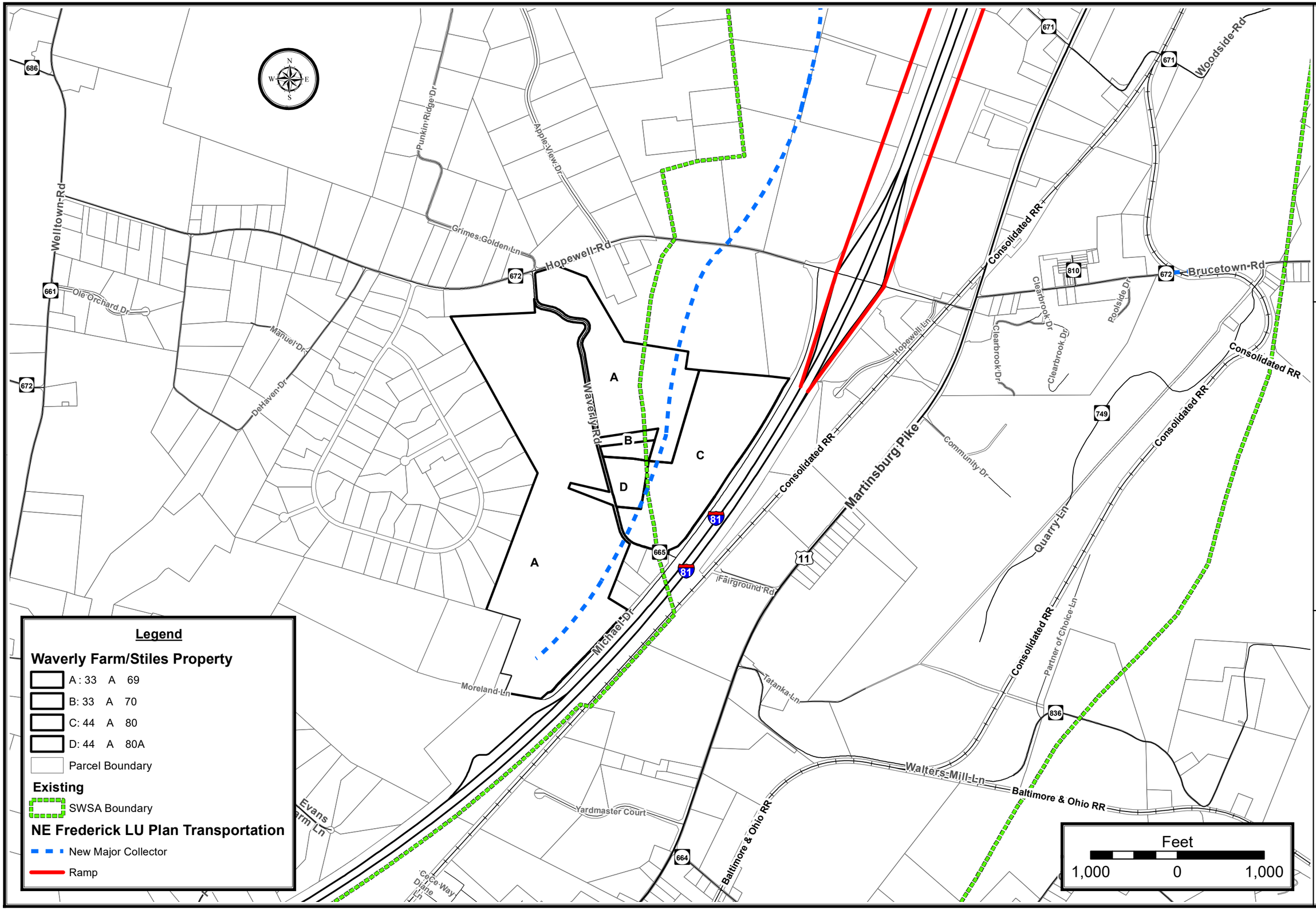

Map Data Source: Frederick County, Va. GIS Department, 2018 Data. Water and Sewer Courtesy of Frederick Water, 2016

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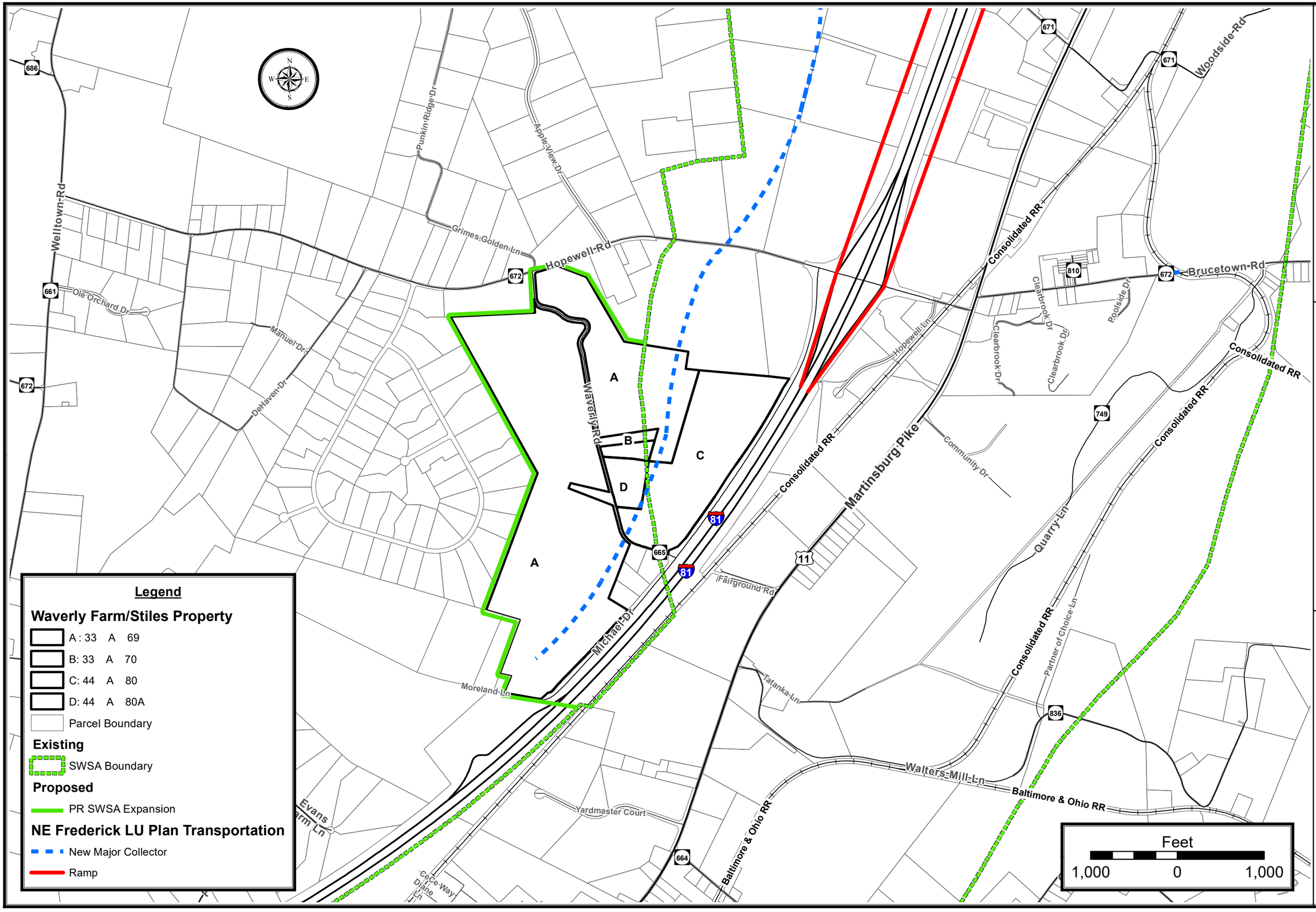
WAVERLY FARM
C.P.P.A. TRANSPORTATION EXHIBIT
EXISTING SWSA
STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA
DATE: 05-30-2018 | PROJECT ID:4915WG | DESIGNED BY: DWE
SCALE: 1 Inch = 1,000 Feet

WAVERLY FARM
COMPREHENSIVE POLICY PLAN AMENDMENT
TRANSPORTATION EXHIBIT
EXISTING SWSA



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WAVERLY FARM
COMPREHENSIVE POLICY PLAN AMENDMENT
TRANSPORTATION EXHIBIT
PROPOSED SWSA EXPANSION

WAVERLY FARM
C.P.P.A. TRANSPORTATION EXHIBIT
PROPOSED SWSA EXPANSION
STONEWALL MAGISTERIAL DISTRICT
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DATE: 05-30-2018 | PROJECT ID:4915WG | DESIGNED BY: DWE
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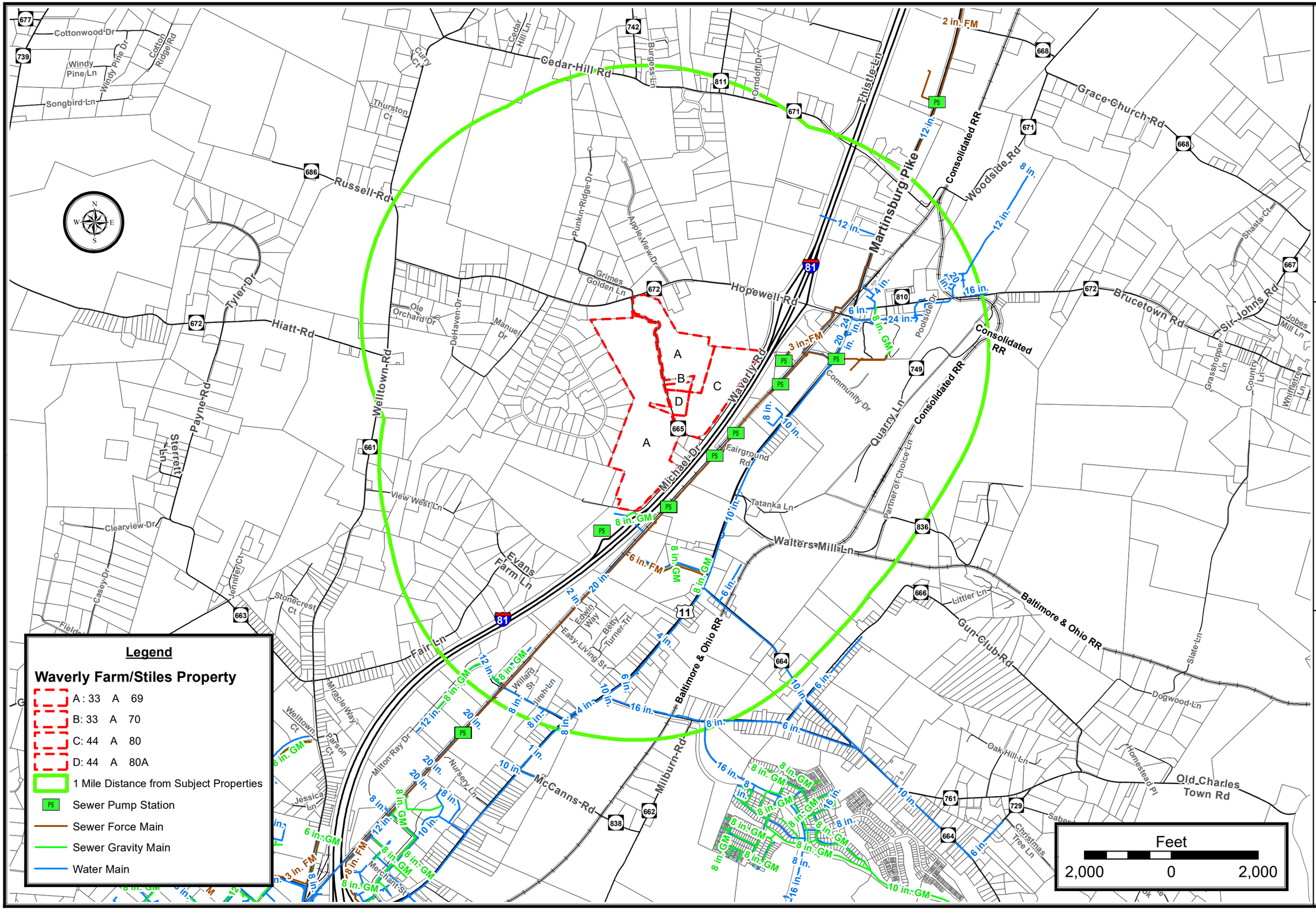

Legend

Waverly Farm/Stiles Property

- A : 33 A 69
- B: 33 A 70
- C: 44 A 80
- D: 44 A 80A
- 1 Mile Distance from Subject Properties
- PS — Sewer Pump Station
- Sewer Force Main
- Sewer Gravity Main
- Water Main

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WAVERLY FARM
C.P.P.A. WATER & SEWER MAP EXHIBIT
1 MILE FROM SUBJECT PROPERTIES
COMPREHENSIVE POLICY PLAN AMENDMENT
STONEWALL MAGISTERIAL DISTRICT
WATER & SEWER EXHIBIT
FREDERICK COUNTY, VIRGINIA
1 MILE FROM SUBJECT PROPERTIES

DATE: 05-30-2018 | PROJECT ID:4915WG | DESIGNED BY: DWE
SCALE: 1 Inch = 2,000 Feet

Map Data Source: Frederick County, Va. GIS Department, 2018 Data. Water and Sewer Courtesy of Frederick Water, 2016

Legend

Waverly Farm/Stiles Property

- A : 33 A 69
- B: 33 A 70
- C: 44 A 80
- D: 44 A 80A
- Parcel Boundary

Existing

- SWSA Boundary
- Sewer Force Main
- Sewer Gravity Main
- Water Main
- PS Sewer Pump Station

Proposed

- PR SWSA Expansion
- PR Force Main
- S PR Gravity Main
- W PR Water Main
- PS PR Sewer Pump Station

Feet

1,000 0 1,000

Map Data Source: Frederick County, Va. GIS Department, 2018 Data. Water and Sewer Courtesy of Frederick Water, 2016

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C.P.P.A. WATER & SEWER MAP EXHIBIT

COMPREHENSIVE POLICY PLAN AMENDMENT

PROPOSED

STONEWALL MAGISTERIAL DISTRICT

FREDERICK COUNTY, VIRGINIA

WATER & SEWER EXHIBIT

PROPOSED

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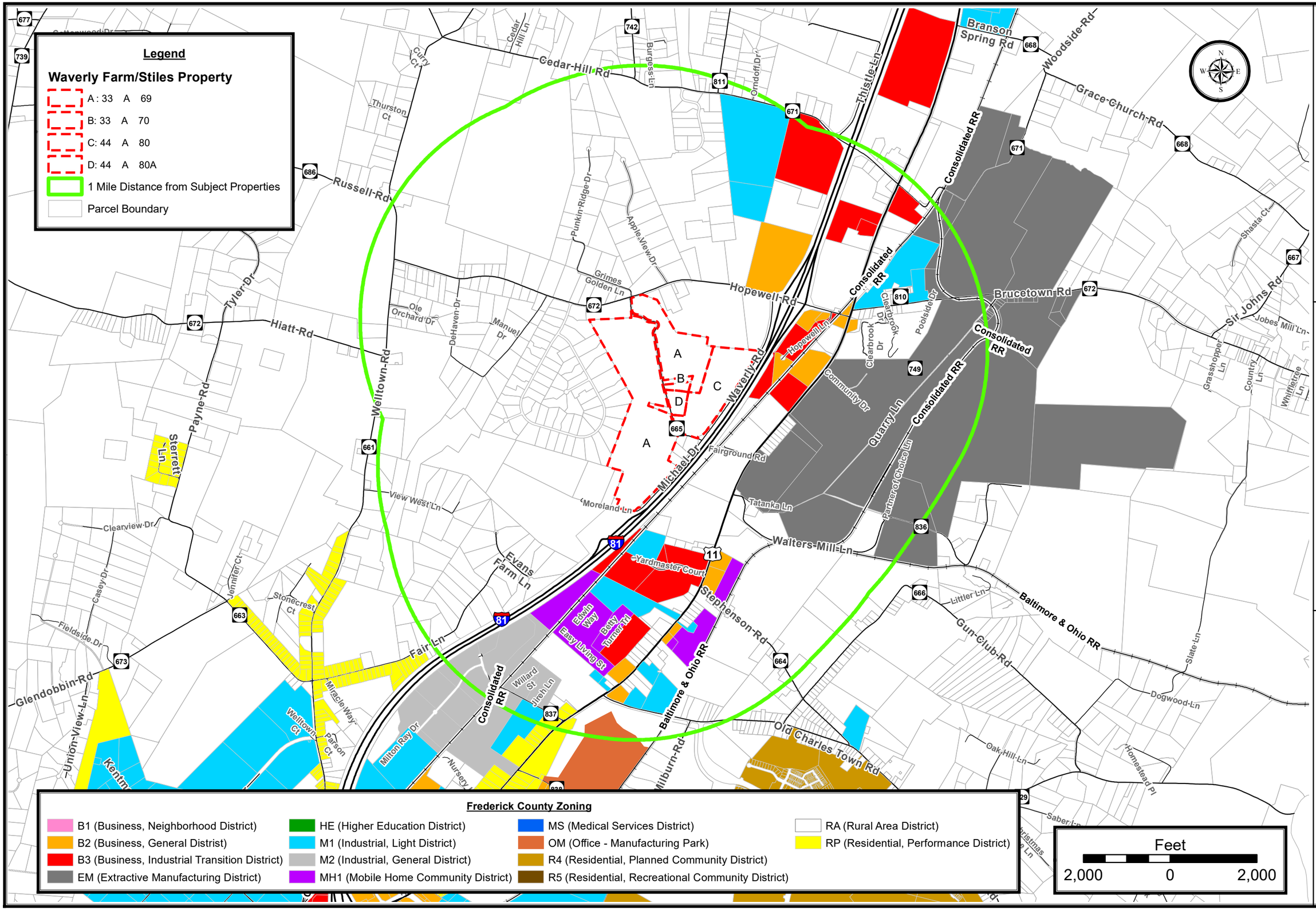

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WAVERLY FARM

C.P.P.A. ZONING MAP EXHIBIT

1 MILE FROM SUBJECT PROPERTIES

STONEWALL MAGISTERIAL DISTRICT

FREDERICK COUNTY, VIRGINIA

ZONING MAP EXHIBIT
1 MILE FROM SUBJECT PROPERTIES

DATE: 05-30-2018 | PROJECT ID:4915WG | DESIGNED BY: DWE

SCALE: 1 Inch = 2,000 Feet

Sewer Collection System Analysis Report

Waverly Farm
Water and Sewer Feasibility Study
Frederick County, Virginia

March 14, 2018
Revised May 31, 2018

Prepared for:
The Walker Group
4720 Montgomery Lane, Suite 1000
Bethesda, MD 20814

Prepared By:
Randy L. Kepler, PE
Greenway Engineering, Inc.

151 Windy Hill Lane
Winchester, VA 22602
Telephone 540-662-4185
Fax 540-722-4185
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CONTENTS

- Narrative
- Existing Sewer System
- On-Site Sewer
- Off-Site Sewer - Existing 8” Gravity
- Off-Site Sewer - Existing VDOT Pump Station
- Off-Site Sewer - VDOT Pump Station – 30 Year Evaluation
- Conclusions and Recommendations

Appendices

1. Sewer Capacities
2. VDOT Welcome Center Gravity Sewer Evaluation
3. VDOT Pump Station Evaluation
4. Excerpts from the FW 2017 Sanitary Sewer Master Plan
5. VDOT PS - 30 yr Buildout Preliminary Computation
6. Map Exhibits – (Land Bay, On-site sewer, Off-site sewer)

Revisions	Date	Details
1	May 31, 2018	Added Additional Evaluation on 30 yr. Master Plan Flows

WAVERLY FARM DEVELOPMENT
SANITARY COLLECTION-FINAL REPORT

Narrative

The Frederick County Northeast Frederick Land Use Plan recommends commercial, mixed office and industrial, and industrial land use for parcels located in the southwestern quadrant of I-81 Exit 321. This quadrant consists of an assortment of parcels totaling approximately 425 acres. Waverly Farm comprises approximately 46% of the area within this quadrant, of which 51.4± acres is currently within the Sewer and Water Service Area (SWSA) and 145.5± acres is adjacent to the SWSA. Waverly Farm is petitioning Frederick County to include the remaining acreage within the SWSA. As a part of this process, an evaluation of the existing and proposed sewer system was completed to determine operational issues for the 425-acre quadrant area.

The evaluation was completed by following standard engineering practices for sewer design and standards as set forth in the Frederick Water's (FW) Water and Sewer Standards and Specifications, most recent revision dated February 20, 2018. We also took into consideration the data, information and direction provided by Frederick Water in their 2017 Sanitary Sewer Master Plan approved August 15, 2017. Data on pump station design and pump run time records were provided to Greenway by FW for evaluation. Existing grades were used for the proposed development within the project site to determine system needs. All elevations in the evaluation and calculations, where necessary, were set at either the existing ground elevation since a detailed design and final sewer collection for the project have yet to be determined. It is anticipated the development of the 425-acre analysis area consistent with the land uses recommended by the Frederick County Northeast Frederick Land Use Plan will require a sewer system that will have the eventual capacity of 322,233 GPD.

Existing Sewer System

The nearest sewer system consists of an 8-inch gravity sewer system within the VDOT Welcome Center that flows under I-81 to the existing FW-VDOT Pump Station. This station pumps through an 8-inch force main south along the railroad, under Route 11 and I-81 and into the Red Bud Pump Station. There is approximately 16,600 linear feet of force main.

On-Site Sewer

The 425-acre analysis area was evaluated to determine availability of gravity sewer flow to the main point of connection to the existing system at the VDOT Welcome Center. There is an area within the 425-acre analysis area along I-81 that won't flow by gravity and will need to be pumped. The 425-acre analysis area was divided into seven land bays to better analyze and understand the project. Land Bays 1-5 are anticipating a need for pumps while Land Bays 6 and 7 should have the ability to flow by gravity to this existing gravity sewer. These land bays can be seen in the attached exhibits.

Off-Site Sewer – Existing 8" Gravity

The existing 8" gravity line at the Welcome Center flows east to the highway crossing, through a bore and then into the VDOT Pump Station. All existing lines are 8" diameter. Evaluation of the full buildout flow shows this existing 8" line does not have the capacity for full buildout flows plus existing flows. The sections below the 425 acre analysis area tie in point will need to be upgraded to 12". We anticipate a capacity in this existing 8" line of 101,000 gallons is currently available above existing flows before the existing system is at capacity and the upgrade is needed.

Off Site Sewer – Existing VDOT Pump Station

Data was provided by Frederick Water (FW) on the existing design data on the pump station as well as the current operating conditions. The pump station was originally designed with two phases. The first phase was designed to handle 20,000 GPD of flow and pump through an 8" FM that had a length of 16,600 LF. The pumps however were sized to pump 325 GPM, which when calculated comes to 187,200 GPD. The current average daily flow into the pump station (April 2016-April 2017) was 31,484 GPD. This flow is over the design intent of the initial flow but well within the capacity of the currently specified pump. The second and ultimate phase was for the pump station to handle 320,000 GPD of flow and pump through the same 8" force main however the length of that force main was reduced to 6,600 LF. It is unclear on the exact intent of this FM reduction although it appears that the 8" FM was to be directed into a new gravity sewer or pump station along the same route (approximately at the DeHaven PS shown on the exhibit) or sewer pumped into a new 6,600 LF force main on a new route to a gravity sewer discharge. The pump for this ultimate phase was sized at 560 GPM. It appears from the calculations that in the ultimate condition, that because of the reduced losses with the shorter force main, the only change necessary was for the reduction of the pump impeller from 12" diameter to a 11.5" diameter. The pump specified (Smith and Loveless 4C3B, 1760 rpm, 30 HP) is the same in both phases.

Taking this existing condition information and inputting the proposed development's flows of 322, 233 GPD with a sewer growth capacity, partial capacity appears to be available in the station. We estimate a design flow of 359,717 GPD (625 gpm peak flow) necessary to handle to flows from the buildout of the 425-acre analysis area based on the land uses recommended by the Frederick County Northeast Frederick Land Use Plan. The Phase 1 pumps have the capacity of 187,200 GPD. They are seeing 31,484 GPD of flow leaving a capacity of 155,716 GPD which is 48% of the needed capacity of the proposed development. However as was noted in the FW's Master Sewer Plan and confirmed with this evaluation, the flow velocity in the downstream 8" force main is a concern. We believe there are currently 5 pump stations of various sizes connected to this shared 8" force main, each with pumps in the 100 to 200 GPM size. When multiple pumps run concurrently on these force mains, the velocities, as reported in the master plan, are reaching 6 fps with engineering standards not allowing velocities over 8 fps. Because of this velocity issue, there isn't as much available capacity as is perceived apparent in looking at the pumping capacities at the VDOT pump station.

To determine the best option for obtaining offsite sewer capacity for this project, we looked at several options for sewer collection expansion or improvement. We then considered the Frederick Water's Master Sewer Plan to then confirm and compare the options developed. Below are a few of the alternatives listed in this Master Sewer Plan that appear to be in some form or another, tasks that are appropriate for this project.

The Master Sewer Plan Alternatives are:

- Alternative NR10.01 This alternative calls for the addition of SCADA to the VDOT and Woodbine pump stations in anticipation of an additional 216,000 GPD of expected growth.

- Alternative NR15.02 and 15.03 This alternative calls for the upgrade of the VDOT Pump Station and increase of the force main to a 12-inch diameter line.

We believe portions of these listed alternatives put together into a project will achieve what is necessary to provide capacity for the buildout of the 425-acre analysis area based on the land uses recommended by the Frederick County Northeast Frederick Land Use Plan.

Based on our calculations the best option for providing sewer is to install a new 12" force main along the same route as the existing 8-inch force main as a replacement of the existing 8" FM. This greatly reduces the friction head on the system and allows more volume through the pipe at lower velocities. Other routes for force mains or gravity sewers from various points along the existing force main or even directly from the VDOT Pump Station weren't found acceptable mostly due to the large number of property owners that would need to agree to providing a sanitary sewer easement for this connection. Since this is a private development without the same capacities of Frederick Water for easement acquisition, these other options were only briefly evaluated. It was determined the time and effort to evaluate upgrade of the existing system within the existing easements allowed for the best and quickest route for the client.

The force main termination point in these calculations has been changed from the current terminus at the Red Bud Pump Station. As was understood from previous projects and then confirmed with FW's Master Sewer Plan's discussion on existing conditions and directions on future sewer routing, the Red Bud Pump Station is again at or near capacity. This VDOT pump station's existing force main ties into the Red Bud Pump Station, flows into the Abrams Creek Interceptor and then to the Opequon WRF. To bypass this restricted section of the sewer collection system, we are recommending the re-routing of the existing force main by the addition of force main through the Graystone Industrial Park to the new Graystone Gravity Interceptor sewer (listed as NR5.01 in the master plan). It is our understanding that this gravity sewer is or soon will be under construction and will be available for connection of this force main by the time this project will need capacity and the improvements constructed. The calculations on the proposed improvements include the additional 3,550 LF of 12" force main. This would transfer the sewer flows from the Red Bud Station to the Stephenson Regional Pump Station as is recommended in the FW MSP. This action will require the need for a 20' sanitary sewer easement from the current land owners, Crider & Shockey Inc. of WV.

Based on our calculations, the existing VDOT pump station should be able to remain and, depending on the wear on the pumps, utilize the same pumps as currently specified. With the change in diameter and direction, the existing pumps will have a capacity of 625 GPM which is the design flow expected at the VDOT Pump Station based on the full buildout of this project, along with the existing base flows and a reasonable growth rate based on the current county growth data (359,717 GPD). The pump station should still be evaluated and any controls that are near the end of their service life should be repaired, the emergency pump around requirements of Frederick Water should be added as well as providing for an automatic transfer switch and a permanent standby generator to handle the capacity of both pumps running should be installed to ensure a better operating system. This pump station, along with the other pump stations along this common force main, should be installed (if not already) with a SCADA (Supervisory Control and Data Acquisition) system to allow the different pump stations to communicate so pumps are running concurrently on the force main.

The intent, with regard to constructability of this upgrade, was to install the 12" force main in the 8" FM trench by replacement of the existing force main. Due to the high quantity of rock along this route and the existing 20" water line running parallel with the force main in the same easement, blasting and excavation of a new trench wasn't practical. Our constructability process is suggesting making the improvements to the VDOT pump station first including the emergency pump bypass. The contractor would then use the emergency pump bypass and a certain amount of temporary force main in short, manageable 1,000' segments placed on the ground to dig up the existing 8" line and replace with the 12" line. With the appropriate temporary systems and piping, installation of this upsized line can be completed with no disruption of sewer collection.

Calculations showing the results described here are included in the attachments to this report.

Off-Site Sewer –VDOT Pump Station – 30 Year Evaluation

One of the concerns of Frederick Water is providing sewer for the future anticipated growth areas within their Northern Service Region. The priority is to provide service to zoned properties and approved facilities within the Northern Service Region before additional properties are included in the SWSA. This section includes evaluation to demonstrate how the recommended improvements associated with the buildout of the 425-acre analysis area comply with the Master Sewer Plan and how the recommended improvements enhance the existing FW infrastructure to benefit the greater region for needed capacities.

The adopted August 15, 2017 FW Master Sewer Plan provides a future flow evaluation for each of the county's service region. It also breaks down each service region into specific pump station locations and the developable area and flows expected at these locations. Estimates and decisions to determine the flows are included in the Master Sewer Plan and summarized in Table A-1 – FCSA Future Flow Data. 5, 10, 15, 20 and 30 year projected sanitary sewer flows are provided. The subject project is located in the Northern Service Region and is included in the 20 year growth window. This Waverly evaluation only looked at the 30-year flow situation as considered full builtout. The 30 year buildout shows the Woodbine Pump Station will be see existing and projected sewer flows of 1.753 MGD. Table A-1 also shows the VDOT Pump Station will be see existing and projected sewer flows, in its drainage shed, of 0.445 MGD. As it is currently situated and modeled in the MSP, the VDOT Pump Station re-pumps the sewer flows from the Woodbine Pump Station through the existing 8" force main to the Red Bud Pump Station. Without further modifications to the existing conditions or the Master Plan, the VDOT pump station will need to be able to handle both the calculated flows from Woodbine and VDOT PSs. The combined flows come to a total of 2.196 MGD or when converted to a pump size, 3,812.50 GPM.

The Master Sewer Plan briefly describes the areas included in these pump station regions by way of a future growth map labeled as Figure 1 – Projected Growth Map. Frederick Water, through their consultant, evaluated the county and determined parcels that were anticipated to be a part of development. They assigned these parcels to the year event of 5,10,15,20,30-year development and assigned them with a color coding. Evaluation of this map was completed to determine if the subject parcels were a part of the anticipated sewer growth. This evaluation showed the entirety of the 425-acre analysis area was shown in yellow, which is identified as part of the 20-year growth flows. This included both the parcels located within the Water and Sewer Service Area as well as outside the Water and Sewer Service Area. Based on this understanding, the projected flows for the subject parcel are already included in the FW SSMP 20-year growth numbers so added flows above the master plan in this evaluation are not needed.

The FW Master Sewer Plan includes recommendations for system modifications to handle the necessary flows in this Northern Region and are broken down into the 5 different year projections. Specific recommendations of note from the report are as follows:

NRC.01 – Install SCADA to reduce multiple pumps running simultaneously.

NR10.01 - Add Woodbine PS and any new pump stations in the Rt. 11 Corridor to the proposed SCADA system.

NR15.02 – Upgrade the VDOT PS to convey the 30-year projected flow of 2.250 MGD.

There is no recommendation for changes to the VDOT PS's existing 8" force main from the VDOT pump station although one would expect it with the anticipated flow increase. The report does reference this need in the alternative analysis section as item NR15.03 – increase the VDOT force main to a 12" diameter pipe.

Evaluation of this 30-year flow requirements demonstrates that the recommended improvements associated with the buildout of the 425-acre analysis area complies with the Master Sewer Plan and provides for infrastructure improvements that benefit the Northern Service Region.

One item of note, to confirm the force main size for this expanded 30-year flow, we evaluated the capacity of a 12" force main seeing a flow of 3,812.50 gpm. Based on our calculations it appears this sized force main will see a sewer velocity of approximately 10.7 fps at the full 30-year capacity. Typically, code limits the velocity to 8 fps but allows for increased velocity if specific design concerns are addressed. The 12" force main design will need to be installed using suitable construction methods to confirm stabilization and minimize long term wear (12VAC 5-581-500).

Conclusions and Recommendations

Results of this study demonstrate that the 425-acre analysis area can be provided with on-site sewer, and that the off-site improvements will provide adequate routing with sufficient capacity for sewer flows. It is recommended the gravity sewer upgrades and the pump station upgrades described above be completed to provide service to the project. It is also recommended an agreement be entered with Frederick Water to protect the interests of this project with the up-front infrastructure costs for the improvements to guarantee the capacity purchased.

The results of the study also demonstrate that the 2017 Sanitary Sewer Master Plan approved by the Frederick Water Board of Directors on August 15, 2017 included the 425-acre analysis area in their 30-year master sewer plan for properties that would be considered within the limits of the SWSA. Evaluation of this Master Plan also shows that the recommendations made in this report for the upgrade of the VDOT pump station's force main and extension of the upgraded force main into the proposed Graystone gravity sewer system will provide very important sections of improvement needed for full 30-year buildout of the county's master plan.

We believe the gravity portions of the offsite facilities have certain existing capacities to allow for a partial buildout of this project to allow for deferment of infrastructure improvements until further development is acquired. The VDOT pump station improvements might, with additional calculations and agreements with Frederick Water, have some capacity in the system to allow for a small start. Addition investigations into the details of this offsite system would be necessary to see if some small infrastructure improvements (such as the SCADA system installation) would provide added capacities to also defer capital costs on the proposed work to further along the project development timeline.

Waverly Farm Development
Sewer System Evaluation
Appendix 1

Sewer Capacities

SEWER COMPUTATIONS

Project: Waverly Farms Development - Pump Station Capacity

Calculated by: RLK **Date:** 3/17/2017 **J.N.:** 4915WG

Revised: *5/31/2018*

Flow rates per use listed below are per:

Table 3 of the VA SCAT Regulations
Wastewater Engineering, Metcalf and Eddy, Third Ed., 1991
Sewer Flow Regulations from surrounding juridictions
Recent Flow Records from FCSA (meter readings) for similar facilities

Land Bay 1 (Commercial)*							
	35.07	acres	10	persons/acre*	75	gpd/person	26,303 gpd
Land Bay 2 (Commercial)*							
	30.37	acres	10	persons/acre*	75	gpd/person	22,778 gpd
Land Bay 3 (Industrial)*							
	47.53	acres	40	persons/acre*	25	gpd/person	47,530 gpd
Land Bay 4 (Industrial)*							
	8.12	acres	40	persons/acre*	25	gpd/person	8,120 gpd
Land Bay 5 (Industrial)*							
	26.87	acres	40	persons/acre*	25	gpd/person	26,870 gpd
Land Bay 6 (Industrial)*							
	61.55	acres	40	persons/acre*	25	gpd/person	61,550 gpd
Land Bay 7 (90%Industrial, 10% Business)*							
Industrial	101.97	acres	40	persons/acre*	75	gpd/person	305,910 gpd
Business	11.33	acres	10	persons/acre*	25	gpd/person	2,833 gpd
Total	113.3	acres	37	persons/acre*	30	gpd/person	125,763 gpd
Land Bay 8 (Industrial)*							
	3.32	acres	40	persons/acre*	25	gpd/person	3,320 gpd

Total Flows

		Total Development Flow	322,233	gpd
		Total Development Flow	224	gpm
Peak	2.5	times	805,583	gpd
Peak Flow		or	559	gpm

On Site Pump Station

		Total OnSite Pump Station Flow	131,600	gpd	(LB 1,2,3,4,5)
		Total Pump Station Flow	91	gpm	
Peak	2.5	times	329,000	gpd	
Peak Flow		or	228	gpm	

Pump Design Rate	228	gpm

VDOT Pump Station Data

Existing Pump Station Data
Smith and Loveless Pump Station
Initial Capacity Conditions (FM to Redbud)
4C3B Duplex suction lift pump station with 12" impellers on 30HP pumps

Average Design Flow	20,000 GPD	31,484.4 GPD	Average (4/16 thru 4/17)	
ADF	14 GPM	21.9 GPM		
Peak	35 GPM	54.7 GPM		actual
Pump Design Rate	325 GPM			

Existing Pump Station Data
Smith and Loveless Pump Station
Ultimate Capacity Conditions - FM shortened to 6,600 LF
4C3B Duplex suction lift pump station with 11.5" impellers on 30HP pumps

Average Design Flow	320,000 GPD	
ADF	222 GPM	
Peak	556 GPM	
Pump Design Rate	560 GPM	

Pump Station Upgrade Requirement

Current Flow	31,484 GPD		
Per Capita Growth	6,000 GPD	20yrs/0.87% growth (current county growth average)	
Proposed Flow	322,233 GPD		
Design Flow	359,717 GPD		
	250 GPM		
peak factor 2.5	625 GPM		
Pump Design Rate	625 GPM		

Future Flow Evaluation - FW Master Sewer Plan Data

VDOT Pump Station Only
Table 3.2 defines flow increases projected over a 30 year period
According to the FW S.Sewer Master Plan, Figure #1-FCSA Projected Growth Map, the subject parcels in this report are included in the 20 yr Growth Flow Numbers listed in Table 3.2 so project flows don't need to be added on top of the SSMP flows

0.45	MGD VDOT station Only
445,000.00	GPD
309.03	GPM
2.50	peaking factor for pump sizing
772.57	GPM pump sizing needed

VDOT and Woodbine Pump Stations
Table 3.2 defines flow increases projected over a 30 year period

1.751	MGD 30 yr Woodbine PS Flow
0.445	MGD 30 yr VDOT PS Flow (Includes Project Area)

According to the FW S.Sewer Master Plan, Figure #1-FCSA Projected Growth Map, the subject parcels in this report are included in the 20 yr Growth Flow Numbers listed in Table 3.2 so project flows don't need to be added on top of the SSMP flows

2,196,000.00	GPD (Woodbine and VDOT)
1,525.00	GPM
2.50	peaking factor for pump sizing
3,812.50	GPM - pump sizing needed at 30 year buildout of the VDOT PS

Waverly Farm Development
Sewer System Evaluation
Appendix 2

VDOT Welcome Center Gravity Sewer Evaluation

Project: Existing VDOT San Sewer to VDOT Pump Station

Calculated by: RLK **Date:** 4/11/2017 **J.N.:** 4915WG

User entered data
Calculated data

FROM MH	TO MH	UNITS OR AREA	FLOW/ UNIT	AVG. FLOW INCREMENT	AVG. FLOW TOTAL	PEAK FACTOR	Q TOTAL GPD	PIPE SIZE(IN.)	SLOPE %	ACTUAL VEL.(FPS)	FULL FLOW VEL.(FPS)	CAPACITY GPD	q/Q %	LENGTH FEET	INVERT UPPER	INVERT LOWER
Ex MH 1	Ex MH 2			0	20.000	2.5	50.000	8	0.16%	0.62	1.38	310.079	16.12%	170.00	643.79	643.52
Ex MH 2	Ex MH 3			0	20.000		50.000	8	0.81%	1.40	3.11	701.336	7.13%	256.00	643.52	641.44
Ex MH 3	Ex MH 4			0	20.000		50.000	8	0.38%	0.96	2.13	480.453	10.41%	674.00	636.74	634.17
Ex MH 4	ROW C/O			0	20.000		50.000	8	6.04%	3.40	8.48	1,912.114	2.61%	76.00	633.97	629.38
ROW C/O	ew MH ROW			0	20.000		50.000	8	0.21%	0.72	1.59	358.669	13.94%	240.00	629.38	628.87
lew MH ROW	Ex MH 5			0	20.000		50.000	8	7.32%	3.74	9.34	2,105.086	2.38%	25.00	628.87	627.04
Ex MH 5	Ex MH 6			0	20.000		50.000	8	0.94%	1.51	3.35	755.635	6.62%	176.00	627.04	625.38
Ex MH 6	Ex MH 7			0	20.000		50.000	8	4.93%	3.07	7.66	1,727.578	2.89%	100.00	625.38	620.45
Ex MH 7	Wetwell			0	20.000		50.000	8	0.58%	1.19	2.64	594.255	8.41%	60.00	620.45	620.10
Wetwell	MH-VDOT PS			0	20.000		50.000	8	2.50%	2.45	5.46	1,230.224	4.06%	16.00	619.90	619.50

Existing Capacity
20000 GPD

Project: Existing VDOT San Sewer to VDOT Pump Station

Calculated by: RLK **Date:** 4/11/2017 **J.N.:** 4915WG

User entered data
Calculated data

FROM MH	TO MH	UNITS OR AREA	FLOW/ UNIT	AVG. FLOW INCREMENT	AVG. FLOW TOTAL	PEAK FACTOR	Q TOTAL GPD	PIPE SIZE(IN.)	SLOPE %	ACTUAL VEL.(FPS)	FULL FLOW VEL.(FPS)	CAPACITY GPD	q/Q %	LENGTH FEET	INVERT UPPER	INVERT LOWER
Ex MH 1	Ex MH 2			0	20.000	2.5	50.000	8	0.16%	0.62	1.38	310.079	16.12%	170.00	643.79	643.52
Ex MH 2	Ex MH 3			0	20.000		50.000	8	0.81%	1.40	3.11	701.336	7.13%	256.00	643.52	641.44
Ex MH 3	Ex MH 4			0	20.000		50.000	8	0.38%	0.96	2.13	480.453	10.41%	674.00	636.74	634.17
Ex MH 4	ROW C/O	1	322.233	322.233	342.233	2.5	905.583	8	6.04%	3.82	8.48	1.912.114	47.36%	76.00	633.97	629.38
ROW C/O	ew MH ROW			0	342.233		905.583	12	0.21%	0.94	2.09	1.058.906	85.52%	240.00	629.38	628.87
New MH ROW	Ex MH 5			0	342.233		905.583	12	7.32%	5.51	12.25	6.214.890	14.57%	25.00	628.87	627.04
Ex MH 5	Ex MH 6			0	342.233		905.583	12	0.94%	1.98	4.40	2.230.877	40.59%	176.00	627.04	625.38
Ex MH 6	Ex MH 7			0	342.233		905.583	12	4.93%	4.52	10.05	5.100.366	17.76%	100.00	625.38	620.45
Ex MH 7	Wetwell			0	342.233		905.583	12	0.58%	1.56	3.46	1.754.431	51.62%	60.00	620.45	620.10
Wetwell	MH-VDOT PS			0	342.233		905.583	12	2.50%	3.22	7.16	3.632.017	24.93%	16.00	619.90	619.50

Existing Capacity
20000 GPD

Proposed Need
322.233.00 GPD

Project: Existing VDOT San Sewer to VDOT Pump Station

Calculated by: RLK KDP **Date:** 12/13/2017 **J.N.:** 4915WG

User entered data
Calculated data

FROM MH	TO MH	UNITS OR AREA	FLOW/ UNIT	AVG. FLOW INCREMENT	AVG. FLOW TOTAL	PEAK FACTOR	O TOTAL GPD	PIPE SIZE(IN.)	SLOPE %	ACTUAL VEL.(FPS)	FULL FLOW VEL.(FPS)	CAPACITY GPD	q/Q %	LENGTH FEET	INVERT UPPER	INVERT LOWER
Ex MH 1	Ex MH 2			0	20.000	2.5	50.000	8	0.16%	0.62	1.38	310.079	16.12%	170.00	643.79	643.52
Ex MH 2	Ex MH 3			0	20.000		50.000	8	0.81%	1.40	3.11	701.336	7.13%	256.00	643.52	641.44
Ex MH 3	Ex MH 4			0	20.000		50.000	8	0.38%	0.96	2.13	480.453	10.41%	674.00	636.74	634.17
Ex MH 4	ROW C/O	1	103.000	103.000	123.000	2.5	357.500	8	6.04%	3.82	8.48	1.912.114	18.70%	76.00	633.97	629.38
ROW C/O	New MH ROW			0	123.000		357.500	8	0.21%	0.72	1.59	358.669	99.67%	240.00	629.38	628.87
New MH ROW	Ex MH 5			0	123.000		357.500	8	7.32%	4.20	9.34	2.105.086	16.98%	25.00	628.87	627.04
Ex MH 5	Ex MH 6			0	123.000		357.500	8	0.94%	1.51	3.35	755.635	47.31%	176.00	627.04	625.38
Ex MH 6	Ex MH 7			0	123.000		357.500	8	4.93%	3.45	7.66	1.727.578	20.69%	100.00	625.38	620.45
Ex MH 7	Wetwell			0	123.000		357.500	8	0.58%	1.19	2.64	594.255	60.16%	60.00	620.45	620.10
Wetwell	MH-VDOT PS			0	123.000		357.500	8	2.50%	2.45	5.46	1.230.224	29.06%	16.00	619.90	619.50

Existing Capacity
20000 GPD

Maximum Additional Capacity to Existing System
103.000 GPD

Waverly Farm Development
Sewer System Evaluation
Appendix 3

VDOT Pump Station Evaluation

I-81 Rest Area Pump station

Data in first three columes and pump rate provided by Frederick Water

Hour Run Time Data

time time pump rate = 325 gpm 19,500 gph

Date	Pump#1 hrs	Pump#2 hrs	Days	Pump 1 (hrs)	Pump 2 (hrs)	Pump 1	Pump 2	Total Station (gallons)	Total Station GPD	
4/1/2016	2255.78	2338.5	4	2.97	2.83	57915 Gal	55185 Gal	113100	28,275.0	
4/5/2016	2258.75	2341.33	3	1.99	2.25	38805 Gal	43875 Gal	82680	27,560.0	
4/8/2016	2260.74	2343.58	3	2.32	2.37	45240 Gal	46215 Gal	91455	30,485.0	
4/11/2016	2263.06	2345.95	2	1.22	1.28	23790 Gal	24960 Gal	48750	24,375.0	
4/13/2016	2264.28	2347.23	2	1.87	1.97	36465 Gal	38415 Gal	74880	37,440.0	
4/15/2016	2266.15	2349.2	3	2.31	2.33	45045 Gal	45435 Gal	90480	30,160.0	
4/18/2016	2268.46	2351.53	4	3.07	3.11	59865 Gal	60645 Gal	120510	30,127.5	
4/22/2016	2271.53	2354.64	3	2.39	2.54	46605 Gal	49530 Gal	96135	32,045.0	
4/25/2016	2273.92	2357.18								30,058.4 GPD (avg)
5/3/2016	2280.12	2364.06	6	4.54	4.89	88530 Gal	95355 Gal	183885	30,647.5	
5/9/2016	2284.66	2368.95	3	2.62	2.65	51090 Gal	51675 Gal	102765	34,255.0	
5/12/2016	2287.28	2371.6	4	3.34	6.04	65130 Gal	117780 Gal	182910	45,727.5	
5/16/2016	2290.62	2377.64	1	1.11	0.69	21645 Gal	13455 Gal	35100	35,100.0	
5/17/2016	2291.73	2378.33	6	4.76	5.25	92820 Gal	102375 Gal	195195	32,532.5	
5/23/2016	2296.49	2383.58								35,652.5 GPD (avg)
6/1/2016	2303.69	2391.41	2	2.08	2.31	40560 Gal	45045 Gal	85605	42,802.5	
6/3/2016	2305.77	2393.72	3	3.24	3.16	63180 Gal	61620 Gal	124800	41,600.0	
6/6/2016	2309.01	2396.88	1	0.39	0.4	7605 Gal	7800 Gal	15405	15,405.0	
6/7/2016	2309.4	2397.28	2	1.8	2.13	35100 Gal	41535 Gal	76635	38,317.5	
6/9/2016	2311.2	2399.41	5	4	4.29	78000 Gal	83655 Gal	161655	32,331.0	
6/14/2016	2315.2	2403.7	1	0.68	0.85	13260 Gal	16575 Gal	29835	29,835.0	
6/15/2016	2315.88	2404.55	7	6.33	6.31	123435 Gal	123045 Gal	246480	35,211.4	
6/22/2016	2322.21	2410.86	2	2.62	2.74	51090 Gal	53430 Gal	104520	52,260.0	
6/24/2016	2324.83	2413.6	3	2.27	2.32	44265 Gal	45240 Gal	89505	29,835.0	
6/27/2016	2327.1	2415.92	2	1.71	1.81	33345 Gal	35295 Gal	68640	34,320.0	
6/29/2016	2328.81	2417.73								35,191.7 GPD (avg)
7/5/2016	2334.66	2423.94	6	6.4	6.77	124800 Gal	132015 Gal	256815	42,802.5	
7/11/2016	2341.06	2430.71	3	2.6	2.74	50700 Gal	53430 Gal	104130	34,710.0	
7/14/2016	2343.66	2433.45	4	4.34	4.7	84630 Gal	91650 Gal	176280	44,070.0	
7/18/2016	2348	2438.15	1	0.66	0.64	12870 Gal	12480 Gal	25350	25,350.0	
7/19/2016	2348.66	2438.79	3	3.07	3.33	59865 Gal	64935 Gal	124800	41,600.0	

7/22/2016	2351.73	2442.12	4	3.4	3.64	66300	Gal	70980	Gal	137280	34,320.0	
7/26/2016	2355.13	2445.76										37,142.1 GPD (avg)
8/2/2016	2361.54	2452.65	9	8.65	8.94	168675	Gal	174330	Gal	343005	38,111.7	
8/11/2016	2370.19	2461.59	4	3.59	3.75	70005	Gal	73125	Gal	143130	35,782.5	
8/15/2016	2373.78	2465.34	7	6.5	6.48	126750	Gal	126360	Gal	253110	36,158.6	
8/22/2016	2380.28	2471.82	3	2.92	2.96	56940	Gal	57720	Gal	114660	38,220.0	
8/25/2016	2383.2	2474.78	5	4.35	4.11	84825	Gal	80145	Gal	164970	32,994.0	
8/30/2016	2387.55	2478.89										36,253.3 GPD (avg)
9/7/2016	2396.11	2487.43	1	0.79	0.75	15405	Gal	14625	Gal	30030	30,030.0	
9/8/2016	2396.9	2488.18	5	4.53	4.74	88335	Gal	92430	Gal	180765	36,153.0	
9/13/2016	2401.43	2492.92	3	3.34	3.34	65130	Gal	65130	Gal	130260	43,420.0	
9/16/2016	2404.77	2496.26	4	3.54	3.59	69030	Gal	70005	Gal	139035	34,758.7	
9/20/2016	2408.31	2499.85	6	6.03	6.28	117585	Gal	122460	Gal	240045	40,007.5	
9/26/2016	2414.34	2506.13	4	4.88	4.81	95160	Gal	93795	Gal	188955	47,238.7	
9/30/2016	2419.22	2510.94										38,601.3 GPD (avg)
10/3/2016	2422.11	2513.99	8	8.7	10.18	169650	Gal	198510	Gal	368160	46,020.0	
10/11/2016	2430.81	2524.17	6	5.27	5.21	102765	Gal	101595	Gal	204360	34,060.0	
10/17/2016	2436.08	2529.38	3	3.18	3.24	62010	Gal	63180	Gal	125190	41,730.0	
10/20/2016	2439.26	2532.62	4	3.22	4.19	62790	Gal	81705	Gal	144495	36,123.7	
10/24/2016	2442.48	2536.81	7	6.04	6.35	117780	Gal	123825	Gal	241605	34,515.0	
10/31/2016	2448.52	2543.16										38,489.7 GPD (avg)
11/4/2016	2452.08	2547.32	3	1.9	1.95	37050	Gal	38025	Gal	75075	25,025.0	
11/7/2016	2453.98	2549.27	2	1.56	1.67	30420	Gal	32565	Gal	62985	31,492.5	
11/9/2016	2455.54	2550.94	5	4.52	4.98	88140	Gal	97110	Gal	185250	37,050.0	
11/14/2016	2460.06	2555.92	7	5.71	5.52	111345	Gal	107640	Gal	218985	31,283.6	
11/21/2016	2465.77	2561.44	7	4.41	5.99	85995	Gal	116805	Gal	202800	28,971.4	
11/28/2016	2470.18	2567.43	1	0.7	0.74	13650	Gal	14430	Gal	28080	28,080.0	
11/29/2016	2470.88	2568.17										30,317.1 GPD (avg)
12/3/2016	2473.07	2570.49	2	2.05	2.12	39975	Gal	41340	Gal	81315	40,657.5	
12/5/2016	2475.12	2572.61	7	4.97	4.92	96915	Gal	95940	Gal	192855	27,550.7	
12/12/2016	2480.09	2577.53	3	2.5	2.16	48750	Gal	42120	Gal	90870	30,290.0	
12/15/2016	2482.59	2579.69	4	2.57	2.34	50115	Gal	45630	Gal	95745	23,936.2	
12/19/2016	2485.16	2582.03	8	5.01	5.77	97695	Gal	112515	Gal	210210	26,276.3	

12/27/2016	2490.17	2587.8	2	1.45	1.53	28275	Gal	29835	Gal	58110	29,055.0	
12/29/2016	2491.62	2589.33										29,627.6 GPD (avg)
1/4/2017	2495.07	2592.75	2	1.21	1.42	23595	Gal	27690	Gal	51285	25,642.5	
1/6/2017	2496.28	2594.17	3	1.39	1.53	27105	Gal	29835	Gal	56940	18,980.0	
1/9/2017	2497.67	2595.7	4	2.33	2.63	45435	Gal	51285	Gal	96720	24,180.0	
1/13/2017	2500	2598.33	3	1.48	1.49	28860	Gal	29055	Gal	57915	19,305.0	
1/16/2017	2501.48	2599.82	2	1.23	1.24	23985	Gal	24180	Gal	48165	24,082.5	
1/18/2017	2502.71	2601.06	5	2.82	3.02	54990	Gal	58890	Gal	113880	22,776.0	
1/23/2017	2505.53	2604.08	2	1.4	1.57	27300	Gal	30615	Gal	57915	28,957.5	
1/25/2017	2506.93	2605.65	2	1.59	1.66	31005	Gal	32370	Gal	63375	31,687.5	
1/27/2017	2508.52	2607.31	3	1.45	1.72	28275	Gal	33540	Gal	61815	20,605.0	
1/30/2017	2509.97	2609.03										24,024.0 GPD (avg)
2/6/2017	2513.91	2613.06	3	2.07	1.86	40365	Gal	36270	Gal	76635	25,545.0	
2/9/2017	2515.98	2614.92	5	2.82	3.22	54990	Gal	62790	Gal	117780	23,556.0	
2/14/2017	2518.8	2618.14	7	4.16	4.22	81120	Gal	82290	Gal	163410	23,344.3	
2/21/2017	2522.96	2622.36	2	1.23	1.25	23985	Gal	24375	Gal	48360	24,180.0	
2/23/2017	2524.19	2623.61	4	2.31	2.39	45045	Gal	46605	Gal	91650	22,912.5	
2/27/2017	2526.5	2626										23,907.6 GPD (avg)
3/1/2017	2527.89	2627.47	5	2.68	3.23	52260	Gal	62985	Gal	115245	23,049.0	
3/6/2017	2530.57	2630.7	1	0.42	0.42	8190	Gal	8190	Gal	16380	16,380.0	
3/7/2017	2530.99	2631.12	6	4.14	3.66	80730	Gal	71370	Gal	152100	25,350.0	
3/13/2017	2535.13	2634.78	2	1.03	1.02	20085	Gal	19890	Gal	39975	19,987.5	
3/15/2017	2536.16	2635.8	4	1.97	3.39	38415	Gal	66105	Gal	104520	26,130.0	
3/19/2017	2538.13	2639.19	1	0.4	0.34	7800	Gal	6630	Gal	14430	14,430.0	
3/20/2017	2538.53	2639.53	8	4.69	5.3	91455	Gal	103350	Gal	194805	24,350.6	
3/28/2017	2543.22	2644.83										21,382.4 GPD (avg)
4/4/2017	2547.78	2649.68	3	2.11	2.64	41145	Gal	51480	Gal	92625	30,875.0	
4/7/2017	2549.89	2652.32	3	2.22	1.84	43290	Gal	35880	Gal	79170	26,390.0	
4/10/2017	2552.11	2654.16	3	2.31	2.58	45045	Gal	50310	Gal	95355	31,785.0	
4/13/2017	2554.42	2656.74	4	2.7	2.54	52650	Gal	49530	Gal	102180	25,545.0	
4/17/2017	2557.12	2659.28										28,648.8 GPD (avg)
											31,484.4	GPD (year avg.)
											20,000	GPD Design avg.

PORTION OF AS-BUILT DRAWINGS SHEET C22 DATED 5-20-2004:
FOR PROJECT "IMPROVEMENTS TO WATERWORKS-FCSA SANITARY SEWER AND FORCE MAIN IMPROVEMENTS-PROJECT TWENTY-TWO
PUMP STATION DETAILS AND NOTES
DESIGN BY CLIFFORD AND ASSOCIATES
SHEET PROVIDED FOR USE BY FREDERICK WATER

STATE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SH N
VA	IM-081-3(151) IM-081-3(150)	I-81	0081-034-116, L801 0081-034-117, L801	

PPMS 52333

PUMP STATION DESIGN DATA

IDENTIFICATION

VDOT	INITIAL CONSTRUCTION

DESIGN FLOW

AVERAGE DAILY FLOW FROM REST AREA	10000	GPD
FLOW OCCURS OVER A 12 HOUR PERIOD	20000	GPD
PEAK FACTOR	2.5	
AVERAGE DESIGN FLOW per day	20000	GPD
AVERAGE DESIGN FLOW per minute	14	GPM
PEAK DESIGN FLOW	35	GPM
PUMP DESIGN FLOW (2 FPS VELOCITY IN 8" FORCE MAIN)	325	GPM

FORCE MAIN

STATION PIPING:

STATION PIPING DIAMETER	6	INCHES
STATION PIPING	25	FEET
EQUIVALENT FITTING LENGTH	100	FEET
TOTAL EQUIVALENT LENGTH	125	FEET
FRICTION HEAD LOSS (ft/100 ft); C=120	1.079	
TOTAL FRICTION LOSS	1.3	FEET

SITE PIPING:
DISCHARGE AT REDBUD RUN PUMP STATION

STATION PIPING DIAMETER	8	INCHES
SITE PIPING:	16600	FEET
EQUIVALENT FITTING LENGTH	400	FEET
TOTAL EQUIVALENT LENGTH	17000	FEET
FRICTION HEAD LOSS (ft/100 ft); C=120	0.266	
TOTAL FRICTION LOSS	45.3	FEET
TOTAL FRICTION LOSS	**46.6**	**FEET**

STATIC LIFT

PUMP OFF LEVEL	615.5	FEET
HIGH POINT IN FORCE MAIN	716.0	FEET
STATIC LIFT	100.5	FEET
TOTAL DYNAMIC HEAD (TDH)	**147.1**	**FEET**

PUMP STATION DIMENSIONS AND ELEVATIONS

DIMENSIONS

Two Each DIAMETER OF WETWELL	96	INCHES

ELEVATIONS

"1"	TOP OF WETWELL	628.00	FEET
"2"	PROPOSED GRADE AT WET WELL	627.50	FEET
"3"	EXISTING GRADE AT WET WELL	624.50	FEET
"4"	DISCHARGE INVERT	623.50	FEET
"5"	INFLUENT INVERT	619.50	FEET
"6"	HIGH WATER ALARM	617.00	FEET

PUMP STATION DESIGN DATA

IDENTIFICATION

VDOT	ULTIMATE CAPACITY

DESIGN FLOW

AVERAGE DAILY FLOW FROM REST AREA AND OTHER SERVICE AREAS	320000	GPD
PEAK FACTOR	2.5	
AVERAGE DESIGN FLOW per day	320000	GPD
AVERAGE DESIGN FLOW per minute	222	GPM
PEAK DESIGN FLOW	556	GPM
PUMP DESIGN FLOW	560	GPM

FORCE MAIN

STATION PIPING:

STATION PIPING DIAMETER	6	INCHES
STATION PIPING	25	FEET
EQUIVALENT FITTING LENGTH	100	FEET
TOTAL EQUIVALENT LENGTH	125	FEET
FRICTION HEAD LOSS (ft/100 ft); C=120	2.953	
TOTAL FRICTION LOSS	3.7	FEET

SITE PIPING:
DISCHARGE AT FUTURE PUMP STATION

STATION PIPING DIAMETER	8	INCHES
SITE PIPING:	6600	FEET
EQUIVALENT FITTING LENGTH	150	FEET
TOTAL EQUIVALENT LENGTH	6750	FEET
FRICTION HEAD LOSS (ft/100 ft); C=120	0.728	
TOTAL FRICTION LOSS	49.2	FEET
TOTAL FRICTION LOSS	**52.9**	**FEET**

STATIC LIFT

PUMP OFF LEVEL	613.5	FEET
HIGH POINT IN FORCE MAIN	682.0	FEET
STATIC LIFT	68.5	FEET
TOTAL DYNAMIC HEAD (TDH)	**121.4**	**FEET**

PUMP STATION DIMENSIONS AND ELEVATIONS

DIMENSIONS

Two Each DIAMETER OF WETWELL	96	INCHES

ELEVATIONS

"1"	TOP OF WETWELL	628.00	FEET
"2"	PROPOSED GRADE AT WET WELL	627.50	FEET
"3"	EXISTING GRADE AT WET WELL	624.50	FEET
"4"	DISCHARGE INVERT	623.50	FEET
"5"	INFLUENT INVERT	619.50	FEET
"6"	HIGH WATER ALARM	619.00	FEET

PUMP STATION HEAD ANALYSIS

Waverly Farm - Feasibility Study - Existing VDOT Pump Station Evaluation ***Job Number:*** 4915WG

Date: March 12, 2018

XXXXXXX *"- Enter information where locations are blue"*

"- calculated locations, no entry required"

Must have the preliminary design of PS system prior to analysis with this spreadsheet

Suction water surface elevation	615.50	feet	
Discharge water surface elevation	716.00	feet	high point in FM
Static head	100.5	feet	

Pipe Information	Size	type	location
Pipe 1	6	DIP	pump station piping
Pipe 2	8	PVC	force main
Pipe 3			
Pipe 4			
Pipe 5			
Pipe 6			

	Pipe 1	Pipe 2	Pipe 3	Pipe 4	Pipe 5	Pipe 6
Pipe length (feet)	25	16600				
Pipe diameter (inches)	6.00	8.00				
Pipe C-factor	110	120				
Portion of Flow	1.00	1.00				
Cross-sectional area (feet)	0.196	0.349				
Hydraulic radius	0.125	0.167				

Number of fittings for each pipE

	Pipe 1	Pipe 2	Pipe 3	Pipe 4	Pipe 5	Pipe 6
Gate Valve	1	2				
Plug Valve (99% open)						
Butterfly Valve						
Swing Check Valve	1					
90° Bend	2					
45° Bend		10				
22.5° Bend		4				
11.25° Bend		2				
Tee (through)						
Tee (side out)						
Cross (through)						
Cross (side out)						
Reducer/Increaser	1	1				
Discharge to air		1				
Sum of losses in fittings	3.29	4.08				
Other miscellaneous losses						
Sum of minor losses (K)	3.29	4.08				

PUMP STATION HEAD ANALYSIS

Waverly Farm - Feasibility Study - Existing VDOT Pump Station Evaluation ***Job Number:*** 4915WG

head loss parameters for following table

Minimum flow for results 200 gpm

Flow Increment 25 gpm

Head Loss Calculations

Flow (gpm)	Pipe 1 Loss (feet)	Pipe 2 Loss (feet)	Pipe 3 Loss (feet)	Pipe 4 Loss (feet)	Pipe 5 Loss (feet)	Pipe 6 Loss (feet)	TDH (feet)
200	0.39	17.96	0	0	0	0	118.86
225	0.49	22.35	0	0	0	0	123.34
250	0.61	27.16	0	0	0	0	128.27
275	0.73	32.41	0	0	0	0	133.64
300	0.86	38.08	0	0	0	0	139.44
325	1.01	44.16	0	0	0	0	145.67
350	1.17	50.66	0	0	0	0	152.33
375	1.34	57.57	0	0	0	0	159.41
400	1.52	64.89	0	0	0	0	166.90
425	1.71	72.60	0	0	0	0	174.81
450	1.91	80.71	0	0	0	0	183.12
475	2.12	89.21	0	0	0	0	191.83
500	2.34	98.11	0	0	0	0	200.95
525	2.58	107.39	0	0	0	0	210.47
550	2.83	117.06	0	0	0	0	220.38
575	3.08	127.11	0	0	0	0	230.69
600	3.35	137.54	0	0	0	0	241.39
625	3.63	148.34	0	0	0	0	252.47
650	3.92	159.52	0	0	0	0	263.94

Velocity Calculations

Flow (gpm)	Pipe 1 Velocity (fps)	Pipe 2 Velocity (fps)	Pipe 3 Velocity (fps)	Pipe 4 Velocity (fps)	Pipe 5 Velocity (fps)	Pipe 6 Velocity (fps)	
200	2.27	1.28	0	0	0	0	
225	2.55	1.44	0	0	0	0	
250	2.84	1.60	0	0	0	0	
275	3.12	1.76	0	0	0	0	
300	3.40	1.91	0	0	0	0	
325	3.69	2.07	0	0	0	0	325 gpm at 147.1' TD
350	3.97	2.23	0	0	0	0	
375	4.26	2.39	0	0	0	0	
400	4.54	2.55	0	0	0	0	
425	4.82	2.71	0	0	0	0	
450	5.11	2.87	0	0	0	0	
475	5.39	3.03	0	0	0	0	
500	5.67	3.19	0	0	0	0	
525	5.96	3.35	0	0	0	0	
550	6.24	3.51	0	0	0	0	
575	6.52	3.67	0	0	0	0	
600	6.81	3.83	0	0	0	0	
625	7.09	3.99	0	0	0	0	
650	7.38	4.15	0	0	0	0	

PUMP STATION HEAD ANALYSIS

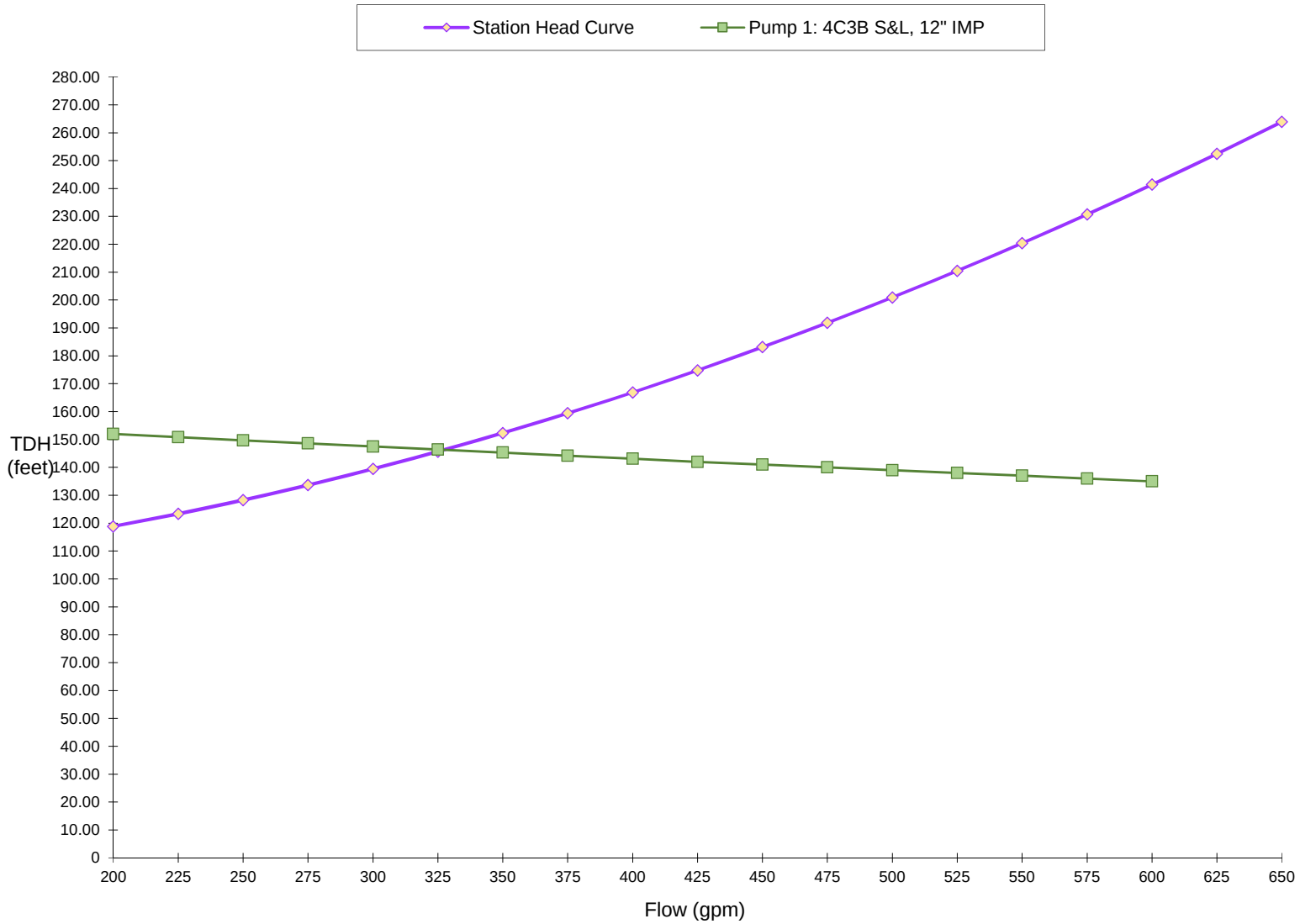
Waverly Farm - Feasibility Study - Existing VDOT Pump Station Evaluation ***Job Number:*** 4915WG

Pump Selection

Pump Descriptions:
Pump 1: 4C3B S&L, 12" IMP
Pump 2:
Pump 3:

Flow (gpm)	Pump 1 Curve TDH (ft)	Pump 2 Curve TDH (ft)	Pump 3 Curve TDH (ft)
200	152.00		
225	150.80		
250	149.70		
275	148.60		
300	147.50		
325	146.40		
350	145.30		
375	144.20		
400	143.10		
425	142.00		
450	141.00		
475	140.00		
500	139.00		
525	138.00		
550	137.00		
575	136.00		
600	135.00		
625			
650			

Pump Comparison Chart



PUMP STATION HEAD ANALYSIS

Waverly Farm - Feasibility Study - Proposed VDOT Pump Station Improvements ***Job Number:*** 4915WG

Date: March 12, 2018

XXXXXXX *"- Enter information where locations are blue"*

"- calculated locations, no entry required"

Must have the preliminary design of PS system prior to analysis with this spreadsheet

Suction water surface elevation	615.50	feet	
Discharge water surface elevation	716.00	feet	high point in FM
Static head	100.5	feet	

Pipe Information	Size	type	location
Pipe 1	6	DIP	pump station piping
Pipe 2	12	PVC	force main
Pipe 3			
Pipe 4			
Pipe 5			
Pipe 6			

	Pipe 1	Pipe 2	Pipe 3	Pipe 4	Pipe 5	Pipe 6
Pipe length (feet)	25	18500				
Pipe diameter (inches)	6.00	12.00				
Pipe C-factor	110	120				
Portion of Flow	1.00	1.00				
Cross-sectional area (feet)	0.196	0.785				
Hydraulic radius	0.125	0.250				

Number of fittings for each pipE

	Pipe 1	Pipe 2	Pipe 3	Pipe 4	Pipe 5	Pipe 6
Gate Valve	1	2				
Plug Valve (99% open)						
Butterfly Valve						
Swing Check Valve	1					
90° Bend	2					
45° Bend		10				
22.5° Bend		4				
11.25° Bend		2				
Tee (through)						
Tee (side out)						
Cross (through)						
Cross (side out)						
Reducer/Increaser	1	1				
Discharge to air		1				
Sum of losses in fittings	3.29	4.08				
Other miscellaneous losses						
Sum of minor losses (K)	3.29	4.08				

PUMP STATION HEAD ANALYSIS

Waverly Farm - Feasibility Study - Proposed VDOT Pump Station Improvements ***Job Number:*** 4915WG

head loss parameters for following table

Minimum flow for results 300 gpm

Flow Increment 25 gpm

Head Loss Calculations

Flow (gpm)	Pipe 1 Loss (feet)	Pipe 2 Loss (feet)	Pipe 3 Loss (feet)	Pipe 4 Loss (feet)	Pipe 5 Loss (feet)	Pipe 6 Loss (feet)	TDH (feet)
300	0.86	5.90	0	0	0	0	107.26
325	1.01	6.84	0	0	0	0	108.35
350	1.17	7.85	0	0	0	0	109.52
375	1.34	8.92	0	0	0	0	110.76
400	1.52	10.05	0	0	0	0	112.07
425	1.71	11.25	0	0	0	0	113.46
450	1.91	12.51	0	0	0	0	114.91
475	2.12	13.82	0	0	0	0	116.45
500	2.34	15.20	0	0	0	0	118.05
525	2.58	16.64	0	0	0	0	119.72
550	2.83	18.14	0	0	0	0	121.47
575	3.08	19.70	0	0	0	0	123.28
600	3.35	21.31	0	0	0	0	125.16
625	3.63	22.99	0	0	0	0	127.12
650	3.92	24.72	0	0	0	0	129.14
675	4.22	26.51	0	0	0	0	131.23
700	4.53	28.36	0	0	0	0	133.39
725	4.85	30.27	0	0	0	0	135.62
750	5.18	32.23	0	0	0	0	137.91

Velocity Calculations

Flow (gpm)	Pipe 1 Velocity (fps)	Pipe 2 Velocity (fps)	Pipe 3 Velocity (fps)	Pipe 4 Velocity (fps)	Pipe 5 Velocity (fps)	Pipe 6 Velocity (fps)	
300	3.40	0.85	0	0	0	0	
325	3.69	0.92	0	0	0	0	
350	3.97	0.99	0	0	0	0	
375	4.26	1.06	0	0	0	0	
400	4.54	1.13	0	0	0	0	
425	4.82	1.21	0	0	0	0	
450	5.11	1.28	0	0	0	0	
475	5.39	1.35	0	0	0	0	
500	5.67	1.42	0	0	0	0	
525	5.96	1.49	0	0	0	0	
550	6.24	1.56	0	0	0	0	
575	6.52	1.63	0	0	0	0	
600	6.81	1.70	0	0	0	0	
625	7.09	1.77	0	0	0	0	pump design flow
650	7.38	1.84	0	0	0	0	
675	7.66	1.91	0	0	0	0	
700	7.94	1.99	0	0	0	0	
725	8.23	2.06	0	0	0	0	
750	8.51	2.13	0	0	0	0	

PUMP STATION HEAD ANALYSIS

Waverly Farm - Feasibility Study - Proposed VDOT Pump Station Improvements ***Job Number:*** 4915WG

Pump Selection

Pump Descriptions:

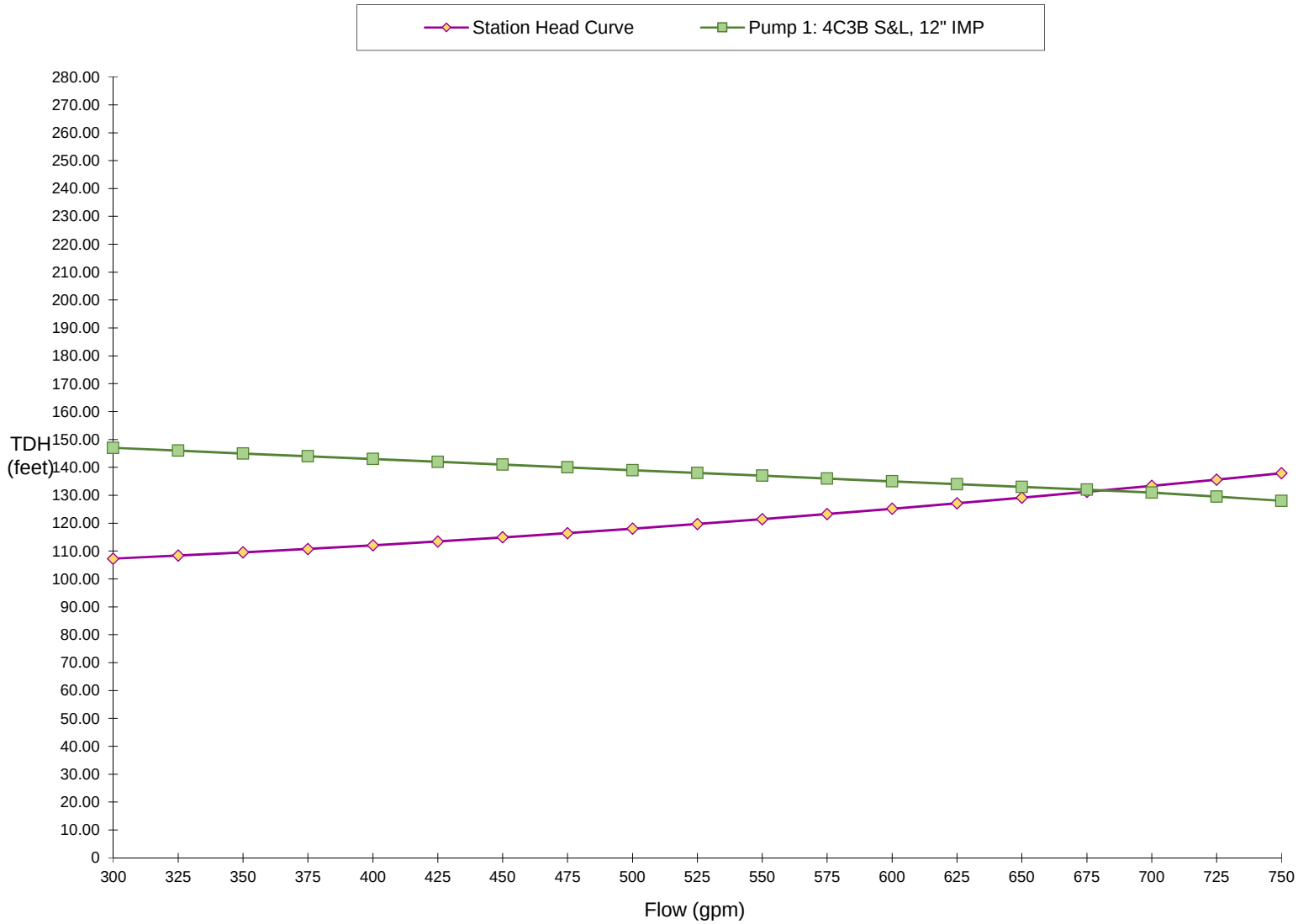
Pump 1: 4C3B S&L, 12" IMP

Pump 2:

Pump 3:

Flow (gpm)	Pump 1 Curve TDH (ft)	Pump 2 Curve TDH (ft)	Pump 3 Curve TDH (ft)
300	147.00		
325	146.00		
350	145.00		
375	144.00		
400	143.00		
425	142.00		
450	141.00		
475	140.00		
500	139.00		
525	138.00		
550	137.00		
575	136.00		
600	135.00		
625	134.00		
650	133.00		
675	132.00		
700	131.00		
725	129.50		
750	128.00		

Pump Comparison Chart-Future VDOT PS



Waverly Farm Development
Sewer System Evaluation
Appendix 4

Excerpts from the FW 2017 Sanitary Sewer Master Plan
Included:
Table A-1 FCSA Future Flow Data
Figure 1 – FCSA Projected Growth Map

Table A-1 FCSA Future Flow Data

Location	Development Type	EDU/ Acre	Existing Average Flow (mgd)	5 Year Growth (Ac.)	5 Year Flow Increase (EDU)	5 Year Flow Increase (mgd)	10 Year Growth (Ac.)	10 Year Flow Increase (EDU)	10 Year Flow Increase (mgd)	15 Year Growth (Ac.)	15 Year Flow Increase (EDU)	15 Year Flow Increase (mgd)	20 Year Growth (Ac.)	20 Year Flow Increase (EDU)	20 Year Flow Increase (mgd)	30 Year Growth (Ac.)	30 Year Flow Increase (EDU)	30 Year Flow Increase (mgd)	Total Development Area By	Total Flow Increase By	Total Flow Increase By	Estimated Total System Flow
NORTHERN REGION																						
Woodbine PS																						
	Business	2					23	47	0.012	29	58	0.015	32	64	0.016				84	169	0.042	
	Industrial	9								237	2133	0.533	41	369	0.092	131	1179	0.295	409	3681	0.920	
	MUIO	8					102	816	0.204	271	2168	0.542							373	2984	0.746	
	Warehouse	0.35														238	83	0.021	238	83	0.021	
Total			**0.022**				**125**	**863**	**0.216**	**537**	**4359**	**1.090**	**73**	**433**	**0.108**	**369**	**1262**	**0.316**	**1104**	**6917**	**1.751**	**1.773**
VDOT PS																						
	Business	2		60	120	0.030	1	2	0.001				143	286	0.072				204	408	0.102	
	Industrial	9											103	927	0.232				103	927	0.232	
	MUIO	8					2	16	0.004				35	280	0.070				37	296	0.074	
Total			**0.037**	**60**	**120**	**0.030**	**3**	**18**	**0.005**				**281**	**1493**	**0.373**				**344**	**1631**	**0.445**	**0.482**
Rutherford Crossing PS																						
	Business	2		18	36	0.009							34	68	0.017				52	104	0.026	
	Industrial	9											174	1566	0.392				360	1566	0.392	
	MUIO	8		14	112	0.028	36	288	0.072				88	704	0.176				138	1104	0.276	
Total			**0.015**	**32**	**148**	**0.037**	**36**	**288**	**0.072**				**296**	**2338**	**0.585**				**550**	**2774**	**0.709**	**0.724**
Red Bud Run PS																						
	Business	2											30	60	0.015				30	60	0.015	
	Industrial	9					284	2556	0.639				99	891	0.223				383	3447	0.862	
	Residential	4											38	152	0.038				38	152	0.038	
Total			**0.593**				**284**	**2556**	**0.639**				**167**	**1103**	**0.276**				**451**	**3659**	**1.508**	**2.101**
Stephenson Regional																						
	Business	2		6	12	0.003													6	12	0.003	
	Industrial	9		186	1674	0.419	33	297	0.074										219	1971	0.493	
	Planned Unit Dev.	4		157	628	0.157				232	928	0.232							389	1556	0.389	
	Industrial Flow					1.000																
Total			**0.038**	**349**	**2314**	**1.579**	**33**	**297**	**0.074**	**232**	**928**	**0.232**							**614**	**3539**	**1.923**	**1.961**
Abrams Creek System																						
	Existing System Flows Only																					
Total			**0.491**																		**0.491**	**0.982**
Route 50 West PS																						
	Business	2					181	362	0.091				64	128	0.032				245	490	0.123	
Total			**0.072**				**181**	**362**	**0.091**				**64**	**128**	**0.032**				**245**	**490**	**0.195**	
Opequon WRF			**1.268**			**1.646**			**1.096**			**1.322**			**1.374**		**0.316**				**6.530**	**7.798**
Northern Redirect						**0.067**			**0.292**			**1.090**			**1.066**		**0.316**				**2.905**	

NOT TO SCALE

City of Winchester

OPEQUON WATER RECLAMATION FACILITY

PARKINS MILLS WASTEWATER TREATMENT PLANT

CROOKED RUN WASTEWATER TREATMENT PLANT

Legend

- WWTP
- Pump Stations
- Forcemains
- Gravity Sewers
- Gravity Sewers

Frederick County Eastern Road Plan

Representation: EasternRdPlan_May2015_Rep

- New Major Arterial
- Improved Major Arterial
- New Minor Arterial
- Improved Minor Arterial
- New Major Collector
- Improved Major Collector
- New Minor Collector
- Improved Minor Collector
- Ramp
- Roundabout
- Trails
- NEW Sewer Service Area

Parcels

Growth Period

- Current Parcels
- 5 Year Growth
- 10 Year Growth
- 15 Year Growth
- 20 Year Growth
- 30 Year Growth
- Winchester

BUCHART HORN
ENGINEERS • ARCHITECTS • PLANNERS

FCSA
Projected Growth Map

FIGURE 1

Waverly Farm Development
Sewer System Evaluation
Appendix 5

VDOT PS - 30yr Buildout Preliminary Computation

PUMP STATION HEAD ANALYSIS

Waverly Farm - Feasibility Study - Proposed VDOT Pump Station Improvements Job Number: 4915WG
INCLUDING 30 yr FW BUILDOUT

XXXXXXX *"- Enter information where locations are blue"*

"- calculated locations, no entry required"

Must have the preliminary design of PS system prior to analysis with this spreadsheet

Suction water surface elevation	615.50	feet	
Discharge water surface elevation	716.00	feet	high point in FM
Static head	100.5	feet	

Pipe Information	Size	type	location
Pipe 1	12	DIP	pump station piping
Pipe 2	12	PVC	force main
Pipe 3			
Pipe 4			
Pipe 5			
Pipe 6			

	Pipe 1	Pipe 2	Pipe 3	Pipe 4	Pipe 5	Pipe 6
Pipe length (feet)	25	18500				
Pipe diameter (inches)	12.00	12.00				
Pipe C-factor	110	120				
Portion of Flow	1.00	1.00				
Cross-sectional area (feet)	0.785	0.785				
Hydraulic radius	0.250	0.250				

Number of fittings for each pipE

	Pipe 1	Pipe 2	Pipe 3	Pipe 4	Pipe 5	Pipe 6
Gate Valve	1	2				
Plug Valve (99% open)						
Butterfly Valve						
Swing Check Valve	1					
90° Bend	2					
45° Bend		10				
22.5° Bend		4				
11.25° Bend		2				
Tee (through)						
Tee (side out)						
Cross (through)						
Cross (side out)						
Reducer/Increaser	1	1				
Discharge to air		1				
Sum of losses in fittings	3.29	4.08				
Other miscellaneous losses						
Sum of minor losses (K)	3.29	4.08				

PUMP STATION HEAD ANALYSIS

Waverly Farm - Feasibility Study - Proposed VDOT Pump Station Improvements ***Job Number:*** 4915WG

head loss parameters for following table

Minimum flow for results 1600 gpm

Flow Increment 200 gpm

30 Year Buildout Flow 3,812.50 GPM-Peak flow (pump size)

Head Loss Calculations

Flow (gpm)	Pipe 1 Loss (feet)	Pipe 2 Loss (feet)	Pipe 3 Loss (feet)	Pipe 4 Loss (feet)	Pipe 5 Loss (feet)	Pipe 6 Loss (feet)	TDH (feet)
1600	1.26	131.24	0	0	0	0	233.00
1800	1.59	163.26	0	0	0	0	265.35
2000	1.96	198.47	0	0	0	0	300.92
2200	2.36	236.81	0	0	0	0	339.67
2400	2.81	278.25	0	0	0	0	381.56
2600	3.29	322.75	0	0	0	0	426.54
2800	3.80	370.27	0	0	0	0	474.58
3000	4.36	420.78	0	0	0	0	525.64
3200	4.95	474.25	0	0	0	0	579.71
3400	5.59	530.65	0	0	0	0	636.74
3600	6.25	589.96	0	0	0	0	696.71
3800	6.96	652.14	0	0	0	0	759.60
4000	7.70	717.19	0	0	0	0	825.39
4200	8.48	785.07	0	0	0	0	894.05
4400	9.30	855.77	0	0	0	0	965.57
4600	10.16	929.27	0	0	0	0	1039.92
4800	11.05	1005.54	0	0	0	0	1117.09
5000	11.98	1084.58	0	0	0	0	1197.06
5200	12.95	1166.37	0	0	0	0	1279.81

Velocity Calculations

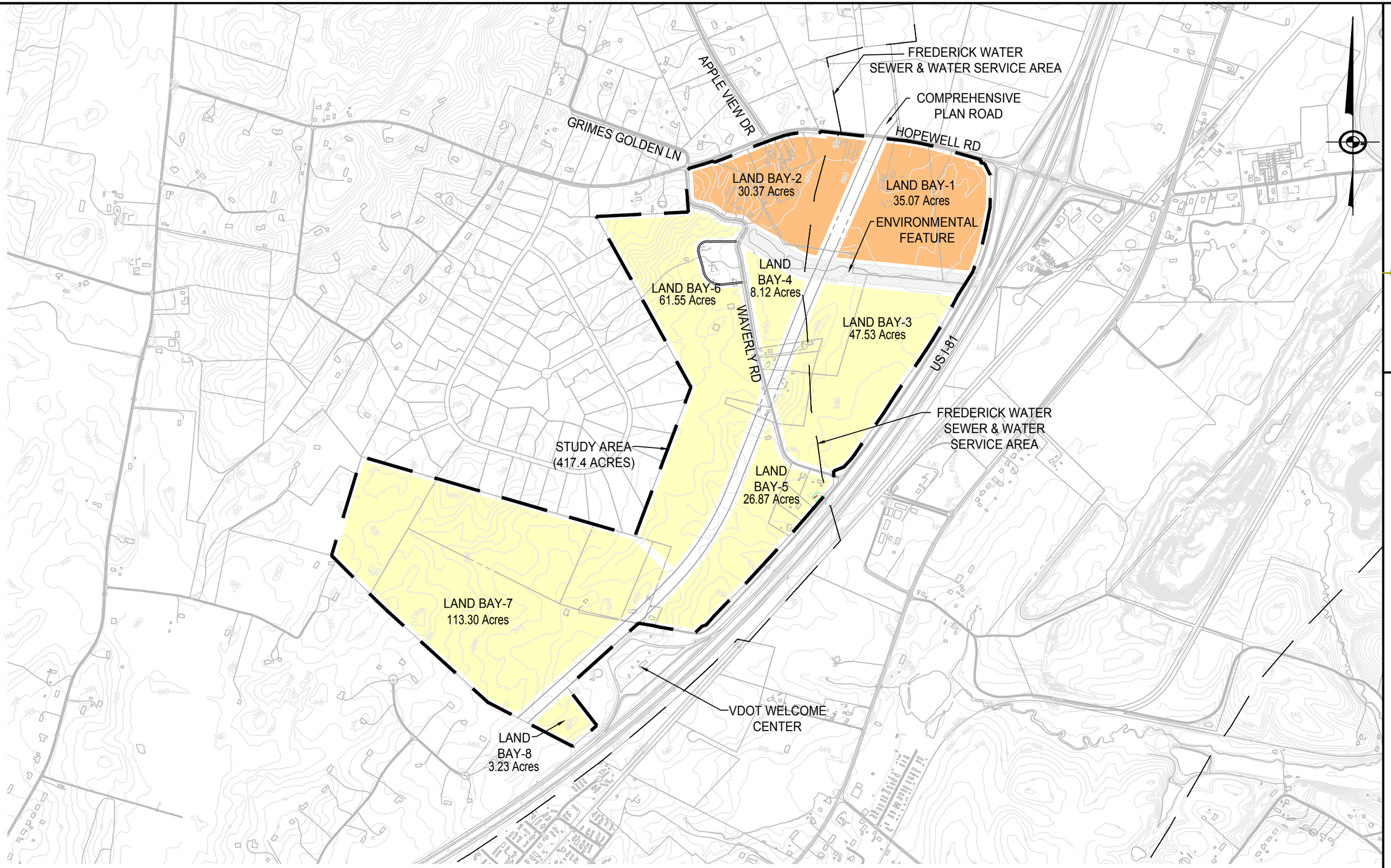
Flow (gpm)	Pipe 1 Velocity (fps)	Pipe 2 Velocity (fps)	Pipe 3 Velocity (fps)	Pipe 4 Velocity (fps)	Pipe 5 Velocity (fps)	Pipe 6 Velocity (fps)
1600	4.54	4.54	0	0	0	0
1800	5.11	5.11	0	0	0	0
2000	5.67	5.67	0	0	0	0
2200	6.24	6.24	0	0	0	0
2400	6.81	6.81	0	0	0	0
2600	7.38	7.38	0	0	0	0
2800	7.94	7.94	0	0	0	0
3000	8.51	8.51	0	0	0	0
3200	9.08	9.08	0	0	0	0
3400	9.65	9.65	0	0	0	0
3600	10.21	10.21	0	0	0	0
3800	10.78	10.78	0	0	0	0
4000	11.35	11.35	0	0	0	0
4200	11.91	11.91	0	0	0	0
4400	12.48	12.48	0	0	0	0
4600	13.05	13.05	0	0	0	0
4800	13.62	13.62	0	0	0	0
5000	14.18	14.18	0	0	0	0
5200	14.75	14.75	0	0	0	0

Pump Flow: 30 yr BO

Waverly Farm Development
Sewer System Evaluation
Appendix 6

Map Exhibits

Land Bay Exhibit
Waverly Farm – Water and Sewer Improvements – On Site
Waverly Farm – Water and Sewer Improvements – Off Site



1000 0 1000 2000

SCALE: 1" = 1000'

LEGEND	
HW/ COMMERCIAL -	
BUSINESS / INDUSTRIAL - 10% / 90%	

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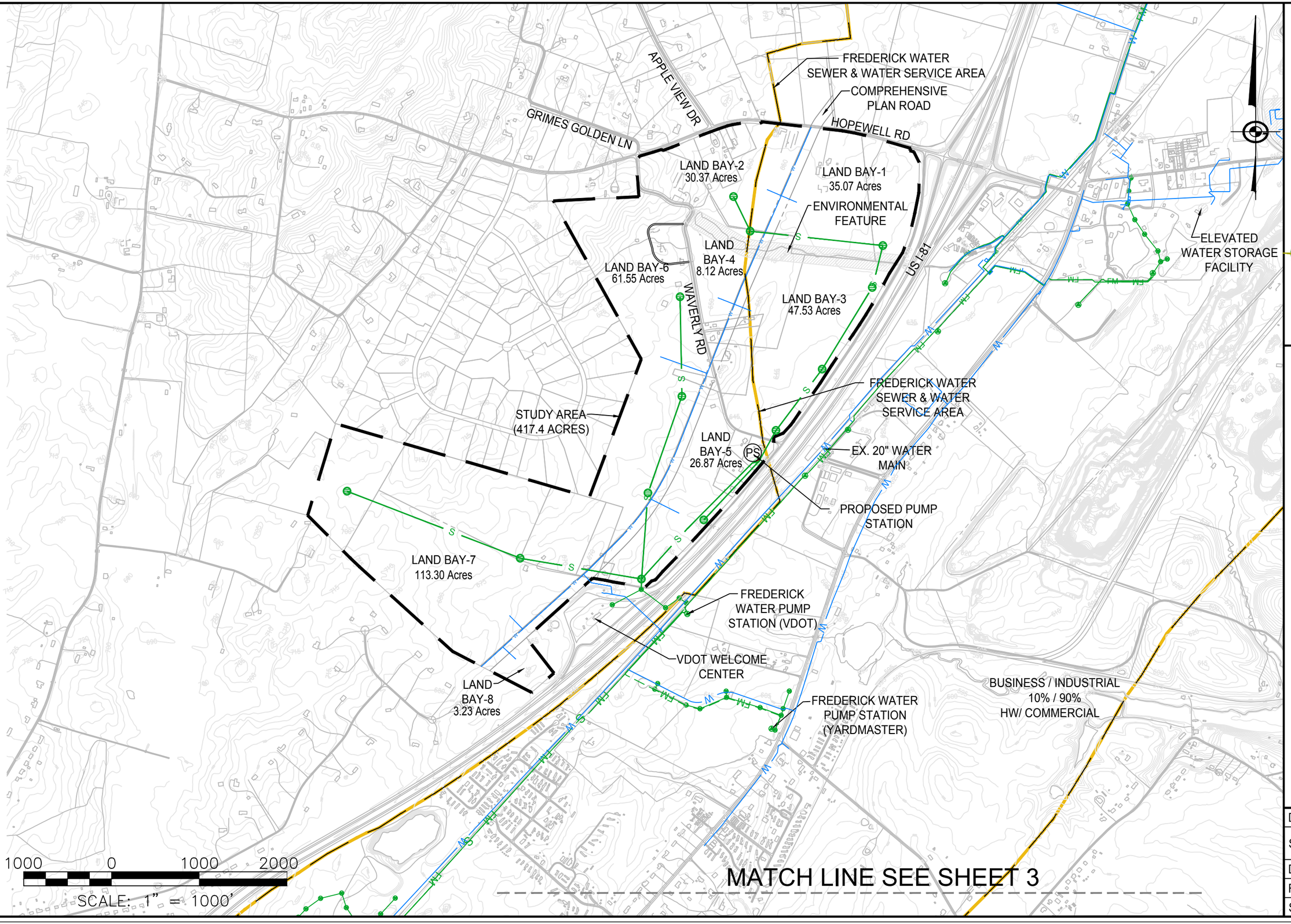
OFFICES IN: WINCHESTER, VA & MARTINSBURG, WV

LAND BAY EXHIBIT
WAVERLY FARMS

STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE: 03/16/2018
SCALE: 1" = 1000'
DESIGN BY: JMM
FILE NO. 4915WG
SHEET 1 OF 3



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WAVERLY FARMS DEVELOPMENT
WATER & SEWER IMPROVEMENTS - ON SITE

STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE:	03/16/2018
SCALE:	1" = 1000'
DESIGN BY:	JMM
FILE NO.	4915WG
SHEET	2 OF 3

MATCH LINE SEE SHEET 2

US I-81

EX. 20" WATER MAIN

FW PUMP STATION (CAROLL)

FW PUMP STATION (DEHAVEN)

FW PUMP STATION (RUTHERFORD)

FW PUMP STATION (OMPS)

FW PUMP STATION (REDBUD)

GRAYSTONE GRAVITY SEWER (APPROXIMATE LOCATION) CONSTRUCTION BY OTHERS

FREDERICK WATER SEWER & WATER SERVICE AREA

1000 0 1000 2000

SCALE: 1" = 1000'

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WAVERLY FARMS DEVELOPMENT
WATER & SEWER IMPROVEMENTS - OFF SITE

STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE:	03/16/2018
SCALE:	1" = 1000'
DESIGN BY:	JMM
FILE NO.	4915WG
SHEET	3 OF 3

Water Distribution System Analysis Report

Waverly Farm
Water and Sewer Feasibility Study
Frederick County, Virginia

March 14, 2018
Revised May 31, 2018

Prepared for:
The Walker Group
4720 Montgomery Lane, Suite 1000
Bethesda, MD 20814

Prepared By:
Randy L. Kepler, PE
Greenway Engineering, Inc.

151 Windy Hill Lane
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Conclusions and Recommendations

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Scenario 2 – Peak Hour Demand

Scenario 3 – Peak Hour Demand Plus 1500 gpm Fire Flow

Supporting Data

WAVERLY FARM DEVELOPMENT
WATER MODEL-FINAL REPORT

Narrative

The Frederick County Northeast Frederick Land Use Plan recommends commercial, mixed office and industrial, and industrial land use for parcels located in the southwestern quadrant of I-81 Exit 321. This quadrant consists of an assortment of parcels totaling approximately 425 acres. Waverly Farm comprises approximately 46% of the area within this quadrant, of which 51.4± acres is currently within the Sewer and Water Service Area (SWSA) and 145.5± acres is adjacent to the SWSA. Waverly Farm is petitioning Frederick County to include the remaining acreage within the SWSA. As a part of this process, an evaluation of the existing and proposed water system was completed to determine operational issues for the 425-acre quadrant area. This model was based on preliminary design of the land bay.

The water model was developed by following standard engineering practices for water modeling and standards as set forth in the Frederick Water's (FW) Water and Sewer Standards and Specifications, most recent revision dated February 20, 2018. The model was developed in Bentley Systems, Haestad Method's WaterCAD, Connect Edition V10.01. The existing system was sized based on system data provided by FW through the use of fire hydrant flow data. The hydrant test results are included in the flow calculation spreadsheet included in this report. The data provides flow and pressure information found at the end of the existing water system on the VDOT Welcome Center site along I-81 located to the south of the project. The model connects to this one point. Existing grades were used for the project area within the project site. All elevations in the model were set at either the existing ground elevation since a detailed design and hydrant locations for the project have yet to be determined. Where appropriate, a generally conservative elevation (higher elevation than average) within each specific land bay was chosen to ensure appropriate pressures and flows are achieved within whole of each land bay. This will provide a conservative result and ensure model and field results will meet the requirements at the future designed hydrants. The elevations between the model and the existing data were evaluated and calibrated to ensure the supplied data was accurate. Minor losses were added to the model system based on the field and design data. The project will require a water system that will provide a static pressure of at least 20 psi and a fire flow of 1,500 gpm plus peak hour demand while maintaining 20 psi in the remainder of the system. The peak hourly demand on each node was calculated based on the specific land use. Based on the anticipated use, the total average daily demand is 322,233 GPD (223.77 gpm) and peak hour demand for the 425-acre analysis area and the volume used in the model is 1,118.86 gpm.

Water Model Scenarios

The model was broken out into 3 scenarios. Flow calculations for the scenarios can be found in the following sections. The scenarios are listed below.

- Scenario 1 – Average Daily Demand. This scenario was developed to evaluate the proposed water distribution system infrastructure using the allocated water usage demands that correspond to each land bay and total 322,233 GPD (223.77 gpm).
- Scenario 2 – Peak Hour Demand. This scenario was completed to evaluate the peak hour demand for full buildout of the development. Pipe sizes and notes were developed to show capacity.
- Scenario 3 – Peak Hour Demand Plus 1500 gpm Fire Flow. The scenario was completed to ensure pipe sizes and connections were provided to meet the FW requirements.

Steady State Analysis

The proposed project was evaluated with multiple water lines located throughout the site and surrounding areas. Pipe line sizes can be determined from the system map and pipe flex table for each scenario. Junctions were labeled as land bays where the demand was placed. The steady state analysis for Peak Hour Demand was completed and the results are as follows.

- Scenario 2 - The minimum system pressure was found at Land Bay 7 (LB-7) with a pressure of 127 psi. The next lowest was at Land Bay 6 (LB-6) with a pressure of 130 psi. This criteria meets the FW steady state requirement of 20 psi minimum.

Fire Flow Analysis

The fire flow analysis was run on the proposed water system for the development buildout. A fireflow demand of 1,500 gpm was used and evaluated at each critical node while maintaining 20 psi residual system wide. The fire flow analysis included the peak hour flows included in the steady state evaluation. The results are as follows.

- Scenario 3 - The minimum system fireflow was found at J-12 with a flow of 2,000 gpm psi with a minimum zone pressure of 54 psi. These results meet the fireflow requirement of 1,500 gpm at 20 psi residual pressure.

Conclusions and Recommendations

Results of this water model shows that the system designed and connected to the existing 12” line at the VDOT Welcome Center will provide the needed pressures and flows to meet the County and state requirements for the buildout of the 425-acre analysis area.

Note that Frederick Water code requires system connection in two locations to the existing distribution system. This model only provides the one point of connection with the Welcome Center connection.

Waverly Farm Development
Water System Evaluation

Scenario 1 – Average Daily Demand
with Land Bay Map

WATER SYSTEM DEMAND-WAVERLY FARM

JN 4915WG
17-Mar-2017
Revised:

Flow Calculations Based on:

Virginia Administrative Code - Ch 590 Waterworks Regs - 12VAC5-590-690 Capacity of Waterworks
Wastewater Engineering, Metcalf and Eddy, Third Ed., 1991 Section 2-3
Area calculations from developable acres of land bays shown on the Waverly Farms Land Bay Exhibit by Greenway

Flow Calculations

Land Bay 1 (Commercial)

Area:	35.07	acres	10	persons/acre	
Employees	351	# persons	75	GPD/person	
			Total System Average Daily Demand (ADD)	26,302.50	GPD
				18.27	GPM
			Peak Hour Demand (PHD)	131,512.50	GPD
			5xADD	91.33	GPM

Land Bay 2 (Commercial)

Area:	30.37	acres	10	persons/acre	
Employees	304	# persons	75	GPD/person	
			Total System Average Daily Demand (ADD)	22,777.50	GPD
				15.82	GPM
			Peak Hour Demand (PHD)	113,887.50	GPD
			5xADD	79.09	GPM

Land Bay 3 (Industrial)

Area:	47.53	acres	40	persons/acre	
Employees	1,901	# persons	25	GPD/person	
			Total System Average Daily Demand (ADD)	47,530.00	GPD
				33.01	GPM
			Peak Hour Demand (PHD)	237,650.00	GPD
			5xADD	165.03	GPM

Land Bay 4 (Industrial)

Area:	8.12	acres	40	persons/acre	
Employees	325	# persons	25	GPD/person	
			Total System Average Daily Demand (ADD)	8,120.00	GPD
				5.64	GPM
			Peak Hour Demand (PHD)	40,600.00	GPD
			5xADD	28.19	GPM

Land Bay 5 (Industrial)

Area:	26.87	acres	40	persons/acre	
Employees	1,075	# persons	25	GPD/person	
			Total System Average Daily Demand (ADD)	26,870.00	GPD
				18.66	GPM
			Peak Hour Demand (PHD)	134,350.00	GPD
			5xADD	93.30	GPM

WATER SYSTEM DEMAND-WAVERLY FARM **JN 4915WG**

17-Mar-2017

Land Bay 6 (Industrial)

Area:	61.55	acres	40	persons/acre	
Employees	2,462	# persons	25	GPD/person	
			Total System Average Daily Demand (ADD)	61,550.00	GPD
				42.74	GPM
			Peak Hour Demand (PHD)	307,750.00	GPD
			5xADD	213.72	GPM

Land Bay 7 (90% Industrial, 10% Commercial)*

Area:	113.3	acres	37	persons/acre	
Employees	4,192	# persons	30	GPD/person	
			Total System Average Daily Demand (ADD)	125,763.00	GPD
				87.34	GPM
			Peak Hour Demand (PHD)	628,815.00	GPD
			5xADD	436.68	GPM

* Industrial = 101.97 acres @ 40 persons per acre and 75 gpd per person
Commercial = 11.33 acres @ 10 persons per acre and 25 gpd per person

Land Bay 8 (Industrial)

Area:	3.32	acres	40	persons/acre	
Employees	133	# persons	25	GPD/person	
			Total System Average Daily Demand (ADD)	3,320.00	GPD
				2.31	GPM
			Peak Hour Demand (PHD)	16,600.00	GPD
			5xADD	11.53	GPM

Summary

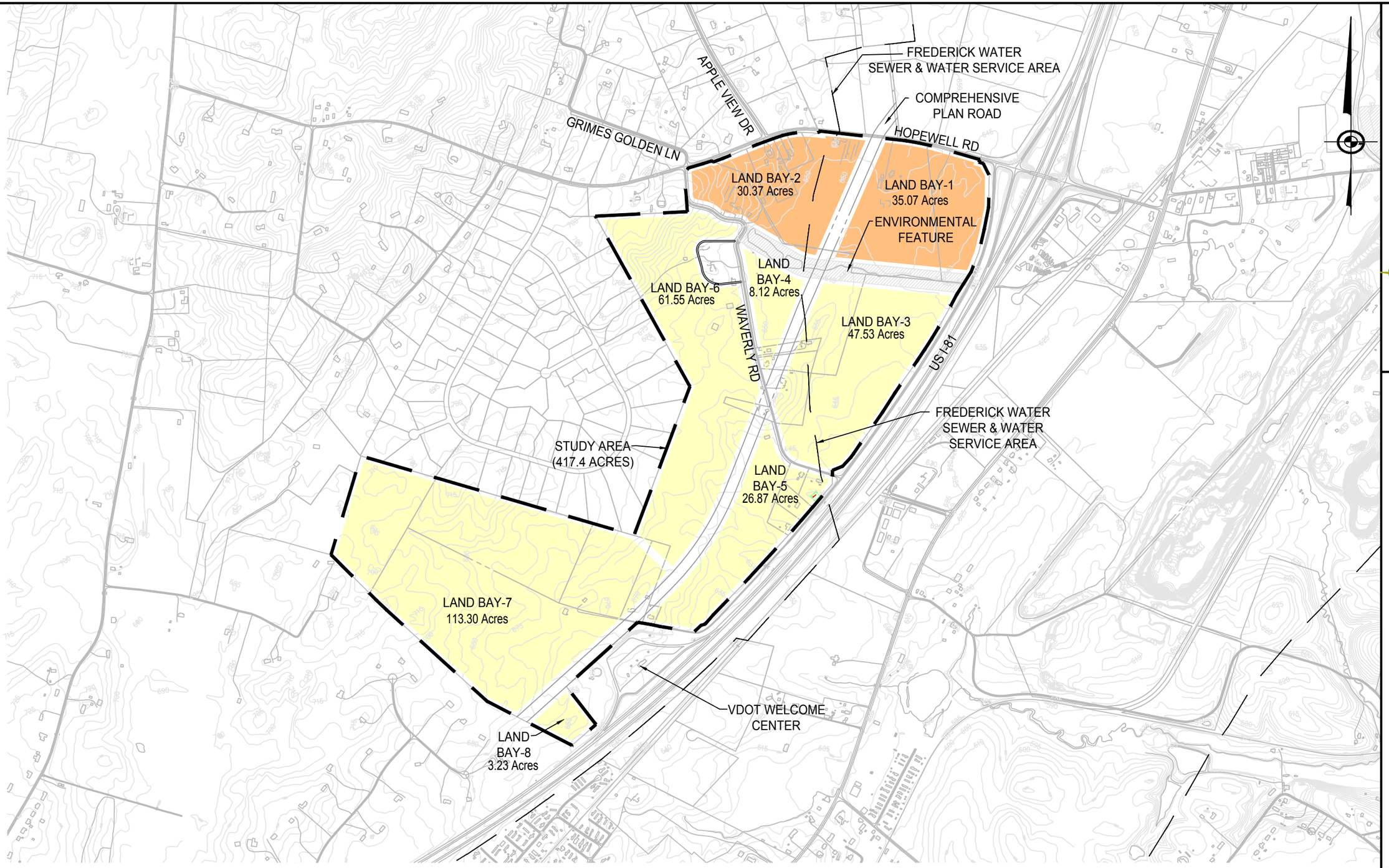
Total System Average Daily Demand (ADD)	322,233.00	GPD
	223.77	GPM
Peak Hour Demand (PHD)	1,611,165.00	GPD
5xADD	1,118.86	GPM

Hydrant Data

Hydrant data from FCSA by Email on 4/18/17

Existing Hydrant 1 (Ex HYD 1) - VDOT Rest Area

	Discharge (gpm)	Pressure (psi)	Head (feet)
Static		146	337
Design	1,428	136	313
Residual	2,076	125	289



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SCALE: 1" = 1000'

LEGEND	
HW/ COMMERCIAL -	
BUSINESS / INDUSTRIAL - 10% / 90%	

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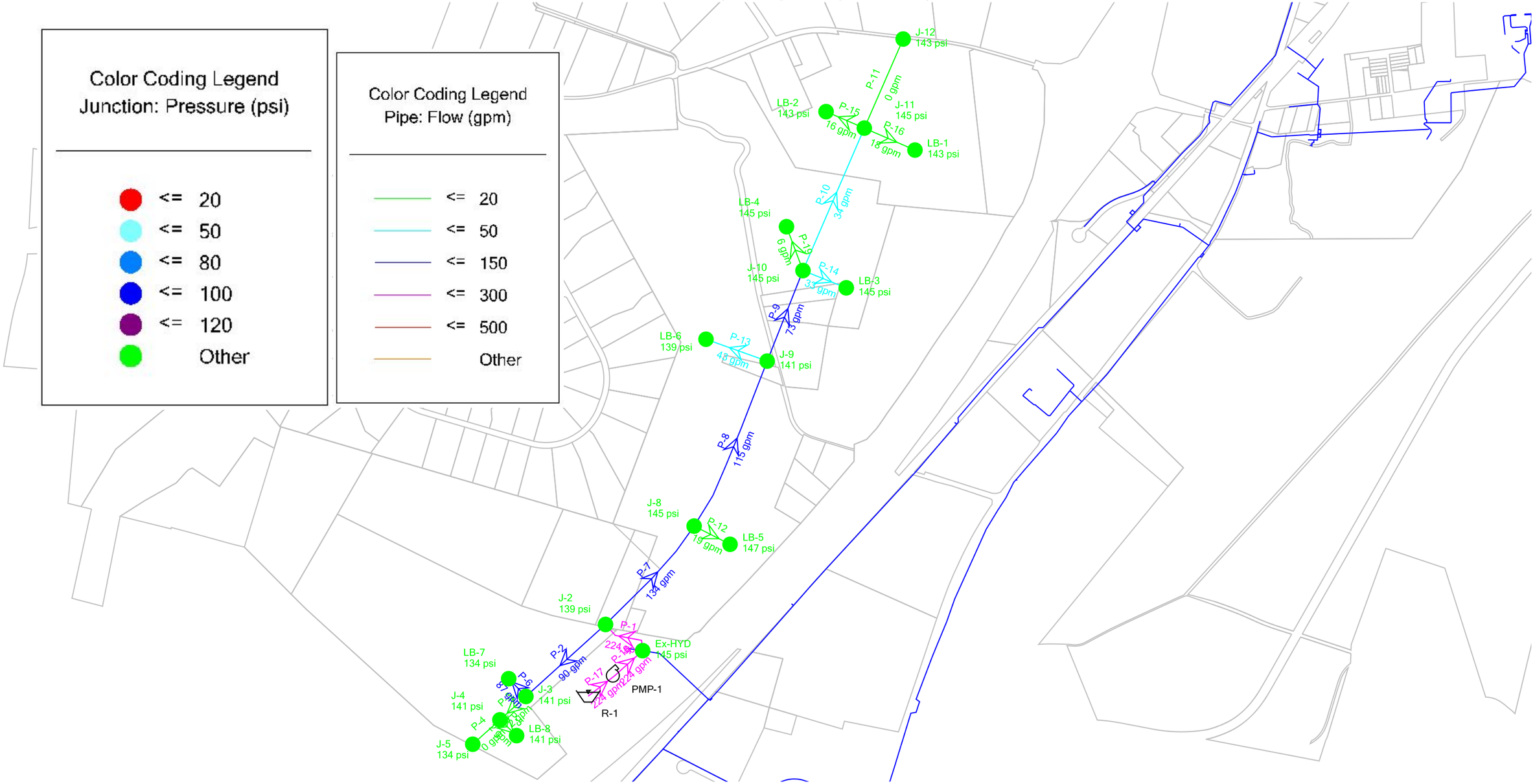
STONEWALL MAGISTERIAL DISTRICT
FREDERICK COUNTY, VIRGINIA

DATE:	03/16/2018
SCALE:	1" = 1000'
DESIGN BY:	JMM
FILE NO.	4915WG
SHEET	1 OF 3

Scenario: ADD (Average Daily Demand)



Scenario Summary Report
Scenario: ADD (Average Daily Demand)

Scenario Summary

ID	74
Label	ADD (Average Daily Demand)
Notes	
Active Topology	<I> Base Active Topology
Physical	<I> Base Physical
Demand	<I> Base Demand
Initial Settings	<I> Base Initial Settings
Operational	<I> Base Operational
Age	<I> Base Age
Constituent	<I> Base Constituent
Trace	<I> Base Trace
Fire Flow	<I> Base Fire Flow
Energy Cost	<I> Base Energy Cost
Transient	<I> Base Transient
Pressure Dependent Demand	<I> Base Pressure Dependent Demand
Failure History	<I> Base Failure History
SCADA	<I> Base SCADA
User Data Extensions	<I> Base User Data Extensions
Steady State/EPS Solver Calculation Options	<I> Base Calculation Options
Transient Solver Calculation Options	<I> Base Calculation Options

Hydraulic Summary

Time Analysis Type	Steady State	Use simple controls during steady state?	True
Friction Method	Hazen-Williams	Is EPS Snapshot?	False
Accuracy	0.001	Start Time	12:00:00 AM
Trials	40	Calculation Type	Hydraulics Only

Pump Definition Detailed Report: Ex-HYD

Element Details

ID	67	Notes	
Label	Ex-HYD		

Pump Definition Type

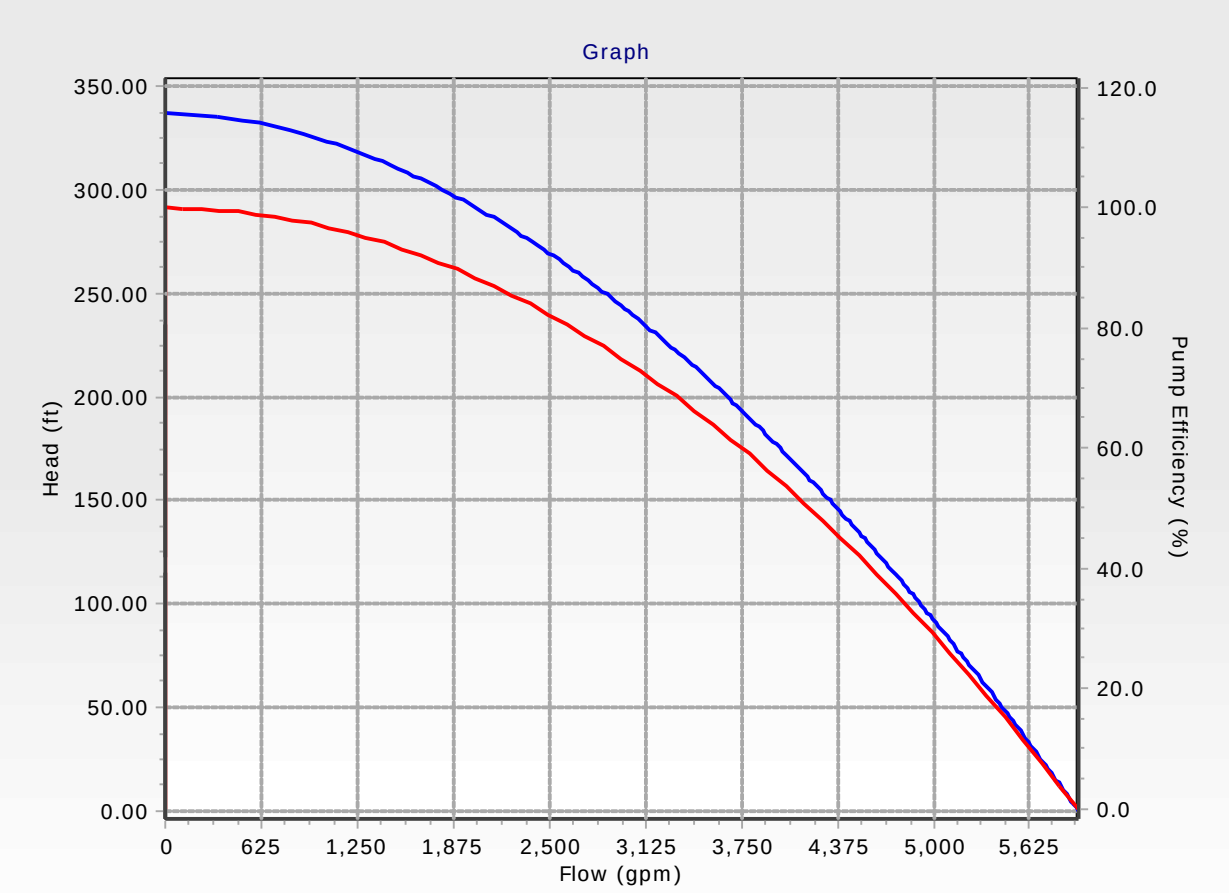
Pump Definition Type	Standard (3 Point)	Design Head	313.00 ft
Shutoff Flow	0 gpm	Maximum Operating Flow	2,076 gpm
Shutoff Head	337.00 ft	Maximum Operating Head	289.00 ft
Design Flow	1,428 gpm		

Pump Efficiency Type

Pump Efficiency Type	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0 gpm		

Transient (Physical)

Inertia (Pump and Motor)	0.000 lb·ft²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True



FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Has Check Valve?	Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
32	P-1	451	Ex-HYD	J-2	12.0	Ductile Iron	120.0	False	1.500	224	0.63	0.000	False	0
34	P-2	934	J-2	J-3	12.0	Ductile Iron	120.0	False	1.500	90	0.25	0.000	False	0
36	P-3	304	J-3	J-4	12.0	Ductile Iron	120.0	False	1.500	2	0.01	0.000	False	0
38	P-4	318	J-4	J-5	12.0	Ductile Iron	120.0	False	1.500	0	0.00	0.000	False	0
40	P-5	200	J-4	LB-8	12.0	Ductile Iron	120.0	False	1.500	2	0.01	0.000	False	0
42	P-6	215	J-3	LB-7	12.0	Ductile Iron	120.0	False	1.500	87	0.25	0.000	False	0
44	P-7	1,154	J-2	J-8	12.0	Ductile Iron	120.0	False	1.500	134	0.38	0.000	False	0
46	P-8	1,573	J-8	J-9	12.0	Ductile Iron	120.0	False	1.500	115	0.33	0.000	False	0
48	P-9	847	J-9	J-10	12.0	Ductile Iron	120.0	False	1.500	73	0.21	0.000	False	0
50	P-10	1,349	J-10	J-11	12.0	Ductile Iron	120.0	False	1.500	34	0.10	0.000	False	0
52	P-11	845	J-11	J-12	12.0	Ductile Iron	120.0	False	1.500	0	0.00	0.000	False	0
54	P-12	351	J-8	LB-5	12.0	Ductile Iron	120.0	False	1.500	19	0.05	0.000	False	0
56	P-13	566	J-9	LB-6	12.0	Ductile Iron	120.0	False	1.500	43	0.12	0.000	False	0
58	P-14	406	J-10	LB-3	12.0	Ductile Iron	120.0	False	1.500	33	0.09	0.000	False	0
60	P-15	362	J-11	LB-2	12.0	Ductile Iron	120.0	False	1.500	16	0.04	0.000	False	0
62	P-16	481	J-11	LB-1	12.0	Ductile Iron	120.0	False	1.500	18	0.05	0.000	False	0
65	P-17	291	R-1	PMP-1	48.0	Ductile Iron	140.0	False	1.500	224	0.04	0.000	True	1
66	P-18	327	PMP-1	Ex-HYD	12.0	Ductile Iron	140.0	False	1.500	224	0.63	0.010	True	1
69	P-19	407	J-10	LB-4	12.0	Ductile Iron	120.0	False	1.500	6	0.02	0.000	False	0

FlexTable: Junction Table

ID	Label	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
30	Ex-HYD	650.00	<None>	<Collection: 0 items>	0	985.72	145
31	J-2	665.00	<None>	<Collection: 0 items>	0	985.62	139
33	J-3	660.00	<None>	<Collection: 0 items>	0	985.59	141
35	J-4	660.00	<None>	<Collection: 0 items>	0	985.59	141
37	J-5	675.00	<None>	<Collection: 0 items>	0	985.59	134
39	LB-8	660.00	<None>	<Collection: 1 items>	2	985.59	141
41	LB-7	675.00	<None>	<Collection: 1 items>	87	985.58	134
43	J-8	650.00	<None>	<Collection: 0 items>	0	985.54	145
45	J-9	660.00	<None>	<Collection: 0 items>	0	985.45	141
47	J-10	650.00	<None>	<Collection: 0 items>	0	985.43	145
49	J-11	650.00	<None>	<Collection: 0 items>	0	985.42	145
51	J-12	655.00	<None>	<Collection: 0 items>	0	985.42	143
53	LB-5	645.00	<None>	<Collection: 1 items>	19	985.54	147
55	LB-6	665.00	<None>	<Collection: 1 items>	43	985.45	139
57	LB-3	650.00	<None>	<Collection: 1 items>	33	985.43	145
59	LB-2	655.00	<None>	<Collection: 1 items>	16	985.42	143
61	LB-1	655.00	<None>	<Collection: 1 items>	18	985.42	143
68	LB-4	650.00	<None>	<Collection: 1 items>	6	985.43	145

Waverly Farm Development
Water System Evaluation

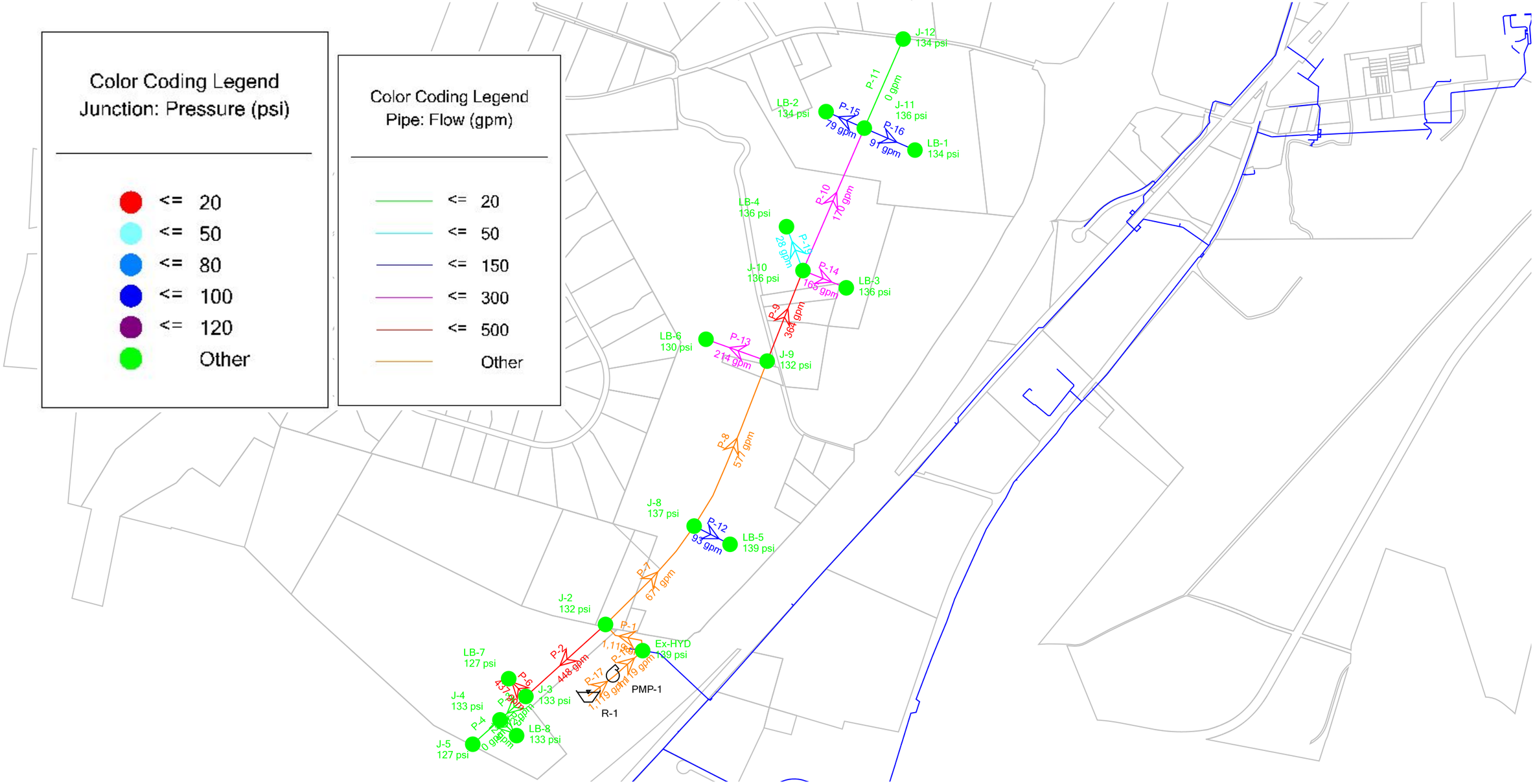
Scenario 2 – Peak Hour Demand
With System Map

Color Coding Legend
Junction: Pressure (psi)

<= 20
<= 50
<= 80
<= 100
<= 120
Other

Color Coding Legend
Pipe: Flow (gpm)

<= 20
<= 50
<= 150
<= 300
<= 500
Other



Scenario Summary Report
Scenario: PHD (Peak Hour Demand)

Scenario Summary

ID	80
Label	PHD (Peak Hour Demand)
Notes	
Active Topology	<I> Base Active Topology
Physical	<I> Base Physical
Demand	PHD Peak Factor=5.0
Initial Settings	<I> Base Initial Settings
Operational	<I> Base Operational
Age	<I> Base Age
Constituent	<I> Base Constituent
Trace	<I> Base Trace
Fire Flow	<I> Base Fire Flow
Energy Cost	<I> Base Energy Cost
Transient	<I> Base Transient
Pressure Dependent Demand	<I> Base Pressure Dependent Demand
Failure History	<I> Base Failure History
SCADA	<I> Base SCADA
User Data Extensions	<I> Base User Data Extensions
Steady State/EPS Solver Calculation Options	<I> Base Calculation Options
Transient Solver Calculation Options	<I> Base Calculation Options

Hydraulic Summary

Time Analysis Type	Steady State	Use simple controls during steady state?	True
Friction Method	Hazen-Williams	Is EPS Snapshot?	False
Accuracy	0.001	Start Time	12:00:00 AM
Trials	40	Calculation Type	Hydraulics Only

FlexTable: Pipe Table

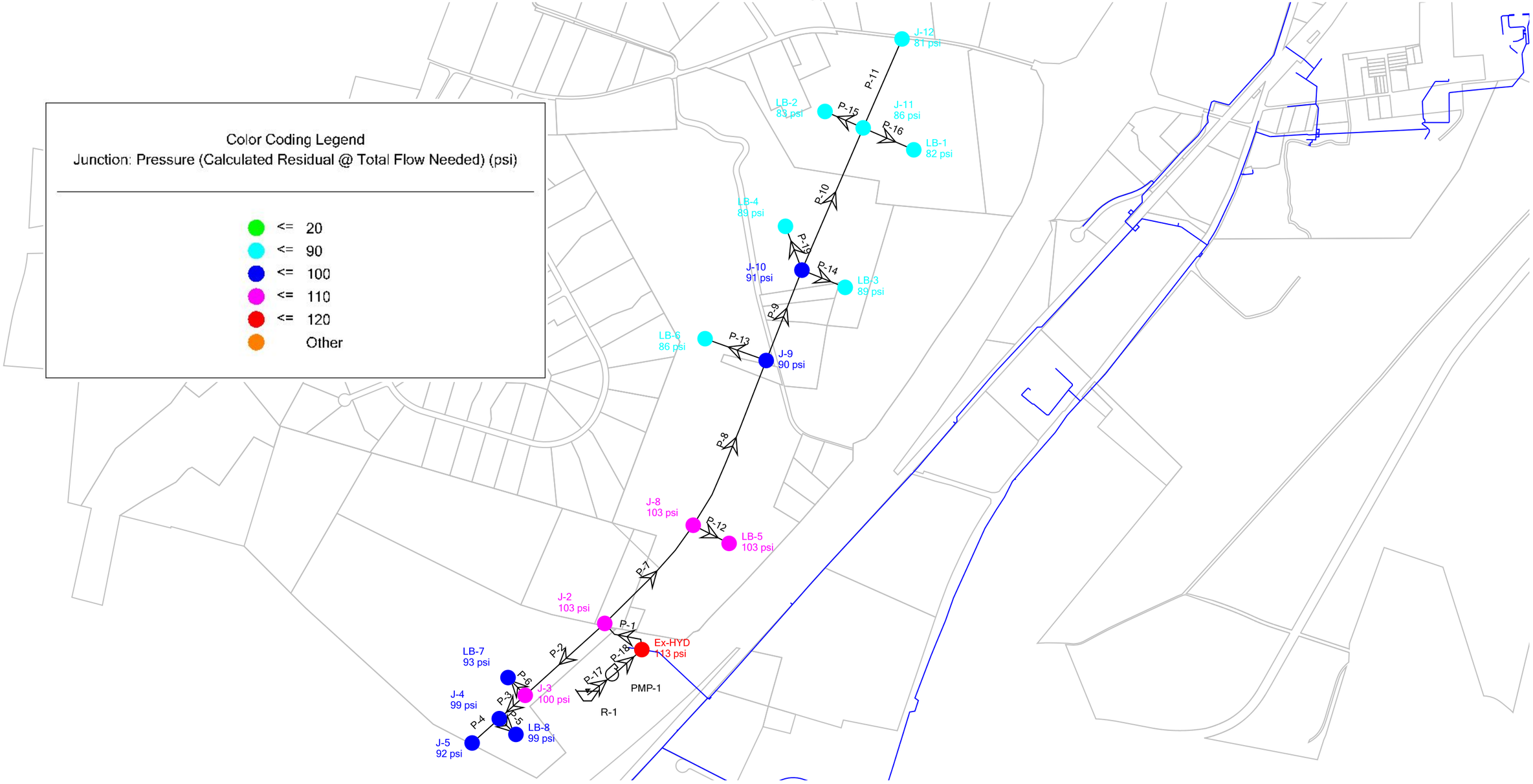
ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Has Check Valve?	Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
32	P-1	451	Ex-HYD	J-2	12.0	Ductile Iron	120.0	False	1.500	1,119	3.17	0.004	False	0
34	P-2	934	J-2	J-3	12.0	Ductile Iron	120.0	False	1.500	448	1.27	0.001	False	0
36	P-3	304	J-3	J-4	12.0	Ductile Iron	120.0	False	1.500	12	0.03	0.000	False	0
38	P-4	318	J-4	J-5	12.0	Ductile Iron	120.0	False	1.500	0	0.00	0.000	False	0
40	P-5	200	J-4	LB-8	12.0	Ductile Iron	120.0	False	1.500	12	0.03	0.000	False	0
42	P-6	215	J-3	LB-7	12.0	Ductile Iron	120.0	False	1.500	437	1.24	0.001	False	0
44	P-7	1,154	J-2	J-8	12.0	Ductile Iron	120.0	False	1.500	671	1.90	0.001	False	0
46	P-8	1,573	J-8	J-9	12.0	Ductile Iron	120.0	False	1.500	577	1.64	0.001	False	0
48	P-9	847	J-9	J-10	12.0	Ductile Iron	120.0	False	1.500	364	1.03	0.000	False	0
50	P-10	1,349	J-10	J-11	12.0	Ductile Iron	120.0	False	1.500	170	0.48	0.000	False	0
52	P-11	845	J-11	J-12	12.0	Ductile Iron	120.0	False	1.500	0	0.00	0.000	False	0
54	P-12	351	J-8	LB-5	12.0	Ductile Iron	120.0	False	1.500	93	0.26	0.000	False	0
56	P-13	566	J-9	LB-6	12.0	Ductile Iron	120.0	False	1.500	214	0.61	0.000	False	0
58	P-14	406	J-10	LB-3	12.0	Ductile Iron	120.0	False	1.500	165	0.47	0.000	False	0
60	P-15	362	J-11	LB-2	12.0	Ductile Iron	120.0	False	1.500	79	0.22	0.000	False	0
62	P-16	481	J-11	LB-1	12.0	Ductile Iron	120.0	False	1.500	91	0.26	0.000	False	0
65	P-17	291	R-1	PMP-1	48.0	Ductile Iron	140.0	False	1.500	1,119	0.20	0.001	True	1
66	P-18	327	PMP-1	Ex-HYD	12.0	Ductile Iron	140.0	False	1.500	1,119	3.17	0.237	True	1
69	P-19	407	J-10	LB-4	12.0	Ductile Iron	120.0	False	1.500	28	0.08	0.000	False	0

FlexTable: Junction Table

ID	Label	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
30	Ex-HYD	650.00	<None>	<Collection: 0 items>	0	970.99	139
31	J-2	665.00	<None>	<Collection: 0 items>	0	969.12	132
33	J-3	660.00	<None>	<Collection: 0 items>	0	968.46	133
35	J-4	660.00	<None>	<Collection: 0 items>	0	968.46	133
37	J-5	675.00	<None>	<Collection: 0 items>	0	968.46	127
39	LB-8	660.00	<None>	<Collection: 1 items>	12	968.46	133
41	LB-7	675.00	<None>	<Collection: 1 items>	437	968.29	127
43	J-8	650.00	<None>	<Collection: 0 items>	0	967.42	137
45	J-9	660.00	<None>	<Collection: 0 items>	0	965.68	132
47	J-10	650.00	<None>	<Collection: 0 items>	0	965.27	136
49	J-11	650.00	<None>	<Collection: 0 items>	0	965.12	136
51	J-12	655.00	<None>	<Collection: 0 items>	0	965.12	134
53	LB-5	645.00	<None>	<Collection: 1 items>	93	967.40	139
55	LB-6	665.00	<None>	<Collection: 1 items>	214	965.58	130
57	LB-3	650.00	<None>	<Collection: 1 items>	165	965.23	136
59	LB-2	655.00	<None>	<Collection: 1 items>	79	965.11	134
61	LB-1	655.00	<None>	<Collection: 1 items>	91	965.10	134
68	LB-4	650.00	<None>	<Collection: 1 items>	28	965.27	136

Waverly Farm Development
Water System Evaluation

Scenario 3 – Peak Hour Demand Plus 1500 gpm Fire Flow


Color Coding Legend
Junction: Pressure (Calculated Residual @ Total Flow Needed) (psi)
<= 20
<= 90
<= 100
<= 110
<= 120
Other
J-12
81 psi
P-11
LB-2
83 psi
P-15
J-11
86 psi
P-16
LB-1
82 psi
P-10
LB-4
89 psi
P-14
J-10
91 psi
LB-3
89 psi
P-9
LB-6
86 psi
P-13
J-9
90 psi
P-8
J-8
103 psi
P-12
LB-5
103 psi
P-7
J-2
103 psi
P-1
Ex-HYD
113 psi
P-18
P-17
PMP-1
R-1
P-2
LB-7
93 psi
P-6
J-3
100 psi
P-3
J-4
99 psi
P-4
P-5
LB-8
99 psi
J-5
92 psi

Scenario Summary Report
Scenario: PHD Plus 1500 gpm Fire Flow

Scenario Summary

ID	84
Label	PHD Plus 1500 gpm Fire Flow
Notes	
Active Topology	<I> Base Active Topology
Physical	<I> Base Physical
Demand	<I> PHD Peak Factor=5.0
Initial Settings	<I> Base Initial Settings
Operational	<I> Base Operational
Age	<I> Base Age
Constituent	<I> Base Constituent
Trace	<I> Base Trace
Fire Flow	<I> Base Fire Flow
Energy Cost	<I> Base Energy Cost
Transient	<I> Base Transient
Pressure Dependent Demand	<I> Base Pressure Dependent Demand
Failure History	<I> Base Failure History
SCADA	<I> Base SCADA
User Data Extensions	<I> Base User Data Extensions
Steady State/EPS Solver Calculation Options	Fire Flow Analysis
Transient Solver Calculation Options	<I> Base Calculation Options

Hydraulic Summary

Time Analysis Type	Steady State	Use simple controls during steady state?	True
Friction Method	Hazen-Williams	Is EPS Snapshot?	False
Accuracy	0.001	Start Time	12:00:00 AM
Trials	40	Calculation Type	Fire Flow

Fire Flow Node FlexTable: Fire Flow Report

Label	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Zone Lower Limit) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
Ex-HYD	2	True	1,500	2,000	1,500	2,000	20	101	20	89	LB-7	89	LB-7	True
J-2	2	True	1,500	2,000	1,500	2,000	20	89	20	84	LB-7	84	LB-7	True
J-3	2	True	1,500	2,000	1,500	2,000	20	84	20	78	LB-7	78	LB-7	True
J-4	2	True	1,500	2,000	1,500	2,000	20	82	20	76	J-5	76	J-5	True
J-5	2	True	1,500	2,000	1,500	2,000	20	74	20	78	LB-7	78	LB-7	True
LB-8	2	True	1,500	2,000	1,512	2,012	20	81	20	76	J-5	76	J-5	True
LB-7	2	True	1,500	2,000	1,937	2,437	20	76	20	78	J-5	78	J-5	True
J-8	2	True	1,500	2,000	1,500	2,000	20	86	20	78	LB-6	78	LB-6	True
J-9	2	True	1,500	2,000	1,500	2,000	20	69	20	67	LB-6	67	LB-6	True
J-10	2	True	1,500	2,000	1,500	2,000	20	68	20	65	LB-1	65	LB-1	True
J-11	2	True	1,500	2,000	1,500	2,000	20	60	20	58	LB-1	58	LB-1	True
J-12	2	True	1,500	2,000	1,500	2,000	20	54	20	58	LB-1	58	LB-1	True
LB-5	2	True	1,500	2,000	1,593	2,093	20	86	20	78	LB-6	78	LB-6	True
LB-6	2	True	1,500	2,000	1,714	2,214	20	63	20	69	J-9	69	J-9	True
LB-3	2	True	1,500	2,000	1,665	2,165	20	65	20	65	LB-1	65	LB-1	True
LB-2	2	True	1,500	2,000	1,579	2,079	20	56	20	58	LB-1	58	LB-1	True
LB-1	2	True	1,500	2,000	1,591	2,091	20	55	20	58	LB-2	58	LB-2	True
LB-4	2	True	1,500	2,000	1,528	2,028	20	65	20	65	LB-1	65	LB-1	True