



AGENDA

Thursday, January 20, 2022: 6:00 PM
Planning Board
Douglass Community Center: 1185 W. Pennsylvania Ave

1. CALL TO ORDER

2. APPROVAL OF MINUTES

3. PUBLIC FORUMS

a. PD-12-21 Preliminary Development Plan for Waterworks

PD-12-21 Preliminary Development Plan for Waterworks

b. PD-13-21 Preliminary Development Plan within Morganton Park South

Proposed Preliminary Development Plan for the purpose of developing a 7,000 SF retail building on 1.12 acres located at the corner of West Morganton Road and Brucewood Road; PIN 857100484800; PARID 20200422

4. UNFINISHED BUSINESS

5. NEW BUSINESS

6. ADJOURNMENT

Agenda Item

To: Planning Board

From: BJ Grieve, Planning Director

Subject: PD-12-21: Planned Development - Preliminary Development Plan for Phase 1 of the Waterworks mixed-use development; Applicant: Andy Bleggi, PTAH Corporation; Authorized Agent: Kevin Lindsay of Crawford Design.

Date: January 20, 2022

I. SUMMARY OF APPLICATION REQUEST:

The applicant has applied for a Preliminary Development Plan (PDP) for Phase 1 of the Waterworks development. Waterworks Phase 1 will include construction of a 33,000 square foot expansion of the existing 4,260 square foot recently-renovated Waterworks building. The new expanded building will be used for office space as permitted by the Waterworks Conceptual Development Plan (CDP). A new, additional 9,600 square foot building will also be built as part of the Phase 1 PDP. The building is presently planned to be occupied by Workhorse Fitness, a by-right use in the Waterworks CDP. However, any other by-right use may occupy the building in the future subject to UDO design standards. Phase 1 will also include construction of 152 permanent parking spaces and 20 temporary gravel parking spaces to serve the proposed buildings. Access will be provided off Central Drive, directly across from Reservoir Park Road.

Waterworks Phase 1 PDP will include development of a walking path connecting north across wetlands to the Town's Greenway system, as depicted on the CDP. Water and sewer services are available to the subject property. Detailed site plan review as well as an Architectural Compliance Permit will be required prior to construction. The subject property is identified as PIN: 858300245709 (PARID: 00039185) and per the Moore County tax records, the property owner is listed as PTAH, LLC.

Figure 1: Vicinity and Zoning Map (Subject Parcel Outlined Red).

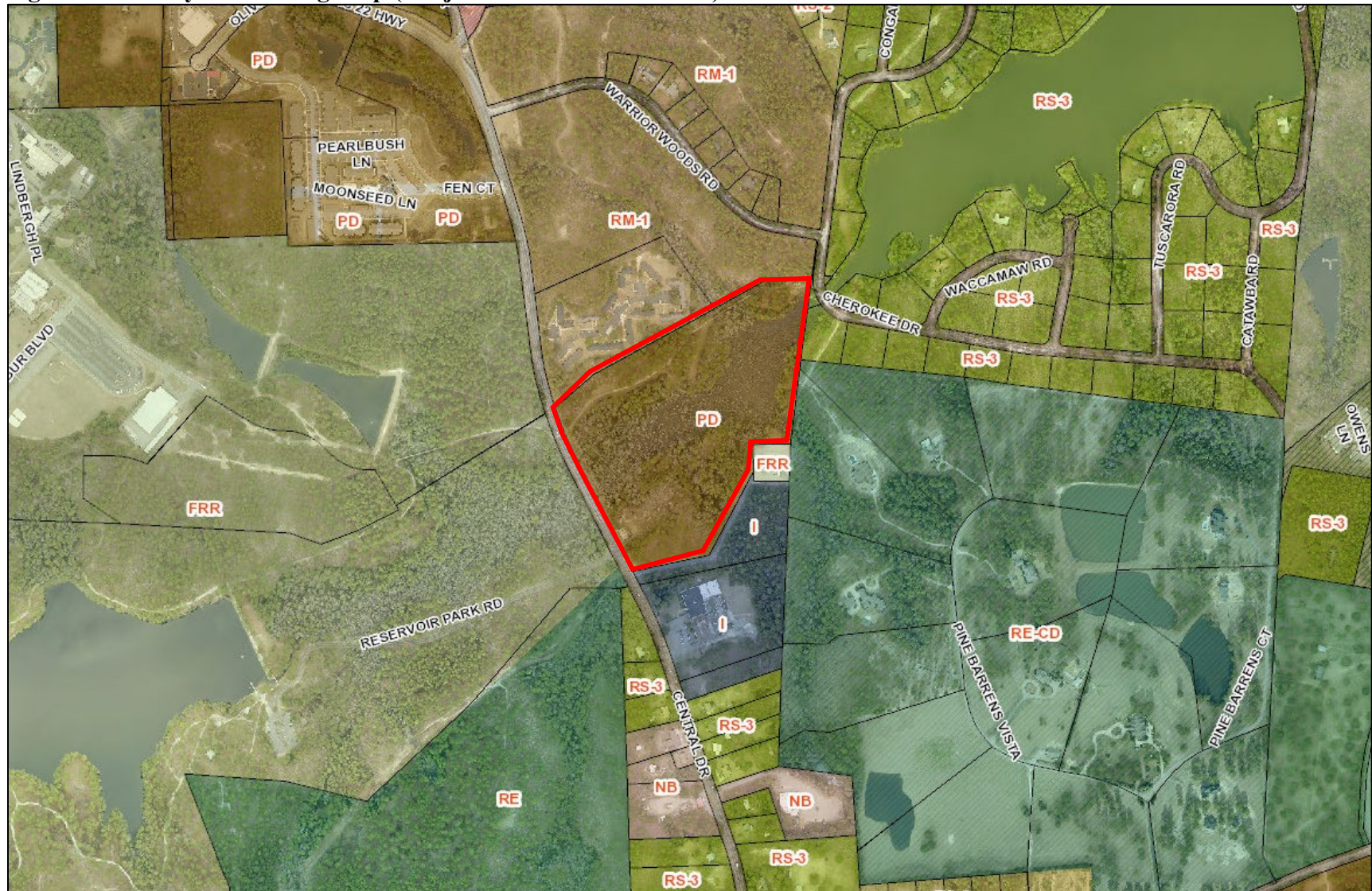


Figure 2: Subject Property as Presently Developed



II. STAFF REVIEW:

A. Criteria for Review:

The criteria for review and approval of the second step in the process, Preliminary Development Plan, are as follows:

Preliminary Development Plan - UDO § 2.18.5(H):

1. *The application demonstrates that it will achieve the purposes of the PDD and this section;*
2. *The Preliminary Development Plan is consistent with the Conceptual Development Plan and conforms to all applicable provisions of this UDO;*
3. *The proposed Development is located in an area of the Town that is appropriate; and*
4. *The proposed Development will not cause the need for inefficient extensions and expansions of public facilities, utilities and services.*

B. Staff Comments:

i. Consistency evaluation with the Unified Development Ordinance (UDO) and the Waterworks Conceptual Development Plan (CDP):

- Phase 1 of Waterworks will include development of a proposed walking trail. The trail will connect from the existing Greenway path on the north side of the property south to the proposed Phase 1 development. The location of the south end of the walking path is depicted on the Phase 1 PDP site plan. The walking path will be designed and reviewed with Phase 1 site plan review.
- The Traffic Impact Analysis (TIA) from 2018 was submitted with the current Waterworks Phase 1 PDP. The TIA was not updated based on the changes in land use from the original Phase 1 PDP to this Phase 1 PDP. An unsigned copy of NCDOT's letter of April 11, 2018 with comments on the proposed development (at that time) was included with the current PDP application materials. One call-out has been added by the applicants indicating that a 5- foot storage lane has been modified to a 75-foot storage lane and a left turn lane into Reservoir Park has been added. The Town Engineer has reviewed the 2018 TIA and the call-out added and has stated in an email of January 5, 2022 that the TIA is likely still applicable and additional trip generation can be reviewed at site plan review.
- No deviations to signage standards have been requested and no deviation is contemplated or approved as part of this PDP. Therefore, all signage must comply with UDO §4.06 per Section 5.5.7 of the approved Waterworks CDP. Three large "SNC" wall signs as depicted on the building elevations will not be permitted.

- A substantial portion of Phase 1 will be allocated to parking in excess of the minimum number of spaces required by the UDO. The applicants are proposing 152 spaces with Phase 1, plus 20 additional temporary gravel spaces with Phase 1 that are located in Phase 2.
- Private drives and yards internal to Waterworks Phase 1 will be reviewed for compliance with the private drive and yard cross-sections found in Exhibit X of the Waterworks CDP.
- All other design standards not addressed as deviations in the Phase 1 PDP will be reviewed for compliance with the UDO and/or CDP, as applicable, during site plan review and Architectural Compliance Permit review.
- Final Development Plans pursuant to UDO §2.18.7 will be required to demonstrate compliance with the Preliminary Development Plan.

ii. General Comments:

- The Planning Board will hold a Preliminary Forum for this request. The meeting will provide an opportunity to hear comment, but no part of the Forum may be used as a basis for a decision by the Town Council.
- Notices of the Planning Board's Preliminary Forum were posted, mailed and published as required by the UDO.
- On January 5, 2022 a copy of the proposed Phase 1 PDP was emailed to members of the Town's Technical Review Committee (TRC). Responses have been incorporated into this report where applicable.

C. Outside Agency Comments:

- A request for comments was emailed to agencies on December 20, 2021. Agencies notified include Town of Southern Pines Streets, Utilities, Fire, Recreation and Parks, and Engineering departments, the Regional Land Use Advisory Commission (RLUAC) and the North Carolina Department of Transportation (NCDOT).
- On December 29, 2021 RLUAC provided comment: *RLUAC does not have any comments on PD-12-21 or PD-13-21.*

III. ATTACHMENTS:

The following materials are provided as attachments to this staff memorandum:

1. Preliminary Development Plan Application

- a. Application
- b. Agent Authorization Form
- c. Narrative and Comments
- d. Building Elevations
- e. PDP Site Plan
- f. Drainage Concept Plan
- g. Soils Information
- h. TIA

2. RLUAC Comment

Additional documents related to this application including (but not limited to) property deeds, Authorization of Agent forms, email correspondence, meeting minutes and adjacent property notification records are on file in the Town of Southern Pines Planning Office and available for public inspections during normal business hours.

IV. PLANNING BOARD ACTION:

Pursuant to North Carolina General Statute §160D-301(b)(6) and Unified Development Ordinance §2.5.2, the Planning Board may hold a Preliminary Forum on a matter requiring a quasi-judicial decision by the Town Council. However, no part of the forum or any recommendation may be used as a basis for the deciding board.

Therefore, the Planning Board may wish to use the following motion to identify issues to bring to the attention of the Town Council at the evidentiary hearing.

I move to adopt the following for transmission to the Town Council as a result of the January 20, 2022 Preliminary Forum on application PD-12-21, Waterworks Phase 1 PDP:

The information presented at the forum indicated that the following issues be considered in applying the criteria for a PDP to application PD-12-21:

- 1.

In addition, the following concerns were raised during the forum, but do not seem to apply in determining whether the PDP criteria are satisfied:

- 1.

Planned Development District Preliminary Development Plan

REQUIRED APPLICATION MATERIALS:

- X **Application fee** in the amount of **\$1,800.00 plus \$25.00 per lot.**
- X **Completed Application** for a Planned Development District - Preliminary Development Plan signed by the applicant.
- X **Appointment of Agent**, if applicable, signed by the property owner(s) and the agent.
- X **List of Adjacent Property Owners:** Please list all properties that are that are within two hundred (200) feet of the outermost boundaries of the subject property (**not counting streets, railroads or other transportation corridors**). Attach additional pages if needed. No fewer than ten (10) property owners shall be notified by mail.
- X **Written narrative** describing the application's consistency with the Conceptual Development Plan, the UDO, and any other applicable regulations.
- NA **Neighborhood meeting records** if not provided in conjunction with an application for Conceptual Development Plan approval or if additional meetings have been held. [See CDP.](#)
- X **Additional documentation:** Additional text and/or maps to demonstrate consistency with **UDO §2.18.5(H) Criteria (1) through (4).** [Preliminary Elevations are provided](#)
- X **PDD Preliminary Development Plan:** One (1) full-size copy of a preliminary plat or scaled drawings of the entire tract to be subdivided. Please refer to the **UDO Appendices** for plan requirements.
- X **Drainage concept plan** if applicable.
- X **Traffic Impact Analysis** if applicable.
- X **Electronic copy (PDF) of all application materials** submitted to plan@southernpines.net.

PLEASE SUBMIT ONLY ONE (1) COMPLETE SET OF ALL MATERIALS.

REVIEW AND APPROVAL:

1. **Staff review:** Planning staff will review the application and notify the applicant if additional information or materials are needed.
2. **Public hearing:** The applicant is expected to attend a public hearing on the application before the Town Council at its regular monthly meeting. (Please refer to the **Application Processing Timeline** to determine the hearing date.) The Town Council will consider evidence and testimony presented and may approve, conditionally approve or deny the request.
3. **Approval:** Please refer to UDO **§2.18.5(I) Effect of Approval.**



Planned Development District Preliminary Development Plan Application

Fee: \$ _____ Date Received: _____ Case No.: PD- _____ - _____

Project Information:

Project Name: Waterworks

Physical Address: 1605 Central Drive

PIN: 858300245709 Parcel ID: 00039185

Site Size: 28.8 acres Zoning: PDD

Applicant:

Name(s): Andy Bleggi, PTAH Corporation

Email: andybleggi@gmail.com Phone: 910-639-1985

Mailing Address: 730 South Bennett Street, Southern Pines, NC 28387

Authorized Agent, if different from Applicant:

Name(s): Kevin Lindsay, PD

Email: kevinlindsay@crawforddsn.com Phone: 910-920-7661

Mailing Address: 230 West Pennsylvania Ave., Suite C, Southern Pines, NC 28387

Legal Property Owner(s), if different from Applicant:

Name(s): _____

Email: _____ Phone: _____

Mailing Address: _____

8-27-21

TO THE TOWN OF SOUTHERN PINES PLANNING BOARD AND TOWN COUNCIL:

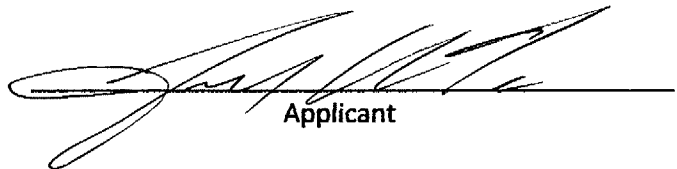
I, the undersigned, do hereby make application to and petition the Planning Board and Town Council for approval of a Planned Development District – Preliminary Development Plan as required by the Town of Southern Pines Zoning Ordinance. The following information is submitted in support of this application:

The property which is the subject of this application is located on the East side of Central Dr/NC22 (St./Ave.), between Warrior Woods (St./Ave.) and Aiken Rd (St./Ave.). The property has a frontage of 970 feet and a depth of 1,540 feet.

The request is based upon **Section 2.18.5** of the **Town of Southern Pines Unified Development Ordinance**. The proposed use of the property is as follows:

Office, Commercial, Retail, Residential

Date: 12-13-2021


Applicant

PLANNING DEPARTMENT
TOWN OF SOUTHERN PINES
plan@southernpines.net (910) 692-4003 www.southernpines.net

APPOINTMENT OF AGENT

The undersigned owner(s), Andy Bleggi, hereby appoint(s) Kevin S. Lindsay, PE as the exclusive agent for the purpose of making an application to the Town of Southern Pines for the approval of the Planned Development District – Preliminary Development Plan described in the attached application. The owner(s) hereby agree(s) that this agent has the authority to act for and on behalf of the owner(s) as follows:

1. to submit an application and required supplemental materials;
2. to appear at public meetings and give representation and comments on behalf of the owner(s);
3. to accept conditions or recommendations made by the Town of Southern Pines Town Council for the approval of a Planned Development District – Preliminary Development Plan; and
4. to act on behalf of the property owner(s) without limitations with regard to any and all things directly or indirectly connected with or arising out of any application for a Planned Development District -Preliminary Development Plan under the Southern Pines Unified Development Ordinance.

This Appointment of Agent shall remain in effect until final resolution of the attached application.

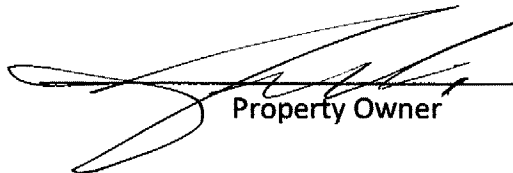
Signed this 13 day of Dec, 2021.

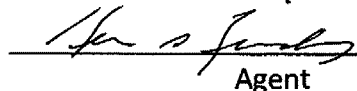
PAH, LLC

Andy Bleggi

MEMBER Alex

Property Owner


Property Owner


Agent

2.18.5 (H) Preliminary Development Plan (PDP) Criteria:

(1) The application demonstrates that it will achieve the purposes of the PDD and this section:

This proposed PDP represents Phase 1 of Waterworks (~3.5 acres). The CDP and this PDP are being revised from the CDP and PDP approved in 2018 because the tenant for the corporate headquarters desired to be located where they could be visible from Central Drive/NC-22. The overall intent of the development remains the same as the 2018 submission: a mixed use of commercial and residential development incorporating the now renovated treatment plant and preserving a large tract of land as open space.

(2) The Preliminary Development Plan is consistent with the Conceptual Development Plan and conforms to all applicable provisions of this UDO:

The planned construction of a corporate headquarters attached to the recently renovated former treatment plant and a new facility for Workhorse Fitness is that same as described in the CDP submitted in November of 2021.

(3) The proposed Development is located in an area of the Town that is appropriate:

The mixed use development with 64% remaining as open space fits in very well with other developments along NC 22 / Central Drive which include: single family detached and attached, multi-family, retail, restaurants, offices, industrial, institutional, and recreational.

(4) The proposed Development will not cause the need for inefficient extensions and expansions of public facilities, utilities and services.

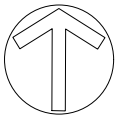
Water, sewer, electricity, and natural gas are all available to the site without extensions (extensions will be needed within the site, but not to the site). The site is located on NC 22 and is opposite Reservoir Park. The double left turn lanes will be a significant improvement to the exiting interchange. The development will be connected to the Town's Greenway system and preserve a significant wetlands area.

Additional Comments:

1. Architectural: Please see attached preliminary elevations for corporate headquarters and new fitness facility.
2. Signage: No change from CDP submittal.
3. Parking: 152 spaces area planned for Phase 1 compared with estimated requirement of 141 based on UDO standards. Note a portion of phase 2 will be graded to provide 20 temporary spaces for existing waterworks tenant (Workhorse Fitness) to continue operating while until their new facility is available.
4. Pedestrian Connectivity: Phase 1 will be connected to the Town's walking trail system. Internal sidewalks will allow safe passage between buildings.
5. Streets: As noted in CDP left turn lanes will be provided for access to waterworks and to Reservoir Park--a major improvement over current conditions. In addition a right turn in and right turn out will be provided along Central Drive/NC-22. Internally, vehicle use areas shall be constructed for access to future phases 2 & 3.
6. Open Space: As described in the CDP, 18.8 acres of Open space (65%) shall be preserved on the site including .49 acres in Phase 1.
7. Stormwater Control: A drypond is planned for Phase 1 that will reduce post construction runoff for the 1 and 10 years storms to preconstruction rates.
8. Utilities: Public water and sewer are available to the site.
9. Other: All TOSP Landscaping, lighting, buffers and setbacks will be followed.



WATERWORKS
Exhibit VI - Adjacent Property Owners
Southern Pines, NC

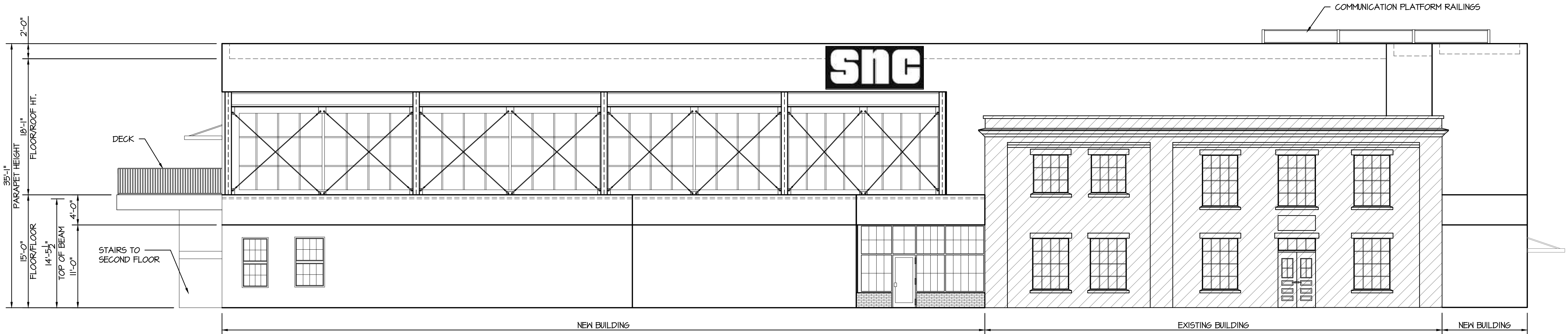


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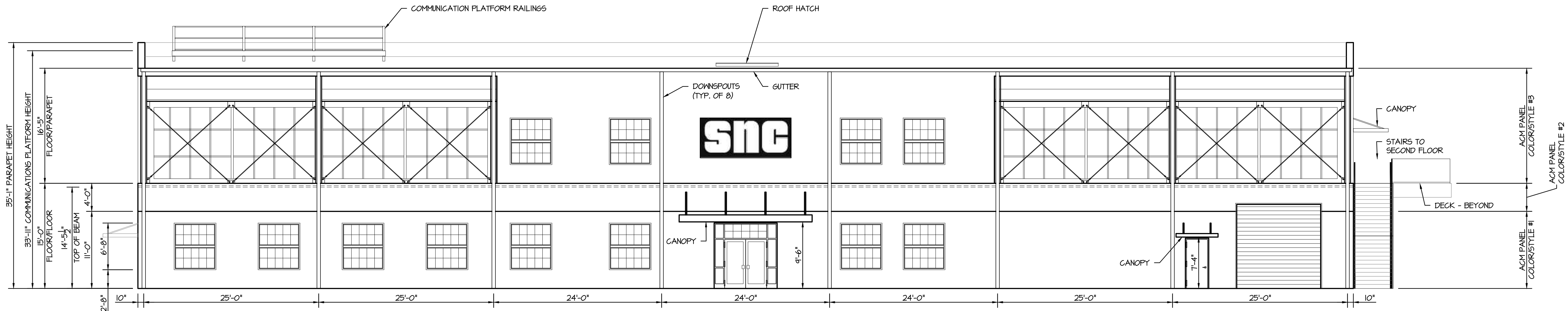
ADJACENT PARCEL OWNERS

NAME	NAME (2)	ADDRESS	CITY	ST	ZIP	PARCEL ID	REF
HOI LIMITED PARTNERSHIP OF SOUTHERN PINES		PO BOX 26405	GREENSBORO	NC	27404	39144	1
PINEHURST AREA REALTY, INC		POBOX 1511	PINEHURST	NC	28370	37593	2
PINEHURST AREA REALTY, INC		POBOX 1511	PINEHURST	NC	28370	37664	3
PINEHURST AREA REALTY, INC		POBOX 1511	PINEHURST	NC	28370	37604	4
CHAMBERLAIN, ROBERT JOSEPH JR	CHAMBERLAIN, KIMBERLY K	405 Pine Barrens Vista	Southern Pines	NC	28387	20020232	5
MASON, DUSTINA TRUSTEE		375 Pine Barrens Vista	Southern Pines	NC	28387	20020233	6
DIXIE PIPELINE COMPANY	ATTN: AD VALOREM TAX DEPT	PO BOX 4018	HOUSTON	TX	77210	32927	7
TRIE CASSYN GROUP, LLC		1485 Central Dr	Southern Pines	NC	28387	20020309	8
SOUTHERN PINES, TOWN OF		PO BOX 870	Southern Pines	NC	28388	39729	9
MOORE COUNTY COMMUNITY COLLEGE	BOARD OF TRUSTEES	2200 Airport Rd.	PINEHURST	NC	28374	991683	10

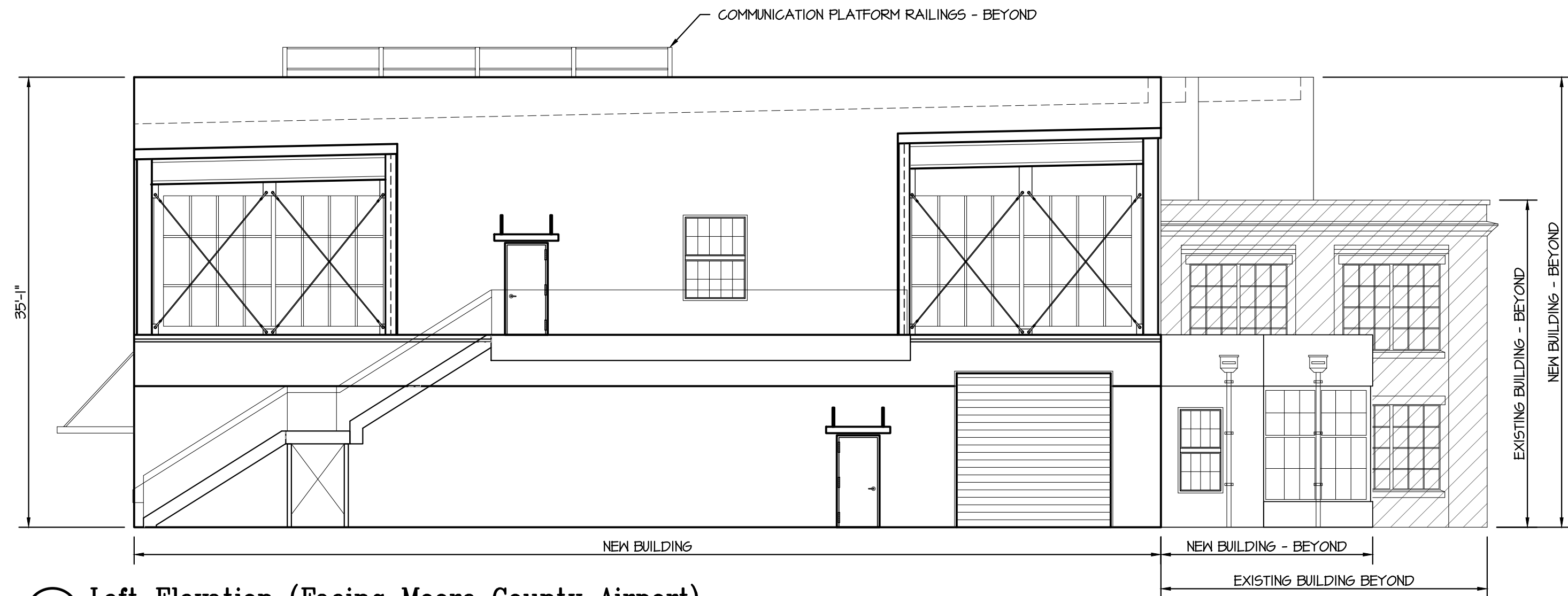
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PROGRESS PRINTS 06OCT21
PROGRESS PRINTS 23SEPT21
PROGRESS PRINTS 22SEPT21
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PROGRESS PRINTS 05AUG21
PROGRESS PRINTS 03AUG21
PROGRESS PRINTS 02AUG21



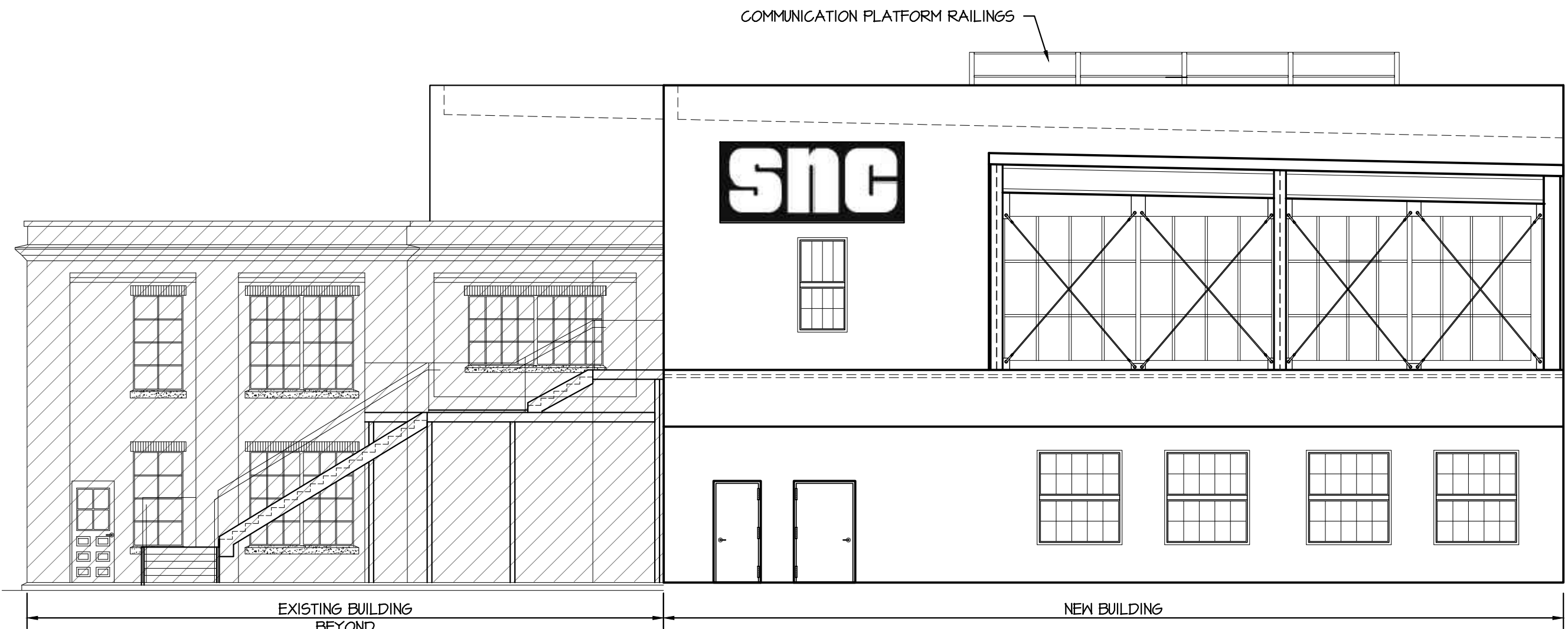
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G1.1 1/8" = 1'-0"



2 Rear Elevation (Facing Parking Lot)
G1.1 1/8" = 1'-0"



3 Left Elevation (Facing Moore County Airport)
G1.1 1/8" = 1'-0"



4 Right Elevation (Facing Entry Drive)
G1.1 1/8" = 1'-0"

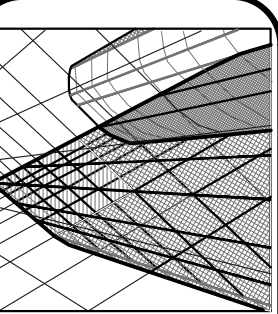
WATERWORKS SNC

Southern Pines, NC

EXTERIOR ELEVATIONS

REVISIONS:

REVISIONS:



Neal Smith Engineering, Inc.
139 Pinhurst Avenue - Suite C
Southern Pines, NC 28387
Phone: (910) 695-8825
Fax: (910) 695-8832
www.nseengineering.com
License No. C-1425

NSE

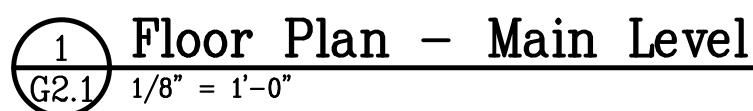
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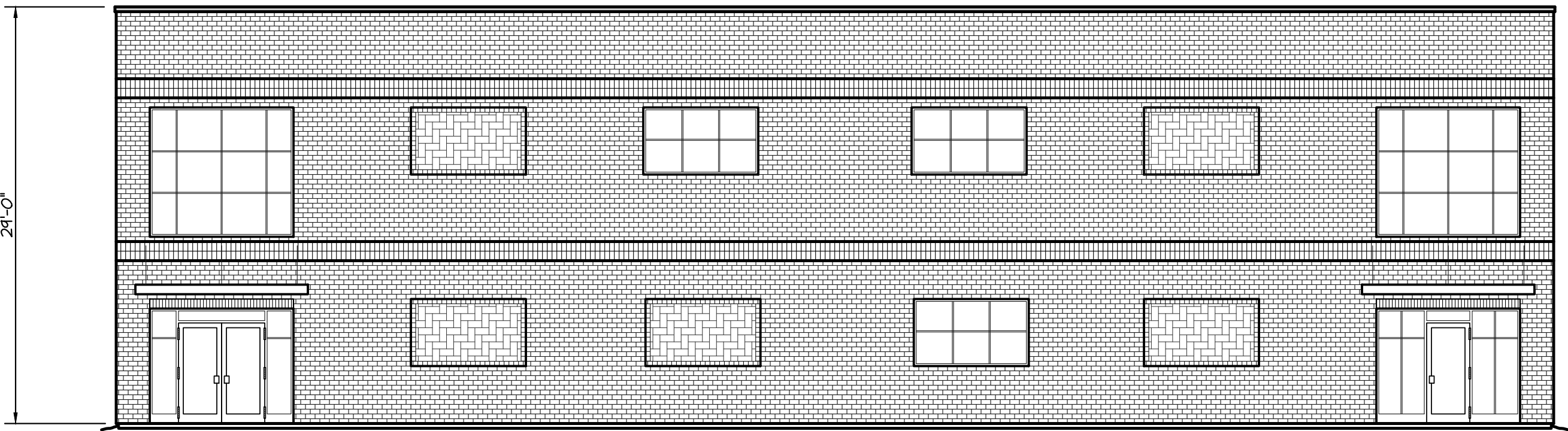
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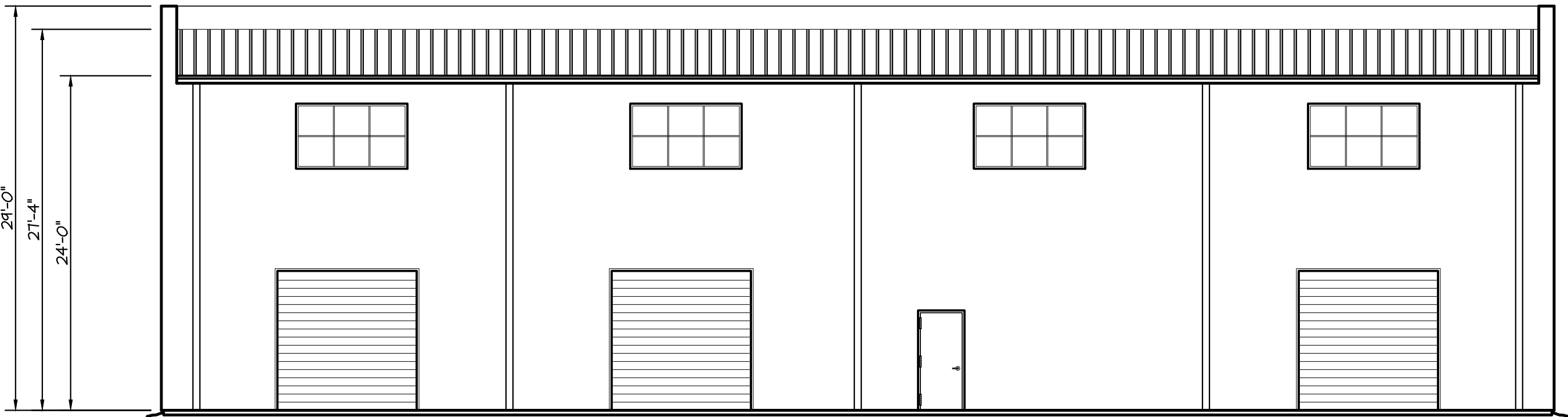


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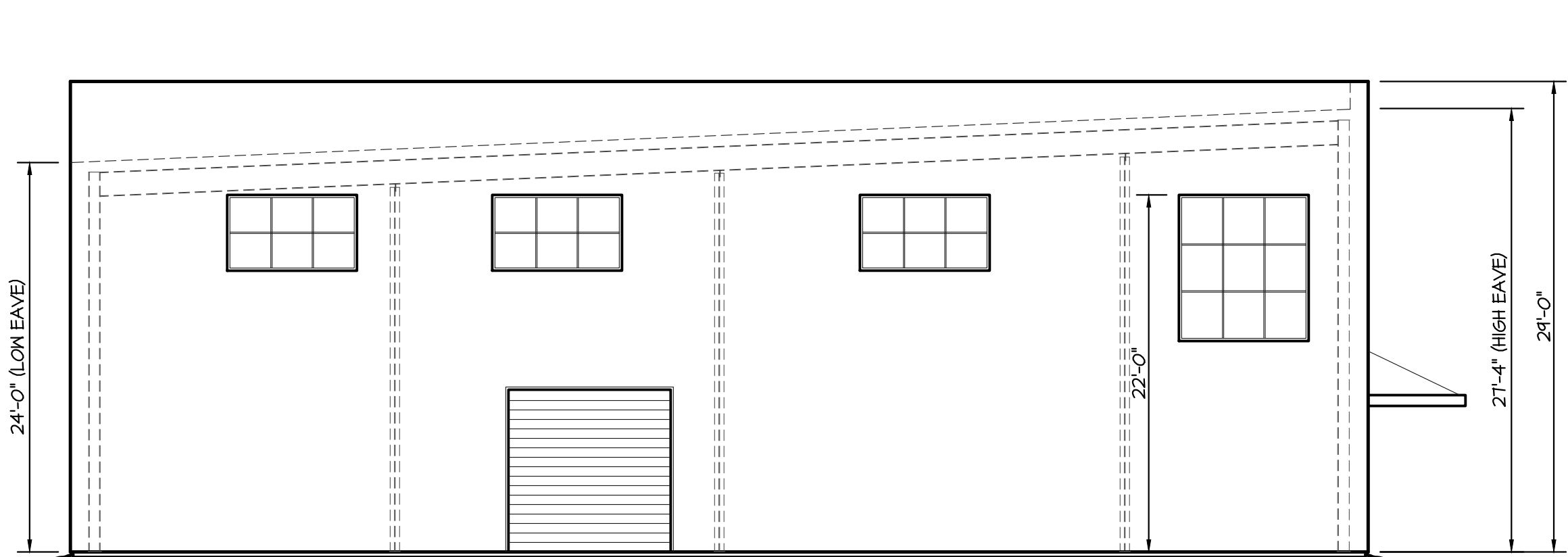
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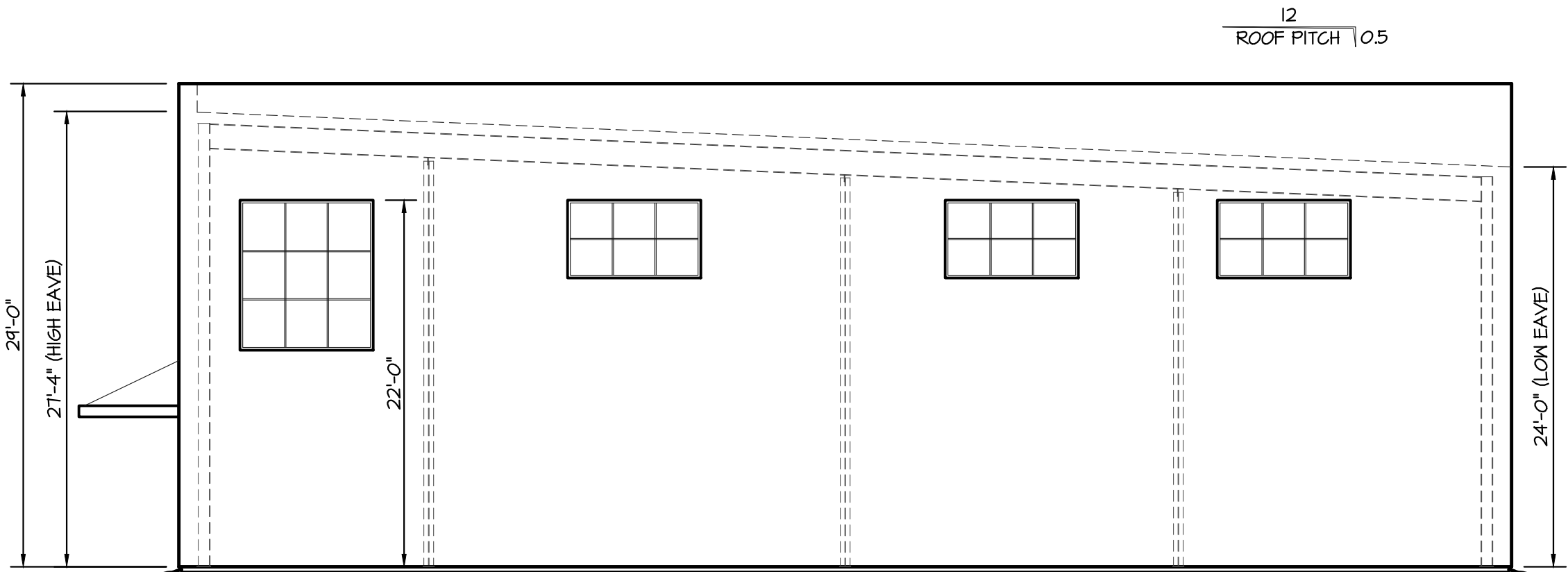
1 Front Elevation
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3 Left Elevation
G1.1 1/8" = 1'-0"



4 Right Elevation
G1.1 1/8" = 1'-0"

PROGRESS PLANS 040CT21A
PROGRESS PLANS 040CT21
PROGRESS PLANS 27SEP21
PROGRESS PLANS 24SEP21
PROGRESS PLANS 01SEP21
PROGRESS PLANS 30AUG21

WORKHORSE
Southern Pines, NC

EXTERIOR ELEVATIONS

REVISIONS	REVISIONS

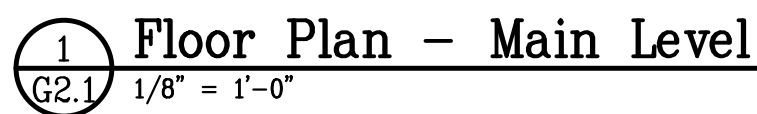
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NSE

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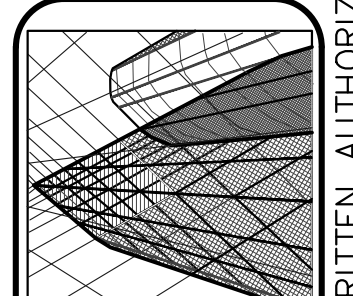
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2112002

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G2.

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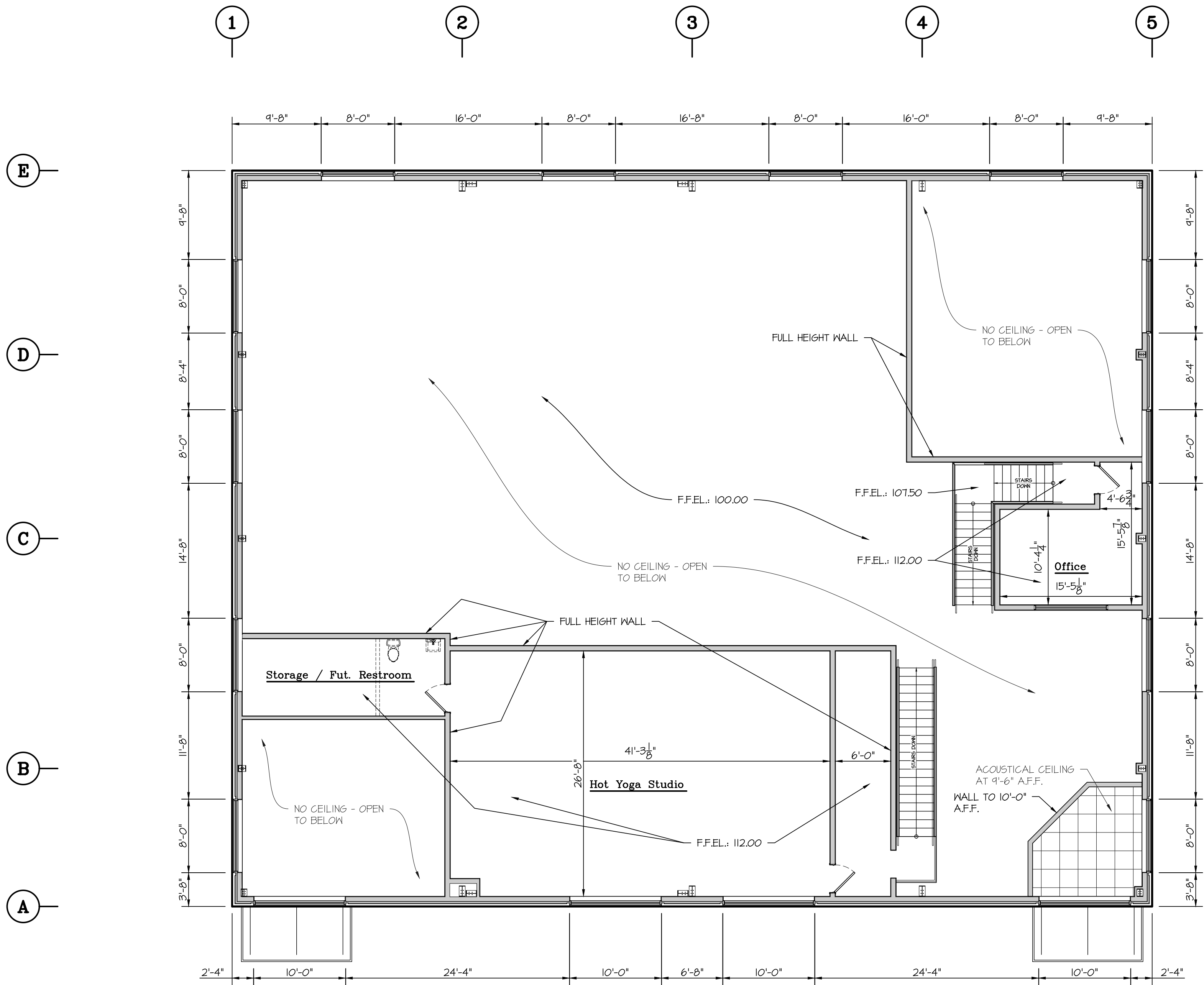


REVISIONS:

FROM THE ENGINEER

WORKHORSE
Southern Pines, NC

THIS DRAWING IS THE PROPERTY OF NEAL SMITH ENGINEERING, INC., AND MAY NOT BE REPRODUCED WITHOUT WRITTEN AUTHORIZATION FROM THE ENGINEER. THIS DRAWING IS VOID WITHOUT ORIGINAL SIGNATURE AND SEAL.



1 Floor Plan - Upper Level
G2.2 1/8" = 1'-0"

PROGRESS PLANS 04OCT21A
PROGRESS PLANS 04OCT21
PROGRESS PLANS 27SEP21
PROGRESS PLANS 24SEP21
PROGRESS PLANS 01SEP21
PROGRESS PLANS 31AUG21
PROGRESS PLANS 30AUG21

WORKHORSE
Southern Pines, NC

FLOOR PLAN - UPPER LEVEL

REVISIONS

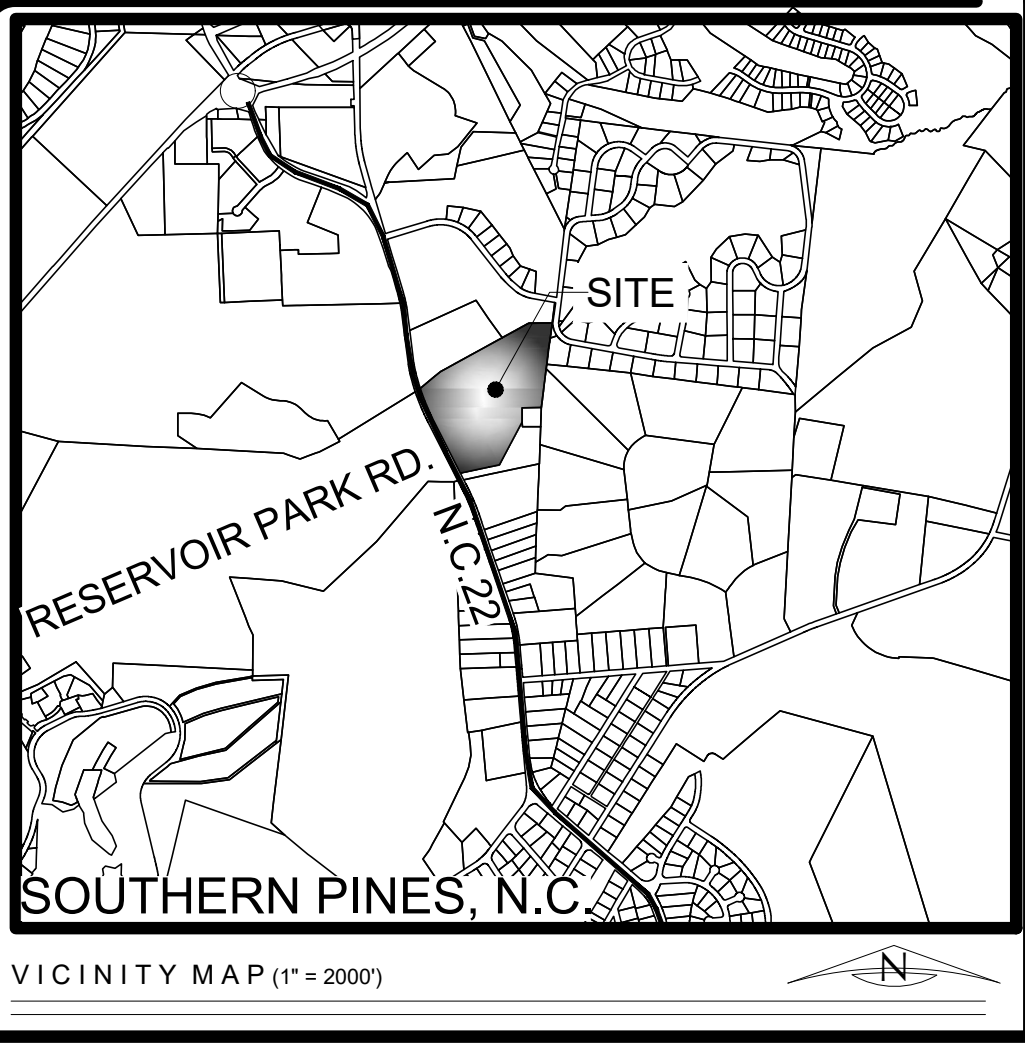
Neal Smith Engineering, Inc.
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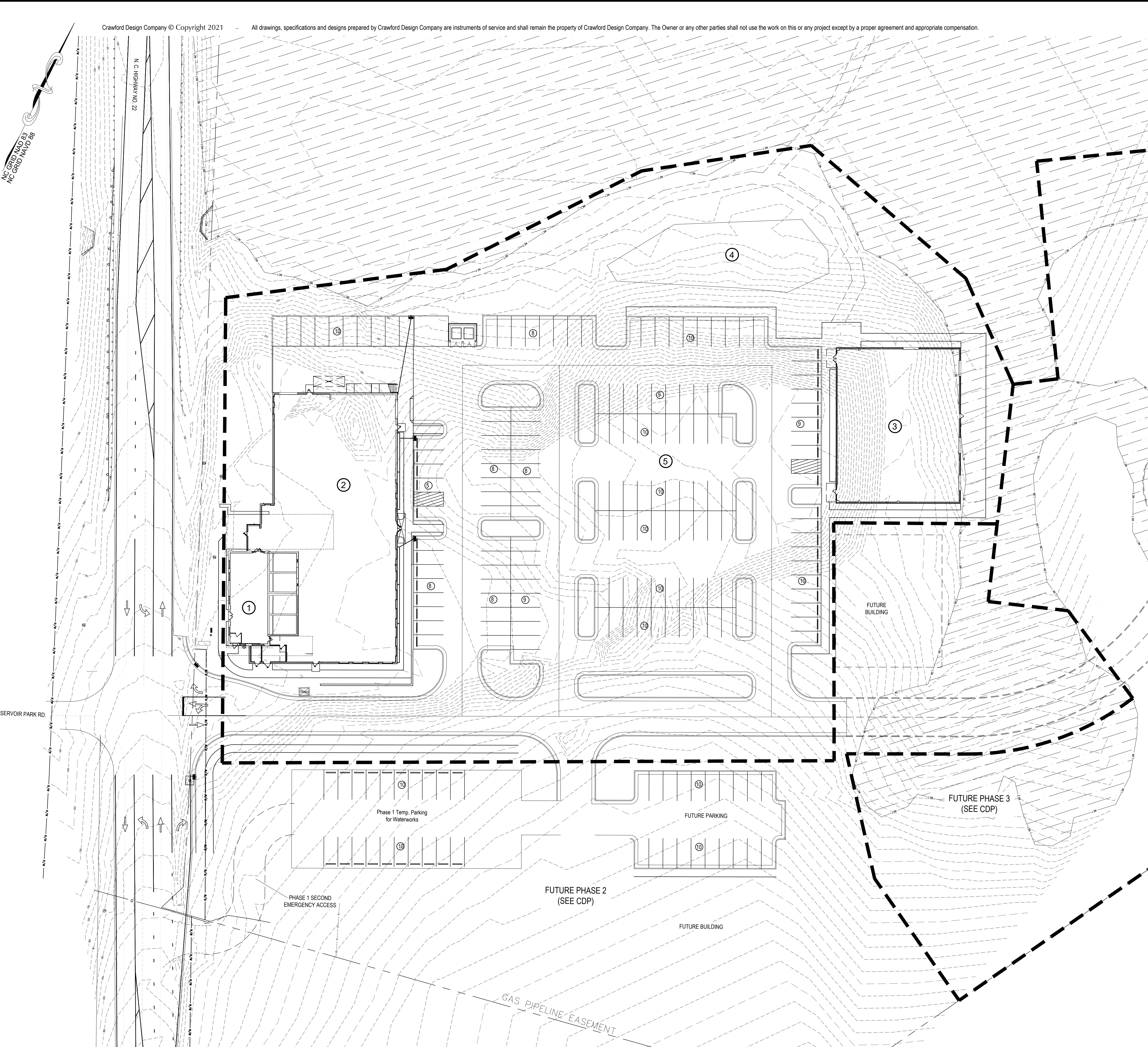
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DRAWINGS
Do not use for
construction

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JOB NUMBER: 2112002
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- SITE NOTES**
- 1 CURRENT WATERWORKS IN USE BY WORKHORSE FITNESS 4,260 SF--WILL BE CONVERTED TO OFFICE
 - 2 CORPORATE HEADQUARTERS ~33,000 SF
 - 3 NEW WORKHORSE FITNESS ~9,600 SF
 - 4 STORMWATER CONTROL MEASURE FOR PHASE 1 & 2
 - 5 152 PHASE 1 PARKING SPACES (142 REQUIRED FOR USES ABOVE)



**Crawford
Design Company**

LANDSCAPE
ARCHITECTURE
.....
ENGINEERING
.....
PLANNING

Landscape Architecture ♦ Fayetteville, NC
Civil Engineering ♦ Southern Pines, NC
230C W. Pennsylvania Ave. ♦ Southern Pines, NC 28387
Voice: 910-725-1107
www.crawforddsn.com



[PLAN PHASE]

PTAH, LLC
PTAH-WW-SNC

WATERWORKS REVISED PHASE 1
PRELIMINARY DEVELOPMENT PLAN (PDP)

Project Manager: KSL
CAD Technician: RFN/GER
Reviewed / Approved By:
Project Number: 17028

Full Scale: Horiz.: 1" = 30'
Half Scale: Horiz.: 1" = 60'

12/13/2021

C2.0

1. Project Summary:

The Waterworks project will be done in phases as will the drainage and Stormwater Control Measures (SCMs):

Completed: Renovation of former treatment plant and temporary parking area. Now in use as a fitness facility.

Phase 1 (Watershed 1). Construction of new corporate headquarters and new fitness facility. A dry pond shall be constructed in phase 1 shall be constructed to reduce the 1-year and 10-year storm peaks to preconstruction rates. This SCM shall be sized for the additional impervious areas planned for Phase 2.

Phase 2. (Watershed 1) Mixed Use Commercial & Residential Buildings and expansion of Vehicle Use Areas. As previously stated the phase 1 SCM shall be sized to handle the planned Phase 2 impervious areas to keep the 1-year and 10-year storm peaks to preconstruction rates.

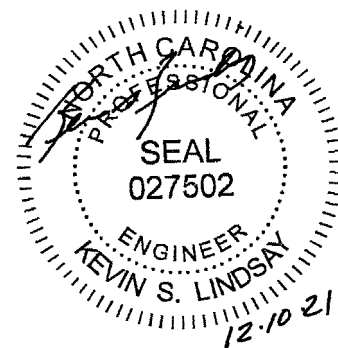
Phase 3. Commercial/Mixed Use/Single Family Housing. Additional SCMs shall be constructed in Phase 3 to keep the 1-year and 10-year storm peaks to preconstruction rates.

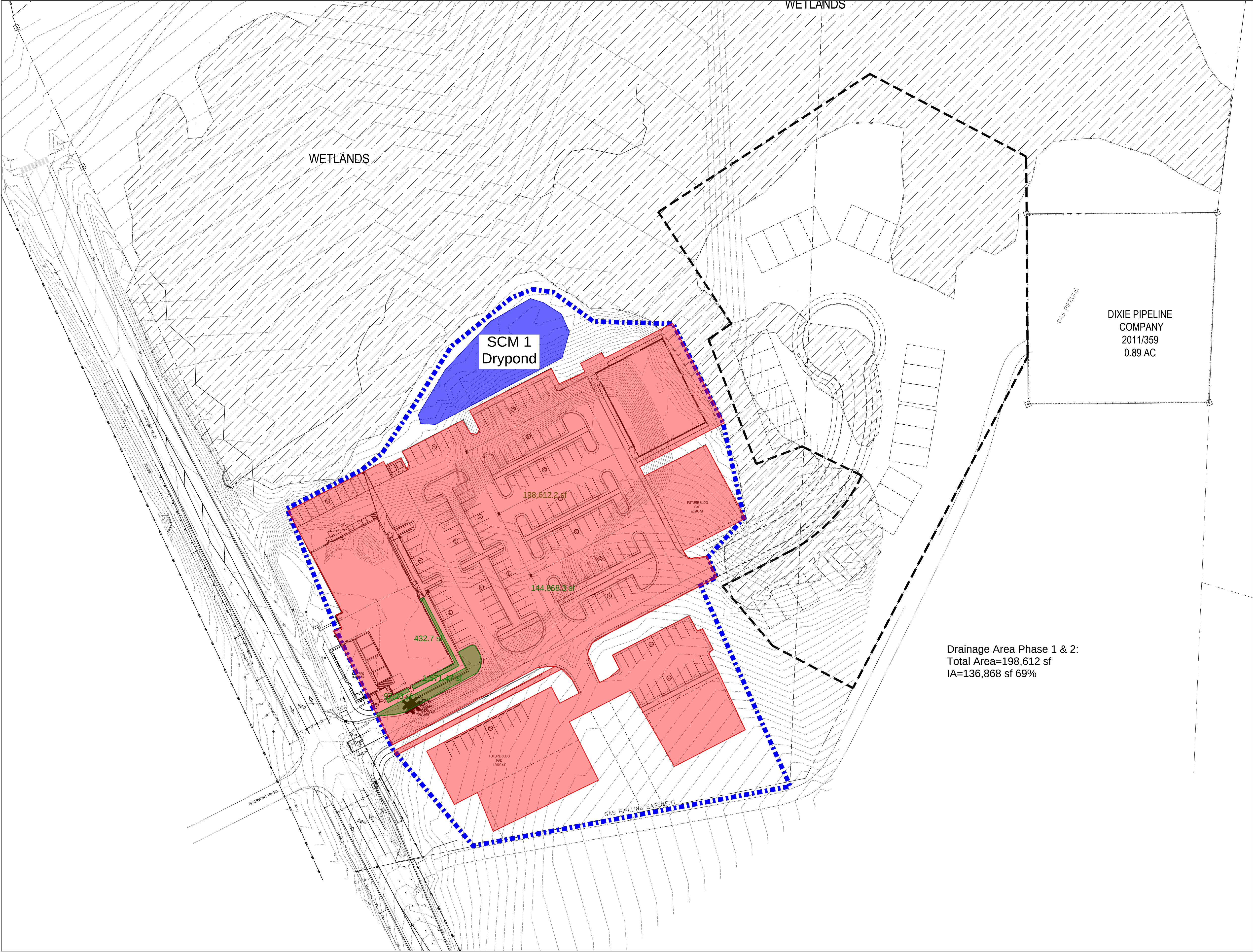
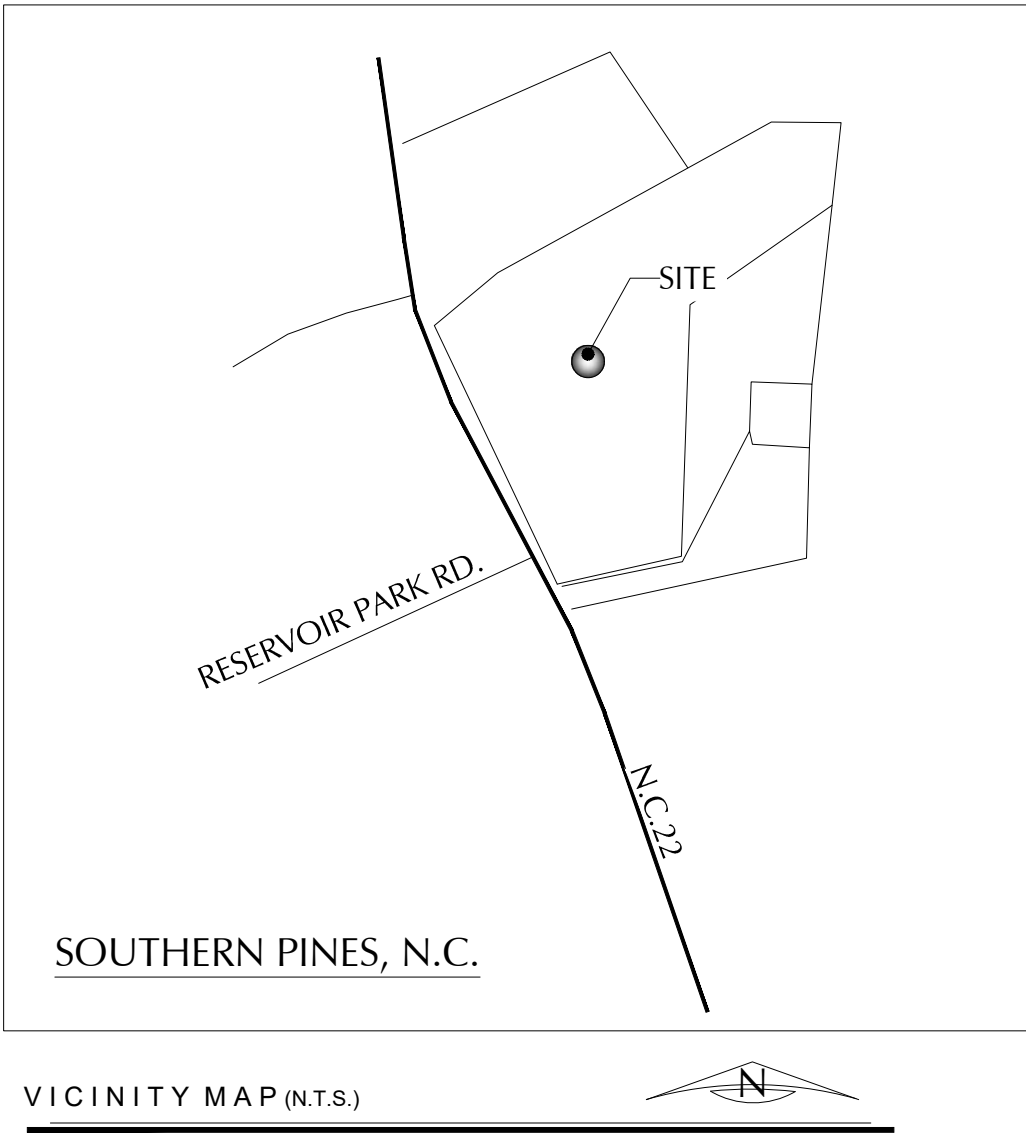
Phase 4. 3 Single Family Homes. Each home site shall have a small peak reduction basin to keep post development runoff for the 1 and 10 years storms to predevelopment rates.

2. Analysis:

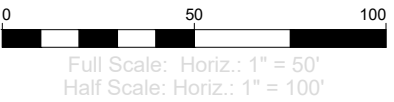
Watershed 1 contains 0.4.56 acres including most of the existing building. It will drain to SCM 1. It includes the impervious areas to be added for phases 1 & 2. The table below summarizes how dry pond 1 reduces the runoff from all planned construction in this watershed to preconstruction rates for the 10-year storm.

3. Calculation: Please see attached watershed maps and calculations.





Waterworks Phase 1 PDP Conceptual Drainage Plan



151 PARKING SPACES

Attachment B--Hydraulic Calculations Summary				Waterworks	
Item	Existing Conditions	Post Development		Max Post Dev WSE	Notes/Freeboard
		Without BMP	With BMP		
Drainage Area (ac)	4.56				
Curve Number	61.00	86.46			
C-Value	0.18	0.71			
Q, 1-yr Storm (cfs)	3.92	17.40	0.93	343.88	4.12
Q, 10-yr Storm (cfs)	5.84	25.90	4.00	345.75	2.25
Q, 100-Yr Storm (cfs)	7.11	31.55	14.87	346.74	1.26
Peak Redux Outlet/NML Pool			343.50		3 ea 6" Orifice
Primary Riser Outlet			346.50		16' weir
Emergency Weir EL			346.50		10' weir
Top of Berm			348.00		

Phase 1			
Total Area=	198,612	sf	
Post Cx Impervious Areas=	136,686	sf	69%
Total Exist. IA=	5,245	sf	3%



Built Upon Areas (BUA) - Waterworks

Date

6/8/18

Project Name

The Waterworks

Project No.

17028

Location

Southern Pines, North Carolina

By

KSL

Checked By

KSL

Impervious Areas:

Total Built Upon Area:

Pre-development	5,245 Sq. Ft.	0.12 Acres	3% BUA Pre
Post-development	136,686 Sq. Ft.	3.14 Acres	69% BUA Post

Total Drainage Area:

198,612 Sq. Ft. 4.56 Acres

Total BUA Estimate:

68.82%

Attachment B--Hydraulic Calculations

Waterworks <i>Hydrograph formulation</i> Drainage Subarea: 1	Time of Concentration and Intensity Derivations: Kirpich's Equation: $T_c = \frac{K * (L^3/H)^{0.385}}{128}$ L = 731 Overland H = 54 K = 1 Hydraulic Length of watershed (ft) Elevation diff. along "L" (ft) Multiplier for flow path conditions (see HRM supp. p2-4) Calculated T_c = 3.42 T_c = 5.00 min. (use 5 as minimum) g & h are regression coeff listed in HRM supplement p. 5-3 $I = \frac{g}{h + T}$ (from HRM p. 2-6) $T = T_c$
---	--

Runoff Volume Estimate (SCS Curve Number Method) Drainage Area (ac) = 4.560 acres CN = 58 SCS Curve Number C = 0.16 Rat'l Coeff. $S = \frac{1000}{CN} - 10$ $S = 7.24$ $R.O. (in) = \frac{(P - 0.2*S)^2}{(P + 0.8*S)}$	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%;">1-yr</th> <th style="width: 25%;">10-yr</th> <th style="width: 25%;">25-yr</th> <th style="width: 25%;">100-yr</th> </tr> <tr> <td>P (in) = 2.17</td> <td>P (in) = 4.2</td> <td>P (in) = 5</td> <td>P (in) = 6.13</td> </tr> <tr> <td>g = 129</td> <td>g = 256</td> <td>g = 271</td> <td>g = 341</td> </tr> <tr> <td>h = 19</td> <td>h = 27</td> <td>h = 28</td> <td>h = 30</td> </tr> <tr> <td>I (in/hr) = 5.38</td> <td>I (in/hr) = 8.00</td> <td>I (in/hr) = 8.21</td> <td>I (in/hr) = 9.74</td> </tr> <tr> <td colspan="4" style="background-color: #d3d3d3; padding: 5px;"> Peak Flow (Rational Method) for duration = T_c $Q (cfs) = C_i A$ </td> </tr> <tr> <td>Q (cfs) = 3.92</td> <td>Q (cfs) = 5.84</td> <td>Q (cfs) = 5.99</td> <td>Q (cfs) = 7.11</td> </tr> <tr> <td>T_p (min) = 3.3</td> <td>T_p (min) = 25.8</td> <td>T_p (min) = 38.7</td> <td>T_p (min) = 51.3</td> </tr> </table>	1-yr	10-yr	25-yr	100-yr	P (in) = 2.17	P (in) = 4.2	P (in) = 5	P (in) = 6.13	g = 129	g = 256	g = 271	g = 341	h = 19	h = 27	h = 28	h = 30	I (in/hr) = 5.38	I (in/hr) = 8.00	I (in/hr) = 8.21	I (in/hr) = 9.74	Peak Flow (Rational Method) for duration = T_c $Q (cfs) = C_i A$				Q (cfs) = 3.92	Q (cfs) = 5.84	Q (cfs) = 5.99	Q (cfs) = 7.11	T_p (min) = 3.3	T_p (min) = 25.8	T_p (min) = 38.7	T_p (min) = 51.3
1-yr	10-yr	25-yr	100-yr																														
P (in) = 2.17	P (in) = 4.2	P (in) = 5	P (in) = 6.13																														
g = 129	g = 256	g = 271	g = 341																														
h = 19	h = 27	h = 28	h = 30																														
I (in/hr) = 5.38	I (in/hr) = 8.00	I (in/hr) = 8.21	I (in/hr) = 9.74																														
Peak Flow (Rational Method) for duration = T_c $Q (cfs) = C_i A$																																	
Q (cfs) = 3.92	Q (cfs) = 5.84	Q (cfs) = 5.99	Q (cfs) = 7.11																														
T_p (min) = 3.3	T_p (min) = 25.8	T_p (min) = 38.7	T_p (min) = 51.3																														

1-yr	10-yr	25-yr	100-yr
I (24hr)= 0.126	I (24hr)= 0.23	I (24hr)= 0.279	I (24hr)= 0.362
Q24(cfs)= 0.092	Q24(cfs)= 0.168	Q24(cfs)= 0.204	Q24(cfs)= 0.264
R.O. (in) = 0.07	R.O.(in) = 0.76	R.O. (in) = 1.17	R.O. (in) = 1.84
R.O. (cf) = 1,083	R.O.(cf) = 12,541	R.O. (cf) = 19,344	R.O. (cf) = 30,426

Attachment B--Hydraulic Calculations

Waterworks <i>Hydrograph formulation</i> Drainage Subarea: 1	Time of Concentration and Intensity Derivations: Kirpich's Equation: $T_c = \frac{K * (L^3/H)^{0.385}}{128}$ L = 731 H = 54 K = 1 Overland Calculated T_c = 3.42 T_c = 5.00 min. (use 5 as minimum) Hydraulic Length of watershed (ft) Elevation diff. along "L" (ft) Multiplier for flow path conditions (see HRM supp. p2-4)
Post Construction	g & h are regression coeff listed in HRM supplement p. 5-3 $I = \frac{g}{h + T}$ (from HRM p. 2-6) $T = T_c$

	1-yr	10-yr	25-yr	100-yr
Runoff Volume Estimate (SCS Curve Number Method) Drainage Area (ac) = 4.560 acres CN = 86.46 SCS Curve Number C = 0.71 Rat'l Coeff. $S = \frac{1000}{CN} - 10$ $S = 1.57$ $R.O. (in) = \frac{(P - 0.2*S)^2}{(P + 0.8*S)}$	P (in) = 2.17 g = 129 h = 19 I (in/hr) = 5.38	P (in) = 4.2 g = 256 h = 27 I (in/hr) = 8.00	P (in) = 5 g = 271 h = 28 I (in/hr) = 8.21	P (in) = 6.13 g = 341 h = 30 I (in/hr) = 9.74
	Peak Flow (Rational Method) $Q (cfs) = C_i A$			
	Q (cfs) = 17.40	Q (cfs) = 25.90	Q (cfs) = 26.59	Q (cfs) = 31.55
	Tp (min) 11.5	Tp (min) 21.2	Tp (min) 26.2	Tp (min) 28.8

1-yr	10-yr	25-yr	100-yr
I (24hr)= 0.126	I (24hr)= 0.23	I (24hr)= 0.279	I (24hr)= 0.362
Q24(cfs)= 0.408	Q24(cfs)= 0.745	Q24(cfs)= 0.903	Q24(cfs)= 1.172
R.O. (in) = 1.01	R.O.(in) = 2.77	R.O. (in) = 3.51	R.O. (in) = 4.58
R.O. (cf) = 16,676	R.O.(cf) = 45,862	R.O. (cf) = 58,151	R.O. (cf) = 75,861

Waterworks

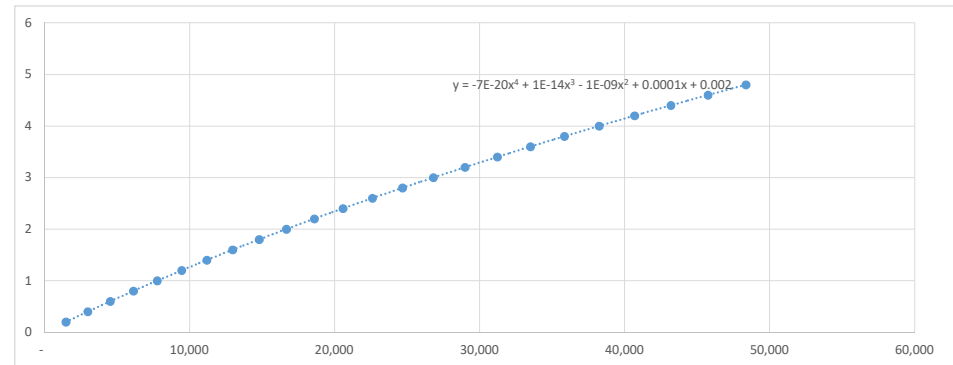
Computation of the Stage Storage Function

	Contour (ft)	Area (sf)	Incr. Vol. (ft^3)	Accum. Vol. (ft^3)	Stage (ft)	Z est (ft)
0	342	7,200	0	-	0	0.00
	342.2	7,423	1,462	1,462	0.2	0.20
	342.4	7,646	1,507	2,969	0.4	0.40
	342.6	7,870	1,552	4,521	0.6	0.60
	342.8	8,093	1,596	6,117	0.8	0.80
1	343.0	8,316	1,641	7,758	1	1.00
	343.2	8,554	1,687	9,445	1.2	1.20
	343.4	8,791	1,734	11,179	1.4	1.40
	343.6	9,029	1,782	12,961	1.6	1.60
	343.8	9,266	1,830	14,791	1.8	1.80
2	344.0	9,504	1,877	16,668	2	2.00
	344.2	9,756	1,926	18,594	2.2	2.20
	344.4	10,008	1,976	20,570	2.4	2.40
	344.6	10,260	2,027	22,597	2.6	2.60
	344.8	10,512	2,077	24,674	2.8	2.80
3	345.0	10,764	2,128	26,802	3	3.00
	345.2	11,030	2,179	28,981	3.2	3.20
	345.4	11,297	2,233	31,214	3.4	3.40
	345.6	11,563	2,286	33,500	3.6	3.60
	345.8	11,830	2,339	35,839	3.8	3.80
4	346.0	12,096	2,393	38,232	4	4.00
	346.2	12,377	2,447	40,679	4.2	4.20
	346.4	12,658	2,503	43,183	4.4	4.40
	346.6	12,938	2,560	45,742	4.6	4.60
	346.8	13,219	2,616	48,358	4.8	4.80
5	347.0	13,500	2,672	51,030	5	5.00

6 14,976

4th Order Polynomial Coefficients

b	2.346E-03
c1	1.375E-04
c2	-1.255E-09
c3	1.291E-14
c4	-6.921E-20



	L	W	Area	
0	342	60	120	7,200
1	343	66	126	8,316
2	344	72	132	9,504
3	345	78	138	10,764
4	346	84	144	12,096
5	347	90	150	13,500
6	348	96	156	14,976

Waterworks			
Routing Table (using HRM's "Chainsaw" method)			
Qp (cfs) =	17.40		
Tp (min) =	11.5		1-yr
dT (min) =	1	Suggested Time Increment (Tp/10)	
dT (min) =	1	Selected Time Increment	
b	2.346E-03		
c1	1.375E-04		
c2	-1.255E-09	4th order polynomial coefficients	
c3	1.291E-14	used to estimate stage	
c4	-6.921E-20		
Ref. Ele. =	342	(Perm Pool)	
Results:			
Max. Total Outflow	0.93	cfs	
Max WQ Risers	-	cfs	
Max Peak Redux Orifice	0.93	cfs	
Max Primary Riser	0.93	cfs	
Max. Emer.Weir Outflow	-	cfs	
Max. Water Surf. Ele.	343.88	ft	
Max. Stage:	1.88	ft	
Max. Storage:	15,509	cu.ft.	

Structure Data													
Circular Office 1 (WQ) not used				Peak Reduction Orifice 3 ea				Primary Rec Riser & Cir Barrel				Weirs	
Riser:		Barrel:		Riser:		Barrel:		Rec Riser:		Barrel:		Emergency Weir	
Dia. (in)	24	Dia. (in)	2	Dia. (in)	24	Dia. (in)	6	Width (in)	48.00				
Inv Ele. (ft)	1000	Inv (in)	1000	Inv Ele. (ft)	343.5	Inv (in)	343.5	Length (in)	48.000	Dia. (in)	15	Cw =	3
Cd	3.3	Cd	0.6	Inv Ele. (ft)	343.5	Cd	0.6	Top Ele. (ft)	346.50	Inv (in)	342.00	Ele. (ft)	346.5
Cd	0.6			Cd	0.6			Cd	3.3	Cd	0.6	Length (ft)	10
				Cd	0.6			Cd	0.6				
Weir Equation: $Q = C_w L H^{3/2}$				Weir Equation: $Q = C_w L H^{3/2}$		Orifice Equation: $Q = C_d A (2'g'h)^{1/2}$		Weir Equation: $Q = C_w L H^{3/2}$		Orifice Equation: $Q = C_d A (2'g'h)^{1/2}$			
$Q = C_w L H^{3/2}$				$Q = C_w L H^{3/2}$		$Q = C_d A (2'g'h)^{1/2}$		$Q = C_w L H^{3/2}$		$Q = C_d A (2'g'h)^{1/2}$			

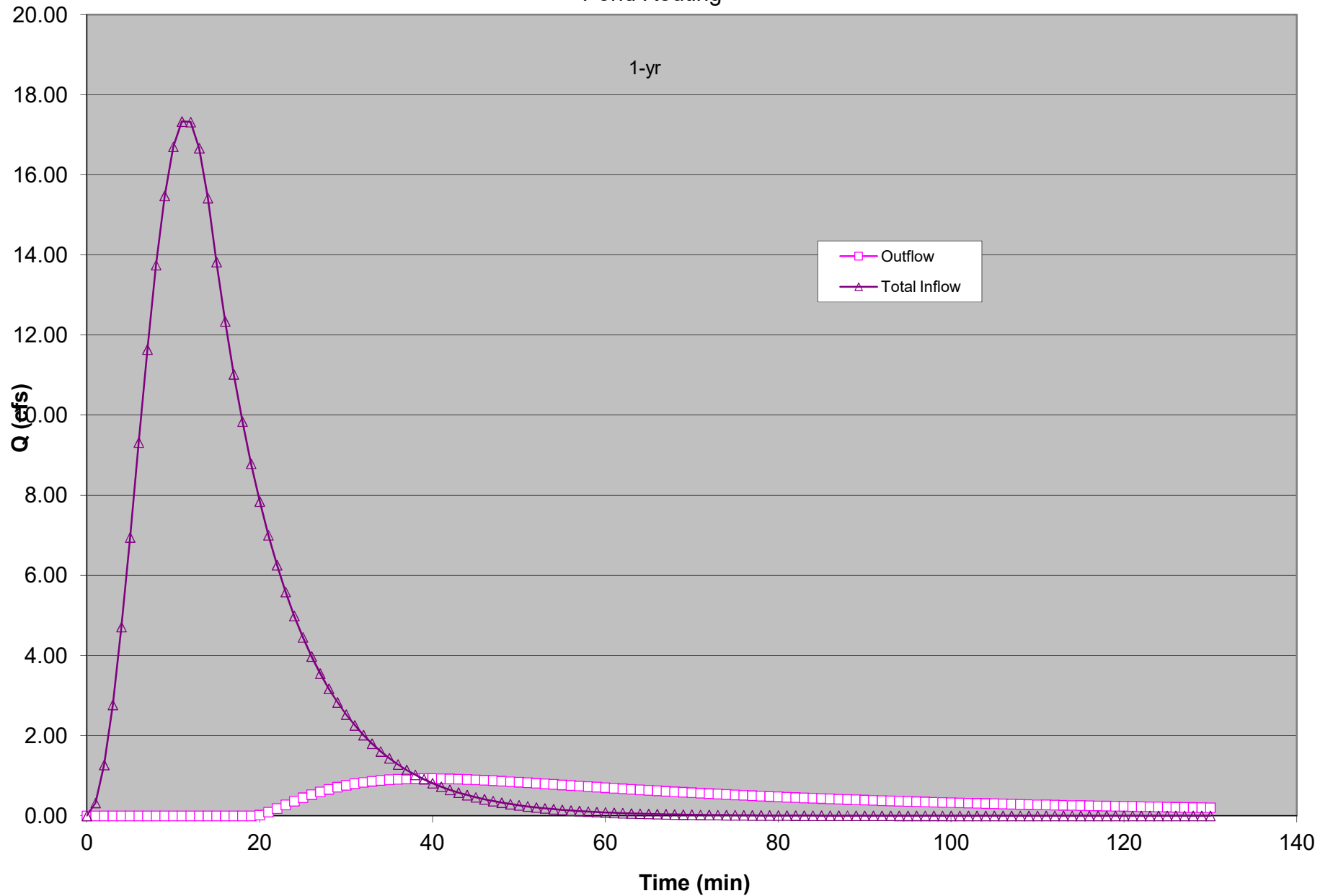
*NOTE: Check Primary Riser Barrel to ensure total outflow is always less than or equal to Primary Barrel flow.

Routing Table:							Computed Outflow Data:															
Time	R.O. Inflow	Total Inflow	Storage	Wtr Surf. Ele	Stage	Outflow'	Circular 1 (WQ)				Peak Reduction Orifice 3 ea				Rectangular Riser Primary				Riser Intakes	Barrel*	Control	Emergency Weir
(min)	(cfs)	(cfs)	(cf)	(ft)	(ft)	(cfs)	Riser (weir)	Riser (orifice)	Barrel	Control	Riser (weir)	Riser (orifice)	Barrel	Control (ft3)	Riser (weir)	Riser (orifice)	Control					
0	0.00	0.00	0.00	342.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1	0.32	0.00	0.00	342.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	1.27	1.27	19.42	342.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3	2.77	2.77	95.68	342.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	
4	4.71	4.71	261.93	342.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	
5	6.95	6.95	544.67	342.08	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	
6	9.32	9.32	961.70	342.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	
7	11.64	11.64	1520.85	342.21	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	
8	13.75	13.75	2219.36	342.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	
9	15.47	15.47	3044.10	342.41	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00	
10	16.70	16.70	3972.58	342.53	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29	0.00	0.00	
11	17.33	17.33	4974.55	342.66	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.78	0.00	0.00	
12	17.32	17.32	6014.31	342.79	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.34	0.00	0.00	
13	16.66	16.66	7053.35	342.91	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.93	0.00	0.00	
14	15.42	15.42	8053.22	343.03	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.52	0.00	0.00	
15	13.82	13.82	8978.37	343.14	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10	0.00	0.00	
16	12.34	12.34	9807.68	343.24	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.63	0.00	0.00	
17	11.02	11.02	10548.21	343.33	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.95	0.00	0.00	
18	9.84	9.84	11209.46	343.40	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.20	0.00	0.00	
19	8.79	8.79	11799.93	343.47	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.42	0.00	0.00	
20	7.85	7.85	12327.19	343.53	1.53	0.00	0.00	0.00	0.00	0.00	0.11	2.63	0.23	0.02	0.00	0.00	0.00	0.00	5.61	0.02	0.00	
21	7.01	7.01	12796.78	343.58	1.58	0.09	0.00	0.00	0.00	0.00	0.49	4.33	0.03	0.09	0.00	0.00	0.00	0.00	5.77	0.09	0.00	
22	6.26	6.26	13211.55	343.63	1.63	0.18	0.00	0.00	0.00	0.00	0.95	5.41	0.06	0.18	0.00	0.00	0.00	0.00	5.91	0.18	0.00	
23	5.59	5.59	13575.93	343.67	1.67	0.28	0.00	0.00	0.00	0.00	1.43	6.20	0.09	0.28	0.00	0.00	0.00	0.00	6.03	0.28	0.00	
24	4.99	4.99	13894.55	343.70	1.70	0.37	0.00	0.00	0.00	0.00	1.90	6.82	0.12	0.37	0.00	0.00	0.00	0.00	6.13	0.37	0.00	
25	4.45	4.45	14171.84	343.73	1.73	0.45	0.00	0.00	0.00	0.00	2.34	7.31	0.15	0.45	0.00	0.00	0.00	0.00	6.21	0.45	0.00	
26	3.98	3.98	14411.97	343.76	1.76	0.53	0.00	0.00	0.00	0.00	2.74	7.70	0.18	0.53	0.00	0.00	0.00	0.00	6.28	0.53	0.00	
27	3.55	3.55	14618.81	343.78	1.78	0.60	0.00	0.00	0.00	0.00	3.12	8.03	0.20	0.60	0.00	0.00	0.00	0.00	6.35	0.60	0.00	
28	3.17	3.17	14795.87	343.80	1.80	0.66	0.00	0.00	0.00	0.00	3.42	8.30	0.22	0.66	0.00	0.00	0.00	0.00	6.40	0.66	0.00	
29	2.83	2.83	14946.39	343.82	1.82	0.72	0.00	0.00	0.00	0.00	3.70	8.52	0.24	0.72	0.00	0.00	0.00	0.00	6.44	0.72	0.00	
30	2.53	2.53	15073.27	343.83	1.83	0.76	0.00	0.00	0.00	0.00	3.95	8.70	0.25	0.76	0.00	0.00	0.00	0.00	6.48	0.76	0.00	
31	2.26	2.26	15179.15	343.84	1.84	0.80	0.00	0.00	0.00	0.00	4.15	8.85	0.27	0.80	0.00	0.00	0.00	0.00	6.51	0.80	0.00	
32	2.02	2.02	15266.39	343.85	1.85	0.84	0.00	0.00	0.00	0.00	4.32	8.94	0.28	0.84	0.00	0.00	0.00	0.00	6.53	0.84	0.00	
33	1.80	1.80	15337.13	343.86	1.86	0.86	0.00	0.00	0.00	0.00	4.46	9.07	0.29	0.86	0.00	0.00	0.00	0.00	6.55	0.86	0.00	
34	0.00	0.00	15393.29	343.87	1.87	0.89	0.00	0.00	0.00	0.00	4.58	9.14	0.30	0.89	0.00	0.00	0.00	0.00	6.57	0.89	0.00	
35	1.44	1.44	15436.57	343.87	1.87	0.90	0.00	0.00	0.00	0.00	4.66	9.20	0.30	0.90	0.00	0.00	0.00	0.00	6.58	0.90	0.00	
36	1.28	1.28	15468.51	343.87	1.87	0.92	0.00	0.00	0.00	0.00	4.73	9.24	0.31	0.92	0.00	0.00	0.00	0.00	6.59	0.92	0.00	
37	1.14	1.14	15490.48	343.88	1.88	0.92	0.00	0.00	0.00	0.00	4.77	9.27	0.31	0.92	0.00	0.00	0.00	0.00	6.60	0.92	0.00	
38	1.02	1.02	15503.69	343.88	1.88	0.93	0.00	0.00	0.00	0.00	4.80	9.28	0.31	0.93	0.00	0.00	0.00	0.00	6.60	0.93	0.00	
39	0.91	0.91	15509.23	343.88	1.88	0.93	0.00	0.00	0.00	0.00	4.81	9.30	0.31	0.93	0.00	0.00	0.00	0.00	6.60	0.93	0.00	
40	0.82	0.82	15508.07	343.88	1.88	0.93	0.00	0.00	0.00	0.00	4.81	9.29	0.31	0.93	0.00	0.00	0.00	0.00	6.60	0.93	0.00	
41	0.73	0.73	15501.08	343.88	1.88	0.93	0.00	0.00	0.00	0.00	4.79	9.28	0.31	0.93	0.00	0.00	0.00	0.00	6.60	0.93	0.00	
42	0.65	0.65	15489.02	343.88	1.88	0.92	0.00	0.00	0.00	0.00	4.77	9.27	0.31	0.92	0.00	0.00	0.00	0.00	6.60	0.92	0.00	
43	0.58	0.58	15472.57	343.87	1.87	0.92	0.00	0.00	0.00	0.00	4.74	9.25	0.31	0.92	0.00	0.00	0.00	0.00	6.59	0.92	0.00	
44	0.52	0.52	15452.33	343.87	1.87	0.91	0.00	0.00	0.00	0.00	4.69	9.22	0.30	0.91	0.00	0.00	0.00	0.00	6.59	0.91	0.00	
45	0.46	0.46	15428.84	343.87	1.87	0.90	0.00	0.00	0.00	0.00	4.65	9.19	0.29	0.89	0.00	0.00	0.00	0.00	6.58	0.90	0.00	
46	0.41	0.41	15402.58	343.87	1.87	0.89	0.00	0.00	0.00	0.00	4.59	9.15	0.30	0.89	0.00	0.00	0.00	0.00	6.57	0.89	0.00	
47	0.37	0.37	15373.96	343.86	1.86	0.88	0.00	0.00	0.00	0.00	4.54	9.12	0.29	0.88	0.00	0.00	0.00	0.00	6.56	0.88	0.00	
48	0.33	0.33	15343.36	343.86	1.86	0.87	0.00	0.00	0.00	0.00	4.48	9.07	0.29	0.87	0.00	0.00	0.00	0.00	6.56	0.87	0.00	
49	0.29	0.29	15311.09	343.86	1.86	0.85	0.00	0.00	0.00	0.00	4.41	9.03	0.28	0.85	0.00	0.00	0.00	0.00	6.55	0.85	0.00	
50	0.26	0.26	15277.46	343.85	1.85	0.84	0.00	0.00	0.00	0.00	4.34	8.98	0.28	0.84	0.00	0.00	0.00	0.00	6.54	0.84	0.00	
51	0.23	0.23	15242.72	343.85	1.85	0.83	0.00	0.00	0.00	0.00	4.28	8.94	0.28	0.83	0.00	0.00	0.00	0.00	6.53	0.83	0.00	
52	0.21	0.21	15207.09	343.85	1.85	0.81	0.00	0.00	0.00	0.00	4.21	8.89	0.27	0.81	0.00	0.00	0.00	0.00	6.51	0.81	0.00	
53	0.19	0.19	15170.76	343.84	1.84	0.80	0.00	0.00	0.00	0.00	4.13	8.84	0.27	0.80	0.00	0.00	0.00	0.00	6.51	0.80	0.00	
54	0.17	0.17	15133.92	343.84	1.84	0.79	0.00	0.00	0.00	0.00	4.06	8.79	0.26	0.79	0.00	0.00	0.00	0.00	6.50	0.79	0.00	
55	0.15	0.15	15096.71	343.83	1.83	0.77	0.00	0.00	0.00	0.00	3.99	8.73	0.26	0.77	0.00	0.00	0.00	0.00	6.49	0.77	0.00	
56	0.13	0.13	15059.26	343.83	1.83	0.76	0.00	0.00	0.00	0.00	3.92	8.68	0.25	0.76	0.00	0.00	0.00	0.00	6.47	0.76	0.00	
57	0.12	0.12	15021.69	343.83	1.83	0.75	0.00	0.00	0.00	0.00	3.85	8.63	0.25	0.75	0.00	0.00	0.00	0.00	6.46	0.75	0.00	
58	0.11	0.11	14984.11	343.82	1.82	0.73	0.00	0.00	0.00	0.00	3.78	8.57	0.24	0.73	0.00</							

60	0.08	0.08	14909.21	343.81	1.81	0.70	0.00	0.00	0.00	0.00	3.63	8.47	0.23	0.70	0.00	0.00	0.00	0.70	6.43	0.70	0.00
61	0.08	0.08	14872.05	343.81	1.81	0.69	0.00	0.00	0.00	0.00	3.56	8.41	0.23	0.69	0.00	0.00	0.00	0.69	6.42	0.69	0.00
62	0.07	0.07	14835.15	343.81	1.81	0.68	0.00	0.00	0.00	0.00	3.50	8.36	0.23	0.68	0.00	0.00	0.00	0.68	6.41	0.68	0.00
63	0.06	0.06	14798.56	343.80	1.80	0.66	0.00	0.00	0.00	0.00	3.43	8.30	0.22	0.66	0.00	0.00	0.00	0.66	6.40	0.66	0.00
64	0.05	0.05	14762.32	343.80	1.80	0.65	0.00	0.00	0.00	0.00	3.36	8.25	0.22	0.65	0.00	0.00	0.00	0.65	6.39	0.65	0.00
65	0.05	0.05	14726.47	343.79	1.79	0.64	0.00	0.00	0.00	0.00	3.30	8.19	0.21	0.64	0.00	0.00	0.00	0.64	6.38	0.64	0.00
66	0.04	0.04	14691.03	343.79	1.79	0.63	0.00	0.00	0.00	0.00	3.23	8.14	0.21	0.63	0.00	0.00	0.00	0.63	6.37	0.63	0.00
67	0.04	0.04	14656.04	343.79	1.79	0.61	0.00	0.00	0.00	0.00	3.17	8.09	0.20	0.61	0.00	0.00	0.00	0.61	6.36	0.61	0.00
68	0.03	0.03	14621.50	343.78	1.78	0.60	0.00	0.00	0.00	0.00	3.11	8.03	0.20	0.60	0.00	0.00	0.00	0.60	6.35	0.60	0.00
69	0.03	0.03	14587.44	343.78	1.78	0.59	0.00	0.00	0.00	0.00	3.05	7.98	0.20	0.59	0.00	0.00	0.00	0.59	6.34	0.59	0.00
70	0.03	0.03	14553.86	343.77	1.77	0.58	0.00	0.00	0.00	0.00	2.99	7.93	0.19	0.58	0.00	0.00	0.00	0.58	6.33	0.58	0.00
71	0.02	0.02	14520.78	343.77	1.77	0.57	0.00	0.00	0.00	0.00	2.93	7.88	0.19	0.57	0.00	0.00	0.00	0.57	6.32	0.57	0.00
72	0.02	0.02	14488.20	343.77	1.77	0.56	0.00	0.00	0.00	0.00	2.87	7.83	0.19	0.56	0.00	0.00	0.00	0.56	6.31	0.56	0.00
73	0.02	0.02	14456.13	343.76	1.76	0.55	0.00	0.00	0.00	0.00	2.82	7.77	0.18	0.55	0.00	0.00	0.00	0.55	6.30	0.55	0.00
74	0.02	0.02	14424.56	343.76	1.76	0.53	0.00	0.00	0.00	0.00	2.76	7.72	0.18	0.53	0.00	0.00	0.00	0.53	6.29	0.53	0.00
75	0.02	0.02	14393.51	343.76	1.76	0.52	0.00	0.00	0.00	0.00	2.71	7.67	0.17	0.52	0.00	0.00	0.00	0.52	6.28	0.52	0.00
76	0.01	0.01	14362.96	343.75	1.75	0.51	0.00	0.00	0.00	0.00	2.66	7.62	0.17	0.51	0.00	0.00	0.00	0.51	6.27	0.51	0.00
77	0.01	0.01	14332.93	343.75	1.75	0.50	0.00	0.00	0.00	0.00	2.60	7.58	0.17	0.50	0.00	0.00	0.00	0.50	6.26	0.50	0.00
78	0.01	0.01	14303.39	343.75	1.75	0.49	0.00	0.00	0.00	0.00	2.55	7.53	0.16	0.49	0.00	0.00	0.00	0.49	6.25	0.49	0.00
79	0.01	0.01	14274.36	343.74	1.74	0.49	0.00	0.00	0.00	0.00	2.51	7.48	0.16	0.49	0.00	0.00	0.00	0.49	6.24	0.49	0.00
80	0.01	0.01	14245.82	343.74	1.74	0.48	0.00	0.00	0.00	0.00	2.46	7.43	0.16	0.48	0.00	0.00	0.00	0.48	6.23	0.48	0.00
81	0.01	0.01	14217.77	343.74	1.74	0.47	0.00	0.00	0.00	0.00	2.41	7.38	0.16	0.47	0.00	0.00	0.00	0.47	6.22	0.47	0.00
82	0.01	0.01	14190.21	343.74	1.74	0.46	0.00	0.00	0.00	0.00	2.37	7.34	0.15	0.46	0.00	0.00	0.00	0.46	6.22	0.46	0.00
83	0.01	0.01	14163.12	343.73	1.73	0.45	0.00	0.00	0.00	0.00	2.32	7.29	0.15	0.45	0.00	0.00	0.00	0.45	6.21	0.45	0.00
84	0.01	0.01	14136.51	343.73	1.73	0.44	0.00	0.00	0.00	0.00	2.28	7.25	0.15	0.44	0.00	0.00	0.00	0.44	6.20	0.44	0.00
85	0.00	0.00	14110.36	343.73	1.73	0.43	0.00	0.00	0.00	0.00	2.24	7.20	0.14	0.43	0.00	0.00	0.00	0.43	6.19	0.43	0.00
86	0.00	0.00	14084.66	343.72	1.72	0.43	0.00	0.00	0.00	0.00	2.19	7.16	0.14	0.43	0.00	0.00	0.00	0.43	6.18	0.43	0.00
87	0.00	0.00	14059.41	343.72	1.72	0.42	0.00	0.00	0.00	0.00	2.15	7.11	0.14	0.42	0.00	0.00	0.00	0.42	6.18	0.42	0.00
88	0.00	0.00	14034.61	343.72	1.72	0.41	0.00	0.00	0.00	0.00	2.11	7.07	0.14	0.41	0.00	0.00	0.00	0.41	6.17	0.41	0.00
89	0.00	0.00	14010.24	343.72	1.72	0.40	0.00	0.00	0.00	0.00	2.08	7.02	0.13	0.40	0.00	0.00	0.00	0.40	6.16	0.40	0.00
90	0.00	0.00	13986.29	343.71	1.71	0.39	0.00	0.00	0.00	0.00	2.04	6.98	0.13	0.39	0.00	0.00	0.00	0.39	6.15	0.39	0.00
91	0.00	0.00	13962.76	343.71	1.71	0.39	0.00	0.00	0.00	0.00	2.00	6.94	0.13	0.39	0.00	0.00	0.00	0.39	6.15	0.39	0.00
92	0.00	0.00	13939.64	343.71	1.71	0.38	0.00	0.00	0.00	0.00	1.97	6.90	0.13	0.38	0.00	0.00	0.00	0.38	6.14	0.38	0.00
93	0.00	0.00	13916.52	343.71	1.71	0.37	0.00	0.00	0.00	0.00	1.93	6.86	0.12	0.37	0.00	0.00	0.00	0.37	6.13	0.37	0.00
94	0.00	0.00	13894.60	343.70	1.70	0.37	0.00	0.00	0.00	0.00	1.90	6.82	0.12	0.37	0.00	0.00	0.00	0.37	6.13	0.37	0.00
95	0.00	0.00	13872.66	343.70	1.70	0.36	0.00	0.00	0.00	0.00	1.86	6.77	0.12	0.36	0.00	0.00	0.00	0.36	6.12	0.36	0.00
96	0.00	0.00	13851.10	343.70	1.70	0.35	0.00	0.00	0.00	0.00	1.83	6.73	0.12	0.35	0.00	0.00	0.00	0.35	6.11	0.35	0.00
97	0.00	0.00	13829.91	343.70	1.70	0.35	0.00	0.00	0.00	0.00	1.80	6.70	0.12	0.35	0.00	0.00	0.00	0.35	6.11	0.35	0.00
98	0.00	0.00	13809.08	343.69	1.69	0.34	0.00	0.00	0.00	0.00	1.77	6.66	0.11	0.34	0.00	0.00	0.00	0.34	6.10	0.34	0.00
99	0.00	0.00	13788.61	343.69	1.69	0.34	0.00	0.00	0.00	0.00	1.74	6.62	0.11	0.34	0.00	0.00	0.00	0.34	6.09	0.34	0.00
100	0.00	0.00	13768.49	343.69	1.69	0.33	0.00	0.00	0.00	0.00	1.71	6.58	0.11	0.33	0.00	0.00	0.00	0.33	6.08	0.33	0.00
101	0.00	0.00	13748.71	343.69	1.69	0.32	0.00	0.00	0.00	0.00	1.68	6.54	0.11	0.32	0.00	0.00	0.00	0.32	6.08	0.32	0.00
102	0.00	0.00	13729.26	343.68	1.68	0.32	0.00	0.00	0.00	0.00	1.65	6.50	0.11	0.32	0.00	0.00	0.00	0.32	6.07	0.32	0.00
103	0.00	0.00	13710.14	343.68	1.68	0.31	0.00	0.00	0.00	0.00	1.62	6.47	0.10	0.31	0.00	0.00	0.00	0.31	6.07	0.31	0.00
104	0.00	0.00	13691.34	343.68	1.68	0.31	0.00	0.00	0.00	0.00	1.59	6.43	0.10	0.31	0.00	0.00	0.00	0.31	6.06	0.31	0.00
105	0.00	0.00	13672.86	343.68	1.68	0.30	0.00	0.00	0.00	0.00	1.57	6.39	0.10	0.30	0.00	0.00	0.00	0.30	6.06	0.30	0.00
106	0.00	0.00	13654.68	343.68	1.68	0.30	0.00	0.00	0.00	0.00	1.54	6.36	0.10	0.30	0.00	0.00	0.00	0.30	6.05	0.30	0.00
107	0.00	0.00	13636.80	343.67	1.67	0.29	0.00	0.00	0.00	0.00	1.51	6.32	0.10	0.29	0.00	0.00	0.00	0.29	6.04	0.29	0.00
108	0.00	0.00	13619.22	343.67	1.67	0.29	0.00	0.00	0.00	0.00	1.49	6.29	0.10	0.29	0.00	0.00	0.00	0.29	6.04	0.29	0.00
109	0.00	0.00	13601.93	343.67	1.67	0.28	0.00	0.00	0.00	0.00	1.47	6.25	0.09	0.28	0.00	0.00	0.00	0.28	6.03	0.28	0.00
110	0.00	0.00	13584.91	343.67	1.67	0.28	0.00	0.00	0.00	0.00	1.44	6.22	0.09	0.28	0.00	0.00	0.00	0.28	6.03	0.28	0.00
111	0.00	0.00	13568.18	343.67	1.67	0.27	0.00	0.00	0.00	0.00	1.42	6.19	0.09	0.27	0.00	0.00	0.00	0.27	6.02	0.27	0.00
112	0.00	0.00	13551.71	343.67	1.67	0.27	0.00	0.00	0.00	0.00	1.39	6.15	0.09	0.27	0.00	0.00	0.00	0.27	6.02	0.27	0.00
113	0.00	0.00	13535.51	343.66	1.66	0.27	0.00	0.00	0.00	0.00	1.37	6.12	0.09	0.27	0.00	0.00	0.00	0.27	6.01	0.27	0.00
114	0.00	0.00	13519.57	343.66	1.66	0.26	0.00	0.00	0.00	0.00	1.35	6.09	0.09	0.26	0.00	0.00	0.00	0.26	6.01	0.26	0.00
115	0.00	0.00	13503.89	343.66	1.66	0.26	0.00	0.00	0.00	0.00	1.33	6.05	0.09	0.26	0.00	0.00	0.00	0.26	6.00	0.26	0.00
116	0.00	0.00	13488.45	343.66	1.66	0.25	0.00	0.00	0.00	0.00	1.31	6.02	0.08	0.25	0.00	0.00	0.00	0.25	6.00	0.25	0.00
117	0.00	0.00	13473.26	343.66	1.66	0.25	0.00	0.00	0.00	0.00	1.29	5.99	0.08	0.25	0.00	0.00	0.00	0.25	5.99	0.25	0.00
118	0.00	0.00	13458.31	343.66	1.66	0.25	0.00	0.00	0.00	0.00	1.27	5.96	0.08	0.25	0.00	0.00	0.00	0.25	5.99	0.25	0.00
119	0.00	0.00	13443.59	343.65	1.65	0.24	0.00	0.00													

Waterworks

Pond Routing



Waterworks			
Routing Table (using HRM's "Chainsaw" method)			
Qp (cfs) =	25.90	10-yr	
TP (min) =	21.2		
dT (min) =	2	Suggested Time Increment (TP/10)	
dT (min) =	1	Selected Time Increment	
b1	2.346E-03	4th order polynomial coefficients used to estimate stage	
c1	1.375E-04		
c2	-1.255E-09		
c3	1.291E-14		
c4	-6.921E-20		
Ref. Ele. =	342	(Perm Pool)	
Results:			
Max. Total Outflow	4.00	cfs	
Max WQ Risers	-	cfs	
Max Peak Redux Orifice	4.00	cfs	
Max Primary Riser	4.00	cfs	
Max. Emer. Weir Outflow	-	cfs	
Max. Water Surf. Ele.	345.75	ft	
Max. Stage	3.75	ft	
Max. Storage	35,233	cu.ft.	

Structure Data									
Circular Orifice 1 (WQ) not used				Peak Reduction Orifice 3 ea				Primary Rec Riser & Cir Barrel	
Riser:		Barrel:		Riser:		Barrel:		Weirs	
Riser:		Barrel:		Riser:		Barrel:		Emergency Weir	
Dia. (in)	24	Dia. (in)	2	Dia. (in)	24	Dia. (in)	6	Width (in)	48.00
Inv Ele. (ft)	1000	Invert (ft)	1000	Inv Ele. (ft)	343.5	Invert (ft)	343.5	Length (in)	48.00
Cw	3.3	Cd	0.6	Cw	3.3	Cd	0.6	Top Ele. (ft)	346.50
Cd	0.6			Cd	0.6			Inv Ele. (ft)	342.00
Weir Equation: $Q = Cw \cdot L \cdot H^{3/2}$		Orifice Equation: $Q = Cd \cdot A \cdot (2 \cdot g \cdot h)^{1/2}$		Weir Equation: $Q = Cw \cdot L \cdot H^{3/2}$		Orifice Equation: $Q = Cd \cdot A \cdot (2 \cdot g \cdot h)^{1/2}$		Weir Equation: $Q = Cw \cdot L \cdot H^{3/2}$	
								Orifice Equation: $Q = Cd \cdot A \cdot (2 \cdot g \cdot h)^{1/2}$	

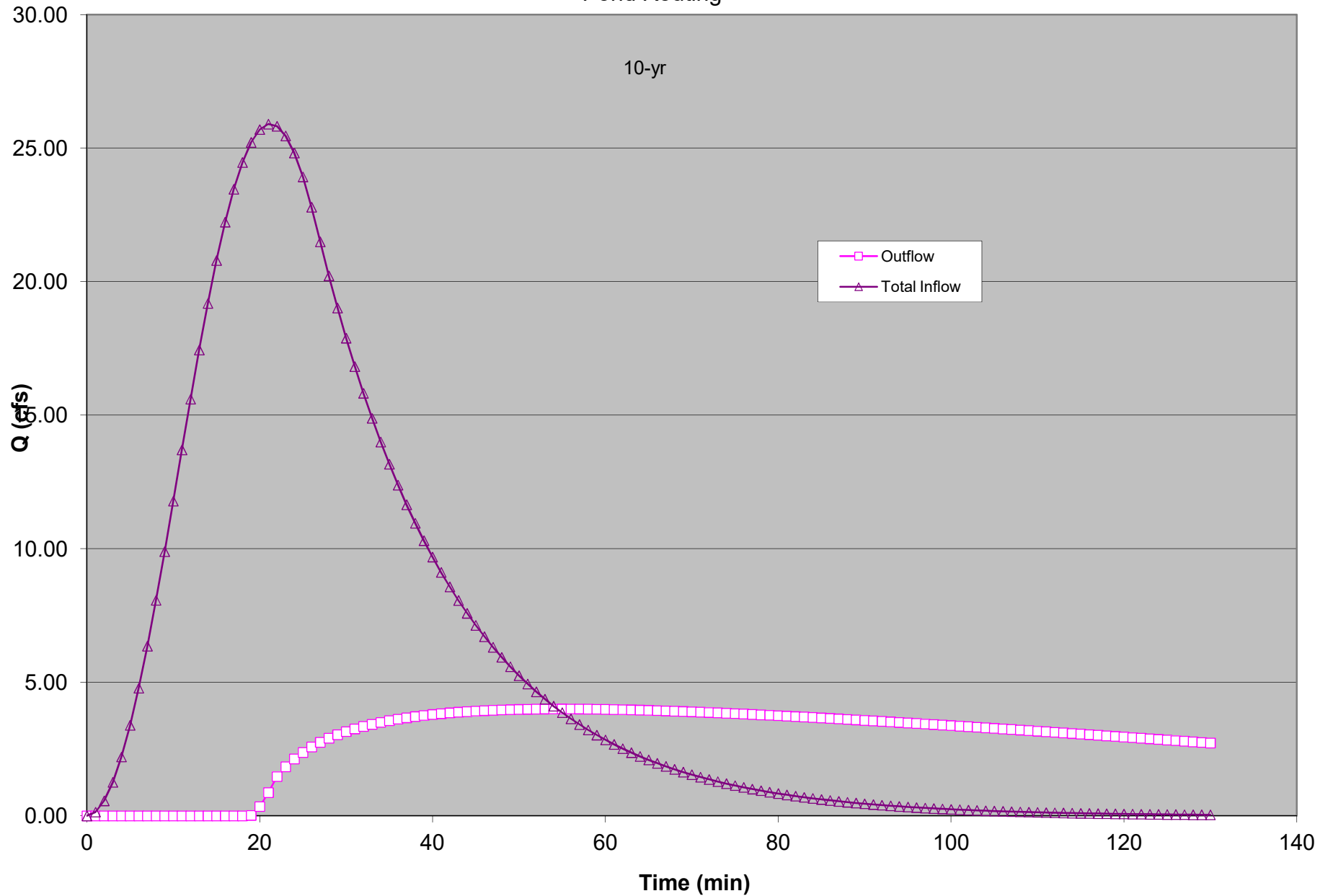
*NOTE: Check Primary Riser Barrel to ensure total outflow is always less than or equal to Primary Barrel flow

Routing Table:						Computed Outflow Data:																	
Time	R.O. Inflow	Total Inflow	Storage	Wtr Surf. Ele	Stage	Outflow*	Circular 1 (WQ)				Peak Reduction Orifice 3 ea				Rectangular Riser Primary				Riser Intakes	Barrel*	Control	Emergency Weir	
(min)	(cfs)	(cfs)	(cf)	(ft)	(ft)		Riser (weir)	Riser (orifice)	Barrel	Control	Riser (weir)	Riser (orifice)	Barrel	Control (ft3)	Riser (weir)	Riser (orifice)	Control						
0	0.00	0.00	0.00	342.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.14	0.14	0.00	342.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.56	0.56	8.50	342.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.26	1.26	42.34	342.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	2.21	2.21	117.77	342.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
5	3.39	3.39	250.16	342.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
6	4.78	4.78	453.61	342.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
7	6.36	6.36	740.69	342.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
8	8.07	8.07	1122.13	342.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00
9	9.90	9.90	1606.57	342.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00
10	11.79	11.79	2200.44	342.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00
11	13.70	13.70	2907.73	342.39	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00
12	15.60	15.60	3729.99	342.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.18	0.00	0.00	0.00
13	17.45	17.45	4666.21	342.62	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.63	0.00	0.00	0.00
14	19.19	19.19	5712.93	342.75	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.17	0.00	0.00	0.00
15	20.80	20.80	6864.24	342.89	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.82	0.00	0.00	0.00
16	22.23	22.23	8111.95	343.04	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.56	0.00	0.00	0.00
17	23.46	23.46	9445.75	343.20	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40	0.00	0.00	0.00
18	24.46	24.46	10853.48	343.36	1.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.07	0.00	0.00	0.00
19	25.21	25.21	12321.32	343.53	1.53	0.02	0.00	0.00	0.00	0.00	0.10	2.57	0.01	0.02	0.00	0.00	0.00	0.00	0.02	5.61	0.02	0.00	0.00
20	25.70	25.70	13832.98	343.70	1.70	0.35	0.00	0.00	0.00	0.00	1.80	6.70	0.12	0.35	0.00	0.00	0.00	0.00	0.35	6.11	0.35	0.00	0.00
21	25.90	25.90	15353.75	343.86	1.86	0.87	0.00	0.00	0.00	0.00	4.50	9.09	0.29	0.87	0.00	0.00	0.00	0.00	0.87	6.56	0.87	0.00	0.00
22	25.82	25.82	16855.37	344.02	2.02	1.47	0.00	0.00	0.00	0.00	7.78	10.91	0.49	1.47	0.00	0.00	0.00	0.00	1.47	6.97	1.47	0.00	0.00
23	25.46	25.46	18316.12	344.17	2.17	1.84	0.00	0.00	0.00	0.00	11.42	12.40	0.61	1.84	0.00	0.00	0.00	0.00	1.84	7.34	1.84	0.00	0.00
24	24.82	24.82	19733.08	344.32	2.32	2.13	0.00	0.00	0.00	0.00	15.29	13.67	0.71	2.13	0.00	0.00	0.00	0.00	2.13	7.67	2.13	0.00	0.00
25	23.92	23.92	21094.39	344.45	2.45	2.37	0.00	0.00	0.00	0.00	19.27	14.76	0.79	2.37	0.00	0.00	0.00	0.00	2.37	7.98	2.37	0.00	0.00
26	22.79	22.79	22387.40	344.58	2.58	2.58	0.00	0.00	0.00	0.00	23.26	15.72	0.86	2.58	0.00	0.00	0.00	0.00	2.58	8.25	2.58	0.00	0.00
27	21.50	21.50	23599.91	344.70	2.70	2.76	0.00	0.00	0.00	0.00	27.17	16.55	0.92	2.76	0.00	0.00	0.00	0.00	2.76	8.49	2.76	0.00	0.00
28	20.22	20.22	24724.29	344.80	2.80	2.91	0.00	0.00	0.00	0.00	30.90	17.28	0.97	2.91	0.00	0.00	0.00	0.00	2.91	8.71	2.91	0.00	0.00
29	19.02	19.02	25762.88	344.90	2.90	3.04	0.00	0.00	0.00	0.00	34.45	17.92	1.01	3.04	0.00	0.00	0.00	0.00	3.04	8.90	3.04	0.00	0.00
30	17.89	17.89	26721.44	344.99	2.99	3.16	0.00	0.00	0.00	0.00	37.80	18.48	1.05	3.16	0.00	0.00	0.00	0.00	3.16	9.08	3.16	0.00	0.00
31	16.82	16.82	27605.23	345.07	3.07	3.26	0.00	0.00	0.00	0.00	40.95	19.98	1.09	3.26	0.00	0.00	0.00	0.00	3.26	9.23	3.26	0.00	0.00
32	15.82	15.82	28419.12	345.15	3.15	3.35	0.00	0.00	0.00	0.00	43.89	19.42	1.12	3.35	0.00	0.00	0.00	0.00	3.35	9.37	3.35	0.00	0.00
33	14.88	14.88	29167.59	345.22	3.22	3.43	0.00	0.00	0.00	0.00	46.63	19.82	1.14	3.43	0.00	0.00	0.00	0.00	3.43	9.50	3.43	0.00	0.00
34	14.00	14.00	29854.80	345.28	3.28	3.50	0.00	0.00	0.00	0.00	49.17	20.17	1.17	3.50	0.00	0.00	0.00	0.00	3.50	9.61	3.50	0.00	0.00
35	13.17	13.17	30494.65	345.33	3.33	3.56	0.00	0.00	0.00	0.00	51.53	20.49	1.19	3.56	0.00	0.00	0.00	0.00	3.56	9.71	3.56	0.00	0.00
36	12.38	12.38	31060.73	345.39	3.39	3.62	0.00	0.00	0.00	0.00	53.70	20.77	1.21	3.62	0.00	0.00	0.00	0.00	3.62	9.80	3.62	0.00	0.00
37	11.65	11.65	31586.43	345.43	3.43	3.67	0.00	0.00	0.00	0.00	55.70	21.03	1.22	3.67	0.00	0.00	0.00	0.00	3.67	9.88	3.67	0.00	0.00
38	10.96	10.96	32064.91	345.47	3.47	3.72	0.00	0.00	0.00	0.00	57.53	21.26	1.24	3.72	0.00	0.00	0.00	0.00	3.72	9.96	3.72	0.00	0.00
39	10.30	10.30	32499.11	345.51	3.51	3.76	0.00	0.00	0.00	0.00	59.20	21.46	1.25	3.76	0.00	0.00	0.00	0.00	3.76	10.02	3.76	0.00	0.00
40	9.69	9.69	32891.79	345.55	3.55	3.80	0.00	0.00	0.00	0.00	60.72	21.64	1.27	3.80	0.00	0.00	0.00	0.00	3.80	10.08	3.80	0.00	0.00
41	9.12	9.12	33245.54	345.58	3.58	3.83	0.00	0.00	0.00	0.00	62.09	21.80	1.28	3.83	0.00	0.00	0.00	0.00	3.83	10.14	3.83	0.00	0.00
42	8.57	8.57	33562.80	345.61	3.61	3.86	0.00	0.00	0.00	0.00	63.33	21.95	1.29	3.86	0.00	0.00	0.00	0.00	3.86	10.18	3.86	0.00	0.00
43	8.06	8.06	33845.82	345.63	3.63	3.88	0.00	0.00	0.00	0.00	64.43	22.07	1.29	3.88	0.00	0.00	0.00	0.00	3.88	10.23	3.88	0.00	0.00
44	7.58	7.58	34096.75	345.65	3.65	3.90	0.00	0.00	0.00	0.00	65.41	22.19	1.30	3.90	0.00	0.00	0.00	0.00	3.90	10.26	3.90	0.00	0.00
45	7.13	7.13	34317.59	345.67	3.67	3.92	0.00	0.00	0.00	0.00	66.28	22.28	1.31	3.92	0.00	0.00	0.00	0.00	3.92	10.29	3.92	0.00	0.00
46	6.71	6.71	34510.21	345.69	3.69	3.94	0.00	0.00	0.00	0.00	67.00	22.37	1.31	3.94	0.00	0.00	0.00	0.00	3.94	10.32	3.94	0.00	0.00
47	6.31	6.31	34676.37	345.70	3.70	3.96	0.00	0.00	0.00	0.00	67.70	22.44	1.32	3.96	0.00	0.00	0.00	0.00	3.96	10.35	3.96	0.00	0.00
48	5.94	5.94	34817.74	345.71	3.71	3.97	0.00	0.00	0.00	0.00	68.25	22.50	1.32	3.97	0.00	0.00	0.00	0.00	3.97	10.37	3.97	0.00	0.00
49	5.58	5.58	34935.87	345.72	3.72	3.98	0.00	0.00	0.00	0.00	68.72	22.55	1.33	3.98	0.00	0.00	0.00	0.00	3.98	10.38	3.98	0.00	0.00
50	5.25	5.25	35032.22	345.73	3.73	3.99	0.00	0.00	0.00	0.00	69.10	22.59	1.33	3.99	0.00	0.00	0.00	0.00	3.99	10.40	3.99	0.00	0.00
51	4.94	4.94	35108.16	345.74	3.74	3.99	0.00	0.00	0.00	0.00	69.40	22.63	1.33	3.99	0.00	0.00	0.00	0.00	3.99	10.41	3.99	0.00	0.00
52	4.65	4.65	35164.99	345.74	3.74	4.00	0.00	0.00	0.00	0.00	69.63	22.65	1.34	4.00	0.00	0.00	0.00	0.00	4.00	10.42	4.00	0.00	0.00
53	4.37	4.37	35203.91	345.75	3.75	4.00	0.00	0.00	0.00	0.00	69.78												

60	2.85	2.85	35062.53	345.73	3.73	3.99	0.00	0.00	0.00	0.00	69.22	22.61	1.33	3.99	0.00	0.00	0.00	3.99	10.40	3.99	0.00
61	2.68	2.68	34993.96	345.73	3.73	3.98	0.00	0.00	0.00	0.00	68.95	22.58	1.33	3.98	0.00	0.00	0.00	3.98	10.39	3.98	0.00
62	2.52	2.52	34915.59	345.72	3.72	3.98	0.00	0.00	0.00	0.00	68.64	22.54	1.33	3.98	0.00	0.00	0.00	3.98	10.38	3.98	0.00
63	2.37	2.37	34828.09	345.71	3.71	3.97	0.00	0.00	0.00	0.00	68.29	22.51	1.32	3.97	0.00	0.00	0.00	3.97	10.37	3.97	0.00
64	2.23	2.23	34732.06	345.71	3.71	3.96	0.00	0.00	0.00	0.00	67.92	22.46	1.32	3.96	0.00	0.00	0.00	3.96	10.35	3.96	0.00
65	2.09	2.09	34628.08	345.70	3.70	3.95	0.00	0.00	0.00	0.00	67.51	22.42	1.32	3.95	0.00	0.00	0.00	3.95	10.34	3.95	0.00
66	1.97	1.97	34516.70	345.69	3.69	3.94	0.00	0.00	0.00	0.00	67.07	22.37	1.31	3.94	0.00	0.00	0.00	3.94	10.32	3.94	0.00
67	1.85	1.85	34398.43	345.68	3.68	3.93	0.00	0.00	0.00	0.00	66.60	22.32	1.31	3.93	0.00	0.00	0.00	3.93	10.31	3.93	0.00
68	1.74	1.74	34273.76	345.67	3.67	3.92	0.00	0.00	0.00	0.00	66.11	22.26	1.31	3.92	0.00	0.00	0.00	3.92	10.29	3.92	0.00
69	1.64	1.64	34143.13	345.66	3.66	3.91	0.00	0.00	0.00	0.00	65.60	22.21	1.30	3.91	0.00	0.00	0.00	3.91	10.27	3.91	0.00
70	1.54	1.54	34006.98	345.64	3.64	3.90	0.00	0.00	0.00	0.00	65.06	22.15	1.30	3.90	0.00	0.00	0.00	3.90	10.25	3.90	0.00
71	1.45	1.45	33865.71	345.63	3.63	3.88	0.00	0.00	0.00	0.00	64.51	22.08	1.29	3.88	0.00	0.00	0.00	3.88	10.23	3.88	0.00
72	1.36	1.36	33719.69	345.62	3.62	3.87	0.00	0.00	0.00	0.00	63.94	22.02	1.29	3.87	0.00	0.00	0.00	3.87	10.21	3.87	0.00
73	1.28	1.28	33569.28	345.61	3.61	3.86	0.00	0.00	0.00	0.00	63.35	21.95	1.29	3.86	0.00	0.00	0.00	3.86	10.19	3.86	0.00
74	1.21	1.21	33414.81	345.59	3.59	3.84	0.00	0.00	0.00	0.00	62.75	21.88	1.28	3.84	0.00	0.00	0.00	3.84	10.16	3.84	0.00
75	1.13	1.13	33256.60	345.58	3.58	3.83	0.00	0.00	0.00	0.00	62.13	21.81	1.28	3.83	0.00	0.00	0.00	3.83	10.14	3.83	0.00
76	1.07	1.07	33094.95	345.56	3.56	3.81	0.00	0.00	0.00	0.00	61.50	21.73	1.27	3.81	0.00	0.00	0.00	3.81	10.11	3.81	0.00
77	1.00	1.00	32930.14	345.55	3.55	3.80	0.00	0.00	0.00	0.00	60.87	21.66	1.27	3.80	0.00	0.00	0.00	3.80	10.09	3.80	0.00
78	0.94	0.94	32762.42	345.54	3.54	3.78	0.00	0.00	0.00	0.00	60.22	21.58	1.26	3.78	0.00	0.00	0.00	3.78	10.06	3.78	0.00
79	0.89	0.89	32592.05	345.52	3.52	3.77	0.00	0.00	0.00	0.00	59.56	21.50	1.26	3.77	0.00	0.00	0.00	3.77	10.04	3.77	0.00
80	0.84	0.84	32419.26	345.51	3.51	3.75	0.00	0.00	0.00	0.00	58.89	21.42	1.25	3.75	0.00	0.00	0.00	3.75	10.01	3.75	0.00
81	0.79	0.79	32244.27	345.49	3.49	3.74	0.00	0.00	0.00	0.00	58.22	21.34	1.25	3.74	0.00	0.00	0.00	3.74	9.99	3.74	0.00
82	0.74	0.74	32067.28	345.47	3.47	3.72	0.00	0.00	0.00	0.00	57.54	21.26	1.24	3.72	0.00	0.00	0.00	3.72	9.96	3.72	0.00
83	0.70	0.70	31888.49	345.46	3.46	3.70	0.00	0.00	0.00	0.00	56.85	21.17	1.23	3.70	0.00	0.00	0.00	3.70	9.93	3.70	0.00
84	0.65	0.65	31708.08	345.44	3.44	3.68	0.00	0.00	0.00	0.00	56.16	21.09	1.23	3.68	0.00	0.00	0.00	3.68	9.90	3.68	0.00
85	0.62	0.62	31526.23	345.43	3.43	3.67	0.00	0.00	0.00	0.00	55.47	21.00	1.22	3.67	0.00	0.00	0.00	3.67	9.88	3.67	0.00
86	0.58	0.58	31343.10	345.41	3.41	3.65	0.00	0.00	0.00	0.00	54.77	20.91	1.22	3.65	0.00	0.00	0.00	3.65	9.85	3.65	0.00
87	0.54	0.54	31158.83	345.39	3.39	3.63	0.00	0.00	0.00	0.00	54.07	20.82	1.21	3.63	0.00	0.00	0.00	3.63	9.82	3.63	0.00
88	0.51	0.51	30973.58	345.38	3.38	3.61	0.00	0.00	0.00	0.00	53.37	20.73	1.20	3.61	0.00	0.00	0.00	3.61	9.79	3.61	0.00
89	0.48	0.48	30787.49	345.36	3.36	3.59	0.00	0.00	0.00	0.00	52.67	20.64	1.20	3.59	0.00	0.00	0.00	3.59	9.76	3.59	0.00
90	0.45	0.45	30600.66	345.35	3.35	3.58	0.00	0.00	0.00	0.00	51.97	20.55	1.19	3.58	0.00	0.00	0.00	3.58	9.73	3.58	0.00
91	0.43	0.43	30413.24	345.33	3.33	3.56	0.00	0.00	0.00	0.00	51.26	20.45	1.19	3.56	0.00	0.00	0.00	3.56	9.70	3.56	0.00
92	0.40	0.40	30225.33	345.31	3.31	3.54	0.00	0.00	0.00	0.00	50.56	20.36	1.18	3.54	0.00	0.00	0.00	3.54	9.67	3.54	0.00
93	0.38	0.38	30037.04	345.29	3.29	3.52	0.00	0.00	0.00	0.00	49.85	20.26	1.17	3.52	0.00	0.00	0.00	3.52	9.64	3.52	0.00
94	0.35	0.35	29848.46	345.28	3.28	3.50	0.00	0.00	0.00	0.00	49.15	20.17	1.17	3.50	0.00	0.00	0.00	3.50	9.61	3.50	0.00
95	0.33	0.33	29659.72	345.26	3.26	3.48	0.00	0.00	0.00	0.00	48.45	20.07	1.16	3.48	0.00	0.00	0.00	3.48	9.58	3.48	0.00
96	0.31	0.31	29470.88	345.24	3.24	3.46	0.00	0.00	0.00	0.00	47.75	19.98	1.15	3.46	0.00	0.00	0.00	3.46	9.55	3.46	0.00
97	0.29	0.29	29282.02	345.23	3.23	3.44	0.00	0.00	0.00	0.00	47.05	19.88	1.15	3.44	0.00	0.00	0.00	3.44	9.52	3.44	0.00
98	0.28	0.28	29093.23	345.21	3.21	3.42	0.00	0.00	0.00	0.00	46.35	19.78	1.14	3.42	0.00	0.00	0.00	3.42	9.48	3.42	0.00
99	0.26	0.26	28904.59	345.19	3.19	3.40	0.00	0.00	0.00	0.00	45.66	19.68	1.13	3.40	0.00	0.00	0.00	3.40	9.45	3.40	0.00
100	0.25	0.25	28716.16	345.18	3.18	3.38	0.00	0.00	0.00	0.00	44.97	19.58	1.13	3.38	0.00	0.00	0.00	3.38	9.42	3.38	0.00
101	0.23	0.23	28528.02	345.16	3.16	3.36	0.00	0.00	0.00	0.00	44.28	19.48	1.12	3.36	0.00	0.00	0.00	3.36	9.39	3.36	0.00
102	0.22	0.22	28340.22	345.14	3.14	3.34	0.00	0.00	0.00	0.00	43.60	19.38	1.11	3.34	0.00	0.00	0.00	3.34	9.36	3.34	0.00
103	0.20	0.20	28152.83	345.12	3.12	3.32	0.00	0.00	0.00	0.00	42.92	19.28	1.11	3.32	0.00	0.00	0.00	3.32	9.33	3.32	0.00
104	0.19	0.19	27965.90	345.11	3.11	3.30	0.00	0.00	0.00	0.00	42.24	19.18	1.10	3.30	0.00	0.00	0.00	3.30	9.29	3.30	0.00
105	0.18	0.18	27779.49	345.09	3.09	3.28	0.00	0.00	0.00	0.00	41.57	19.07	1.09	3.28	0.00	0.00	0.00	3.28	9.26	3.28	0.00
106	0.17	0.17	27593.64	345.07	3.07	3.26	0.00	0.00	0.00	0.00	40.90	18.97	1.09	3.26	0.00	0.00	0.00	3.26	9.23	3.26	0.00
107	0.16	0.16	27408.41	345.06	3.06	3.24	0.00	0.00	0.00	0.00	40.24	18.87	1.08	3.24	0.00	0.00	0.00	3.24	9.20	3.24	0.00
108	0.15	0.15	27223.83	345.04	3.04	3.21	0.00	0.00	0.00	0.00	39.58	18.76	1.07	3.21	0.00	0.00	0.00	3.21	9.17	3.21	0.00
109	0.14	0.14	27039.96	345.02	3.02	3.19	0.00	0.00	0.00	0.00	38.93	18.66	1.06	3.19	0.00	0.00	0.00	3.19	9.13	3.19	0.00
110	0.13	0.13	26856.82	345.00	3.00	3.17	0.00	0.00	0.00	0.00	38.28	18.56	1.06	3.17	0.00	0.00	0.00	3.17	9.10	3.17	0.00
111	0.13	0.13	26674.46	344.99	2.99	3.15	0.00	0.00	0.00	0.00	37.64	18.45	1.05	3.15	0.00	0.00	0.00	3.15	9.07	3.15	0.00
112	0.12	0.12	26492.92	344.97	2.97	3.13	0.00	0.00	0.00	0.00	37.00	18.35	1.04	3.13	0.00	0.00	0.00	3.13	9.04	3.13	0.00
113	0.11	0.11	26312.22	344.95	2.95	3.11	0.00	0.00	0.00	0.00	36.36	18.24	1.04	3.11	0.00	0.00	0.00	3.11	9.00	3.11	0.00
114	0.10	0.10	26132.40	344.94	2.94	3.09	0.00	0.00	0.00	0.00	35.74	18.14	1.03	3.09	0.00	0.00	0.00	3.09	8.97	3.09	0.00
115	0.10	0.10	25953.50	344.92	2.92	3.06	0.00	0.00	0.00	0.00	35.11	18.03	1.02	3.06	0.00	0.00	0.00	3.06	8.94	3.06	0.00
116	0.09	0.09	25775.53	344.90	2.90	3.04	0.00	0.00	0.00	0.00	34.50	17.92	1.01	3.04	0.00	0.00	0.00	3.04	8.91	3.04	0.00
117	0.09	0.09	25598.52	344.89	2.89	3.02	0.00	0.00	0.00	0.00	33.89	17.82	1.01	3.02	0.00	0.00	0.00	3.02	8.87	3.02	0.00
118	0.08	0.08	25422.51	344.87	2.87	3.00	0.00	0.00	0.00	0.00	33.28	17.71	1.00	3.00	0.00	0.00</					

Waterworks

Pond Routing



Waterworks			
Routing Table (using HRM's "Chainsaw" method)			
Qp (cfs) =	31.55	100-yr	
TP (min) =	28.8		
dT (min) =	3	Suggested Time Increment (TP/10)	
dT (min) =	1	Selected Time Increment	
b	2.346E-03		
c1	1.375E-04		
c2	-1.255E-09	4th order polynomial coefficients	
c3	1.291E-14	used to estimate stage	
c4	-6.921E-20		
Ref. Ele. =	342	(Perm Pool)	
Results:			
Max. Total Outflow	14.87	cfs	
Max WQ Risers	-	cfs	
Max Peak Redux Orifice	4.90	cfs	
Max Primary Riser	7.07	cfs	
Max. Emer. Weir Outflow	11.26	cfs	
Max. Water Surf. Ele.	346.74	ft	
Max. Stage:	4.74	ft	
Max. Storage:	47,612	cu ft	

Structure Data											
Circular Orifice 1 (WQ) not used				Peak Reduction Orifice 3 ea				Primary Rec Riser & Cir Barrel			
Riser:		Barrel:		Riser:		Barrel:		Rect Riser:		Barrel:	
Dia. (in)	24	Dia. (in)	2	Dia. (in)	24	Dia. (in)	6	Width (in)	48.00	Dia. (in)	15
Inv Ele. (ft)	1000	Invert (ft)	1000	Inv Ele. (ft)	343.5	Invert (ft)	343.5	Top Ele. (ft)	346.50	Invert (ft)	342.00
Cw	3.3	Cd	0.6	Cw	3.3	Cd	0.6	Cw	3.3	Cd	0.6
Cd	0.6			Cd	0.6			Cd	0.6		
Weir Equation: Q = Cw*L*H ^{3/2} (3/2)				Weir Equation: Q = Cw*L*H ^{3/2} (1/2)				Weir Equation: Q = Cw*L*H ^{3/2} (3/2)			
Orifice Equation: Q = Cd*A*(2*g*h) ^{1/2} (1/2)				Orifice Equation: Q = Cd*A*(2*g*h) ^{1/2} (1/2)				Orifice Equation: Q = Cd*A*(2*g*h) ^{1/2} (1/2)			

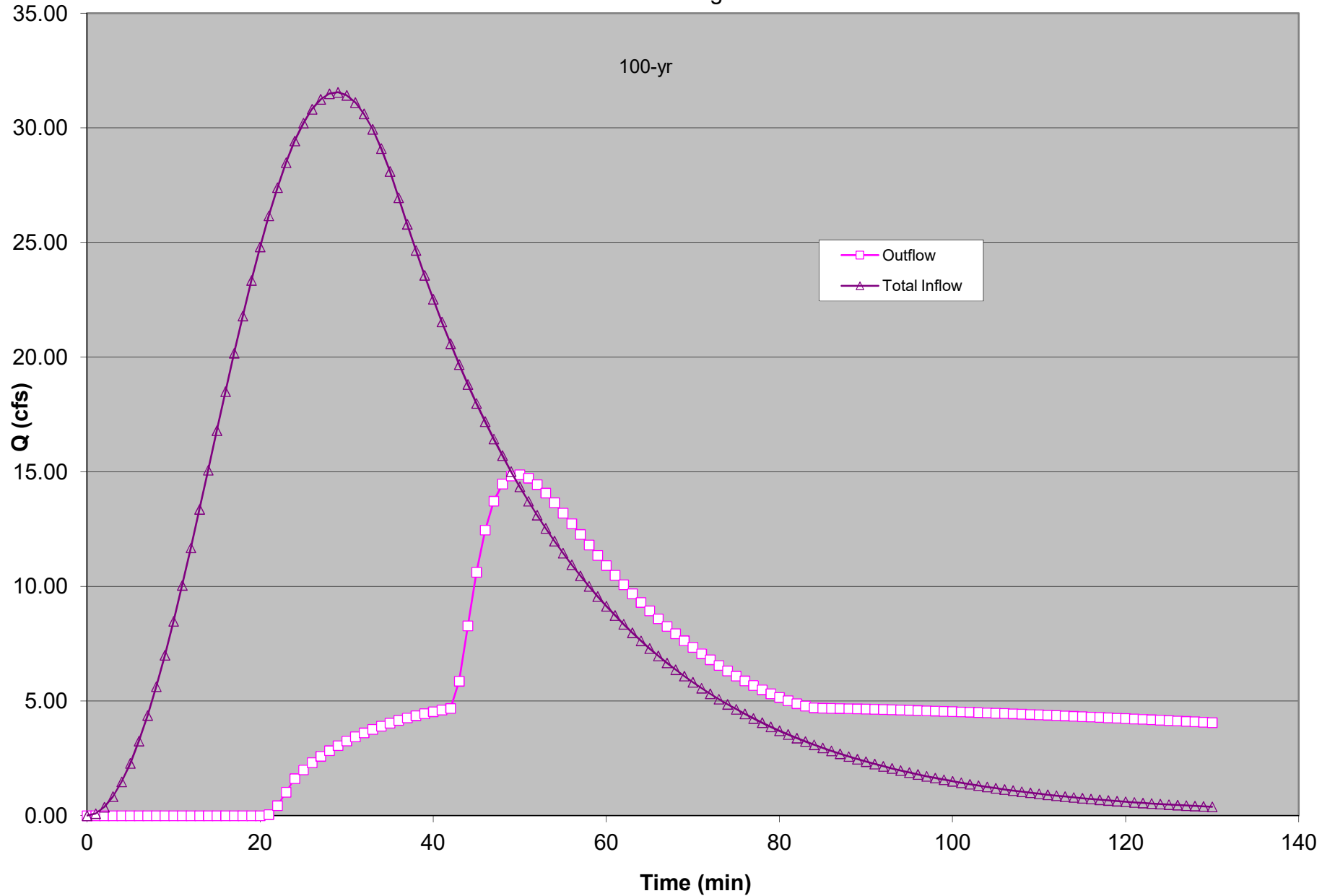
*NOTE: Check Primary Riser Barrel to ensure total outflow is always less than or equal to Primary Barrel flow.

Routing Table:						Computed Outflow Data:																	
Time	R.O. Inflow		Total Inflow	Storage	Wtr Surf. Ele	Stage	Outflow*	Circular 1 (WQ)				Peak Reduction Orifice 3 ea				Rectangular Riser Primary				Riser Intakes	Barrel†	Control	Emergency Weir
(min)	(cfs)	(cfs)	(cf)	(ft)	(ft)	(cfs)	Riser (weir)	Riser (orifice)	Barrel	Control	Riser (weir)	Riser (orifice)	Barrel	Control (t/3)	Riser (weir)	Riser (orifice)	Control						
0	0.00	0.00	0.00		342.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.09	0.09	0.00		342.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.37	0.37	0.00		342.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.84	0.84		28.03	342.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	1.48	1.48		78.21	342.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
5	2.29	2.29		166.79	342.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
6	3.26	3.26		303.97	342.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
7	4.38	4.38		499.35	342.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00
8	5.63	5.63		761.85	342.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00
9	7.00	7.00		1099.60	342.15	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00
10	8.48	8.48		1519.82	342.21	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00
11	10.05	10.05		2028.77	342.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.00
12	11.68	11.68		2631.63	342.36	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00
13	13.36	13.36		3332.49	342.45	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
14	15.07	15.07		4134.26	342.55	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.00	0.00
15	16.79	16.79		5038.66	342.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.00	0.00
16	18.50	18.50		6046.20	342.79	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.35	0.00	0.00
17	20.17	20.17		7156.14	342.93	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.99	0.00	0.00
18	21.80	21.80		8366.54	343.07	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.72	0.00	0.00
19	23.35	23.35		9674.28	343.23	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.55	0.00	0.00
20	24.81	24.81		11075.05	343.39	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.15	0.00	0.00
21	26.16	26.16		12563.47	343.56	1.56	0.05	0.00	0.00	0.00	0.00	3.58	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.05	6.69	0.05	0.00
22	27.39	27.39		14129.91	343.73	1.73	0.44	0.00	0.00	0.00	0.00	2.27	7.23	0.15	0.44	0.00	0.00	0.00	0.00	0.44	6.20	0.44	0.00
23	28.48	28.48		15746.98	343.90	1.90	1.03	0.00	0.00	0.00	0.00	5.30	9.60	0.34	1.03	0.00	0.00	0.00	0.00	1.03	6.67	1.03	0.00
24	29.42	29.42		17394.29	344.08	2.08	1.62	0.00	0.00	0.00	0.00	9.07	11.48	0.54	1.62	0.00	0.00	0.00	0.00	1.62	7.11	1.62	0.00
25	30.20	30.20		19062.66	344.25	2.25	2.00	0.00	0.00	0.00	0.00	13.42	13.08	0.67	2.00	0.00	0.00	0.00	0.00	2.00	7.52	2.00	0.00
26	30.81	30.81		20754.92	344.42	2.42	2.32	0.00	0.00	0.00	0.00	18.26	14.50	0.77	2.32	0.00	0.00	0.00	0.00	2.32	7.90	2.32	0.00
27	31.24	31.24		22464.65	344.59	2.59	2.59	0.00	0.00	0.00	0.00	23.51	15.77	0.86	2.59	0.00	0.00	0.00	0.00	2.59	8.26	2.59	0.00
28	31.49	31.49		24183.61	344.75	2.75	2.84	0.00	0.00	0.00	0.00	29.09	16.93	0.95	2.84	0.00	0.00	0.00	0.00	2.84	8.61	2.84	0.00
29	31.55	31.55		25902.59	344.92	2.92	3.06	0.00	0.00	0.00	0.00	34.94	18.00	1.02	3.06	0.00	0.00	0.00	0.00	3.06	8.93	3.06	0.00
30	31.42	31.42		27611.83	345.07	3.07	3.26	0.00	0.00	0.00	0.00	40.97	18.98	1.09	3.26	0.00	0.00	0.00	0.00	3.26	9.23	3.26	0.00
31	31.10	31.10		29301.30	345.23	3.23	3.44	0.00	0.00	0.00	0.00	47.12	19.89	1.15	3.44	0.00	0.00	0.00	0.00	3.44	9.52	3.44	0.00
32	30.61	30.61		30960.89	345.38	3.38	3.61	0.00	0.00	0.00	0.00	53.32	20.72	1.20	3.61	0.00	0.00	0.00	0.00	3.61	9.79	3.61	0.00
33	29.93	29.93		32580.58	345.52	3.52	3.77	0.00	0.00	0.00	0.00	59.51	21.50	1.26	3.77	0.00	0.00	0.00	0.00	3.77	10.04	3.77	0.00
34	29.09	29.09		34150.65	345.66	3.66	3.91	0.00	0.00	0.00	0.00	65.63	22.21	1.30	3.91	0.00	0.00	0.00	0.00	3.91	10.27	3.91	0.00
35	28.10	28.10		35661.78	345.78	3.78	4.04	0.00	0.00	0.00	0.00	71.60	22.86	1.35	4.04	0.00	0.00	0.00	0.00	4.04	10.49	4.04	0.00
36	26.95	26.95		37105.19	345.91	3.91	4.16	0.00	0.00	0.00	0.00	77.39	23.46	1.39	4.16	0.00	0.00	0.00	0.00	4.16	10.69	4.16	0.00
37	25.79	25.79		38472.78	346.02	4.02	4.27	0.00	0.00	0.00	0.00	82.94	24.01	1.42	4.27	0.00	0.00	0.00	0.00	4.27	10.87	4.27	0.00
38	24.66	24.66		39764.45	346.13	4.13	4.36	0.00	0.00	0.00	0.00	88.22	24.51	1.45	4.36	0.00	0.00	0.00	0.00	4.36	11.04	4.36	0.00
39	23.57	23.57		40981.93	346.22	4.22	4.45	0.00	0.00	0.00	0.00	93.25	24.97	1.48	4.45	0.00	0.00	0.00	0.00	4.45	11.19	4.45	0.00
40	22.53	22.53		42128.76	346.32	4.32	4.54	0.00	0.00	0.00	0.00	98.01	25.39	1.51	4.54	0.00	0.00	0.00	0.00	4.54	11.34	4.54	0.00
41	21.54	21.54		43208.29	346.40	4.40	4.61	0.00	0.00	0.00	0.00	102.53	25.77	1.54	4.61	0.00	0.00	0.00	0.00	4.61	11.47	4.61	0.00
42	20.59	20.59		44223.68	346.48	4.48	4.68	0.00	0.00	0.00	0.00	106.79	26.12	1.56	4.68	0.00	0.00	0.00	0.00	4.68	11.59	4.68	0.00
43	19.68	19.68		45177.94	346.56	4.56	4.87	0.00	0.00	0.00	0.00	110.81	26.45	1.58	4.74	0.00	0.00	0.00	0.00	4.74	11.70	4.74	0.00
44	18.81	18.81		46006.63	346.62	4.62	4.88	0.00	0.00	0.00	0.00	114.32	26.72	1.60	4.80	2.22	26.79	2.22	7.02	11.79	7.02	1.26	
45	17.98	17.98		46638.31	346.67	4.67	4.90	0.00	0.00	0.00	0.00	117.00	26.86	1.61	4.84	2.68	31.72	2.68	8.52	11.86	8.52	2.09	
46	17.19	17.19		47080.02	346.70	4.70	12.46	0.00	0.00	0.00	0.00	118.88	27.07	1.62	4.87	4.84	34.74	4.84	9.71	11.91	9.71	2.75	
47	16.43	16.43		47363.77	346.72	4.72	13.72	0.00	0.00	0.00	0.00	120.08	27.16	1.63	4.88	5.63	36.54	5.63	10.52	11.95	10.52	3.20	
48	15.70	15.70		47526.36	346.74	4.74	14.47	0.00	0.00	0.00	0.00	120.77	27.22	1.63	4.89	6.10	37.53	6.10	11.00	11.96	11.00	3.47	
49	15.01	15.01		47600.54	346.74	4.74	14.81	0.00	0.00	0.00	0.00	121.09	27.24	1.63	4.90	6.32	37.97	6.32	11.22	11.97	11.22	3.59	
50	14.35	14.35		47612.29	346.74	4.74	14.87	0.00	0.00	0.00	0.00	121.14	27.24	1.63	4.90	6.36	38.04	6.36	11.26	11.97	11.26	3.61	
51	13.72	13.72		47580.98	346.74	4.74	14.72	0.00	0.00	0.00	0.00	121.91	27.23	1.63	4.90	6.27	37.86	6.27	10.95	11.97	10.95	3.56	
52	13.11	13.11		47520.55	346.74	4.74	14.49	0.00	0.00	0.00	0.00	120.75	27.21	1.63	4.89	6.09	37.62	6.09	10.71	11.98	10.71	3.48	
53	12.53	12.53		47440.78	346.73	4.73	14.07	0.00	0.00	0.00	0.00	120.41	27.19	1.63	4.89	5.85	37.01	5.85	10.74	11.95	10.74	3.33	
54	11.98	11.98		47348.48	346.72	4.72	13.65	0.00	0.00	0.00	0.00	120.02	27.16	1.63	4.88	5.59	36.44						

60		9.14	9.14	46712.04	346.68	4.68	10.91	0.00	0.00	0.00	0.00	117.31	26.95	1.61	4.84	3.87	32.24	3.87	8.71	11.87	8.71	2.20
61		8.74	8.74	46605.54	346.67	4.67	10.49	0.00	0.00	0.00	0.00	116.86	26.92	1.61	4.84	3.60	31.48	3.60	8.44	11.86	8.44	2.05
62		8.35	8.35	46500.42	346.66	4.66	10.08	0.00	0.00	0.00	0.00	116.41	26.89	1.61	4.83	3.35	30.71	3.35	8.18	11.85	8.18	1.90
63		7.98	7.98	46396.84	346.65	4.65	9.68	0.00	0.00	0.00	0.00	115.97	26.85	1.61	4.82	3.10	29.94	3.10	7.92	11.84	7.92	1.76
64		7.63	7.63	46294.89	346.64	4.64	9.30	0.00	0.00	0.00	0.00	115.54	26.82	1.61	4.82	2.86	29.15	2.86	7.68	11.83	7.68	1.62
65		7.29	7.29	46194.60	346.64	4.64	8.94	0.00	0.00	0.00	0.00	115.12	26.79	1.60	4.81	2.63	28.35	2.63	7.44	11.81	7.44	1.50
66		6.97	6.97	46095.96	346.63	4.63	8.59	0.00	0.00	0.00	0.00	114.70	26.75	1.60	4.80	2.41	27.54	2.41	7.22	11.80	7.22	1.37
67		6.66	6.66	45998.94	346.62	4.62	8.25	0.00	0.00	0.00	0.00	114.29	26.72	1.60	4.80	2.20	26.73	2.20	7.00	11.79	7.00	1.25
68		6.37	6.37	45903.47	346.61	4.61	7.94	0.00	0.00	0.00	0.00	113.88	26.69	1.60	4.79	2.01	25.90	2.01	6.80	11.78	6.80	1.14
69		6.09	6.09	45809.44	346.61	4.61	7.63	0.00	0.00	0.00	0.00	113.49	26.66	1.60	4.79	1.82	25.08	1.82	6.60	11.77	6.60	1.03
70		5.82	5.82	45716.87	346.60	4.60	7.34	0.00	0.00	0.00	0.00	113.09	26.63	1.59	4.78	1.63	24.19	1.63	6.41	11.76	6.41	0.93
71		5.56	5.56	45625.56	346.59	4.59	7.07	0.00	0.00	0.00	0.00	112.71	26.60	1.59	4.77	1.46	23.31	1.46	6.24	11.75	6.24	0.83
72		5.32	5.32	45535.42	346.58	4.58	6.80	0.00	0.00	0.00	0.00	112.33	26.57	1.59	4.77	1.30	22.40	1.30	6.07	11.74	6.07	0.74
73		5.08	5.08	45446.34	346.58	4.58	6.55	0.00	0.00	0.00	0.00	111.95	26.54	1.59	4.76	1.14	21.47	1.14	5.90	11.73	5.90	0.65
74		4.86	4.86	45358.17	346.57	4.57	6.32	0.00	0.00	0.00	0.00	111.58	26.51	1.59	4.76	0.99	20.50	0.99	5.75	11.72	5.75	0.57
75		4.64	4.64	45270.76	346.56	4.56	6.09	0.00	0.00	0.00	0.00	111.21	26.48	1.58	4.75	0.86	19.49	0.86	5.61	11.71	5.61	0.49
76		4.44	4.44	45183.97	346.56	4.56	5.88	0.00	0.00	0.00	0.00	110.84	26.45	1.58	4.74	0.72	18.44	0.72	5.47	11.70	5.47	0.41
77		4.24	4.24	45097.58	346.55	4.55	5.68	0.00	0.00	0.00	0.00	110.48	26.42	1.58	4.74	0.60	17.32	0.60	5.34	11.69	5.34	0.34
78		4.06	4.06	45011.40	346.54	4.54	5.49	0.00	0.00	0.00	0.00	110.11	26.39	1.58	4.73	0.49	16.14	0.49	5.22	11.68	5.22	0.28
79		3.88	3.88	44925.18	346.54	4.54	5.32	0.00	0.00	0.00	0.00	109.75	26.36	1.58	4.73	0.38	14.85	0.38	5.11	11.67	5.11	0.21
80		3.71	3.71	44838.63	346.53	4.53	5.16	0.00	0.00	0.00	0.00	109.38	26.33	1.57	4.72	0.28	13.43	0.28	5.00	11.66	5.00	0.16
81		3.54	3.54	44751.39	346.52	4.52	5.02	0.00	0.00	0.00	0.00	109.01	26.30	1.57	4.72	0.19	11.84	0.19	4.91	11.65	4.91	0.11
82		3.39	3.39	44663.00	346.52	4.52	4.89	0.00	0.00	0.00	0.00	108.64	26.27	1.57	4.71	0.11	9.96	0.11	4.82	11.64	4.82	0.06
83		3.24	3.24	44572.88	346.51	4.51	4.78	0.00	0.00	0.00	0.00	108.26	26.24	1.57	4.70	0.05	7.58	0.05	4.75	11.63	4.75	0.03
84		3.09	3.09	44480.16	346.50	4.50	4.71	0.00	0.00	0.00	0.00	107.87	26.21	1.57	4.70	0.01	3.80	0.01	4.70	11.62	4.70	0.00
85		2.96	2.96	44383.37	346.49	4.49	4.69	0.00	0.00	0.00	0.00	107.46	26.18	1.56	4.69	0.00	0.00	0.00	4.69	11.61	4.69	0.00
86		2.83	2.83	44279.38	346.49	4.49	4.68	0.00	0.00	0.00	0.00	107.03	26.14	1.56	4.68	0.00	0.00	0.00	4.68	11.59	4.68	0.00
87		2.70	2.70	44167.97	346.48	4.48	4.68	0.00	0.00	0.00	0.00	106.56	26.10	1.56	4.68	0.00	0.00	0.00	4.68	11.58	4.68	0.00
88		2.58	2.58	44049.53	346.47	4.47	4.67	0.00	0.00	0.00	0.00	106.06	26.06	1.56	4.67	0.00	0.00	0.00	4.67	11.57	4.67	0.00
89		2.47	2.47	43924.41	346.46	4.46	4.66	0.00	0.00	0.00	0.00	105.53	26.02	1.55	4.66	0.00	0.00	0.00	4.66	11.55	4.66	0.00
90		2.36	2.36	43792.96	346.45	4.45	4.65	0.00	0.00	0.00	0.00	104.98	25.97	1.55	4.65	0.00	0.00	0.00	4.65	11.54	4.65	0.00
91		2.26	2.26	43655.51	346.44	4.44	4.64	0.00	0.00	0.00	0.00	104.40	25.93	1.55	4.64	0.00	0.00	0.00	4.64	11.52	4.64	0.00
92		2.16	2.16	43512.37	346.43	4.43	4.63	0.00	0.00	0.00	0.00	103.80	25.88	1.54	4.63	0.00	0.00	0.00	4.63	11.50	4.63	0.00
93		2.06	2.06	43363.84	346.41	4.41	4.62	0.00	0.00	0.00	0.00	103.18	25.83	1.54	4.62	0.00	0.00	0.00	4.62	11.48	4.62	0.00
94		1.97	1.97	43210.21	346.40	4.40	4.61	0.00	0.00	0.00	0.00	102.53	25.77	1.54	4.61	0.00	0.00	0.00	4.61	11.47	4.61	0.00
95		1.88	1.88	43051.75	346.39	4.39	4.60	0.00	0.00	0.00	0.00	101.87	25.72	1.53	4.60	0.00	0.00	0.00	4.60	11.45	4.60	0.00
96		1.80	1.80	42888.73	346.38	4.38	4.59	0.00	0.00	0.00	0.00	101.19	25.66	1.53	4.59	0.00	0.00	0.00	4.59	11.43	4.59	0.00
97		1.72	1.72	42721.41	346.36	4.36	4.58	0.00	0.00	0.00	0.00	100.49	25.60	1.53	4.58	0.00	0.00	0.00	4.58	11.41	4.58	0.00
98		1.65	1.65	42550.01	346.35	4.35	4.57	0.00	0.00	0.00	0.00	99.77	25.54	1.52	4.57	0.00	0.00	0.00	4.57	11.39	4.57	0.00
99		1.57	1.57	42374.77	346.34	4.34	4.55	0.00	0.00	0.00	0.00	99.04	25.48	1.52	4.55	0.00	0.00	0.00	4.55	11.37	4.55	0.00
100		1.50	1.50	42195.32	346.32	4.32	4.54	0.00	0.00	0.00	0.00	98.29	25.41	1.51	4.54	0.00	0.00	0.00	4.54	11.34	4.54	0.00
101		1.44	1.44	42013.65	346.31	4.31	4.53	0.00	0.00	0.00	0.00	97.53	25.35	1.51	4.53	0.00	0.00	0.00	4.53	11.32	4.53	0.00
102		1.37	1.37	41828.18	346.29	4.29	4.52	0.00	0.00	0.00	0.00	96.76	25.28	1.51	4.52	0.00	0.00	0.00	4.52	11.30	4.52	0.00
103		1.31	1.31	41639.69	346.28	4.28	4.50	0.00	0.00	0.00	0.00	95.98	25.21	1.50	4.50	0.00	0.00	0.00	4.50	11.27	4.50	0.00
104		1.26	1.26	41448.37	346.26	4.26	4.49	0.00	0.00	0.00	0.00	95.18	25.14	1.50	4.49	0.00	0.00	0.00	4.49	11.25	4.49	0.00
105		1.20	1.20	41254.40	346.25	4.25	4.47	0.00	0.00	0.00	0.00	94.38	25.07	1.49	4.47	0.00	0.00	0.00	4.47	11.23	4.47	0.00
106		1.15	1.15	41057.94	346.23	4.23	4.46	0.00	0.00	0.00	0.00	93.56	25.00	1.49	4.46	0.00	0.00	0.00	4.46	11.20	4.46	0.00
107		1.10	1.10	40859.16	346.21	4.21	4.45	0.00	0.00	0.00	0.00	92.74	24.92	1.48	4.45	0.00	0.00	0.00	4.45	11.18	4.45	0.00
108		1.05	1.05	40658.21	346.20	4.20	4.43	0.00	0.00	0.00	0.00	91.91	24.85	1.48	4.43	0.00	0.00	0.00	4.43	11.15	4.43	0.00
109		1.00	1.00	40455.23	346.18	4.18	4.42	0.00	0.00	0.00	0.00	91.07	24.77	1.47	4.42	0.00	0.00	0.00	4.42	11.13	4.42	0.00
110		0.96	0.96	40250.38	346.17	4.17	4.40	0.00	0.00	0.00	0.00	90.22	24.70	1.47	4.40	0.00	0.00	0.00	4.40	11.10	4.40	0.00
111		0.92	0.92	40043.78	346.15	4.15	4.39	0.00	0.00	0.00	0.00	89.37	24.62	1.46	4.39	0.00	0.00	0.00	4.39	11.07	4.39	0.00
112		0.88	0.88	39835.57	346.13	4.13	4.37	0.00	0.00	0.00	0.00	88.52	24.54	1.46	4.37	0.00	0.00	0.00	4.37	11.05	4.37	0.00
113		0.84	0.84	39625.87	346.11	4.11	4.35	0.00	0.00	0.00	0.00	87.65	24.46	1.45	4.35	0.00	0.00	0.00	4.35	11.02	4.35	0.00
114		0.80	0.80	39414.79	346.10	4.10	4.34	0.00	0.00	0.00	0.00	86.79	24.38	1.45	4.34	0.00	0.00	0.00	4.34	10.99	4.34	0.00
115		0.76	0.76	39202.46	346.08	4.08	4.32	0.00	0.00	0.00	0.00	85.92	24.30	1.44	4.32	0.00	0.00	0.00	4.32	10.97	4.32	0.00
116		0.73	0.73	38988.98	346.06	4.06	4.31	0.00	0.00	0.00	0.00	85.04	24.21	1.44	4.31	0.00	0.00	0.00	4.31	10.94	4.31	0.00
117		0.70	0.70	38774.4																		

Waterworks

Pond Routing





United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Moore County, North Carolina



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Custom Soil Resource Report Soil Map



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Moore County, North Carolina
Survey Area Data: Version 20, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 13, 2014—Feb 4, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Bb	Bibb loam, 0 to 2 percent slopes, frequently flooded	2.1	26.2%
CaC	Candor sand, 4 to 12 percent slopes	5.9	73.8%
Totals for Area of Interest		8.0	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

Moore County, North Carolina

Bb—Bibb loam, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 3thx
Elevation: 350 to 660 feet
Mean annual precipitation: 38 to 52 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 210 to 245 days
Farmland classification: Not prime farmland

Map Unit Composition

Bibb, undrained, and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bibb, Undrained

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandy and loamy alluvium

Typical profile

A - 0 to 6 inches: sandy loam
Cg1 - 6 to 60 inches: sandy loam
Cg2 - 60 to 80 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Pelion

Percent of map unit: 4 percent
Landform: Low hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope

Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

CaC—Candor sand, 4 to 12 percent slopes

Map Unit Setting

National map unit symbol: 3thz
Elevation: 160 to 660 feet
Mean annual precipitation: 38 to 52 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 210 to 245 days
Farmland classification: Not prime farmland

Map Unit Composition

Candor and similar soils: 85 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Candor

Setting

Landform: Low hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and loamy marine deposits and/or eolian sands

Typical profile

A - 0 to 8 inches: sand
E - 8 to 26 inches: sand
Bt - 26 to 38 inches: loamy sand
E' - 38 to 62 inches: sand
B't - 62 to 80 inches: sandy clay loam

Properties and qualities

Slope: 4 to 12 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 72 to 78 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s

Custom Soil Resource Report

Hydrologic Soil Group: A

Ecological site: Dry Sandy Backslope Woodland - PROVISIONAL
(F137XY004GA)

Hydric soil rating: No

Minor Components

Bibb, undrained

Percent of map unit: 3 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: Yes

April 11, 2018

Josh Reinke, PE
Ramey Kemp & Associates, Inc.
5808 Faringdon Place, Suite 100
Raleigh, NC 27609

SUBJECT: Driveway Permit— Access to NC 22
Waterworks Development
Permit # Preliminary

Dear Mr. Reinke,

Thank you for submitting the Traffic Impact Analysis for the subject development. The preliminary site plan and traffic impact analysis have been reviewed by District Staff, Division Staff, and Congestion Management in accordance with the Policy on Street and Driveway Access to North Carolina Highways. We have the following comments for the subject access permit.

NC 22 and Reservoir Park Drive/Site Driveway

- We agree with the TIA recommendation to provide site access via a full movement intersection to align with Reservoir Park Drive and provide one ingress and two egress lanes.
- We agree with the TIA recommendation to provide stop control for the site drive.
- We agree with the TIA recommendation to construct an exclusive northbound right-turn lane on NC 22 with 50 feet of storage and appropriate taper.
- We agree with the TIA recommendation to construct an exclusive southbound left-turn lane on NC 22 with 50 feet of storage and appropriate tapers.
- Provide an internal protected stem with a minimum length of 100 feet for the site driveway.

This was recently changed to 75 feet at DOT's request. Also, a left turn lane into Reservoir Park has been added. Kevin Lindsay

NC 22 and Service Driveway

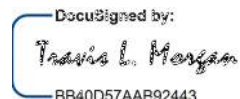
- We agree with the TIA recommendation to provide site access via a full movement intersection and provide one ingress and one egress lane.
- We agree with the TIA recommendation to provide stop control for the service driveway.
- We agree with the TIA recommendation to provide restricted access signage for service vehicles only.
- Provide an internal protected stem with a minimum length of 100 feet for the service driveway.

NC 22 and Airport Road

- Please provide potential roundabout mitigation for the reduction in level of service.

Please incorporate the above comments into your planning. When the above comments have been addressed please submit site plans along with a driveway permit and any necessary encroachment agreements to this office for review. Also, please be aware that future site expansion may result in further roadway improvements being required by the Department. If further information is needed, please advise.

Sincerely,


Travis L. Morgan, PE
District Engineer

TLM:mer

CC: Brandon Jones, PE
David Willett
Josh Brooks, EI
Chris Kennedy
Brent Lockamy, PE
File

Traffic Impact Analysis Waterworks Development Southern Pines, NC



**TRAFFIC IMPACT
ANALYSIS**

FOR

WATERWORKS DEVELOPMENT

LOCATED

IN

SOUTHERN PINES, NORTH CAROLINA

Prepared For:
Ptah, LLC
795 SW Broad Street
Southern Pines, NC

Prepared By:
Ramey Kemp & Associates, Inc.
5808 Faringdon Place, Suite 100
Raleigh, NC 27609
License #C-0910

February 2018

RKA Project No. 17376



Prepared By: SH

Reviewed By: JR

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Appendix B:	Traffic Counts
Appendix C:	Adjacent Development Information
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TRAFFIC IMPACT ANALYSIS
WATERWORKS DEVELOPMENT
SOUTHERN PINES, NORTH CAROLINA

1. INTRODUCTION

The contents of this report present the findings of the Traffic Impact Analysis (TIA) conducted for the proposed Waterworks development to be located east of NC 22 and north of Aiken Road in Southern Pines, North Carolina. The purpose of this study is to determine the potential impacts to the surrounding transportation system created by traffic generated by the proposed development, as well as recommend improvements to mitigate the impacts.

The proposed development, anticipated to be completed in 2019, is assumed to consist of the following uses:

- 5,000 sq. ft. of shopping center
- 14,812 sq. ft. of warehousing
- 5,920 sq. ft. high-turnover sit-down restaurant
- 13,500 sq. ft. of office
- 15 single-family homes
- 7 mid-rise residential units (apartments)

The study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- Existing (2018) Traffic Conditions
- Background (2019) Traffic Conditions
- Combined (2019) Traffic Conditions
- Combined (2028) Traffic Conditions – Per Town’s UDO
- Combined (2038) Traffic Conditions – Per Town’s UDO

1.1. Site Location and Study Area

The development is proposed to be located east of NC 22 and north of Aiken Road in Southern Pines, North Carolina. Refer to Figure 1 for the site location map.

The study area for the TIA was determined through coordination with the North Carolina Department of Transportation (NCDOT) and the Town of Southern Pines (Town) and consists of the following existing intersections:

- NC 22 and Airport Road
- NC 22 and Olivetree Lane
- NC 22 and Mill Creek Road
- Mill Creek Road and Poverty Hill Circle
- NC 22 and Fen Court
- NC 22 and Reservoir Park Drive
- NC 22 and Aiken Road
- NC 22 and Pee Dee Road

1.2. Proposed Land Use and Site Access

The proposed development, anticipated to be completed in 2019, is assumed to consist of the following uses:

- 5,000 sq. ft. of shopping center
- 14,812 sq. ft. of warehousing
- 5,920 sq. ft. high-turnover sit-down restaurant
- 13,500 sq. ft. of office
- 15 single-family homes
- 7 mid-rise residential units

Site access is proposed via two full movement intersections on NC 22. It should be noted the northern site drive will be utilized as a service driveway and the southern site drive will align with the existing roadway of Reservoir Park Drive. Refer to Figure 2 for a copy of the preliminary site plan.

1.3. Adjacent Land Uses

The proposed development is located in an area consisting primarily of undeveloped land and residential development. It should be noted the existing office building on-site will be renovated to be incorporated in the development.

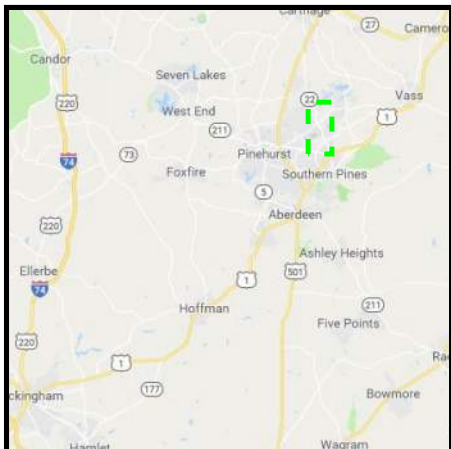
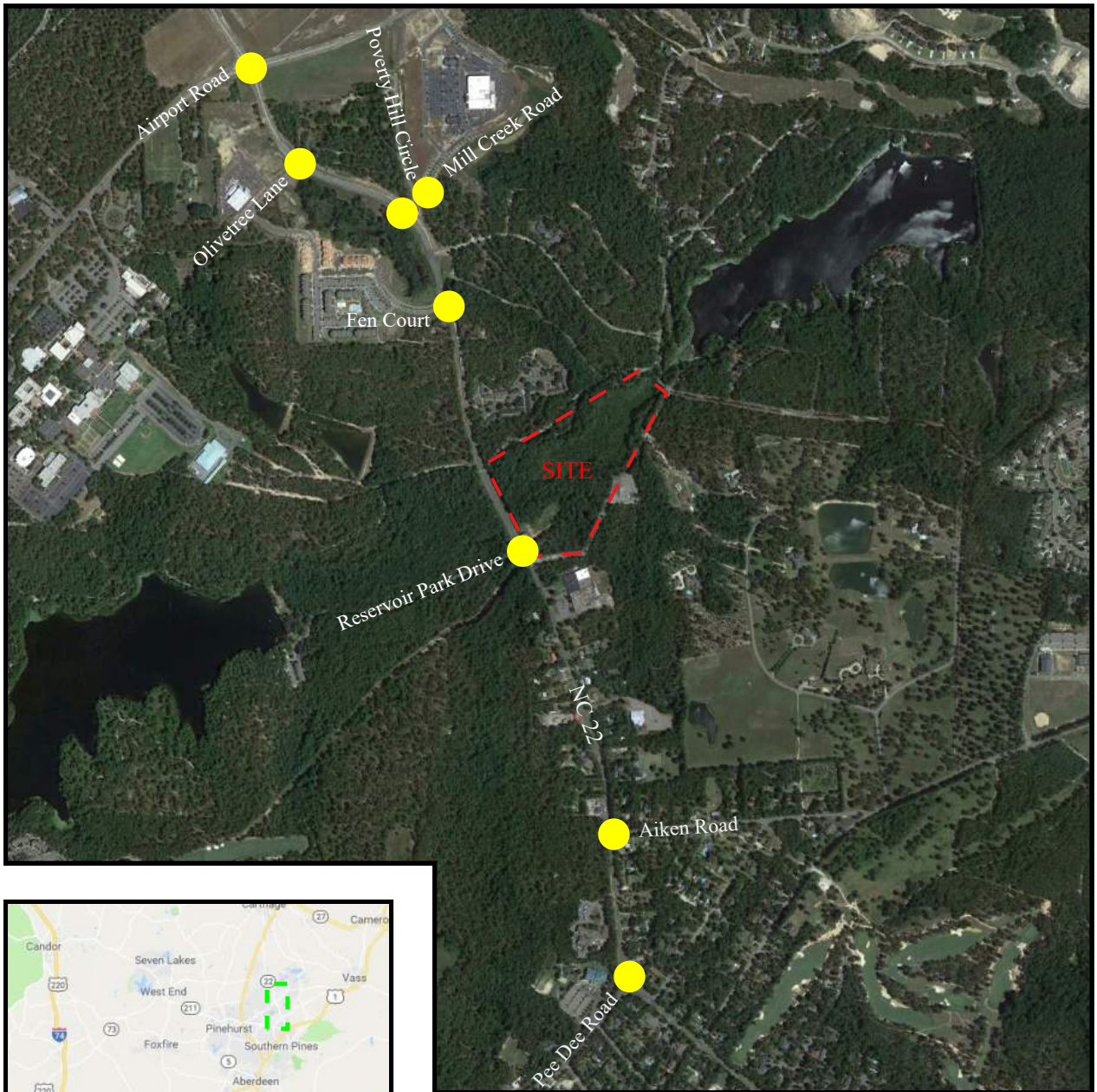
1.4. Existing Roadways

Existing lane configurations (number of traffic lanes on each intersection approach), lane widths, storage capacities, and other intersection and roadway information was collected through field reconnaissance by Ramey Kemp & Associates, Inc. (RKA). Table 1 provides a summary of the field data collected. Refer to Figure 3 for an illustration of the existing lane configurations within the study area.

Table 1: Existing Roadway Inventory

Road Name	Route Number	Speed Limit	Maintained By	AADT (vpd)
Central Drive	NC 22	45 mph	NCDOT	8,000
Airport Road	SR 1843	45 mph	NCDOT	6,000
Olivetree Lane	N/A	25 mph (assumed)	Private Entity	900*
Mill Creek Road	N/A	20 mph	Private Entity	1,500*
Poverty Hill Circle	SR 1953	25 mph (assumed)	NCDOT	100*
Fen Court	N/A	15 mph	Private Entity	300*
Reservoir Park Drive	N/A	20 mph	Private Entity	40*
Aiken Road	SR 1853	35 mph	NCDOT	2,800
Pee Dee Road	SR 1848	35 mph	NCDOT	4,000

* ADT based on the traffic counts from 2018 and assuming the weekday PM peak hour volume is 10% of the average daily traffic.



LEGEND

- - - Proposed Site Location
- Study Intersection
- - - Study Area

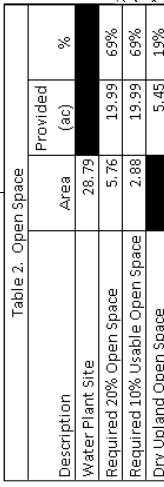


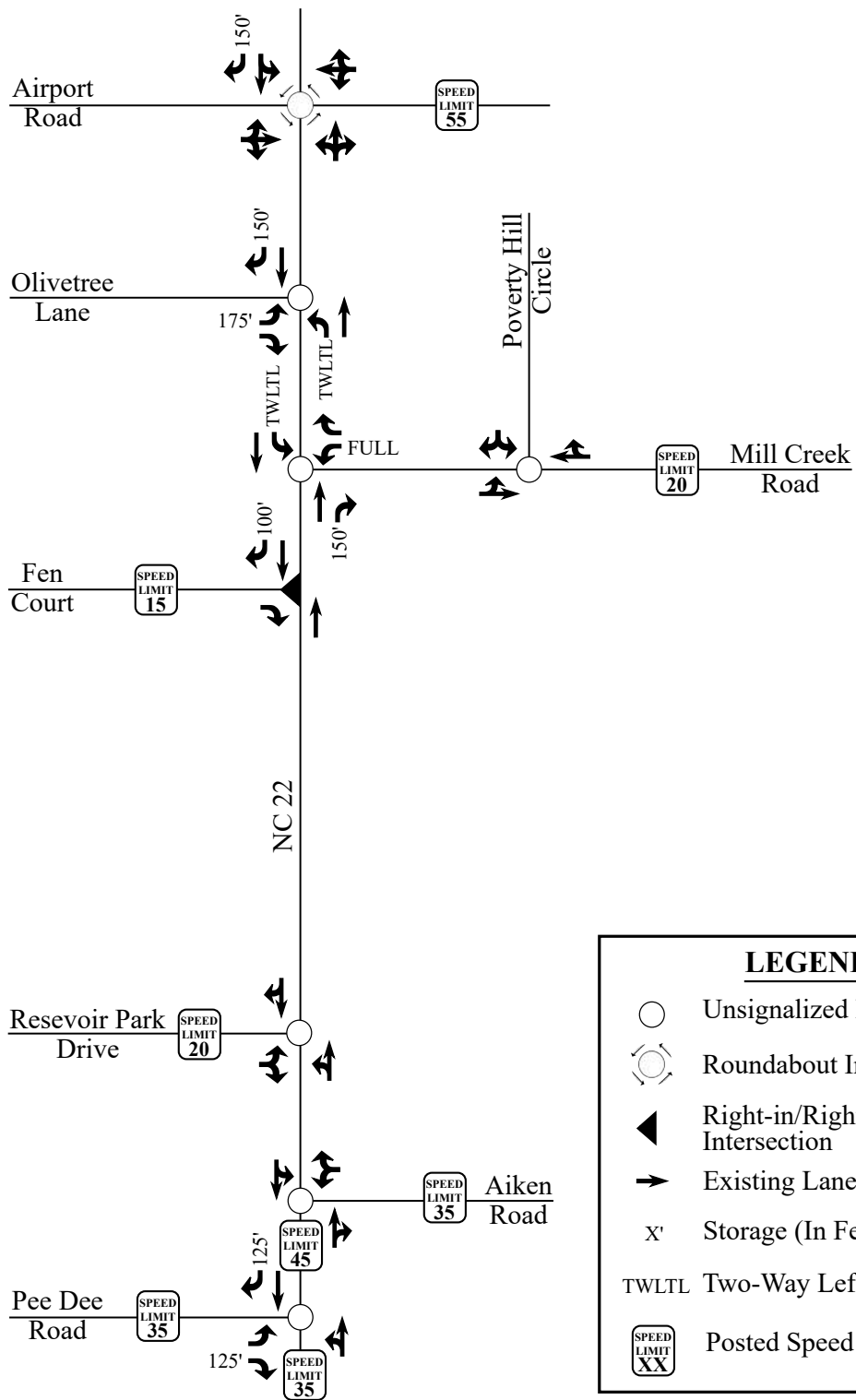
Waterworks Development
Southern Pines, NC

Site Location Map

Scale: Not to Scale

Figure 1





Waterworks Development Southern Pines, NC

Existing
Lane Configurations

Scale: Not to Scale

Figure 3

2. EXISTING (2018) PEAK HOUR CONDITIONS

2.1. Existing (2018) Peak Hour Traffic

Existing peak hour traffic volumes were determined based on traffic counts conducted at the study intersections listed below, in January 2018 by RKA during a typical weekday AM (7:00 AM – 9:00 AM) and PM (4:00 PM – 6:00 PM) peak periods:

- NC 22 and Olivetree Lane
- NC 22 and Mill Creek Road (PM Only)
- NC 22 and Fen Court (PM Only)
- NC 22 and Reservoir Park Drive (PM Only)
- NC 22 and Pee Dee Road

The following study intersection traffic counts were taken from the adjacent development TIA, Advanced Career Center. These counts were taken in September 2016 by RKA during a typical weekday AM (7:00 AM – 9:00 AM) peak period:

- NC 22 and Mill Creek Road
- NC 22 and Fen Court
- NC 22 and Reservoir Park Drive

The following study intersection traffic counts were taken from the adjacent development TIA, Knollwood School. These counts were taken in October 2016 by NDS during a typical weekday AM (7:00 AM – 9:00 AM) and PM (4:00 PM – 6:00 PM) peak periods:

- NC 22 and Aiken Road

The following study intersection traffic counts were taken from the adjacent development TIA, Ravensbrook Residential. These counts were taken in June 2017 by J.M. Teague Engineering and Planning during a typical weekday AM (7:00 AM – 9:00 AM) and PM (4:00 PM – 6:00 PM) peak periods:

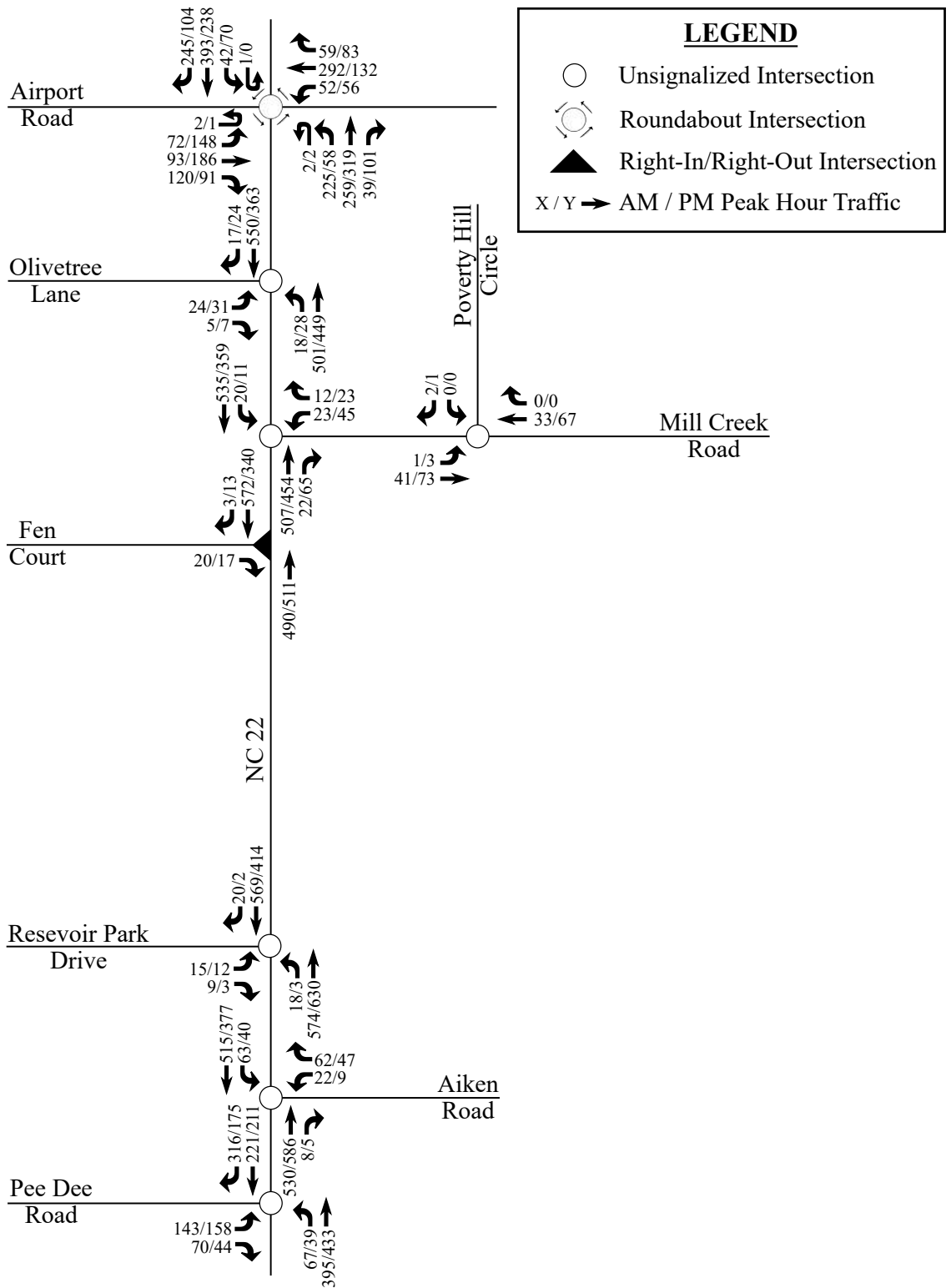
- NC 22 and Airport Road

Traffic volumes utilized from the year 2016 or 2017 were grown at an annual rate of 2% to generate projected (2018) weekday AM and PM peak hour traffic volumes. Additionally, traffic volumes were balanced between study intersections, where appropriate. It should be

noted that traffic counts were not conducted at the intersection of Mill Creek Road and Poverty Hill Circle and a conservative trip generation for four (4) single-family homes was utilized and distributed to the turning movements. Refer to Figure 4 for existing (2018) weekday AM and PM peak hour traffic volumes. A copy of the count data and trip generation calculations is located in Appendix A of this report.

2.2. Analysis of Existing (2018) Peak Hour Traffic

The existing (2018) weekday AM and PM peak hour traffic volumes were analyzed to determine the current levels of service at the study intersections under existing roadway conditions. The results of the analysis are presented in Section 7 of this report.



Waterworks Development Southern Pines, NC

Existing (2018)
Peak Hour Traffic

Scale: Not to Scale

Figure 4

3. BACKGROUND (2019) PEAK HOUR CONDITIONS

In order to account for growth of traffic and subsequent traffic conditions at a future year, background traffic projections are needed. Background traffic is the component of traffic due to the growth of the community and surrounding area that is anticipated to occur regardless of whether or not the proposed development is constructed. Background traffic is comprised of existing traffic growth within the study area and additional traffic created as a result of adjacent approved developments.

3.1. Ambient Traffic Growth

Through coordination with the Town and NCDOT, it was determined that an annual growth rate of 2% would be used to generate projected (2019) weekday AM and PM peak hour traffic volumes. Through coordination with the Town, it was determined that an annual growth rate of 1% would be used to project the existing traffic volumes to the future years 2028 and 2038. Due to the unknown nature of the surrounding area in the next twenty years, a 1% growth rate would provide a conservative estimate of background traffic growth for the future years 2028 and 2038. Refer to Figure 5 for projected (2019) peak hour traffic.

3.2. Adjacent Development Traffic

Through coordination with the Town, several developments were identified to be included as an adjacent development in this study. The traffic generated by these proposed adjacent developments is in addition to the growth rate discussed in Section 3.1.

Knollwood is a proposed elementary school development that will have a maximum enrollment capacity of 800 student and serve grades K-5. The development is proposed to be located on the south side of Camp Easter Road in Southern Pines, NC and is expected to be built out by 2019. It should be noted the site trips were distributed at the intersection of NC 22 and Airport Road based on the approved site trip distribution for the Advanced Career Center adjacent development.

Ravensbrook is a proposed residential development to consist of 100 single-family homes. The development is proposed to be located along Waynor Road in Southern Pines, NC and is expected to be built out by 2020.

Advanced Career Center is a proposed school development that will have approximately 400 students attending one AM shift and one PM shift, for a total capacity of 800 students per day. The development is proposed to be located west of NC 22 and north of Reservoir Park Drive in Southern Pines, NC and is expected to be built out by 2019.

Adjacent development trips are shown in Figure 6. Adjacent development information can be found in Appendix C.

3.3. Future Roadway Improvements

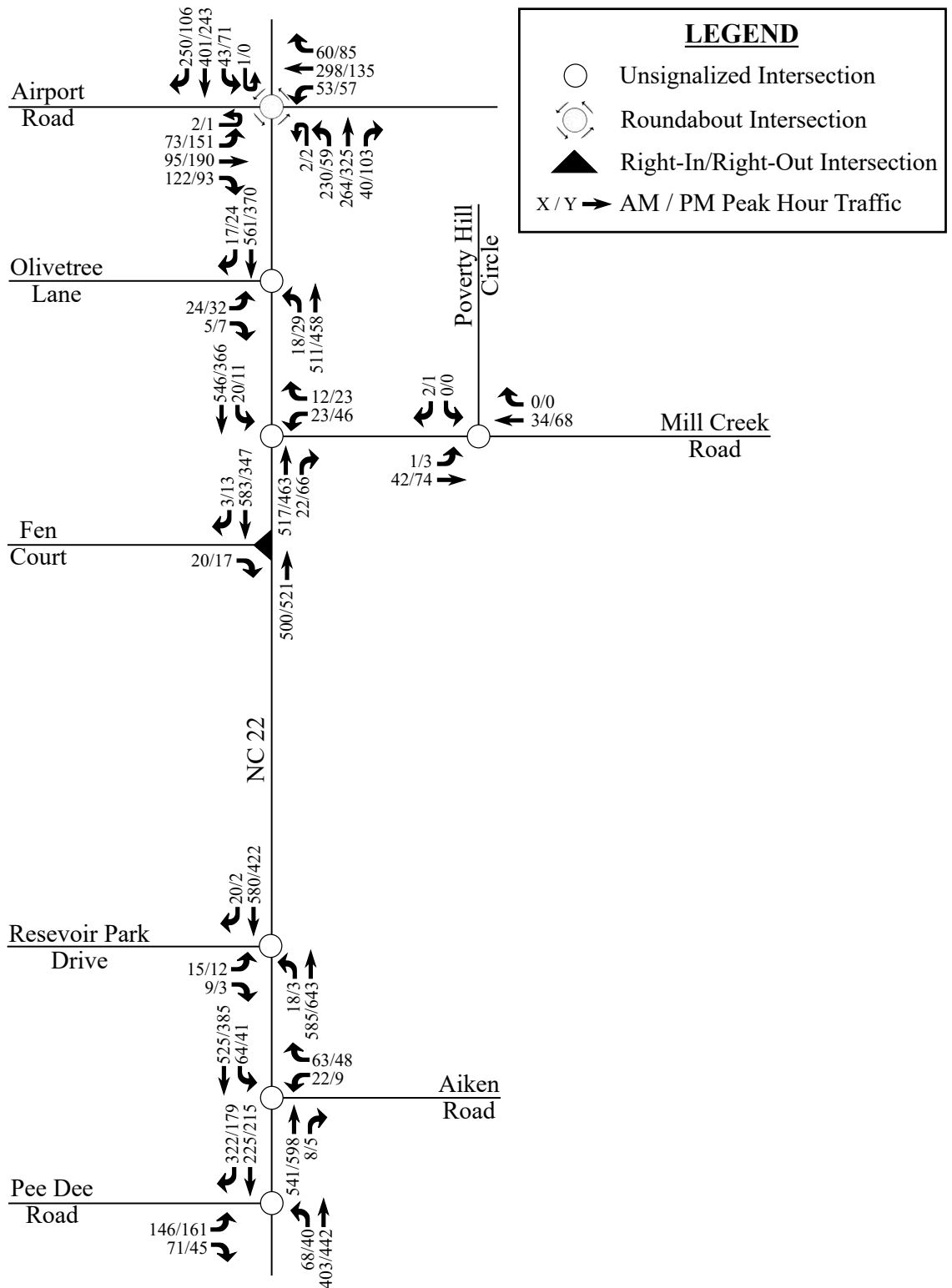
Based on coordination with the NCDOT and the Town, it was determined there were no future roadway improvements to consider with this study.

3.4. Background (2019, 2028, 2038) Peak Hour Traffic Volumes

The background (2019, 2028, and 2038) traffic volumes were determined by projecting the existing (2018) peak hour traffic to the future years. Refer to Figures 7-9 for an illustration of the background (2019, 2028, and 2038) peak hour traffic volumes at the study intersections.

3.5. Analysis of Background (2019) Peak Hour Traffic Conditions

The background (2019) AM and PM peak hour traffic volumes at the study intersections were analyzed with future geometric roadway conditions and traffic control. The analysis results are presented in Section 7 of this report.

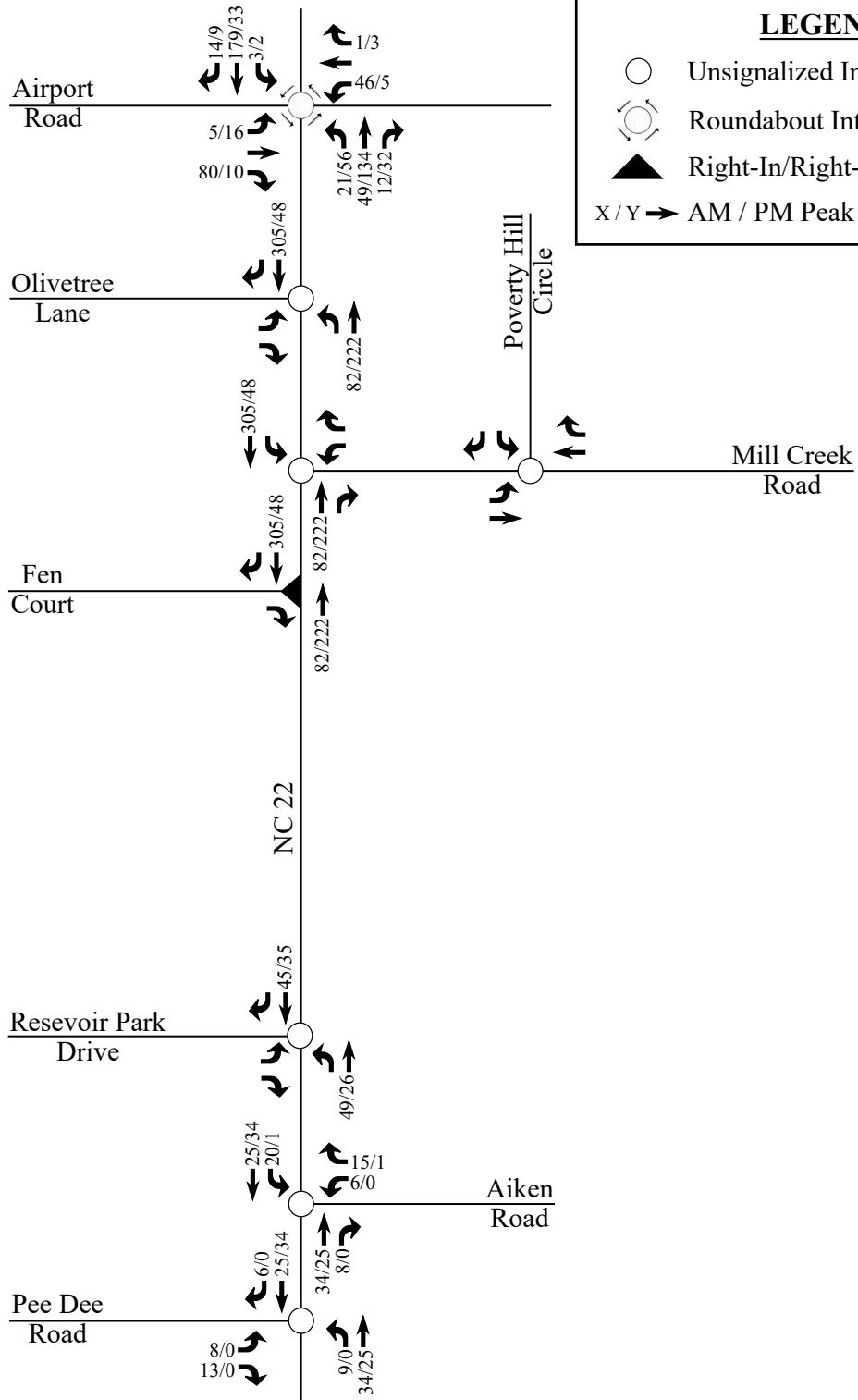


Waterworks Development
Southern Pines, NC

Projected (2019)
Peak Hour Traffic

Scale: Not to Scale

Figure 5

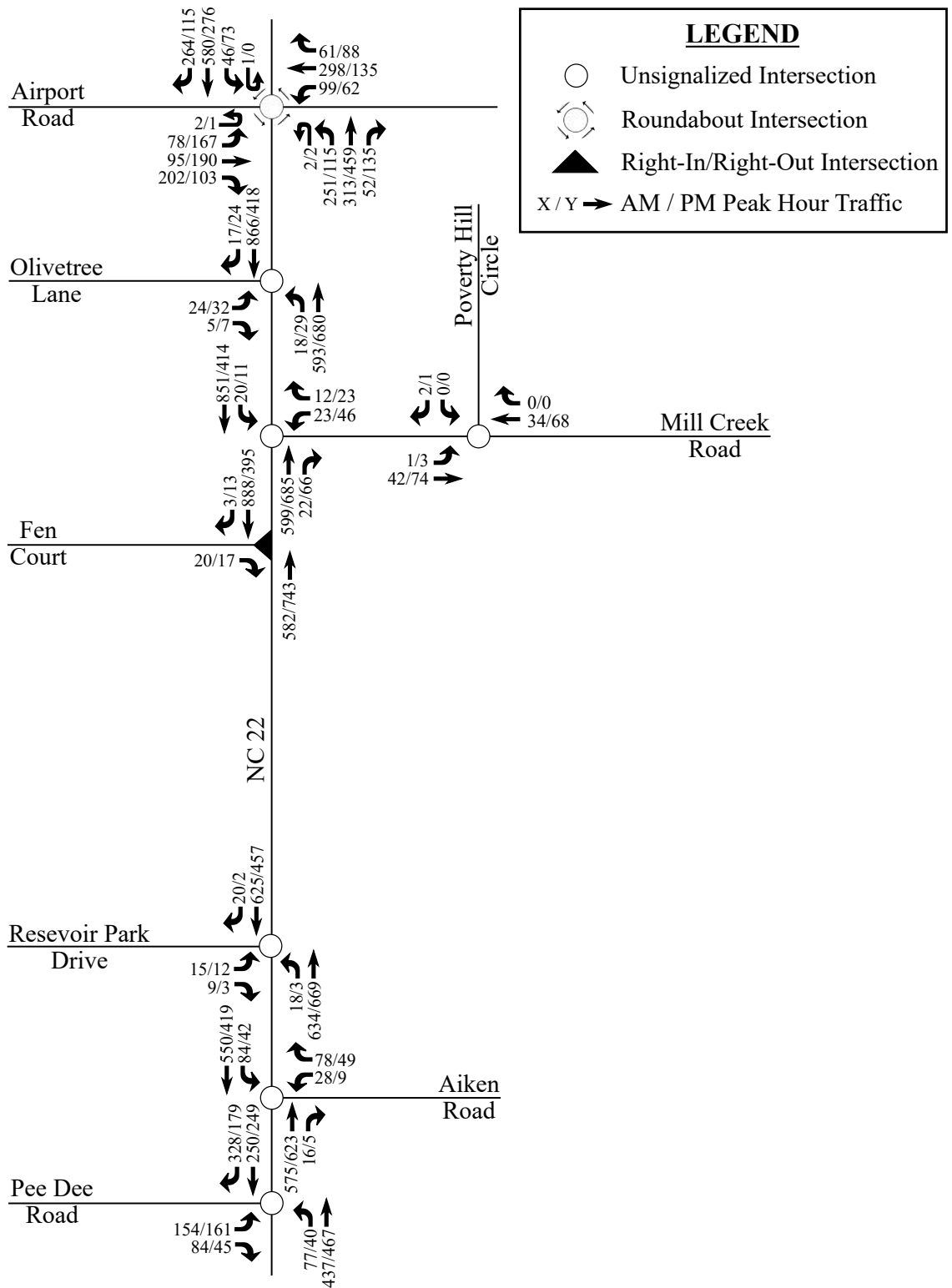


Waterworks Development Southern Pines, NC

Peak Hour Adjacent
Development Trips

Scale: Not to Scale

Figure 6

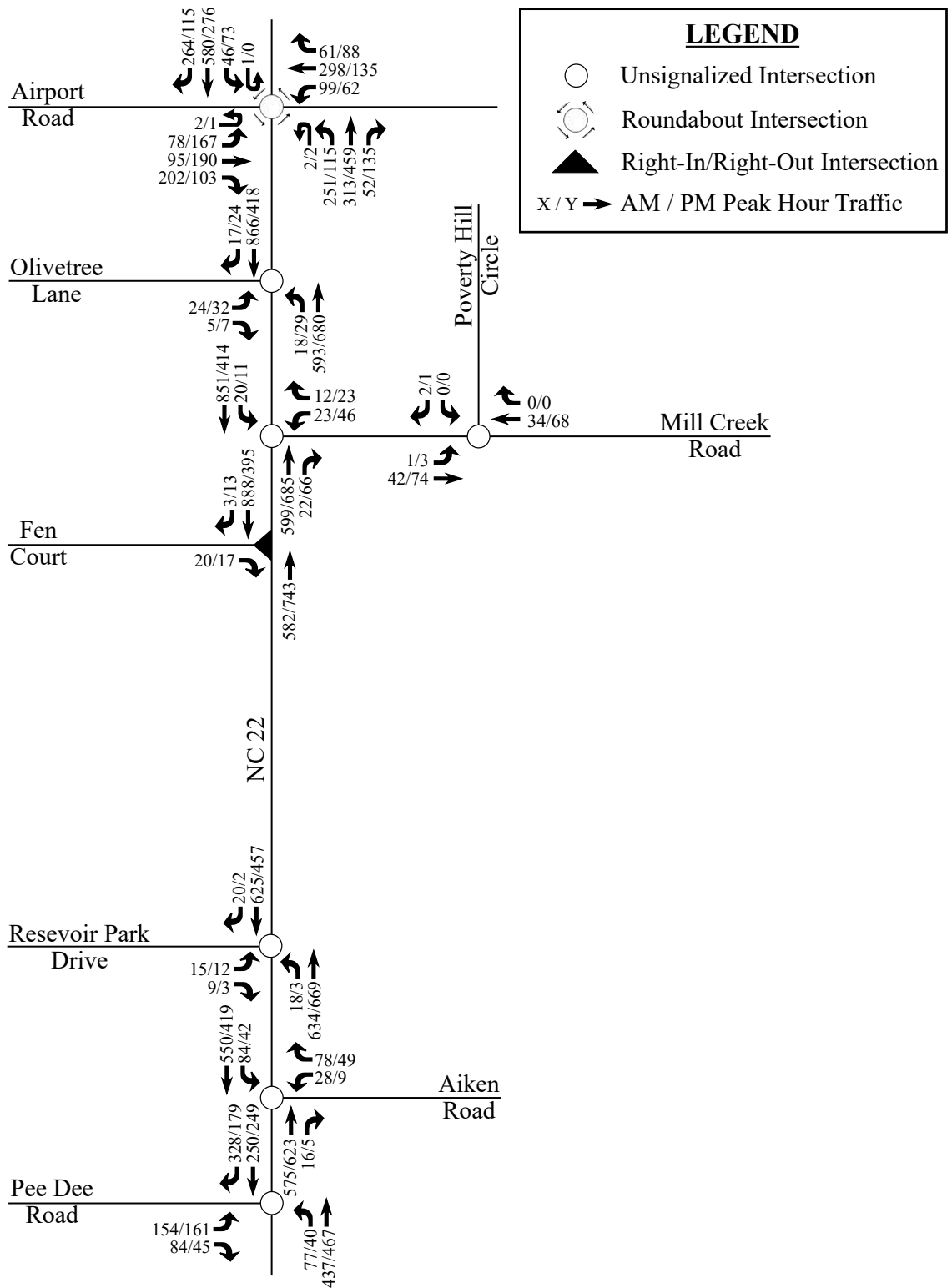


Waterworks Development Southern Pines, NC

Background (2019)
Peak Hour Traffic

Scale: Not to Scale

Figure 7

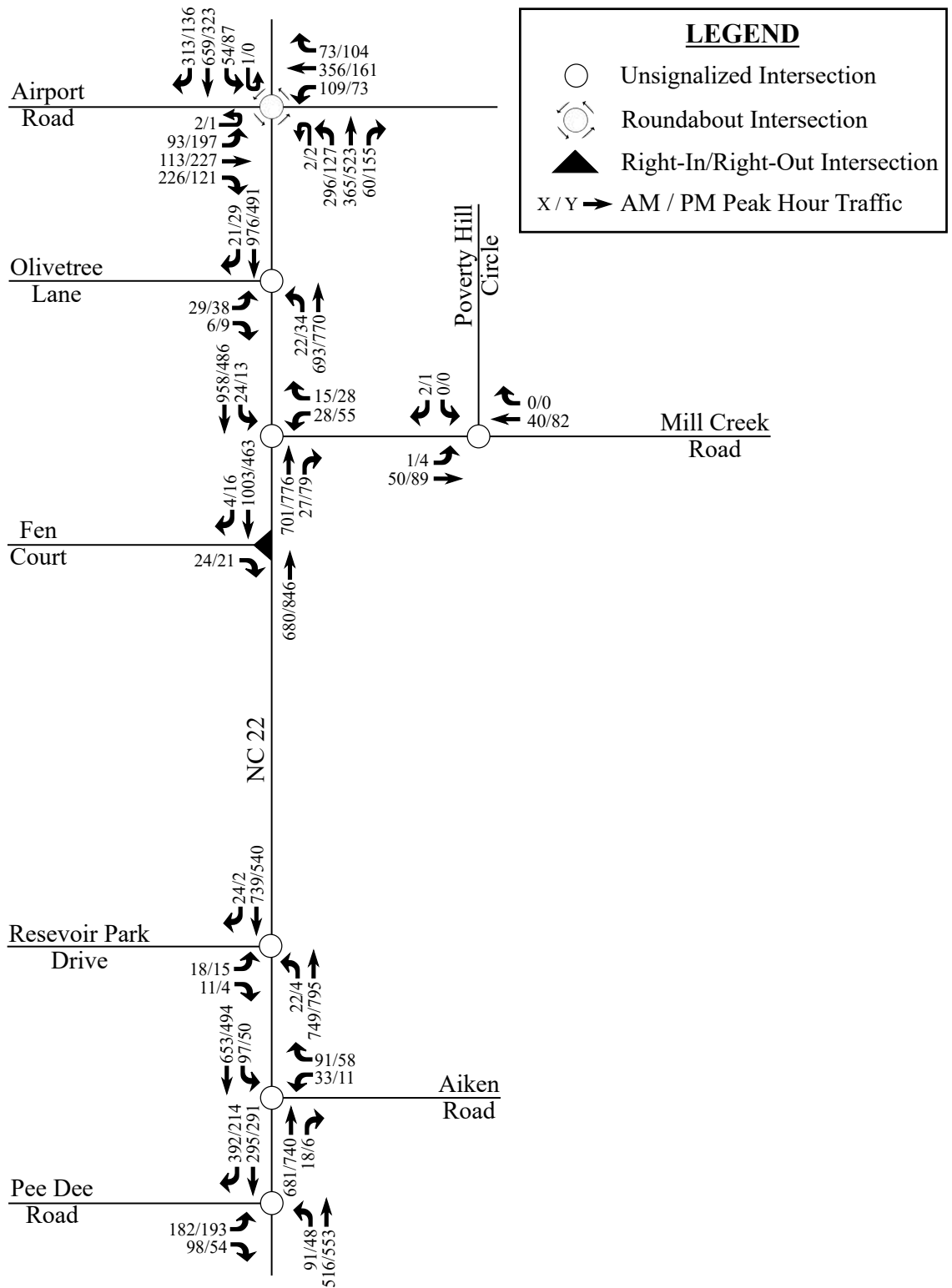


Waterworks Development Southern Pines, NC

Background (2028)
Peak Hour Traffic

Scale: Not to Scale

Figure 8



Waterworks Development Southern Pines, NC

Background (2038)
Peak Hour Traffic

Scale: Not to Scale

Figure 9

4. SITE TRIP GENERATION AND DISTRIBUTION

4.1. Trip Generation

The proposed development is assumed to consist of approximately 15 single-family homes, 7 mid-rise residential units (apartments), 14,812 s.f. of warehousing, 13,500 s.f. of office, 5,000 s.f. of retail, and a 5,920 sq. ft. high-turnover sit-down restaurant. Average weekday daily, AM peak hour, and PM peak hour trips for the proposed development were estimated using methodology contained within the *ITE Trip Generation Manual*, 10th Edition. Table 2 provides a summary of the trip generation potential for the site.

Table 2: Trip Generation Summary

Land Use (ITE Code)	Intensity	Daily Traffic (vpd)	AM Peak Hour Trips (vph)		PM Peak Hour Trips (vph)	
			Enter	Exit	Enter	Exit
Warehousing (150)	14,812 s.f.	30	2	1	2	1
Single Family Detached (210)	15 units	150	3	8	9	6
Mid-Rise Residential (221)	7 units	60	1	2	3	1
Office (710)	13,500 s.f.	160	34	5	3	14
Shopping Center (820)	5,000 s.f.	790	3 ¹	2 ¹	28	31
High-Turnover Sit-Down Restaurant (932)	5,920 s.f.	670	47	36	54	49
Total Trips (Before Internal Capture)		1,860	90	54	99	102
<i>Internal Capture (10% PM)</i>			--	--	-9	-10
Total External Trips			90	54	90	92
<i>Shopping Center Pass-By Trips (34% PM)</i>			--	--	-9	-9
<i>High-Turnover Sit-Down Restaurant (43% PM)</i>			--	--	-20	-20
Total Primary Trips			90	54	61	63

¹ Rates were utilized instead of equations to accurately depict the anticipated trip generation. Due to the size of the shopping center, utilizing the equation overestimates the anticipated trip generation by approximately 150 site trips.

It is estimated that the proposed development will generate approximately 1,860 total site trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 144 trips (90 entering and 54 exiting) will occur during the AM peak hour and 201 trips (99 entering and 102 exiting) will occur during the PM peak hour.

Internal capture of trips between the office, residential, and retail uses was considered in this study. Internal capture is the consideration for trips that will be made within the site between different land uses, so the vehicle technically never leaves the internal site but can still be considered as a trip to that specific land use. Internal capture typically only considers trips between residential, office, and retail/restaurant land uses. Based on ITE 9th Edition methodology, a PM peak hour internal capture rate of 11% was calculated. To be conservative, a PM peak hour internal capture rate of 10% was utilized. The internal capture reductions are expected to account for approximately 19 trips (9 entering and 10 exiting) during the PM peak hour.

Pass-by trips were also taken into consideration in this study. Pass-by trips are made by the traffic already using the adjacent roadway, entering the site as an intermediate stop on their way to another destination. Pass-by percentages are applied to site trips after adjustments for internal capture. Pass-by trips are expected to account for approximately 58 trips (29 entering and 29 exiting) during the weekday PM peak hour. It should be noted that the pass-by trips were balanced, as it is likely that these trips would enter and exit in the same hour. The reduction due to pass-by trips was calculated after the reduction due to internal capture was considered.

The total primary site trips are the calculated site trips after the reduction for internal capture and pass-by trips. Primary site trips are expected to generate approximately 144 trips (90 entering and 54 exiting) during the AM peak hour and 124 trips (61 entering and 63 exiting) will occur during the PM peak hour.

4.2. Site Trip Distribution and Assignment

Trip distribution percentages used in assigning site traffic for this development were estimated based on a combination of existing traffic patterns, population centers adjacent to the study area, and engineering judgment. It is estimated that trips will be distributed as follows:

Residential Site Trip Distribution:

- 25% to/from the south via NC 22
- 20% to/from the north via NC 22
- 15% to/from the east via Airport Road
- 15% to/from the west via Airport Road
- 15% to/from the west via Pee Dee Road
- 10% to/from the east via Aiken Road

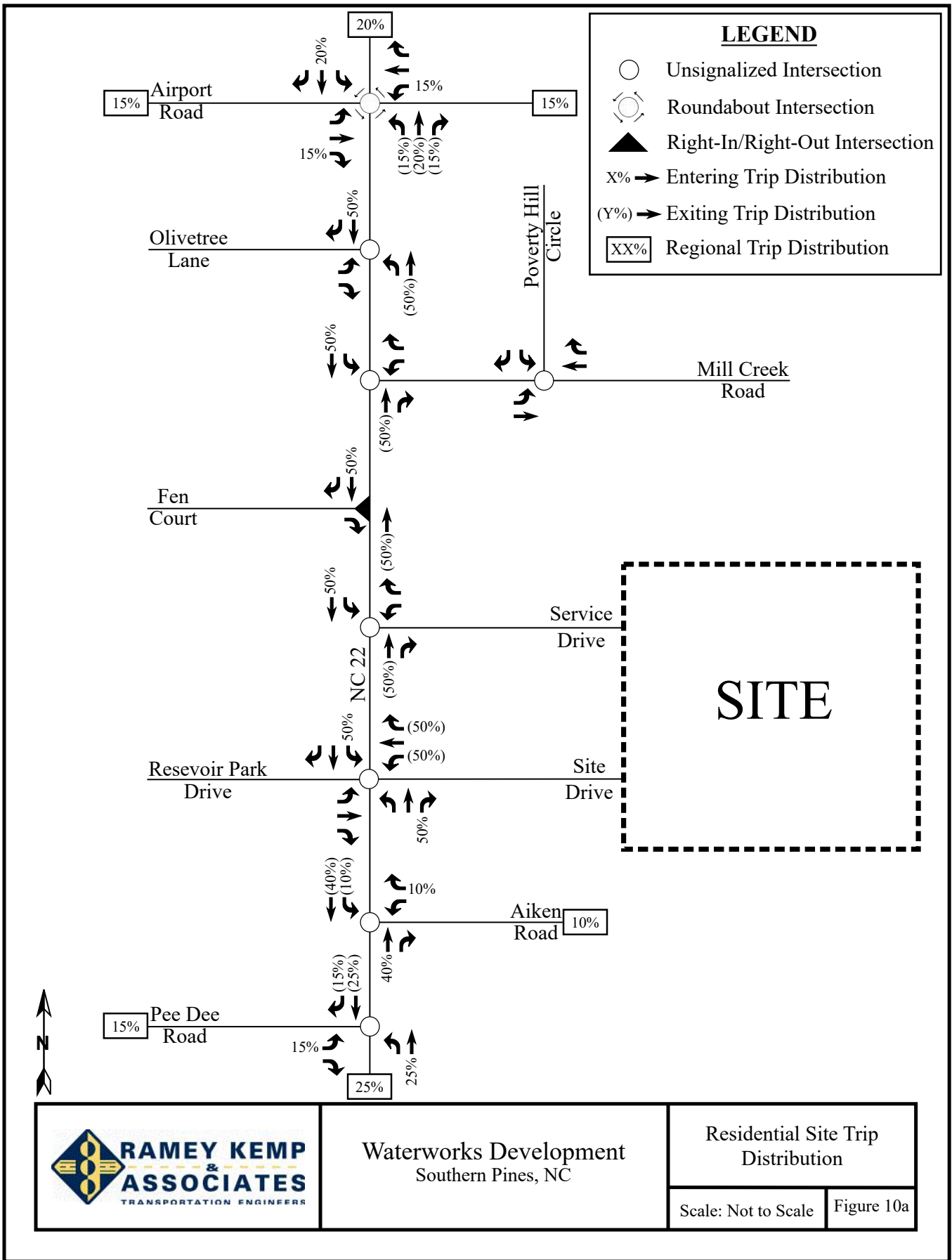
Retail / Office Site Trip Distribution:

- 20% to/from the north via NC 22
- 20% to/from the south via NC 22
- 20% to/from the west via Airport Road
- 15% to/from the east via Airport Road
- 10% to/from the west via Pee Dee Road
- 10% to/from the east via Aiken Road
- 5% to/from the west via Fen Court and Olivetree Lane

The site trip distribution is shown in Figure 10. Refer to Figure 11a for the residential site trip assignment, Figure 11b for the retail site trip assignment, and Figure 11c for the office site trip assignment.

The pass-by site trips were distributed based on existing traffic patterns with consideration given to the proposed driveway access and site layout. Refer to Figure 12 for the PM pass-by site trip distribution. Pass-by site trips are shown in Figure 13.

The total site trips were determined by adding the primary site trips and the pass-by site trips. Refer to Figure 14 for the total peak hour site trips at the study intersections.

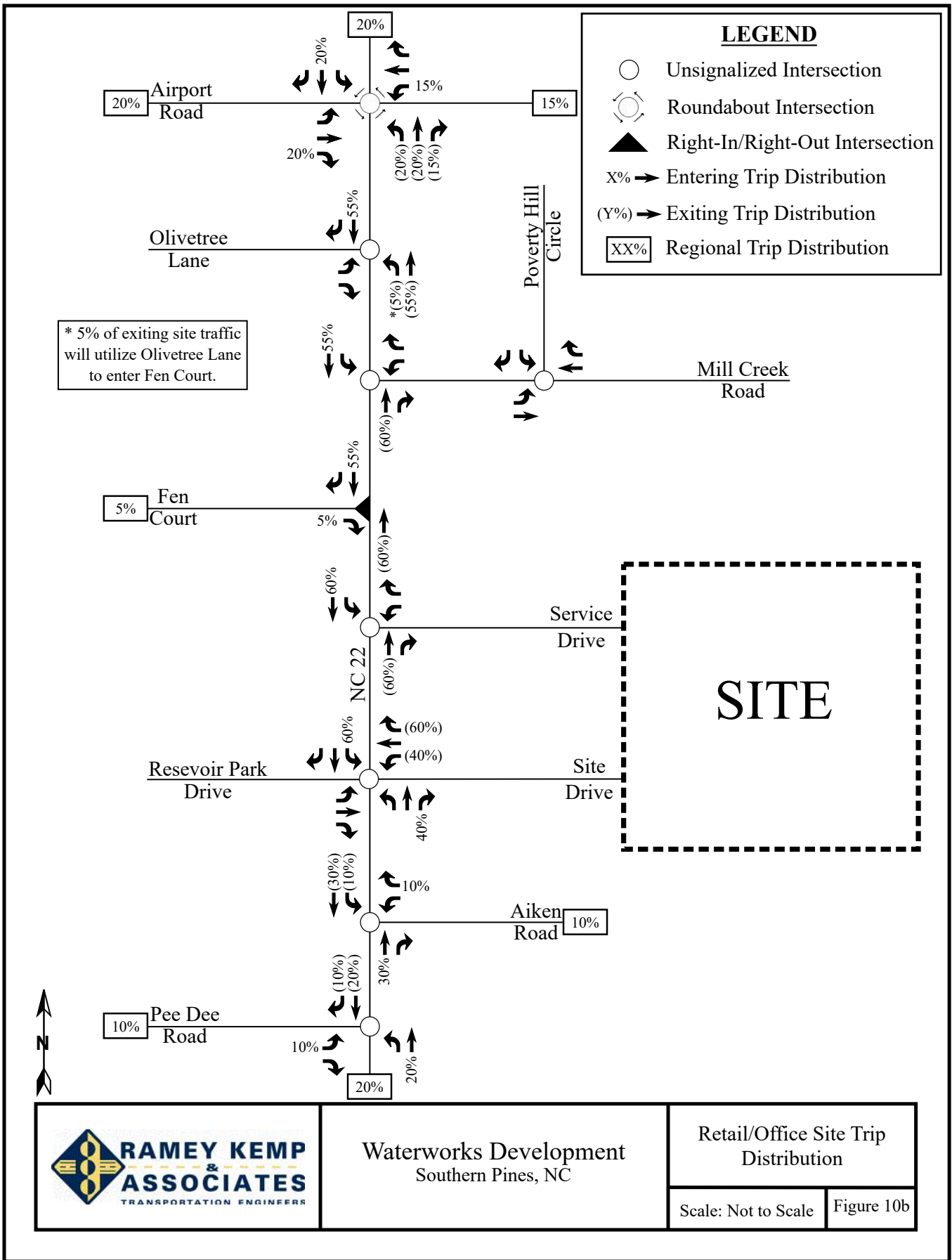


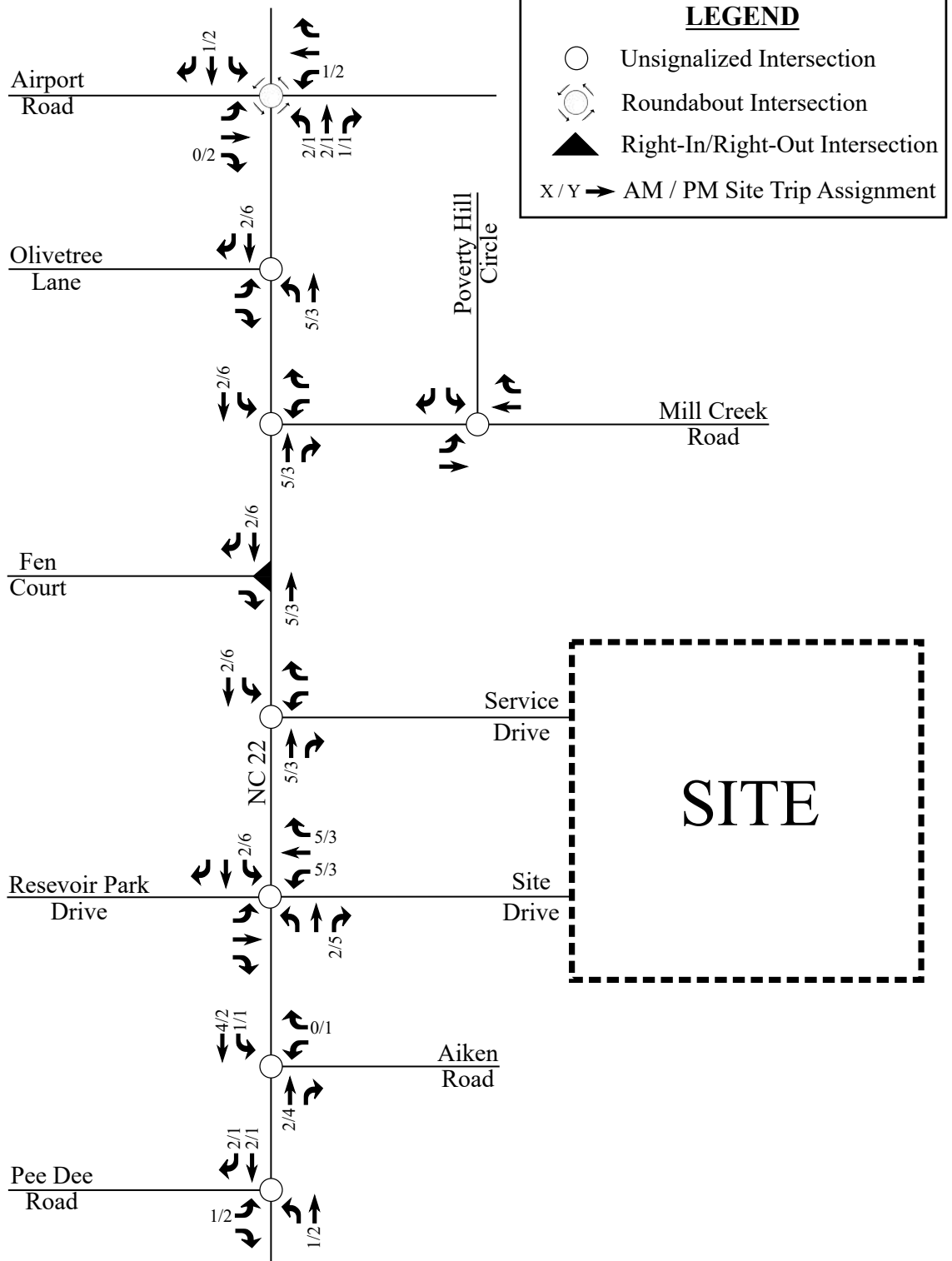
Waterworks Development
Southern Pines, NC

Residential Site Trip
Distribution

Scale: Not to Scale

Figure 10a



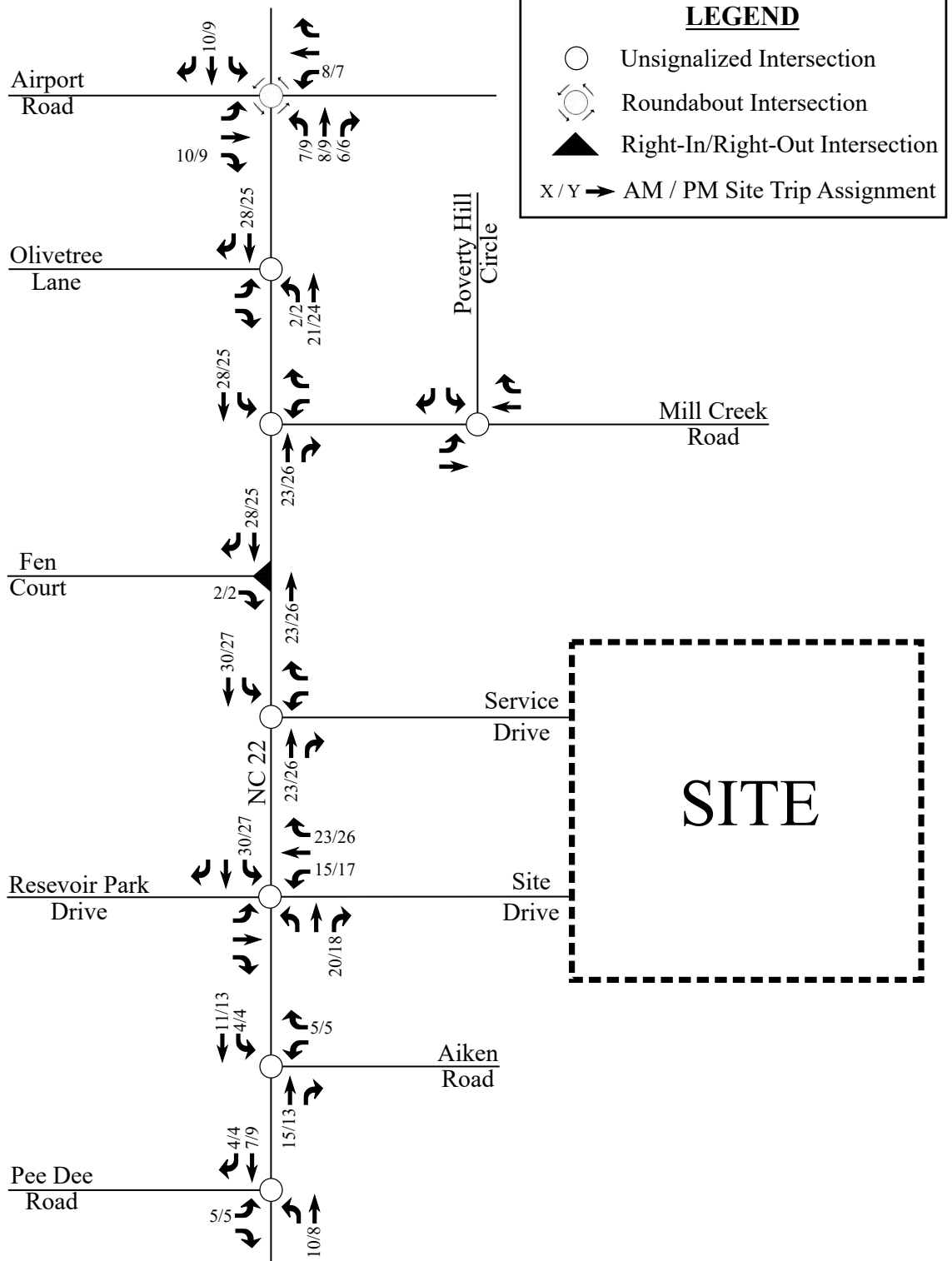


Waterworks Development
Southern Pines, NC

Residential Site
Trip Assignment

Scale: Not to Scale

Figure 11a

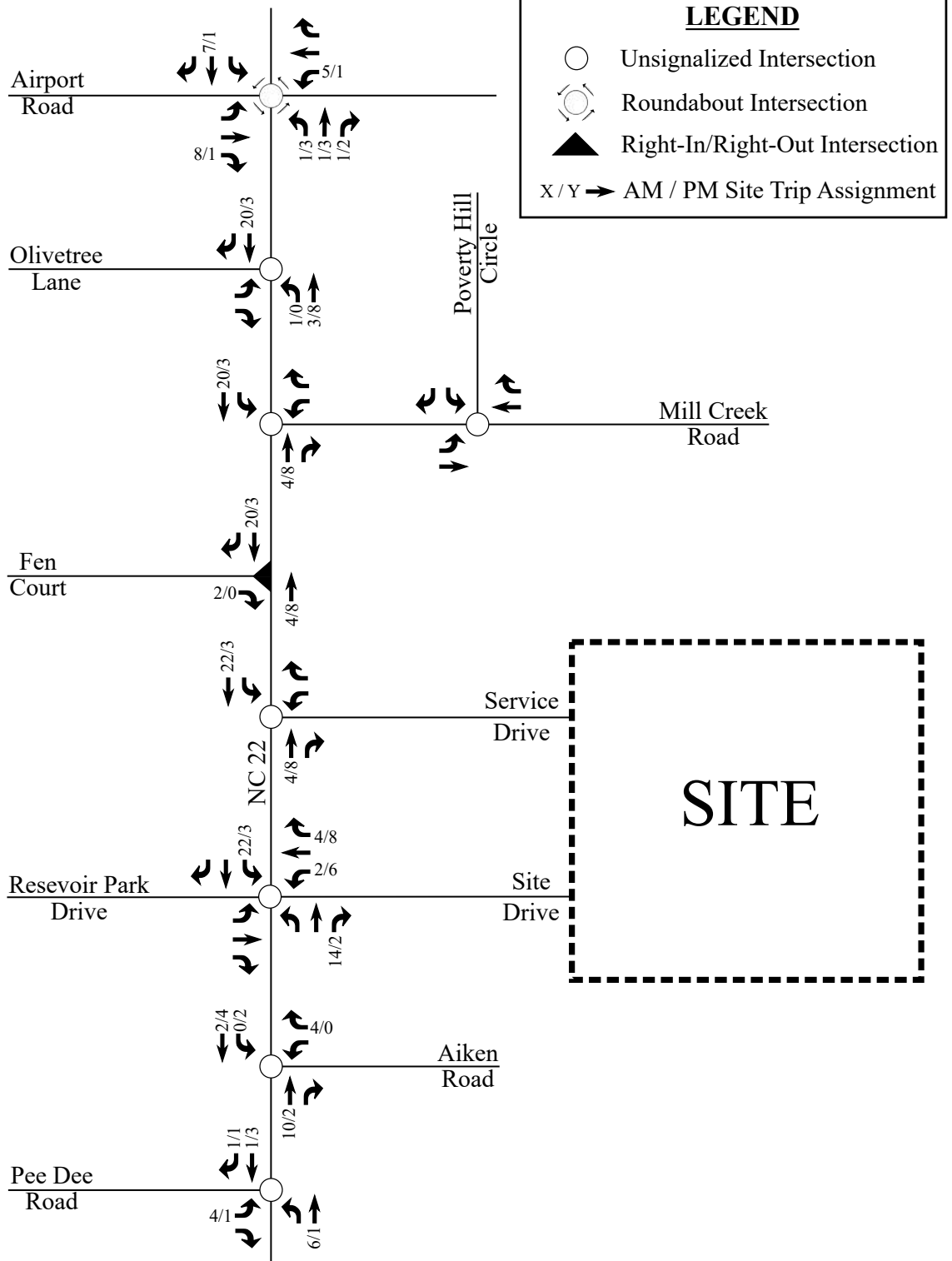


Waterworks Development Southern Pines, NC

Retail Site Trip Assignment

Scale: Not to Scale

Figure 11b

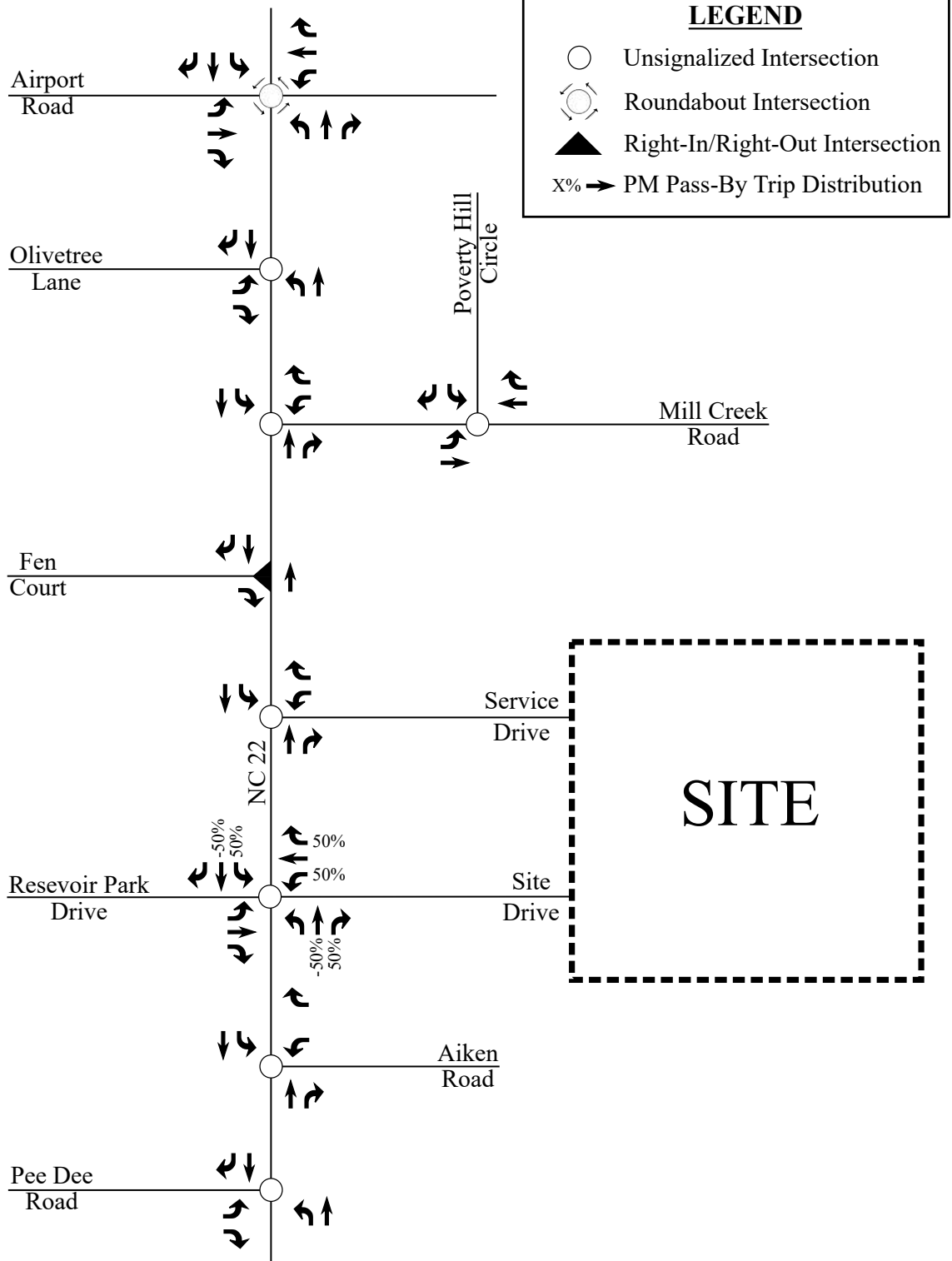


Waterworks Development
Southern Pines, NC

Office Site
Trip Assignment

Scale: Not to Scale

Figure 11c

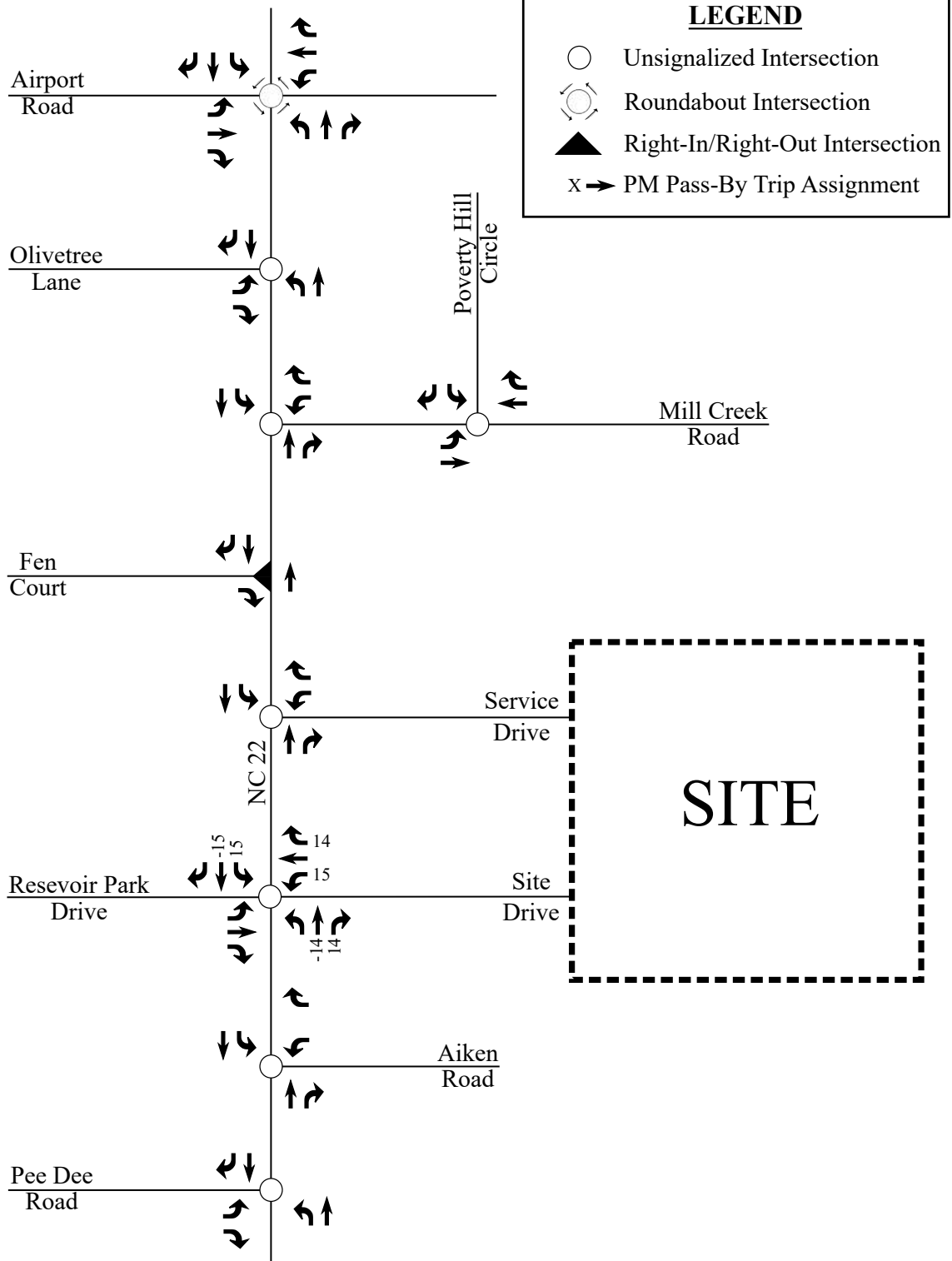


Waterworks Development
Southern Pines, NC

PM Pass-By
Trip Distribution

Scale: Not to Scale

Figure 12

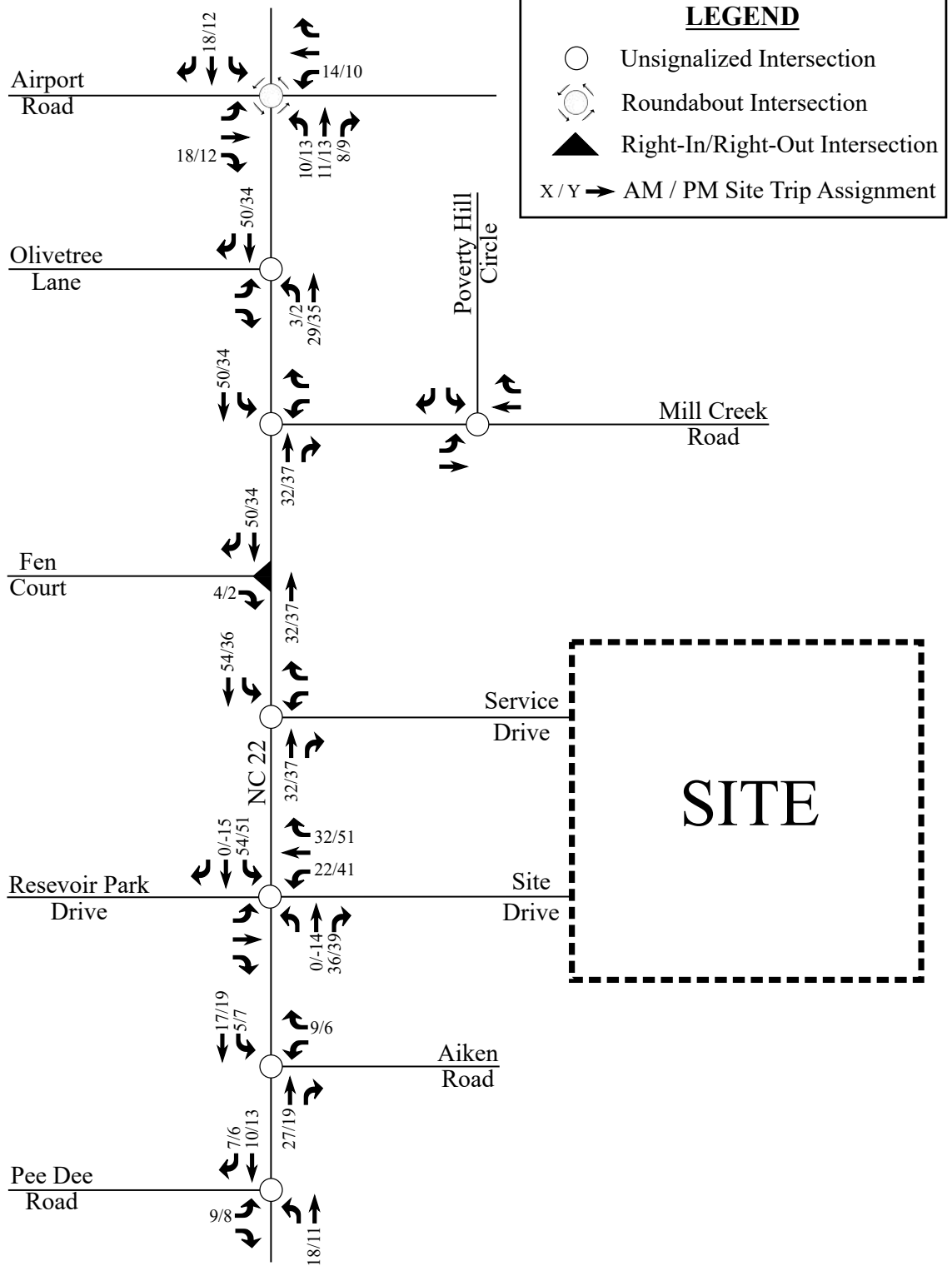


Waterworks Development
Southern Pines, NC

PM Pass-By
Trip Assignment

Scale: Not to Scale

Figure 13



Waterworks Development
Southern Pines, NC

Total Site
Trip Assignment

Scale: Not to Scale

Figure 14

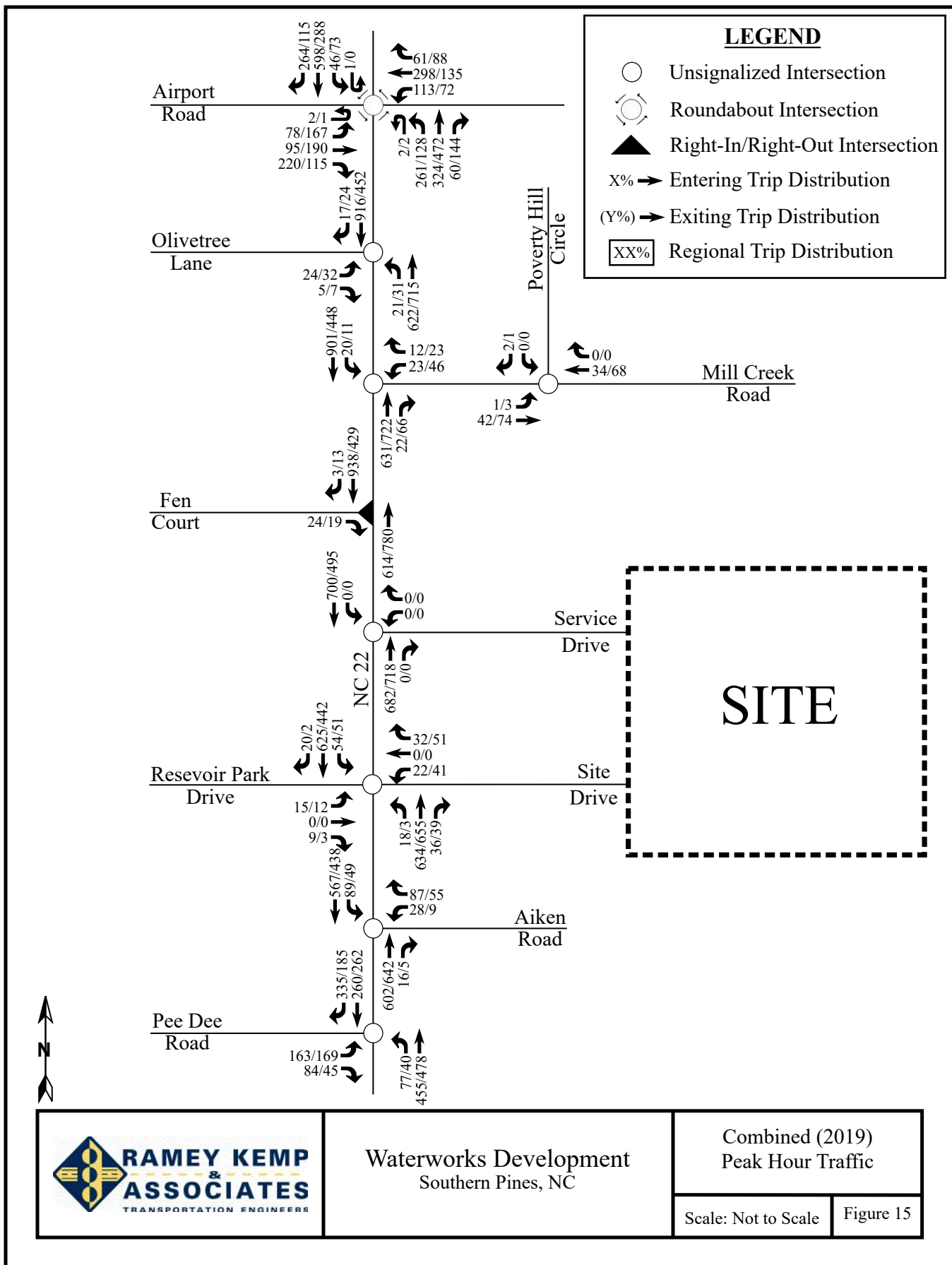
5. COMBINED (2019) TRAFFIC CONDITIONS

5.1. Combined (2019) Peak Hour Traffic Volumes

To estimate traffic conditions with the site fully built-out, the total site trips were added to the background (2019) traffic volumes to determine the combined (2019) traffic volumes. Refer to Figure 15 for an illustration of the combined (2019) peak hour traffic volumes with the proposed site fully developed.

5.2. Analysis of Combined (2019) Peak Hour Traffic

Study intersections were analyzed with the combined (2019) traffic volumes using the same methodology previously discussed for existing and background traffic conditions. Intersections were analyzed with improvements necessary to accommodate future traffic volumes. The results of the capacity analysis for each intersection are presented in Section 7 of this report.



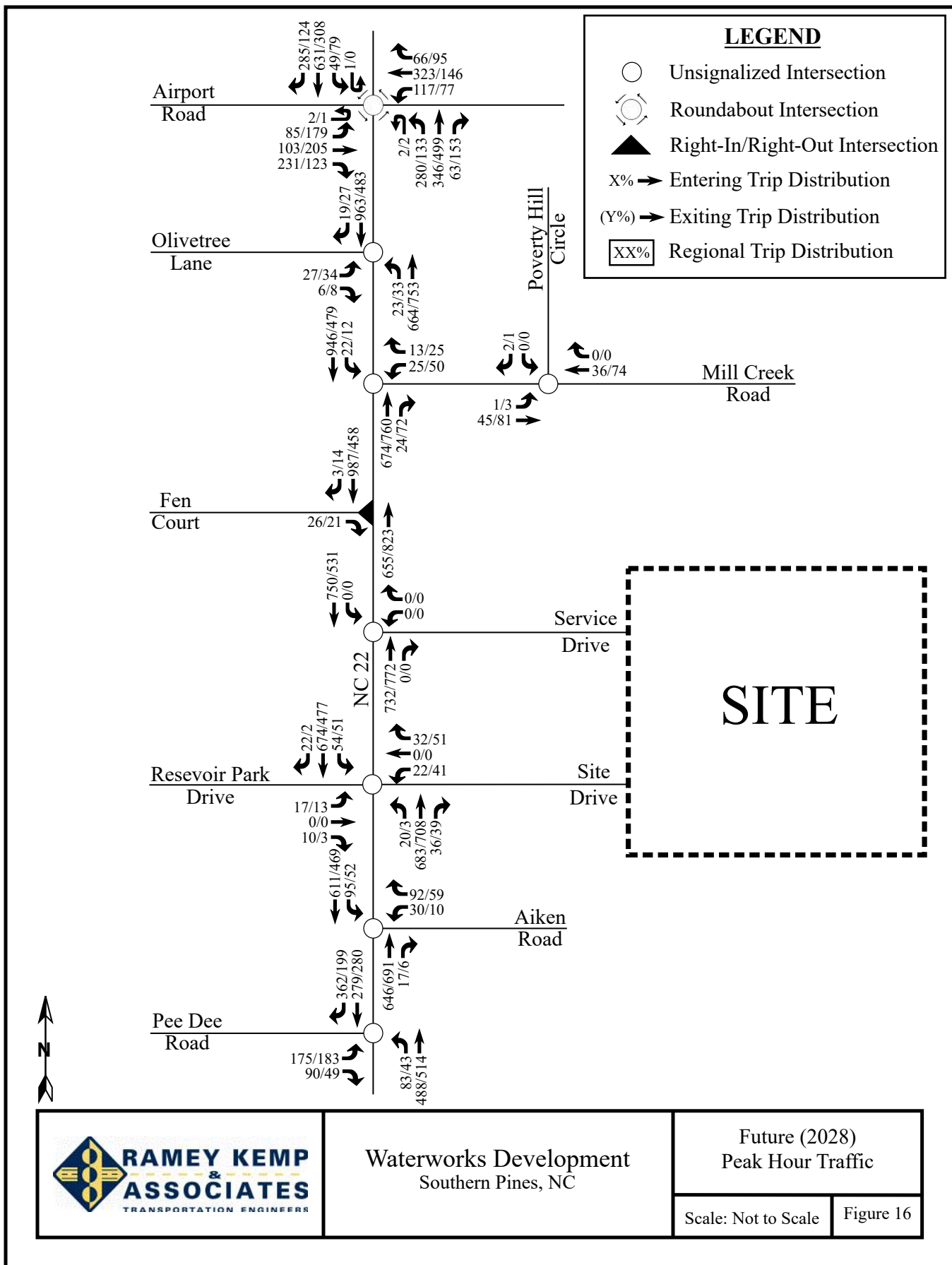
6. FUTURE (2028 and 2038) TRAFFIC CONDITIONS

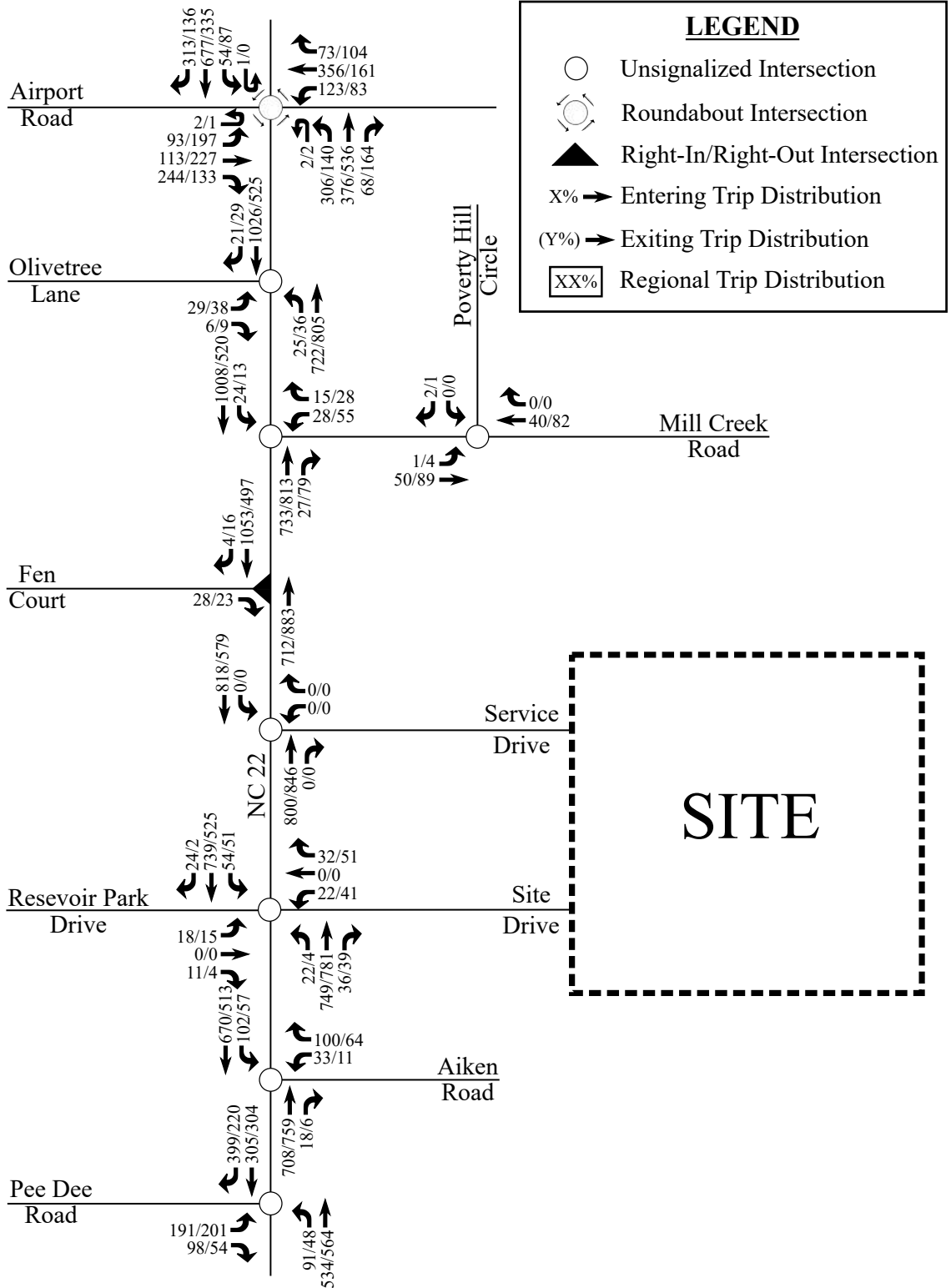
6.1. Future (2028 and 2038) Peak Hour Traffic Volumes

To estimate traffic conditions with the site fully built-out in future years, the total site trips were added to the background (2028 and 2038) traffic volumes to determine the future (2028 and 2038) traffic volumes. Refer to Figures 16 and 17 for an illustration of the future (2028 and 2038) peak hour traffic volumes with the proposed site fully developed.

6.2. Analysis of Future (2028 and 2038) Peak Hour Traffic

Study intersections were analyzed with the future (2028 and 2038) traffic volumes using the same methodology previously discussed for existing and background traffic conditions. The results of the capacity analysis for each intersection are presented in Section 7 of this report.





Waterworks Development
Southern Pines, NC

Future (2038)
Peak Hour Traffic

Scale: Not to Scale

Figure 17

7. TRAFFIC ANALYSIS PROCEDURE

Study intersections were analyzed using the methodology outlined in the *2010 Highway Capacity Manual* (HCM) published by the Transportation Research Board. Capacity and level of service are the design criteria for this traffic study. A computer software package, Synchro (Version 9.2), was used to complete the analyses for most of the study area intersections. Please note that the unsignalized capacity analysis does not provide an overall level of service for an intersection; only delay for an approach with a conflicting movement.

The HCM defines capacity as “the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.” Level of service (LOS) is a term used to represent different driving conditions, and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers.” Level of service varies from Level “A” representing free flow, to Level “F” where breakdown conditions are evident. Refer to Table 3 for HCM levels of service and related average control delay per vehicle for both signalized and unsignalized intersections. Control delay as defined by the HCM includes “initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay”. An average control delay of 50 seconds at a signalized intersection results in LOS “D” operation at the intersection.

Table 3: Highway Capacity Manual – Levels-of-Service and Delay

UNSIGNALIZED INTERSECTION		SIGNALIZED INTERSECTION	
LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)	LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)
A	0-10	A	0-10
B	10-15	B	10-20
C	15-25	C	20-35
D	25-35	D	35-55
E	35-50	E	55-80
F	>50	F	>80

Round-a-bout intersections were analyzed utilizing a computer software package, Sidra Intersections (Version 6.1), which is an NCDOT approved analysis software. Sidra Intersections provides a level of service for each approach and the overall intersection.

7.1. Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the Town's UDO and NCDOT Congestions Management Guidelines.

8. CAPACITY ANALYSIS

8.1. NC 22 and Airport Road

The existing round-a-bout at NC 22 and Airport Road was analyzed under existing (2018), background (2019), combined (2019), future (2028), and future (2038) traffic conditions with existing lane configurations and traffic control. Refer to Table 4 for a summary of the analysis results. Copies of the SIDRA analysis output reports are provided in Appendix D.

Table 4: Analysis Summary of NC 22 and Airport Road

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2018) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH, 1 RT	B B B B	B (12)	B B B A	B (12)
Background (2019) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH, 1 RT	D D B C	C (28)	B C E A	C (30)
Combined (2019) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH, 1 RT	E D B C	D (36)	B C E A	D (36)
Future (2028) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH, 1 RT	F F B D	D (54)	C C F A	D (52)
Future (2038) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH-RT 1 LT-TH-RT 1 LT-TH, 1 RT	F F C D	F (83)	C C F A	F (81)
Future (2038) Conditions - Improved	EB WB NB SB	1 LT-TH, 1 RT 1 LT-TH-RT 1 LT-TH, 1 RT 1 LT-TH, 1 RT	C F B D	D (53)	B E C A	C (28)

Capacity analysis indicates that the round-a-bout at the intersection of NC 22 and Airport Road is expected to operate at an overall LOS D or better under all analysis scenarios during the weekday AM and PM peak hours, except under future (2038) traffic conditions which is expected to operate at an overall LOS F during both AM and PM peak hours. To improve the round-a-bout level-of-service, additional laneage was considered in the form of an exclusive eastbound right-turn slip lane and an exclusive northbound right-turn slip lane. Under future (2038) improved traffic conditions, the round-a-bout is expected to operate at an overall LOS D during the weekday AM peak hour and an overall LOS C during the weekday PM peak hour.

It should be noted that this improvement is triggered due to the background traffic growth (not proposed site traffic) in the surrounding area. Traffic counts should be conducted in the future to determine if the turn lanes will be necessary to improve overall traffic conditions at the round-a-bout.

8.2. NC 22 and Olivetree Lane

The existing unsignalized intersection of NC 22 and Olivetree Lane was analyzed under existing (2018), background (2019), combined (2019), future (2028), and future (2038) traffic conditions with existing lane configurations and traffic control. Refer to Table 5 for a summary of the analysis results. Refer to Appendix E for the Synchro capacity analysis reports.

Table 5: Analysis Summary of NC 22 and Olivetree Lane

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2018) Conditions	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	C ² A ¹ --	N/A	C ² A ¹ --	N/A
Background (2019) Conditions	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	E ² B ¹ --	N/A	D ² A ¹ --	N/A
Combined (2019) Conditions	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	F ² B ¹ --	N/A	D ² A ¹ --	N/A
Combined (2019) Conditions - Signalized	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	C A A	A (6)	B A A	A (6)
Future (2028) Conditions	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	F ² B ¹ --	N/A	D ² A ¹ --	N/A
Future (2028) Conditions - Signalized	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	C A A	A (6)	B A A	A (6)
Future (2038) Conditions	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	F ² B ¹ --	N/A	E ² A ¹ --	N/A
Future (2038) Conditions - Signalized	EB NB SB	1 LT, 1 RT 1 LT, 1 TH 1 TH, 1 RT	C A A	A (7)	B A A	A (7)

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

Capacity analysis of all analysis scenarios indicates all major-street left-turn movements are expected to operate at LOS B or better during both weekday AM and PM peak hours. Under existing (2018) traffic conditions, the eastbound approach is expected to operate at LOS C

during both weekday AM and PM peak hours. Under background (2019) traffic conditions, the eastbound approach is expected to operate at LOS E during the weekday AM peak hour and LOS D during the weekday PM peak hour. Under combined (2019) traffic conditions, the eastbound approach is expected to operate at LOS F during the weekday AM peak hour and LOS D during the weekday PM peak hour.

It should be noted the poor level-of-service experienced at this intersection is not uncommon for unsignalized minor-street approaches at a mainline with heavy volumes. The westbound approach was observed to operate with minimal delay and queuing in the SimTraffic simulation. During both weekday peak hours, the eastbound approach is expected to have a queue of approximately three (3) vehicles. Under future (2028) traffic conditions, the eastbound approach is expected to operate at LOS F during the weekday AM peak hour and LOS D during the weekday PM peak hour. Under future (2038) traffic conditions, the eastbound approach is expected to operate at LOS F during the weekday AM peak hour and LOS E during the weekday PM peak hour.

Additional laneage was considered at this intersection under future analysis scenarios; however, these improvements are not expected to mitigate the increase in delay for the minor-street approach. Therefore, to meet the Town UDO guidelines of achieving an LOS D or better, a traffic signal was considered at this intersection. With signalization, the intersection is expected to operate at an overall LOS A during both weekday AM and PM peak hours, under combined (2019) and future (2028/2038) traffic conditions.

Additionally, the combined (2019) and future (2028)/2038) traffic volumes were analyzed utilizing the criteria contained in the *Manual on Uniform Traffic Control Devices* (MUTCD). It should be noted that a traffic signal was not warranted during any of the weekday peak hours under combined (2019) and future (2028/2038) traffic conditions, and it is unlikely that a 4-hour or 8-hour signal warrant would be met due to the nature of the development on Olivetree Lane, which are preferred by the NCDOT for installation of signals. This improvement is the only improvement that would provide gaps in the mainline traffic to allow minor-street traffic to turn since separate turn lanes are already provided for the minor-street approach.

8.3. NC 22 and Mill Creek Road

The existing unsignalized intersection of NC 22 and Mill Creek Road was analyzed under existing (2018), background (2019), combined (2019), future (2028), and future (2038) traffic conditions with existing lane configurations and traffic control. Refer to Table 6 for a summary of the analysis results. Refer to Appendix F for the Synchro capacity analysis reports.

Table 6: Analysis Summary of NC 22 and Mill Creek Road

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2018) Conditions	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	C ² -- A ¹	N/A	C ² -- A ¹	N/A
Background (2019) Conditions	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	E ² -- A ¹	N/A	D ² -- A ¹	N/A
Combined (2019) Conditions	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	E ² -- A ¹	N/A	D ² -- A ¹	N/A
Combined (2019) Conditions - Signalized	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	B A A	A (6)	B A A	A (7)
Future (2028) Conditions	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	F ² -- A ¹	N/A	D ² -- A ¹	N/A
Future (2028) Conditions - Signalized	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	C A A	A (6)	B A A	A (7)
Future (2038) Conditions	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	F ² -- A ¹	N/A	E ² -- A ¹	N/A
Future (2038) Conditions - Signalized	WB NB SB	1 LT, 1 RT 1 TH, 1 RT 1 LT, 1 TH	C A B	A (9)	B A A	A (8)

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.

Capacity analysis of all analysis scenarios indicates all major-street left-turn movements are expected to operate at LOS A during both weekday AM and PM peak hours. Under existing

(2018) traffic conditions, the westbound approach is expected to operate at LOS C during both weekday AM and PM peak hours. Under background (2019) and combined (2019) traffic conditions, the westbound approach is expected to operate at LOS E during the weekday AM peak hour and LOS D during the weekday PM peak hour.

It should be noted the poor level-of-service experienced at this intersection is not uncommon for unsignalized minor-street approaches at a mainline with heavy volumes. The westbound approach was observed to operate with minimal delay and queuing in the SimTraffic simulation. During both weekday peak hours, the westbound approach is expected to have a queue of approximately three (3) vehicles. Under future (2028/2038) traffic conditions, the westbound approach is expected to operate at LOS F during the weekday AM peak hour and LOS E or better during the weekday PM peak hour.

Additional laneage was considered at this intersection under future analysis scenarios; however, these improvements are not expected to mitigate the increase in delay for the minor-street approach. Therefore, to meet the Town UDO guidelines of achieving an LOS D or better, a traffic signal was considered at this intersection. With signalization, the intersection is expected to operate at an overall LOS A during both weekday AM and PM peak hours, under combined (2019) and future (2028/2038) traffic conditions.

Additionally, the combined (2019) and future (2028)/2038) traffic volumes were analyzed utilizing the criteria contained in the *Manual on Uniform Traffic Control Devices* (MUTCD). It should be noted that a traffic signal was not warranted during any of the weekday peak hours under combined (2019) and future (2028/2038) traffic conditions, and it is unlikely that a 4-hour or 8-hour signal warrant would be met, which are preferred by the NCDOT for installation of signals. This improvement is the only improvement that would provide gaps in the mainline traffic to allow minor-street traffic to turn since separate turn lanes are already provided for the minor-street approach.

8.4. Mill Creek Road and Poverty Hill Circle

The existing unsignalized intersection of Mill Creek Road and Poverty Hill Circle was analyzed under existing (2018), background (2019), combined (2019), future (2028), and future (2038) traffic conditions with proposed lane configurations and traffic control. Refer to Table 7 for a summary of the analysis results. Refer to Appendix G for the Synchro capacity analysis reports.

Table 7: Analysis Summary of Mill Creek Road and Poverty Hill Circle

ANALYSIS SCENARIO	A P P R O V I D E N C E	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2018) Conditions	EB WB SB	1 LT-TH 1 TH-RT 1 LT-RT	A ¹ -- A ²	N/A	A ¹ -- A ²	N/A
Background (2019) Conditions	EB WB SB	1 LT-TH 1 TH-RT 1 LT-RT	A ¹ -- A ²	N/A	A ¹ -- A ²	N/A
Combined (2019) Conditions	EB WB SB	1 LT-TH 1 TH-RT 1 LT-RT	A ¹ -- A ²	N/A	A ¹ -- A ²	N/A
Future (2028) Conditions	EB WB SB	1 LT-TH 1 TH-RT 1 LT-RT	A ¹ -- A ²	N/A	A ¹ -- A ²	N/A
Future (2038) Conditions	EB WB SB	1 LT-TH 1 TH-RT 1 LT-RT	A ¹ -- A ²	N/A	A ¹ -- A ²	N/A

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.

Capacity analysis under all analysis scenarios indicates all minor-street approaches and major-street left-turn movements at the intersection of Mill Creek Road and Poverty Hill Circle are expected to operate at LOS A during the weekday AM and PM peak hours.

8.5. NC 22 and Fen Court

The existing unsignalized intersection of NC 22 and Fen Court was analyzed under existing (2018), background (2019), combined (2019), future (2028), and future (2038) traffic conditions with proposed lane configurations and traffic control. Refer to Table 8 for a summary of the analysis results. Refer to Appendix H for the Synchro capacity analysis reports.

Table 8: Analysis Summary of NC 22 and Fen Court

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2018) Conditions	EB NB SB	1 RT 1 TH 1 TH, 1 RT	B ² -- --	N/A	B ² -- --	N/A
Background (2019) Conditions	EB NB SB	1 RT 1 TH 1 TH, 1 RT	C ² -- --	N/A	B ² -- --	N/A
Combined (2019) Conditions	EB NB SB	1 RT 1 TH 1 TH, 1 RT	C ² -- --	N/A	B ² -- --	N/A
Future (2028) Conditions	EB NB SB	1 RT 1 TH 1 TH, 1 RT	C ² -- --	N/A	B ² -- --	N/A
Future (2038) Conditions	EB NB SB	1 RT 1 TH 1 TH, 1 RT	C ² -- --	N/A	B ² -- --	N/A

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.

Capacity analysis under all analysis scenarios indicates all minor-street approaches at the intersection of NC 22 and Fen Court are expected to operate at LOS C or better during the weekday AM and PM peak hours.

8.6. NC 22 and Reservoir Park Drive / Site Driveway

The existing unsignalized intersection of NC 22 and Reservoir Park Drive was analyzed under existing (2018) and background (2019) traffic conditions with existing lane configurations and traffic control. It should be noted the proposed site driveway will align with Reservoir Park Drive. The proposed unsignalized intersection of NC 22 and Reservoir Park Drive / Site Driveway was analyzed under combined (2019), future (2028), and future (2038) traffic conditions with proposed lane configuration and traffic control. Refer to Table 9 for a summary of the analysis results. Refer to Appendix I for the Synchro capacity analysis reports.

Table 9: Analysis Summary of NC 22 and Reservoir Park Drive / Site Driveway

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2018) Conditions	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	C ² A ¹ --	N/A	C ² A ¹ --	N/A
Background (2019) Conditions	EB NB SB	1 LT-RT 1 LT-TH 1 TH-RT	D ² A ¹ --	N/A	C ² A ¹ --	N/A
Combined (2019) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH, 1 RT 1 LT-TH, 1 RT 1 LT, 1 TH-RT	F ² E ² A ¹ A ¹	N/A	E ² E ² A ¹ A ¹	N/A
Combined (2019) Conditions - Signalized	EB WB NB SB	1 LT-TH-RT 1 LT-TH, 1 RT 1 LT-TH, 1 RT 1 LT, 1 TH-RT	C C B B	B (13)	B B B A	B (11)
Future (2028) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH, 1 RT 1 LT-TH, 1 RT 1 LT, 1 TH-RT	F ² F ² A ¹ A ¹	N/A	E ² E ² A ¹ A ¹	N/A
Future (2028) Conditions - Signalized	EB WB NB SB	1 LT-TH-RT 1 LT-TH, 1 RT 1 LT-TH, 1 RT 1 LT, 1 TH-RT	C C B B	B (14)	B B B A	B (11)

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

Recommended improvements by the developer are shown in **BOLD**.

Table 9: Analysis Summary of NC 22 and Reservoir Park Drive / Site Driveway [cont.]

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Future (2038) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT-TH, 1 RT 1 LT-TH, 1 RT 1 LT, 1 TH-RT	F ² F ² A ¹ A ¹	N/A	F ² F ² A ¹ B ¹	N/A
Future (2038) Conditions - Signalized	EB WB NB SB	1 LT-TH-RT 1 LT-TH, 1 RT 1 LT-TH, 1 RT 1 LT, 1 TH-RT	C C B B	B (16)	C C B B	B (15)

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

Recommended improvements by the developer are shown in **BOLD**.

Capacity analysis of existing (2018) and background (2019) traffic conditions indicates all major-street left-turn movements are expected to operate at LOS A and all minor-street approaches are expected to operate at LOS D or better during both weekday AM and PM peak hours.

To determine whether additional turn lanes should be considered at this intersection, the methodology outlined in the *Policy on Street and Driveway Access to North Carolina Highways* (published by the NCDOT) was utilized. Based on the findings from the turn lane warrant analysis, the intersection of NC 22 and Reservoir Park Drive / Site Driveway meets the criteria to warrant an exclusive southbound left-turn lane and northbound right-turn lane into the proposed site. Under combined (2019) traffic conditions, all major-street left-turn movements are expected to operate at LOS A and all minor-street approaches are expected to operate at LOS E during the weekday AM and PM peak hours, except for the eastbound minor-street approach which is expected to operate at LOS F during the weekday AM peak hour.

It should be noted the poor level-of-service experienced at this intersection is not uncommon for unsignalized minor-street approaches at a mainline with heavy volumes. The westbound approach was observed to operate with minimal delay and queuing in the SimTraffic simulation. During both weekday peak hours, the minor-street approaches are expected to have

a queue of approximately three (3) vehicles or less. Under future (2028/2038) traffic conditions, the minor-street approaches are expected to operate at LOS F during the weekday AM peak hour and LOS F or better during the weekday PM peak hour.

Additional laneage was considered at this intersection under future analysis scenarios; however, these improvements are not expected to mitigate the increase in delay for the minor-street approach. Therefore, to meet the Town UDO guidelines of achieving an LOS D or better, a traffic signal was considered at this intersection. With signalization, the intersection is expected to operate at an overall LOS B during both weekday AM and PM peak hours, under combined (2019) and future (2028/2038) traffic conditions.

Additionally, the combined (2019) and future (2028)/2038) traffic volumes were analyzed utilizing the criteria contained in the *Manual on Uniform Traffic Control Devices* (MUTCD). It should be noted that a traffic signal was not warranted during any of the weekday peak hours under combined (2019) and future (2028/2038) traffic conditions. A full signal warrant analysis may be necessary upon full-build out to determine if this intersection will satisfy the MUTCD 8-hour and 4-hour warrants, which NCDOT favors for installation of a traffic signal; however, these longer period warrants are not expected to be met based on the trip generation for the proposed site.

8.7. NC 22 and Aiken Road

The existing unsignalized intersection of NC 22 and Aiken Road was analyzed under existing (2018), background (2019), combined (2019), future (2028), and future (2038) traffic conditions with existing lane configurations and traffic control. Refer to Table 10 for a summary of the analysis results. Refer to Appendix J for the Synchro capacity analysis reports.

Table 10: Analysis Summary of NC 22 and Aiken Road

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2018) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	C ² -- A ¹	N/A	C ² -- A ¹	N/A
Background (2019) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	D ² -- A ¹	N/A	C ² -- A ¹	N/A
Combined (2019) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	D ² -- A ¹	N/A	C ² -- A ¹	N/A
Future (2028) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	E ² -- A ¹	N/A	C ² -- A ¹	N/A
Future (2028) Conditions - Improved	WB NB SB	1 LT, 1 RT 1 TH-RT 1 LT-TH	D ² -- A ¹	N/A	C ² -- A ¹	N/A
Future (2038) Conditions	WB NB SB	1 LT, 1 RT 1 TH-RT 1 LT-TH	E ² -- B ¹	N/A	C ² -- A ¹	N/A
Future (2028) Conditions - Signalized	WB NB SB	1 LT, 1 RT 1 TH-RT 1 LT-TH	C A B	B (13)	B A A	A (8)

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

Recommended improvements to maintain LOS D or better shown in **BOLD**.

Capacity analysis of existing (2018), background (2019), and combined (2020) traffic conditions indicates the major-street left-turn movement is expected to operate at LOS A and the minor-street approach is expected to operate at LOS D or better during both weekday AM and PM peak hours. Under future (2028) traffic conditions, the major-street left-turn

movement is expected to operate at LOS A and the minor-street approach is expected to operate at LOS E during the weekday AM peak hour and LOS C during the PM peak hour.

It should be noted the poor level-of-service experienced at this intersection is not uncommon for unsignalized minor-street approaches at a mainline with heavy volumes. To improve the minor-street approach level-of-service, additional laneage was considered in the form of an exclusive westbound right-turn lane. This improvement is triggered due to the background traffic growth in the surrounding area and new traffic counts should be conducted in the future to determine if the turn lane would be necessary to improve traffic conditions at the intersection. Under future (2028) improved traffic conditions, the minor-street approach is expected to operate at LOS D or better during both weekday AM and PM peak hours.

Under future (2038) traffic conditions, the minor-street approach is expected to operate at LOS E during the weekday AM peak hour and LOS C during the weekday PM peak hour. Additional laneage was considered at this intersection under future analysis scenarios; however, these improvements are not expected to mitigate the increase in delay for the minor-street approach. Therefore, to meet the Town UDO guidelines of achieving an LOS D or better, a traffic signal was considered at this intersection. With signalization, the intersection is expected to operate at an overall LOS B or better during both weekday AM and PM peak hours, under future (2038) traffic conditions.

Additionally, the future (2038) peak hour traffic volumes were analyzed utilizing the criteria contained in the *Manual on Uniform Traffic Control Devices (MUTCD)*. This intersection met only the weekday AM peak hour warrant for signalization. A full signal warrant analysis may be necessary in the future to determine if this intersection will satisfy the MUTCD 8-hour and 4-hour warrants, which NCDOT favors for installation of a traffic signal; however, these longer period warrants are not typically met for residential areas due to the distinct peak traffic periods for residential developments.

8.8. NC 22 and Pee Dee Road

The existing unsignalized intersection of NC 22 and Pee Dee Road was analyzed under existing (2018), background (2019), combined (2019), future (2028), and future (2038) traffic conditions with existing lane configurations and traffic control. Refer to Table 11 for a summary of the analysis results. Refer to Appendix K for the Synchro capacity analysis reports.

Table 11: Analysis Summary of NC 22 and Pee Dee Road

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2018) Conditions	EB NB SB	1 LT, 1 RT 1 LT-TH 1 TH, 1 RT	C ² A ¹ --	N/A	C ² A ¹ --	N/A
Background (2019) Conditions	EB NB SB	1 LT, 1 RT 1 LT-TH 1 TH, 1 RT	D ² A ¹ --	N/A	D ² A ¹ --	N/A
Combined (2019) Conditions	EB NB SB	1 LT, 1 RT 1 LT-TH 1 TH, 1 RT	D ² A ¹ --	N/A	D ² A ¹ --	N/A
Future (2028) Conditions	EB NB SB	1 LT, 1 RT 1 LT-TH 1 TH, 1 RT	F ² A ¹ --	N/A	E ² A ¹ --	N/A
Future (2028) Conditions - Signalized	EB NB SB	1 LT, 1 RT 1 LT-TH 1 TH, 1 RT	B B A	B (11)	B B A	A (10)
Future (2038) Conditions	EB NB SB	1 LT, 1 RT 1 LT-TH 1 TH, 1 RT	F ² A ¹ --	N/A	F ² A ¹ --	N/A
Future (2038) Conditions - Signalized	EB NB SB	1 LT, 1 RT 1 LT-TH 1 TH, 1 RT	B B A	B (12)	B B A	B (11)

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

Capacity analysis of existing (2018), background (2019), combined (2019) traffic conditions indicates all minor-street approaches are expected to operate at LOS D or better during both weekday AM and PM peak hours. Under all analysis scenarios, the major-street left-turn movement is expected to operate at LOS A during both the weekday AM and PM peak hours.

Under future (2028) traffic conditions, the minor-street approach is expected to operate at LOS E during both weekday AM and PM peak hours. Under future (2038) traffic conditions, the minor-street approach is expected to operate at LOS F during both the weekday AM and PM peak hours. It should be noted the poor level-of-service experienced at this intersection is not uncommon for unsignalized minor-street approaches at a mainline with heavy volumes. Additional laneage was considered at this intersection under future analysis scenarios; however, these improvements are not expected to mitigate the increase in delay for the minor-street approach. Therefore, to meet the Town UDO guidelines of achieving an LOS D or better, a traffic signal was considered at this intersection. With signalization, the intersection is expected to operate at an overall LOS B or better during both weekday AM and PM peak hours, under future (2028/2038) traffic conditions.

Additionally, the combined (2019) and future (2028/2038) peak hour traffic volumes were analyzed utilizing the criteria contained in the *Manual on Uniform Traffic Control Devices (MUTCD)*. This intersection met both the weekday AM and PM peak hour warrants for signalization. A full signal warrant analysis may be necessary in the future to determine if this intersection will satisfy the MUTCD 8-hour and 4-hour warrants, which NCDOT favors for installation of a traffic signal; however, these longer period warrants are not typically met for residential areas due to the distinct peak traffic periods for residential developments.

8.9. NC 22 and Service Driveway

The existing unsignalized intersection of NC 22 and Service Driveway was analyzed under combined (2019), future (2028), and future (2038) traffic conditions with existing lane configurations and traffic control. Refer to Table 12 for a summary of the analysis results. Refer to Appendix L for the Synchro capacity analysis reports.

Table 12: Analysis Summary of NC 22 and Service Driveway

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Combined (2019) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	C ² A ¹ --	N/A	C ² A ¹ --	N/A
Future (2028) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	D ² A ¹ --	N/A	C ² A ¹ --	N/A
Future (2038) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT-TH	D ² A ¹ --	N/A	D ² A ¹ --	N/A

1. Level of service for major-street left-turn movement.
2. Level of service for minor-street approach.

Capacity analysis of combined (2019) traffic conditions indicates all minor-street approaches and major-street left-turn movements at the intersection of NC 22 and Service Driveway are expected to operate at acceptable levels-of-service during the weekday AM and PM peak hours.

9. CONCLUSIONS

This Traffic Impact Analysis was conducted to determine the potential traffic impacts of the proposed Waterworks Development, located east of NC 22 and north of Aiken Road in Southern Pines, North Carolina. The proposed development is expected to be a mixed-use development and be built out in 2019. Site access is proposed via two full movement intersections on NC 22. The southern site driveway will align with the existing roadway of Reservoir Park Drive.

The study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- Existing (2018) Traffic Conditions
- Background (2019) Traffic Conditions
- Combined (2019) Traffic Conditions
- Future (2028) Traffic Conditions – Per Town’s UDO
- Future (2038) Traffic Conditions – Per Town’s UDO

Trip Generation

The total primary site trips are the calculated site trips after the reduction for internal capture and pass-by trips. Primary site trips are expected to generate approximately 151 trips (94 entering and 57 exiting) during the AM peak hour and 135 trips (66 entering and 69 exiting) will occur during the PM peak hour. Pass-by and internal capture information can be found in Section 4.1.

Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the Town’s UDO and NCDOT Congestion Management Guidelines.

Intersection Capacity Analysis Summary

All the study area intersections (including the proposed site driveways) are expected to operate at acceptable levels-of-service under existing and future year conditions with the exception of the following intersections. A summary of the study area intersections that are expected to need improvements are as follows:

NC 22 and Airport Road

Capacity analysis indicates the round-a-bout at NC 22 and Airport Road is expected to operate at LOS F during the weekday AM and PM peak hours under future (2038) traffic conditions. To improve the round-a-bout level-of-service to meet the Town's UDO requirements, additional laneage was considered in the form of an exclusive eastbound right-turn slip lane and an exclusive northbound right-turn slip lane. It should be noted that this improvement is triggered due to the background traffic growth in the surrounding area (not the proposed site traffic). New traffic counts should be conducted in the future to determine if the turn lanes will be necessary to improve overall traffic conditions at the round-a-bout.

NC 22 and Olivetree Lane

Capacity analysis indicates the minor-street approach is expected to operate at LOS E during the weekday AM peak hour under background (2019) traffic conditions. Under combined (2019) traffic conditions, the minor-street approach is expected to operate at LOS F during the weekday AM peak hour. Under future (2028/2038) traffic conditions, the minor-street approach is expected to operate at LOS F during the weekday AM peak hour and LOS E during the weekday PM peak hour. It should be noted the eastbound approach was observed to operate with minimal delay and queuing in the SimTraffic simulation. Because turn lanes already exist at this intersection, a traffic signal was considered to meet the Town's UDO requirements of achieving LOS D or better. The traffic volumes at this intersection do not meet peak hour warrants and it is unlikely the 8-hour and 4-hour warrants will be met, which are preferred by the NCDOT for installation of signals. No improvements are recommended.

NC 22 and Mill Creek Road

Capacity analysis indicates the minor-street approach is expected to operate at LOS E during the weekday AM peak hour under background (2019) and combined (2019) traffic conditions. Under future (2028) traffic conditions, the minor-street approach is expected to operate at LOS F during the weekday AM peak hour. Under future (2038) traffic conditions, the minor-street approach is expected to operate at LOS F during the weekday AM peak hour and LOS E during the weekday PM peak hour. It should be noted the westbound approach was observed to operate with minimal delay and queuing in the SimTraffic simulation. Because turn lanes

already exist at this intersection, a traffic signal was considered to meet the Town's UDO requirements of achieving LOS D or better. The traffic volumes at this intersection do not meet peak hour warrants and it is unlikely the 8-hour and 4-hour warrants will be met, which are preferred by the NCDOT for installation of signals. No improvements are recommended.

NC 22 and Reservoir Park Drive / Site Driveway

Capacity analysis indicates the minor-street approaches are expected to operate at LOS F or better during the weekday AM peak hour and LOS E during the weekday PM peak hour under combined (2019) traffic conditions. Under future (2028) traffic conditions, the minor-street approach is expected to operate at LOS F during the weekday AM peak hour and LOS E during the weekday PM peak hour. Under future (2038) traffic conditions, the minor-street approach is expected to operate at LOS F during the weekday AM and PM peak hours. It should be noted the eastbound approach was observed to operate with minimal delay and queuing in the SimTraffic simulation.

Additional laneage was considered at this intersection under future analysis scenarios; however, these improvements are not expected to mitigate the increase in delay for the minor-street approaches. To meet the Town's UDO requirements of achieving LOS D or better, a traffic signal was considered at this intersection. The traffic volumes at this intersection do not meet peak hour warrants. A full signal warrant analysis may be necessary upon full-build out to determine if this intersection will satisfy the MUTCD 8-hour and 4-hour warrants, which NCDOT favors for installation of a traffic signal; however, these longer period warrants are not expected to be met based on the trip generation for the proposed site.

NC 22 and Aiken Road

Capacity analysis indicates the minor-street approach is expected to operate at LOS E during the weekday AM peak hour under future (2028) traffic conditions. It should be noted the westbound approach was observed to operate with minimal delay and queuing in the SimTraffic simulation. To improve the minor-street approach level-of-service to meet the Town's UDO requirement of achieving LOS D or better, additional laneage was considered in the form of an exclusive westbound right-turn lane. It should be noted this improvement is

triggered due to background traffic growth in the surrounding area (not proposed site traffic). New traffic counts should be conducted in the future to determine if the turn lane would be necessary to improve traffic conditions at the intersection.

With the addition of the westbound right-turn lane, the minor-street approach is expected to operate at LOS E during the weekday AM peak hour under future (2038) traffic conditions. Additional laneage was considered at this intersection under future analysis scenarios; however, these improvements are not expected to mitigate the increase in delay for the minor-street approach. To meet the Town's UDO requirements of achieving LOS D or better, a traffic signal was considered at this intersection. This intersection met only the weekday AM peak hour warrant for signalization. A full signal warrant analysis may be necessary in the future to determine if this intersection will satisfy the MUTCD 8-hour and 4-hour warrants, which NCDOT favors for installation of a traffic signal. No improvements are recommended.

NC 22 and Pee Dee Road

Capacity analysis indicates the minor-street approach is expected to operate at LOS F during the weekday AM peak hour and LOS E during the weekday PM peak hour under future (2028) traffic conditions. Under future (2038) traffic conditions, the minor-street approach is expected to operate at LOS F during the weekday AM and PM peak hour.

Additional laneage was considered at this intersection under future analysis scenarios; however, these improvements are not expected to mitigate the increase in delay for the minor-street approaches. To meet the Town's UDO requirements of achieving LOS D or better, a traffic signal was considered at this intersection. This intersection met both the weekday AM and PM peak hour warrants for signalization. A full signal warrant analysis may be necessary in the future to determine if this intersection will satisfy the MUTCD 8-hour and 4-hour warrants, which NCDOT favors for installation of a traffic signal. It should be noted this improvement is triggered due to the background traffic growth in the surrounding area (not proposed site traffic). New traffic counts should be conducted in the future to determine if the signal would be necessary to improve traffic conditions at the intersection.

10. RECOMMENDATIONS

Based on the findings of this study, specific geometric improvements have been identified and are recommended to accommodate future traffic conditions. See a more detailed description of the recommended improvements below. Refer to Figure 15 for an illustration of the recommended lane configuration for the proposed development.

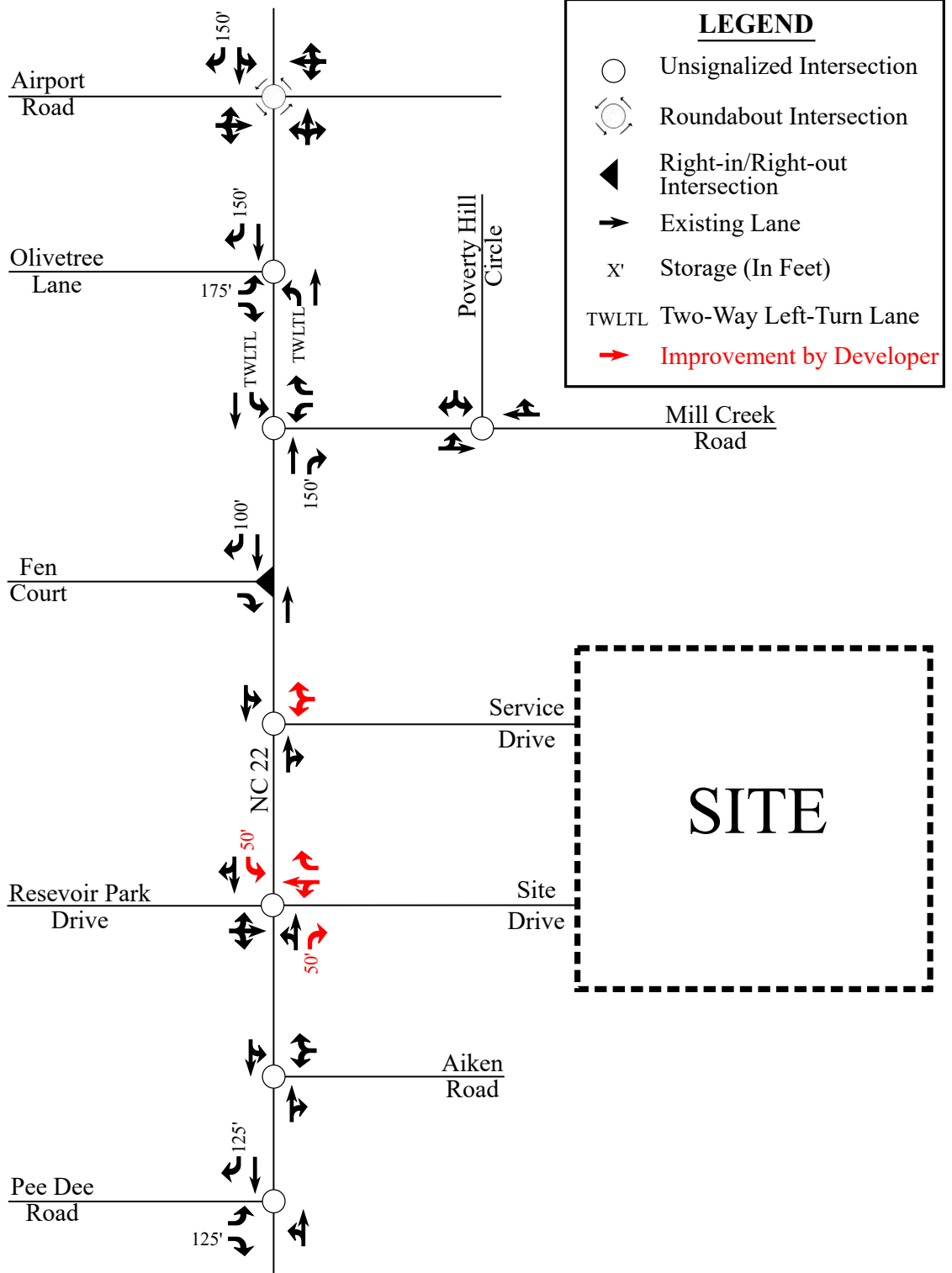
Recommended Improvements by Developer

NC 22 and Reservoir Park Drive / Site Driveway

- Provide site access via a full movement intersection to align with Reservoir Park Drive and provide one ingress and two egress lanes.
- Provide stop control for Site Driveway.
- Provide an exclusive northbound right-turn lane on NC 22 with 50 feet of storage and appropriate taper.
- Provide an exclusive southbound left-turn lane on NC 22 with 50 feet of storage and appropriate taper.

NC 22 and Service Driveway

- Provide site access via a full movement intersection and provide one ingress and one egress lane.
- Provide stop control for Service Driveway.
- Provide restricted access signage for service vehicles only.



Waterworks Development
Southern Pines, NC

Recommended
Lane Configurations

Scale: Not to Scale

Figure 18

BJ Grieve

From: Cindy Williams
Sent: Wednesday, December 29, 2021 11:55 AM
To: BJ Grieve; Suzy Russell
Subject: RLUAC response re: PD-12-21 & PD-13-21

Sincerely,

Cindy Williams, CZO
Planning Department
Town of Southern Pines
(910) 692-4003

From: RLUAC Executive Director <director@rluac.com>
Sent: Wednesday, December 29, 2021 11:45 AM
To: Cindy Williams <CWilliams@southernpines.net>
Subject: RLUAC Land Use Reviews

Cindy,

RLUAC does not have any comments on PD-12-21 or PD-13-21.

Thanks,

Vagn

Vagn K. Hansen II, AICP, Executive Director
Regional Land Use Advisory Commission
6205 Raeford Road
Fayetteville, NC 28304
(910) 398-3743
director@rluac.com
www.rluac.com

Agenda Item

To: Planning Board

From: Suzy Russell, Planner II

Subject: PD-13-21: Planned Development - Preliminary Development Plan for the new development of a retail building; Applicant: Ubuntu Developer LLC, Sanjeev Bhunta; Authorized Agent: Kevin Lindsay of Crawford Design Company

Date: January 20, 2022

I. SUMMARY OF APPLICATION REQUEST:

The applicant has applied for a preliminary development plan for the purpose of developing a retail building. The proposed Old Morganton Road Lot 1 development will be located in the planned development known as Morganton Park South. The retail building is a 7,000 square foot building located on 1.12 acres that are currently located in the Town of Southern Pines limits. The subject property is located on the corner of West Morganton Road and Brucewood Road with Old Morganton Road on its southwest corner, lies within the Morganton Road Overlay and is designated as traditional mixed use on the future land use map in the comprehensive long-range plan. The GIS mapping shows sewer and water availability. The subject property is identified as PIN: 857100484800 (PARID: 20200422) and per the Moore County tax records, the property owners are listed as Ubuntu Developer LLC.



II. STAFF REVIEW:

A. Criteria for Review:

The criteria for review and approval of the second step in the process, Preliminary Development Plan, are as follows:

Preliminary Development Plan - UDO § 2.18.5(H):

1. *The application demonstrates that it will achieve the purposes of the PDD and this section;*
2. *The Preliminary Development Plan is consistent with the Conceptual Development Plan and conforms to all applicable provisions of this UDO;*
3. *The proposed Development is located in an area of the Town that is appropriate; and*
4. *The proposed Development will not cause the need for inefficient extensions and expansions of public facilities, utilities and services.*

B. Staff Comments:

i. Consistency evaluation with the Unified Development Ordinance (UDO) and the Morganton Park North Conceptual Development Plan (CDP), MRD-01-13:

- The applicant has stated that public water and sewer stubouts have been installed for this site.
- The Southern pines Town Engineer has waived the requirement for a TIA/TDA.
- The applicant is compliant with the UVHCO district development standards found in Exhibit 3-13 of the UDO but deviates from the parking requirement and is requesting a parking waiver.
- The applicant is compliant with the MRO district standards found in UDO §3.6.6 but deviates from the parking requirement and is requesting a parking waiver.
- The applicant is requesting a modification to allow up to 46 parking spaces, which is in excess of the maximum number of parking spaces allowed within the Urban Village Road Highway Corridor Overlay District (UVHCO). The UVHCO requires that the number of parking spaces shall be a maximum of one space per 200 square feet of gross floor area. This equates to a maximum of 35 parking spaces for a 7,000 square foot retail building. The proposed development plan proposes parking for 46 vehicles, or one space per 150 square feet of gross floor area. The applicant has provided a parking waiver request and it is included in the attachment portion of the staff report.

The UDO in §4.5.4 states *the Town Council recognizes that, due to the particularities of any given Development, the inflexible application of the parking standards set forth in Exhibit 4-6 may result in a Development either with inadequate or excess parking space. The former situation may lead to traffic congestion or parking violations in adjacent streets as well as unauthorized parking in nearby private Lots. The latter situation results in a waste of money as well as a waste of space that could more desirably be used for Development or environmentally useful open space. Therefore, the Planning Director may permit reductions in the number of spaces or require more parking if the Planning Director finds in writing and notes on the building permit or zoning permit approval that such deviations are more likely to satisfy actual parking needs in accordance with this section.*

- Any proposed signage will be required to be compliant with the Sign Code in UDO §4.6.
- Final Development Plans pursuant to UDO §2.18.7 will be required to demonstrate compliance with the Preliminary Development Plan.
- The subject property is part of the Morganton Park South Conceptual Development Plan (CDP) that was approved by the Town of Southern Pines on May 14, 2013 (MRD-01-13). The applicant is compliant with the standards of the approved CDP.

ii. General Comments:

- The public hearing for this request will be evidentiary in format and will follow the procedures set forth in UDO §2.14.

C. Outside Agency Comments:

- A request for comments was emailed to agencies on November 22, 2021. Agencies notified include Town of Southern Pines Streets, Utilities, Fire, Recreation and Parks, and Engineering departments, the Regional Land Use Advisory Commission (RLUAC) and the North Carolina Department of Transportation (NCDOT).
- On December 29, 2021 RLUAC provided comment: *RLUAC does not have any comments.*
- At this time the Town Engineer is not requiring a TIA/TDA.

III. ATTACHMENTS:

The following materials are provided as attachments to this staff memorandum:

1. Preliminary Development Plan Application
2. Deed

3. Preliminary Development Plan Narrative/Justification
4. Parking Request
5. Conceptual Development Plan
6. Preliminary Development Site Plan
7. Elevation Drawings
8. Impervious Information from CDP

Additional documents related to this application including (but not limited to) property deeds, Authorization of Agent forms, email correspondence, meeting minutes and adjacent property notification records are on file in the Town of Southern Pines Planning Office and available for public inspections during normal business hours.

IV. PLANNING BOARD ACTION:

Pursuant to North Carolina General Statute §160D-301(b)(6) and Unified Development Ordinance §2.5.2, the Planning Board may hold a Preliminary Forum on a matter requiring a quasi-judicial decision by the Town Council. However, no part of the forum or any recommendation may be used as a basis for the deciding board.

Therefore, the Planning Board may wish to use the following motion to identify issues to bring to the attention of the Town Council at the evidentiary hearing.

I move to adopt the following for transmission to the Town Council as a result of the January 20, 2022 Preliminary Forum on application PD-13-21, Lot 1 Old Morganton Road:

The information presented at the forum indicated that the following issues be considered in applying the criteria for a PDP to application PD-13-21:

- 1.

In addition, the following concerns were raised during the forum, but do not seem to apply in determining whether the PDP criteria are satisfied:

- 1.

Planned Development District Preliminary Development Plan

REQUIRED APPLICATION MATERIALS:

- X **Application fee** in the amount of **\$1,800.00 plus \$25.00 per lot.**
- X **Completed Application** for a Planned Development District - Preliminary Development Plan signed by the applicant.
- X **Appointment of Agent**, if applicable, signed by the property owner(s) and the agent.
- X **List of Adjacent Property Owners**: Please list all properties that are that are within two hundred (200) feet of the outermost boundaries of the subject property (**not counting streets, railroads or other transportation corridors**). Attach additional pages if needed. No fewer than ten (10) property owners shall be notified by mail.
- X **Written narrative** describing the application's consistency with the Conceptual Development Plan, the UDO, and any other applicable regulations.
- NA **Neighborhood meeting records** if not provided in conjunction with an application for Conceptual Development Plan approval or if additional meetings have been held. [See Morganton Park South CDP.](#)
- X **Additional documentation**: Additional text and/or maps to demonstrate consistency with **UDO §2.18.5(H) Criteria (1) through (4)**. [Deed, select pages from CDP, blow up of PH 1 Drainage plan and Architect's preliminary elevations provided](#)
- X **PDD Preliminary Development Plan**: One (1) full-size copy of a preliminary plat or scaled drawings of the entire tract to be subdivided. Please refer to the **UDO Appendices** for plan requirements. [Due to small size of project 11x17 at 1"=20' used](#)
- NA **Drainage concept plan** if applicable. [See Morganton Park South Phase 1 drainage plan.](#)
- NA **Traffic Impact Analysis** if applicable. [See TIA for Morganton Park South Phase 1.](#)
- X **Electronic copy (PDF) of all application materials** submitted to plan@southernpines.net.

PLEASE SUBMIT ONLY ONE (1) COMPLETE SET OF ALL MATERIALS.

REVIEW AND APPROVAL:

1. **Staff review**: Planning staff will review the application and notify the applicant if additional information or materials are needed.
2. **Public hearing**: The applicant is expected to attend a public hearing on the application before the Town Council at its regular monthly meeting. (Please refer to the **Application Processing Timeline** to determine the hearing date.) The Town Council will consider evidence and testimony presented and may approve, conditionally approve or deny the request.
3. **Approval**: Please refer to UDO **§2.18.5(I) Effect of Approval**.



Planned Development District Preliminary Development Plan Application

Fee: \$ _____ Date Received: _____ Case No.: PD- _____ - _____

Project Information:

Project Name: Old Morganton Road Lot 1

Physical Address: Lot 1, Old Morganton Road (corner of Brucewood Rd and Old Morganton Rd)

PIN: 857100484800 Parcel ID: 20200422

Site Size: 1.12 acres Zoning: PDD

Applicant:

Name(s): _____

Email: _____ Phone: _____

Mailing Address: _____

Authorized Agent, if different from Applicant:

Name(s): Kevin Lindsay, PD

Email: kevinlindsay@crawforddsn.com Phone: 910-920-7661

Mailing Address: 230 West Pennsylvania Ave., Suite C, Southern Pines, NC 28387

Legal Property Owner(s), if different from Applicant:

Name(s): Ubuntu Developer LLC, a North Carolina LLC

Email: _____ Phone: _____

Mailing Address: PO Box 249, Southern Pines, NC 2838

8-27-21

TO THE TOWN OF SOUTHERN PINES PLANNING BOARD AND TOWN COUNCIL:

I, the undersigned, do hereby make application to and petition the Planning Board and Town Council for approval of a Planned Development District – Preliminary Development Plan as required by the Town of Southern Pines Zoning Ordinance. The following information is submitted in support of this application:

The property which is the subject of this application is located on the South side of Brucewood Rd (St./Ave.), between Morganton Rd (St./Ave.) and Old Morganton Rd (St./Ave.). The property has a frontage of 156 feet and a depth of 280 feet.

The request is based upon **Section 2.18.5** of the **Town of Southern Pines Unified Development Ordinance**. The proposed use of the property is as follows:

Retail center with restaurant, office, and retail

Date: 12/14/2021



Applicant

Sanjeev Bhunta, Manager
Ubunta Developer LLC

PLANNING DEPARTMENT
TOWN OF SOUTHERN PINES
plan@southernpines.net (910) 692-4003 www.southernpines.net

APPOINTMENT OF AGENT

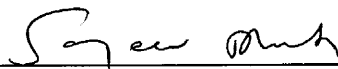
The undersigned owner(s), of Ubuntu Developer LLC, hereby appoint(s) Kevin Lindsay, PE as the exclusive agent for the purpose of making an application to the Town of Southern Pines for the approval of the Planned Development District – Preliminary Development Plan described in the attached application. The owner(s) hereby agree(s) that this agent has the authority to act for and on behalf of the owner(s) as follows:

1. to submit an application and required supplemental materials;
2. to appear at public meetings and give representation and comments on behalf of the owner(s);
3. to accept conditions or recommendations made by the Town of Southern Pines Town Council for the approval of a Planned Development District – Preliminary Development Plan; and
4. to act on behalf of the property owner(s) without limitations with regard to any and all things directly or indirectly connected with or arising out of any application for a Planned Development District -Preliminary Development Plan under the Southern Pines Unified Development Ordinance.

This Appointment of Agent shall remain in effect until final resolution of the attached application.

Signed this 14 day of DECEMBER, 2021.

Sanjeev Bhunta, Manager, Ubuntu Developer LLC
Property Owner


Property Owner


Agent

UDO §2.18 Planned Development

§2.18.5(H) Preliminary Development Plan Criteria

- (1) The application demonstrates that it will achieve the purposes of the PDD and this section;
- (2) The Preliminary Development Plan is consistent with the Conceptual Development Plan and conforms to all applicable provisions of this UDO;
- (3) The proposed Development is located in an area of the Town that is appropriate; and
- (4) The proposed Development will not cause the need for inefficient extensions and expansions of public facilities, utilities and services.

For Registration Register of Deeds
Judy D. Martin

Moore County, NC

Electronically Recorded

October 15, 2021 1:58:15 PM

Book: 5724 Page: 400 - 402 #Pages: 3

Fee: \$26.00 NC Rev Stamp: \$1,730.00

Instrument# 2021022866

Excise Tax \$1,730.00 Recording Time, Book and Page
Parcel ID 20200422 PIN 857100484800
Verified by _____ County on the _____ day of _____, 20____
by _____

Mail after recording to: _____ Grantee

This instrument was prepared by: Charles E. Nichols, Jr. of Weatherspoon & Voltz LLP (without title examination)

Brief description for the Index: Parcel 1, PC17-712

NORTH CAROLINA SPECIAL WARRANTY DEED

THIS DEED made this 13th day of October, 2021, by and between

GRANTOR

CPGKRE Pinehurst Lowes Outparcels, LLC,
a North Carolina limited liability company

1330 St. Mary's Street, Suite 100
Raleigh, NC 27605

GRANTEE

Ubuntu Developer LLC,
a North Carolina limited liability company
PO Box 249
Southern Pines, NC 28388

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto

submitted electronically by "Robbins May & Rich LLP"
in compliance with North Carolina statutes governing recordable documents
and the terms of the submitter agreement with the Moore County Register of Deeds.

the Grantee in fee simple, all of that certain lot or parcel of land situated in Guilford County, North Carolina and more particularly described as follows:

BEING ALL OF Parcel 1 as shown on that subdivision plat for CPGKRE Pinehurst Lowes, LLC prepared by McNeill Surveying and Land Planning, PLLC dated August 15, 2016 and recorded in Book 17, Page 712, Moore County, North Carolina, Registry.

All or a portion of the property herein conveyed includes or X does not include the primary residence of a Grantor.

The Property was acquired by Grantor by instrument recorded in Book 5397, Page 95, Moore County Registry.

A map showing the above described property is recorded in Plat Cabinet 17, Page 712, Moore County Registry.

TO HAVE AND TO HOLD the aforesaid lot or parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee, that Grantor has done nothing to impair such title as Grantor received, and Grantor will warrant and defend the title against the lawful claims of all persons claiming by, under or through Grantor, except for the exceptions hereinafter stated.

Title to the property hereinabove described is subject to the following exceptions:

This property is conveyed subject to covenants, restrictions, easements and other matters of record affecting said property and to 2022 ad valorem taxes and taxes for subsequent years.

[SIGNATURE PAGE FOLLOWS]

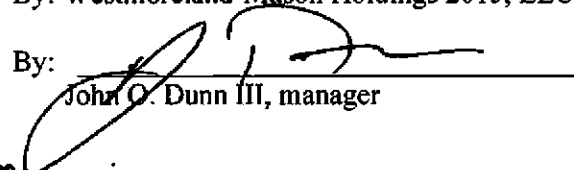
IN WITNESS WHEREOF, the Grantor has executed this instrument as of the day and year first above written.

CPGKRE Pinehurst Lowes Outparcels, LLC, a North Carolina limited liability company

By: CPG Ellison Pinehurst Lowes, LLC, its manager

By: CPG Pinehurst Lowes, LLC, its manager

By: Westmoreland-Mason Holdings 2015, LLC, its manager

By: 
John O. Dunn III, manager

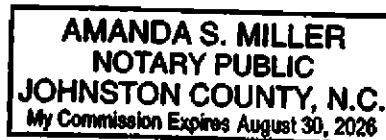
STATE OF North Carolina :
COUNTY OF Wake :

I certify that the following person personally appeared before me this day, acknowledging to me that to me that he voluntarily signed the foregoing document for the purpose stated therein and in the capacity indicated: John O. Dunn III.

Date: 10/13/2021

[Affix Notary Seal]

Notary Public: A S Miller
Printed Name: Amanda S. Miller
My Commission Expires: 8/30/2026



**CONSENT OF INITIAL MEMBERS
OF
UBUNTU DEVELOPER LLC
TO ACTION WITHOUT MEETING**

We, the undersigned, being all of the Members of Ubuntu Developer LLC (hereinafter the "Company") do hereby unanimously adopt the following Resolutions with the approval of the Members by signing our written consent hereto:

APPOINTMENT OF MANAGERS

RESOLVED, that as Article III, Section 3.1 of the Operating Agreement of the Company provides that Managers shall be elected by the Members and the following persons be, and they hereby are, elected as Managers of the Company by the Members:

Name

George Manley
Sanjeev Bhuta

LOAN RESOLUTIONS

WHEREAS the Company has been capitalized by the contribution of cash and/or property paid in for its Membership Units; and

WHEREAS it is anticipated that the Company will need additional funds from time to time and that such funds can be borrowed under promissory notes issued by the Company;

NOW, THEREFORE, BE IT RESOLVED, that the Members of the Company be, and they hereby are, authorized to borrow money on behalf of the Company from time to time and to issue promissory notes therefore repayable over varying periods of years with interest at such rates, and upon such other terms and conditions, as all of the Members may deem necessary and appropriate.

BANKING RESOLUTIONS

RESOLVED that _____ (name of bank) be, and it hereby is, designated as a depository of the Company and that funds deposited therewith may be withdrawn upon a check, draft, note or order of the Company, signed by the Managers named herein, whose signatures shall be certified to the said Bank as Members of the Company; and no checks, drafts, notes, or orders drawn against such account shall be valid unless so signed; and

RESOLVED, FURTHER, that the said Bank is hereby authorized to honor, receive, certify, or pay all instruments signed in accordance with the foregoing resolutions even though drawn or endorsed to the order of any person signing the same or tendered by him for cashing or in payment of the individual obligation of such person, or for deposit to his personal account, and said Bank shall not be required to inquire as to the circumstances of the issuance or use of any instrument signed in accordance with the foregoing resolution, or the application or disposition of such instrument or the proceeds thereof; and

RESOLVED FURTHER, that these resolutions shall remain in effect until rescinded or modified by resolution of the Member of the Company and until a certified copy of such resolution shall have been filed with the said Bank.

To evidence the establishment of the aforesaid Bank as depository of the Company, the Members shall certify a copy of these resolutions to said Bank or in lieu thereof file with the bank an appropriate designation on such Bank's form(s). A copy of such form(s) shall, if used, be inserted in the Company's Minute Book.

PRIOR ACTS

RESOLVED that all acts and things heretofore done for and on behalf and in the name of the Company by any organizer be, and they hereby are, ratified and affirmed in each, all, and every respect.

COMMENCEMENT OF BUSINESS

RESOLVED that the Company proceed to carry on the business which it was organized, commencing same, 17th day of August, 2021.

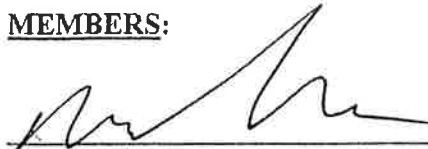
GENERAL AUTHORIZATION

RESOLVED that the Members of the Company be, and they hereby are, further authorized and empowered to do any and all other and further things and matters, of every nature whatsoever, which they, in their sole and unlimited discretion, shall deem necessary or proper for the purposes of the resolutions and matters in connection with the full organization and operation of the Company.

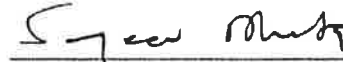
This action is effective from and after this the 17th day of August, 2021.

UBUNTU DEVELOPER LLC

MEMBERS:

 (SEAL)
Mubarak Shahbain

SRM DEVELOPERS LLC

By:  (SEAL)

Name: Sanjeev Bhuta

Title: Manager

 (SEAL)
Helen Spofford Bell - Member

 (SEAL)
George Manley - Member

Execution Version

**Operating Agreement
of
Ubuntu Developer LLC**

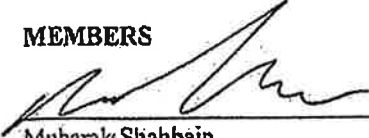
(A North Carolina Manager-Managed Limited Liability Company)

August 17, 2021

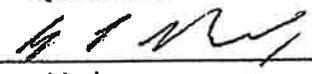
THE LLC OWNERSHIP INTERESTS REPRESENTED BY THIS OPERATING AGREEMENT HAVE NOT BEEN REGISTERED WITH THE SECURITIES AND EXCHANGE COMMISSION UNDER THE SECURITIES ACT OF 1933, AS AMENDED, OR UNDER THE NORTH CAROLINA SECURITIES ACT, OR SIMILAR LAWS OR ACTS OF OTHER STATES IN RELIANCE UPON EXEMPTIONS UNDER THOSE ACTS. THE SALE OR OTHER DISPOSITION OF THE OWNERSHIP INTERESTS IS RESTRICTED AS STATED IN THIS OPERATING AGREEMENT, AND IN ANY EVENT IS PROHIBITED UNLESS THE LLC RECEIVES AN OPINION OF COUNSEL SATISFACTORY TO IT AND ITS COUNSEL THAT SUCH SALE OR OTHER DISPOSITION CAN BE MADE WITHOUT REGISTRATION UNDER THE SECURITIES ACT OF 1933, AS AMENDED, AND ANY APPLICABLE STATE SECURITIES ACTS AND LAWS. BY ACQUIRING THE OWNERSHIP INTEREST REPRESENTED BY THIS OPERATING AGREEMENT, THE MEMBER REPRESENTS THAT IT WILL NOT SELL OR OTHERWISE DISPOSE OF ITS OWNERSHIP INTERESTS WITHOUT REGISTRATION OR OTHER COMPLIANCE WITH THE AFORESAID ACTS AND THE RULES AND REGULATIONS ISSUED THEREUNDER.

IN WITNESS WHEREOF, the undersigned, being all of the initial Members of the Company, have caused this Agreement to be duly adopted by the Company as of the 17th day of August, 2021 and do hereby assume and agree to be bound by and to perform all of the terms and provisions set forth in this Agreement.

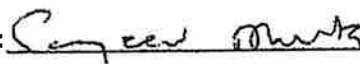
MEMBERS


Mubarak Shahbain


Helen Spofford Bell


George Manley

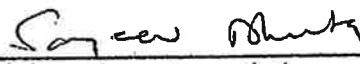
SRM DEVELOPERS LLC

By: 

Name: SANJEEV DHUTA

Its: Manager

MANAGERS




2.18.5 (H) Preliminary Development Plan (PDP) Criteria:

(1) The application demonstrates that it will achieve the purposes of the PDD and this section:

The proposed PDP is for a 1.12 out-parcel that was planned for in the Morganton Park South CDP and Phase 1 plans. It has water, sewer, and storm stubouts on the property and will use the existing entrance.

(2) The Preliminary Development Plan is consistent with the Conceptual Development Plan and conforms to all applicable provisions of this UDO:

The proposed PDP is very similar to that shown in the approved CDP. It is what was envisioned for this area. The finishes will match that of the existing buildings.

(3) The proposed Development is located in an area of the Town that is appropriate:

This area has excellent access to the four land divided highway Morganton Road and from there to US 15/501 and US 1. The proposed use is in line with the zoning and approved CDP and the completed Phase 1 development of Morganton Park South.

(4) The proposed Development will not cause the need for inefficient extensions and expansions of public facilities, utilities and services.

There are existing 2" water, 6" sanitary sewer, and 15" storm stubouts on the property that were placed there in anticipation of this project. No public water or sewer main extensions will be required.

Additional Comments:

- 1. Architectural: Please see attached preliminary elevations. The building will match the existing structures as much as possible and is being designed by the same architect.*
- 2. Signage: No additional signage is planned at this time.*
- 3. Parking: By the UDO, 51 spaces would be required based on expected tenant types. 48 spaces are currently planned. This 6% reduction is reasonable based on the location, types of businesses expected, and availability of public parking surrounding the site.*
- 4. Pedestrian Connectivity: The existing asphalt walking trail provides excellent connectivity to the site.*
- 5. Streets: No internal streets are planned. VUAs will meet TOSP UDO requirements.*
- 6. Open Space: Open space has been accounted for in the larger development--no open spaces were planned for this site in the approved CDP.*
- 7. Stormwater Control: This site was planned for as part of Morganton Road South Phase 1 (including .67 acres of impervious area). An existing catch basin will connect this site to the downstream Stormwater Control Measures.*
- 8. Utilities: Public water and sewer stubouts have been installed for this site.*
- 9. Other: All TOSP Landscaping, lighting, buffers and setbacks will be followed.*



January 6, 2022

Town of Southern Pines
Planning Department
180 SW Broad Street
Southern Pines, NC 28387

**Re: Additional Parking Waiver Request
Lot 1 Old Morganton Road**

To Whom It May Concern:

This letter is requesting a waiver for additional parking spaces for Lot 1 on Old Morganton Road. The lot is part of a Planned Development District (PDD) and is in the Highway Corridor Overlay (HCO) and Morganton Road Overlay (MRO). As such, the maximum allowable parking is 1 space per 200 sf of building (HCO) and 1 space per 250 sf of building (MRO). It is assumed that the one space per 200 sf would govern here. Based on a planned building of 7,000 sf and 400 sf of outdoor eating, we could only provide a maximum of 37 spaces. Since approximately 3,200 sf of the 7,000 sf will be restaurant, we don't feel 37 spaces is adequate. If we used the general off street parking requirements in the UDO, we estimate that 51 spaces would be required for the anticipated mix of restaurant, office, and retail—please see table in Preliminary Development Plan (PDP) submittal. Our current design includes 45 spaces and meets all other requirements of the approved CDP, proposed PDP, HCO, and MRO. We would therefore like to request and waiver to place up to 45 parking spaces (two of which will be ADA spaces) on the property.

Please contact me at 910-920-7661 if you have any questions.

Sincerely,
Crawford Design Company

A handwritten signature in black ink, appearing to read "Kevin Lindsay".

Kevin Lindsay, PE
Vice President

LANDSCAPE
ARCHITECTURE
ENGINEERING
PLANNING



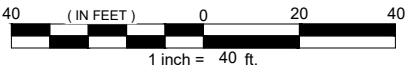
LandDesign.
 KOONTZDesign
 LAND PLANNING | LANDSCAPE ARCHITECTURE

MORGANTON PARK SOUTH MASTER PLAN ILLUSTRATIVE SOUTHERN PINES, NORTH CAROLINA

MARCH 1, 2013

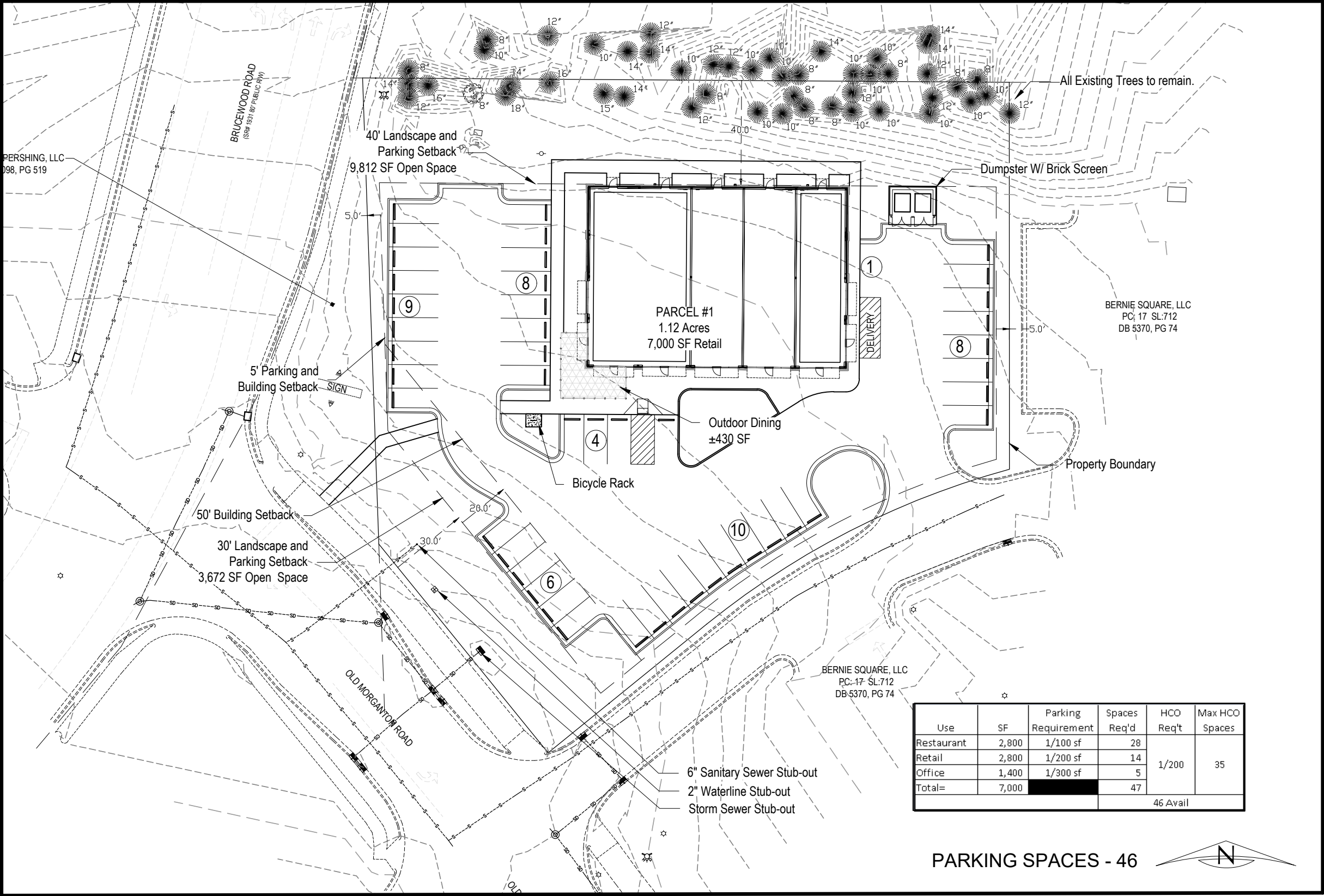
 LINCOLN
 HARRIS

MORGANTON PARK OUTPARCEL
LOT 1 OLD MORGANTON ROAD



A

- NOTES
- 1. Drainage: Parcel include in Morganton Park South Phase 1 stormwater design and shown as having a maximum 0f .67 acres impervious (29,185 SF).
 - 2. Impervious area as shown = 29,185 SF (60%).
 - 3. TIA: See Morganton Park South Phase 1 TIA.
 - 4. Site has existing 2" waterline stub-out.
 - 5. Site has existing 6" sewer stub-out.
 - 6. Site has existing storm sewer stub-out.
 - 7. Site has 13,484 SF Open Space. (27% > 20% required).
 - 8. Planned building height 24' < 35' max. allowed.
 - 9. Building 7,000 SF, 14% < 30% allowed.
 - 10. Built Upon Area (BUA) 29,185 SF. 60% < 70% allowed.
 - 11. Parking: Per HCO, 35 spaces allowed. Requesting waiver to place 46 spaces (includes 2 ADA) on property. Please see waiver request.



January, 2022

PRELIMINARY PLAN



230C.W. Pennsylvania Ave. - Southern Pines, NC 28387
910.725.1107
www.crawforddsn.com

All drawings, specifications and designs prepared by Crawford Design Company are instruments of service and shall remain the property of Crawford Design Company. The Owner or any other parties shall not use the work on this or any project except by a proper agreement and appropriate compensation.

CRAWFORD DESIGN COMPANY
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Use	SF	Parking Requirement	Spaces Req'd	HCO Req't	Max HCO Spaces
Restaurant	2,800	1/100 sf	28	1/200	35
Retail	2,800	1/200 sf	14		
Office	1,400	1/300 sf	5		
Total=	7,000		47		
			46 Avail		

PARKING SPACES - 46



ELEVATION NOTES

- 1

PRE-FINISHED METAL COPING-CAP FLASHING
- 2

EIFS CORNICE TRIM CAP AT PARAPET WALL
- 3

EIFS WALL CLADDING SYSTEM
- 4

MODULAR BRICK VENEER
- 5

ACCENT BRICK HERRINGBONE PATTERN FEATURE
- 6

PRE-FINISHED STANDING SEAM METAL ROOFING OVER SLOPED METAL CANOPY
- 7

METAL ALUMINUM FRAME AWNING (Hanger rod mount)
- 8

PRE-FINISHED ALUMINUM STOREFRONT SYSTEM WITH INSULATED GLAZING
- 9

TENANT SIGN AREA
- 10

CONCRETE SIDEWALK
- 11

EXTERIOR WALL MOUNTED LIGHT FIXTURE (SCONCE) SEE ELECTRICAL SCHEDULE
- 12

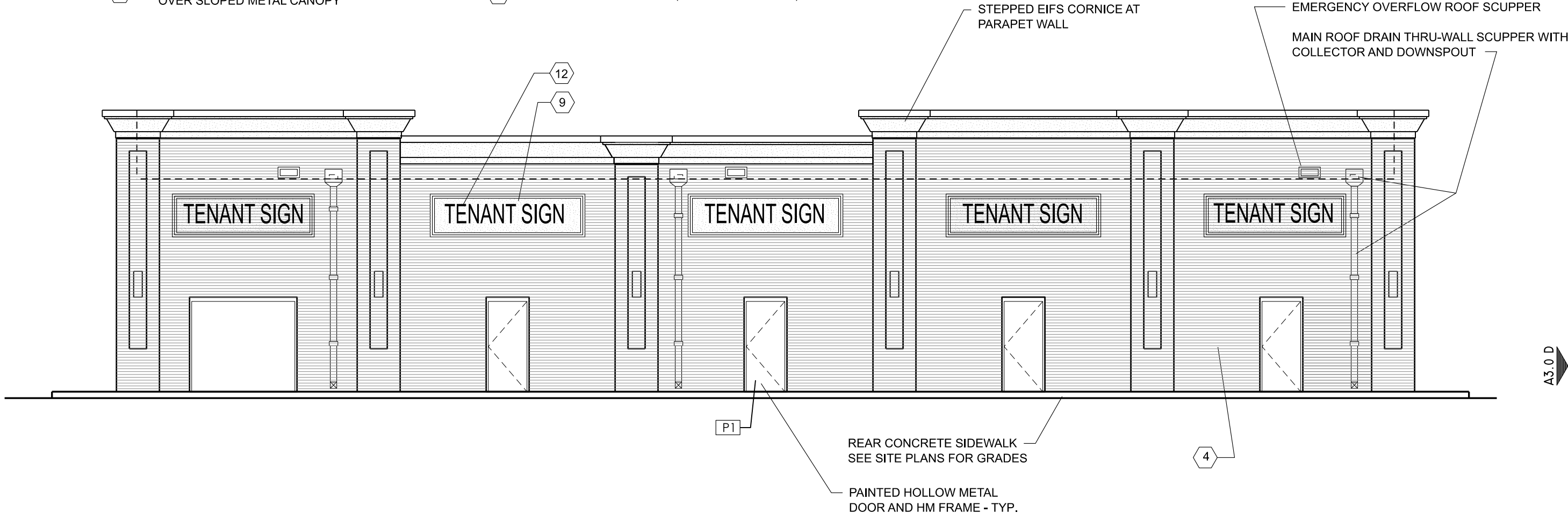
FUTURE TENANT SIGN (SIGNS BY OTHERS)
- 13

STREET ADDRESSING LETTERING ON GLAZING ABOVE ENTRY DOOR (LETTERING BY GC)
- 14

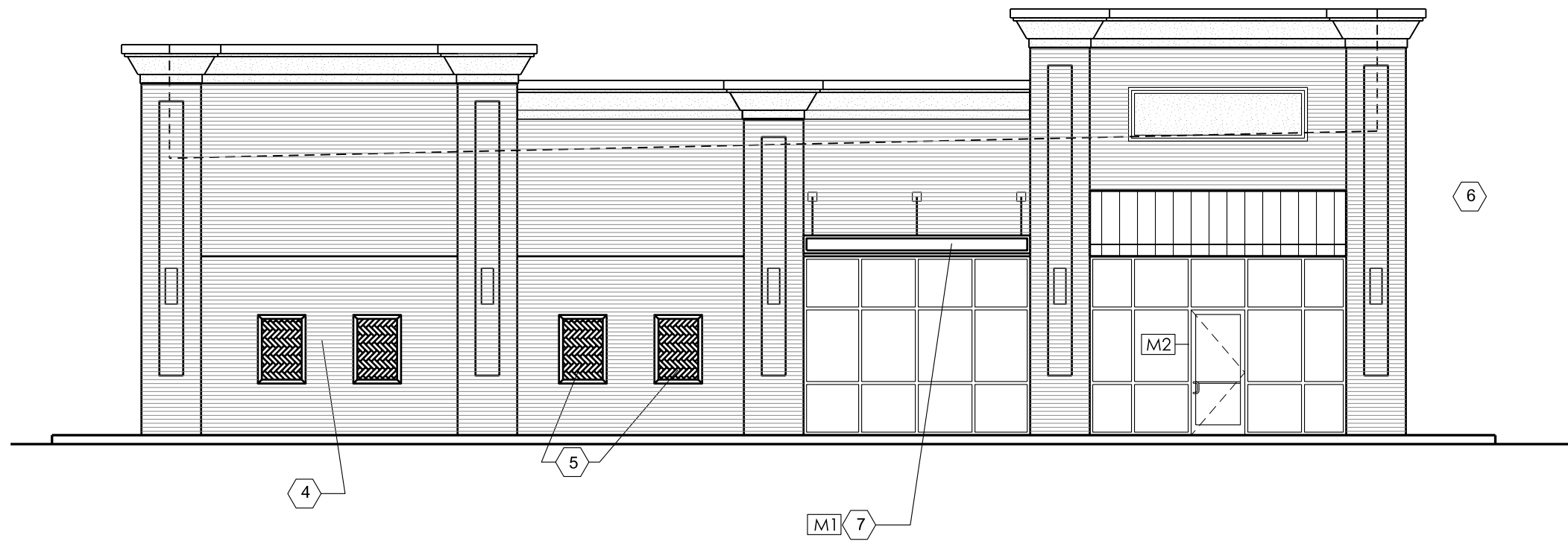
ACCENT BRICK VENEER
- 15

EIFS CONTROL JOINT
- 16

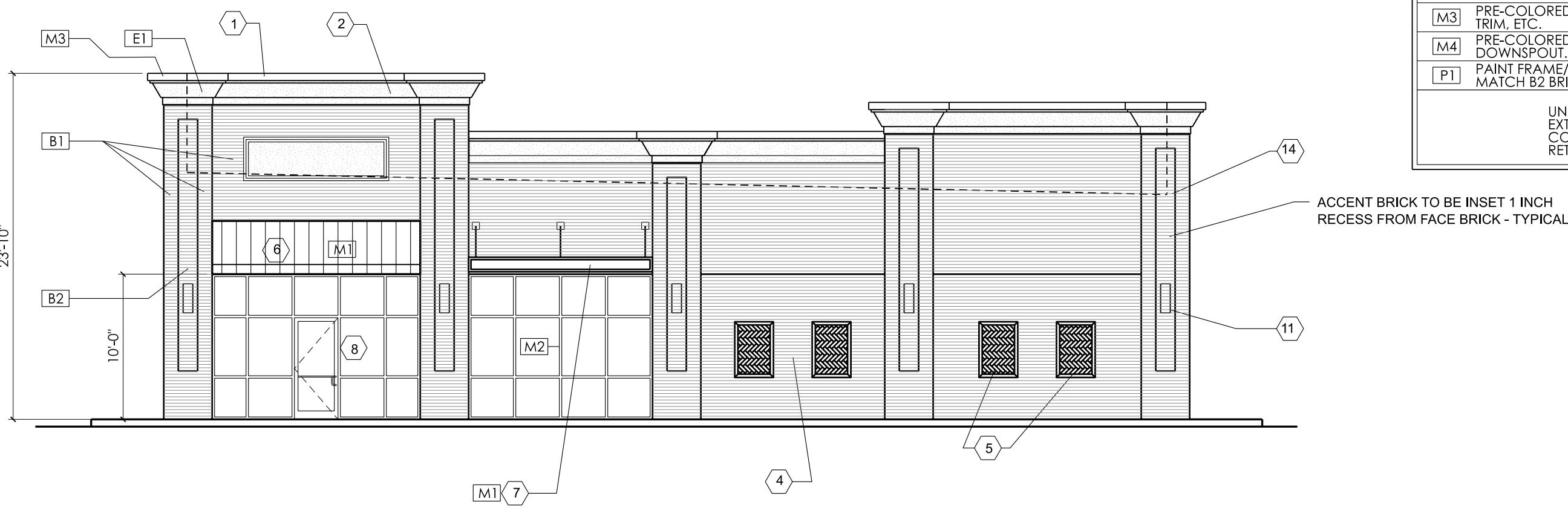
BRICK (MASONRY) CONTROL JOINT



A3.0 C REAR ELEVATION: SCALE: 1/8" = 1'-0"



A3.0 D RIGHT SIDE ELEVATION: SCALE: 1/8" = 1'-0"

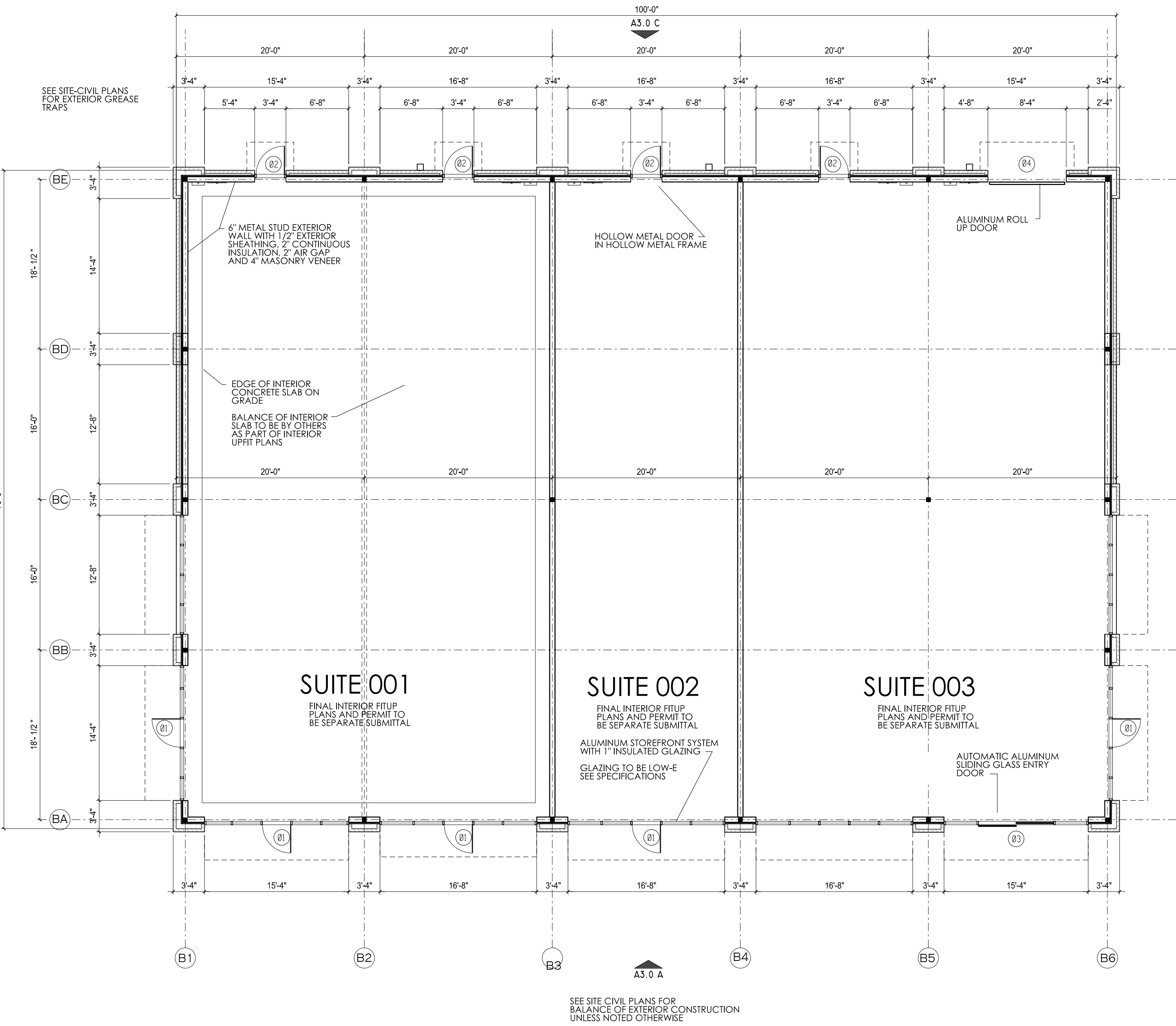


A3.0 B LEFT SIDE ELEVATION: SCALE: 1/8" = 1'-0"

EXTERIOR FINISH LEGEND	
PRODUCT	MANUFACTURER
B1 BRICK VENEER, FIELD COLOR	SEE BRICK ALLOWANCE
B2 BRICK VENEER, ACCENT COLOR	SEE BRICK ALLOWANCE
E1 EIFS	FRENCH VANILLA
M1 PRE-COLORED METAL ROOFING AND TRIM	METAL ROOFING SYSTEMS, DARK BRONZE
M2 ALUMINUM STOREFRONT	DARK BRONZE
M3 PRE-COLORED FLASHING, TRIM, ETC.	TO MATCH E1, SELECTED FROM MANUF. STD. COLORS
M4 PRE-COLORED GUTTER & DOWNSPOUT	TO MATCH M1
P1 PAINT FRAME/DOOR TO MATCH B2 BRICK	SHERWIN-WILLIAMS

UNLESS NOTED OTHERWISE EXTERIOR MATERIALS AND COLORS TO MATCH EXISTING RETAIL BUILDING ON SITE - TYP.

ACCENT BRICK TO BE INSET 1 INCH RECESS FROM FACE BRICK - TYPICAL



A3.0 .1 FLOOR PLAN SCALE: 1/8" = 1'-0"

RETAIL BUILDING OUT-PARCEL 1
70' X 100'-0"
7,000 SF



A3.0 A FRONT ELEVATION: SCALE: 1/8" = 1'-0"

