LAKE LURE TOWN COUNCIL
PLANNING RETREAT PACKET

Monday, January 8, 2024
8:30 a.m.

Mayor Carol C. Pritchett
Mayor Pro Tem David DiOrio
Commissioner Patrick Bryant
Commissioner Scott Doster
Commissioner Jim Proctor

TOWN OF LAKE LURE

Town Council Special Planning Retreat

Monday, January 8, 2024 - 8:30 AM

Lake Lure Municipal Center

Agenda

Initial Council Discussions from 8:30 a.m. to 9:00 a.m. Town staff included discussions from 9:00 a.m. until adjournment.

I. Call to Order

II. Introduction

III. Review Accomplishments Following 2023 Town Council Planning Retreat

IV. Major Project Updates

- **A. Dam**
- **B. Sewer**
- **C. Drain Valve Installation**
- **D. Dredging**
- **E. Cell Tower**
- **F. Wastewater Treatment Plant**
- **G. Dam Bridge**

V. Comprehensive Plan

VI. Transportation Goals

VII. Workforce Housing

VIII. Future Fire Department

IX. Public Safety

X. Finance

XI. Parks, Recreation, and Lake

XII. Utilities

XIII. Public Services

XIV. Community Development

XV. Communications

XVI. Administration

XVII. Closing Discussion

XVIII. Adjournment

This packet provides supporting documents for the following agenda items:

- Review Accomplishments Following 2023 Town Council Planning Retreat – *Page 1*

- Major Project Updates – *Page 4*

- Future Fire Department – *Page 46*

All other agenda items do not include supporting documents, but will be discussed at the time of the planning retreat.

Review Accomplishments Following 2023 Town Council Planning Retreat

Supporting Documents:

- Summary of Accomplishments and Items to be Addressed – Page 2

Accomplishments based on goals discussed during the 2023 Town Council planning retreat:

- Establishment of multiple capital reserve funds for the purpose of building equity for capital projects
- Continued maintenance of the existing sewer system
- Decreased the amount of budget amendments and transfer of fund balance use
- Submitted documentation for the Water System Management Plan and waiting on DEQ approval
- Continued communications with Chimney Rock Village to determine appropriate terms in regard to water system operations
- Completion of LaBella Associate's task for the Wastewater Treatment Plant (WWTP) Master Plan
- Drain valve installation project underway and on-schedule
- Creation of a staging area for major projects
- Relocation of the ABC Store
- Appraisal of the former ABC Store property and a lease in progress for the use of the property
- Compiled a list of all Town assets
- Completion of the fire space needs study to initiate the future public safety building
- Increased law enforcement on the Lake
- Initiation of long term dredging plans
- Enforcement of policies and plans in relation to major projects
- Project Manager monitoring project costs and enhancing cost-effectiveness
- Established and enforced a penalty fee for zoning and land use projects that are began without obtaining proper permits
- Established a lake structure permit for minor structural repairs, demolitions, and deck-top accessory structures
- Updated the database for vacation renters and continued coordination between departments to ensure that vacation rentals obtain VR boat permits
- Re-evaluation of how the Town expends funds for 4th of July activities and determining that it would be more beneficial to fund improved holiday lighting that will eliminate congestion caused by the 4th of July festivities and will better accommodate residents.
- Initiation of installing keypad security systems for Town facilities

Items discussed at the 2023 planning retreat that will be addressed at a later date or will need to be re-evaluated:

- Pavement conditions assessment every four years, determining impacts, and evaluating if the Town can double match the Powell Bill funds to complete road improvements in 10 years
- Continued enforcement of dock inspection, tags, and addresses on lake structures
- Long range planning for the Lake Lure Green Space will begin following the determination of the future fire department based on the space needs study
- Preliminary cost analysis for emergency access West End Connector
- Utilization of the Policy Group

Major Project Updates

Supporting Documents:

- Draft Wastewater Treatment Plant Master Plan – Page 5

WASTEWATER TREATMENT PLANT MASTER PLAN

DRAFT

October 10, 2023

CONTENTS

Executive Summary

The Town of Lake Lure's 54-year-old Wastewater Treatment Plant (WWTP) sits on a small parcel entirely within the floodplain of the Broad River. Over the last 30+ years, it has undergone modifications to enable it to accommodate a large amount of Inflow and Infiltration (I&I) received from the now-100-year-old Lake-bottom sewer collection system. As a result of these modifications, the facility is no longer capable of biological wastewater treatment. As the Town develops the replacement sewer system and approaches abandonment of the old one, a WWTP will be required which can adequately treat the anticipated undiluted wastewater via a biological treatment process.

LaBella evaluated capacity needs, treatment process options, and site alternatives in the development of a Master Plan for the future replacement WWTP.

Capacity needs were determined by adding those estimated for existing development to those estimated for future growth through 2050, resulting in a wastewater production of approximately 723,000 gallons per day, substantially greater than the original design capacity of the existing WWTP. Considering regulatory-required excess capacity margins, rounding up to potentially extend the service life of the new WWTP slightly beyond 2050, and targeting a goal of maintaining classification as a Minor Municipal discharger under National Pollutant Discharge Elimination System (NPDES) permitting, LaBella recommends a design capacity for the new facility at 0.995 million gallons per day (MGD). Ultimately when the Town's service area is fully built out, a WWTP capacity of approximately 1.5 MGD may be required.

Three treatment process options were evaluated which could meet the anticipated NPDES effluent discharge limitations while providing the Town particular benefits over the original WWTP's design. LaBella recommends the Integrated Fixed-film Activated Sludge (IFAS) process, which combines the familiar and reliable aspects of traditional activated sludge treatment with the improved process stability and lowered capital and operating cost benefits of attached-growth treatment.

In addition to brief consideration of utilizing the existing WWTP site, LaBella examined three other potential locations for the new WWTP. The parcel between the dam and the existing WWTP, a portion of which the Town is currently negotiating for construction of a new dam, contains an easternmost portion which could accommodate the new WWTP as well as a potential future buildout WWTP. Though it contains difficult terrain, a pump station would not be required to carry new sewer system flows to it, and it provides excellent access to the Broad River discharge location.

Based on the recommended capacity, treatment process and site, LaBella estimates a construction cost of approximately $28.9 million for the new facility, and a total Project cost of approximately $33.4 million (both 2023 values, subject to future inflation). Timing of this expenditure should be driven by the timing of the completion of the new sewer collection system, such that LaBella recommends that the development of the WWTP begin three to four years prior to the anticipated switch-over from the existing Lake-bottom system.

Introduction

The Town of Lake Lure owns and operates conveyance and treatment facilities that provide wastewater services for the Town's residents, businesses, and industries. The Town has secured partial funding for a Wastewater Collection and Treatment Improvements Program (the 'Program') that involves the planning, design and construction for the renovation/replacement of the existing 100-year-old Lake-bottom wastewater collection system and improvements/replacement of the existing Wastewater Treatment Plant (WWTP).

The Program consists of multiple phases. The initial phases include rehabilitation of the existing Lake perimeter manholes (completed in 2022) and construction of approximately 9,000 linear feet of new wastewater collection system piping. The manhole rehabilitation project was intended to immediately reduce sewer infiltration to 'buy time' to implement subsequent phases of wastewater collection system construction. The first sections of the new collection system are anticipated to be constructed in 2023-24, with all phases being completed over the following five to ten years, depending on funding availability.

This Report addresses the Program's planning regarding the WWTP, specifically the preparation of a WWTP Master Plan. The timing of the actual WWTP construction work is dependent on completion of the entirety of the new sewer collection system, since redirection of incoming flows from the existing collection system to a new facility would create the same problems that have plagued the existing facility. Yet, until the very last customer is removed from the existing collection system it cannot be abandoned and so related problems will persist. Therefore, while immediate implementation of the full recommendations of this Report is not anticipated, initial steps are identified and a reasonable approach to scheduling full implementation is presented.

Existing WWTP

The Town currently owns and operates a WWTP that was originally constructed as a 0.350 million-gallon-per-day (MGD) activated sludge facility in 1969. In 1991, the WWTP was converted into a physical/chemical (P/C) process and its permit was modified for an annual average daily flow capacity of 0.995 MGD. The reasoning for the conversion was excessive Inflow and Infiltration (I&I) in the influent wastewater stream which dilutes it to the extent that operation of a biological treatment process is not practical. However, even the P/C treatment process is not capable of reliably meeting some of the effluent parameters required by the WWTP's National Pollutant Discharge Elimination System (NPDES) permit (ammonia, in particular), and therefore the facility struggles to maintain regulatory compliance.

The existing WWTP operates under NPDES permit number NC0025381. The most recent issue of this permit listed an expiration date of August 31, 2018, but the North Carolina Department of Environmental Quality (NCDEQ) indicated to LaBella that it is still considered effective.

In early 2022, NCDEQ and the Town entered into a Special Order by Consent (SOC), which suspended certain outstanding and future permit violation penalties and relaxed certain effluent limits in exchange for the Town's deliberate and continuous progress towards correction of the problem (i.e. primarily, elimination of the I&I by replacement of the collection system). This SOC has enabled the Town to focus on the root problem and plan for a more orderly and cost-effective approach to WWTP replacement.

The NPDES permit is a two-tier permit with a flow trigger that makes the higher tier effective thenceforth. The two tiers are for annual average flows up to 0.495 MGD and 0.995 MGD, but WWTP flows exceeded the lower tier years ago and the higher tier is now and will continue to be in effect. Table 1 below indicates notable currently effective discharge limits.

Table 1. Effluent Limits

Effluent Characteristics	By NPDES Permit NC0025381		By SOC	
	Monthly Average	Weekly Average	Monthly Average	Weekly Maximum[1]
Flow	0.995 MGD		(no change)	
CBOD5	30 mg/L[2]	45 mg/L	60 mg/L	90 mg/L
Total Suspended Solids	30 mg/L	45 mg/L	200 mg/L	300 mg/L
NH_3 as N (April 1 – October 31)	5.2 mg/L	15.6 mg/L	(no change)	
NH_3 as N (November 1 – March 31)	Monitor and Report		(no change)	

Notes: 1. The language of the heading in the SOC differs from that in the NPDES permit but is understood by LaBella to have the same meaning
2. mg/L = milligrams per liter

Little consideration is given herein to a concept of continued use of the existing WWTP for future needs. The facility's entire site is tightly constrained and located within and well below the 100-year flood plain of the Broad River. There is no redundancy in the 54-year-old main treatment structures, and much of the equipment suitable for biological treatment has been removed or abandoned. Therefore, an entirely new facility is envisioned.

However via discussions with NCDEQ regarding future discharge limitations, LaBella determined that the NPDES limits are likely to remain very similar to existing assuming the new WWTP is relatively similar in capacity to the existing and the discharge continues to be directed to the main body of the Broad River near or at the current discharge location (i.e., dilution of the discharge is not significantly changed). The one *possible* change suggested by NCDEQ was a tightening of the ammonia (NH_3) limit, but the Town should not expect phosphorus or nitrogen limits to be imposed, which are more characteristic of discharges to sensitive or low-flow water bodies.

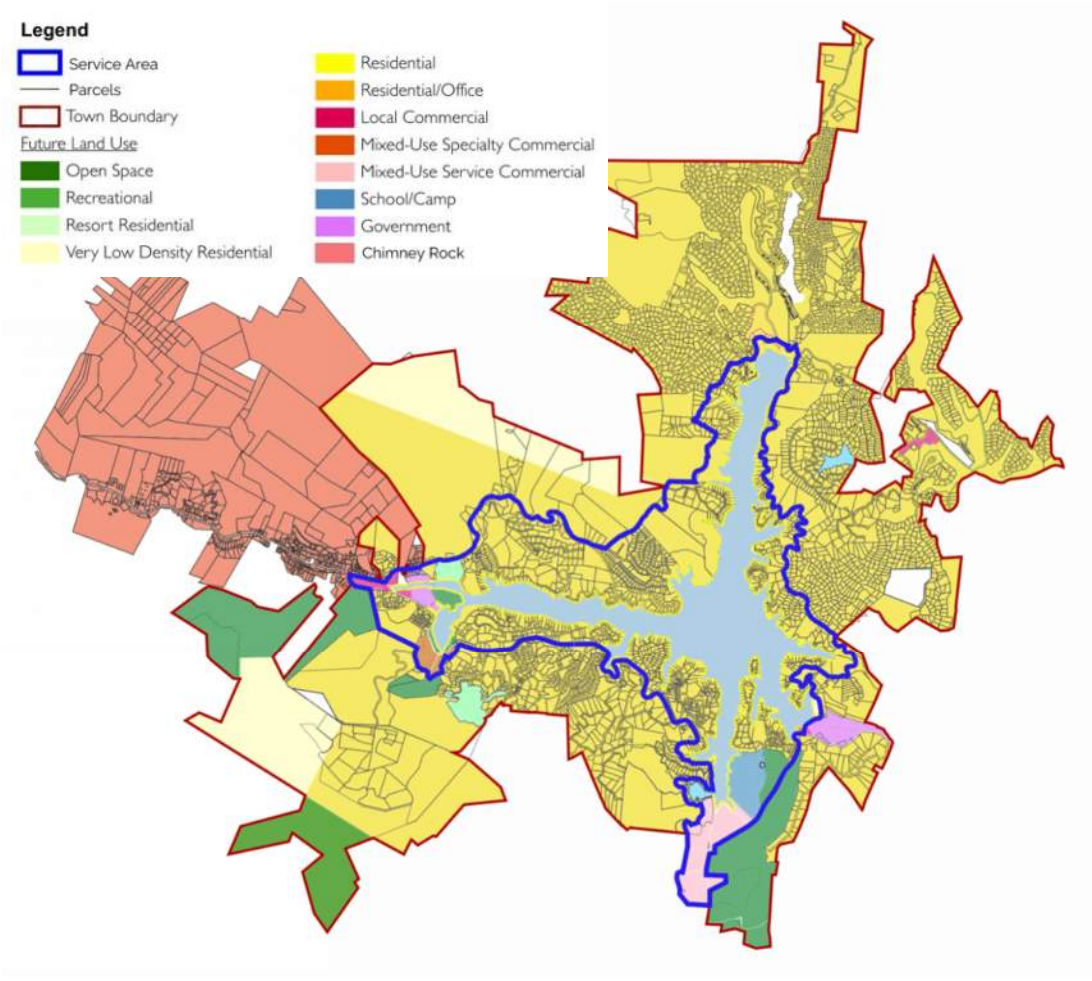
WWTP Capacity

Population growth data and multiple land use plans relevant to the Town's existing and anticipated service area were evaluated to determine the recommended capacity of the future WWTP. Population data was derived from Census,gov[1], and zoning and land use data for parcels within the Town's current and potential service area were obtained from the Rutherford County GIS. Existing land use maps were compared to future planning maps and areas where residential zoning changes have been recorded.

Service Area

For purposes of this Master Plan, the Town's future service area was defined during a November 2022 meeting between LaBella and Town officials as being bounded by US Highway 64 to the south, and Buffalo Shoals and Boys Camp Roads to the north, plus the connected systems of Chimney Rock Village and the development of Rumbling Bald Resort. LaBella also included certain already-developed and immediately adjacent areas, particularly those that are already served by the Town's sewers. Figure 1 below illustrates these boundaries and the planned uses within them.

Figure 1: Town Wastewater Service Area



[1] Data group DP05 – ACS Demographic and Housing Estimates

Within the service area (not including the connected systems), 'tiers' of serviceable residential lots are considered as indicated in Table 2 below:

Table 2. Tier Descriptions

Tier Level	Description
Tier 1	Lakefront properties only
Tier 2	Properties located behind Tier 1
Tier 3	All other parcels within the service area

Tier 2 properties are generally those that are immediately adjacent to (or across a street from) Tier 1 properties. Table 3 identifies the quantities and sewer service of parcels in each tier, and the total number of properties within Tier 1 and Tier 2 is 1,042. This corresponds closely to a GIS-based count of parcels within 200 feet of the Lake shoreline, which the Town has previously indicated includes 1,140 addresses.

Table 3. Current Properties per Tier

	Tier 1	Tier 2	Tier 3	Total
Existing Connected Properties	593	10	57	660
Existing Properties with Septic Systems	-	134	253	387
Undeveloped Properties	133	172	344	649
Total	726	316	654	1,696

One assumption represented in Table 3 is that all existing lakefront residences are already connected to the existing wastewater collection system. Though this is not exactly true (data suggests many are on septic systems, though the Town has occasionally discovered previously unknown connections), it is anticipated that those residences which are directly serviceable by the new system will quickly connect once it is available to them, and all Lakefront lots developed in the future will also connect.

Buildout

Twenty-one properties (plus one additional in the Rumbling Bald Resort community – see discussion on page 6) counted in Table 3 consist of large undeveloped parcels either residentially-zoned or planned for residential uses, and these are assumed to be developable into multiple properties depending on their current zoning and acreage. Appendix A identifies these properties, their current tier, and ultimate developable parcel count. These 21 parcels are estimated to be developable into 454 parcels. Applying this approach to determine the total number of buildout residences results in the counts indicated in Table 4 below.

Table 4. Buildout Properties per Tier

	Tier 1	Tier 2	Tier 3	Total
Existing Connected Properties	593	10	57	660
Existing Properties with Septic Systems	-	134	253	387
Undeveloped Properties	364	260	458	1,082
Total	957	404	768	2,129

This estimated property count was then adjusted downward using a factor estimated by the Town, accounting for those properties which would be unlikely to voluntarily abandon their existing septic systems for public sewer in any foreseeable future. Town officials believe that only about one-quarter of residences within the service

area (which are not already served) will ultimately remain on septic systems. However, this percentage is expected to be lower for those nearer the Lake (i.e., Tier 2). Table 5 indicates the result of this reduction.

Table 5. Buildout Served Properties per Tier

	Tier 1	Tier 2[1]	Tier 3	Total[2]
Existing Connected Properties	593	10	57	660
Existing Properties abandoning Septic Systems	-	121	169	290
Undeveloped Properties	364	234	214	812
Total	957	365	440	1,762

Notes: 1. 90% of Tier 2 from Table 4, not including those already connected
2. 75% of Tier 3 from Table 4, not including those already connected

Data from the 2020 census determined that the average number of persons per household in Lake Lure was 1.9, such that the buildout served residential population can be estimated as follows:

$$buildout\ served\ population = total\ buildout\ served\ residential\ parcels \times 1.9\ {}^{\text{persons}}/_{household}$$

The resulting population was then multiplied by a per-person wastewater flow factor of 100 gallons per day (gpd), consistent with the Recommended Standards for Wastewater Facilities (the '10 States Standards'), which are referenced by NCDEQ regulations.

$$buildout\ residential\ flow = buildout\ served\ population\ \times 100\ \text{gpd}$$

The result of this flow calculation approach yields the following total buildout residential flow:

$$1{,}762 * 1.9 \times 100\ gpd \approx 335{,}000\ gpd$$

Commercial

There are flows contributing to the Town's sewer system now and in the future which are not residential. While these flows are believed to constitute a relatively small portion of the total today, future development on land available for such uses would permit significant growth. The future land use plan from the 2007 (most recent) Comprehensive Plan identified potential areas of various commercial, institutional and governmental ('CIG') uses, to which estimated wastewater flow factors can be applied to estimate buildout contribution, as tallied in Table 6 below.

Table 6. Buildout 'CIG' Wastewater Flows

Development Type	Acres	Flow Factor	Estimated Flow
Restaurant Commercial	29	3500 gpd/ac	101,500
Other Commercial	117	2000 gpd/ac	234,000
School / Camp	55	600 gpd/ac	33,000
Government	20	2000 gpd/ac	40,000
Total	221		408,500

Vacationers

Lake Lure is an intensely tourist-impacted Town. Summertime population balloons significantly, with one source estimating a nine-fold increase in-season[2]. While this may be on the extreme end of estimates, it points to the fact that the short-term rental market is a significant driver for demands on the Town. With no way of truly knowing the long-term 'buildout' scenario implications of this factor, the following approach is taken which is believed to be conservative: One half of the buildout Tier 1 and Tier 2 properties are considered to potentially be available as short-term rentals, with 5 persons per unit rather than the census household population of 1.9. Therefore, the wastewater flow impact of these vacationers can be estimated as follows:

$$vacationer\ wastewater\ flow = half\ of\ Tiers\ 1\&2\ parcels\ \times (5.0 - 1.9) \times 100\ gpd$$

$$1/2 \times (957 + 365) \times (5.0 - 1.9) \times 100\ gpd \approx 205{,}000\ gpd$$

Connected Systems

The Town also receives flow from outside users that maintain independent collection systems. Chimney Rock Village is not anticipated to grow substantially, as it is topographically limited to both the north and south of the densely developed US Highway 64 corridor, and therefore its buildout flow is estimated at 120% of current. A recent flow metering effort yielded an estimated average daily flow of 32,000 gpd (see Appendix A), which therefore results in a Village buildout flow estimate of 38,400 gpd.

Rumbling Bald Resort currently has 446 customers connected to a Carolina Water Service (CWS, a private investor-owned utility) collection system which flows to the Town's system. CWS reports that there are 49 serviceable but unoccupied residential lots in their service area, and LaBella identified one large parcel (see Appendix A) in the development that could be subdivided into an additional 126 lots. In addition, a 67-room (assumed 134-bed) assisted living facility is planned within that service area. There are other nearby large parcels that CWS does not currently identify as being within their service area, but that boundary is ill-defined and additional future development flows could be added.

Rumbling Bald Resort's monthly flows for 2019 and 2021 are included in Appendix A, yielding a maximum 3-month average flow of just under 96,000 gpd. With the identified remaining growth opportunities, an additional flow of approximately 50,000 gpd could occur, calculated as follows:

$$(49 + 126)\ residences \times 1.9\ {}^{persons}/_{residence} \times 100\ gpd = 33{,}250\ gpd$$

$$(67\ rooms) \times 2\ {}^{beds}/_{room} \times 120\ {}^{gpd}/_{bed} = 16{,}080\ gpd$$

Under the assumption that these possible future developments would reflect buildout of the Rumbling Bald Resort community, the total buildout flow is estimated at 146,000 gpd.

Summary

The sum of the above-estimated flows yields the total anticipated buildout (seasonal) wastewater flow expected to be received at the new WWTP. This is given in Table 7 below:

[2] https://www.egovlink.com/lakelure/faq.asp

Table 7. Total Buildout Estimated Wastewater Flows

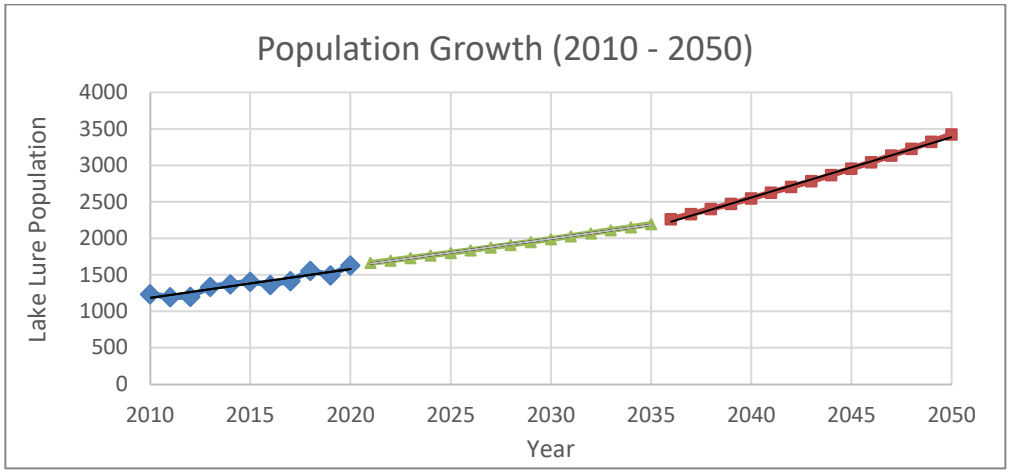
Wastewater Source	Flow (gpd)
Residential	335,000
Commercial	408,500
Vacationers	205,000
Chimney Rock Village	38,400
Rumbling Bald Resort	146,000
Total Estimated Flow	1,132,900

Planning Horizon 2050

Census data between 2010 and 2020 indicated an average annual population growth rate of 2.8% (1,240 to 1,634 in 10 years) in the Town. In 2022, NCDEQ imposed a sewer moratorium on the Town in conjunction with the SOC, which limits the ability of sewered development to occur during the period of construction of the new collection system and WWTP facility. Therefore, a slow growth rate within the Town – somewhat less than that which occurred in the previous decade – is expected. Once the new wastewater collection system and WWTP is completed, the sewer moratorium will be lifted, allowing development as well as new connections from existing structures. It is anticipated that this will result in a short-term surge in new sewer connections, but an overall return to normal growth rates and perhaps somewhat higher. Projected population was therefore estimated using three growth periods:

- 2010 – 2020: data given by Census (2.8% average)
- 2020 – 2035: moratorium-limited growth of 2.0% annual average
- 2036 – 2050: annual growth of 3.0% post-moratorium

The result of this growth projection is a 2050 population of 3,426, which is roughly 2.1 times the Town's 2020 population and an increase of 1,792, as shown on the graph below.



The estimation of service area growth within the planning horizon requires a logical set of assumptions relating to connection status of properties among the three tiers, and development rate of new properties within the service area as compared to that of the Town overall.

Residential

As previously indicated, it is assumed that all developed Tier 1 properties are currently served, or will very soon be connected upon availability of the new collection system. Likewise, a small number of Tier 2 and Tier 3 properties are already known to be served. This yields a total of 660 residential parcels[3] which it is estimated would be connected to the new collection system today were it available. This count is therefore considered to represent the current residential sewer demand due to census population.

The estimate of 2,129 buildout properties in Table 4 versus the 1,047 already-developed properties (660+387)[3] represents a ratio of 2.03, slightly less than the 2.1 population increase ratio anticipated by 2050. If it were assumed that growth rate within the sewered service area will match that outside the service area, that would suggest that all of the undeveloped buildout parcels in the service area will be developed by 2050. It may even be reasonable to expect that development within the service area will occur at a higher rate than unsewered areas outside of it. For example, once sewer is available to all Tier 1 and Tier 2 properties, it is expected that a substantial development surge among these undeveloped properties will occur, such that they will be relatively rapidly built out. Tier 3 undeveloped properties will account for the remaining development within the service area.

Tier 2 and 3 properties currently served by septic will require significant upland sewer extensions in order to be served, and this could be expected to accompany development of new properties. However, it is estimated that the proportion of existing septic-served properties connecting will occur at a slower rate than new development, and so a '4 new to 1 existing' ratio is used to estimate the portion of these septic-served lots to be connected. This results in the following:

$$1{,}082\ new\ development\ lots\ \times (1/4) = 270\ existing\ septic\ lots\ converted$$

However, as only 290 existing septic-served lots are estimated to be eventually connected (see Table 5), this is nearly equivalent to buildout and so no substantial difference in residential flows from 2050 to buildout is anticipated. The total 2050 residential flow is therefore estimated as equal to buildout, or approximately 335,000 gpd.

Commercial

Existing non-residential demands were previously estimated based on a property-by-property evaluation using NCDEQ-approved flow factors for various use types. The resulting tally is included in Appendix A and totals 30,200 gallons per day. It is fair to assume that these 'CIG' flows will increase proportionately with population growth, and therefore a 2.1 factor is applied to estimate 2050 flow at 63,400 gpd.

Vacationers

As a seasonally tourism-intensive Town, Lake Lure experiences a high influx of vacationers for a large part of the year. Wastewater flow impacts of these visitors is perhaps best indicated by recognizing the extent of vacation rentals available in the Town – a search of Airbnb and VRBO websites yields approximately 300 rentals suitable for 4 or more persons. Many of these are Tier 1 and Tier 2 properties which are often fully booked in season. A flow adjustment can be applied for these by accounting for the difference in population per household (1.9) and likely visitors per unit (estimated at an average of 5), resulting in an additional seasonal residential flow. In addition, it is assumed that this flow will increase with population growth but at a slower rate, so a factor of 1.5 is applied (suggesting that about one half of newly developed parcels are made available for such rentals), resulting in the following residential vacationer flow addition:

[3] See Table 3

$$300 \times (5.0 - 1.9) \times 100\ gpd \times 1.5 \approx 140{,}000\ gpd$$

Connected Systems

As discussed on page 6, Chimney Rock Village is not anticipated to grow substantially and therefore would be expected to reach buildout growth by 2050. Rumbling Bald can be reasonably expected to grow at a rate similar to that of the resto of Lake Lure, but has much less than sufficient area to accommodate a 2.1 growth factor and therefore is also likely to reach buildout by 2050. Therefore, 2050 flows for these two areas are estimated at:

$$Chimney\ Rock\ Village\colon\ 32{,}000 \times 120\% = 38{,}400\ gpd$$

$$Rumbling\ Bald\ Resort\colon\ 96{,}000 + 50{,}000 = 146{,}000\ gpd$$

Summary

The sum of the above-estimated flows yields the total anticipated 2050 (seasonal) wastewater flow expected to be received at the new WWTP. This is given in Table 9 below:

Table 9. Total 2050 Estimated Wastewater Flows

Wastewater Source	Flow (gpd)
Residential	335,000
Commercial, Institution, Government	63,400
Vacationers	140,000
Chimney Rock Village	38,400
Rumbling Bald Resort	146,000
Total Estimated Flow	722,800

Sizing of the new WWTP must take into account NCDEQ's so-called '80/90 Rule'[4], which relates to timing for planning of expansion of such facilities. In essence, once a WWTP in a growing locality is approaching annual average flows equal to 80 percent of design capacity, the Town will need to submit a plan for expansion. By the time flows reach 90 percent of design capacity, the Town will need to have completed design and obtained permits for an expansion. Because of this rule, the 2050 WWTP design capacity should be equal to:

$$Total\ Estimated\ Flow / 80\% = 903{,}500\ gpd$$

A minimal additional capacity (i.e., 10-15%) in a new WWTP often comes with very little additional capital investment, but can delay the need for future upgrades. NCDEQ permits WWTPs below 1.0 MGD as 'Minor Municipal' facilities, which carries some permitting advantages including potentially less stringent limits, and lesser sampling and staffing requirements. Therefore, in order to extend the service life of the WWTP somewhat further into the future beyond 2050, LaBella recommends the new WWTP be sized for 0.995 MGD, which matches the existing permitted capacity. *(Applying this same approach to sizing for the ultimate buildout flows of 1.13 MGD indicated in Table 7 would yield a design capacity of approximately 1.5 MGD.)*

[4] 15A NCAC 02T .0118

WWTP Process Alternatives

The heart of typical wastewater treatment is a biological process in which an aerated environment is maintained to support a biomass of bacteria which consumes the majority of the incoming organic waste. After a settling phase, what remains is a small volume of solids (sludge) and an effluent suitable for environmental discharge which is approximately equal to the incoming flow volume. The biological process is selected primarily in consideration of effluent limitations and is usually preceded by screening (and sometimes also grit removal) to remove untreatable inorganics. Prior to discharge, effluent may pass through a filtration process if discharge limits are particularly stringent, and the last treatment step is typically disinfection.

The Introduction section of this Report outlines the current NPDES effluent limits (see page 2), which are not expected to change significantly in the future per discussions with NCDEQ. The Town's WWTP appears to have originally employed an Extended Aeration Activated Sludge (EAAS) process before it was converted to a P/C facility. 'Activated' refers to the fact that sludge carried to downstream processes is biologically active, and the majority of it is returned to the aeration basin to maintain a target biomass population. Such processes were commonplace at the time of the Town plant's construction and many remain in operation today, meeting effluent limits similar to those contained in the Town's permit. Properly applied, the EAAS process is stable, reliable and relatively simple to operate.

The Town could certainly elect to continue with an EAAS process in a future facility. However, more modern process alternatives offer distinct advantages, particularly with regards to space (i.e., land area required), chemical usage and energy efficiency. LaBella therefore investigated several such processes, which are also characterized by the following:

- Compactness – Limited land area is available in the Town of Lake Lure to locate a new WWTP because of the mountainous terrain.
- Ability to treat variable flows – The initial flows to the proposed WWTP will be small. In addition, Lake Lure is a resort community where influent flows to the WWTP will vary seasonally between summer and winter. The new WWTP needs to be modular to accommodate initial low flows and varying seasonal influent flows.
- Efficiency – The Town is interested in an efficient and economical process design that is relatively simple to operate and maintain.

Alternative 1 – IFAS Process

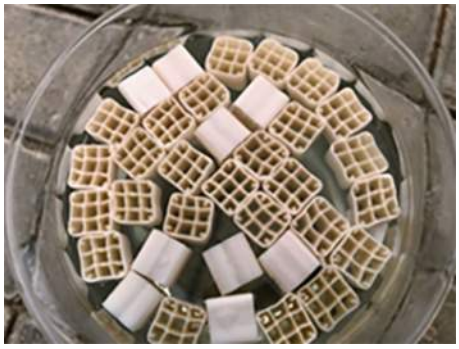
Whereas conventional activated sludge (including EAAS) treatment involves a biomass entirely suspended in liquid, the Integrated Fixed-film Activated Sludge (IFAS) process adds a physical media (either fixed or free-floating) into the activated sludge tank to facilitate biomass growth on media surfaces. The increased density of biomass – both in liquid suspension and attached to media surfaces – provides several advantages.

The amount of organic waste that is treatable by a biological process is directly related to the amount of biomass available to process it. A higher density of biomass can treat the same loading of waste in a smaller treatment volume. In fully suspended processes, however, a higher density of biomass produces a high loading on the settling phase of treatment (the clarifier), which must then be substantially larger in order to produce a clear effluent. In IFAS where much of the biomass (the media-attached portion) remains in the aeration tanks, the biological process benefits from the higher treatment density without increasing clarifier loading.

An IFAS process is inherently more stable than a fully-suspended process, since the attached portion of the biomass cannot be easily 'flushed' out by hydraulic surges. Biomass attaches to media in layers and is therefore more protected from toxic slugs than liquid-suspended biomass, so it is also more capable of processing varying

organic waste loads. The more stable biofilm lasts longer (with a higher sludge age) and so less waste sludge is produced.

The media types used for IFAS fall into two main categories: dispersed media that floats freely throughout the aeration basin and fixed media that is mounted on racks and submerged. Dispersed media (example at right) consists of thousands of small pieces with a combination of substantial surface area and cell openings large enough to prevent clogging, which promotes free flow of aerated wastewater (food and oxygen) to the attached biomass. Various manufacturers use different shapes and sizes, mostly of various types of plastic.



Headworks International Active Cell Media

Dispersed media offers advantages of exceptional mixing and a high surface area to support a high biomass. In addition, dispersed media is self-cleaning (allowing slough-off of spent biomass) if sufficient coarse bubble aeration is provided to keep it moving and agitated. Dispersed media systems require some type of screening at the effluent end of the aeration tank to prevent loss of media to downstream processes.

Ovivo Cleartec® IFAS Fixed Media Racks

Fixed media IFAS systems typically include racks of high surface area cloth-like material (e.g., open-weave polypropylene) that are strategically located in aeration tanks. While providing the surface area for attached growth biomass, the media can't escape the basin. Because it doesn't require mixing to remain suspended, it can function in basins with low-energy fine-bubble aeration systems. In addition, it can be installed in mechanically-mixed basins without concern for media breakdown. However, occasional scour of the media is required most often via a fixed coarse bubble system located below the racks.

IFAS systems are often applied where biological nutrient removal (i.e., of nitrogen and/or phosphorus) is required since different types of bacteria can be supported in the liquid-suspended biomass and on the physical media. However, the capital cost benefits (smaller tankage) and operational benefits (more stable process, less energy, less chemical addition, less sludge, less volume to aerate) are realized even when complying with more lenient effluent limits as well, such as in the Town's case.

Alternative 2 – SBR Process

A Sequencing Batch Reactor (SBR) process is an activated sludge process configured to carry out each step of the biological treatment process and settling/clarification steps in a single tank. A batch of screened wastewater enters the reactor until a full batch volume is reached, and then flow is diverted to another reactor. Subsequently, the filled reactor is aerated (and sometimes separately or simultaneously mixed, sometimes in multiple steps) for a predetermined period, then settled for a predetermined period, then decanted of effluent, and then finally drained of a waste portion of the activated sludge. Once the full cycle is complete, the reactor is available for another batch.

Emptied Alfa Laval AS-H SBR Reactor

Continuous influent flows require multiple reactors since one must always be available for filling. The number of reactors

ultimately depends on the expected volume of wastewater flow, pre-equalization, and the amount of time allowed for treatment of each batch in the reactor. This provides an inherent benefit where flows are seasonally variable, as individual reactors can remain empty and idle for extended periods of time, and simply be rotated back into service when flows increase.

Since all functions occur in a single tank, there is a substantial amount of equipment in each one and basins are relatively deep (18 to 20 feet). Aeration diffusers can be fixed to the floor or on removeable racks for ease of maintenance. Mixing can be accomplished with submerged or floating mixers, and decanters must be floating in order to withdraw clarified effluent from the top 6 to 12 inches of the declining settled wastewater surface during the decant stage. Since clarification occurs in the reactor, separate clarifiers are not needed, but downstream processes including disinfection and filtration may need to be oversized to accommodate high decant rates unless post-equalization is provided.

In addition to the smaller footprint owing to the absence of clarifiers, the main advantage of SBRs is that they can be designed and programmed to accommodate a wide variety of effluent requirements. Longer or shorter cycle times, and different process combinations and orders of operations are driven by a computer program that can be modified to match changes in wastewater strength and/or effluent limits. This comes with a corresponding disadvantage, however, in that the high level of automation requires sophisticated controls understanding and a substantial amount of automated equipment and valves, all of which are subject to maintenance and possible failure.

Alternative 3 – RBC Process

Rotating Biological Contactors (RBCs) employ a fixed-film biomass population on rotating stacks of disks mounted on a horizontal shaft. The slow rotation (1 to 2 rotations per minute) and partial submergence of the disks alternately submerges the biomass in the wastewater where it contacts the organic waste and raises it above the liquid level where it is exposed to oxygen in the air. As with other fixed-film processes, RBCs are dense with biomass and therefore more stable in the presence of variable organic loadings. The rotational speed controls the amount of biomass retained, by creating a higher shearing action at higher speeds. Wasted biomass is collected in a downstream clarifier and removed from the process. Recirculation of sludge or wastewater is not usually involved, so it is a single-pass process.

Evoqua Water Technologies Envirex® RBC Units

RBCs typically do not employ diffused air for biological treatment and the slow-rotating discs have a very low energy consumption. The units themselves are very quiet due to the minimal rotating energy and the absence of aeration blowers. The stable sludge has a long sludge age and so the process yields a low volume of waste relative to conventional activated sludge processes. Since all of the active biomass resides on the contactors (rather than in liquid suspension) resulting in an increased biomass density, and the process is single-pass without flow recirculation, clarifiers following RBCs are relatively small.

RBC biomass can be adversely impacted when exposed to sunlight and weather, and RBCs are particularly susceptible to performance impacts at low temperatures (below 50°F). Therefore, they are typically covered, particularly in colder climates. However, covers must be configured with adequate ventilation since the biomass relies on oxygen available in the air above the wastewater. Whether open-air or covered and ventilated, the atmosphere-exposed biomass increases the likelihood of odors.

The trade-off between aeration equipment in IFAS and SBR systems and low-speed low-energy motors in RBCs comes with higher maintenance and breakdown risk. Rotating parts are bulky, heavy, and require regular lubrication and maintenance, and discs must be occasionally spray-washed to minimize clogging and prevent overloading or shaft imbalance. A failed motor will quickly starve the attached media of either oxygen (submerged portion) or food, nutrients, and wetting liquid (exposed portion), so having uninstalled spares on hand is essential to consistently meet permit limits.

Recommendation

Table 10 on the following page provides a comparison of the three processes evaluated, against each other and to a conventional activated sludge process. LaBella recommends the Town plan for an IFAS process in the new WWTP, as it provides a combination of the reliable, familiar and easy-to-operate activated sludge process along with advantages owing to the innovation of fixed-film media addition. The particulars of the process can be determined at design time, including whether fixed or dispersed media should be used.

Table 10. Comparison of WWTP Processes
(versus conventional Activated Sludge)

IFAS (Integrated Fixed-film Activated Sludge)	SBR (Sequencing Batch Reactor)	RBC (Rotating Biological Contactor)
Process Advantages		
High biomass density resulting in smaller reactor	(n/a)	High biomass density resulting in smaller reactor
Higher sludge age results in less sludge produced	(n/a)	Higher sludge age results in less sludge produced
Stable attached biomass can handle variable waste loads	Process can be reconfigured to address varying wastes and hydraulic loads	Stable attached biomass can handle variable waste loads
Media-attached biomass results in smaller clarifier	No separate clarifier	Smallest clarifier since all active biomass is attached to contactor and process is single-pass
Less aeration volume resulting in lower energy	(n/a)	No mechanical aeration or sludge recirculation equipment (lowest energy)
Can meet more stringent future effluent limits	Can meet more stringent future effluent limits	(n/a)
(n/a)	(n/a)	Very quiet operation due to minimal motors
Lowest capital cost due to smaller basins	Lower capital cost due to fewer basins	Lowered capital cost due to basin sizes, but offset by high capital cost of equipment
Process Disadvantages		
Fixed media replacement every 15-20 years	Difficult in-basin equipment maintenance	Attentive maintenance of contactors required to ensure longevity
Maintenance typical of activated sludge WWTPs	Complex controls resulting in substantial amount of automated equipment subject to failure	Potential structural overloading of contactor and/or shaft imbalance leading to damage
Odor concerns typical of aerated WWTPs	Odor concerns typical of aerated WWTPs	Highest potential for odor
(n/a)	Equalization or oversized processes required downstream of reactors	(n/a)
Operation complexity typical of activated sludge WWTPs	Highly dependent on computer automation	Simple to operate, but temperature-sensitive

WWTP Site Selection

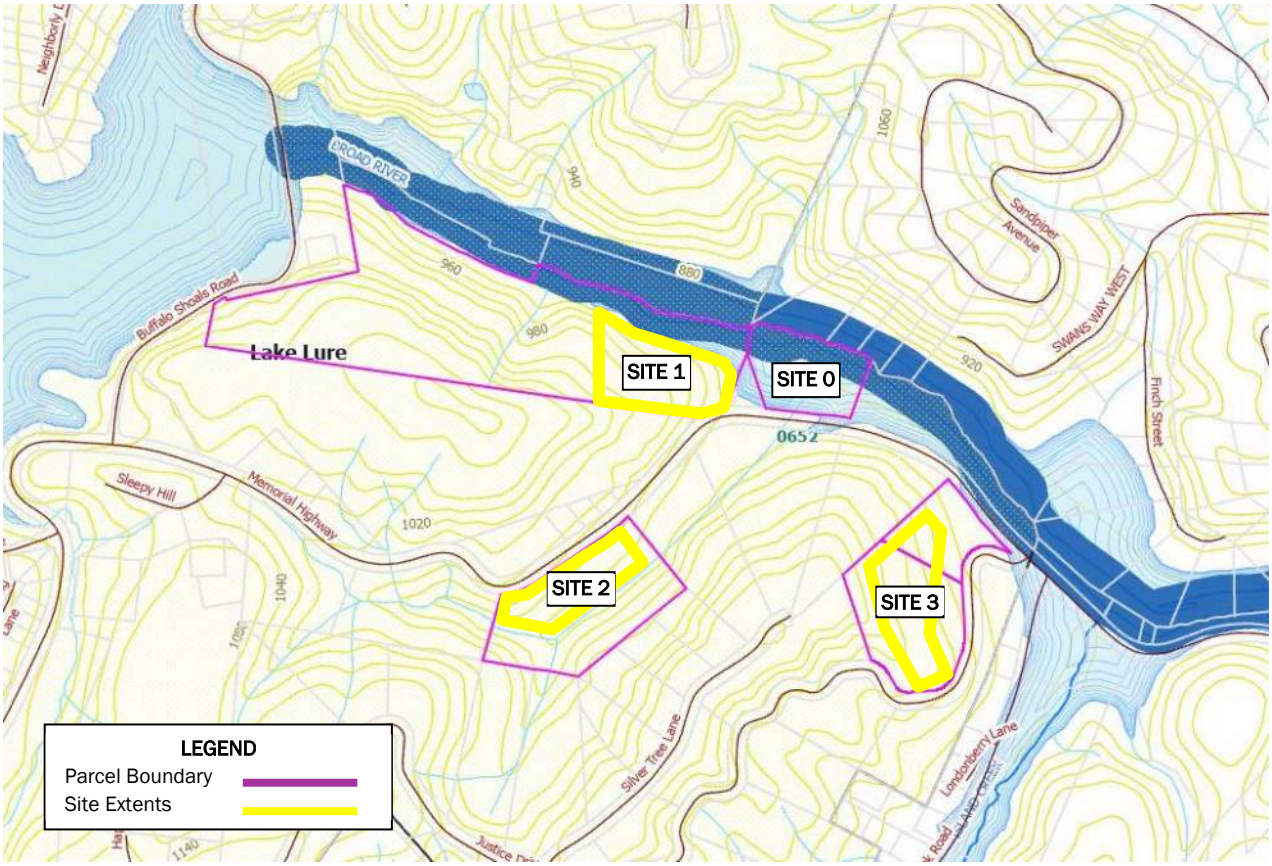
Based on the land area requirements for the WWTP for 2050 projected flows (and potentially also for flows projected at buildout), LaBella evaluated several site options. Each option was evaluated based on the criteria listed below. Ultimately, certain of these issues are captured in a comparison of site-specific costs, and so such a comparison is also provided.

- Elevation relative to floodplain
- Site development difficulty
- Sufficient buildable area for new WWTP
- Sufficient area for future expansion
- Reachable by gravity sewer (no pump station)
- Accessibility for construction and operation
- Availability of land for purchase

The sites included the following, which are illustrated in Figure 2:

- Site '0' – I.e., the existing WWTP Site
- Site 1 – a portion of Parcl 226751, which abuts the dam, the existing WWTP, and the Broad River
- Site 2 – Parcel 1618826, which lies south of Memorial highway southwest of the existing WWTP
- Site 3 – A combination of Parcels 217875 and 229609, which lie southeast of the existing WWTP along Memorial Highway.

Figure 2: Site Alternatives



Site 0 - Existing Site

The existing site is small, lacking much unused area and located entirely within the 100-year floodplain of the Broad River, but it does represent the most level and buildable site among the four options investigated. To resolve the floodplain issue, the site would need to be raised as much as 8 feet. While technically possible, it presents substantial obstacles and drawbacks. A temporary plant would be needed while the demolition of the existing and construction of the new plant takes place. Most significant, however, is that filling in the flood plain is very difficult to justify from a permitting standpoint. According to the Flood Insurance Rate Map (FIRM) for this site (provided in Appendix B), a floodway has not been established. The Floodway Ordinance has specific rules for development in a floodplain with no established floodway. Article 5, Section E (2) states:

> *"Until a regulatory floodway or non-encroachment area is designated, no encroachments, including fill, new construction, substantial improvements, or other development, shall be permitted unless certification with supporting technical data by a registered professional engineer is provided demonstrating that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one (1) foot at any point within the community."*

Based on the extent of fill that would be required in the floodplain to build the WWTP, it is unlikely this standard can be met. A detailed flood study would be required to determine this, which would attract substantial scrutiny from regulatory agencies. LaBella considers it unlikely to be permittable, particularly when other viable options exist.

Figure 3: Site '0' – Existing Site

Site Alternative 1

Site 1 sits on Parcel 226751 between the dam and the exiting plant at grades substantially above the floodplain, but has the added challenge of steep terrain (30% to 50% and higher). According to the USDA Web Soil Survey (WSS) website[5], it most likely contains substantial bedrock, adding an additional effort to excavation and construction activities. A soil report was generated from WSS and excepts are included in Appendix C.

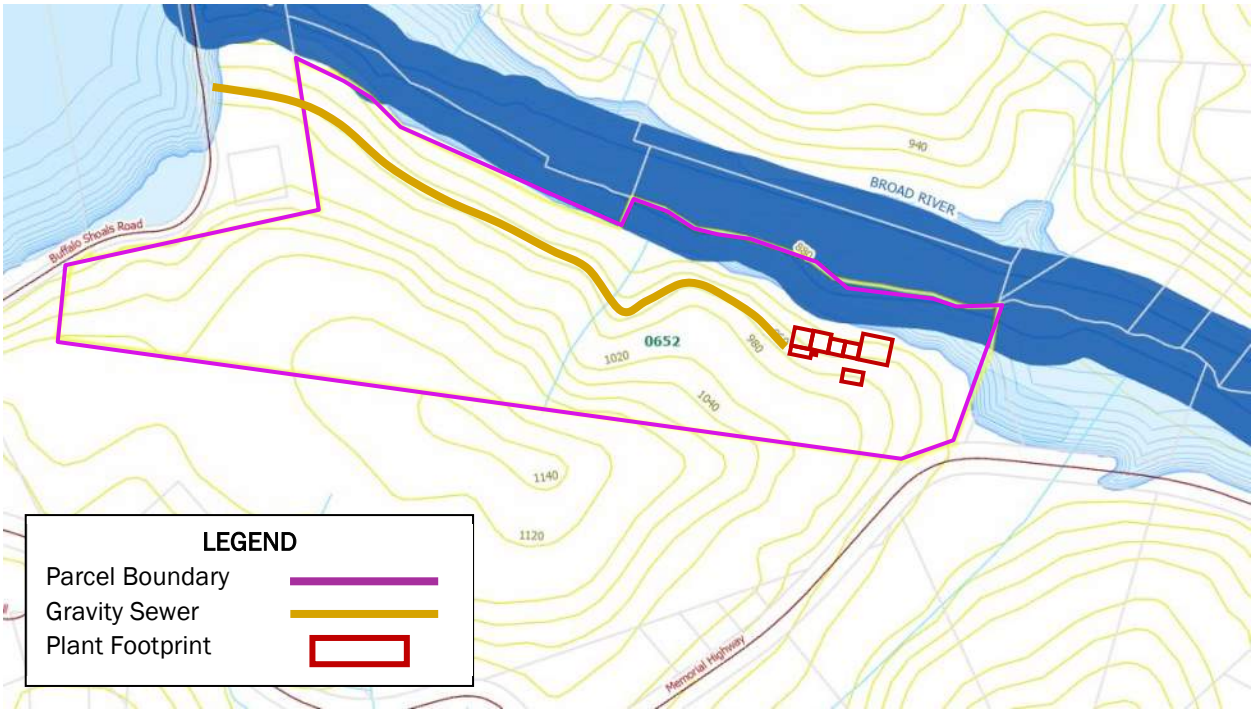
On the northern portion of the site, grades fall towards the Broad River, and this lower portion is where the WWTP process basins would be located in order to avoid the need for an influent pump station. Depending on the portion of the parcel acquired, area for future expansion could be reserved. Structures which are not a part of the main process train (office, equipment building(s), sludge processing), could be located on higher portions of the site. Approximately 1,200 linear feet of gravity sewer would be required from the end of the collection system at the existing dam to reach the WWTP site. Gravity effluent discharge to the river would be immediately adjacent to the site.

Public right-of-way access from Memorial Highway is possible but grades rise significantly on the site from this access point. It may be possible to construct a rear site exit onto the dam access road, but this may require a substantial retaining wall, and design would need to consider future expansion.

The Town is already in discussions with the Owner of the parcel containing this site, as the new dam construction will also impact it considerably. Given the progress of those discussions thus far, it is believed that this site could be acquired without substantial difficulty.

A conceptual plant layout is illustrated in Figure 4 below.

Figure 4: Site Alternative 1



[5] https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Site Alternative 2

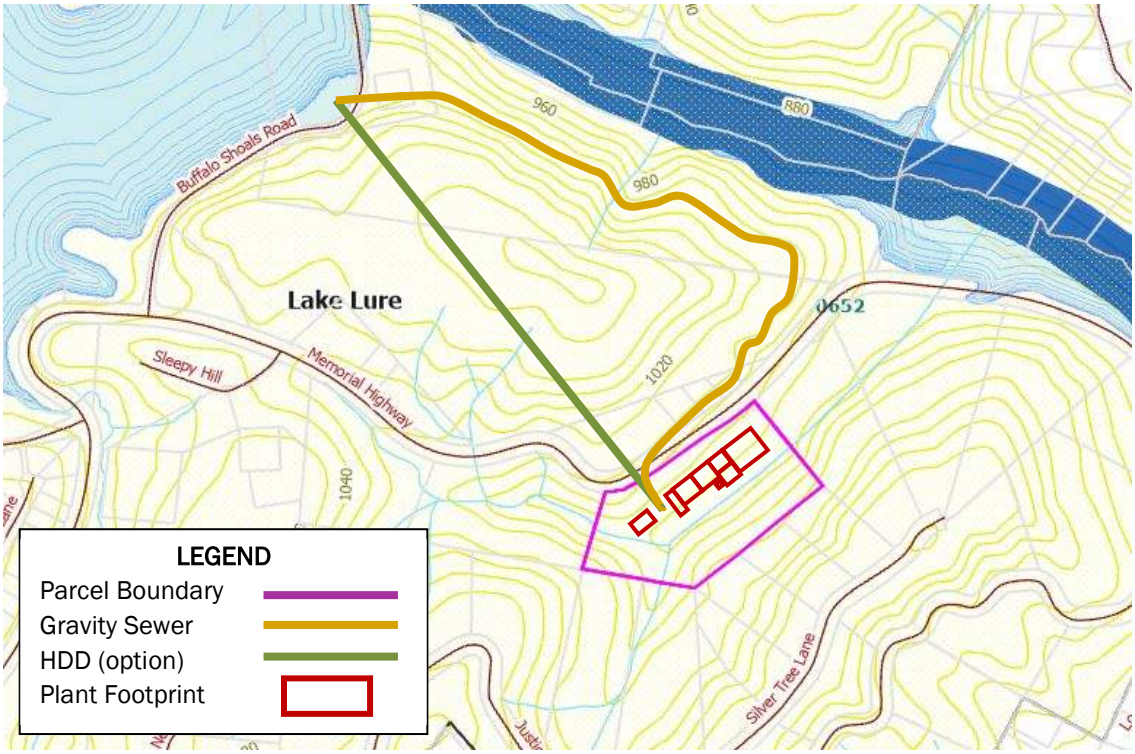
Site 2 utilizes Parcel 1618826, which is considerably less rugged than Site 1, with mild to semi-steep slopes (25% to 40%). The site lies above the floodplain, but a stream bisects the parcel, and it is unclear whether this stream is ephemeral or perennial as LaBella was not permitted to enter the property to evaluate. This is a substantial factor, in that the presence of a perennial stream would require buffers that would further constrain the site. The soil report excerpts contained in Appendix C illustrate that geologic conditions are similar to those of Site 1, with substantial bedrock.

The entire site is relatively low and so it can be reached by gravity without an influent pump station. A conceptual site layout (see Figure 5 below) illustrates that the site could contain all buildings and structures for the anticipated WWTP, but area for future expansion would be minimal or entirely non-existent, particularly if stream buffers are required. Gravity sewer from the collection system was laid out using two different methods: a) a 1,600 linear foot horizontal directional drill (HDD) from the Lake side of the dam and b) a 2,300 linear foot gravity sewer that follows a downslope path around the hilltop southeast of the dam. Either of these approaches would likely carry similar costs, with the latter being more impactful on properties, and the former presenting very unique technical construction challenges. Effluent would be discharged to the Broad River approximately 800 feet away, which would require crossing Memorial Highway.

The site has a considerable frontage on Memorial Highway but the limited available area on the site (particularly with stream buffers) would necessitate that the plant access road be very close to and parallel to the public right-of-way, and a retaining wall would likely be required. Turn-around or drive-thru access would be difficult or unlikely.

The property owner for this site has not been approached formally but has indicated a disinterest in selling as evidenced by LaBella's inability to obtain permission to inspect the stream.

Figure 5: Site Alternative 2



Site Alternative 3

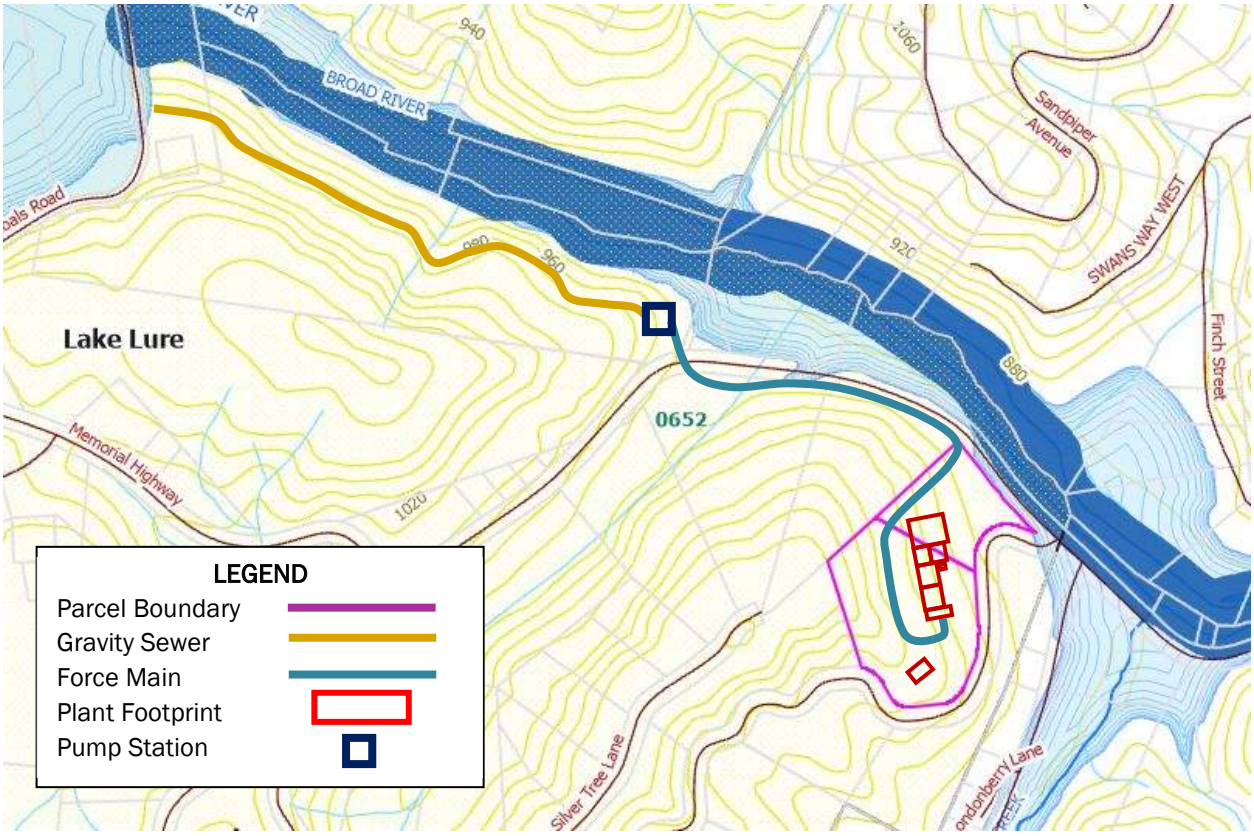
Site 3 consists of two parcels (217875 and 229609) which collectively provide sufficient area on which to construct the anticipated WWTP while also reserving area for future expansion. The site is well above the floodplain, with moderate to extreme slopes (30% to 55%) but without substantial indication of rock, according to the WSS website[5]. A soil report for this site was generated from WSS and excerpts are included in Appendix D.

Any site east of the stream that crosses Site 2 cannot be served by gravity, and so an influent pump station is required. As such, elevations at the site are somewhat inconsequential except for their implications on required pumping energy. A conceptual site layout is shown in Figure 6. The pump station would be expected to be situated near the existing WWTP site, and a force main would extend from there to the site. In all, approximately 1,500 LF of gravity sewer and 1,300 LF of force main would be required. Gravity effluent discharge to the Broad River would be immediately across Memorial Highway from the site.

The site has frontage suitable for multiple entrance points on both Memorial Highway and Justice Drive.

The property owner(s) for this site have not been approached, so availability for purchase is not known.

Figure 6: Site Alternative 3



Summary

A side-by-side comparison of the three Site Alternatives according to the criteria identified on page 15 is given in Table 11. Except for development difficulty, Site 1 appears to be the most favorable. Except for the need for an influent pump station, Site 3 may also be favorable. Site 2 carries concerns primarily with space limitations and potential acquisition difficulty.

Table 11. Site Criteria Comparison

	Site 1	Site 2	Site 3
Floodplain Impacts	No	No	No
Development difficulty	High	Medium	Low
Area for new WWTP	Yes	Yes	Yes
Area for expansion	Yes	Limited/No	Yes
Gravity-fed	Yes	Yes	No
Accessibility	Fair	Fair	Good
Readily Purchase-able	Yes	No	Unknown

Differential costs associated with the Site Alternatives were evaluated and are presented in Table 12 below. The substantially higher costs of Site 3 are primarily attributable to the need for an influent pump station. In addition to the higher initial capital investment indicated below, the perpetual operation and maintenance costs of pumping to the head of the WWTP further detracts from this alternative. Site 2 remains the most cost-effective, but this is likely at the expense of foregoing expandability in the future.

Table 12. Site Development Cost Comparison

Item	Site 1	Site 2	Site 3
Influent Sewer	$600,000	$1,150,000	$2,640,000
Effluent Sewer	$66,000	$485,000	$225,000
Excavation	$1,250,000	$1,250,000	$500,000
Ruggedness Premium	$2,000,000	$1,000,000	$1,000,000
Site Development (drainage, pavement, etc)	$1,300,000	$1,000,000	$1,300,000
Demolition of Existing WWTP	$500,000	$500,000	$500,000
Site Subtotal	$5,716,000	$5,385,000	$6,165,000

Recommendation

The Town's ubiquitously mountainous terrain provides few 'good' options for siting a WWTP. However, Site 1 appears to meet the needs the anticipated and possible buildout WWTP, and at a cost that still makes it attractive as compared to sites that would require influent pumping, and therefore LaBella recommends it.

Conclusions & Implementation

Having identified the capacity, process selection and site for the anticipated new WWTP, LaBella prepared a rough cost estimate which is provided in Table 13 below. A substantial contingency is included since little in the way of design detail can be known at such a conceptual point in the planning process. However, it should be highlighted that the costs are presented in 2023 dollars. Recent inflation has had a dramatic impact on costs for heavy construction and if this persists, the budget would need to be adjusted accordingly for any project development occurring substantially into the future.

Table 13. Recommended WWTP Project Budget

Item Description	Cost
IFAS WWTP Facility (Generic Site)	
Influent Screen	$700,000
Aeration Basins	$2,750,000
Clarifiers	$1,450,000
Return Pump Station	$175,000
Disinfection	$1,560,000
Building	$400,000
Blowers	$1,300,000
Aerobic Digester Tank	$975,000
Plant Piping	$3,200,000
Electrical	$3,200,000
WWTP Facility Subtotal	**$15,710,000**
Site-Specific Costs	**(Site 1)**
Influent Sewer	$600,000
Effluent Sewer	$66,000
Excavation	$1,250,000
Ruggedness Premium	$2,000,000
Site Development (drainage, pavement, etc)	$1,300,000
Demolition of Existing WWTP	$500,000
Site Subtotal	**$5,716,000**
Construction Costs	**$21,426,000**
Contractor's OH&P @ 15%	$3,210,000
Contingency @ 20%	$4,290,000
Construction Total (2023 Dollars)	**$28,926,000**
Engineering Design @ 10%	$2,890,000
Construction Engineering @ 5%	$1,450,000
Property Acquisition	$100,000
Project Total (2023 Dollars)	**Approx. $33.4M**

As stated in the Introduction, the WWTP is not anticipated to be constructed in the immediate future. First, the Town is rightly focused on eliminating the root of their wastewater problem, which is the replacement of the 100-year old collection system located at the bottom of the Lake. Nevertheless, this Report provides insight into what will be needed as that effort is completed, in order to support the Town's growth for years to come.

The question at hand is timing of the development of the new WWTP. Ideally, completion of the new facility would coincide with completion of the new collection system, since at that time the old collection system will be able to be abandoned (assuming all connected customers have been transferred to the new system). Unfortunately, the precise timing of that event is not easily determined, since it is dependent upon the Town obtaining sufficient funding throughout a period of several years.

Since the wastewater flows from the new collection system will be physically separate from that of the old collection system (only being interconnected downstream of the dam), the new WWTP could be developed early, and only the new collection system flows could be directed to it as customers are transferred. However, construction and commissioning of the WWTP substantially ahead of completion of the sewer system replacement is not without its drawbacks. First (as stated in the Introduction), existing sewer system flows would not be directed to the new WWTP, but they must still be treated. Therefore, the Town would have to operate two WWTPs simultaneously. Secondly, the implementation costs of a new WWTP are substantial in and of themselves and it could be argued that these dollars should continue to be focused on solving the core problem first – i.e., the new collection system.

If the new WWTP development is delayed substantially such that the new collection system is completed before the new WWTP becomes available, the old WWTP will need to remain in operation. However, without substantial upgrades to return the existing facility to a functioning biological WWTP (as envisioned in the 2020 ER-EID developed for the Program funding through NCDEQ), it will not be able to handle the new I&I-free wastewater flow, and it is doubtful that purposefully 'diluting' the incoming flow to allow the existing facility to function as-is would be allowed. Therefore, readiness of the new WWTP upon completion of the collection system is essential.

Certain factors are reasonably foreseeable and can be figured into the timing decision, as listed below:

New WWTP Construction	18 to 24 months
Contractor Procurement (including potential funding approvals)	3 to 6 months
Design and permitting	12 to 18 months
Total WWTP Development Time	33 to 48 months

Therefore, it is recommended that the Town anticipate beginning a WWTP development process at a time where approximately four more years of new collection system construction are anticipated. In the meantime, the Town should move to acquire the preferred site, and the development of the new collection system should incorporate consideration of that site to accommodate gravity flow without an influent pump station.

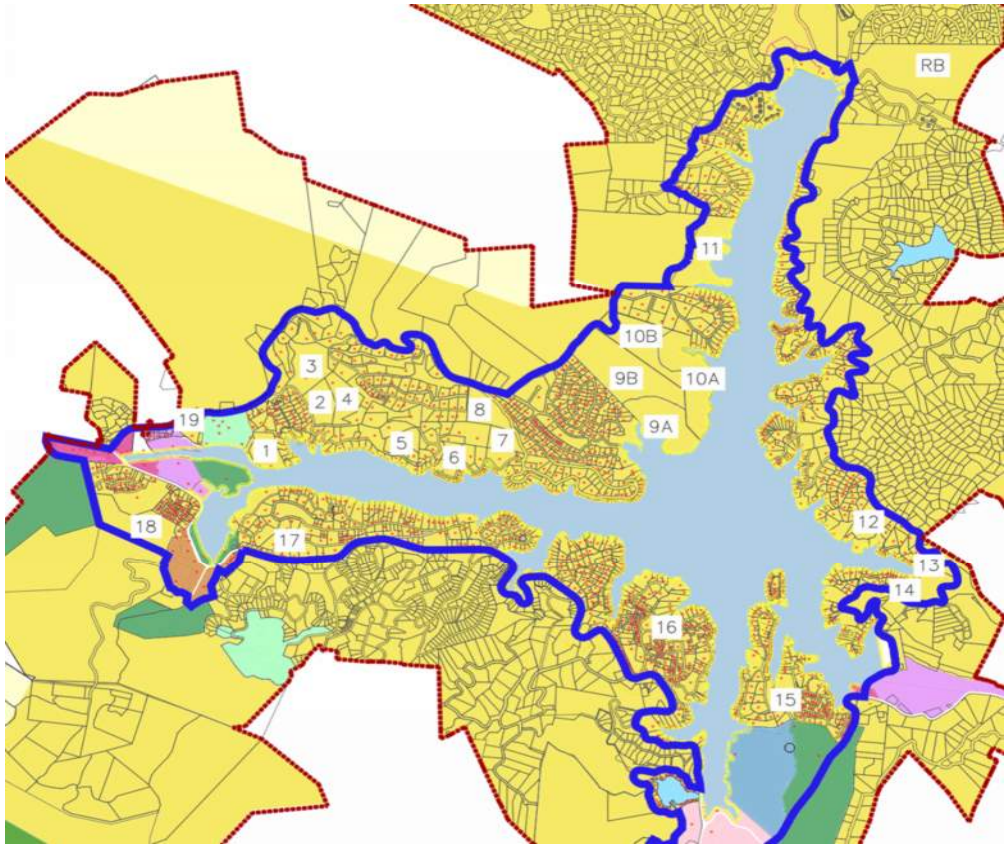
Recognizing that it may be difficult to identify when a point has been reached which is four years out from the completion of the new collection system, the Town may also elect to proceed with design and permitting of the new WWTP at an earlier time. This would reduce the required look-ahead timeframe to 21 to 30 months, which may be more manageable.

APPENDIX A

Contributing Flows

Large Undeveloped Lots

# (See Map)	Acres	Lot Acres (75%)	Zoning	Min. Lot	Max. Lots	Tier
1	8.9	6.7	R-1A	2.00	3	1
2	9.2	6.9	R-3	0.32	21	3
3	15.1	11.4	R-3	0.32	35	3
4	10.1	7.6	R-4	0.23	33	3
5	7.0	5.3	R-3	0.32	16	2
6	5.6	4.2	R-1	0.23	18	2
7	6.1	4.6	R-1A	2.00	2	2
8	10.7	8.0	R-1A	2.00	4	3
9A	22.4	16.8	R-1D	0.50	34	1
9B	39.2	29.4	R-1A	2.00	15	2
10A	23.8	17.8	R-1D	0.50	36	1
10B	24.7	18.5	R-1A	2.00	9	2
11	24.7	18.5	R-1D	0.50	37	1
12	9.3	7.0	R-1	0.23	30	1
13	4.6	3.5	R-1	0.23	15	1
14	3.7	2.8	R-1	0.23	12	1
15	7.7	5.8	R-1	0.23	25	2
16	5.1	3.8	R-1	0.23	17	3
17	3.1	2.4	R-1	0.23	10	3
18	22.2	16.6	R-1	0.23	72	1
19	4.3	3.2	R-2	0.32	10	2
R.B.	53.9	40.4	R-3	0.32	126	RB
TOTAL	**321.6**	**241.2**			**580**	
						(see note)
8	119.6	89.7			239	Tier 1
7	94.7	71.0			95	Tier 2
6	53.4	40.0			120	Tier 3
1	53.9	40.4			126	R.B.



Note: Tier 1 and 2 parcels subdivided are assumed to be 100% and 90% sewered (respectively) based on their current tier. See Table 5 discussion.

Chimney Rock Village Flow Metering

Begin Date		2/19/2020	
End Date		4/22/2020	
Interval of measurement		15	minutes
Number of Measurements		3418	EA
Max Observed Flow (15m interval)		2713	Gal
Peak Observed Flowrate		181	GPM
Average Daily Flow		22.1	GPM
	=	31,885	GPD
Peaking Factor (I&I-driven)		8.2	

Previous Metering Summary by McGill

Max Observed Flow (15m interval)		2030	Gal
Peak Observed Flowate		135	GPM
Average Daily Flow		12.2	GPM
	=	17,611	GPD
Peaking Factor (I&I-driven)		11.1	

Commercial / Governmental / Institutional Parcels

Legend

Establishments

Lake Lure Flowering Bridge

Morse Park

Lake Lure

The Highlands Kitchen & Bar

Lake House Restaurant Bar & Grill

Ingles Markets

Canopy Ridge Fa

1305 1306 1185 1187 1186

Google Earth

5000 ft

N

Commercial / Governmental / Institutional (i.e., Non-Residential) Wastewater Flows

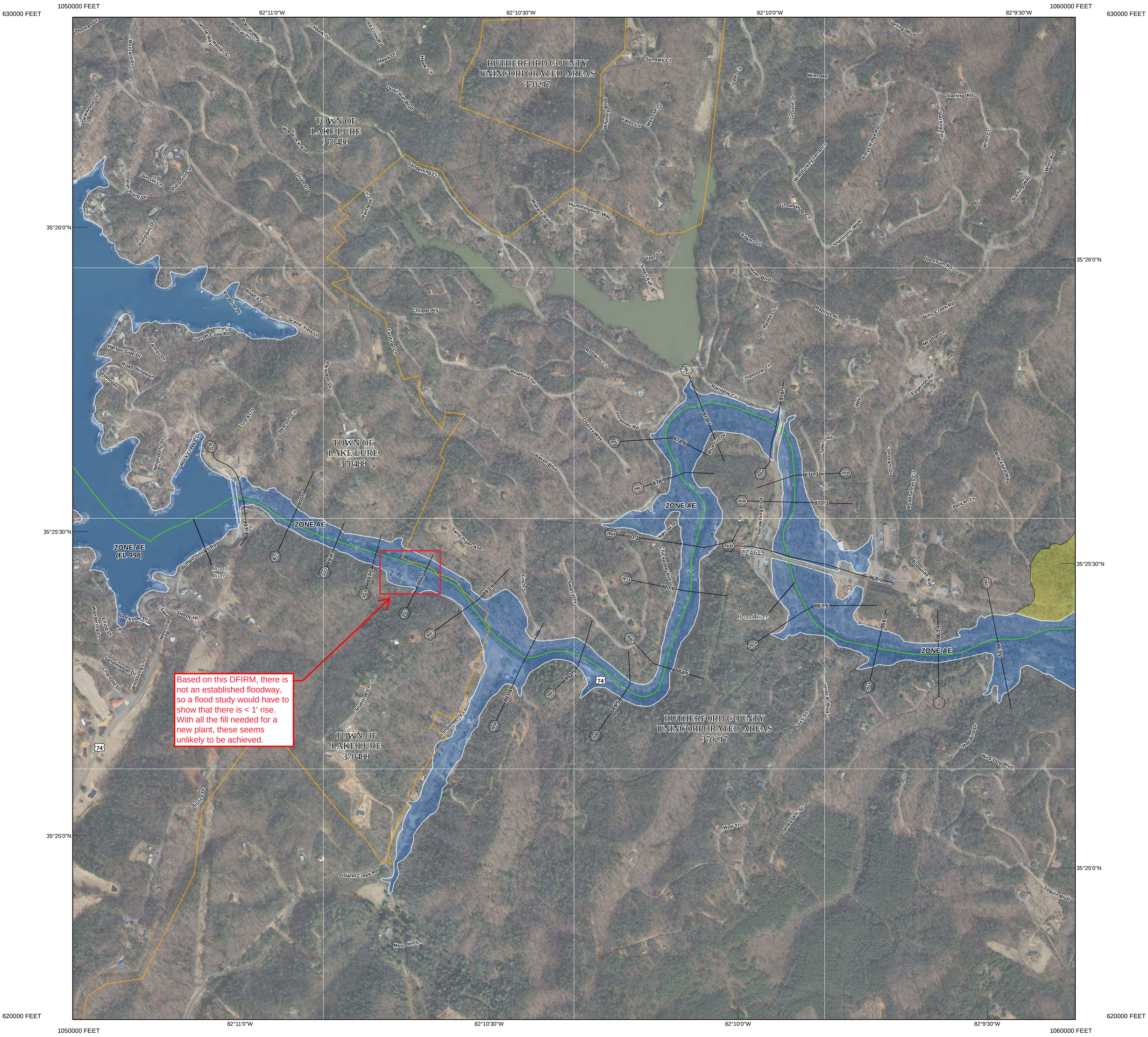
No.	Establishment Name	Unit	Flow Ea	Qty	Flow
1	Hair Therapy Salon	Booth/Bowl	125	4	500
2	Lake Lure Salon	Booth/Bowl	125	4	500
3	US Post Office	Employees	25	20	500
4	Lake Lure Municipal Center	Employees	25	20	500
5	Lake Lure Welcome Center	Employees	25	5	125
6	ABC Store	Employees	25	3	75
7	Joseph R. Hurwitz, Attorney at Law	Employees	25	10	250
8	Crane Creek Baptist Church	Seats	5	150	750
9	Lake Lure Volunteer Fire Department	Persons	25	10	250
10	Lake House Restaurant Bar and Grill	Seats	40	50	2000
11	Lake Lure Food and Beverage	Employees	25	10	250
12	La Strada at Lake Lure	Seats	40	75	3000
13	Japan House Grill and Sushi	Seats	40	30	1200
14	Moose and Goose Lounge	Seats	40	20	800
15	El Lago Mexican Restaurant	Seats	40	50	2000
16	Lured Market and Grill	Seats	40	30	1200
17	Scoop Lake Lure	Floor Area	50	8	400
18	Starbucks	Seats	40	20	800
19	The Highland Kitchen and Bar	Seats	40	30	1200
20	Ingles	Floor Area	125	6	750
21	Gaestehaus Salzburg	Rooms	120	5	600
22	The Lodge on Lake Lure	Rooms	120	5	600
23	The 1927 Lake Lure Inn and Spa	Rooms	120	50	6000
24	Grafton Lodge B&B	Rooms	120	5	600
25	Acorn Cabins Lake Lure	Units	200	2	400
26	Arbor at Lake Lure	Rooms	120	5	600
27	Willowbrook Inn of Lake Lure	Rooms	120	5	600
28	MAHEC Family Health Center at Lake Lure	Practitioners	250	15	3750
				TOTAL	30,200

Rumbling Bald Resort Sewer Flows

	Monthly ADF by Year (gpd)		
Month	**2019**	**2020**	**2021**
Jan	51,610	43,188	36,456
Feb	61,601	50,114	35,291
Mar	58,319	55,062	81,355
Apr	62,815	52,225	53,271
May	65,728	65,404	51,768
Jun	92,507	66,310	60,705
Jul	113,846	82,186	66,118
Aug	77,410	88,260	79,464
Sep	(no data)	78,412	89,651
Oct	73,297	79,393	89,892
Nov	67,256	75,683	45,738
Dec	44,495	65,880	41,964
ADF	69,934	66,920	61,169
Max Mo	113,846	88,260	89,892
Max 3-mo ADF		95,628	

APPENDIX B

Flood Insurance Rate Map for Existing WWTP Site



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://FRIS.NC.GOV/FRIS

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*

OTHER AREAS

- Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Accredited or Provisionally Accredited Levee, Dike, or Floodwall
- Non-accredited Levee, Dike, or Floodwall
- BM5510 — North Carolina Geodetic Survey bench mark
- BM5510 — National Geodetic Survey bench mark
- BM5510 — Contractor Est. NCFMP Survey bench mark
- 012 — 18.2 — Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
- 8 — Coastal Transect
- Coastal Transect Baseline
- Profile Baseline

OTHER FEATURES

- Hydrographic Feature
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at http://www.ncfloodmaps.com, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the North Carolina Floodplain Mapping Program (NCFMP). The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicates the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

- Limit of Moderate Wave Action (LiMWA)

COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE

This map may include approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see http://www.fws.gov/habitatconservation/coastal_barrier.html, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

- CBRS Area
- Otherwise Protected Area

SCALE

Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

PANEL LOCATOR

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

FEMA National Flood Insurance Program

NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 0652

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
LAKE LURE, TOWN OF	370488	0652	J
RUTHERFORD COUNTY	370217	0652	J

MAP NUMBER
3710065200J

MAP REVISED
7/2/2008

APPENDIX C

Soil Report – Hunt & Site 2 Properties

United States Department of Agriculture

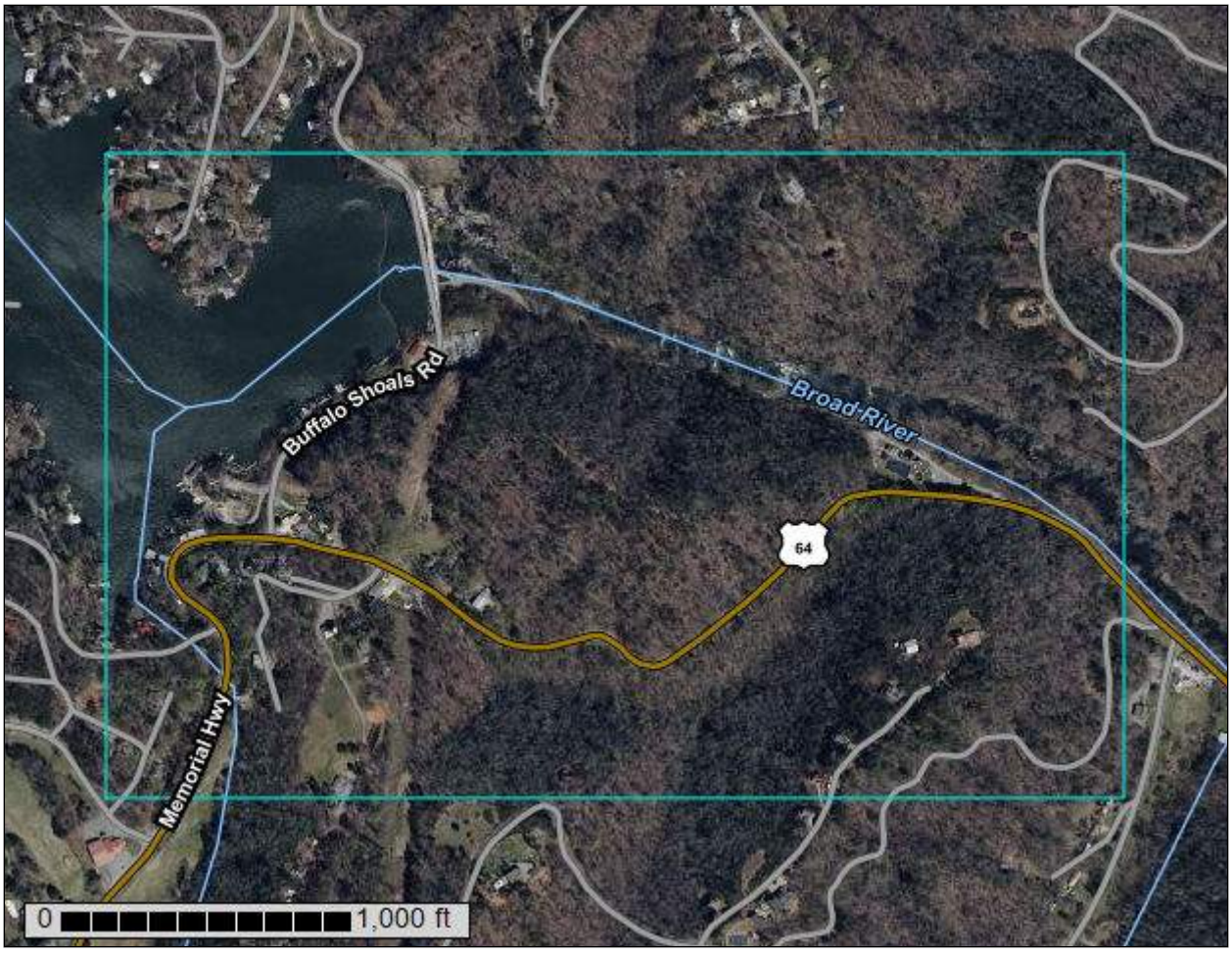
NRCS

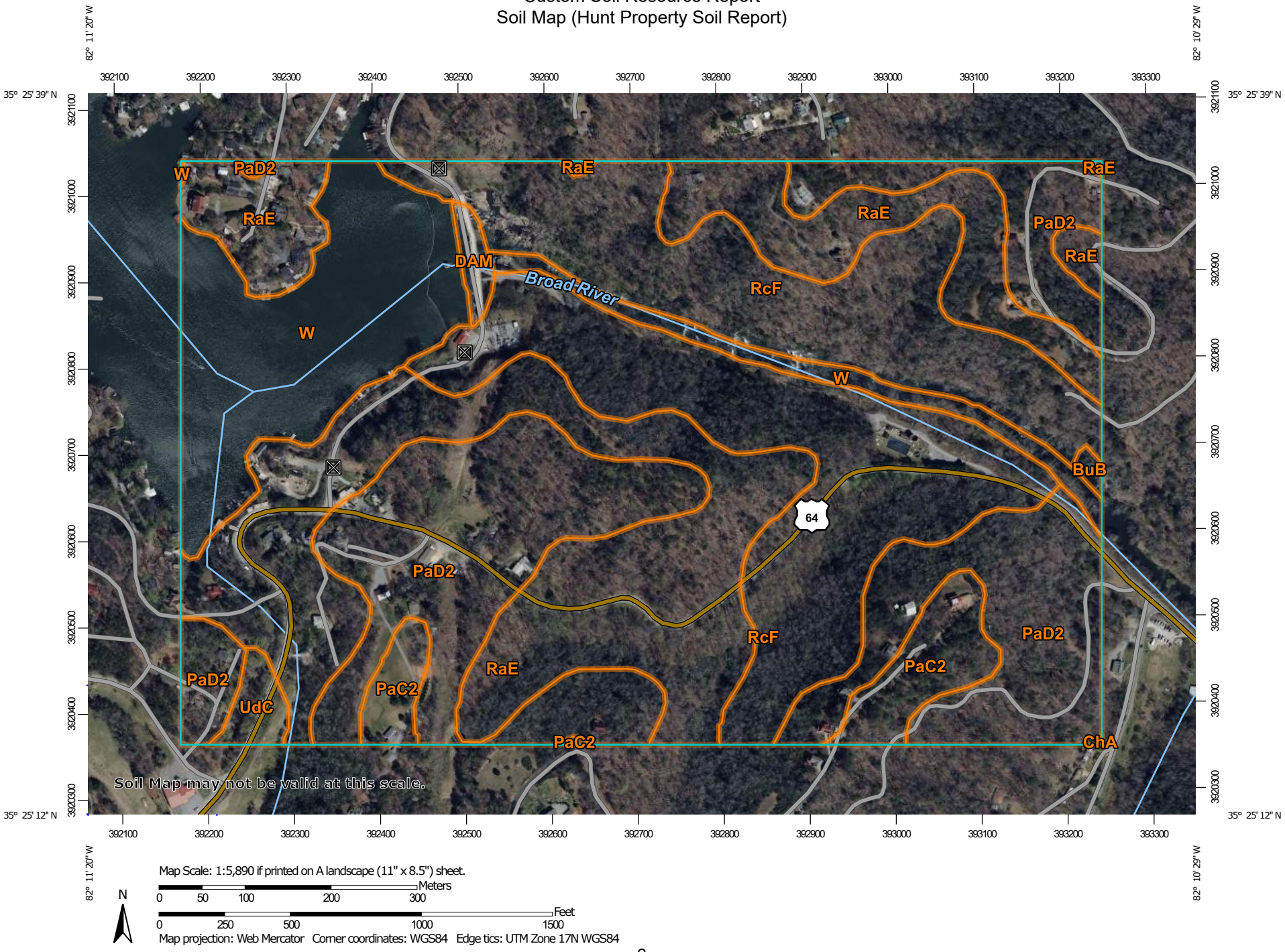
Natural Resources Conservation Service

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 Rutherford County, North Carolina

Hunt Proerty Soil Report




82° 11' 20" W
82° 10' 29" W
35° 25' 39" N
35° 25' 12" N
392100
392200
392300
392400
392500
392600
392700
392800
392900
393000
393100
393200
393300
3921100
3921000
3920900
3920800
3920700
3920600
3920500
3920400
3920300
W
PaD2
RaE
DAM
Broad River
RcF
BuB
64
PaC2
UdC
ChA
Soil Map may not be valid at this scale.
Map Scale: 1:5,890 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 50 100 200 300
Feet
0 250 500 1000 1500
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

Map Unit Legend (Hunt Property Soil Report)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BuB	Buncombe loamy sand, 0 to 5 percent slopes, occasionally flooded	0.3	0.2%
ChA	Chewacla loam, 0 to 2 percent slopes, frequently flooded	0.0	0.0%
DAM	Dam	1.0	0.5%
PaC2	Pacolet sandy clay loam, 8 to 15 percent slopes, moderately eroded	6.4	3.6%
PaD2	Pacolet sandy clay loam, 15 to 25 percent slopes, moderately eroded	46.1	25.6%
RaE	Rion sandy loam, 25 to 45 percent slopes	50.2	27.9%
RcF	Rion-Ashlar-Rock outcrop complex, 45 to 70 percent slopes	51.1	28.4%
UdC	Udorthents, loamy, 0 to 15 percent slopes	1.5	0.8%
W	Water	23.4	13.0%
Totals for Area of Interest		**179.9**	**100.0%**

Map Unit Descriptions (Hunt Property Soil Report)

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.

APPENDIX D

Soil Report – Site 3 Property

United States Department of Agriculture

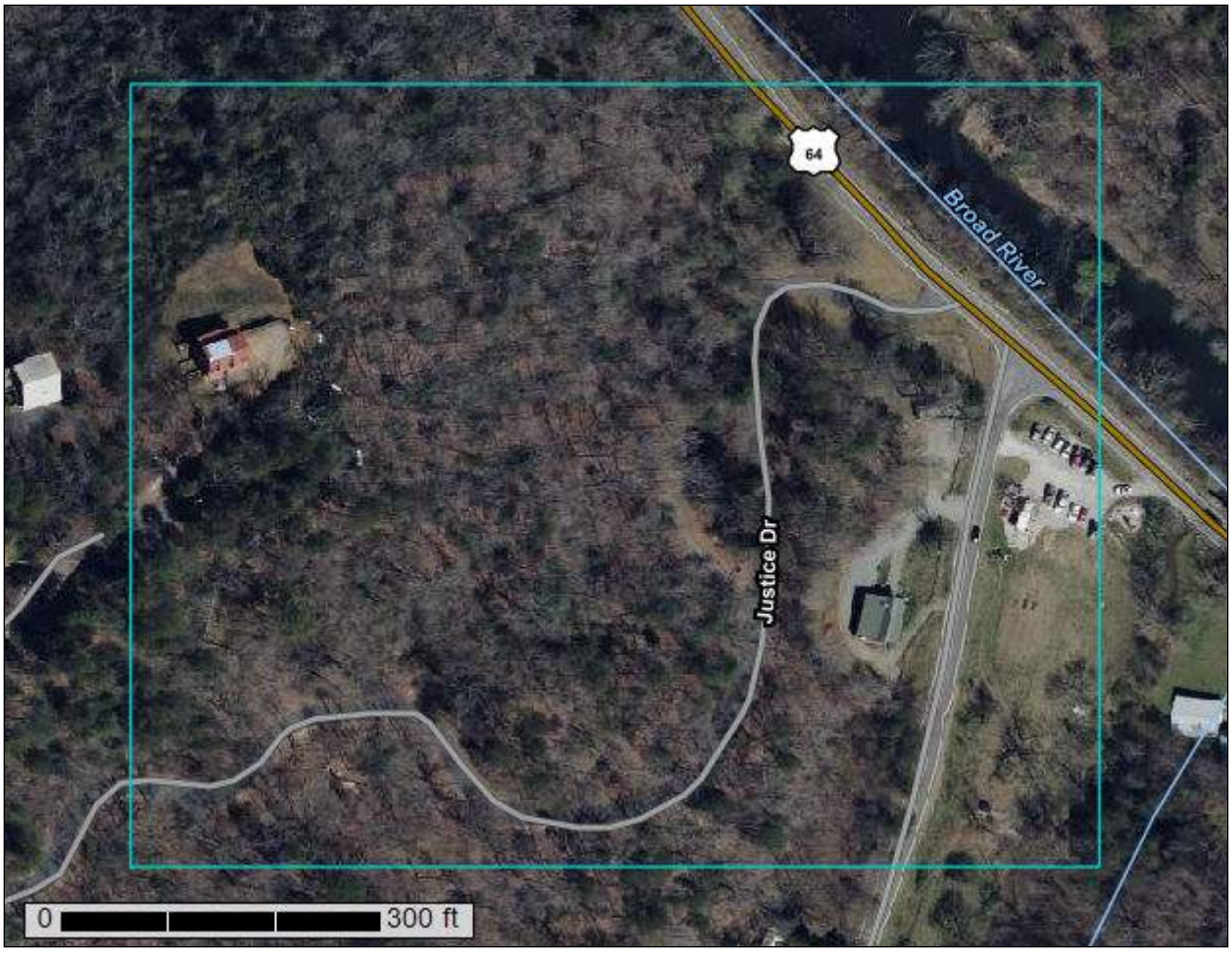
NRCS

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 Rutherford County, North Carolina

Site 3



Soil Map


82° 10' 43" W
82° 10' 27" W
35° 25' 23" N
35° 25' 14" N
392980
393020
393060
393100
393140
393180
393220
393260
393300
393340
393380
3920600
3920560
3920520
3920480
3920440
3920400
3920360
RcF
BuB
W
PaC2
PaD2
ChA
64
Memorial Hwy
Justice Dr
Island Creek
Soil Map may not be valid at this scale.
Map Scale: 1:1,890 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 25 50 100 150
Feet
0 50 100 200 300
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BuB	Buncombe loamy sand, 0 to 5 percent slopes, occasionally flooded	0.4	2.5%
ChA	Chewacla loam, 0 to 2 percent slopes, frequently flooded	2.1	13.8%
PaC2	Pacolet sandy clay loam, 8 to 15 percent slopes, moderately eroded	2.1	13.7%
PaD2	Pacolet sandy clay loam, 15 to 25 percent slopes, moderately eroded	10.2	66.4%
RcF	Rion-Ashlar-Rock outcrop complex, 45 to 70 percent slopes	0.1	0.5%
W	Water	0.5	3.1%
Totals for Area of Interest		**15.3**	**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

Future Fire Department

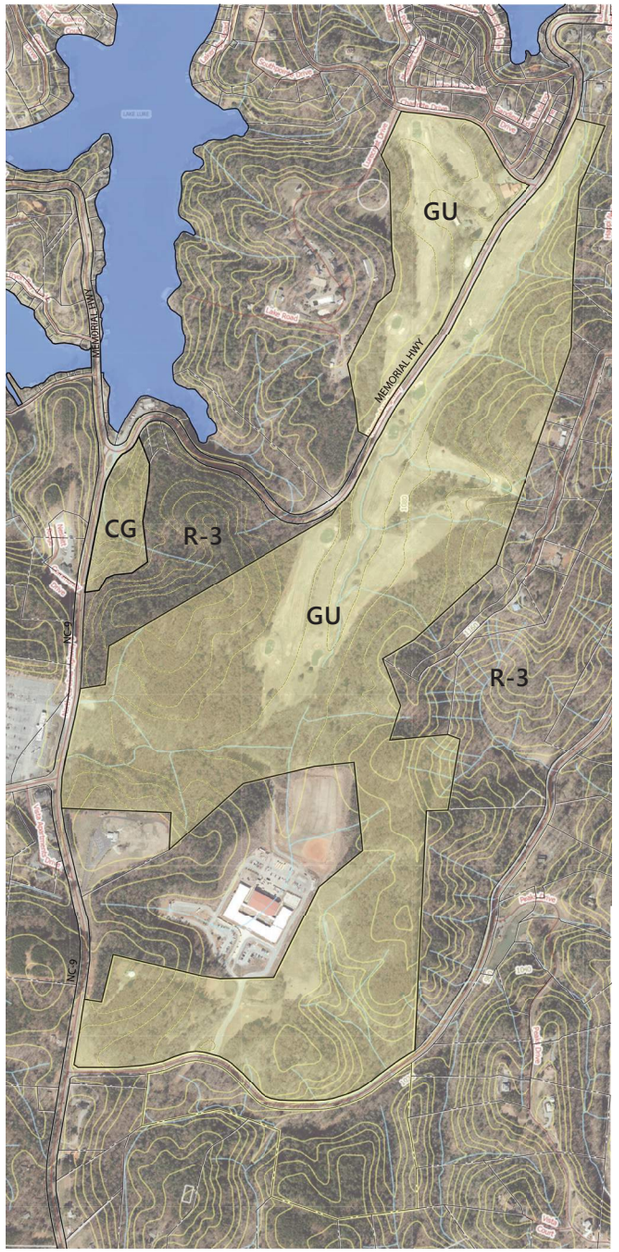
Supporting Documents:

Lake Lure Advanced Planning For Fire and Police

CONCEPTUAL DESIGN | JANUARY 8, 2024

LAKE LURE, NC

adwarchitects
environmentsforlife®



Zoning and Dimensional Requirements for GU District (Government Institutional Use)

Dimensional Requirements (setbacks, building heights, etc.) do not appear to be codified for this district. However, the locations and heights of structures on the proposed, town-owned, former golf course property usually do not come near to any abutting property line.

Buffers abutting residential:

Fence:	8' High min.
Landscaped Area:	8' Wide with evergreen shrubs (can be modified if natural buffers exist)

Parking:

Code requires 1 space for every 200 square feet of gross floor area for government uses (we usually do not provide this much parking since the number of personnel is relatively fixed and is usually determined by shift changes and meeting room occupant load (this is commonly 1 space for every 5 occupants in the largest assembly area).

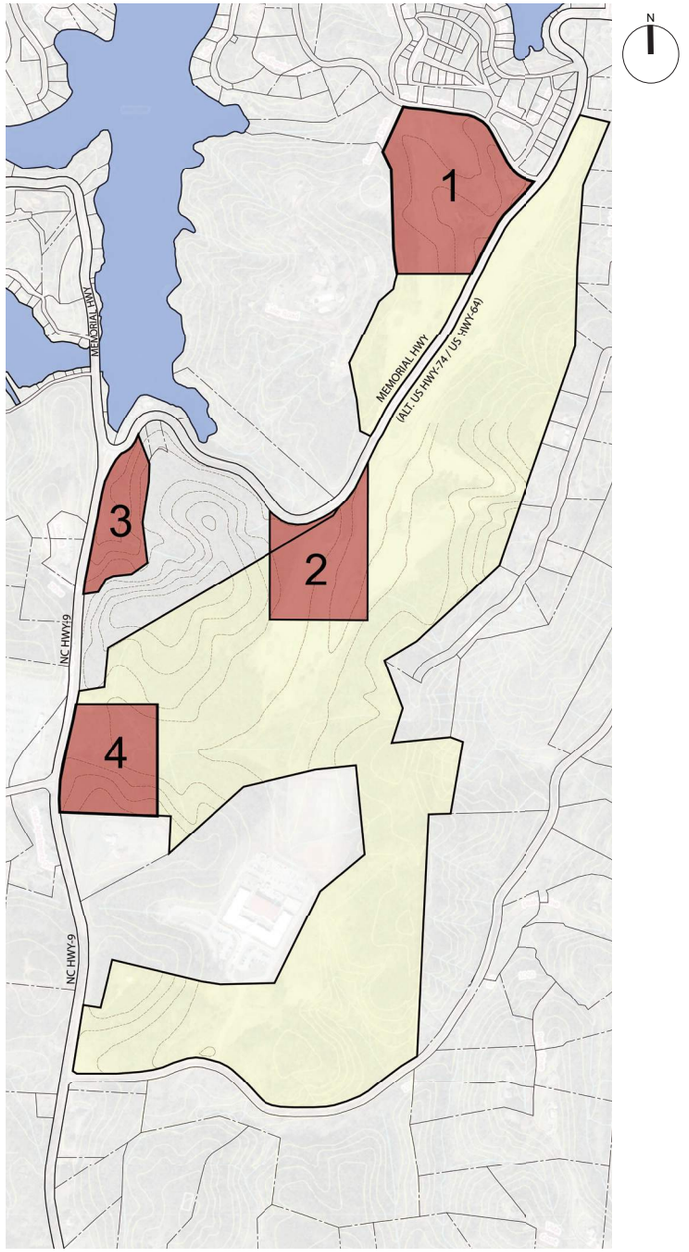
Zoning and Dimensional Requirements for CG District (Commercial General)

Setbacks:	Front:	10'
	Side:	12'
	Rear:	15'

Buffers abutting residential:

Fence:	8' High min.
Landscaped Area:	8' Wide with evergreen shrubs (can be modified if natural buffers exist)

Parking: See GU Zoning above.



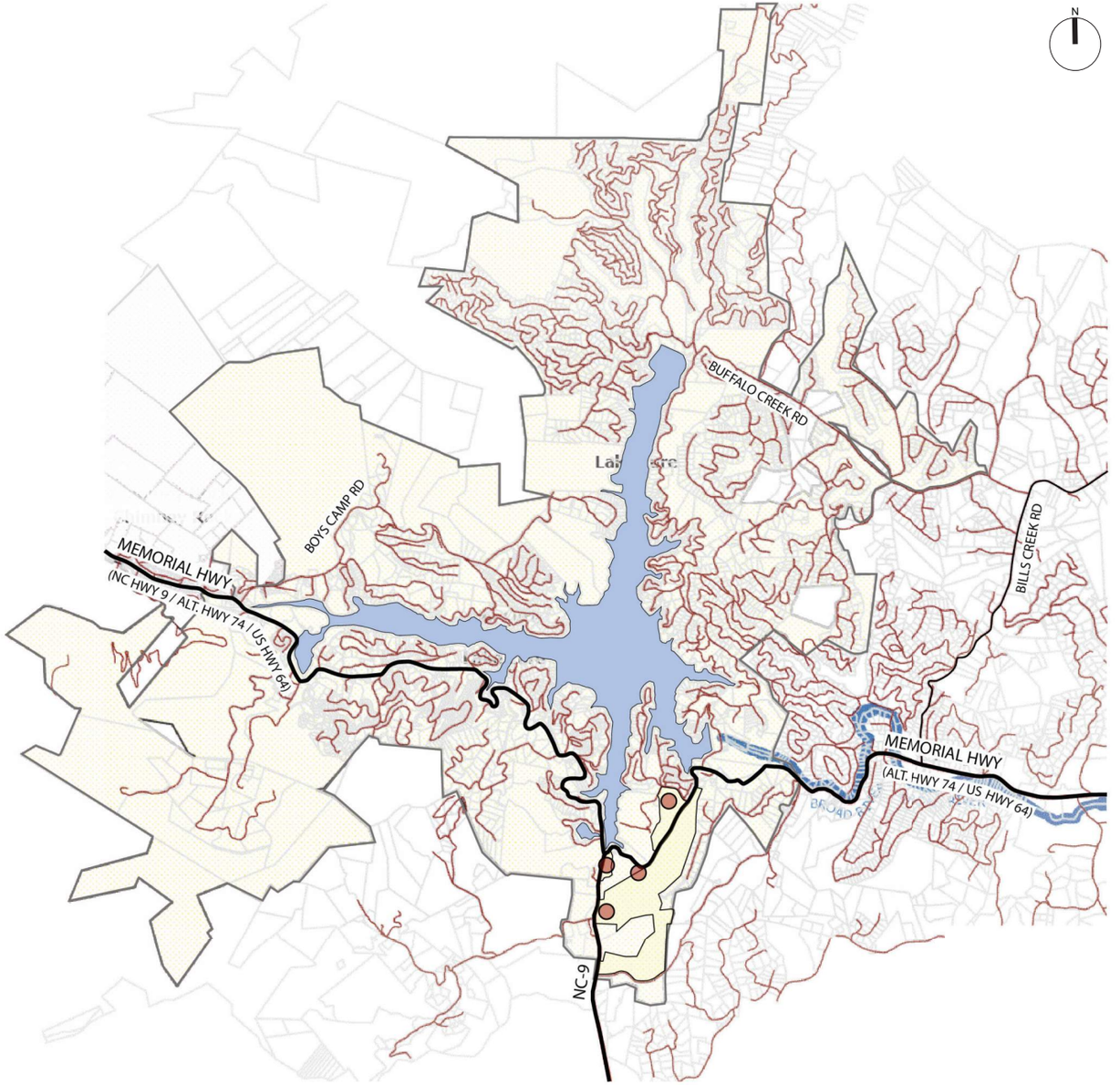
Site Option Key Plan

The town and ADW have narrowed the seven (7) initially proposed sites down to four (4) potential sites where the new fire and future police facility might best be located. One is a stand-alone site on NC Highway 9 near the intersection with Memorial Highway and the other three (3) are in various locations on the former golf course property that was purchased by the town.

A couple of the sites, due to either the size of the parcel, topography, or other site features, might not allow the future police to be located directly adjacent to the fire station without massive retaining walls or other costly accommodations. This distance somewhat limits the spaces that can be shared between Fire and the future Police facility. It should be noted that the large training/ multipurpose room probably could still be shared, but it would involve a short walk between buildings.

On one potential site, it will likely be necessary to go to a 2-story concept just to fit the Fire on the property, but where possible we have tried to stick to 1-story concepts, as they are more cost-effective.

SITE CONTEXT AND RESPONSE AREA DIAGRAM



Site Context

Each of the identified sites lies on an approximately two-mile stretch of NC Highway 9 and Memorial Highway (Alt US Highway 74/ US Highway 64).

The site at the northern extent of this stretch lies just to the south of the existing Fire Station and the site at the southern extent of the stretch lies just across Highway 9 from the existing Ingles.

Response Area and Time

The identified sites are distant enough from each other that response time may be a factor in choosing a final location for the new Fire and Future Police facility.

As a general rule, a mile can be traveled in a time dependent on the speed of the vehicle. This translates to the following:

- 25 mph — 2 minutes and 30 seconds
- 35 mph — 1 minute and 45 seconds
- 45 mph — 1 minute and 15 seconds

So, for example, if we assume that a service vehicle can average about 35 mph on the stretch of highway under study, then site four (4) would be approximately 3 minutes further south than site one (1) near the existing Fire Station on Alt. 74/64 at Charlotte Drive.

For the sake of argument, if we say that the area of the Town to the northwest of the northern prong of the lake is the most difficult point to reach (given distance and road size/conditions), then moving the Fire Station south along this stretch of highway would increase response time to that area of town anywhere from slightly less than a minute to around 3 minutes.

There are many factors affecting response time, but this example serves as a rough illustration to draw attention to a point that needs to be considered in choosing a location for the new facility.

OPTION 1

Pros:

- The full new Fire facility program works with the existing grades as a single-story structure and, barring hitting any significant amount of rock, can likely be graded out beyond the building and parking pads with slopes of 1:2 or less
- The site is near the existing Fire Station, which could be used to store infrequently used equipment and supplies
- The existing grade at new apparatus bays allows for a good slope down to the road

Cons:

- There is not enough room on the site, given the existing topological conditions, for the future Police component to be located directly adjacent to the Fire Station (even if configured as a 2-story building) without massive retaining walls

  There is, however, a possibility that, with some additional grading and the installation of a new retaining wall, the site where the existing Fire Station is located could be developed to accommodate a future single-story Police station

  Some spaces that might be shared in a connected building, such as roll call, public toilets, and mechanical/electrical rooms would have to be provided in the future police facility. The training/multipurpose room still might be shared, but would have to be accessed by Police personnel via an exterior sidewalk or by parking directly at the new fire facility
- There is not enough room on this site for dedicated public parking in the event that the Training/ Multipurpose is used as a community room, however, since Fire does not require secure parking, the spaces shown could be shared if community access is required
- The ideal space for the BMP area lies to the north of the building pad. There is a natural low spot located there where most of the water from the site could be directed. This would, however, require that the current road to the Public Works complex be reconfigured. Any future site improvements to the Public Works likely could share a BMP at this location. A much smaller BMP area to the south of the building pad may be required, but an extensive amount of grading (cut) would be required to site the primary BMP there.

Building Areas:

New Fire Station Bays/Mezzanine:	+/-8,800 SF
New 1-Story Fire Non-Bays:	+/- 12,600 SF
Total Building Area:	+/- 21,400 SF

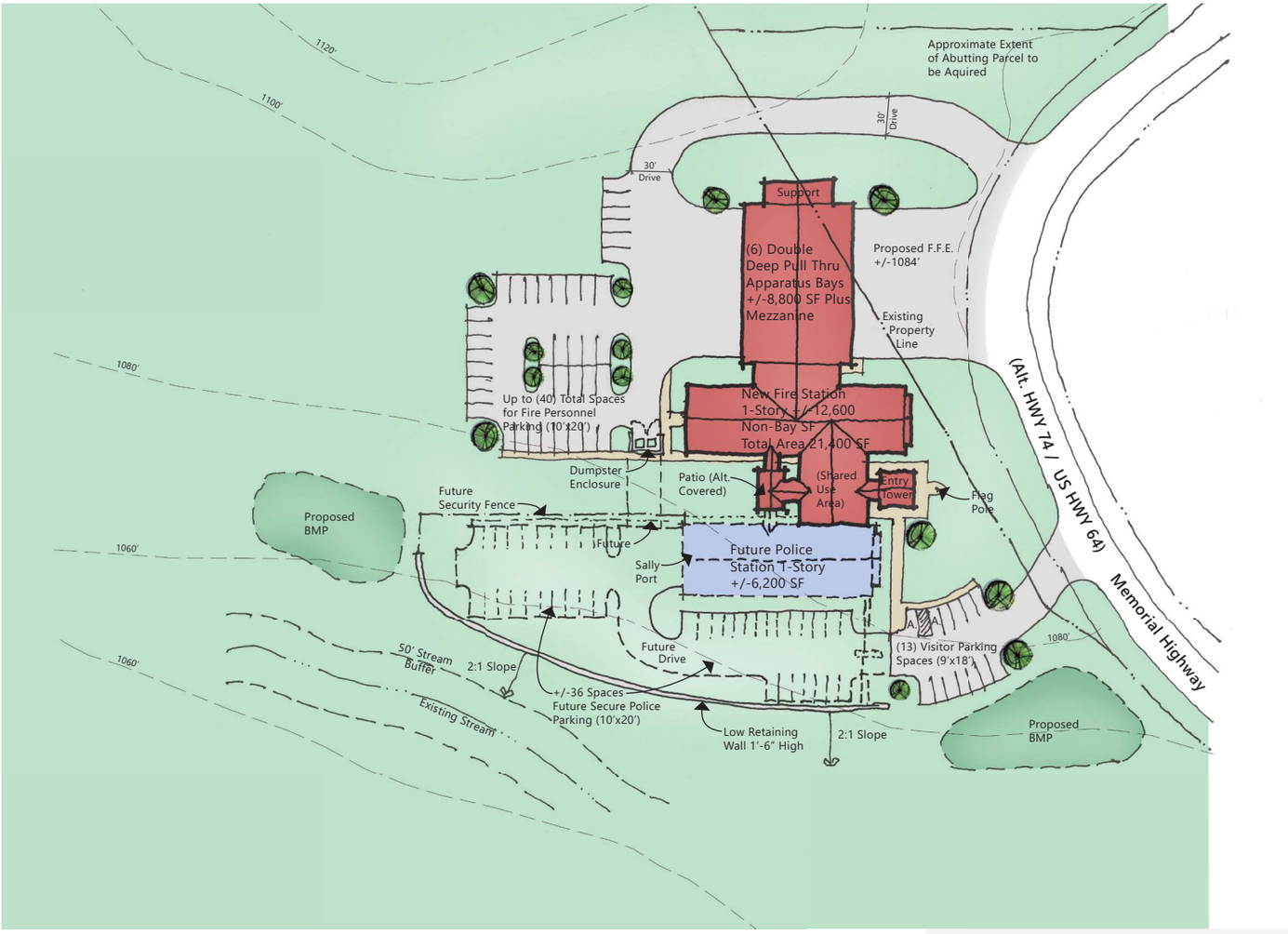
OPTION 2

Pros:

- The full new Fire and future Police facility program and required parking works well with the existing grades as a single-story structure and, barring hitting any significant amount of rock, can likely be graded out beyond the building and parking pads with slopes of 1:2 or less except for a low retaining wall on the western side of the site along the existing stream and a moderate height retaining wall (at its maximum height) at the southwest corner of the Fire access drive.
- The site is located approximately 1/2 of a mile south of the existing Fire Station and should not impact response times significantly
- The site is located in a bend of Memorial Highway (US 74/US 64) which affords good views of oncoming traffic traveling in either direction on the road
- Public parking, in the event that the Training/Multipurpose will be used as a community room, could be provided by the parking spaces already allocated for the Fire facility
- This location has adequate room to place storm water management areas (BMP) in appropriate locations with minimal extra grading.

Cons:

- In order for this site to function as it should, a small wedge of the abutting property to the west would have to be acquired by the town. This parcel, due to its shape and size, should not impact the development of the adjacent property
- While relatively flat, there is need to build some retaining walls in order to site a building complex of this size



Building Areas:

New Fire Station Bays/Mezzanine:	+/-8,800 SF
New 1-Story Fire (Non-Bay Area):	+/- 12,600 SF
Total Building Area:	+/- 21,400 SF
Future 1-Story Police Station:	+/- 6,200 SF

OPTION 3

Pros:

- The site, which is located on NC Highway 9 just south of Memorial Highway, seems to be an acceptable distance from the existing Fire station

Cons:

- This is the smallest of the proposed site options and also has some of the steepest terrain, consequently, it has the least room for grading the site without building tall and costly retaining walls

  The site is also bifurcated by what may be a small stream and, even if it is a feature that can be addressed with grading and normal drainage infrastructure, that southern end of the site is likely too steep to be used for even parking without even more investment in retaining walls.

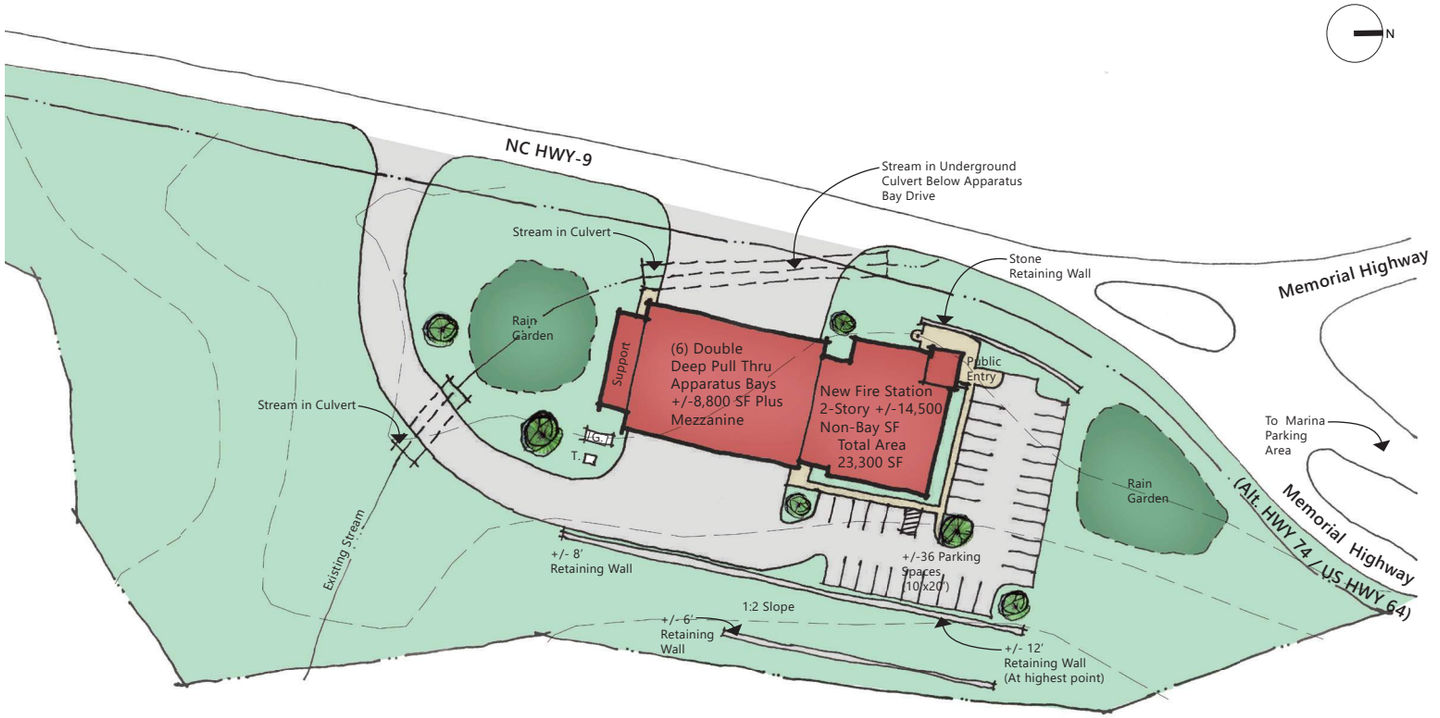
- Because of the physical challenges that this site presents, we do not feel that the future Police facility would be able to fit here with its requisite program area and secure parking needs

- It would also, in all probability, require that, even without including the future Police program at this location, the building be designed as a 2-story structure. This would add anywhere from 2,000 to 2,500 square feet to the building program for stairs, an elevator, sub mechanical and electrical rooms, and potentially upper level men's and women's toilets. These requirements would likely make it one of the costlier options

- (6) pull thru bays would likely require an even longer retaining wall on this site

- The site requires that access to the visitor parking share a drive with the returning fire apparatus vehicles. This is not an optimal situation

- As well as having limited area for simple graded slopes, the site has very little room to place adequate storm water management areas in appropriate locations unless the existing stream bed could be utilized to create a BMP/rain garden.



Building Areas:

New Fire Station Bays:	+/-8,800 SF
New 2-Story Fire Non-Bays:	+/- 14,500 SF
Total Building Area:	+/- 23,300 SF

OPTION 4

Pros:

- This site is one of the most buildable options. It has an area where the entire Fire and future Police buildings and their required parking will fit with fairly minimal site grading and has few other physical impediments to placing a 1-story building at this location

Cons:

- This site, while quite buildable, may be a little far from the existing Fire Station and the change in response time would be the greatest of all the sites. If the distance is not a problem, it would make an excellent site to locate the new Fire and future Police facility on

- There is, on the northern edge of the proposed building area, a gravel parking area for the Dittmer-Watts Nature Trail Park, an existing network of hiking/walking trails. It is not clear whether the potential building area is part of the park, but there may be an opportunity for combining the public visitor and community room parking for the Fire and future Police facility with the parking for the parks Dogwood Trail trailhead

Building Areas:

New Fire Station Bays/Mezzanine:	+/-8,800 SF
New 1-Story Fire (Non-Bay Area):	+/- 12,600 SF
Total Building Area:	+/- 21,400 SF
Future 1-Story Police Station:	+/- 6,200 SF

Lake Lure Fire Station PRELIMINARY Cost Estimate V3

1/2/2024

Construction Cost (2025 Costs)

Item	Cost/SF	Square footage	Cost
Site Option 1			
New Fire Station 1-Story 21,400 sf			
New construction (tank, pump for fire protection)	$410	21,400	$8,774,000
Site Development Costs (walls, septic, well, grading)			$1,975,000
All Contingencies 10%			$1,074,900
CMAR Allowance (not currently included)	$709,434		0
Construction Subtotal	$553		$11,823,900
Land Cost			$0
Owner Soft Costs 18%			$2,128,302
Fire Station Building Total			**$13,952,202**
Site Option 2			
New Fire Station 1-Story 21,400 sf			
New construction (tank, pump for fire protection)	$410	21,400	$8,774,000
Site Development Costs (septic, well, grading)			$1,700,000
All Contingencies 10%			$1,047,400
CMAR Allowance (not currently included)	$691,284		0
Construction Subtotal	$538		$11,521,400
Land Cost			$200,000
Owner Soft Costs 18%			$2,073,852
Fire Station Building Total			**$13,795,252**
Site Option 3			
New Fire Station 2-Story 23,300 sf			
New construction	$475	23,300	$11,067,500
Site Development Costs			$1,850,000
All Contingencies 10%			$1,291,750
CMAR Allowance (not currently included)	$852,555		0
Construction Subtotal	$610		$14,209,250
Land Cost			$900,000
Owner Soft Costs 18%			$2,557,665
Fire Station Building Total			**$17,666,915**

Lake Lure Fire Station PRELIMINARY Cost Estimate V3

1/2/2024

Construction Cost (2025 Costs)

Item	Cost/SF	Square footage	Cost
Site Option 4			
New Fire Station 1-Story 21,400 sf			
New construction	$400	21,400	$8,560,000
Site Development Costs (bad soil issues)			$2,100,000
All Contingencies 10%			$1,066,000
CMAR Allowance (not currently included)	$703,560		0
Construction Subtotal	$548		$11,726,000
Land Cost			$0
Owner Soft Costs 18%			$2,110,680
Fire Station Building Total			**$13,836,680**

LAKE LURE FIRE AND POLICE SPACE NEEDS SUMMARY

Revised 11/15/2023

Space Name	*# Rms*	*Room Size*	*Area (s.f.)*
Fire Department Space Needs			
Main Lobby (larger space required if antique fire vehicle is displayed)	1	12 x 14	168
Entry Vestibule	1	8 x 8	64
Medium Conference Room (seating for 12)	1	14 x 22	308
Small Conference Room (seating for 6)	1	12 x 14	168
Training / Multipurpose Room / Roll Call (seating for 36 @ Training tables / seating for +/- 84 - chairs only	1	32 x 38	1,216
Training / Multipurpose Room / Roll Call Storage (tables, chairs, AV, mats)	2	9 x 18	324
Public Men's Restroom (2 toilets/2 urinal/2 sinks)	1	12 x 21	252
Public Women's Restroom (4 toilets/2 sinks)	1	12 x 21	252
Fitness Room (shared by Fire and Police -- ceiling fans, rubber flooring, floor outlets for treadmills, TV, phone, water fountains, oversize door)	1	24 x 24	576
Private Room (shared -- TV, power/data, fridge, sink, soft seating)	1	8 x 10	80
IT / Server Room (with dedicated HVAC)	1	10 x 16	160
Main Electrical Room	1	12 x 16	192
Mechanical Room	1	14 x 18	252
Sprinkler Riser Room	1	8 x 8	64
Fire Cheifs Office	1	12 x 18	216
Fire Office -- Medium Office	3	12 x 14	504
Fire Workroom / Watch	1	12 x 14	168
Admin File Room	1	8 x 10	80
Decon Room (2 compartment SS sink, extractor, tumbler, drying box, eye wash/show)	1	10 x 16	160
Decon bath / shower	1	9 x 10	90
Turnout Gear Storage (room for 35 gear grid lockers)	1	14 x 28	392
Tool Room / Work Area	1	12 x 12	144
Logistics Storage Room (uniforms, turnout gear, fire prevention, etc.)	1	10 x 12	120
General Storage Room	1	10 x 12	120
Medical Supply Storage Room (AC)	1	6 x 8	48
Rehab Room (with ice machine, freezer, vending, hose bib, door to bays)	1	12 x 12	144
Bedrooms (room for 3 lockers / 3 beds)	4	14 x 18	1,008
Bathrooms (with showers, 50% ADA)	2	11 x 12	264
Linen Lockers (in shared corridor)	12	2 x 2	48
Fitness Room (Shared with Police)	0	24 x 24	0
Laundry Room (residential equipment)	1	8 x 12	96
Day Room (seating for 12)	1	25 x 33	825
Kitchen / Dining (seating for 10) viking/wolf stove, comercial hood, 2 sinks, 3 pantry's, 1 large commercial refrigerator / freezer, 1 undercounter ice dispenser (if on upper level))	1	25 x 34	850
Janitor	1	6 x 8	48
Miscellaneous Circulation, Walls, Etc. (35%)			3,290
Fire Department Non- Bay Subtotal			**12,691**

LAKE LURE FIRE AND POLICE SPACE NEEDS SUMMARY

Revised 11/15/2023

Space Name	*# Rms*	*Room Size*	*Area (s.f.)*
Mezzanine (with stair access -- some space used for mechanical systems)	1	18 x 24	432
6 Double Deep Pull Thru-Bays -- 14x14 ohd, plymovent (12x14 ohd would be 800 sq. ft less)	1	80 x 114	9,120
Fire Department Area Total			**22,243**

Space Name	*# Rms*	*Room Size*	*Area (s.f.)*
Police Department Space Needs			
Spaces Shared with Fire)			
Main Lobby	0	12 x 14	0
Entry Vestibule	0	8 x 8	0
Medium Conference Room (seating for 12)	0	14 x 22	0
Small Conference Room (seating for 6)	0	12 x 14	0
Training / Multipurpose Room / Roll Call (seating for 36 @ Training tables / seating for +/- 84 - chairs only	0	32 x 38	0
Training / Multipurpose Room / Roll Call Storage (tables, chairs, AV, mats)	0	9 x 18	0
Public Men's Restroom (2 toilets/2 urinal/2 sinks)	0	12 x 21	0
Public Women's Restroom (4 toilets/2 sinks)	0	12 x 21	0
Fitness Room (ceiling fans, rubber flooring, floor outlets for treadmills, TV, phone, water fountains, oversize door)	0	24 x 24	0
Private Room (TV, power/data, fridge, sink, soft seating)	0	8 x 10	0
IT / Server Room (with dedicated HVAC)	0	10 x 16	0
Main Electrical Room	0	12 x 16	0
Mechanical Room	0	14 x 18	0
Sprinkler Riser Room	0	8 x 8	0
Police Sub Lobby (seating for 6)	1	10 x 12	120
Soft Interview (off Sub Lobby, seating for 6)	1	12 x 14	168
Police Chiefs Office (TV monitor)	1	12 x 18	216
Lieutenant -- Medium Office (close to Captains Office)	1	12 x 16	192
Investigator -- Medium Office (close to Captains Office)	1	12 x 14	168
Patrol Sergeants Office (shared 2 per room -- 1 room total)	1	12 x 14	168
Officers Patrol Room 4 touchdown workstations w/ file storage)	1	14 x 21	294
Evidence Processing	1	14 x 24	336
Secure Evidence Storage	1	18 x 24	432
Administration Storage	1	8 x 10	80
Workroom alcove (off corridor)	1	4 x 12	48
Breakroom	1	14 x 18	252
Back of House Vestibule	1	8 x 8	64
Sally Port / Garage (Enclosed heated space with 12' x 10' ohd, adjacent to Evidence Suite)	1	18 x 27	486
Interview/Holding Toilet (vandal resistant)	1	8 x 10	80

LAKE LURE FIRE AND POLICE SPACE NEEDS SUMMARY

Revised 11/15/2023

Space Name	*# Rms*	*Room Size*	*Area (s.f.)*
Prisoner Intake / Holding bench (Secure, vandal resistant, bench with handcuff, weapon storage, intoxilizer)	1	7 x 16	112
Interview Room (CMU walls, bolt for shackle, acoustical treatment, reverse door lock (tumbler), tamper proof all items, hard ceiling, WatchGuard recording system)	1	8 x 10	80
Men's Bathroom / Shower	1	10 x 20	200
Men's Locker Room (Vestibule, 18"x24" full height lockers (18), include shoe shelf, foot locker drawer on bottom, top shelf with combination safe large enough for duty weapons)	1	14 x 20	280
Women's Bathroom / Shower	1	10 x 12	120
Women's Locker Room (Vestibule, 18"x24" full height lockers (6), include shoe shelf, foot locker drawer on bottom, top shelf with combination safe large enough for duty weapons)	1	10 x 12	120
Private Room (shared)	0	8 x 10	0
Fitness Room (shared)	0	24 x 24	0
Logistics Storage Room	1	12 x 14	168
Armory / Gun Safe Storage Room (oversized door)	1	8 x 10	80
~~Weapons Cleaning Area~~	0	8 x 8	0
Secure Video Recordings Room	1	8 x 10	80
Janitor	1	6 x 8	48
Exterior Storage	1	12 x 16	192
Miscellaneous Circulation, Walls, Etc. (35%)			1,604
Police Department Subtotal			**6,188**

Subtotal Fire Department	**22,243**
Subtotal Police Department	**6,188**

Total for Police and Fire Building	**28,432**

Site Requirements

Trash and Recycling dumpsters

(34) 10'x20' Fire personnel parking spaces

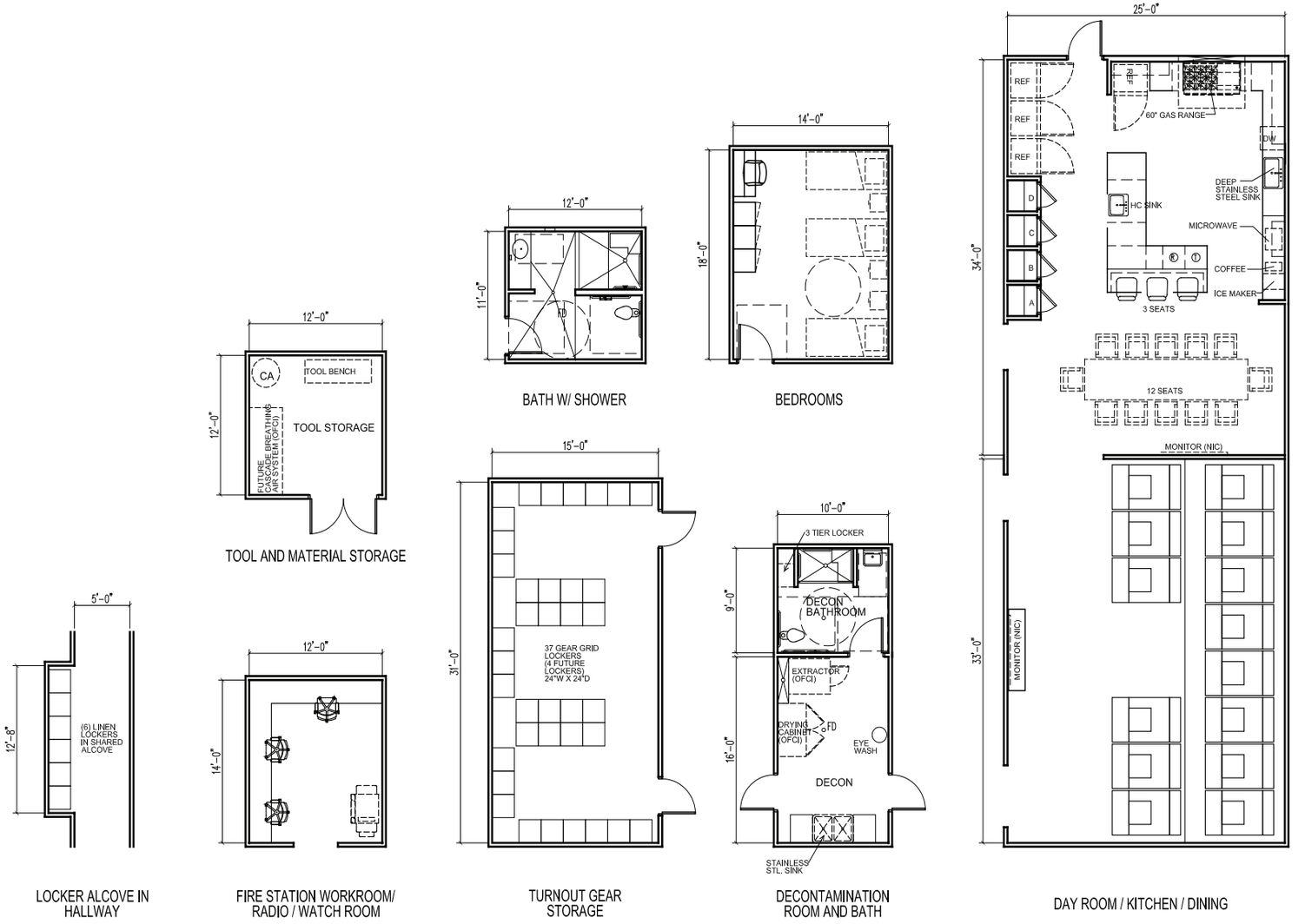
(24) 10'x20' Police patrol (secure) parking spaces

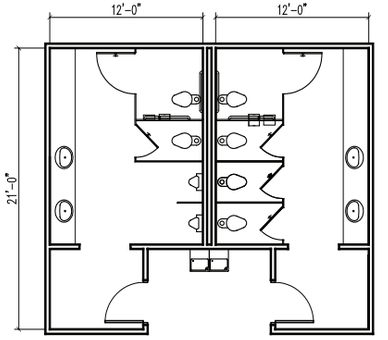
(10) 10'x20' Regular car / visitor parking spaces (add 24 spaces if Multipurpose room will be used as a community room) includes (2) accesssible spaces

Outdoor Break Area with grill (shared by Police and Fire... alternate covered)

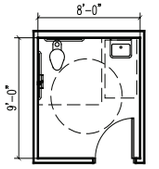
Outdoor Patio / Terrace for Fire personnel w/ NG grill (alternate covered)

Alternate Secure Police Storage for 10 vehicles and 50 bicycles

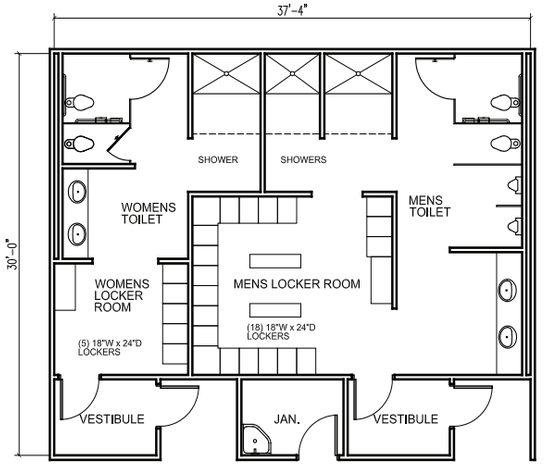

5'–0"
12'–8"
(6) LINEN LOCKERS IN SHARED ALCOVE
LOCKER ALCOVE IN HALLWAY
12'–0"
14'–0"
FIRE STATION WORKROOM/ RADIO / WATCH ROOM
12'–0"
CA
TOOL BENCH
TOOL STORAGE
12'–0"
FUTURE CLOSED BREATHING AIR SYSTEM (OFCI)
TOOL AND MATERIAL STORAGE
12'–0"
11'–0"
FD
BATH W/ SHOWER
14'–0"
18'–0"
BEDROOMS
15'–0"
31'–0"
37 GEAR GRID LOCKERS (4 FUTURE LOCKERS) 24"W X 24"D
TURNOUT GEAR STORAGE
10'–0"
3 TIER LOCKER
9'–0"
DECON BATHROOM
EXTRACTOR (OFCI)
DRYING CABINET (OFCI)
FD
EYE WASH
16'–0"
DECON
STAINLESS STL. SINK
DECONTAMINATION ROOM AND BATH
25'–0"
REF
REF
REF
REF
60" GAS RANGE
DW
DEEP STAINLESS STEEL SINK
HC SINK
MICROWAVE
COFFEE
ICE MAKER
D
C
B
A
3 SEATS
34'–0"
12 SEATS
MONITOR (NIC)
MONITOR (NIC)
33'–0"
DAY ROOM / KITCHEN / DINING



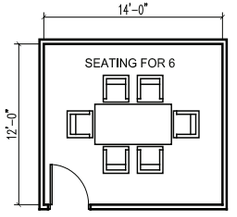
FIRST FLOOR
PUBLIC RESTROOMS



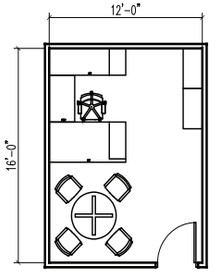
ADA TOILET



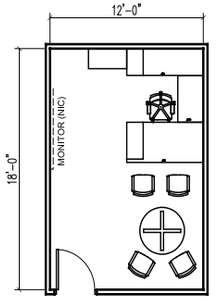
POLICE MENS AND WOMENS LOCKERS AND TOILETS



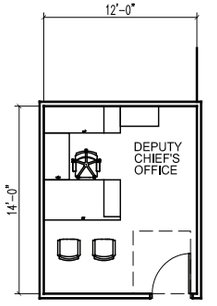
SOFT INTERVIEW ROOM



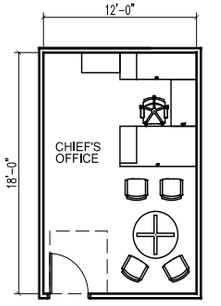
POLICE LIEUTENANT OFFICE



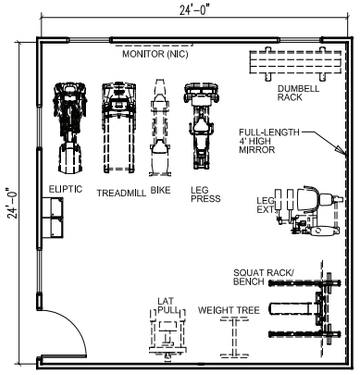
POLICE CHEIF OFFICE



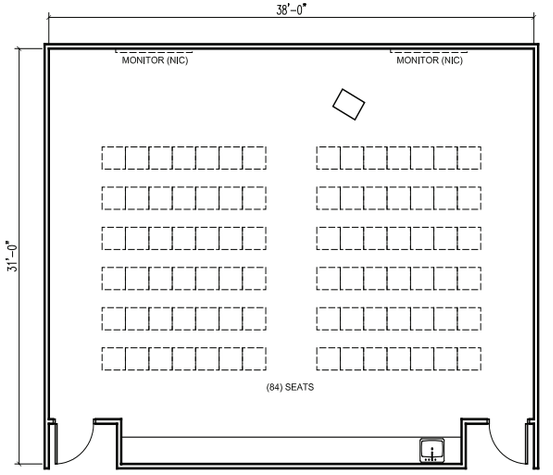
DEPUTY FIRE CHEIF OFFICES



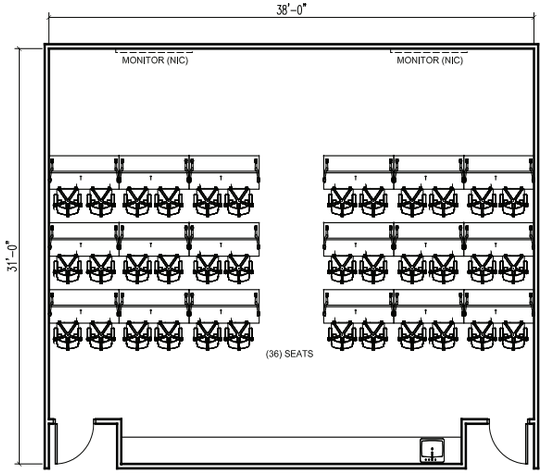
FIRE CHEIF OFFICES



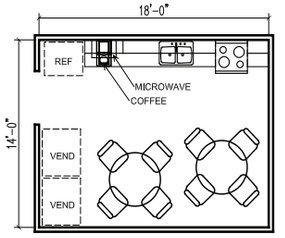
FITNESS



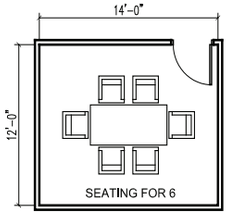
TRAINING / MULTIPURPOSE / ROLL CALL
(Seating for 84 Chairs Only)



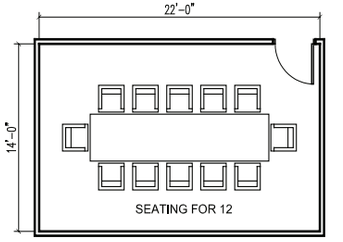
TRAINING / MULTIPURPOSE / ROLL CALL
(Seating for 36 @ Training Tables)



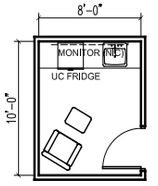
POLICE BREAKROOM



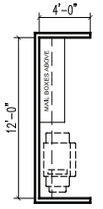
SMALL CONFERENCE ROOM



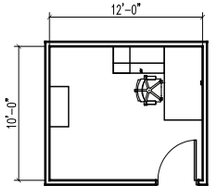
MEDIUM CONFERENCE ROOM



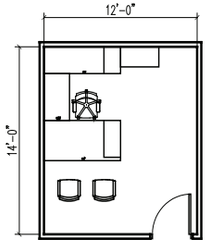
PRIVATE ROOM



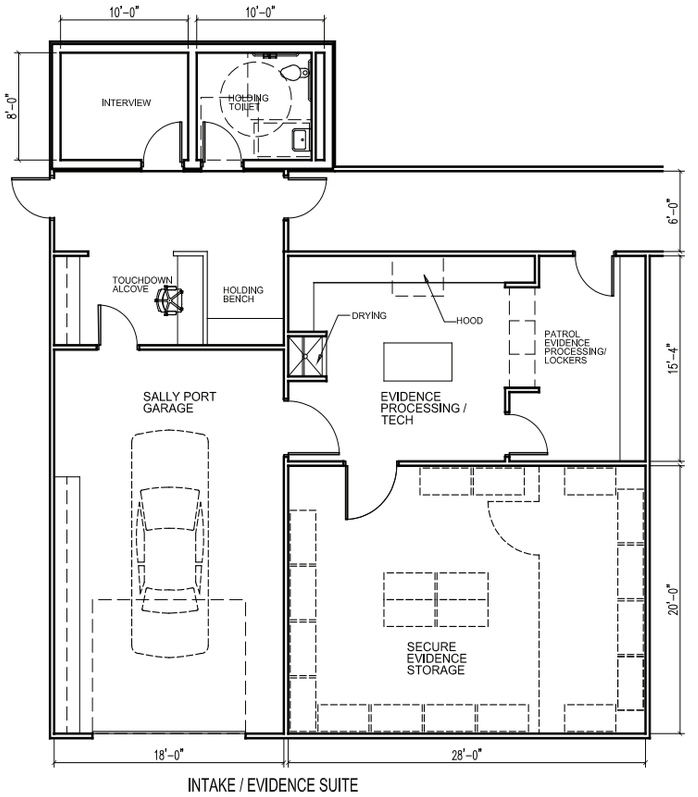
COPY ALCOVE



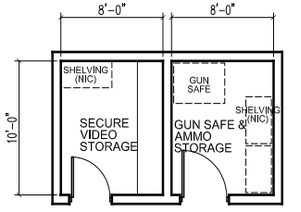
SMALL OFFICE



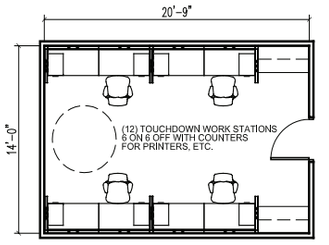
MEDIUM OFFICE



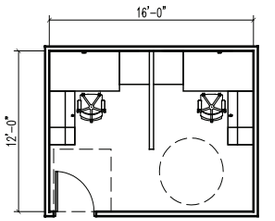
INTAKE / EVIDENCE SUITE



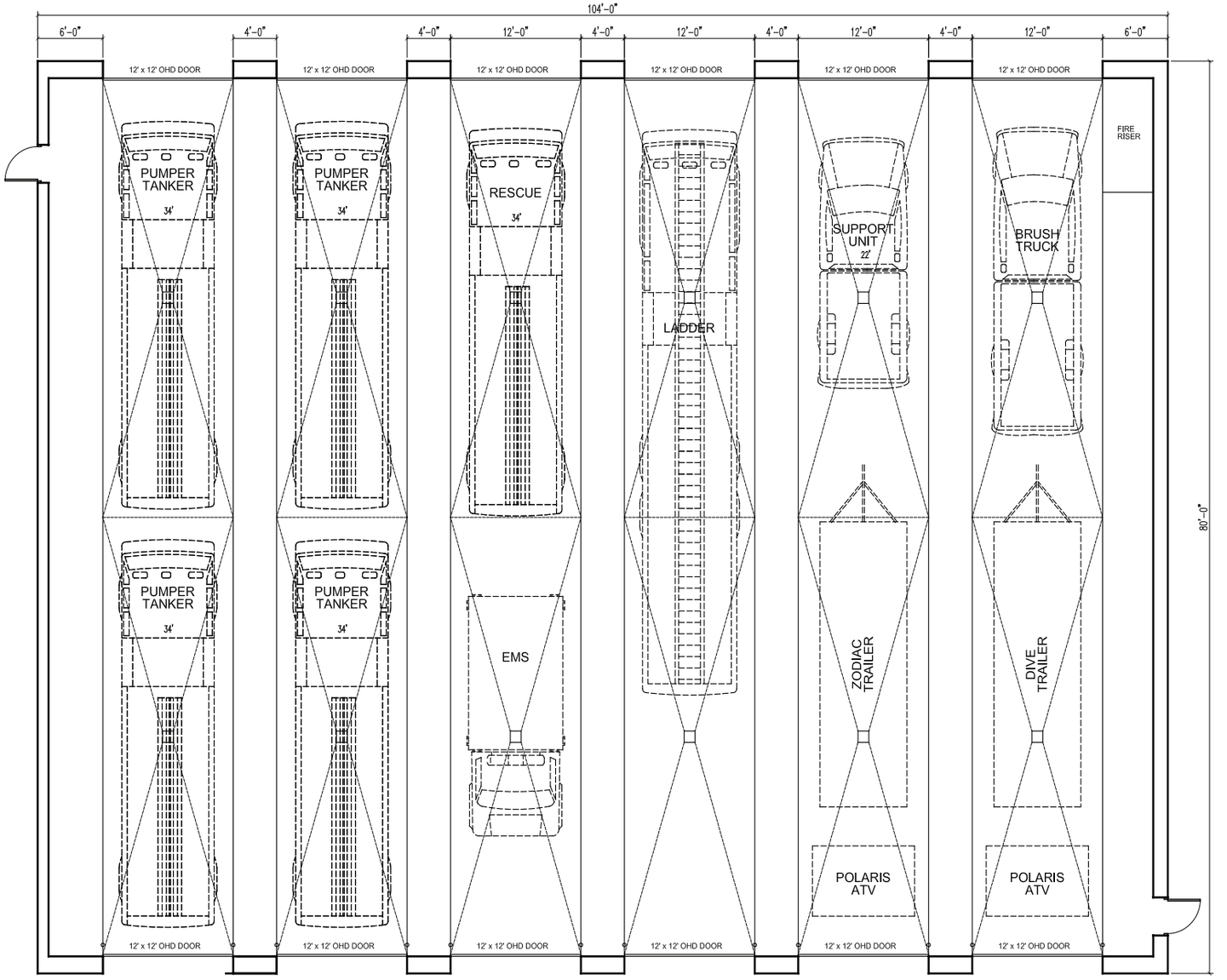
GUN, AMMO, VIDEO AND RECORDINGS ROOM



PATROL ROOM



POLICE SERGEANTS OFFICE (4 OFFICERS)



6-BAY APPARATUS ROOM WITH 12' WIDE BAY DOORS -- 6,186 SF

adw architects

environments for life®

Town of Lake Lure

Fire Station-Public Safety Facility

Debt Service Analysis/Listing and Comparsion of Debt Service Payments

Amount of Loan/Debt:			**$14,000,000**
Interest Rate:			***5.50%***

If the term of the loan is:	**20 Years**
The monthly payment would be:	**$96,304**
Annual budget amount needed for $14 million loan:	**$1,155,648**
For every One Million Dollar increase or decrease the monthly payment would either increase or decrease by:	**$6,879**
Annual budget cost or savings on debt service per $1 million:	**$82,548.00**

If the term of the loan is:	**30 Years**
The monthly payment would be:	**$79,490**
Annual budget amount needed for $14 million loan:	**$953,880**
For every One Million Dollar increase or decrease the monthly payment would either increase or decrease by:	**$5,678**
Annual budget cost or savings on debt service per $1 million	**$68,136.00**

If the term of the loan is:	**40 Years**
The monthly payment would be:	**$72,708**
Annual budget amount needed for $14 million loan:	**$866,496**
For every One Million Dollar increase or decrease the monthly payment would either increase or decrease by:	**$5,158**
Annual budget cost or savings on debt service per $1 million	**$61,896.00**

Specified: Town Manager / Prepared: SBF -Finance-1/4/2023

Town of Lake Lure
Tax Rate Review and Analysis

Real Property Value	$1,270,314,944
Personal Property Values	$55,884,714
(Based on 2023 values)	
Total Properties Value:	$1,326,199,658
Per 1 cent increase calculation	$132,619
Collection Rate	97.50%

Adjusted per 1 cent increase ***or***	
Value of 1 penny in taxes	$129,304