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FIRE PROTECTION DESIGN ANALYSIS

Final Submittal

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MCB Camp Lejeune, North Carolina

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Final Submittal

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1. INTRODUCTION

Jensen Hughes has prepared this fire protection design analysis, as required by Unified Facilities Criteria 3-600-01 for the renovation of Buildings FC550 & FC555 at MCB Camp Lejeune, North Carolina. This design analysis summarizes the applicable fire safety and building code requirements.

2. PROJECT DESCRIPTION

The project involves the renovation of Barracks FC550 & FC555 which are existing three-story buildings, with each floor having a gross footprint area of approximately 16,580-sf. The primary use of Buildings FC550 & FC555 is as a residential facility. The buildings consist of three stories of sleeping rooms with exterior balconies and exterior stairs at each end. In the middle of each floor is a central core consisting of lounge rooms, laundry, and an interior stairway. The building has a sloped combustible roof over the existing flat concrete roof. There are two adjacent Mechanical Buildings for FC550 (FC550A & FC551) and two adjacent Mechanical Buildings for FC555 (FC555A & FC556). Mechanical Buildings FC550A, FC551, FC555A & FC556 will be classified as separate buildings.

Buildings FC550 & FC555 are currently protected throughout with fire alarm and sprinkler systems. The fire protection work involves the demolition of the existing fire alarm and sprinkler systems; the installation of a new wet-pipe fire sprinkler system per NFPA 13R throughout the buildings; and a new fire alarm/mass notification system to coordinate with the repairs to the facility. The existing sprinkler system provides coverage throughout each floor except for the bathroom within the sleeping rooms and the office areas. There is no sprinkler system within the attic.

The project involves extensive repair and replacement of existing building systems including: the replacement of all doors and windows, repainting of the exterior, replacement of bathrooms, expansion and reconfiguration of existing laundries, replacement of all interior finishes, replacement of mechanical, electrical, and fire protection systems throughout. The scope of work can be defined as a modification to the facility in accordance with LSC Section 43.2.2.1.3.

The building is constructed of non-combustible construction apart from the existing combustible roof. Many of the interior walls have a 1-hr fire-resistance rating, and based on an assessment of the construction of the exterior load bearing walls, these have a minimum 2-hr fire-resistance rating, hence the construction type of the building can be considered as Type III-B.

3. DESIGN ANALYSIS

3.0. APPLICABLE CODES

1. The following building and fire safety codes and standards apply to this project:

    - Unified Facilities Criteria (UFC); including, but not limited to:
        - UFC 1-200-01, *DoD Building Code*, Change 4, 17 December 2024;
        - UFC 3-600-01, *Design: Fire Protection Engineering for Facilities*, Change 6, 06 May 2021;
        - UFC 4-021-01, *Design and O&M: Mass Notification Systems,* Change 1, January 2010; and
        - FC 4-721-10N, *Navy and Marine Corps Unaccompanied Housing,* Change 1, 24 April 2025;
    - ICC International Building Code – 2024 Edition (IBC);

- National Fire Protection Association (NFPA) Standards; including, but not limited to:
  - NFPA 13, *Installation of Sprinkler Systems,* 2025 edition
  - NFPA 13R, *Installation of Sprinkler Systems in Low-rise Residential Occupancies,* 2025 Edition;
  - NFPA 70, *National Electrical Code,* 2026 Edition;
  - NFPA 72, *National Fire Alarm and Signaling Code,* 2025 Edition;
  - NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* 2024 Edition; and
  - NFPA 101, *Life Safety Code,* 2024 Edition (LSC); and
- The *Architectural Barriers Act* (ABA).

2. Other UFC and NFPA codes and standards apply to the project and are referenced in these documents.

3. Buildings FC550 & FC555 will undergo modifications as defined by UFC 3-600-01 and the LSC and as such is required to comply with the requirements for new construction [LSC §43.5.1.3].

4. UFC 3-600-01 generally requires construction issues to comply with IBC criteria and life safety/egress issues to meet the requirements of the LSC. Conflicts between the IBC and the LSC related to fire resistance ratings are required to comply with the LSC criteria and applicable provisions of the UFC code [UFC 3-600-01 §3-2 & §3-3].

5. Buildings FC550 & FC555 will be protected with a NFPA 13R residential sprinkler system. IBC code allowances for fully-sprinklered buildings have not been applied for increases in building area and height. LSC code allowances for fully-sprinklered buildings have been applied for increases in travel distance and decreases in interior finish ratings.

3.1. CLASSIFICATION OF OCCUPANCY

1. The building consists of a barracks and necessary supporting facilities. The building is classified per the IBC as a Group R-2 building [IBC §310.3]. For LSC compliance, the building will be classified as a dormitory occupancy [LSC §6.1.8.1.4].

2. Rooms or spaces used for assembly purposes (e.g. lounges) and which have a design occupant load of fewer than 50 persons will be classified as residential (Group R-2) occupancies. All assembly-use spaces will have an occupant load of less than 50 persons and will be classified as residential (Group R-2) occupancies.

3. Special hazard areas including mechanical, utility, electrical, telecom, and storage areas are considered incidental to the main occupancy. These areas are required to be protected in accordance with LSC Section 8.7.1 and LSC Table 28.3.2.2.2.

3.2. CONSTRUCTION FEATURES

3.2.1. Minimum Construction Type

1. The minimum construction type of a structure is required to comply with the fire resistance requirements and fire area limitations in UFC 3-600-01 and the IBC. The minimum construction type of a building is typically based on the height, area, occupancy, open street frontage, and automatic sprinkler protection provided in the building.

2. The building is non-combustible construction apart from the existing combustible roof. For Type III-B construction, the following height and area limitations in Table 1 apply to the building for verifying the minimum required construction type.

3. Building area increases for frontage must comply with IBC Section 506.3. The building perimeter has open space greater than 20-ft for 100% of it. The minimum open space is 23.5-ft between Buildings FC550 & FC551 and 29.25-ft between Buildngs FC555 & FC555A. Based on the percentage of building perimeter and the minimum open space, the frontage increase factor is 0.5 [IBC Table 506.3.3].

Table 1: Limitation for Type III-B Construction

IBC Requirement	Allowed/Required	Provided
Construction Classification	III-B	III-B
Occupancy Classification	Group R-2	
Allowable Height [IBC Table 504.3]	60-ft	45-ft
Allowable Number of Stories [IBC Table 504.4]	4-stories	3-stories
Allowable Area per Story [IBC §506.2]	16,000-sf	
Frontage Increase (50%) [IBC §506.3]	8,000-sf	
Total Allowable Area per Story	24,000-sf	FC550: 16,580-sf FC555: 16,580-sf

4. The buildings can be classified as Type III-B construction.

3.2.2. Construction Requirements

1. The required fire resistance ratings of building structural elements as specified in IBC Table 601 are provided in Table 2 below for Type III-B construction:

Table 2: Required Resistance Ratings of Structural Elements

Building Element	IBC Type III-B
Structural frame, including columns, girders, trusses [a]	0-hr
Bearing walls, exterior	2-hr
Bearing walls, interior	0-hr
Non-bearing walls, exterior[b]	0-hr
Non-bearing walls, interior[c]	0-hr
Floor construction, including supporting beams and joists	0-hr
Roof construction, including supporting beams and joists	0-hr

[a] The structural frame is considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads.
[b] Based on IBC Table 705.5 for a fire separation distance of 30-ft or more.
[c] Not less than the fire resistance required by other section of the code.

2. Any load bearing exterior walls require a two-hour rating for Type III-B construction. An examination of the structural drawings prepared for the original construction of the building

indicates that there is a system of load bearing beams and columns along the face of the sleeping rooms; however, the end walls of the building are load bearing walls. These walls consist of 8-in thick CMU blocks with 4-in thick brick veneer. The bricks are noted as being solid with solid grout between all brick units.

a. A standard unfilled 8-in CMU block has an equivalent thickness of 4.0-in [National Concrete Masonry Association TEK 7-1A Table 2]. IBC Table 722.3.2 lists the fire-resistance rating of concrete masonry walls based on the equivalent thickness; a 4.0-in equivalent thickness CMU wall provides a 1.75-hr fire-resistance rating (based on calcareous or siliceous gravel being the least fire-resistant aggregate). A standard brick has an equivalent thickness of 3.6-in. IBC Table 722.4.1(1) lists the fire-resistance rating of brick walls based on the equivalent thickness; a 3.6-in brick wall provides a 1-hr fire-resistance rating. The total fire-resistance rating of the wall can be calculated using IBC Equation 7-7, which results in a 4.4-hr fire-resistance rating.

$$R_a = (R_1^{0.59} + R_2^{0.59})^{1.7} = (1.75^{0.59} + 1^{0.59})^{1.7} = 4.4\text{-hr}$$

3. Various interior CMU partitions require 1/2-hr and 1-hr ratings as identified in Section 3.2.4. These partitions are 8-in thick CMU blocks.

   a. A standard unfilled 8-in CMU block has an equivalent thickness of 4.0-in [National Concrete Masonry Association TEK 7-1A Table 2]. IBC Table 722.3.2 lists the fire-resistance rating of concrete masonry walls based on the equivalent thickness; a 4.0-in equivalent thickness CMU wall provides a 1.75-hr fire-resistance rating (based on calcareous or siliceous gravel being the least fire-resistant aggregate).

4. The existing roof coverings consist of the following:

   a. FC550 – Shingles over felt.

   b. FC555 – Standing seam; underlayment is unknown.

3.2.3. Exterior Fire Exposure

1. The requirements for providing fire resistance-rated exterior walls and openings are based on the fire separation distances between buildings and the occupancy groups within the buildings.

2. The fire separation distance is defined as the distance measured from the building face to the closest interior lot line, to the centerline of a street or public way, or to an imaginary line between two buildings on the same lot [IBC §202].

3. The fire separation distance is a measure of the separation to a point along a line between buildings, not the actual distance between buildings. The fire separation distance is measured at right angles from the face of the wall.

4. Once the location of the lot line is established, all future provisions must be based on this lot line and applied to both buildings. Where the lot line is not parallel to the exterior wall of a building, the required fire resistance rating may vary along the building side.

5. For building sides not fronted by a street, the fire separation distance is measured to an imaginary line between the buildings assuming the buildings are located on the same property (i.e., an interior lot line).

6. Where a new building is erected on the same lot as an existing building, the code requires the assumed property line to be located such that the existing building complies with exterior wall and opening protection criteria [IBC §705.3].

7. The fire-resistance rating of exterior walls with a fire separation distance of 10-ft or less shall be rated for exposure to fire from both sides [IBC §705.5].

8. The exterior walls are required to extend the full height of the building and be constructed to remain in place for the duration of time indicated by the required fire-resistance rating [IBC §705.6].

9. The code requirements for the fire-resistance rating and exterior wall openings are provided in Table 3.

Table 3: Fire-Resistance Rating Requirements for Exterior Walls of B Buildings Based on Fire Separation Distance [IBC Table 705.5]

Fire Separation Distance (FSD)	Group R-2 Type III-B	Group U Type II-B
FSD < 10-ft	1	1
10-ft ≤ FSD < 30-ft	1	0
FSD ≥ 30-ft	0	0

10. The distance between Building FC550 and Mechanical Building FC551 is 23.5-ft. This provides a fire separation distance from Mechanical Building FC551 to the imaginary property line of 3.5-ft and a fire separation distance from Buildings FC550 to the imaginary property line of 20-ft.

    a. The wall of Mechanical Building FC551 is required to have a 1-hr fire resistance rating.

    b. The wall of Building FC550 along XO Office 112 and CO Office 114 is required to have a 1-hr fire resistance rating.

11. The distance between Building FC550 and Mechanical Building FC550A is greater than 40-ft. This provides a fire separation distance from Mechanical Building FC550A to the imaginary property line of 10-ft and a fire separation distance from Building FC550 to the imaginary property line of at least 30-ft. There is no fire resistance rating required for the exterior walls of Buildings FC550 & FC550A based on the fire separation distance.

12. The distance between Building FC555 and Mechanical Building FC555A is 29.25-ft. This provides a fire separation distance from Mechanical Building FC555A to the imaginary property line of 4.25-ft and a fire separation distance from Buildings FC550 to the imaginary property line of 25-ft.

    a. The wall of Mechanical Building FC555A is required to have a 1-hr fire resistance rating.

b. The wall of Building FC555 along Kitchenette 116, XO Office 118, and Sleeping Room 120 is required to have a 1-hr fire resistance rating.

13. The distance between Building FC555 and Mechanical Building FC556 is greater than 40-ft. This provides a fire separation distance from Mechanical Building FC556 to the imaginary property line of 10-ft and a fire separation distance from Building FC555 to the imaginary property line of at least 30-ft. There is no fire resistance rating required for the exterior walls of Buildings FC555 & FC556 based on the fire separation distance.

14. The openings of the exterior walls of the buildings are required to comply with IBC Table 705.8 [IBC §705.8.1].

    a. The 1-hr fire-rated exterior wall of FC550 is permitted to have 45% unprotected openings.
    b. The 1-hr fire-rated exterior wall of FC551 is not permitted to have unprotected openings.
    c. The 1-hr fire-rated exterior wall of FC555 is permitted to have 70% unprotected openings.
    d. The 1-hr fire-rated exterior wall of FC555A is not permitted to have unprotected openings.

3.2.4. Barriers and Partitions

3.2.4.1. Vertical Exit Enclosures

1. Exit stairways and utility shafts connecting less than four (4) stories are required to be enclosed with 1-hr fire-resistance rated construction [LSC §8.6.5]. LSC Section 7.1.3.2.1(2) requires the supporting construction for fire barrier walls, including shaft enclosure walls, to be protected to afford the required fire-resistance rating of the fire barrier supported. Thus, the supporting construction for all 1-hr fire-resistance rated walls must have a minimum 1-hr fire-resistance rating except 1-hr fire barriers for incidental use areas required by LSC Section 8.7.1 and LSC Table 28.3.2.2.2 [LSC §8.2.3.3].

3.2.4.2. Special Hazard Areas

1. A special hazard area is an area or room having a degree of hazard greater than that normal to the general occupancy of the building. LSC requires separation and/or protection by automatic fire suppression systems for these spaces [LSC §8.7.1.1].

2. Special hazard areas will be protected with automatic sprinklers. The following spaces as shown in Table 4 are required to have fire barriers or non-fire-rated smoke partitions in accordance with LSC Section 8.7.1.2.

Table 4: Incidental Use/Special Hazard Area Requirements

Occupancy	Required Fire Barrier Separation	Code Reference
Fuel-fired Heater Rooms	1-hr	LSC Table 28.3.2.2.2
Laundry Rooms > 100-sf	1-hr	LSC Table 28.3.2.2.2

3.2.4.3. Sleeping Room Separations

1. Each sleeping room within a suite shall be separated from other sleeping rooms by walls and floors

constructed as fire barriers having a fire-resistance rating of not less than 1/2-hr [LSC §28.3.7.2]. One door from a sleeping room to the shared bathroom within each suite is required to have a fire-resistance rating of not less than 20-min and shall not be required to be self-closing [LSC §28.3.7.3].

2. Separation of the exterior exit access balcony is not required since dead end conditions do not exist on the balcony [LSC §7.5.3.3]. Doors from the sleeping rooms to the exterior exit access balcony are required to be self-closing and self-latching [LSC §28.3.6.2.3].

3.2.5. Opening Protection

1. Openings in fire resistance rated barriers and walls are required to comply with applicable IBC [Table 716.1(2)] and LSC [Table 8.3.3.2.2] criteria. Per UFC 3-600-01, fire protection rated doors shall comply with NFPA 80 and must be listed by Underwriters Laboratories, approved by Factory Mutual, or listed by a nationally recognized testing laboratory.

2. The fire-protection ratings for door and window openings in fire barriers and fire and smoke partitions are provided in Table 5 [LSC Table 8.3.3.2.2; IBC Table 716.1(2)].

Table 5: Required Fire-Protection Ratings for Openings

Type of Assembly	Required Fire-Protection Rating
1-hr fire barriers enclosing shafts and exit enclosures	1-hr
Other 1-hr fire barriers and 1-hr fire-resistance rated exterior walls	3/4-hr
1/2-hr fire barriers	1/3-hr

3.2.6. Concealed Spaces

2. Draftstopping and fireblocking are required in accordance with IBC Section 718 for combustible concealed spaces based on the anticipated construction type.

3. Fireblocking is required to be installed to cut off concealed draft openings (both vertical and horizontal) and to form an effective barrier between floors, between a top story and a roof or attic space.

    a. As the majority of the building is non-combustible, construction fireblocking is not required.

4. Draftstopping shall be provided in attics or concealed roof spaces of Group R-2 buildings with three or more sleeping units. Occupancies in Group R-2 that do not exceed four stories the attic shall be subdivided by draftstops into areas not exceeding 3,000-sf or every two sleeping units, whichever is smaller. Draftstopping shall be installed above, and in line with, sleeping unit separation walls that do not extend to the underside of the roof sheathing above.

    a. Given that the sleeping units are fire separated by a concrete ceiling from the combustible attic space, the provision of draftstops in-line with the sleeping units below does not appear to be a reasonable requirement.

3.3. HVAC SYSTEMS

1. Air handling, HVAC, and exhaust systems, including fire/smoke dampers, are required to comply with NFPA 90A except as modified by UFC 3-600-01 [UFC 3-600-01 §28-1.1].

2. Fire dampers are required in ductwork or air transfer openings that penetrate fire resistance rated assemblies. NFPA 90A permits the deletion of fire dampers in fully ducted penetrations of 1-hr fire resistance-rated partitions.

    a. Class I Dynamic Fire Dampers are required at duct penetrations of the Mechanical Room floors.

3. Smoke dampers are required in systems with a capacity greater than 15,000-cfm to isolate the air-handling equipment, including filters, from the remainder of the system in order to restrict the circulation of smoke, except where air-handling units are located on the floor they serve and serve only that floor, or air-handling units are located on the roof and serve only the floor immediately below the roof [NFPA 90A §4.3.10.2].

4. The installation of duct detectors is required to comply with NFPA 90A. Smoke detectors listed for use in air distribution systems shall be located as follows:

    a. Downstream of the air filters and ahead of any branch connections in air supply systems having a capacity greater than 2,000-cfm [NFPA 90A §11.4.2.1(1)].

    b. At each story prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air return systems having a capacity greater than 15,000-cfm and serving more than one story [NFPA 90A §11.4.2.1.(2)].

5. Plenum spaces may be used as part of an air handling system where the plenums comply with NFPA 90A.

3.4. INTERIOR FINISH MATERIALS

1. Interior walls and ceiling finishes are required to comply with UFC 3-600-01 Section 8-1 which requires wall and ceiling finishes, and movable partitions to conform to the requirements of the LSC. The LSC restricts the use of certain materials as interior finishes on walls and ceilings based on the flame spread rating and smoke development rating of the material. Interior wall and ceiling finishes shall be classified in accordance with ASTM E-84.

2. The interior finish materials shall be grouped in the following classes, based on their flame spread rating and smoke developed rating [LSC §10.2.3.3]:

    - Class A – Flame spread 0-25, smoke developed 0-450
    - Class B – Flame spread 26-75, smoke developed 0-450
    - Class C – Flame spread 76-200, smoke developed 0-450

3. Table 6 summarizes the interior finish requirements for Buildings FC550 & FC555 [LSC Table A.10.2.2].

Table 6: Interior Finish Requirements

Occupancy	Exits	Exit Access Corridors	Other Spaces
Dormitory	Minimum Class B	Minimum Class C	Minimum Class C

Note: Automatic sprinkler protection allowances have been applied.

4. The codes also specify requirements for interior floor finish and floor covering materials. Interior floor finish materials shall be classified in accordance with NFPA 253, *Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source* as follows [LSC §10.2.7.4]:

   - Class I – Critical radiant heat flux ≥ 0.45 W/cm^2
   - Class II – Critical radiant heat flux ≥ 0.22 W/cm^2

5. There are no additional interior floor finish requirements for fully sprinklered Dormitory Occupancies [LSC Table A.10.2.2, Note 6].

3.5. MEANS OF EGRESS

1. Means of egress are defined as continuous and unobstructed paths of travel in a building that led to a street, alley, or other parcel of land open for public use. Examples of means of egress include, but are not limited to, doors, corridors, ramps, or stairs. Means of egress may include both interior and exterior components. Means of egress are required to comply with the LSC.

3.5.1. Occupant Load

1. The design occupant load for an area or space is calculated based on the anticipated use of the space and the appropriate factors specified in LSC Table 7.3.1.2. The following occupant load factors are applicable to the project:

   - Sleeping Rooms – 2 persons per room
   - Residential use, including laundry and related spaces – 200-sf/person
   - Assembly (less concentrated with tables and chairs) – 15-nsf/person
   - Offices – 150-sf/person
   - Mechanical/electrical equipment rooms – 500-sf/person

2. The building is being designed with an occupant load of 2 persons per sleeping room.

3. Table 7 summarizes the design occupant loads for the building per floor.

Table 7: Calculated Occupant Loads per LSC

Area	Occupancy Use	Approx. Area (sf)	No. of Sleeping Rooms	Occupant Load Factor (sf/person)	Occupant Load (persons)
Mechanical Buildings (FC550A & FC555A)					
Mechanical Building	MEP Space	576	-	500	1
	Total	576	-	-	1
Mechanical Building (FC551 & FC556)					
Mechanical Building	MEP Space	196	-	500	0
	Total	196	-	-	0
First Floor (FC550 & FC555)					
Sleeping Rooms	Residential	300	20	2 per room	40
Offices/Duty	Business	3,213	-	150	21
Mech Rooms	MEP Space	600	-	500	2
Remaining Residential Areas (Laundry, Vending, etc.)	Residential	6,767	-	200	34
	Total	16,580	20	-	97
Second Floor (FC550 & FC555)					
Sleeping Rooms	Residential	300	30	2 per room	60
Lounge	Assembly	660	-	15	44
Mech Rooms	MEP Space	679	-	500	2
Remaining Residential Areas (Laundry, Vending, etc.)	Residential	6,527	-	200	33
	Total	16,866	30	-	139
Third Floor (FC550 & FC555)					
Sleeping Rooms	Residential	300	30	2 per room	60
Lounge	Assembly	660	-	15	44
Office	Business	81	-	150	1
Mech Rooms	MEP Space	600	-	500	2
Remaining Residential Areas (Laundry, Vending, etc.)	Residential	6,525	-	200	32
	Total	16,866	30	-	139

3.5.2. Number & Capacity of Means of Egress

1. The minimum number of exits required from an area or building is based on the design occupant load [LSC §7.4.1.2]. A minimum of two exits is required from areas with an occupant load of less than 500-persons. A single exit is permitted for areas where the exit access is less than the allowable common path of travel [LSC §28.2.4.2].

2. Based on the calculated design occupant load for the building, the building is required to have a minimum of two exits from each floor. The First Floor has an exit from each sleeping room and mechanical rooms. The Second and Third Floors are each provided with two remote exterior exit stairs and one interior exit stair.

3. The capacity of the means of egress is required to comply with LSC Section 7.3. The egress capacity of the exits must be sufficient to accommodate the calculated occupant loads. For level components (e.g., doors) and ramps, the egress capacity is based on 0.2-in/person for doors and 0.3-in/person for stairs [LSC Table 7.3.3.1].

4. Table 8 summarizes the number and capacity of exits provided for the facility per the LSC.

Table 8: Number of Exits and Capacity

Floor Level	Required Exit Capacity	Available Exit Capacity	Number of Exits Required	Number of Exits Provided
Mechanical Buildings (FC550A & FC555A)	0	340 (2 x 2'10" doors)	1	1
Mechanical Buildings (FC551 & FC556)	1	340 (2 x 2'10" doors)	1	1
First Floor (FC550 & FC555)	55	680 (4 x 2'10" doors)	2	4
Second Floor (FC550 & FC555)	139	450 (3 x 3'10" stairs)	2	3
Third Floor (FC550 & FC555)	139	450 (3 x 3'10" stairs)	2	3

5. Based on the proposed floor plan, the number and capacity of the exits serving all floors are adequate.

3.5.3. Arrangement of Means of Egress

1. Where two or more means of egress (exits or exit access) are required, the means of egress are required to be located remote from one another, so that the distance between them is at least one-third the maximum diagonal distance of the area served [LSC §7.5.1.3.3].

2. Travel distance to an exit, dead-ends, and common paths of travel are limited based on occupancy [LSC Table A.7.6]. Table 9 summarizes the exit access travel distance, dead-end, and common path of travel limitations for Buildings FC550 & FC555 being fully sprinklered.

Table 9: General Arrangement of Means of Egress Criteria

Occupancy	Travel Distance from Room Door to Exit	Travel Distance within a Room	Common Path of Travel Limit	Dead-end Corridor Limit
Dormitory	200-ft	125-ft	50-ft	50-ft

Note: Travel distance within a room is in accordance with LSC Section 28.2.6.2. Travel distance from room door to exit is in accordance with LSC Section 28.2.6.3.2.

3. Based on the proposed floor plan, the travel distances are in accordance with the LSC.

3.5.4. Accessible Means of Egress

1. Accessible means of egress are required by LSC Section 7.5.4. The building will be fully-sprinklered such that areas of refuge are not required on floors that are classified as dormitory occupancies [LSC §28.2.2.12.2].

3.5.5. Exit Discharge

1. All exits will discharge directly to the outside [LSC §7.7.1].

3.5.6. Egress Doors

1. Doors serving as part of the means of egress are required to comply with LSC Section 7.2.1. Door openings in means of egress are required to be not less than 32-in clear width [LSC §7.2.1.2.3]. Where a pair of doors is provided, not less than one of the doors is required to provide at least a 32-in clear width.

2. Doors in the means of egress are generally required to be of the side-hinged or pivoted-swinging type [LSC §7.2.1.4]. Where serving a room or area with an occupant load of 50 or more, doors are required to swing in the direction of egress travel [LSC §7.2.1.4.2].

3. Doors shall be arranged to be opened readily from the egress side whenever the building is occupied. Locks, if provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the egress side [LSC §7.2.1.5].

4. Access-controlled egress doors (e.g., equipped with card readers) must comply with LSC Section 7.2.1.6.2. The LSC requirements do not practically permit egress in two directions through doors equipped with access-control hardware.

3.5.7. Exit Stairs

1. Stairs serving as part of the means of egress are required to comply with LSC Section 7.2.2.

2. The minimum required stair width is 44-in for new stairs [LSC Table 7.2.2.2.1.2(B)]. The minimum required stair width is 36-in for existing stairs [LSC Table 7.2.2.2.1.1(b)].

3.5.8. Emergency Lighting & Exit Signage

1. Means of egress illumination must comply with LSC Section 7.8. Means of egress illumination is required for exterior balconies and exit discharge [LSC §28.2.8].

2. Emergency lighting must comply with LSC Section 7.9 [LSC §28.2.9]. The emergency lighting system is required to provide continuous illumination for a duration of not less than 90-min in case of emergency or primary power loss [LSC §7.9.2.1].

3. Means of egress are required to be provided with exit signage in accordance with LSC Section 7.10 [LSC §28.2.10] and UFC 3-600-01 Section 10-2. Internally illuminated signs must be light-emitting diode (LED) type, electroluminescence (LEC), or cold cathode type [UFC 3-600-01 §10-2.2].

3.6. FIRE PROTECTION SYSTEMS

3.6.1. Automatic Suppression Systems

1. In Building FC550 & FC555, the existing sprinkler system provides coverage throughout each floor except for the bathroom within the sleeping rooms and the office areas. There is no sprinkler system within the attic. The existing sprinkler systems must be demolished in their entirety to the flange 1-ft above the finished floor in Mechanical Room 124.

2. Automatic suppression systems are required in all multi-story facilities regardless of floor area or construction type [UFC 3-600-01 §9-7.2.1.2]. Buildings FC550 & FC555 are residential occupancy

buildings less than 4 stories in height allowing an NFPA 13R system to be installed [UFC §9-7.3.1.1]. The central core areas outside of the sleeping units will be designed in accordance with NFPA 13 Section 19.2.3.2.

a. Sprinklers are permitted to be omitted in the following locations:
   i. Bathrooms in dwelling units where the area does not exceed 55-sf [NFPA 13R §6.6.2]
   ii. Closets in dwelling units where the area does not exceed 24-ft [NFPA 13R §6.6.3]
   iii. Attics containing only dwelling unit ventilation equipment [NFPA 13R §6.6.6]

3. Mechanical Buildings FC550A, FC551, FC555A, & FC556 are single-story Type II-B construction facilities less than 15,000-sf and a sprinkler system is not required [UFC 3-600-01 §9-7.2.1.1].

4. All sprinkler system piping must be installed in compliance with UFC 3-600-01 Section 9-7.6. Piping 2-in and less will be minimum Schedule 40 and piping larger than 2-in will be a minimum Schedule 10 [UFC 3-600-01 §9-7.6.2].

5. Standpipe systems are not required in accordance with UFC 3-600-01 Section 9-10.2.1 since the building is less than four stories in height. A standpipe system will not be provided for the building.

6. The sprinkler system design for the building must be based on light/ordinary hazard classification.

7. Fire department connections shall follow the requirements in NFPA 13 Section 16.12. Fire department connections shall consist of one 5-in Storz connection. Fire department connections for sprinkler systems must be provided with suitable all-weather ground access surface for pumper apparatus within 150 feet of such fire department connections.

8. The existing 6-in incoming fire mains will be used for Buildings FC550 & FC555.

9. Hydraulic calculations for the sprinkler system can be found in Appendix A.

3.6.2. Water Supply

1. The fire protection water supply testing is required to comply with UFC 3-600-01 Chapter 9-6.4. The water supply data from the 11 September 2025 test is as follows:

   - Pressure
     - Static: 68-psi
     - Residual: 59-psi
   - Flow: 1,860-gpm

2. The hydrant flow test report can be found in Appendix B.

3.6.3. Fire Hydrants

1. Fire hydrants will be provided and located in accordance with NFPA 24 and UFC 3-600-01 Section 9-3.5.

3.6.4. Fire Alarm System

1. The UFCs provide the following criteria regarding fire alarm/mass notification systems:

    a. UFC 3-600-01 Section 9-18.5.1.1 requires fire detection systems to be provided in areas required by the UFCs or where required by NFPA standards. UFC 3-600-01 Section 9-18.6.1 requires fire alarm notification where required by the LSC or when automatic detection or suppression systems are required by the UFCs.

        i. LSC Section 28.3.4.1 requires a fire alarm system in dormitories.
        ii. UFC 3-600-01 Section 4-37.3.1 requires smoke detection in accordance with the LSC.
        iii. There is a suppression system in the facility.

    b. UFC 4-010-01 requires mass notification systems to be provided in new occupied buildings.

2. Buildings FC550 & FC555 are a three-story sprinklered dormitory facility, so a fire alarm/mass notification system is required.

    a. The existing fire alarm systems serving Buildings FC550 & FC555 will be demolished in their entirety.

3. Mechanical Buildings FC550A, FC551, FC555A, & FC556 are single-story Type IIB construction facilities uninhabited building, and a fire alarm or mass notification system is not required. The Mechanical Buildings FC550A & FC555A will have a 120-V carbon monoxide alarm [UFC 3-600-01 §9-19.1.3].

4. The new system will be a combined voice evacuation system and mass notification system. It will also have the capability to broadcast live voice messages. Issuing of live voice messages will be from the main fire alarm panel and any local operator's console (LOC) provided.

5. Audible notification is required to be provided within all occupied spaces in accordance with NFPA 72 & UFC 4-021-01 criteria. The audible notification will consist of a voice evacuation system and mass notification system throughout the building. In addition, speakers are required at the exterior for the building to provide notification for a 16-ft wide area around the perimeter of the building.

6. Visual notification is required to be provided as follows:

    a. In all normally occupied, public and common use areas (e.g., break rooms, corridors, or conference rooms [UFC 3-600-01 §9-18.6.3(f)].

    b. In all normally unoccupied areas (e.g., mechanical rooms, electrical rooms, janitor rooms, storage areas, communication closets) greater than 900-sf [UFC 3-600-01 §9-18.6.3(g)].

    c. In all offices that are designed for four or more persons at any one time (based on chairs with work surfaces) [UFC 3-600-01§9-18.6.3(i)].

7. The new fire alarm system design and installation will include initiation of the fire alarm system by actuation of any sprinkler system water-flow device, smoke detector, duct smoke detector, or any manual pull station.

8. Smoke detection is required in HVAC ducts in accordance with NFPA 90A.

9. Manual fire alarm pull stations will be provided at each building exit [LSC §9.6.2].

10. Smoke detectors with sounder bases will be provided in sleeping room [UFC 3-600-01 §4-37.3.2]. Smoke detectors will be powered from the fire alarm/mass notification system [UFC 3-600-01 §4-37.3.3].

11. Carbon monoxide detection will be provided in each room with fuel-fired equipment [UFC 3-600-01 §9-19.1.1]. Fuel-fired equipment is only located in Mechanical Buildings FC550A & FC555A. Carbon monoxide detectors shall have no connection to the Building FC550 & FC555 building fire alarm systems.

12. The fire alarm system is required to be connected to a central alarm location, fire department or alarm monitoring location [UFC 3-600-01 §9-18.3.2]. The fire reporting portion of the system must be by via a Digital Alarm Communicator Transmitter (DACT). The DACT will report to the base receiving station utilizing Contact ID Protocol.

13. The mass notification system will be connected to the base wide reporting system via a SIRCOM ISU-010 Radio Transceiver. The contractor is responsible for the enclosure and pathways for the transceiver. The transceiver will be provided and installed by the government.

14. Signaling Line Circuits, Notification Appliances Circuits, and Initiating Device Circuits will be Class A wiring.

3.6.5. Fire Extinguishers

1. General purpose portable fire extinguishers are required to be provided when required by the LSC [UFC 3-600-01 §9-17.1]. The LSC code requires fire extinguishers to be provided in business occupancies [LSC §38.3.5]. The LSC does not require portable fire extinguishers in fully sprinklered dormitories [LSC §28.3.5.6].

2. The base fire department requested fire extinguishers to be provided in all occupancies. Fire extinguishers will be located throughout the building in accordance with NFPA 10.

3.6.6. Fire Department (Emergency) Vehicle Access

1. Facilities greater than 5,000-sf are required to have at least one means of all-weather ground access to allow emergency vehicles unimpeded access to the building [UFC 3-600-01 §9-1.1]. All-weather ground access must be paved, start from the road, and terminate no farther than 33-ft from the building [UFC 3-600-01 §9-1.1]. The existing fire department access width is approximately 10-ft and exceeds 33-ft from an exterior door. These are existing conditions and are not within the scope of this project.

2. All force protection equipment, such as bollards or gates, must not require more than one person to remove or open. Access may require fire apparatus to drive over a curb. Any locking device

controlling vehicle access must be under control of the fire department or 24-hr security personnel located at the facility. Dimensions of fire lanes and turnarounds are required to comply with NFPA 1 and the UFC [UFC 3-600-01 §9-1.3].

3. All fire department connections are to be provided with suitable all-weather ground access surface for pumper apparatus within 150-ft [UFC 3-600-01 §9-1.4].

4. CONCLUSION

Buildings FC550, FC550A, FC551, FC555, FC555A, & FC556 comply with UFC 3-600-01 and National Fire Codes.

APPENDIX A – HYDRAULIC ANALYSIS

Hydraulic Analysis Worksheet

Bldgs FC550 & FC555 - Residential Design Approach

1. Water Quantity:

a. 2 Residential Sprinklers*120%	=	38.4	gpm
b. Outside Hose Stream Allowance	=	250.0	gpm
c. Other	=	0.0	gpm
d. Domestic Demand	=	0.0	gpm
Total Water Demand (a+b+c+d)	=	**288.4**	gpm

2. Water Pressure:

a. End-head-pressure Minimum listed pressure	=	7.6	psi
b. Elevation Loss = height *0.433	=	12.1	psi
c. Outside Friction Loss	=	1.0	psi
d. Backflow Preventer	=	12.0	psi
e. Inside Friction Loss	=	15.0	psi
Total Pressure (a+b+c+d+e) + 10% SF	=	**52.5**	psi

3. Available Pressure:

$P_a = P_s - (P_s - P_r) x (Q_a/Q_t)^{1.85}$ = **67.3** psi

Available Pressure Greater than Required Total

Hydraulic Analysis Worksheet

Bldgs FC550 & FC555 - Ordinary Hazard 3rd Floor

1. Water Quantity:

a. Density*Design Area*120%	=	600.0	gpm
b. Outside Hose Stream Allowance	=	250.0	gpm
c. Other	=	0.0	gpm
d. Domestic Demand	=	0.0	gpm
Total Water Demand (a+b+c+d)	=	**850.0**	gpm

2. Water Pressure:

a. End-head-pressure [density*(area/head)/k-factor]^2	=	10.6	psi
b. Elevation Loss = height *0.433	=	12.1	psi
c. Outside Friction Loss	=	3.0	psi
d. Backflow Preventer	=	12.0	psi
e. Inside Friction Loss	=	15.0	psi
Total Pressure (a+b+c+d+e) + 10% SF	=	**58.0**	psi

3. Available Pressure:

$P_a = P_s - (P_s - P_r) x (Q_a/Q_t)^{1.85}$ = **63.2** psi

Available Pressure Greater than Required Total

APPENDIX B – HYDRANT FLOW TEST REPORT

Hydrant Flow Test Report

Location MCB Camp Lejeune - Buildings FC550 & FC555 Date 11 Sep 2025

Test made by Base Utilities Time 0915

Representative of MCB Camp Lejeune

Witness Aaron Freid, Jensen Hughes

State purpose of test Determine the available water supply for the repairs to BEQs FC550 and FC555.

Consumption rate during test 1,190-gpm

If pumps affect test, indicate pumps operating

Flow hydrants:	A_1	A_2	A_3	A_4	
Size nozzle	2.5				
Pitot reading	50				
Discharge coefficient	0.9				Total gpm
gpm	1,190				1,190

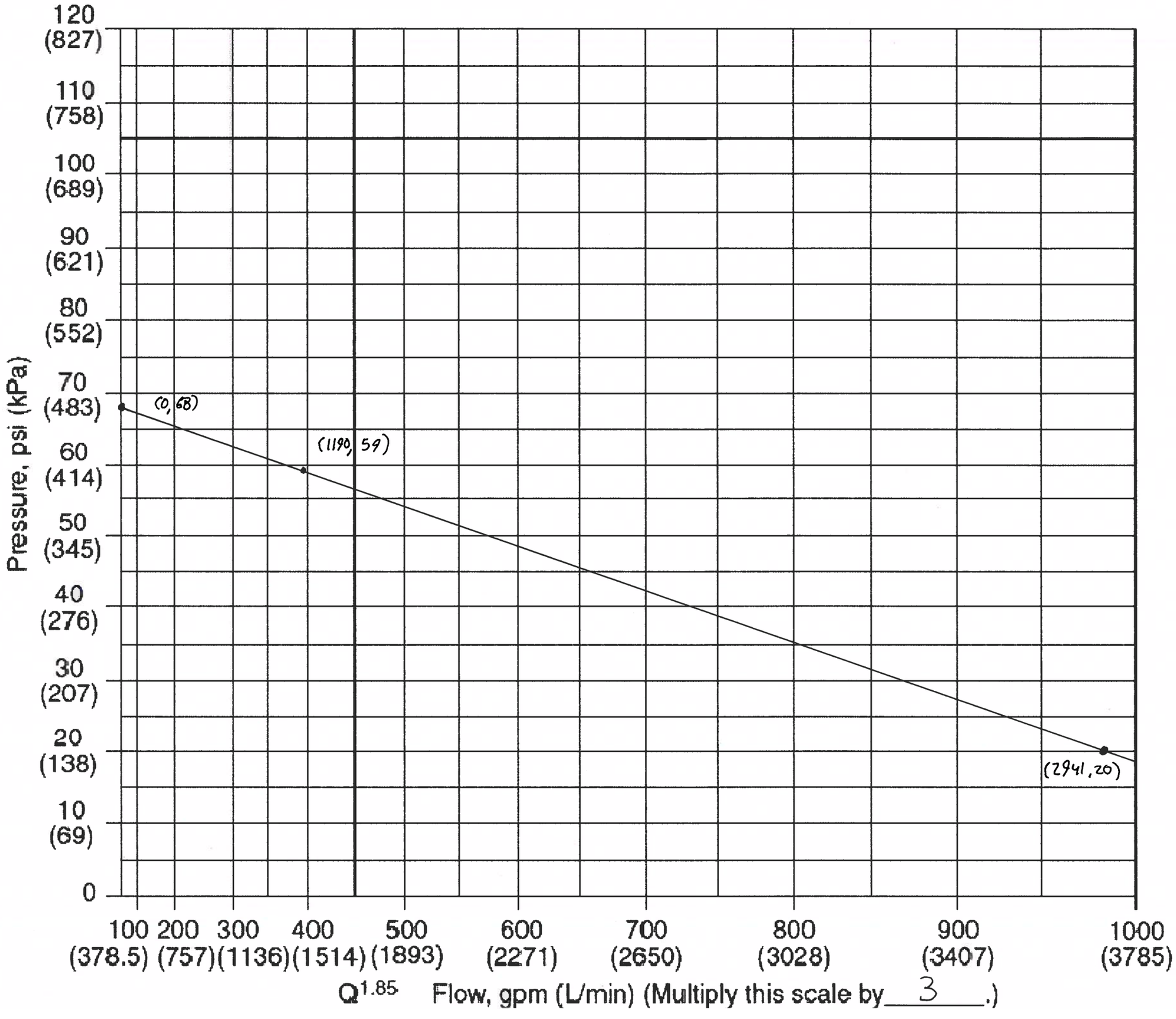
Static B 68 psi Residual B 59 psi

Projected results @20 psi Residual 2,941 gpm; or @___ psi Residual___ gpm

Remarks 8-in main running north of FC550 and west of FC555 along Gonzalez Blvd.

Location map: Show line sizes and distance to next cross-connected line. Show valves and hydrant branch size. Indicate north. Show flowing hydrants – Label A_1, A_2, A_3, A_4. Show location of static and residual – Label B.

Indicate B Hydrant X Sprinkler___ Other (identify)


Pressure, psi (kPa)
120 (827)
110 (758)
100 (689)
90 (621)
80 (552)
70 (483)
60 (414)
50 (345)
40 (276)
30 (207)
20 (138)
10 (69)
0
(0, 68)
(1190, 59)
(2941, 20)
100 (378.5)
200 (757)
300 (1136)
400 (1514)
500 (1893)
600 (2271)
700 (2650)
800 (3028)
900 (3407)
1000 (3785)
Q1.85 Flow, gpm (L/min) (Multiply this scale by 3.)

BLDG
FC555
HYDRANT B
BLDG
FC550
HYDRANT A1