VCU Health

VCUHS New Inpatient Tower

PROGRAMMING AND PLANNING SUMMARY

July 25, 2025

Planning for UNmatched Care

VCUHealth

Contents

Executive Summary

PURPOSE AND OVERVIEW

In alignment with the ONE VCU Master Plan, VCU Health is implementing a bold vision for a new inpatient tower on its downtown Richmond campus. A project that will transform the campus and aims to enhance patient-centered care, operational efficiency, and the VCU Health brand as Virginia's premier academic medical institution that will be seen as a destination for world class health care. The new tower will consolidate inpatient services, modernize facilities, and support future growth and technological advancements.

To shape this bold vision, beginning in June of 2024 VCU Health engaged team of architects, planners, data scientists, and strategists to work closely with the Health System's leadership and project stakeholders to begin the groundwork to make this vision a reality. The team identified and involved key participants including VCUHS leaders, clinicians, staff, and other stakeholders. Together information was gathered through visioning sessions, stakeholder interviews, facility walkthroughs, surveys, and data analysis to confirm project scope and intent. The process included over 64 stakeholder meetings and workshops to ensure the project will be aligned with patient care and operational goals and allow this bold vision to launch into the next phase, the detailed design engagement. The following key objectives for the New Inpatient Tower were developed through this effort:

1. Project Vision Statement: "The new patient tower will serve our diverse community and be a destination for high acuity specialized care. Organized around service line excellence, this new tower will provide resources for advanced education and research, expanding our local and national reach as the preferred academic health system."

2. Patient-Centered Care: Provide all private, acuity-adaptable inpatient rooms to limit patient movement, appropriate technology, and other utility services/infrastructure required to maximize the number of treatments and therapies to be delivered at the bedside without compromising patient safety. Appropriate distribution of resources (supply rooms, med rooms, soiled/clean utility, equipment, etc.) to ensure efficient response to patient needs, and adequate space for professional services required by the specific clinical service lines.

3. Caregiver Amenities: Provide adequate space for the inclusion of family and caregivers to participate in the healing process. Include amenities to foster patient and family wellness and connectedness including appropriate areas of respite and privacy outside the patient room.

4. Optimize Efficiency: Improve operational efficiency and delivery of service by being the vehicle through which all operational processes on campus are reviewed. This includes review of the model of care that will drive the development of the physical environment of care, review and assessment of the space provided for support and professional services campus wide, methods of supply and movement of materials, staff, and patients including both vertical and horizontal movement, and infrastructure/logistics areas.

5. Accessibility and Navigability: Ensure easy access to parking, intuitive wayfinding, unobstructed circulation for patients, staff, and materials, and an easily identifiable "front door" for the tower.

6. Safety and Security: Incorporate robust safety measures to maintain a secure environment for team members, patients, visitors, and the public, including security infrastructure, hardware, and physical features such as dedicated spaces for visitor screening and security personnel.

7. Future-Ready Design: Accommodate expansion, new care models, and advancements in technology and medical education.

8. Team Member Support: Facilitate improved patient care, staff recruitment, and retention by providing appropriate team member support spaces including team/interprofessional rooms, focus work areas, teaching and education spaces as well as respite and recovery areas (e.g. Watson rooms, easily accessible "green" spaces). These areas should provide acoustic privacy, future technology and IT changes/upgrades, and adaptability to changes in the model of care or team composition.

9. Brand Enhancement: Reflect VCU Health's leadership in specialties like Massey Cancer Center, Pauley Heart Center, and others, while engaging community needs.

10. Clinical and Educational Integration: Include appropriately sized teaching spaces for medical, nursing, and community education, and support key clinical services.

11. Technology and Infrastructure: Integrate advanced IT and utility systems to ensure long-term operability and adaptability.

12. Support Services: Recognize the critical role played by support services in the successful delivery of healthcare by providing adequate and appropriately located space for these services on the patient floors as well as operational, administrative, and functional space required to support the new Inpatient Tower and the entire downtown campus efficiently and effectively. Determine which services (e.g., laboratory, pharmacy, central sterile, etc.) can be delivered off-campus to optimize space and operations while decreasing costs.

13. Central Utility Plant: Provide a standalone dedicated CUP for the tower, allowing it to be decanted from the existing steam plant and allowing the Health System to make measurable strides towards its decarbonization goals.

ACTIVITIES COMPLETED

1. Town Hall Presentations
2. Peer Facility Tours- including an Academic Medical Center and Offsite Logistics Center
3. Current and Future State Data Analysis
4. Current State Observation and Assessment
5. Stakeholder Interviews and Surveys
6. Full Size Patient Room Mockup and Survey
7. Knowledge Sharing Presentation
8. Interactive Future State Operational Assessments
9. Service Line Strategy Discussions
10. Engineering Assessments of existing facilities being affected
11. Traffic and Parking analyses of the subject properties and surrounding areas
12. Explored various Tower location and configuration scenarios, measured against cost and other pros and cons

The following report documents these activities and their outcomes in depth, identifies different scenarios that were considered throughout this process, and summarizes the recommendation that was approved by the VCUHS Board of Directors in June of 2025 to be used as the basis for the detailed design and planning for the project.

Our Vision

The new patient tower will serve our diverse community and be a destination for high acuity specialized care. Organized around service line excellence, this new tower will provide resources for advanced education and research, expanding our local and national reach as the preferred academic health system.

Planning & Programming Standards

STANDARDS SUMMARY NARRATIVE

While the operational workshops for current and future state inpatient units were being conducted, the planning and programming efforts were directed towards establishing a series of space standards with VCUHS leadership. The goals for this process included:

1. Review a matrix of potential opportunities to determine what space types would and would not be standardized. The team then decided if:
   a. An existing space standard exists that can be communicated and incorporated into the programming.
   b. There is no standard yet, but there is a desire to create a space standard. The alternative is to allow the space to not be standardized and instead be something that varies, depending on end user input.
   c. For the items that are determined to be standardized, form a VCUHS leadership core team, and identify subject matter experts to direct decisions around those standards.
2. For the items deemed to be standardized, the goal is to establish the decision at the VCUHS Core Team level so that standards can then be disseminated to end users as the formal programming process begins. These items become non-negotiables to help the end users focus on where the VCUHS leadership desires their influence and clinical input.
   a. Should a communicated standard become problematic from a departmental perspective, the team can elevate the issue back to the Core Team with updated information for confirmation.

The Standards teams met for three sessions between August 9 and October 25. The VCUHS Core Teams included:

a. VCUHS Executive Leadership
b. Patient Care & Support Spaces
c. Endo/Cath/EP/Bronch and Procedural Spaces
d. Graduate Medical Education and provider support spaces
e. Family and Public Spaces
f. Interventional Platform, ORs
g. Clinical Team Services- Rapid Response, Vascular Access/ PICC, Pain, Wound Care and Telemetry, Emergency Preparedness

Where appropriate, shared trends and industry benchmarks from other Academic Medical Centers so that Core Team members were aware of how other peer organizations have recently been approaching similar decisions. Comparisons to existing buildings, rooms, sizes, and processes on the main campus were also presented to help provide context and aid in decision making.

Decision Matrix

team collected decisions in a matrix that captures the design strategy (who gets to make the decision), key stakeholders, initial comments, and final decisions. Notes reflecting how these final recommendations were changed by the scope reduction process were also added. Please see the Appendix for full decision matrix on all topics.

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Some key standardized decisions included:

INPATIENT CARE & SUPPORT:

1. Inpatient rooms would all be standardized, acuity adaptable and able to meet ICU standards on day 1, be mirrored not same-handed, and include dialysis boxes and the infrastructure for ceiling lifts in every room.
2. The inpatient toilet room will be in an outboard location (along exterior wall), and all will be sized for ADA compliance.
3. There will be 1 patient room and toilet room sized larger to meet code requirements for patients of size (bariatric) for every 24 beds.
4. Airborne isolation will be managed by including 4 patient rooms designed with negative pressure for every 24 rooms; two of these rooms will include an ante room, two will not.
5. Inpatient units will have a standardized layout, with designated unit specific support spaces that can flex by unit/floor to address unique departmental space needs.
   a. Common support rooms like medication rooms will also be standardized in their layout and location on the floor.
6. In general, there will be no cubicle curtains used in the new Inpatient Tower for infection control purposes. PPE integration on the patient units will be between every two rooms, accessible from the corridor – like CHoR, but deeper with a trash receptacle in alcove below.

STAFF SUPPORT IN CLINICAL AREAS:

1. Offices - 3 private offices and 2 shared (2 person) offices will be included for each unit. Designation and labeling of the offices will occur in a later design phase but should align with VCUHS office assignment standards.
2. There will be 1 conference room per floor, sized for 15-20 people and including space for storage of additional computers and educational materials. This is in addition to consult rooms and separate team rooms.
3. A shared staff lounge will be standardized on the floor in convenient proximity to clinical spaces; lounge size and appliances will be consistent.
4. Staff lockers will be the z-style locker and function as daily use for those staff who permanently work on the floor. There will be separate drop-in lockers for students and non-permanent staff.
5. Staff toilets will be single user, ADA and ultimately unisex.
6. A staff lactation room and separate staff respite/ Watson room will also be provided on each inpatient floor and major department.
7. Two on-call rooms are planned for each bed floor.
8. In addition to Interprofessional Care Team Stations, Team Rooms will be utilized to provide space for work and collaboration:
   a. 1 Teaching Room, planned for 12 with central table and workstations. Includes student support and lockers.
   b. 1 Working Team Room, planned for 8.

PATIENT AND FAMILY SPACES:

1. Family waiting will be minimized to meet codes on the units, as the patient rooms are sized to include a family zone. On Inpatient bed floors, one large consult room will be provided on every floor, sized for 8-10 people, and equipped to accommodate telehealth.
2. Family waiting for surgery will be larger with more family groupings and can be centralized and shared for multiple departments, if convenient. Consult rooms for surgery will include 1 large (8 people) and 2 smaller (4 people) consult rooms positioned near waiting. In the reduced scope program, one large consult will be included.
3. Registration will be centralized by floor for diagnostic and testing departments and bedside for inpatient.
4. Where possible with scope/ budget reductions, the new inpatient tower will offer public amenities like access to public lactation, access to coffee shop, as well as healthy vending options. A patient pick-up, drop-off, discharge/ welcome lounge, and valet are also planned for the building.

PROCEDURAL SPACES:

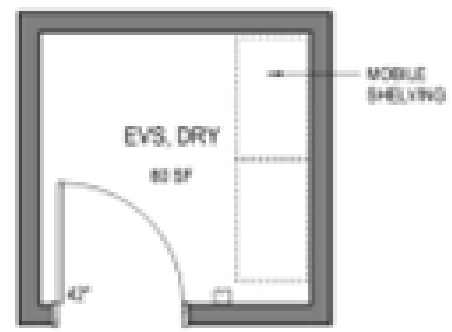
1. General approach to procedure rooms will be to centralize and collocate with the interventional platform, with access to anesthesia support, prep/recovery rooms and staffing - not place on inpatient bed units. (Burn may be an exception.)
   a. Treatment rooms can still be considered on inpatient units, if needed to support bedside therapies.
2. A private, universal room is planned as the model for Prep, Stage II Recovery and PACU on interventional floors.
   a. A hybrid toilet model will provide direct access to toilets for isolation patients along with conveniently located corridor toilets at a ratio of 1 per 6 prep, recovery and PACU rooms.
   b. Shared decentralized charting will be provided outside of the universal rooms to maximize visualization of the patient.
   c. Negative pressure rooms and larger Patient of Size rooms will be included in the Prep/Recovery/PACU areas.
   d. The following ratios will be utilized in establishing the quantity of universal rooms:
      i. ORs: 2.5 Prep/Recovery per room
      ii. Endo and Broch: 3.5 Prep/Recovery per room (program deferred until future phase due to scope/ budget restrictions)
      iii. Cath/ EP: 3.5 Prep/Recovery per room (program deferred until future phase due to scope/ budget restrictions)

Please see the Appendix for presentation slides from each of the Design Strategy and Standards sessions held Sept.9, 2024, Oct. 14, 2024, and Oct. 24-25, 2024.

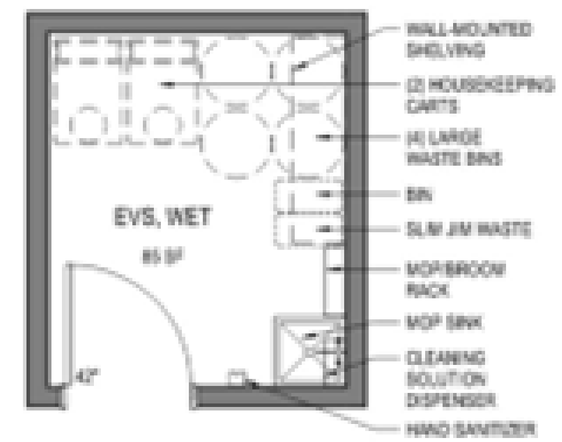
Common Rooms

A series of common rooms were reviewed by the VCUHS team to aid in standardization and right-sizing of critical building blocks that will be used repeatedly throughout the New Inpatient Tower. During the Programming 1 meetings held the week of October 29-31, 2024, user groups like Clinical Support/EVS, Linen, Nutrition, Materials Management, etc., reviewed key room guideplates previously developed to confirm square footage size, significant equipment needs, casework, plumbing, and any additional space needs that would influence design. Developing the detailed layout of these common rooms early helps validate the square footage assigned to them in the program. They can be scaled larger or smaller as needed to align with different ratios or by department, where equipment needs may vary. Establishing benchmark sizes, layouts, and ratios of these building blocks early in Programming allows a standard to be applied throughout the project that has been vetted by the appropriate parties.

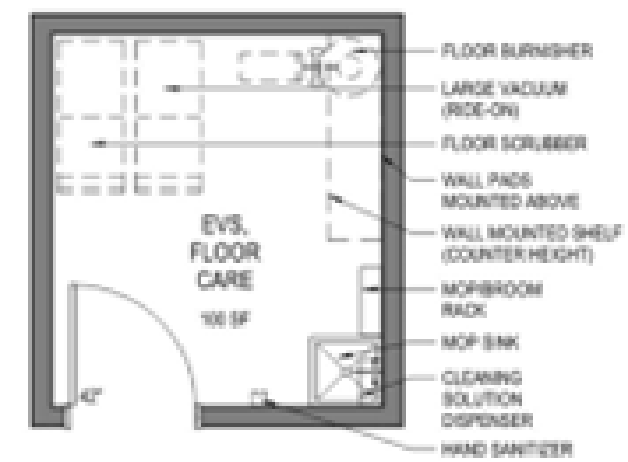
- EVS: EVS rooms are sized according to needs for dry, wet, and floor care, with floor care at a ratio of 1 per floor as compared to 1 per department like wet and dry.



1 per department

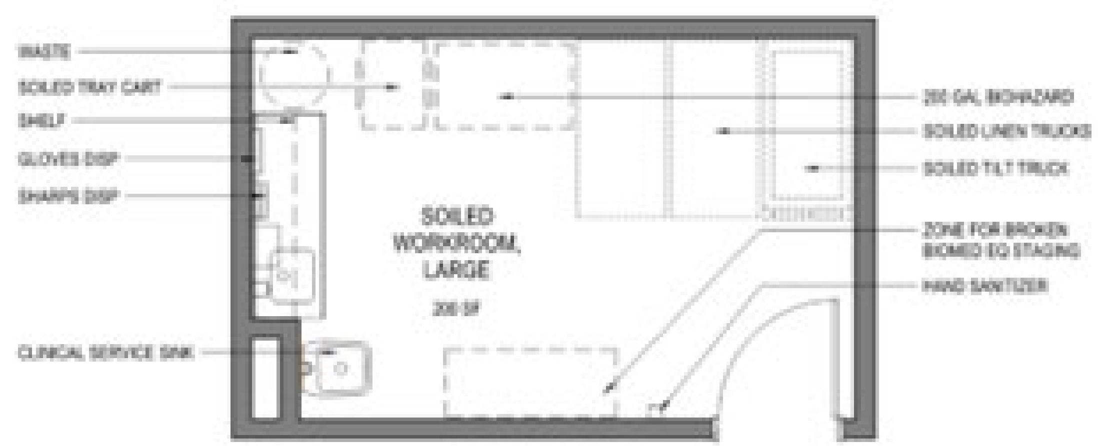


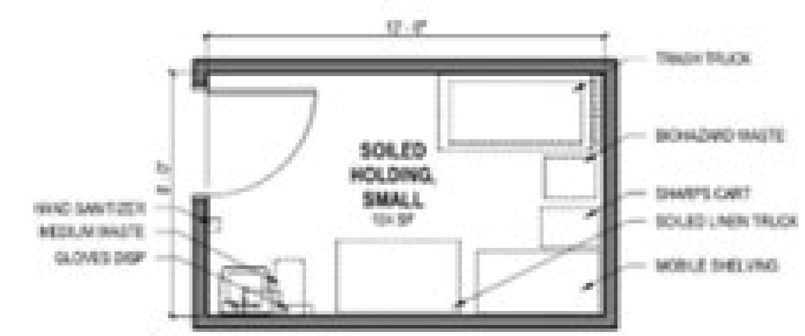
1 min. per department, supports 12-14 beds



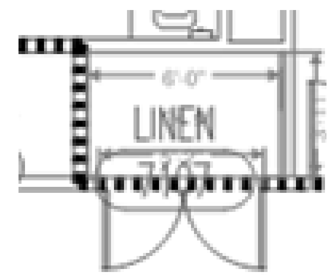
1 per floor, outside unit

- Soiled Holding & Soiled Workroom: The smaller Soiled Holding room is equipped with a wall-mounted sink and array of trucks and bins. The larger Soiled Workroom is equipped with the FGI required sink and work counter, plus a clinical service sink and larger array of trucks and bins, in addition to the soiled tray cart.

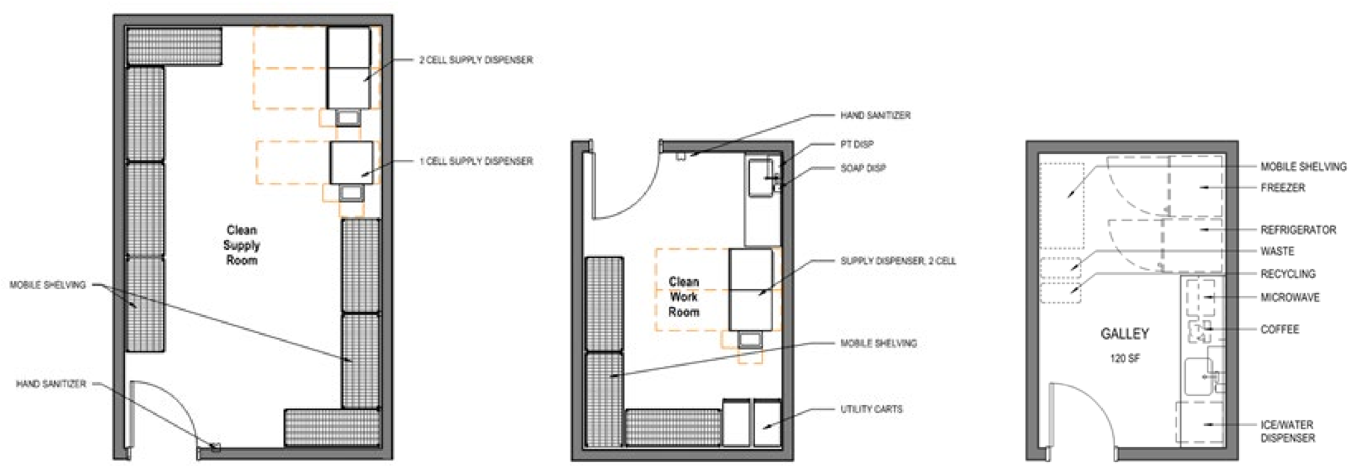




- Linen: The VCUHS user group preferred a decentralized model for Linen, with closets sized at approximately 25 SF serving roughly every 7 beds. It will contain a metro rack to store 2 to 2.5 days of par on the unit. This is like the model employed in the Critical Care Hospital.



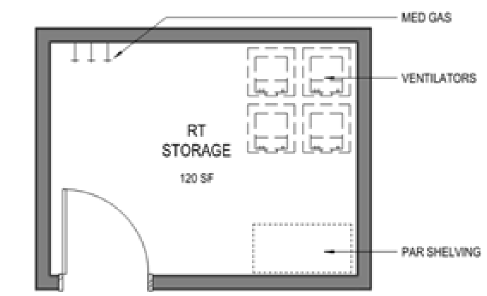
- Clean Supply & Clean Workroom: The preference is for Linen to be stored separate from Clean Supply; Clean Supply would be equipped with shelving and supply dispensers. The Clean Workroom would have the addition of a sink and work counter.



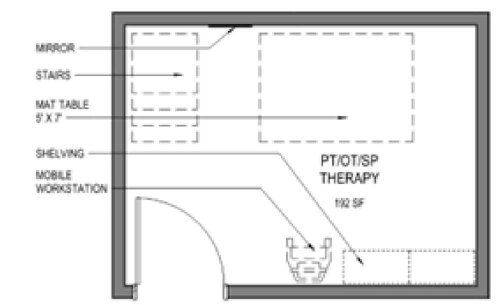
- Nourishment: The nourishment areas are intended to be accessed by families and visitors. The smallest scale alcove has ice dispenser, coffee maker, microwave, and u/c refrigerator, which can grow to larger room layouts with the substitution or addition of a full-size refrigerator and food service cart.

Alcove **Small** **Large**

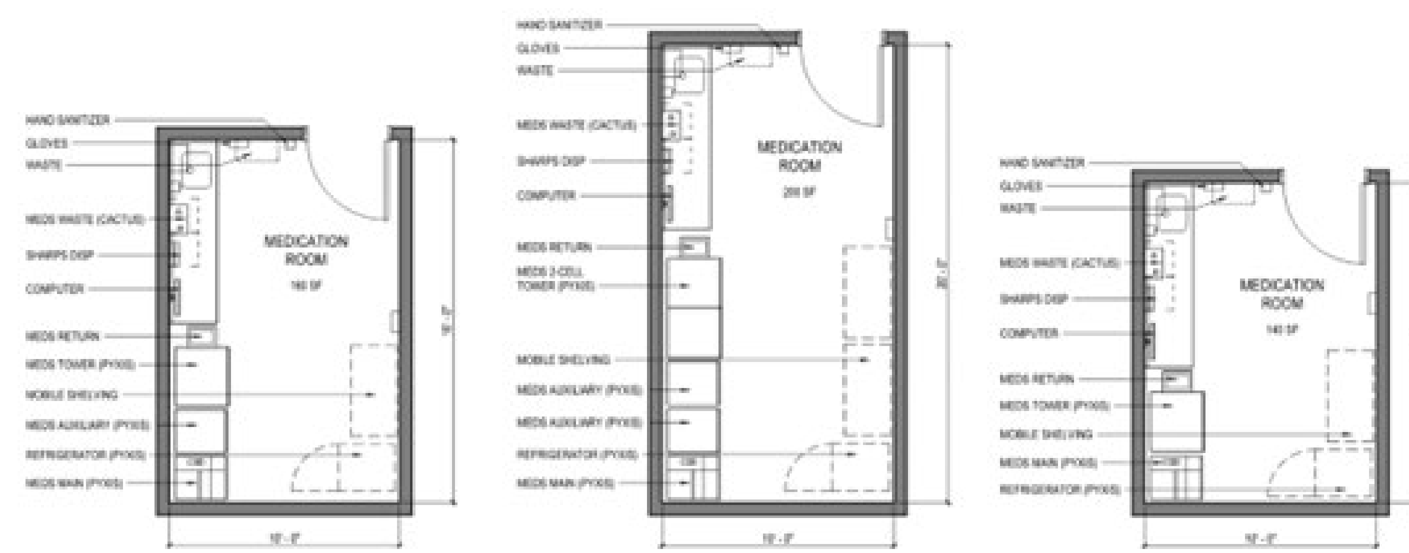
- RT Storage: RT Storage is a flexibly designed space, with open floor area for ventilators, par shelving, or other equipment and supplies as needed. Med gases are the only built-in element of the room.



- PT/OT/SP Therapy: The room is divided into two areas – one area for patient therapy space that includes stairs and a mat table, and one area for limited charting and storage. Therapist team workspace is provided in shared team workroom.



- Medications: The Pharmacy team recommended the ratio of one full suite (main, aux, tower) and a full-size refrigerator, preferably Pyxis, for every 6-8 ICU level patient beds or 12-16 acute care beds. For OR and procedure areas, the recommendation was reduced to a main, tower, and refrigerator.



Patient Unit
(1 meds suite : 6-8 ICU beds)
**1 main + ref + aux + tower*
8 med rooms on a floor of 48 beds = 1,280 SF / floor

Patient Unit
(~2* meds suites : 12-16 ICU beds)
**1 main + ref, double aux + tower*
4 med rooms on a floor of 48 beds = 800 SF / floor

OR / Procedure Areas

Key Adjacencies, Bullseye

Following Future State operational discussions with individual service lines, the information gathered from bullseye exercise was synthesized to identify commonalities among all that would help standardize the inpatient floor layout. This exercise evaluated the priority of key adjacencies and preferred travel distances relative to the patient rooms.

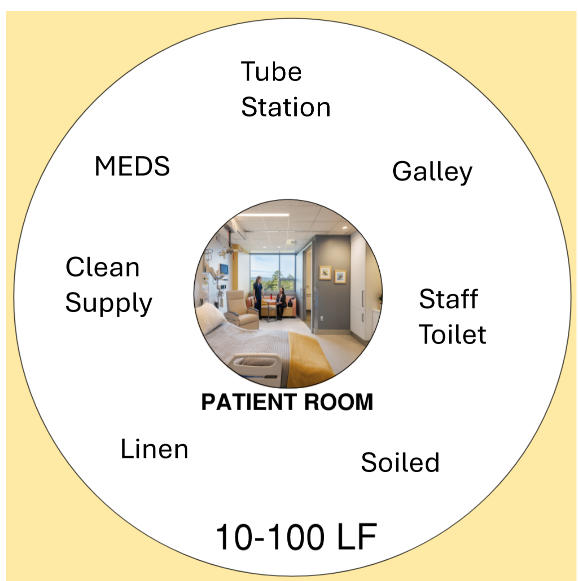
- The spaces desired closest to the rooms like meds, staff toilets and linen will be represented in the program with a larger ratio of spaces in support of the unit size. For instance, there is 1 linen closet planned for every 7 patient rooms to limit walking distances to retrieve clean linen.
- Spaces like equipment storage, specialty storage and family consult are needed on the floor but can be slightly more remote from the rooms, as there are typically fewer trips made to these spaces during a shift.
- Spaces like staff locker room, break room and Watson respite rooms are planned as one per floor and can be remote if they are directly accessible to the clinical units they serve.

Please see the Appendix for Standard Bullseye diagrams for the inpatient units.

10-100 Feet

Maximum walk of about 4 patient rooms

Rooms and things that are accessed multiple times per shift



100-200 Feet

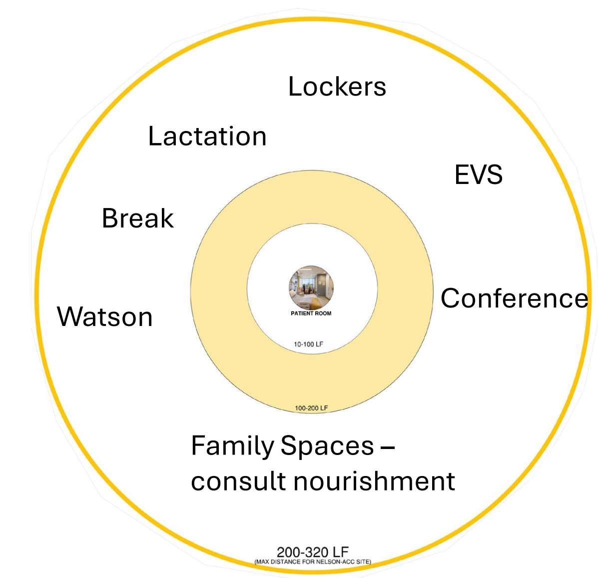
Maximum walk of about 8 patient rooms

Rooms and things that are accessed a few times per shift

200-300 Feet

Maximum walk 16 rooms

Rooms and things that are accessed a couple of times per shift

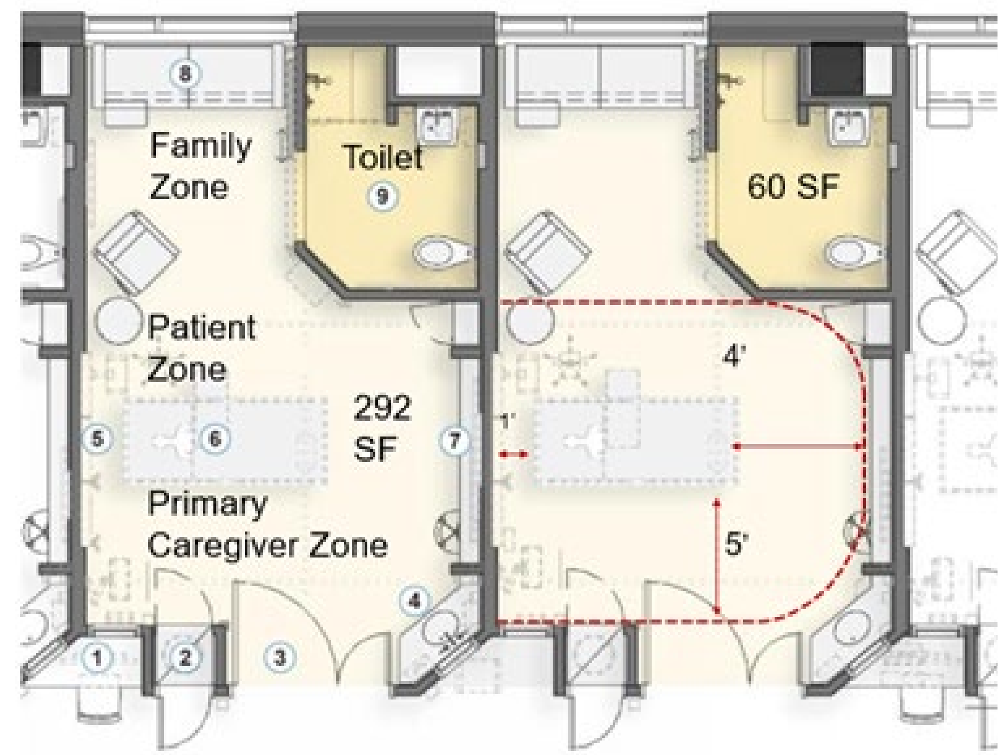


Mock-up Patient Room

MOCK-UP PROCESS AND DESCRIPTION

To validate and build consensus around the area associated with the most replicated square feet planned in the new Inpatient Tower program - the Patient Room - VCUHS invested both time and space to support a full-scale low fidelitv mock-up of the room. Utilizing a vacant waiting room area on Nelson 5, constructed a cardboard room with walls and doors including the bedroom, toilet room, nurse server and decentralized charting alcove in the corridor. The room was set up, and tours were scheduled and hosted beginning September 9, 2024, for approximately one month. Any VCUHS employees were encouraged to attend and provide feedback. The tours were announced and promoted in the kick-off Visioning Session, as well as current state and future state operational user group meetings.

The basis for the mock-up room is an acuity-adaptable room from a previous project that includes same-handed bed orientation, an outboard toilet room location, a dual-sided nurse server, and a decentralized charting alcove in the corridor sized for one person. Attendees were toured through the mock-up room with stops to understand the comparison between the proposed room size and current room sizes in CCH, Main and North Hospitals; the proposed staff zone; patient zone; family zone; and toilet area.



TYPICAL PATIENT ROOM

1. Charting Alcove
2. Nurse Server Cabinet
3. Entry Door
4. Handwash Station
5. Headwall
6. Patient Bed
7. TV & Patient Communication Board
8. Sleeper Sofa
9. Patient Washroom

Trends

INPATIENT TRENDS

Trends for inpatient environments include themes around flexibility, safety and infection prevention, and integration of technology. A bed tower comprised of all-private patient rooms, sized for delivering the highest level of care, is a trend at most Academic Medical Centers (AMCs) that incorporates all these themes.

Acuity adaptability, or the flexibility to change how the unit is operationalized over time to support care ranging from general acute care up through critical care, is an important consideration. This allows for changes to unit definition, preserves the ability to step patients up or down on the same unit or room, and limits down time and future costs for renovations.

In terms of unit composition, many AMCs utilize large patient floor footprints to allow for 2 or more patient units on a single floor. This provides flexibility as service line bed numbers adjust over time. Many include circulation arrangements providing for both "on-stage" and "off-stage" corridors simplifying the wayfinding for patients and families using the "on-stage" corridors immediately outside patient rooms. The noise, activity and congestion associated with materials delivery and staff support can be isolated behind the scenes and often reduces travel distances.

Technology trends extend from providing patients more control of their environment and comfort in the room to integration with the Electronic Health Record. For instance, the combination of entertainment, patient education, translation services, patient precautions, and care team identification upon entry are all possible through the footwall media screen.

INTERVENTIONAL AND PROCEDURAL TRENDS

Since many AMCs are sited in dense, urban environments where land is at a premium, it is rare that a large interventional program can all fit on one floor; instead, many utilize multi-floor arrangements. The trend is to standardize the arrangement of ORs, Cath and EP, IRs, etc. around a clean core, stacking the procedure rooms vertically and then locating the associated prep/recovery and PACU rooms on each floor so that patient transport is limited only to horizontal movement. Imaging integration into the OR environment is very commonplace and the inclusion of robotic console parking is also a standard practice to maximize flexibility and use in many ORs. When included in the scope, complex procedure rooms like bronchoscopy and endoscopy are often located just on the border of the semi-restricted "red line" and unrestricted circulation. This allows future flexibility for designation of procedure rooms over time as more (or less) invasive spaces. High level disinfection (HLD) is often positioned with these spaces to limit scope processing time and scope inventory requirements.

Many health organizations have transitioned away from separated Prep, Stage II Recovery and PACU spaces in favor of a Universal model. This trend typically includes a single, standardized private room that serves the full perioperative patient experience. This flexibility allows for changes in use of the rooms over the course of the day and aligns well with the multi-floor approach. It also may lend flexibility in supporting longer stay, 23-hour post-surgical patients.

Please see the Appendix for the full list of the inpatient and interventional trends shared for initial visioning, project kick-off and standards context.

FUTURE STATE

During the future state workshops the service lines explored ways to improve upon the care they deliver today. The focus was on the themes identified during shadowing as opportunities found within many of the service lines/units as mentioned previously. The teams were guided through highly facilitated activities and conversation around these areas to identify ideal ways to communicate, collaborate, and deliver care.

Communication

Communication and the sharing of information is a topic that every service line discussed. Currently, VCUHS is utilizing multiple means to communicate for various reasons as previously stated. The teams focused solely on what a future communication tool should support in their workdays instead of focusing on accomplishing it via a specific tool. Through this the teams identified key tasks that a tool should be able to support. Below are those tasks.

- Bed Alarm Notification
- Call Bells
- Staff Assist Notification
- Epic Notifications/Critical Values Notification
- Documentation
- Photos in Epic
- Hugs
- Emergency Response
- Phone Calls – providers, units, ancillaries, nurses
- Secure Chat
- Centralized Hospital Paging
- Communicating with other units, ancillaries/support
- Patient communication

Collaboration Strategy

Three distinct space types came out of discussions around team collaboration. A place to converse with families about their loved ones, a location for staff to be onboarded and trained as well as for team huddles and a place for providers and students to dictate, educate and communicate. These areas each play a critical role in a tertiary hospital when patients are their most vulnerable.

Family Interactions

Due to the current size and configuration of many inpatient units throughout Main Hospital, CCH and North Hospital, space for moments of collaboration is limited. All service lines expressed similar concerns about having space for a few different specific interactions. The first was interaction with the patient's family/care giver(s). These interactions were recommended to be discreet and private family/consult rooms. These family/consult rooms should be able to support groups as large as 8-10 people. A lounge for families to step away from the patient room to obtain respite or leave while the medical team conducts a procedure or deliver care requiring a more private setting. Either of these spaces could provide education opportunities for families/caregivers. The family/consult room should have the ability to conduct telehealth.

Staff Meetings/Education

A multipurpose conference space on each unit to support various communication and collaboration is desired. All the teams discussed the need to conduct staff orientation and training on the unit. This educational space should support conferences and demos as well as simulations for (BLS/SCLS/NRP) training. The space needs to be versatile and able to handle large groups of up to 15 to 20 staff to conduct safety huddles for shift change and various meetings throughout a shift.

Provider Interactions

Various workrooms were requested for Attendings, Fellows and Residents. These spaces were desired to maximize workstation space around the perimeter of the room and a larger table in the center for multiple folks to discuss and review patient care. The space needs to be adequately sized to accommodate larger teams on a shift.

Future State Dashboards

The following dashboards have been broken out by service lines to highlight the ideal needs and requests of each. These dashboards represent staff considered the most ideal environment for patient care if no constraints such as space or budget were applied. The activities in future state are meant to be an exercise in developing an environment without constraints.

These lists were then further refined applying constraints and incorporating into design standards discussions with VCUHS leadership to prioritize final inclusions and confirm programmatic locations.

Neurosciences

FUTURE CARE MODELS

Neuroscience faculty is currently growing, and the service line looks to draw beyond its primary and secondary service area. Neurosciences looks to add flexible telemetry monitoring to all rooms in the future with in-house centralized monitoring. This would include specialized cardiac telemetry in EMU which they intend will grow with increased cases of epilepsy. Cases have seen a 70% growth over the past three years. EMU looks to double bed need within the next ten years.

Ideally there would be a dedicated space to conduct various neurophysiology tests. Neurosciences looks to create a spine-specific unit to be able to respond to throughput needs. Dedicated clinical staff and spine surgeons can work to get patients discharged efficiently due to decreased recovery time.

Currently, Neurosciences is moving patients to critical care beds, especially for drains, but they would prefer a dedicated stepdown unit. The unit would need to be proximal for ease of transport.

ADJACENCIES

- On Unit
  - PT
  - OT
  - ST
  - Respiratory Therapy
  - CT Scanner
  - MRI
- To Unit
  - Neuro ICU
  - EMU
  - Stepdown
  - CHOR

Orthopedic/Trauma

FUTURE CARE MODELS

It is ideal to think of Orthopedics and Trauma as one unit. Providers take care of both patient types, and their adjacencies are vital to overall throughput and efficient delivery of care.

With the growth of orthopedics and trauma and its synergies with neurosurgery and burn, looking at a multi-disciplinary transition unit to hold patients 6-12 hours upon arrival to VCUHS to determine appropriate patient placement, would support care delivery and improve patient throughput. The CDU does not currently accept vented patients, so this unit could provide relief to the ED for critical patients. This unit would also reduce the number of transfers a patient might have to endure and would decrease the use of staff resources to complete unit transfers. Placing patients in the right location the first time would benefit all units within the new tower due to the trickle-down effects a transfer causes. This could be a transfer to a different specialty better suited to care for the patient or a change in the level of care.

The service line is looking to create a soft tissue center that provides the ability to care for patients in burn, orthopedics, plastics and dermatology. Capacity issues prevent a center from occurring. A referral pipeline from CMH exists to allow this to grow.

All rooms should be X-ray/fluoro capable of offering bedside imaging for all patients reducing transport needs. Sufficiently sized rehab gyms for trauma and orthopedics are necessary to continue growth and improve efficiency. In addition to the rehab gyms, outdoor therapy space is desired to improve patient experience and allow for better outcomes.

ADJACENCIES

- On Unit
  - Treatment Room
  - PT Gym
  - OT
  - X-Ray
- To Unit
  - Trauma and Ortho adjacent to one another
  - Trauma close to Neurosurgery
  - Trauma close to Surgery ICU
  - Surgery
  - CT
  - MRI

Cardiology/Cardiac Surgery

FUTURE CARE MODELS

Cardiology/Cardiac Surgery wants to develop a 23-hour observation unit to care for patients post-procedure. With more cardiology procedures becoming outpatient, and inpatient stays are no longer necessary due to the advancement in these procedures and how they are completed, patients are not staying in the hospital as long to recover. Beds are needed for the service line to continue to grow and remain efficient.

Outdoor space for patient therapy is desired. The service line would also like a discharge RN to support the discharge process.

ADJACENCIES

- On Unit
  - Pharmacy
  - Respiratory Therapy
- To Unit
  - Surgery
  - Cardiac Cath Lab
  - Echo
  - Ultrasound
  - CT
  - MRI
  - Heart Station
  - EP
  - CVPU
  - ICU/Progressive Care

Oncology/Transplant/CIT

FUTURE CARE MODELS

Oncology, Transplant and CIT want to start an ICU triage unit in the new tower to care for patients that would otherwise take up beds in the ED. This unit would provide care primarily for cell therapy patients in after-hour situations, but could also care for other oncology patients.

Oncology and Transplant look to grow refractory disease care at VCUHS. This area will require support from a satellite lab for cell therapy. If there are issues with chemo, there needs to be a place to fix a broken bag, such as the satellite lab.

Oncology and Transplant don't have a dedicated observation unit, and they send their nurses to care for patients on the observation unit because the observation nurses are not HemOnc certified. Implementing an observation unit for these patients would allow staffing to become more efficient, and patients to not have to be transferred between floors.

Transplant looks to care for all pre-op patients on the transplant unit. Currently those patients are cared for on CCH 7 in acute care surgery. A move to complete bone marrow biopsies bedside versus in procedure rooms in the future is the goal.

The service line would like to provide spaces for patients to heal outside their patient rooms. This patient population has long lengths of stay and providing alternative healing environments such as outdoor therapy locations and access to nature are desired. Oncology and Transplant would like to provide positive distraction locations on unit for patients to get away from their rooms like an activity space.

ADJACENCIES - ONCOLOGY

- To Unit
  - Chemo Pharmacy
  - Blood Bank
  - CIT Clinic

ADJACENCIES - TRANSPLANT

- To Unit
  - Apheresis
  - CIT Clinic
  - Blood Bank

ADJACENCIES - CIT

- To Unit
  - Apheresis
  - Blood Bank
  - Transplant

Mother/Infant

FUTURE CARE MODELS – MOTHER/INFANT

VCUHS looks to move to a couplet care or rooming in model having a single nurse provide care for both mom and baby. To coincide with this model, moving to a decentralized nursing model bringing nurses close to the patient's bedside, allows nurses to care for both patients more easily. Implementation of a step-down nursery for extended stay infants is desired. These babies may stay longer than 30 days.

VCUHS also aspires to offer a mixed model of postpartum and NICU where mother and their NICU baby can reside in the same room to obtain care. This model helps to remove barriers of postpartum care often not sought by a new mother caring for a NICU baby. Implementation of this model has thus far utilized midwifery programs to care for the postpartum mother while she is caring for her NICU infant.

Providing a specific, dedicated care seat trial area for fetal demises on the unit is desired. This space would keep patients dealing with loss separated from the new mother/infant space. Allowing the patient to receive care but not have new infants to hear or see around them.

A location to conduct car seat training and trials on the unit would be ideal. This space can be used for fittings to ensure parents are prepared to safely transport the baby home.

ADJACENCIES – MOTHER/INFANT

- On Unit
  - Treatment Room
- To Unit
  - NICU
  - Labor & Delivery

Labor & Delivery

FUTURE CARE MODELS – LABOR & DELIVERY

Labor & Delivery continues to grow its complex antepartum care. These antepartum rooms will care for patients that have stays greater than 3 months. Along with taking care of high-risk pregnancy patients, pre/post and PACU services are needed to support C-sections. An OR integrated with resuscitation room to care for patients in distress and handle any emergencies is desired.

ADJACENCIES – LABOR & DELIVERY

- On Unit
- To Unit
  - Blood Bank
  - NICU
  - Mother/Infant
  - Milk Bank
  - Antepartum Unit

NICU

FUTURE CARE MODELS – NICU

The NICU looks to provide a mixed model of both postpartum care for the mother and intensive care for the baby in one space. Twin and Triplet rooms are needed to support families of multiples in a bigger space. A small baby unit is also desired to care for babies growing but still fragile.

Other family support spaces to add for the future model of care desired are outdoor spaces such as garden areas with oxygen for babies, a family gym for parents who must stay for long durations caring for their baby, and child life areas for siblings to play.

ADJACENCIES

- On Unit
  - MRI/Fluoro
  - Pharmacy
  - Milk Room
  - Triplet Room
  - ECMO
  - Procedure Room
  - Laboratory
- To Unit
  - Mother/Infant
  - Labor & Delivery
  - Imaging
  - OR
  - CHOR

Burn

FUTURE CARE MODELS

A procedure room shall be large enough to allow x-rays to be completed in the room. Burn looks to complete wound vacs and nutritional procedures in the procedure room in the future instead of moving the patient to surgery to prevent infection. The procedure room will require the addition of prep/recovery.

The addition of a hyperbaric chamber is desired near the unit. From an outpatient clinic perspective, a laser room is needed to perform these treatments for patients. Continuation of a rehab space for patients both inpatient and outpatient is necessary. A child life room will continue to be needed to support pediatric patients being cared for on the unit.

ADJACENCIES

- On Unit
  - Rehab Gym (IP & OP)
  - Procedure Room
- To Unit
  - IP and OP Burn Together
  - STICU
  - CHOR
  - Trauma
  - Plastics

Medicine & Surgical ICU

FUTURE CARE MODELS

Medicine aims to cohort specialties together. Areas such as nephrology, GI, metabolic, diabetes and pulmonary volumes will all increase. VCUHS is moving to a geographic model of care delivery for hospitalists and looks to continue to expand this model in the future.

An increased need for bariatric rooms are anticipated in the future. Medicine also looks to provide more isolation rooms to support patients such as psych, those suffering with comorbidities and patients that are detoxing. It was also mentioned that rooms to support patients that need a safe space should be implemented in the future to provide better support and a better patient experience for the patient and others on units.

Increased use of telehealth in the future is desired to continue to provide the highest quality care by VCUHS.

ADJACENCIES - MEDICINE

- On Unit
  - Rehab Gym
- To Unit
  - Pharmacy
  - Discharge Center
  - Laboratory
  - CT
  - MRI
  - ED

ADJACENCIES - SURGICAL ICU

- On Unit
  - Rehab Gym
  - Telehealth
- To Unit
  - CT
  - MRIs

PHASE 1 RECOMMENDATION

Organic vs. Strategic Growth

			Organic Growth - 10 Year Forecast			Strategic Growth - 10 Year Forecast			
High Acuity Specialty Care	Existing Beds	VCUHS Projection	Growth Percentage	Future Bed Need	Bed Delta	Existing Market Share	Market Share Target	Future Bed Need	Bed Delta
Cardiovascular	91		6%	122	31	16%	32%	300	209
Neurosciences	68		10%	141	73	17%	27%	141	73
Neurosciences			10%						
Spine			0%						
Cancer	28		0%			31%	43%	83	55
Cellular Immunotherapy	21			21					
Trauma | Ortho | Burn	81					13%	23%	104	23
Trauma	30		13%						
Ortho	31		0%						
Burn	20		13%						
Transplant	57		59%	81	24	73%		81	24
Sub Total	427	**448**		365	-83			709	261
NICU*	62		4%	87	25	25%	30%	87	0
Postpartum | Antepartum	35			45	10			45	10
Sub Total	35			45				45	

Note: NICU Beds are not licensed and not included in final bed count.

Organic Growth
Strategic Growth

Specialty Units
Cardiovascular
Neurosciences
Transplant
CIT

Organic 365
Phase 1 240

"Diamond" Reduction Scheme

After iterative reduction studies with associated cost estimations and the prioritization of 240 beds with 10-ORs, the 'Diamond' Reduction Scheme on the existing visitor deck site was recommended by VCUHS leadership for refined conceptual development. This scenario represents the best phased approach, maximizing initial scope with targeted budget.

The Diamond Scheme takes its name from the elongated diamond shape of the building's massing. The diamond is a site response to maximize the bed floors' footprint and perimeter area by utilizing the longest dimension of the site, the diagonal.

PHASE ONE COMPONENTS, EXPANSION & SPACE PROGRAM

The clinical components of the first phase of the Diamond Scheme include inpatient beds, surgical ORs, and shelled future expansion space for the emergency and imaging departments. In support of that clinical program, a back-of-house kitchen, inpatient pharmacy, respiratory therapy, and sterile processing department are included. Public functions will include a two-floor lobby with coffee area, vehicular drop-off/ pick-up drive outside the lobby and an adjacent welcome/ discharge lounge. Building support includes a double-height mechanical floor as well as a logistics floor for materials management with access to a new 8-bay dock. There is no public parking deck in this scheme, but both vehicular and pedestrian access points from the new tower to the existing D-Deck are included. The Central Utility Plant is a freestanding building across Leigh Street and is connected to the new tower via a conduit pathway that crosses the street and enters under the hospital.

Phase 1 of the project is anticipated to be 594,500 building gross square feet (BGSF) for the hospital. The CUP is an additional 73,500 square feet. The total phase 1 scope is planned to be 668,000 BGSF.

This initial phase of the project can be expanded over time in four separate ways. The shell space planned on the ground floor of the hospital can be upfit to include additional emergency department treatment rooms and imaging that would support the inpatients in the new tower. Below level B and above the logistics level of the hospital are 1 3/4 open "stilts" floors. These are areas with exposed columns but no slab that could be upfit and enclosed to create additional clinical or building support space on Levels B1 and B2. Level B1 is a full footprint and level B2 is a ¾ partial footprint to minimize phase 1 excavation costs; together they total approximately 109,000 BGSF of future podium expansion opportunity. Above level 8, the building will be structured to be expanded vertically, up to 7 additional bed floors plus a mechanical penthouse on top. This would add up to 336 more beds for a total of 576 inpatient bed in the new tower long-term. Lastly, the CUP is designed for expansion to support the future growth of the new tower.

DIAMOND SCHEME: COMPONENTS

		Diamond Scheme	
Beds		240 Beds	
Parking	🔴	0, Access to D-Deck	
ED	🟡	Shelled (If Upfitted in Q1 2028 = additional $56M)	
Surgery, SPD	🟢	10 ORs + 1 Proc Rm	
Cath/EP	🟡	Future Stilts Upfit	
Radiation Oncology	🟡	Future Stilts Upfit	
Imaging	🟡	Shelled (If Upfited in Q1 2028 = additional $48M)	
NI Cardio	🟡	Future Stilts Upfit	
Pharmacy & BOH Kitchen	🟢		
Future Expansion	🟡	+336 Beds, 55K shell,109K stilts	
Construction Cost/sf		$1,129/sf	
Total Project Area* BGSF		668K SF	
Construction Cost (Today)		$754M	
Escalation (calendar year)		Q1 2028 (16.87%)	Q3 2028 (19.25%)
Escalation		$127M (Q1-28)	$145M (Q3-28)
Contingency		$31M (3.5%)	$31M (3.5%)
Indirect Cost**		$561M (**)	$572M (**)
Total Project Cost/sf		$2,201/sf	$2,246/sf
Total Project Cost		**$1.47B**	**$1.50B**

KEY PLANNING UNIT (KPU) STATUS: DIAMOND SCHEME

Department	Phase 1 KPUs	Future Opportunities
Inpatient Beds	**240**	336 vert. expansion, 7 floors of 48-beds
Interventional		
Surgical ORs	**10 (incl. hybrid)**	
Cath + EP	0	4+4 Level B1 Stilts Upfit
Int. Radiology	0	
Proc. Rooms	**1**	
Endoscopy	0	
ERCP	0	
Bronchoscopy	0	
Emergency		Upfit LG Shell
Treatment	**Shell**	37 Tx , LG Shell Upfit (+65 Existing Tx)
CDU	0	
ED Imaging	0	

Department	Phase 1 KPUs	Future Opportunities
Imaging		Upfit LG Shell
CT	**Shell**	2
MRI	**Shell**	2
Ultrasound	**Shell**	1
XR/ Rad-Fluoro	**Shell**	2
Future Modality	0	
Rad Onc.		Level B2 Stilts Upfit
Lin Acc. , CT Sim	0	1+1
NI Cardiology		Level B2 Stilts Upfit
Nuc Medicine	0	1
Nuc Stress Test	0	1
CPET	0	1
TEE	0	2

SPACE SUMMARY

Diamond Reduction Scheme

Total beds in Tower: 240

240 new beds, phase 1. Potential for future vertical expansion to 576 total beds.
Assumes deferment of an Offsite Logistics Center until more beds are added in future phase.

VCUHS New Inpatient Tower	KPU per Dept	Total Net SF	Grossing Factor	Program Dept SF	Comments	DGSF/ KPU
Inpatient (IP)						
Inpatient Unit, 48-Beds	48	30,027	1.60	48,044	One Unit of 48 beds: Includes 150 SF each for unit specific spaces	1,001
Inpatient floors at 48 beds				240,219	5 floors of 48 bed units	
Postpartum/ Antepartum (OMITTED)					Not included in new high acuity tower. Assumes PP expands Main 8 or shift to Main 7	
Neonatal Intensive Care Unit (NICU) (OMITTED)					Likely expands in CCH, use floorplates that don't have code compliant inpatient toilets	
Diagnostic and Treatment (D & T)						
Emergency - Adult (SHELLED)	37	15,026	1.60	24,042	**Shelled in Phase 1**: 37 treatment rooms expansion to existing ED in CCH & Main Hospital Buildings.	650
Imaging (SHELLED)	7	12,906	1.50	19,359	**Shelled in Phase 1**	2,766
Surgery with Prep/Rec/PACU	10	28,482	1.60	45,571	10 ORs including Hybrid, plus 1 Proc Room supported by 28 Prep/ Recovery/ PACU rooms	4,557
ED- CDU (OMITTED)	-	-	-	-	Remains in existing ED. Program omitted due to cost / scope reductions.	
Labor and Delivery (LDR), C-Section (OMITTED)					Not included in new high acuity tower. LDR expands in place	
Endo / Bronch + Prep/ Rec (OMITTED)	-	-	-	-	Program omitted due to cost / scope reductions	
Unique Pathogen Unit (UPU) (OMITTED)	-	-	-	-	Not included in new high acuity tower. Likely remains in existing location	
CIT Clinic (Cellular Immunotherapies) (OMITTED)	-	-	-	-	Not included in new high acuity tower. Likely remains in existing location	
Clinical Support						
Respiratory Therapy (RT)		1,633	1.25	2,041	Reduced but maintained for high acuity bed support	
Inpatient Pharmacy (Benchmarked only, no detail program)				10,000	Required to support new beds before Offsite Logistics Center can help supplement	
Shared Clinical Team Services (OMITTED)	-	-	-	-	Not included due to cost/ scope reductions. Support from existing.	
Lab (OMITTED)	-	-	-	-	Not included due to cost/ scope reductions. Support from existing	
Building Support						
Food Service- Back of House (BOH) Kitchen (Benchmarked only, no detail program)				14,000		28
Sterile Processing Department (SPD) (ADDED) (Benchmarked only, no detail program)				12,000	ADDED to program with deferral of Offsite Logistics Center. Supports new Operating Rooms	1,200
Sterile Storage (Benchmarked only, no detail program)				3,000	Storage replaces & supplements Sterile Stor. lost to new corridor connection for materials movement	
Logistics, Linen, Bed Mgmt/ Repair, EVS, Support (Benchmarked only, no detail program)				17,000	Receiving & Distribution, RMW, Clean and Soiled Linen, Stat Supply, Bed Repair, near dock	
Logistics Staging (Benchmarked only, no detail program)				2,200	ADDED to program with deferral of Offsite Logistics Center. Interim holding at LB as materials are moved	
Administration / Staff Support						
Medical Staff, GME & On-Call	-	-	-	-	No centralized - use existing Main 4. Add 'l clinical support (on-call) provided in departmental programs	
Administration	-	-	-	-	No general admin, only departmental admin offices embedded in clinical units	

Public Support						
Public/ Lobby LG		3,075	1.60	4,920	Reduced- includes security, greeter, valet, toilets, and fire command center	
Public/ Lobby L1		2,265	1.60	3,624	Reduced - includes meditation, public lactation & toilets, path to/ from existing hospital CCH L1	
Welcome & Discharge Lounge	8	1,025	1.40	1,435	Level G adjacent to lobby and pick-up/ drop-off	
Café & Dining (Benchmarked only, no detail program)				1,400	Adjusted to coffee retail only due to cost/ scope reductions with access through CCH to L1 cafeteria	
Conference Center (OMITTED)	-	-	-	-	Not included due to cost/ scope reductions. Support from existing.	
Retail Pharmacy (OMITTED)	-	-	-	-	Not included due to cost/ scope reductions. Support from existing.	
Spiritual Services (OMITTED)	-	-	-	-	Reduced to Meditation Room and included in L1 lobby program due to cost/ scope reductions.	

Total Departmental Gross SF (DGSF)		**400,811**	**Excludes all omitted and deferred programs**	
Building Grossing	**0.35**	**138,580**	**REDUCED. Includes IT/Elect, Vert Circ & Elev Lobbies, Shared Circ., Shafts, Exterior Wall**	
Interstitial Floor/ Penthouse/ Service Entry Spaces	**0.12**	**55,112**	**REDUCED. Mechanical, Electrical, Plumbing Infrastructure**	
			SF Excludes Bridge Connectors to Existing CCH and D-Deck, area is captured in pricing only	
TOTAL BUILDING GROSS SQUARE FEET- HOSPITAL ONLY		**594,500**	**Hospital Tower Phase 1 only, Exclusive of CUP**	2,477

ADDITIONAL INFRASTRUCTURE SUPPORT		**BGSF**	**NOT INCLUDED in Hospital BGSF listed above**
Central Utility Plant (CUP)		**73,500**	3 floors, 24,500 SF/ Floor serving new Inpatient Tower. Separate structure across Leigh St.
Parking		**-**	Visitor desk omitted from program due to cost/ scope reductions. Use existing D-Deck with new vehicular ramp access and pedestrian bridge access to connect to new inpatient tower
			Logistics/ EVS shifted into main program and is included above in phase 1 BGSF
TOTAL PROJECT BGSF, Phase 1		**668,000**	**BGSF, Phase 1 Hospital + CUP**

Deferred Program to Future Stilts Expansion					**NOT INCLUDED in phase 1 program listed above**	
	KPUs	NSF	Grossing Factor	DGSF	Comments	
Cath /EP + Prep/ Rec (DEFERRED TO FUTURE)	8	25,524	1.60	40,838	4 Cath, 4 EP - Reduced / Deferred due to cost/scope reductions, potential future stilts expansion	5,105
Radiation Oncology (DEFERRED TO FUTURE)	2	6,206	1.50	9,309	1 Rad Onc Vault, 1 CT Sim - Deferred until future phase, potential stilts expansion	4,655
Non-Invasive Cardiology (DEFERRED TO FUTURE)	5	4,328	1.50	6,491	1 Nuc Med, 1 Stress Test, 2 TEE, 1 CPET - Deferred until future phase, potential stilts expansion	1,298
Mechanical (DEFERRED TO FUTURE) (Benchmarked only, no detail program)				12,000	Further mechanical assumed necessary to support stilts upfit in futur	

Up to 7 Additional Bed Units of 48-beds each are possible as separate future vertical expansion to Phase 1 hospital

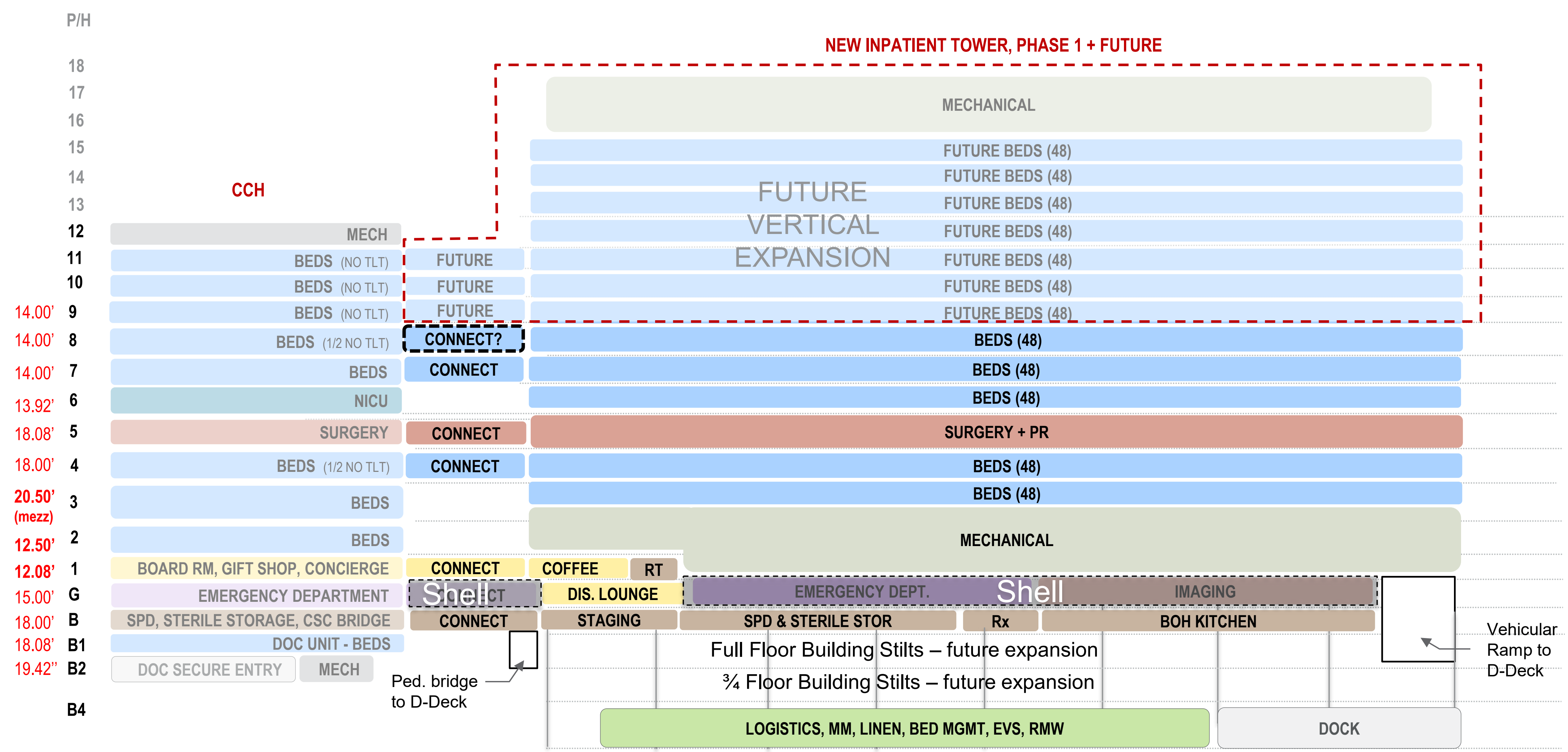
Reference the Diamond Scheme Summary and Detailed Space Program for more information.

STACKING DIAGRAM

The stacking for the first phase of the Diamond Scheme is a high-rise, 8-story building above grade including five floors with 48-beds (two 24-bed units each) totaling 240 beds. Connectivity from the new inpatient tower to existing Critical Care Hospital (CCH) is provided where floor-to-floor heights allow and where the existing CCH department is appropriate. No connection is planned on CCH floors with immunocompromised patients, neonates, or department of corrections patients, as there is no back of house corridor through CCH bed units. Sandwiched between the bed floors is a surgical floor that includes 10 operating rooms and 1 procedure room, supported by 28 prep, recovery and PACU rooms. It is positioned on the 5th floor to ensure horizontal connectivity to the existing perioperative program on the 5th floor of both CCH and Main hospital buildings; this departmental location for surgery was a priority in establishing the stacking diagram for the overall tower. Below the beds, a tall, 2-story height interstitial floor will serve the building mechanically, both up and down. Entry/ grade is level G and includes lobby with a welcome /discharge lounge. This connects via atrium to additional lobby space on level 1 where the public access to CCH is provided. The balance of level G is shell space for future Emergency and Imaging upfit. Below grade there is a floor of support space located on Level B including a back-of-house kitchen, pharmacy, and sterile processing with sterile storage. Materials moving to and from the new dock area into the existing campus will also use this floor and the connection into CCH as the primary path of movement; a small logistics staging area is included to facilitate that circulation. Below Level B are the 1 3/4 floors of open stilts space, available for future expansion. Logistics is located at the base of the sloping site with the adjacent loading dock. Pedestrian connectivity from the D-Deck to the new inpatient tower occurs via bridge on Level B1, with an elevator that takes visitors up to public lobby area. A future vertical expansion of the building would result in a tower that is 576 total beds and 16 floors above grade.

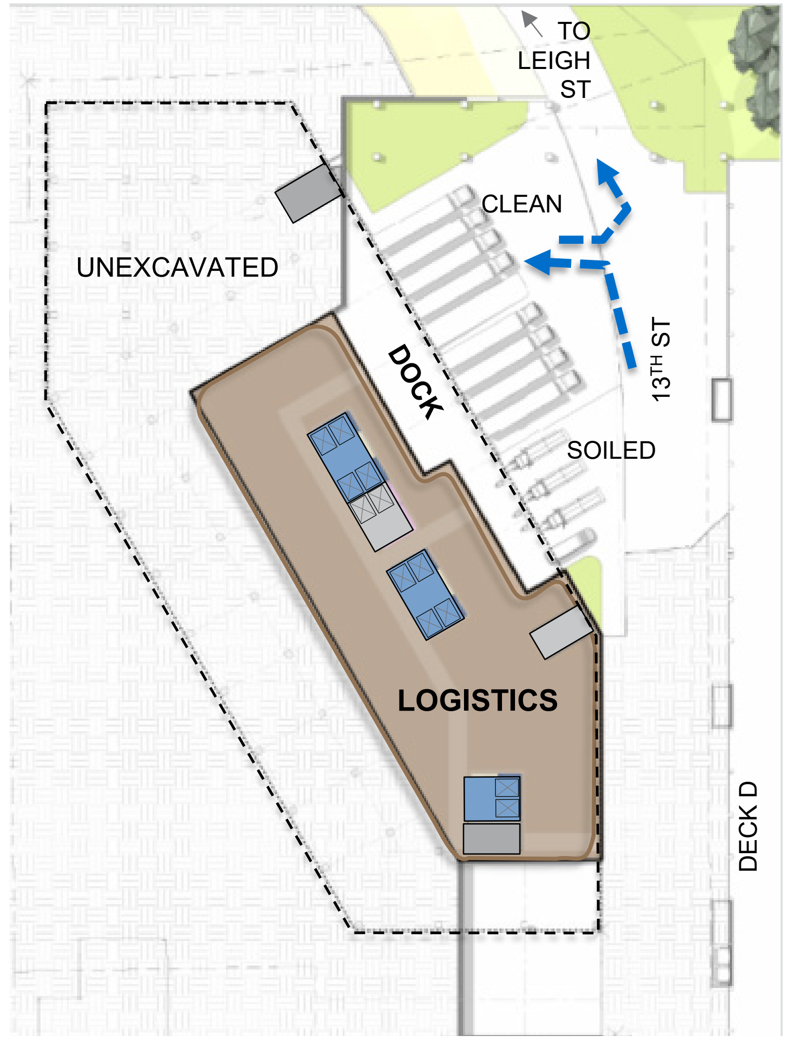
DIAMOND SCHEME

Phase 1, 240 Beds (5 Floors of 48 Beds)
Phase 2, 336 Beds (7 Floors of 48 Beds) Total 576 Total Beds in Future
Future Stilts Infill ~ 1.75 Add'l Floors = 108,700 Expansion BGSF

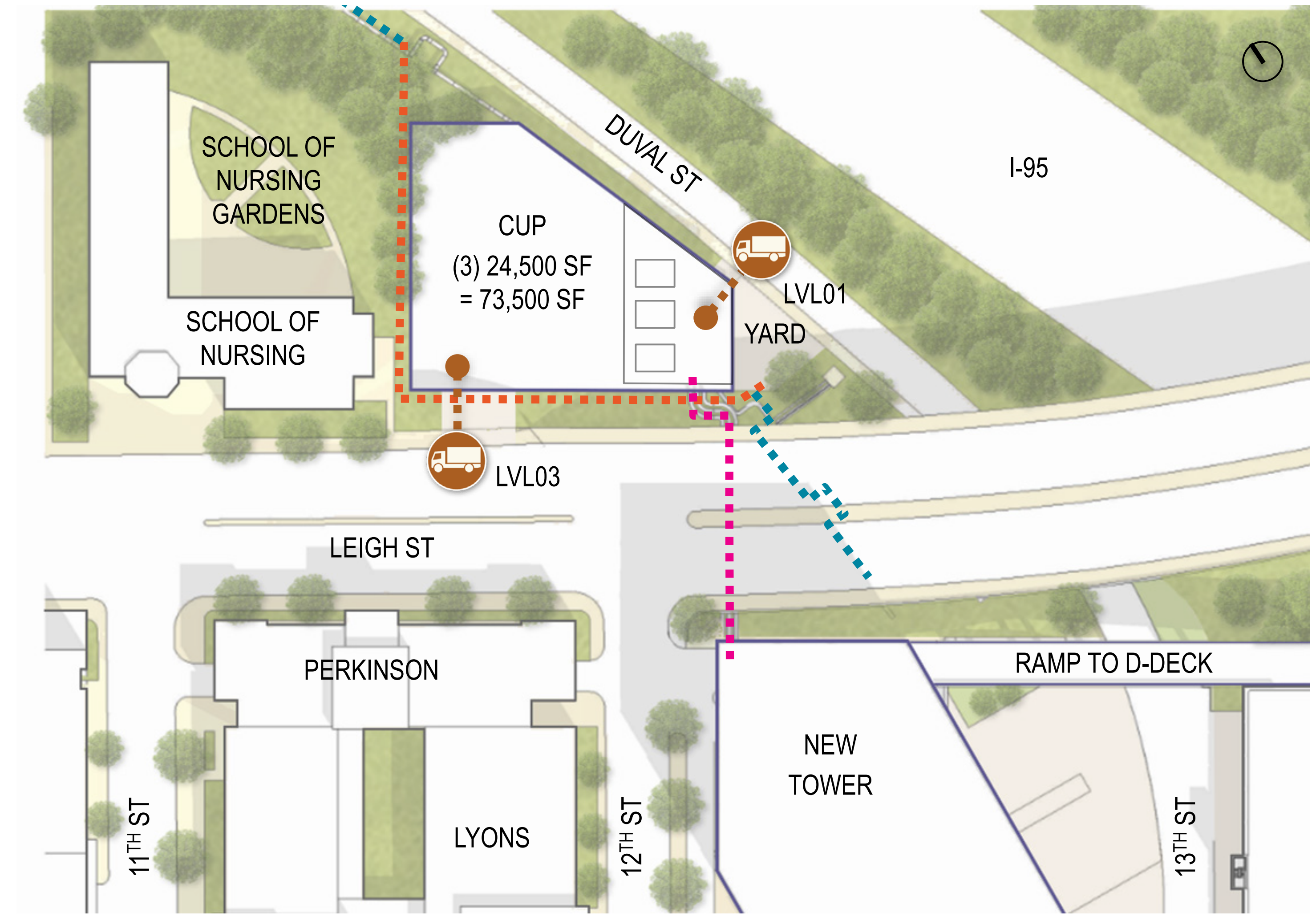


DEPARTMENTAL DIAGRAMS

The Diamond Scheme, viewed in plan and beginning with the lowest level of logistics, illustrates the partial area under the diamond footprint intended to reduce the amount of required excavation. The raised dock area is recessed under the tower with 8 planned truck bays plus compactors, but the truck access occurs external to the building along 13th Street. The long dock allows for the opportunity to separate clean and soiled circulation. The program on this floor includes support for materials management and supply chain, linen, stat supplies, bed repair and regulated medical waste. Only service (phase 1 and preserved space for future) are planned to extend down to the logistics level.



LOGISTICS LEVEL

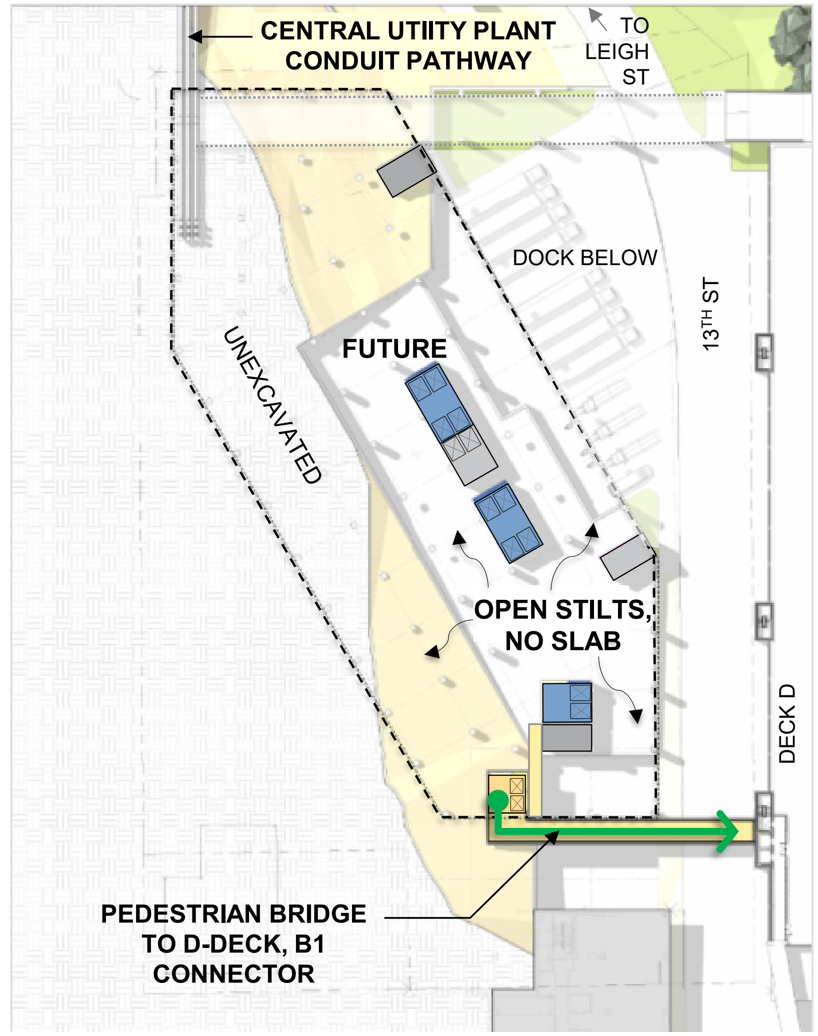


CENTRAL UTILITY PLANT (CUP) - ACROSS LEIGH ST.

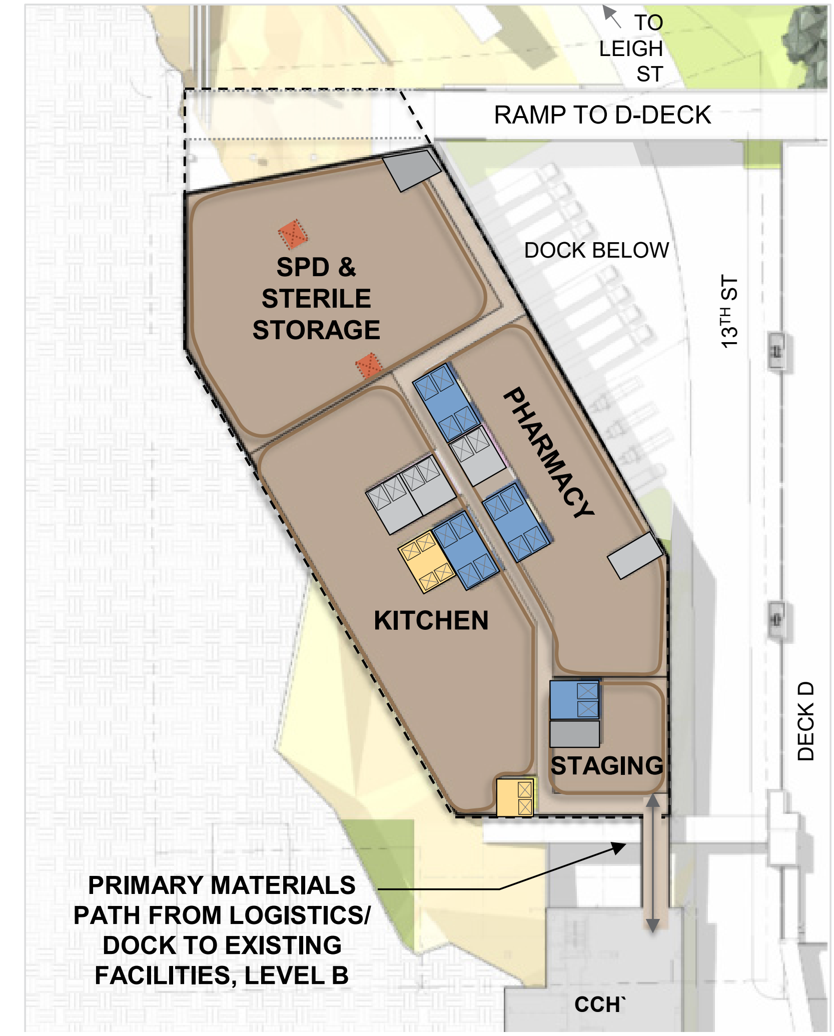
Across Leigh Street to the north of the tower and south of Duval Street is the site for the supporting Central Utility Plant. It is planned as a three-story building set on the sloping site to minimize impact to the adjacent school of nursing. Each floor is 24,500 SF resulting in a 73,500 SF facility. It will require the relocation of a portion of the existing steam line. Service access will be on level 3 because of the grades. The CUP will connect to the new inpatient tower via conduit above grade by crossing Leigh Street, entering on the northwest corner of the diamond at approximately Level B1.

Levels B1 and B2 are open "stilts" areas that will not include a slab nor a thermal building envelope for cost savings in the first phase; the area can be enclosed and upfit as future expansion. The public pedestrian bridge connection from the existing D-Deck across 13th Street to access the new inpatient tower and CCH occurs at Level B1 and connects to 2 new dedicated public elevators in the tower.

Level B is a support floor for the new tower including an inpatient pharmacy, back-of-house kitchen, and sterile processing with sterile storage. The connection path for materials coming to and from the dock into the existing facility is also included on this level.



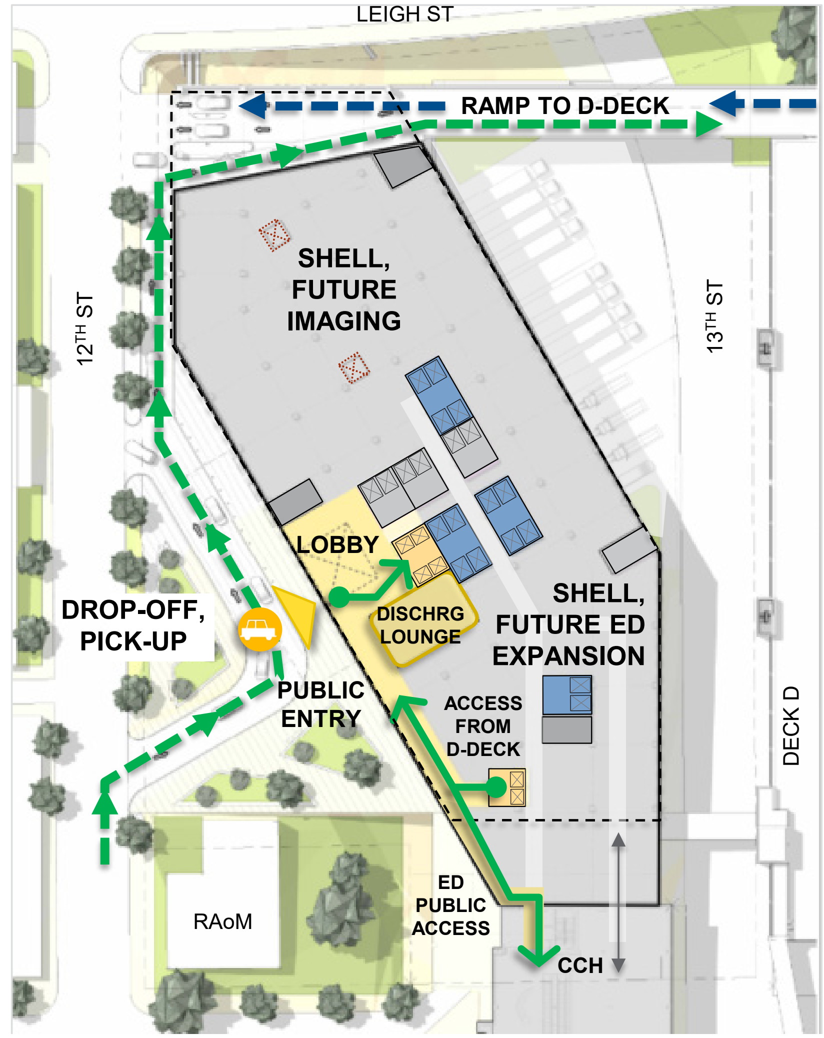
LEVEL B1



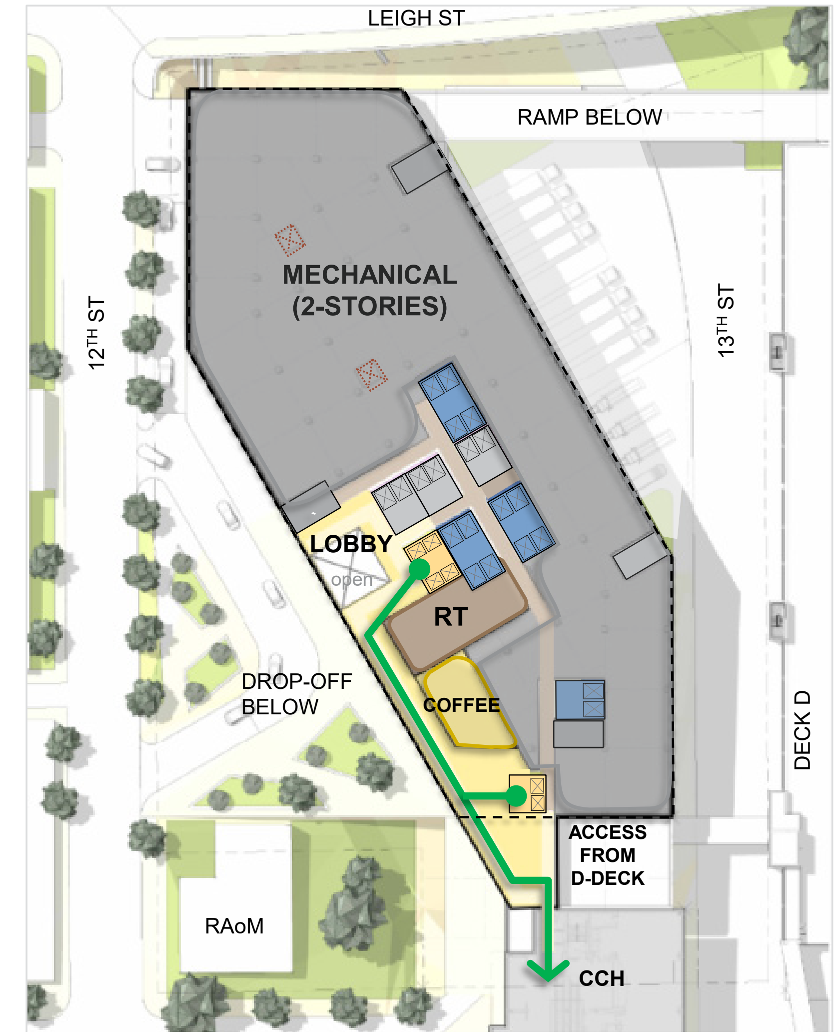
LEVEL B

Level G includes a new public entry point connected to an external drop-off plaza accessed off 12th Street. The lobby will connect to the public elevators from D-Deck, to ED waiting in CCH, and to the lobby on Level 1 above. Level G Lobby includes a welcome/ discharge lounge, valet, and security. The balance of space is reserved as shell for future ED expansion and Imaging.

Level 1 also includes public lobby support. A meditation space, coffee kiosk, and waiting are provided along the path to CCH for public and patients navigating to the existing hospital. Respiratory Therapy is accessed from a back corridor in support of the inpatient beds. A tall mechanical space with mezzanine completes the program for Levels 1 and 2.



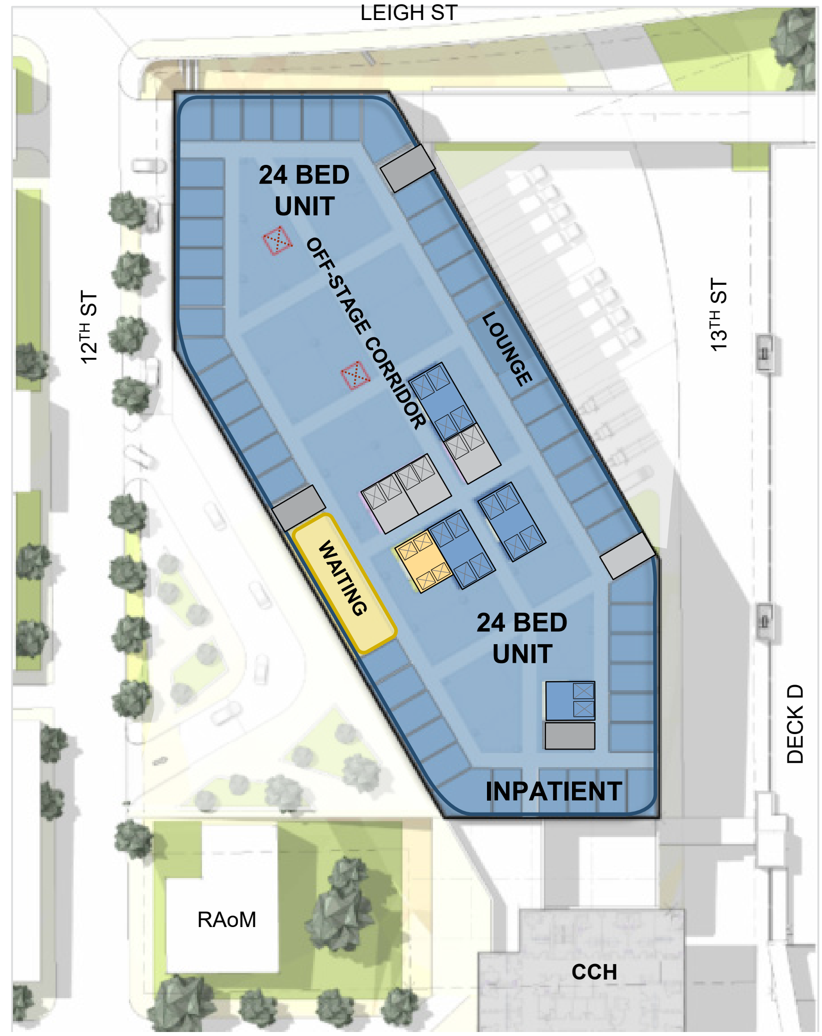
LEVEL G



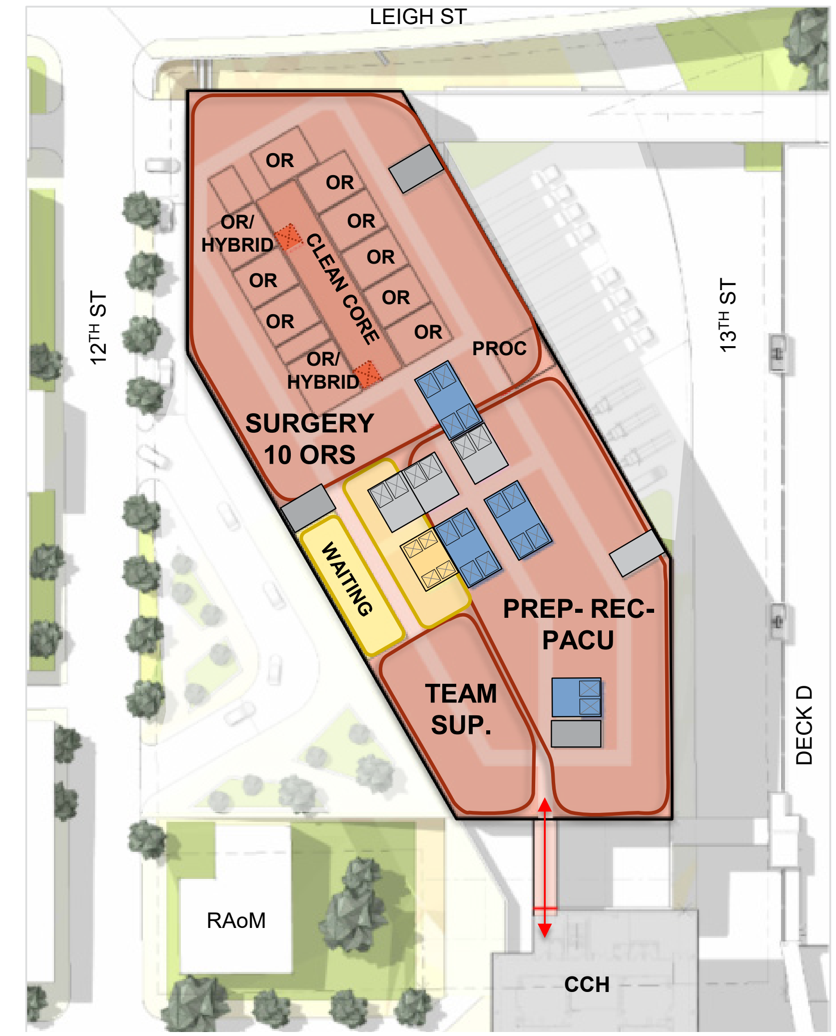
LEVEL 1 (AND LEVEL 2)

Level 3 represents a typical floor of inpatient beds; it does not have connectivity to CCH due to inconsistent lower floor to floor heights in CCH and the tall mechanical space in the new tower. It is comprised of two 24-bed units with shared waiting and staff lounge centralized between the units. The waiting zone is located in a consisent location on every floor for ease of wayfinding. A back of house corridor is planned through the bed floor to allow materials and staff to circulate "off-stage" to minimize noise and disruptions to the patient corridors. Level 4 is also a typical bed floor but is planned with connectivity via bridge to CCH level 4 for patient transport (see Level 7).

Level 5 is the surgery floor, intentionally positioned to extend the surgical department already located on the fifth floor of CCH and Main Hopsitals. On the north side, the red line area is comprised of 10 ORs positioned around a clean core with elevator connectivity to Sterile Processing 5 floors below. Two of the ORs are planned for hybrid use with adjacent control rooms; one large procedure room is also provided. Prep-Recovery and PACU are immediately adjacent to support the ORs with 28 private rooms. Waiting for families is immediately off the public elevators in the same zone as other floors. Team support is on the south side of the new tower. Both team support and Prep/ Recovery/PACU are accessible from the red-line area in CCH surgery, as well.



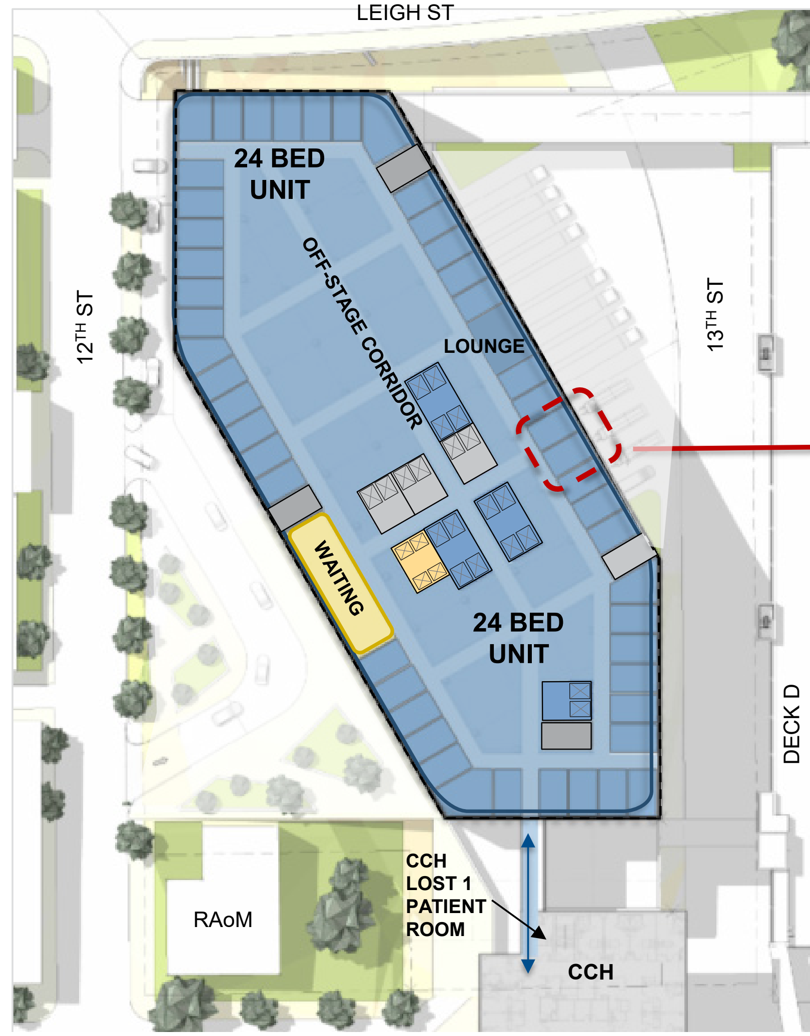
LEVEL 3



LEVEL 5

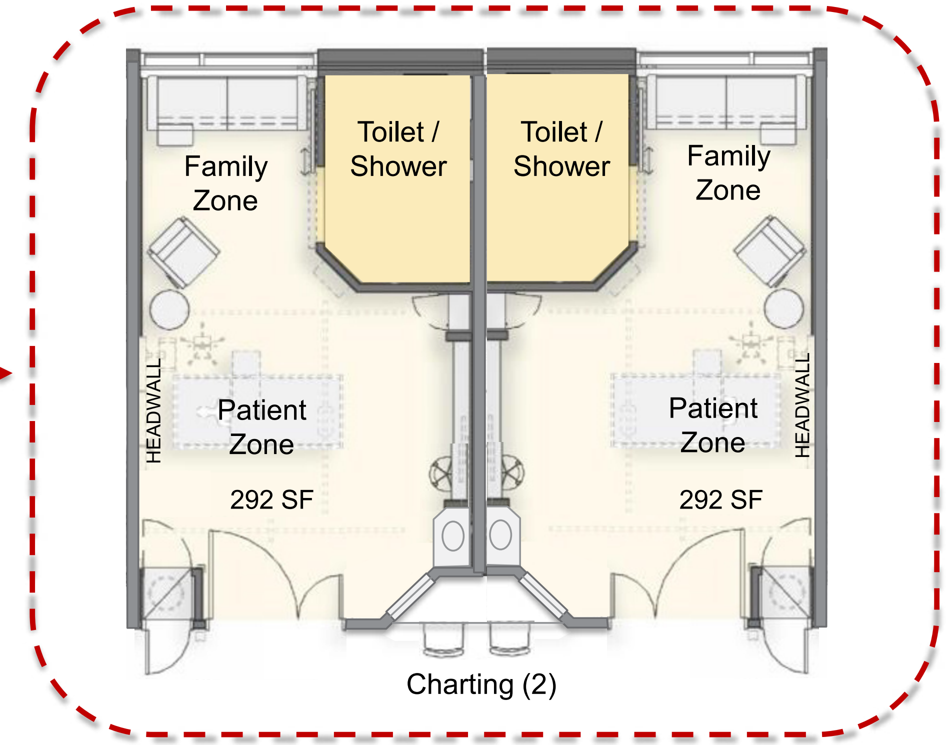
Levels 6-8 are typical bed floors. Like Level 3, Levels 6 and 8 will not connect to CCH because of the patient populations in the existing CCH building. Level 7 illustrates the connectivity to CCH to the south. One patient room in the northwest corner of the CCH, west of the egress stair, will be lost on each floor where a corridor connection is made to the new tower.

The inpatient room that was used for the bed floor layout is based on feedback from the mock-up process conducted with VCUHS in the fall of 2024. This includes rooms that are mirrored so the toilet rooms share a plumbing wall, and the medical gasses are also on a shared head wall between rooms. This arrangement allows for decentralized charting just outside the room, sized for two team members, with visibility to both patients. The rooms are all private and sized to include families overnight and meet intensive care clearances, allowing for an acuity adaptable approach to unit assignment over time.



LEVEL 7

Enlarged Patient Room from Mock-up



- All private rooms with private toilets
- Acuity adaptable for ICU patients
- Decentralized charting

RECOMMENDED SERVICE LINE DISTRIBUTION

The Steering Committee was presented with three strategy options for service line bed distribution based on the first phase of 240 beds. Initial focus included potential consideration for specialty beds for Cardiovascular, Transplant, Burn, Neurosciences and Cancer CIT. The recommendation to the Board was Option C, based on Organic growth projections.

Bed Distribution was based on 10-year Organic Growth Forecast, organized around units of 24 beds. Each Bed Unit has 2 Units, or 48 Beds. Assumptions for Prioritization include:

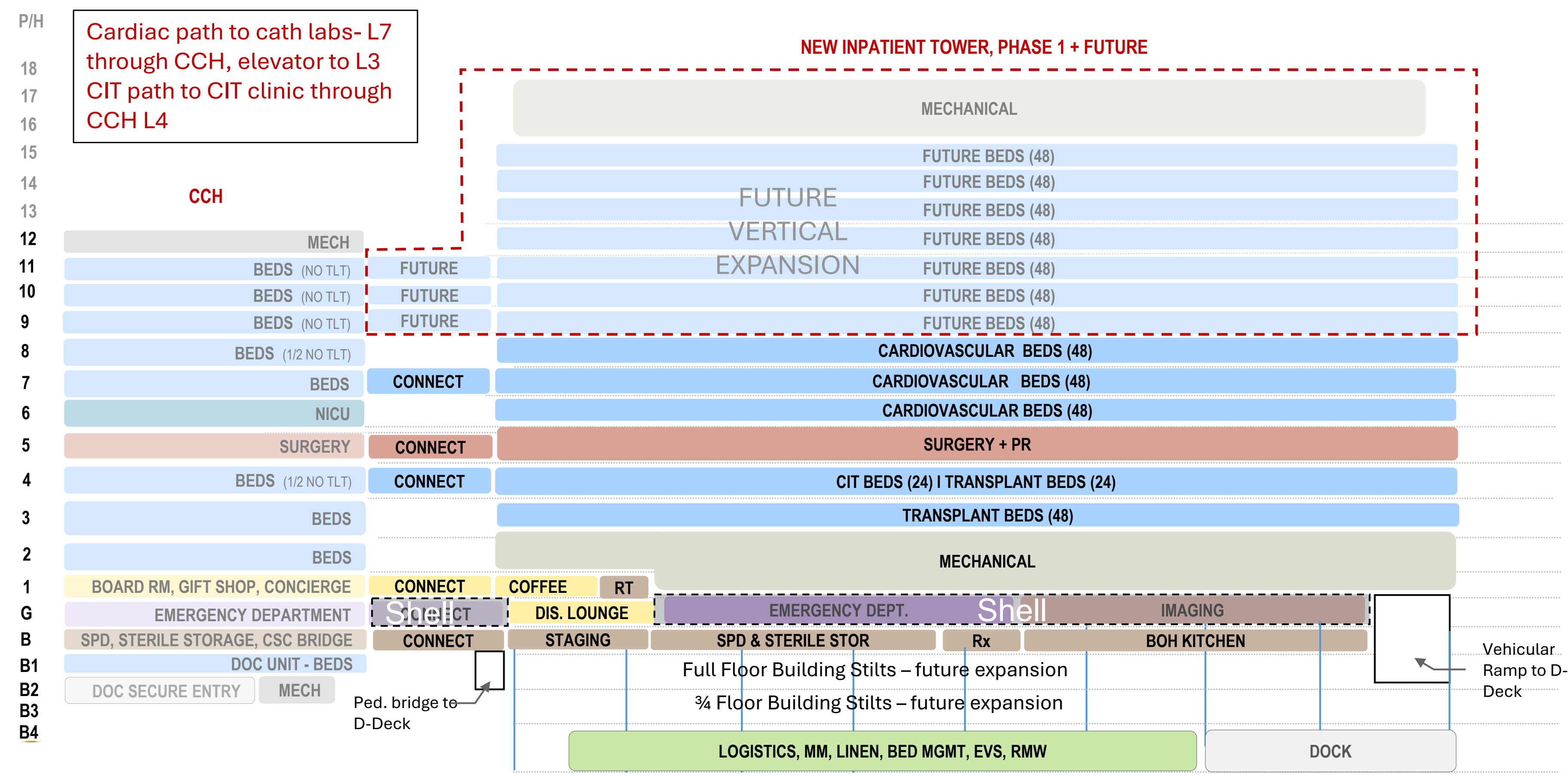
1. **Transplant:** Provide 3 units of 24 beds for Transplant Patients
2. **Cancer (CIT):** Locate a unit of 24 beds for Burn adjacent to Transplant, placing immuno-compromised patients together, providing for swing beds and flexibility of both units.
3. **Cardiovascular**: Provide 3 floors of 48 beds each for Cardiovascular – will achieve Organic Growth bed target.

This option prioritizes Transplant, Cardiovascular and CIT beds. This scenario does not provide for Neurosciences beds in the new tower, but target growth may be achieved through the back fill of Cardiovascular units. This option does not connect on Level 8 and thus does not require the relocation of burn beds into the new tower; burn beds are assumed to remain on CCH 8 as existing. They operate in close association with the trauma beds that are also not included in the phase 1 new tower. Associated OR types are also included to align with the bed strategy.

New Inpatient Tower Phase 1 - Recommendation		Existing Beds	Total	Target	Clarifications/Assumptions
Specialty Beds	240				Doesn't include Neurosciences beds in first phase.
Cardiovascular	144	91	144	144	Provide 3 floors of Cardiovascular - 144 beds. Vacate existing bed units, CCH 10, Main 10.
Transplant	72	57	72	81	Provide 3 Units of 24 beds for transplant Program - Immunocompromised patients.
Cancer (CIT)	24	21	24	21	Provide 1 Unit of 24 beds for CIT - Co-locate with transplant program.
Backfill Option					
Neurosciences		68		141	May utilize vacated CV units for neurosciences bed growth. Location creates a vertical stacking.
Specialty ORs					
Cardiac OR	4				
Hybrid	2				
Transplant	4				

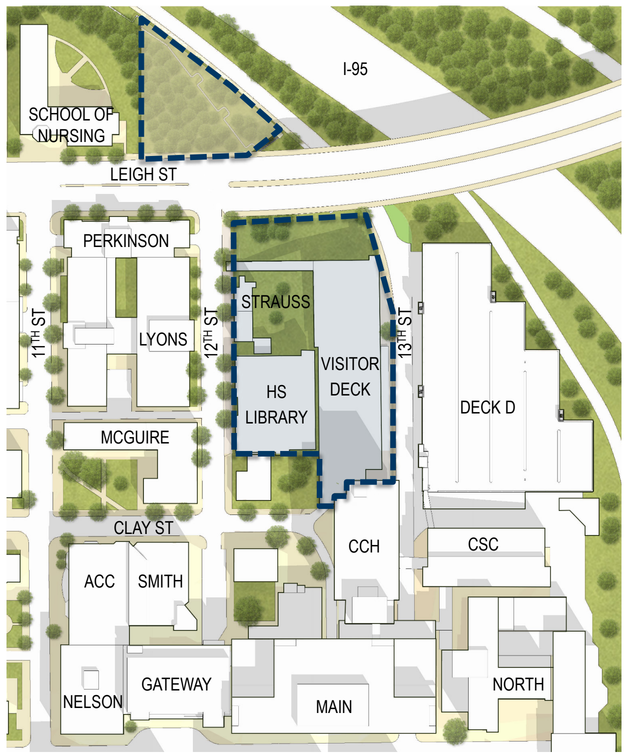
DIAMOND SCHEME OPTION C

Phase 1, 240 Beds (5 Floors of 48 Beds)
Phase 2, 336 Beds (7 Floors of 48 Beds) Total 576 Total Beds in Future
Future Stilts Infill ~ 1.75 Add'l Floors = 108,700 Expansion BGSF

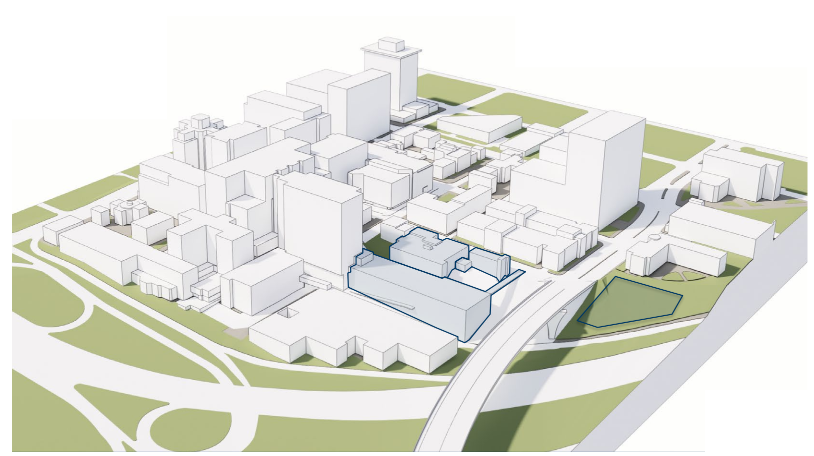


SITE & ACCESS

The site for the new inpatient tower is north of the existing Critical Care Hospital and includes the current Visitor Deck, Health Sciences Library and Strauss Research Buildings, all of which will be demolished to create vacant space for the new construction. A portion of the historic Richmond Academy of Medicine Building will be severed from the Health Sciences Library in the demolition. The demolition scope will include repairs and infill of the impacted north face of Richmond Academy of Medicine. The site for the Central Utility Plant is planned across Leigh Street, south of Duval Street and next to the School of Nursing. Demolition will include some additional cut into the sloping grade for the hospital as well as excavation in the hill for the CUP.



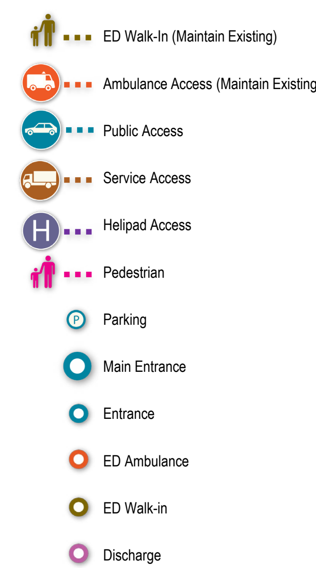
SITE EXTENTS

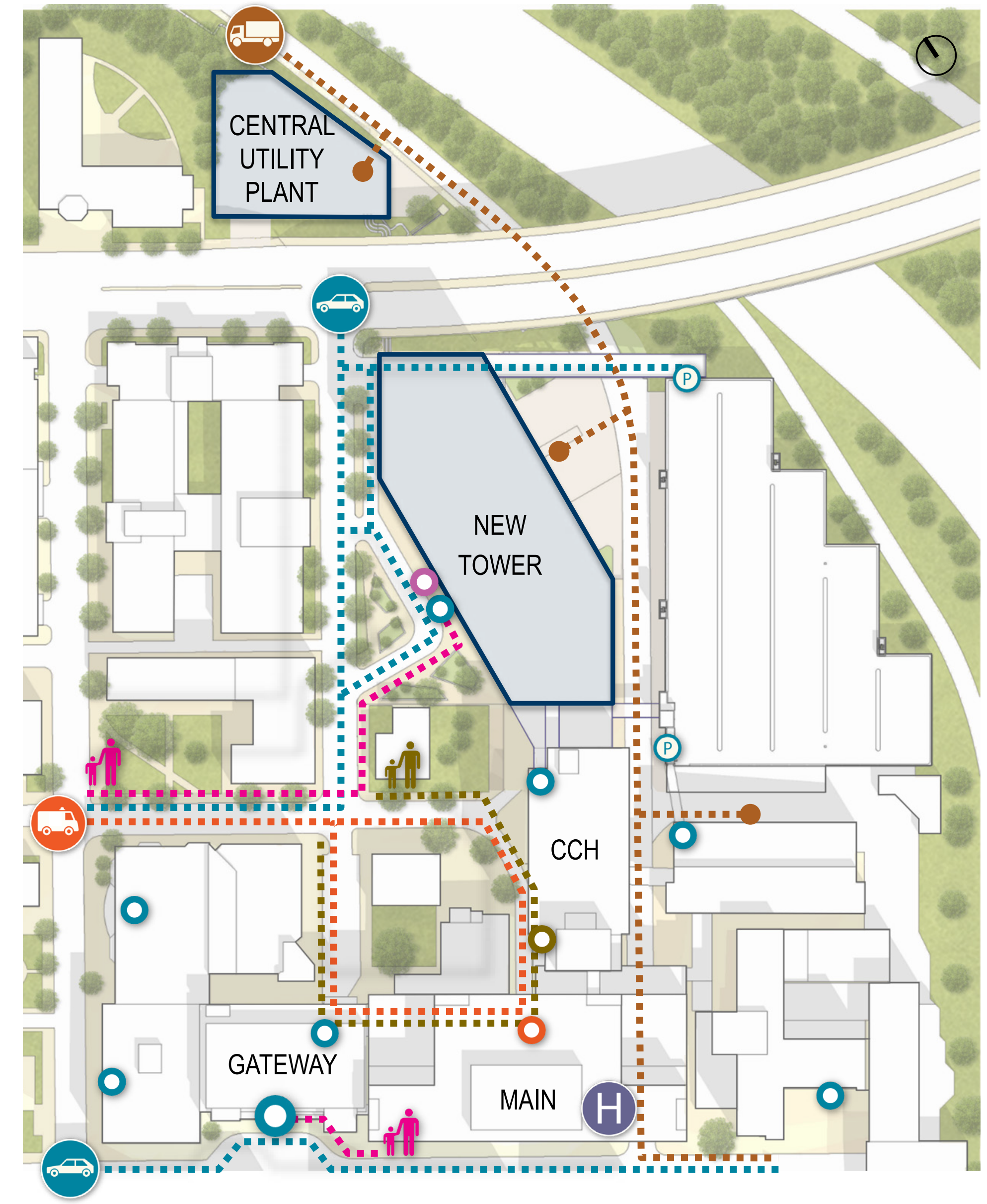


SITE, EXISTING CONDITIONS

Site Plan

Arrival and Site Access





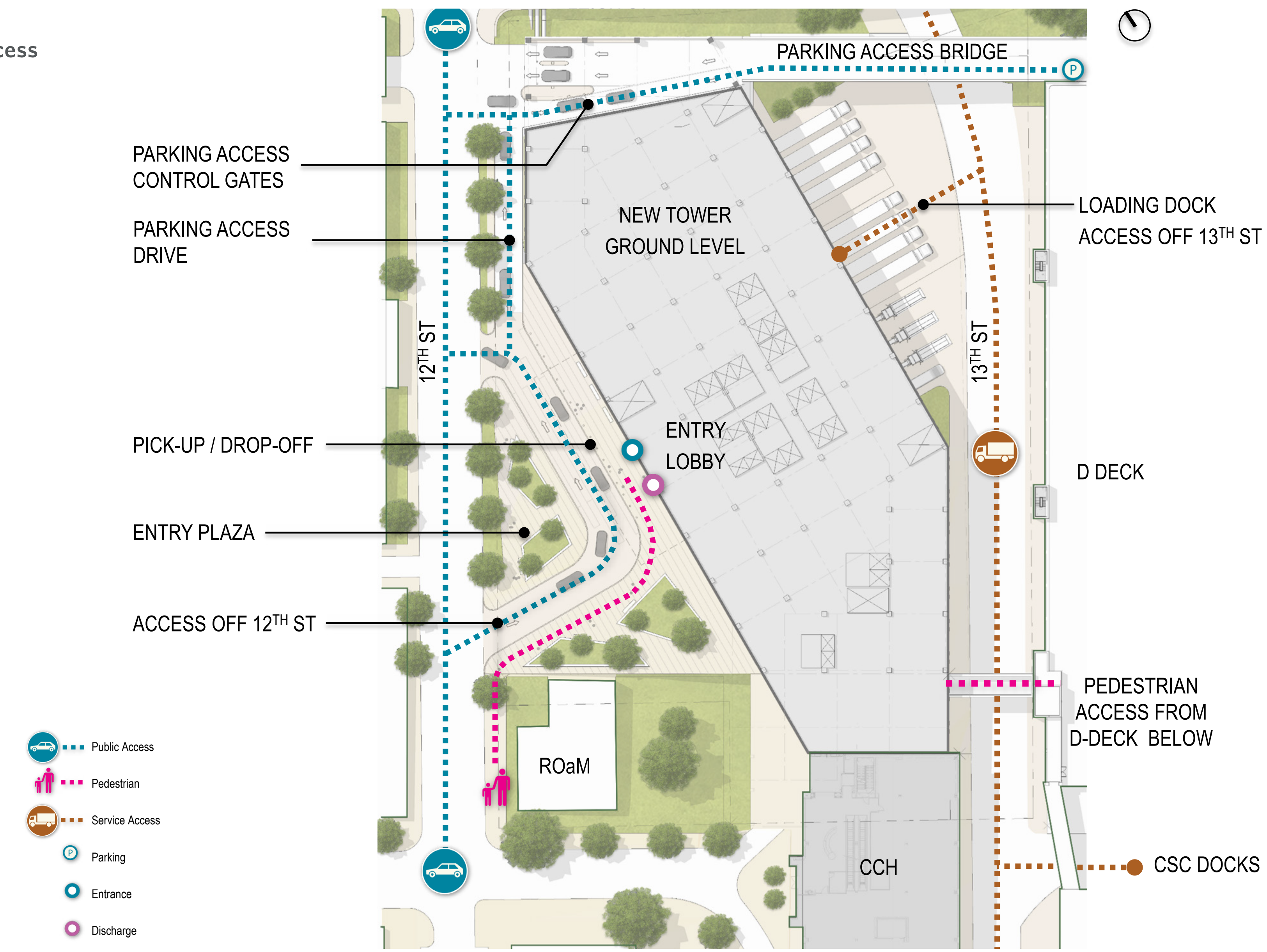
When located on the cleared site, the new inpatient tower will take advantage of the longest dimension of the site by rotating the building on the diagonal, creating a diamond-shaped building. The tower will connect directly to the Critical Care Hospital to the south on six of the levels. It will connect to the existing D-Deck for public parking by the addition of a new vehicular ramp near Leigh Street, connecting at the top / 7th Floor of the D-Deck. A new pedestrian bridge is planned from the D-Deck elevator core across 13th Street, connecting at Level B1 of the new tower. The Central Utility Plant north of Leigh Street is an independent structure, but conduit will connect back to the new tower elevated above grade but below Leigh Street.

Access for public arriving at the new tower will be on Level G off 12th Steet via new pick-up/ drop-off plaza. This new drive uses the rotation of the tower to create gracious space for cars queuing, as well as a by-pass circulation lane, all separated from the traffic on 12th Street. Access to the Emergency Department for both ambulance and ED walk-in patients will remain as existing, via Clay Street. An internal connector is planned to the ED, but the new tower drop-off is not intended for ED traffic; the helipad will also remain in its existing location. Truck traffic is more segregated to 13th Street, separated from the public and patient flows; access to the new loading dock will also be off 13th Street. While the new tower will include limited public support it does not replace the existing hospital main entry at the Gateway Building.

Once a patient is dropped off at the entry plaza, the driver can utilize a new parking access drive that parallels 12th Street to access a vehicular parking access bridge that ramps down to the top of the D-Deck across 13th Street. After parking, the driver can return to the new tower by crossing 13th Street safely in a bridge that connects the deck and the B1 level with elevators that deliver the driver to lobby of the new tower. A driver can use that same path in reverse to come back to the entry plaza for patient pick-up.

New Tower Access

Enlarged arrival and site access



CODES NARRATIVE

Codes and Guidelines

The new Bed Tower shall comply with the version of the Virginia Construction Code (VCC) that will be in effect at the time of permitting. For Healthcare occupancies within the project, the current edition of NFPA-101 as the primary Life Safety Code, as well as the current version of the Facilities Guidelines Institute-Guidelines for the Design and Construction of Hospitals (FGI) will also apply. Other Codes and Regulations that may apply, but are not limited to the below:

- Virginia Construction Code (VCC)
- NFPA 101 Life safety Code
- NFPA 99 Health Care Facilities Code
- International Existing Building Code (IEBC)
- International Mechanical Code (IMC)
- NFPA 54 National Fuel Gas Code
- International Energy Conservation Code (IECC)
- NFPA 70 National Electric Code
- A117.1 Accessible and Usable Buildings and Facilities
- Facilities Guidelines Institute (FGI) for Design and Construction of Hospitals

OCCUPANCIES

1. Healthcare: Buildings or portions of a building that are used for inpatient medical care on a 24-hour basis for persons who are incapable of self-preservation.
2. Ambulatory Healthcare: Buildings or portions of a building that are used for outpatient medical treatment rendering patients incapable of taking action for self-preservation.
3. Business: Buildings or portions of a building that are used for service type transactions and laboratories.
4. Assembly: Buildings or portions of a building that are used for food/drink consumption, awaiting transportation or similar uses.
5. Storage: Buildings or portions of a building that are used for storage.
   a. Low-Hazard Storage:
   b. Standard healthcare materials stored throughout facility.

6. Mechanical spaces.
   a. Moderate-Hazard Storage:
   b. Oxygen tank rooms within the facility. These spaces should be located along the exterior walls of the building.

FIRE PROTECTION

1. Automatic Sprinkler System: Provided throughout entirety of building in accordance with NFPA-13.
2. Fire Command Center: Recommend locating adjacent to elevator(s) that access every floor of the building. Confirm location with local fire department.
3. Protection of Structure: Cast-in-place reinforced concrete structure or spray-applied fire-retardant material at steel structure, or both.
4. Exterior Walls: 1-hour where exterior walls of separate buildings are within 30' of each other.

HIGH-RISE BUILDINGS

1. Definition: A building with an occupied floor located more than 75 feet above the lowest level of fire department vehicle access.
2. Stairways: Every required interior exit stairway serving floors more than 75 feet above the lowest level of fire department vehicle access shall be a 2-hour fire/smokeproof enclosure and include stair pressurization systems.
3. Stairway Doors: can be locked from stair side (except at discharge level), provided a telephone or other device provides 2-way communication at every 5th floor. Locks must be capable of all being unlocked from a central station (fire command center).
4. Elevators: 2-hour fire/smoke hoistway protection required.
   a. Provide enclosed elevator lobbies
   b. Provide doors/curtains at elevator doors that are rated for smoke/draft control.
   c. Pressurize the hoistway mechanically.

FIRE / SMOKE SEPARATIONS

1. Fire Wall: 3-hour, Independent structure separating existing building and expansion with allowable openings. Defined Imaginary Lot Line.
2. Occupancy Separation Walls: 1- and 2-hour interior occupancy separation walls -OR- non-separated mixed occupancies.
3. Horizontal Assemblies: 2-hour floor assemblies.
4. Vertical Shafts: 2-hour enclosures at Stair, Elevator, and Mechanical shafts.
5. Smoke Barriers: 1-hour fire/smoke barriers separating Smoke Compartments. Minimum two smoke compartments per floor in Healthcare occupancy.
6. Smoke Partitions: 0-hour smoke partitions along Corridor and Suite boundary walls in Healthcare occupancies.
7. Hazardous Areas: 1- and 2-hour interior fire barriers.
8. Atriums/Convenience Openings: 1-hour fire barrier separation from adjacent spaces.

CONCEPTUAL COST NARRATIVE

Estimation of Probable Cost- Conceptual

The Conceptual cost estimating strategy for the new tower is built around a live, department-based cost model developed in close collaboration with the Professional Cost Estimator, Cumming-Group.

This dynamic tool enables real-time decision-making and value tracking throughout the design process.

It is important to note that this Estimate is based on high level programming assumptions only and not a conceptual architectural and engineering design, which will occur in the future. At that time, a new estimate shall be created.

This Conceptual Cost Estimate is comprised of (2) major components: Construction Cost and Indirect Cost. Together, these comprise the total Project Cost.

Construction Cost

The cost to build the structure, including the building itself, all directly enabling projects, site preparation, demolition, and unique project elements such as bridge connections, utility rework, and enhanced façade systems.

Indirect Costs

Or "Soft Costs", include items such as permitting, design fees, furniture, equipment, financing, legal fees, etc. For the purposed of this Conceptual Estimate, Indirect costs are modeled at 40% of the total project cost, which is customary in the industry for a project at this early stage.

As the project develops in future design phases, more accuracy for the Indirect Costs can be achieved by establishing these fees and actual scope of owner furnished equipment and furnishings.

Escalation and Contingency

This model projects escalation at 19.25% through Q1 of 2028 (FY27), with a contingency of 3.5% applied to base construction plus escalation. This is an assumption at this time based on historical observations, as future market conditions cannot be accurately predicted.

This also does not take into account the effect of potential future tariffs, which is also an uncertainty currently. As the project continues into the next phases of design, the Owner and Construction Manager will need to continue to assess the market conditions.

Food Services

OVERVIEW

Food Services at VCUHS are currently provided via various locations on campus including the Food Service Supply Center and Main Kitchen in the Clinical Support Center (CSC), numerous galley's on the Inpatient Units, two Doctor Lounges, a VIP kitchen, and several retail food outlets including Starbucks, Food Carts, the main cafeteria, Chick-fil-a, Subway, Panera and Grab and Go venue. A main kitchen and cafeteria is also included in the Children's Hospital (CHoR).

An assessment of the existing main kitchen determined that it could not accommodate any additional workload associated with Inpatient Tower. The distance to potential locations proposed for the new Tower would also significantly challenge the department to deliver meals at safe food temperatures and within prescribed time/delivery commitments. It was concluded therefore that new food service spaces will be required in the new Tower. The development scenarios/strategies outlined in this narrative are conceptual at this time and only for the purposes of this study. As the project develops into the future phases of design, these development scenarios/strategies and systems will need to be reviewed and updated to align with the actual parameters that are developed.

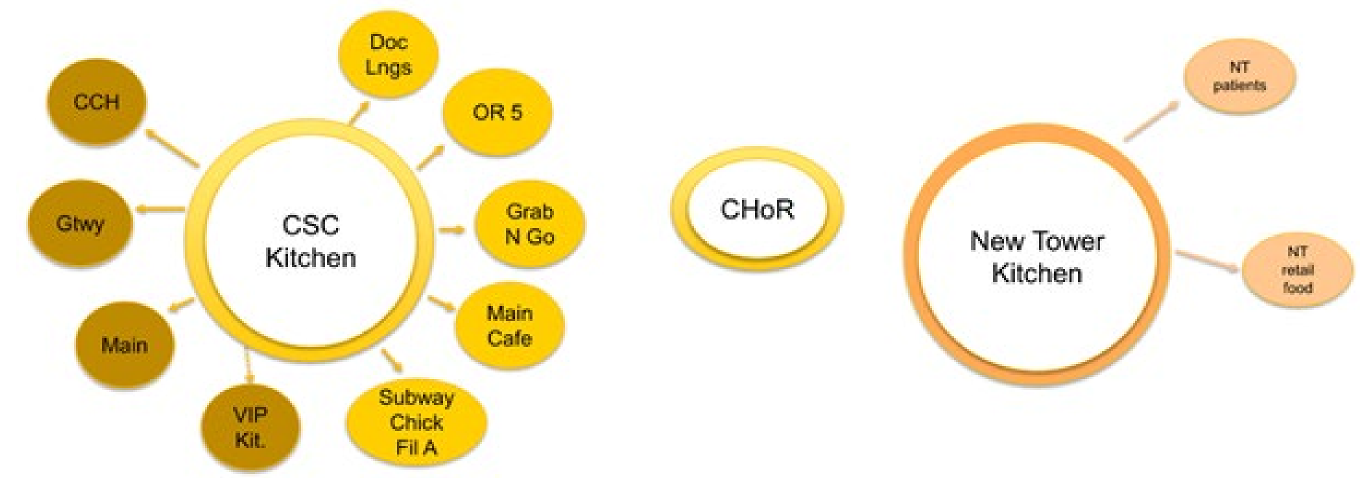
DEVELOPMENT SCENARIOS CONSIDERED

Acknowledging that new kitchen facilities would be required; a study of development options was undertaken to determine the kinds of kitchen(s) needed and whether there was opportunity to leverage the potential construction of a future Off-site Logistics Center (OLC). Illustrated below are four development options considered for the new Tower including:

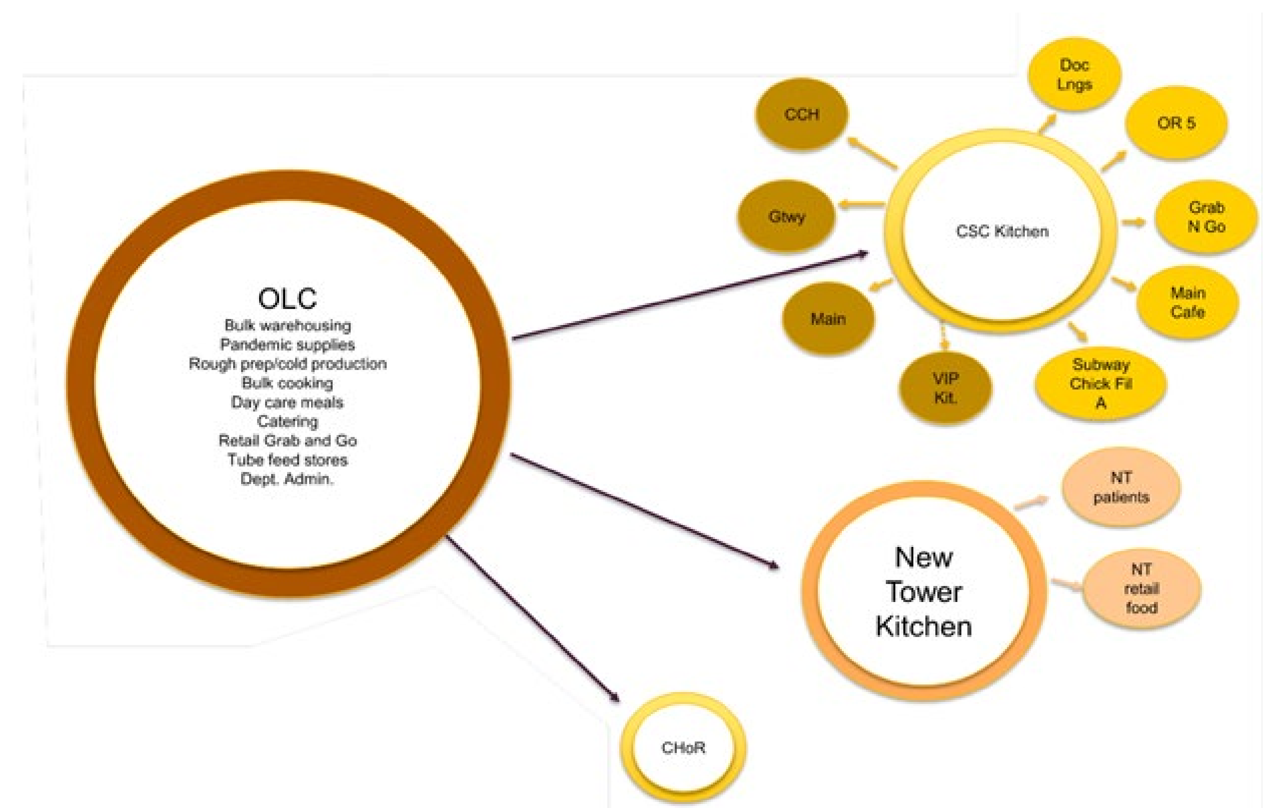
- Scenario A - Continue to operate the existing CSC kitchen with it supporting the patients and retail outlets it does today, along with a new kitchen in the New Towe
- Scenario B - Leverage the construction of an OLC and continue to operate the CSC kitchen, and build a new kitchen in the new Tower. The OLC could also support some warehousing for the CHoR.
  - Pressures in the existing CSC kitchen could be alleviated with the support of an OLC
  - The new kitchen in the new Tower could be built smaller with the support of an OLC

- Scenario C - Leverage the construction of a future OLC. Close the CSC kitchen and build a new larger kitchen in the new Tower to support the entire campus. The OLC could also support some warehousing for the CHoR.
  - The existing CSC kitchen would discontinue
  - The new kitchen in the new Tower could be built smaller with the support of an OLC

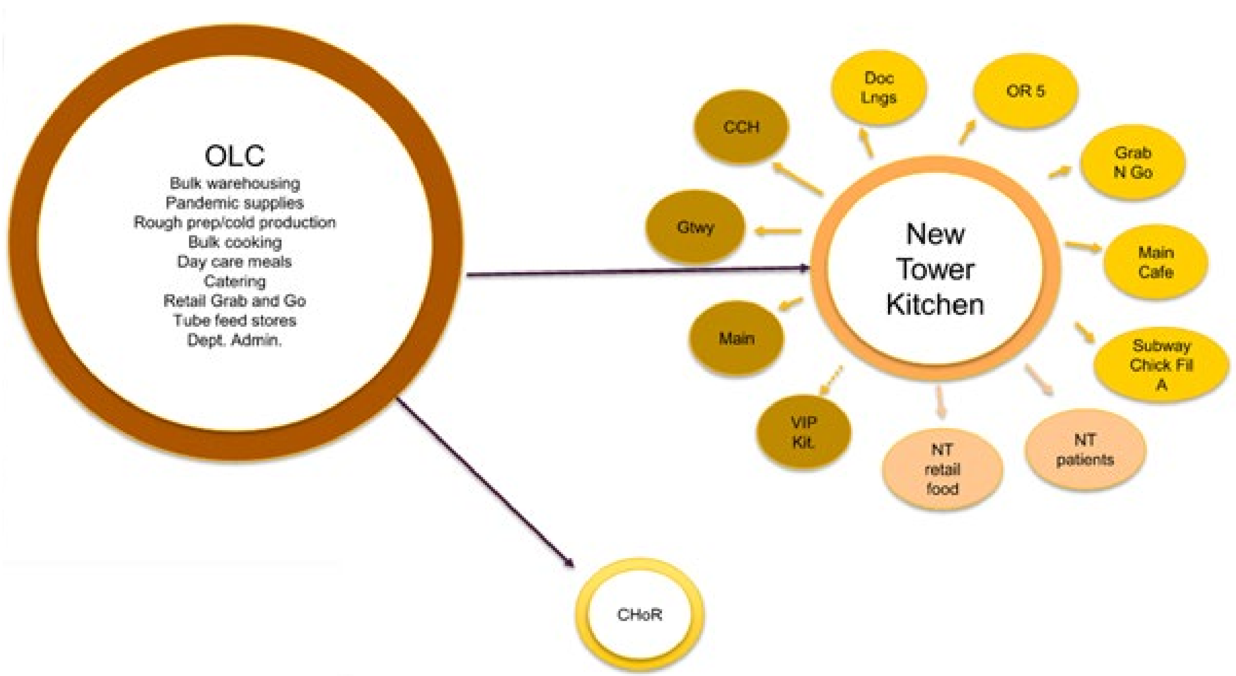
Development Scenario A



Development Scenario B



Development Scenario C



Move Forward Option

Development Scenario A was selected as the move forward option. Construction of an OLC in the future could benefit the campus by decanting either all or some of the workload from the existing CSC kitchen which is aging and re-investment will be required soon. The size and location, as well as the services it would provide will need to be determined in the future.

Description of Services

Food Service in the New Tower will be provided for inpatients, outpatients and retail foodservice customers from the new kitchen and dining facilities.

Kitchen

The kitchen will support the daily meal requirements for the patients in the new Tower. It will be sized to support the initial occupancy of approximately 240 beds plus growth to approximately 500 beds.

The patient meal delivery model will be a hybrid of bedside order entry to set mealtimes (spoken menu) with some on demand service (room service), as currently exists today. It is imperative that convenient access to the service elevators accessing the inpatient units is provided.

Convenient access to the loading docks is required for receipt of incoming goods and for removal of trash/recycling.

Dining Facilities

A new café and dining area will also be provided in the New Tower. The existing main cafeteria will be the primary retail food venue on campus while this new café will offer staff and visitors access to food service in a more convenient location in the New Tower.

The café should be in a high traffic area with excellent circulation from main corridors, the lobby/public spaces and to elevators.

Circulation/ Flow

Kitchen

- Perishable and non-perishable food products will be received at the loading dock and transported to the department's internal department receiving area. Incoming product will be verified, decased and placed into refrigerated, frozen and dry storage rooms within the main kitchen.
- The functional areas will be located to enable a forward flow of food products through the various stages of processing (preparation, bulk cooking, tray assembly, dishwashing).
- Meals will be produced in-house, supplemented with the procurement of selected menu items.
- Meals will be assembled hot, placed in carts and delivered to patient. Carts containing meal trays will exit the kitchen directly to service elevators.
- Once patients are finished their meal, the meal trays will be removed from the bedroom and placed onto a soiled tray collection cart that is held on the unit in either an alcove or soiled utility room. Once the soiled tray collections carts are full they will be transported back to the kitchen and enter directly into the dish room. The dish room will be arranged for a direct flow from soiled to clean. Trash holding space will be provided in the dish room.

Dining

- The retail foodservice venue will be organized with the following three main components:
  - Support space
  - Service area
  - Dining area
- The support space and service area will be immediately adjacent. Similarly, the service area and dining area will be immediately adjacent.
- The service area will be secured from the dining area to allow 24/7 access to the seating while the service area is closed.

Inpatient Units

- Soiled tray collection carts will be held on each inpatient unit in an alcove. Two carts will be positioned in each inpatient unit.

Design Considerations

MEP/General

- A variety of fuel and energy sources will be required for the equipment including natural gas, electricity (in several voltages - 120/208/480), domestic hot/cold water and chilled water supply/return will be required.
- Proper in kitchen safety apparel (hair nets, caps, gowns) at all kitchen entrances will be provided.
- All kitchen areas will require secured access to all major departmental entrances and exits via card access.

Mechanical

- Conditioned velocity supply air as well as ventilation will be provided in all work areas.
- Slight negative pressure will be provided for odor control.
- Commercial cooking exhaust hoods meeting the latest NFPA code will be provided at the kitchen. Variable speed drives that moderate exhaust based on cooking activity will be provided. Fire protection systems interconnected to fuel sources and fire alarm systems will be provided. Capture velocity will be closely evaluated during final designs to ensure proper exhaust capture at each hood system.
- Exhaust will also be required at dishwashers and pot washers. The first 50' of the ducting to these exhaust systems will be stainless steel to prevent corrosion from the chemicals used at this equipment.
- Variable speed exhaust systems will be used to limit energy consumption where required by ASHRAE.
- Building chilled water to be used for heat dissipation at the compressor for the new walk-in cooler.
- Connections to a centralized grease interceptor will be required.
- Filtered water will be required and potentially an RO system.

Security

- Temperature alarms will be provided at each walk-in cooler and freezer. These alarms include a remote contact for interconnection to the buildings automation and security system for the purpose of alarming any malfunction.
- Cameras connected to the building security system(s) will be required at all entrances and exits, main storage areas and point of sale systems within the dining facilities (retail foodservice venues).
- Card access will be provided at all major entrances and exits from kitchen spaces.

Electrical

- At a minimum the lighting, walk-in and reach in refrigerators and freezers, hot beverage equipment and 50% of the cooking will be on the conditional power supply. This will also be required for the Dietary Management Information (IT) Systems which maintain patient diet profiles and for the point-of-sale systems in the retail foodservice venue(s).

Structural

- The walk-in refrigerators and freezers will require depressed floor slabs (9" to 10" deep) to allow for insulation below the finished floor to provide smooth access for carts and staff.
- The back of house kitchen areas will require gradually sloped slab to floor drains for general drainage and to enable mechanically assisted spray washing and chemical sanitation.

Interior Design

- Commercial, heavy duty non-slip flooring which is washable, impervious to food acids and oils and suitable for rolling equipment will be utilized. All corners between walls and floors will be coved.
- Wall finishes in back of house food storage, preparation, cooking and washing areas to be hygienic with the following minimum features:
  - Impact resistant of at least 175lbs using ASTM D5420-21 test.
  - Grout-free
  - Easy to clean
  - HACCP approved
  - USDA compliant
  - Capable of withstanding temperatures of up to 140F
  - Impervious to water
  - Thermoformable on site
  - Include integral corners
  - Compatible with flooring material to ensure a water-resistant joint
  - Installed from top of floor coving to underside of finished ceiling
- Walls in office areas will include glazing for views into the kitchen.
- If a hygienic wall covering is not provided, stainless steel wall panels from finished floor (or coving) to underside of ceiling at cart washing area, dishwashing and pot washing will be provided.
- Stainless steel wall panels from finished floor (or coving) to underside of exhaust hoods behind cooking equipment. If the cooking appliance arrangement is island type, a stainless-steel service wall between the two banks of equipment will be provided. Alternative, retail-oriented wall finishes will be provided behind cooking appliances in retail food spaces where cooking activities are visible to customers.
- Stainless steel enclosure panels or service chases will be provided to conceal plumbing and electrical services to equipment. Provide removable access panels where required.
- Doors to be large enough and with necessary security, automatic openers/holding for daily cart traffic and for delivery of large pieces of equipment.
- High end finishes consistent with retail environments will be provided in the dining facilities (retail foodservice venues).

Hand and Eye Wash Stations

- Hand wash stations will be provided within 18′ of each workstation. They may be shared between workstations. In addition, hand wash stations will be provided at all entrances and exits from the kitchen spaces and in housekeeping rooms. Hand wash stations to include hands-free faucet with either knee operation or electronic eye.
- Eye wash stations will be provided within a 10 second walk or maximum 50′ distance from where exposure to chemicals by staff is possible. At a minimum an eye wash station will be provided at each major functional area (preparation, cooking, dish/pot/cart wash, chemical/janitorial closets)

Equipment

- Commercial, heavy duty food service equipment will be required in all of the Food and Nutrition spaces. Although commercial and heavy duty, the food service equipment in front of house/customer facing areas such as the Retail food space(s) will be higher end with a focus on aesthetics and customer appeal. Whereas the food service equipment in the main kitchen and the support space for the retail food areas will be more robust in nature.
- All equipment will be of the latest technology, meeting requirements for LEED and Energy Star wherever appropriate.
- Dual refrigeration systems comprising of multiple refrigeration parallel racks and evaporator coils will be used inside each of the walk-in refrigerated and frozen storage spaces to provide redundant systems. Similarly, individual refrigeration lines with separate valves will be provided for additional redundancy. Rooms housing refrigeration systems will require refrigerant leak monitoring and exhausting systems.
- Continuous/uninterrupted building chilled water loop system will be used to dissipate heat from refrigeration units for the walk-in coolers and freezers. City water back-up will be required should the chilled water loop system fail.
- Temperature alarms for all refrigerators and freezers networked to a computerized control system will be provided for logging and monitoring internal temperatures of the walk-in cooler and freezers as well as reach-in or roll-in type units.
- Ergonomically friendly equipment will be utilized.
- Front of house/customer facing service counters in the retail food spaces will be constructed on stainless steel skeletons that are clad with retail-oriented fronts and counter tops.

Logistics and Vertical Transportation

INTRODUCTION

- The purpose of this document is to provide a Programming Study Package for a VCUHS Inpatient Bed Tower. Please refer to the Program and Design Narratives within this package.
- The project will consist of diagnostic and treatment spaces, inpatient bed units, and additional shell space for future use. The program is designed to be multi-phased, with the intent for future vertical expansion.
- The strategies outlined in this narrative are conceptual at this time only for the purposes of this study. As the project develops into the future phases of Design, these strategies and systems will need to be reviewed and updated to align with the actual project parameters that are developed.

MATERIALS MANAGEMENT & EVS

Operational Strategy

- The existing campus support will be used and minimally updated, along with the additional support spaces added with the new inpatient tower to support campus operations in the near and medium-term future. VCU Health conducted visioning sessions with   to evaluate the potential of an Off-site Logistics Center (OLC), which is desired to be a long-term goal for the health system. The size, location, occupants, and programming details of an OLC are yet to be determined.

Loading Dock

- The new inpatient tower will include an anticipated 2,200 sq.ft. Loading Dock and Staging area, accessible by traffic via the northeast side of the tower through 13th street. This loading dock is intended to support the new bed tower, as well as existing areas around the campus. The existing loading dock may be used as a separate soiled dock, and/or food delivery dock to support clean and soiled pathway separation.
- Traffic anticipated at the new Loading Dock includes Medical Supply, beds and other equipment drop-off/exchanges, as well as vendors that deliver direct to unit. VCU Health's operational strategy may require this dock to be used additionally for food delivery, waste pick up, and other traffic as necessary. It is highly recommended to not allow small vehicle traffic (those that cannot use a dock bay) to use the dock space, as these should have a designated lot elsewhere to alleviate potential congestion. Common truck types include SU20-40 box trucks, and WB30-50 articulating trailers. Occasionally, vehicles up to size WB65 may be required to deliver to the site.
- **Clean Dock**
  - The new Loading Dock will maintain circulation space at the dock apron substantial enough to allow for WB-65 trucks to enter and exit without waiting for a currently docked truck to move. Bays will have a minimum 12'6" distance from center-to-center, with the ideal distance being 13'6". Loading Dock platforms are typically 48" to bridge elevation gaps between the dock platform and the varying truck bed heights. Hydraulic pit-levelers and overhead doors are planned at each truck bay. Behind each leveler, an 8' clear path should be maintained to allow for two-way operator travel across the dock with MHE. Staging space on the dock itself should be enough for a minimum of approximately six (6) pallets per bay to be held on the dock during the unloading process prior to being brought into the Receiving Staging space. This space does not account for positions that may be occupied for the long term by non-transitory packages, such as old equipment. The Loading Dock will have at least one delivery ramp and one set of stairs for access to/from the Lot, and accessibility for anything requiring a cart, dolly, etc. to/from a vehicle not backed into a bay.

  - Hydraulic Dock Leveler
  - VCU Health has historically used manual or electric pallet jacks for the unload and receiving process, and this is expected to stay the same. If heavier, ride-on equipment is needed in the future, additional spacing may need to be accounted for. The operators use the pallet jacks to unload the trailers onto the Loading Dock stage, then bring the pallets into the Receiving Staging space. The Loading Dock will be immediately adjacent to the Receiving & Distribution space to maximize efficiency and capacity.
  - Secure access to the dock should be maintained, especially during non-operating hours. It is recommended to enforce some sort of secure access between the Dock and internal Receiving space.

- **Soiled Dock**
  - The new Loading Dock will maintain circulation space at the dock apron substantial enough to allow for WB-65 trucks to enter and exit without waiting for a currently docked truck to move. Bays will have a minimum 12'6" distance from center-to-center, with the ideal distance being 13'6".
  - The Soiled Dock will have two basic components: Truck Bays for waste pick up and Trash Bays for compactors and dumpsters. Soiled Docks typically do not need to meet all the same requirements for coverage as Clean Docks do, such as overhead door space. It is recommended to install levelers at each bay a Truck may access. VCU Health may opt to join the Clean and Soiled docks together, to utilize one or more truck bays as "Flex Bays" that can be used to swap Linen or RMW deliveries and pickups to decrease dwell time and preserve dock efficiency.
  - Trash Bays do not need levelers, but may require Cart Tippers. Trash bins used by VCU Health are generally the standard 0.75 cubic yard tipster carts. If the Soiled Dock platform is above grade (typically 48"), the Cart Tippers may not be needed unless preferred. If the compactors are ground loaded, Cart Tippers will be required; there are compactors that have built in cart tippers that may be a desirable option in this scenario. At the trash dock, there will be a cart wash bay to clean out the trash bins.

  - 0.75 cu.yd. tipster cart
  - Cart tipper
  - Trash bins may be staged and stored on the Soiled Dock, or in an internal holding area. If they are held on the dock, staging space should be considered so as not to congest trash operations.

Materials Management Spaces and Operational Methodologies

- **Receiving & Distribution**
  - The Receiving & Distribution space will be immediately adjacent to the Loading Dock to maximize efficiency and capacity. After materials have been unloaded, they will be brought inside to and staged in the area designated to be received.
  - Receiving staging space will be sufficient to hold enough transient pallets to get the Receiving team through the typical day's surge period without halting Unloading operations. The Receiving team will sort through the material deliveries to receive each inbound at their workstations in the priority deemed appropriate by the Receiving Supervisor.
  - Associates at each workstation will have the necessary equipment to check receipts in, including a computer and scanner, and space at their station to set a package (or multiple) down to conduct their necessary audits. VCU Health may opt to add Mobile Workstations into the operation, which may help alleviate space concerns if necessary.
  - Associates will obtain a pallet to be received from the receiving stage, bring it to their station (either behind or next to them) and work through the pallet. Completed receipts will then be taken to the Distribution Staging area and sorted to the destination unit, whether that be a designated Unit, STAT Supply Room, etc. The empty pallet will be brought to the designated empty pallet holding area.
  - The Distribution Staging area should be sized to hold enough transient packages/pallets to get the Distribution team through the typical day's surge period without halting Receiving operations. The Distribution Staging area typically is made up of zones of pallet floor positions on the floor for larger unit deliveries and Wire Rack for smaller unit holding. Adjacent to the Distribution Staging space will be the MHE required to make deliveries such as Pallet Jacks, Flatbed Carts and Hand-trucks/dollies.
  - Additional spaces in the Receiving & Distribution space to account for include:
    i. MHE holding space, ideally split between Receiving and Distribution functions as the two teams will require their MHE at opposite ends of the space
    ii. Receiving supply storage space for paper, document retention, PPE, job tools such as cutters, etc.
    iii. Medium-term holding space for unknown packages or equipment that will inevitably find their way to the dock area
    iv. Lockable storage space for high value or sensitive packages
    v. Parcel drop-off and pick up space for one-off packages being ordered or shipped by employees around campus
    vi. Refrigerated storage space if necessary
    vii. Industrial scale if necessary
    viii. Code Carts may also be stored in this area
  - Not all Loading Dock arrivals may require being passed through the receiving space. Vendor deliveries such as vending machine restocking, office supplies and confidential paper pick ups may all arrive at the dock at some point. Linen deliveries or pickup and EVS Supply deliveries may also arrive at the dock. It is critical to have a pathway outside the receiving space for such arrivals to not add to the traffic and congestion of receiving operations.

- **STAT Supply**
  - VCU Health currently maintains their STAT Supply space, located at the Main Hospital building Level B, to service the existing campus. The new inpatient tower will have its own, similarly sized, STAT supply space to support the tower as well as provide some redundancy to the rest of the campus. The beds in the new inpatient tower are anticipated to be high acuity patients, therefore requiring more supplies per patient than current strategy dictates.
  - Supplies destined for the STAT Supply room will arrive at the loading dock to be systematically received. The Distribution team will bring the supplies directly to STAT Supply's inbound staging space, where the STAT Supply team will check the receipts in and decant the individual items onto shelves to be retrieved on an as-needed basis. STAT Supply will have designated cardboard disposal bins at each workstation and a larger holding area when those bins are full. The cardboard waste will be brought down to the Cardboard Compactor / Baler by the EVS team.
  - Associates at each workstation will have the necessary equipment to check receipts in, including a computer and scanner, and space at their station to set a package (or multiple) down to conduct their necessary audits. Once the material is checked in, associates will utilize carts to stock the items into their designated shelf locations.
  - Inventory Storage will be enough to maintain a minimum of two (2) days on hand for each SKU to be held. VCU Health's Supply Management team may determine that the days on hand requirement may be split between the existing STAT Supply and the new STAT Supply to service their own spaces, or each STAT Supply space should carry full redundancy for the campus (which would be difficult given space constraints), or a blend of the two storage strategies by selecting high priority SKU redundancy.
  - STAT Supply picking operations will require storage space for picking carts, RF units, and storage space for Unit Delivery carts. Unit Delivery cart holding space should be sized to hold the maximum amount of delivery carts "un-nested" to allow for all carts to be prepped at once, as VCU Health's operation is typically busy in the morning and tapers off toward mid-afternoon.

- **Clean Linen**
  - VCU Health's existing Clean Linen space, located at CSC Level 3, is currently undersized for the areas that it serves. The existing Clean Linen room can hold ~60 bulk linen carts, but there are typically 10-15 additional carts kept outside of the room due to capacity constraints. The new inpatient tower will have its own Clean Linen storage space large enough to service its own beds, plus handle minor overflow linen volume requirements from the Main hospital. VCU Health's linen co-op will continue to pick up soiled linen, launder, and restock the linen rooms using bulk carts to top off each space. As of now, there are no plans to move to a full LUM linen model.
  - VCU Health requires one (1) day on hand of clean linen to be kept on site, and the current vendor is located within 10 minutes of campus. Linen storage is mostly bulk carts for bedding, and wire racks for gowns. Scrub storage is not maintained in the Clean Linen room on site.
  - The Clean Linen room will require workstations to check linen in and order more from the vendor and push carts to store and pack gowns. No scales are required in the linen room.

- The current Clean Linen room receives its linen at its own bay at CCH level SB2. The new tower Clean Linen will arrive at the Dock, bypass Materials Receiving, and be brought straight to the Clean Linen room. VCU Health is to determine which dock linen should arrive at for the new inpatient tower. It is recommended to keep the linen deliveries close to the soiled linen pickup location for efficiency, though not completely necessary if this creates a hardship in separating clean and soiled pathways.
- Additional areas to include in the Clean Linen storage area include:
  i. 1 day of supply of scrubs
  ii. 1 day of supply of curtain stock

- **Soiled Linen**
  - VCU Health's existing Soiled Linen space, located at CCH level SB2, is severely undersized. The Soiled Linen holding space should be able to maintain two (2) days on hand. The current linen vendor noted that the existing chute system is not desirable and would like to avoid them in the future. VCU Health is open to exploring an updated chute system for the new inpatient tower.
  - The soiled linen holding room should be located adjacent to the outbound bay it will be picked up at. The soiled linen pick up bay ideally will be situated next to, or be the same as, the clean linen delivery bay so as to maintain efficient swaps.

- **EVS**
  - The existing Environmental Services bulk supply room is located at CSC level B, storing mostly full pallets of materials along with equipment. VCU Health EVS policy is to hold one (1) week of supply in bulk on site and two (2) days of supply in each unit. The new inpatient tower is planned to hold its own EVS supplies. This space will require at least computer workstations and pallet jacks to move materials. It will also be required to store supply delivery carts.
  - VCU Health may be able to leverage existing equipment holding/charging space to service the new inpatient tower, if not, there will be an equipment storage and charging space dedicated for the new tower.
  - Trash compactors and open tops are currently located near the existing receiving dock. This area currently maintains four (4) containers of varying sizes. There is a lockable holding pen for trash bins to be emptied, and a cart wash station/hose bib.
  - The new inpatient tower will require at least one additional compactor and open top container. VCU Health may place these at the new dock and align that space to match current operational strategy, or retrofit the current receiving dock or trash dock to fit the additional capacity.

- **Regulated Medical Waste / Hazardous Waste**
  - Regulated Medical Waste (RMW) refers to waste materials generated during medical or healthcare activities that can cause infection or harm due to their potentially infectious nature. This type of waste requires special handling, treatment, and disposal protocols to protect healthcare workers, the public, and the environment. RMW typically includes sharps, pathological/anatomical waste, microbiological waste, blood and blood products, contaminated PPE, and isolation waste. This waste must be carefully contained and then properly disposed of to avoid infection or spread of disease or bloodborne illness.
  - The existing red bag waste and sharps bins are stored and handled near the current receiving dock. There is an existing rotoclave for processing on site. VCU Health is working through how they will handle RMW in the future. However, the holding area that exists now is undersized, and the new inpatient tower will need its own designated holding space.
  - The RMW holding area will need to account for red bins (empty and full on associated carts), sharps bins, pharmacy waste and a holding area for radioactive decay. VCU Health's current strategy is to have radioactive waste detectors at the entry point of the holding room, which will signal material that needs quarantined. This process will continue in the new space as well. The holding area will be large enough to store two (2) days on hand of RMW until it can be picked up.

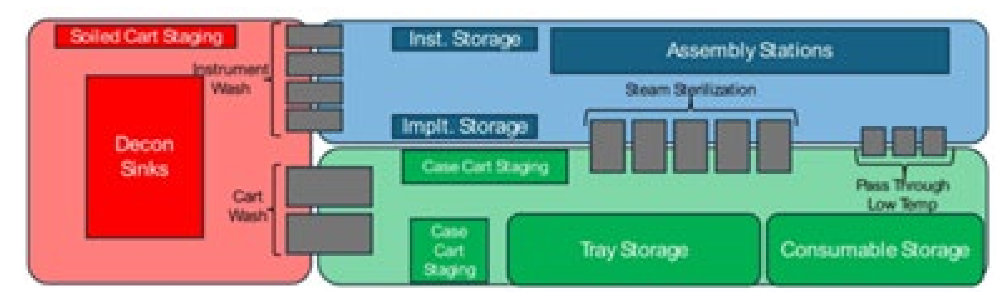
- **Bed Management**
  - Bed Management ownership is split between EVS and BioMed/Clinical Engineering. EVS is responsible for the movement and placement of beds, while BioMed is responsible for storage and maintenance. This strategy is anticipated to continue future state.
  - The new inpatient tower will require its own bed storage space. Bed Stackers are recommended to increase the capacity of the space.
  - Beds will arrive at the dock and be brought directly to the Bed Management space. This space will require ample circulation space to perform maintenance (two (2) bed lifts) and move beds around for storage. There will be workstations, appropriate MHE, and tool cabinets for storage.

- **Clinical Engineering**
  - Clinical Engineering will require general space (non-specialists) for up to 18 people total for the campus. The current space is not quite sufficient, so there will be some presence in the new inpatient tower. Specialist areas such as respiration and dialysis will require a satellite engineering office nearby to store and maintain equipment.

STERILE PROCESSING DEPARTMENT

Sterile Processing and Stores

- Operating Room counts are anticipated to increase by 10, and are assumed to be high acuity specialties. Additionally, 1 procedure room will be built to start with Cath/EP and Radiation Oncology in the future plans.
- The existing SPD, located in CCH Level B, processes between 100-120 cases per day, with Wednesdays being the busiest day of the week typically, and are running close to capacity. The Adult Outpatient Facility (AOP) was built with an SPD shell ready, which can be used to alleviate volume. However, utilizing the AOP will present a significant logistics challenge and is therefore not desirable.
- The new inpatient tower is designed to have a ~12,000 sq.ft. Sterile Processing Department, coupled with a ~3,000 sq. ft. Sterile Storage area to serve the new tower and overflow volume for the rest of the Main campus.
- The Sterile Processing department will include ante rooms for donning PPE, a drop-off staging room for doffing PPE and receiving items from outside the surgery department, a dedicated housekeeping closet, storage for consumable supplies, and a large decontamination area with triple basin sinks and ultrasonic cleaners.
- Case Carts will arrive at the Decontamination room via case cart elevators which connect the SPD to the surgery department, or via the drop off room. Instruments will be processed manually in triple basin sinks and ultrasonic cleaners, loaded on washer manifolds and places in queue for cleaning via cart washer. Carts will be discharged into the case cart holding space in Sterile Stores. Instruments will be passed through to the Clean Work area after going through instrument washer/disinfectors. The Clean Work team inspect, assemble, pack and prepare trays which are then sterilized and passed to the Sterile Stores area.
- Trays enter the instrument storage room and, after cooling, are put away to tray storage carts. When called upon, they are picked and assembled to case carts in a designated area within the Sterile Stores zone with access to case cart holding.



Example 3-Zone Department

VERTICAL TRANSPORTATION

BASIS OF DESIGN

Summary

provided a high-level analysis of the conceptual needs for vertical transportation. The information provided was at a conceptual level for the purposes of this study. The future Design Phase will require an in-depth vertical transportation study to arrive at the appropriate level of detail and actual car counts for the future design, that will take into account future vertical expansion and infill of shell spaces.

Due to the size of the building and quantity of inpatient beds, the design will be best suited by providing multiple elevator cores within the building. This scenario is based on (2) units of 24 beds per floor serving lower logistics levels, main lobby floors, and future landings above. The total combined elevator count estimated at this time may be 26 elevators.

Elevator Analysis & Unit Counts

has evaluated six (6) different elevator groups as follows:

- Public/Visitor Elevators
- Patient Transport Elevators
- Material / Staff Service Elevators
- SPD Elevators
- Kitchen / Cafeteria
- Freight Elevator

Elevator Type	Capacity/Speed	Grouping
Public Inpatient Visitor	5000lb / 700 fpm	6 car group
Inpatient Transport / Trauma	6500lbs & 8000lbs./ 700 fpm	4 car group
Material / Staff / Service Elevators	6500lbs / 700 fpm	2, 6 car groups
SPD Elevators	5000lbs / 500 fpm	2 cars (Simplex Units)
Kitchen / Café Elevator	4500lbs / 200 fpm	1 car (Simplex Unit)
Freight Elevator	10,000lbs / 100 fpm	1 car (Simplex Unit)
Total		**26 Elevators**

ASSUMPTIONS

- Two-way traffic, 15-minute peak period
- Total Travel Distance: approximately 180′ initial phased, and 340′ total estimated future vertical expansion
- 240 currently planned beds
- 576 future beds total
- 1.25 visitors per inpatient bed
- 100% occupancy
- 90% of visitor population is ambulatory
- 10% of the population is in a wheelchair/stroller

DESIGN CRITERIA AND DEFINITIONS

Design Criteria

The efficiency of elevator performance is evaluated by comparison with established standards that relate to anticipated demographic distribution within a facility and traffic demands during peak periods.

Hospital building elevators must be designed to serve separate unique traffic types because of the complexity of the hospital program. The transport of inpatients differs from the transport of ambulatory passengers visiting patients and materials traffic, thus requiring separate and distinct criteria for elevator performance.

The basic criteria used in the design of elevator systems in hospitals must meet the guidelines outlined hereafter.

TRAFFIC TYPES:

Generally, "passenger" and "vehicular" traffic are significant because traffic in these broad categories is best served by elevators of different configuration. Passengers are best served by elevators which are wide and shallow with center opening doors to allow passengers to stand near the doors for expeditious transfer at elevator stops. Vehicular traffic is best served by elevators which are narrow and deep. This shape provides the configuration required to facilitate vehicle loading while allowing room near the entry to accommodate lighter pedestrian staff traffic using these same elevators. The design proposed provides proper passenger and vehicular types.

SEPARATION OF TRAFFIC:

Handling major traffic segments normally starts with separation of pedestrian traffic from that which involves vehicular assist such as beds and carts. Further separation for inpatient and dedicated material traffic is required due to the size and complexity of the building.

PEAK TRAFFIC PERIODS:

Hospital design requires fifteen-minute peak periods for evaluation. This time period is long enough to provide meaningful, measurable information, but not so long as to allow peak activity to be disguised by average activity levels.

ELEVATOR GROUPING:

Grouping elevators rather than providing single units or small groupings at various locations gains the best elevator service. In consolidating elevator service, traffic congestion, infant security and walking distance must be considered.

Horizontal distances up to 150-200 feet are generally acceptable for staff and visitor walking distances. Materials handling elevators are generally allowed greater distances of 250-300 horizontal feet.

VEHICLE MANEUVERING:

Elevator lobby depth is critical in planning for the maneuvering of carts, beds and equipment in and out of elevators. We recommend a 12′-0″ – 14′-0″ deep lobby space to accommodate an appropriate turning radius for beds and large carts and cross traffic where applicable. With elevators configured on the two opposite sides of the lobby, the lobby depth should be a minimum of 14′-0″ since vehicles will be exiting opposing elevators at the same time requiring added room for maneuvering.

Traffic Flow and Separations:

Elevator location, configuration and relationship to traffic flows favor usage recommended for various traffic types shown in Table 1.

Traffic Type	Preferred Elevator Group Use
Visitors	Public
Professional Staff	Public, Patient
Service Staff	Material Service
Dedicated Sterile Material	CPD Clean
Clean Material	Material Service
Soiled Material, Food Waste	Material Service, Dietary
Contaminated Material	Material Service, CPD Soiled
Inpatients / Trauma Patients	Patient, Trauma
Outpatients	Public, Patient
General Material and Equipment	Material Service

Elevator Definitions – Hospital Buildings

In order assist in understanding standards for proper hospital elevatoring, it is helpful to review design terminology so that all those who read this report may reference definition of performance, used to evaluate suitable service. In addition to the above criteria the following were used in developing design recommendations for this report:

AVERAGE INTERVAL (A.I.):

Average interval is the "quality" measure and is defined as the elapsed time in seconds between elevator departures from a terminal floor averaged over a specific time period. Average interval is not a direct measure of how long prospective passengers wait for service. However, it is a value which can be calculated relatively easily and the accuracy of such calculations has been verified by countless tests. Such tests indicate average system response time for service at a typical intermediate floor approximates 65% to 80% of the calculated average interval during heavy incoming traffic periods.

HANDLING CAPACITY (H.C.):

The "quantity" measure of elevator service is called handling capacity. This is defined as the number of persons and/or vehicles which can be transported by the elevator system in a given length of time.
Average interval and handling capacity must be measured or calculated for the same designated time period to be meaningful.

SYSTEM RESPONSE TIMES:

Sometimes called average waiting time, this is a tabulation of the duration of registered hall calls measured over a 15-minute segment in existing buildings. For this all hall calls registered for a group of elevators during a time segment are recorded by measuring the length of time it takes an elevator to answer a hall call after registration. A combined tabulation of all these calls gives an actual group system response or waiting time. A well elevatored hospital should have actual or simulated system response times of about 70-75% of the calculated average interval.

ROUND-TRIP TIME (R.T.T.):

This is the time it takes a loaded elevator car elevator care leaving the loading lobby to transit through the local stops discharging and picking up passengers and/or vehicles in both directions (two-way traffic) and then return to the lobby ready to pick up another load.

PROBABLE STOPS:

Round trip times are established by consideration of the capacity required, the passenger or vehicular load each car must transport during peak activity, and the stops each car will make on a peak round trip. Probable stops are the number of stops we judge a car will make during a typical peak round trip. Probable stops can be determined mathematically by considering the number of persons and/or vehicles in a loaded car and the number of stops possible above the lobby. The consultant must decide if the stops above have equal attraction, have similar populations, include unique activities or facilities, and determine a likely activity pattern for a peak trip. If all activities are not considered, projected performance will not be indicative of "real" activity when the building is operating.

INDIVIDUAL CAR LOAD (I.C.L.):

Car load is the number of ambulatory persons, patients, equipment items, wheelchairs, beds and carts carried on an elevator during the round-trip time calculation. Elevator engineers rate the most commonly used passenger and service elevator sizes as noted in Table 12:

Elevator Size	Maximum Car Load	Hospital Use Car Load (Estimate)
3500 lb.	23 Persons (38.0 ft^2)	12 Persons
4000 lb.	27 Persons (42.2 ft^2)	14 Persons
4500 lb.	30 Persons (46.2 ft^2)	16 Persons
5000 lb.	(50.0 ft^2)	2 Vehicles & 8 Persons OR 1 Bed & 2 Persons
6500 lb.	(61.5 ft^2)	1 Bed & 8 Persons
8000 lb.	(72.8 ft^2)	Trauma Team & Bed
9000 lb.	(80.5 ft^2)	Trauma Team & Bed

Parking & Traffic

The proposed scenario for the tower does not include any additional parking. Instead, a bridge may be built to span across Duval Street Connector to provide direct access to the D Deck from N 12th Street and a portion on the D Deck would be permanently repurposed for visitor parking. The connection would be for both entering and exiting traffic, which would reduce circulation of exiting traffic that may need to pick-up or drop-off at the front of the building.

We understand that visitor parking is vital to hospital operations, therefore it is important that enough spaces at the D Deck are reserved for visitor parking.

There are currently 8,680 spaces on campus, the proposed project would replace the existing visitor deck, leaving 7,167 spaces total. Of those 7,167 spaces, 1,930 of them are current for visitors and patients (at CHORP and AOP). The initial phase of the project would create a demand of 212 spaces, bringing the total demand for patient/visitor parking for the campus to 2,296. Therefore, it is recommended that at least 578 spaces in D Deck be reserved for patients/visitors.

Program Type	Program	Parking Ratio	Parking Demand	Employee Allocation	Patient/Visitor Allocation
Current Program	N/A	N/A	6,561 Spaces	4,265 Spaces	2,296 Spaces
Diamond Reduction Program, Phase 1 - Beds	240 beds	2/Bed	480 Spaces	312 Spaces	168 Spaces
Diamond Reduction Program, Phase 1 - Other Services	190,691 SF	1.51/1,000 SF [2]	126 Spaces	82 Spaces	44 Spaces
Total Parking Demand			**7,167 Spaces**	**4,659 Spaces**	**2,508 Spaces**

Parking Demand	Parking Inventory	Parking Surplus/Deficit	Occupancy %
7,167	7,781	614	92%

With the full future build out, the demand for patient/visitor parking would be 547 spaces, with a total demand of 2,843 spaces for patients/visitors. Therefore, it is recommended that at least 913 spaces in D Deck be reserved for patients/visitors.

The total demand for parking for the full future buildout is 8,126 spaces, which is greater than the current supply by 345 spaces. It is recommended that either a new centrally located patient/visitor parking structure be constructed and the spaces in the D Deck be reclaimed for staff parking, or an additional offsite staff parking deck be constructed.

Program Type	Program	Parking Ratio	Parking Demand	Employee Allocation	Patient/Visitor Allocation
Current Program	N/A	N/A	6,561 Spaces	4,265 Spaces	2,296 Spaces
Diamond Reduction Program, Phase 1 - Beds	240 beds	2/Bed	480 Spaces	312 Spaces	168 Spaces
Diamond Reduction Program, Phase 1 - Other Services	190,691 SF	1.51/1,000 SF [2]	126 Spaces	82 Spaces	44 Spaces
Diamond Reduction Program, Phase 2 - Beds	336 beds	2/Bed	672 Spaces	437 Spaces	235 Spaces
Diamond Reduction Program, Phase 2 - Other Services	112,039 SF	2.56/1,000 SF [2]	287 Spaces	187 Spaces	100 Spaces
Total Parking Demand			**8,126 Spaces**	**5,283 Spaces**	**2,843 Spaces**

Parking Demand	Parking Inventory	Parking Surplus/Deficit	Occupancy %
8,126	7,781	(345)	104%

The initial buildout is expected to bring 5,357 additional trips to the campus, with 430 happening in the AM Peak Hour and 406 of them happening in the PM Peak Hour. Not all of those trips will be to the site, as it includes staff who will primarily park off site. The full buildout will bring 7,500 trips to the campus, with 601 trips in the AM Peak Hour and 568 in the PM Peak Hour; again, not all of those will be to the site, but instead will be distributed to different parking locations across the campus.

To encourage patients/visitors to access the site from Leigh Street and not to cut through the campus, it is recommended that a traffic signal be installed at the intersection of Leigh Street at 12th Street.

Understanding that the site is constrained, and that there are multiple different services that need to access the site, the site should try to keep the access types (self-park, valet, emergency, and ambulances) separated as much as possible while keeping the driveways as far away from the intersection with Leigh Street as possible.

Engineering

The purpose of this document is to provide a Programming Study Package for a VCUHS Inpatient Bed Tower. Please refer to the Program and Design Narratives within this package. The project will consist of diagnostic and treatment spaces and inpatient bed units, along with shell space. The program is designed to be multi-phased, with the intent for future vertical expansion.

The central utility plant (CUP) is envisioned to be a separate building, on the other side of Leigh Street. The CUP will be a multi-story building of approximately 73,500 square feet in size. Equipment for the first phase of the Bed Tower will be added to the CUP as a part of this project.

During the course of this engagement, other alternative siting options for the building were studied. For informational purposes, studies and findings for those alternatives are included in the Appendix section of this package.

The strategies outlined in this narrative are conceptual at this time only for the purposes of this study. As the project develops into the future phases of Design, these strategies and systems will need to be reviewed and updated to align with the actual project parameters that are developed.

EXISTING CONDITIONS

STEAM

- The proposed tower site south of Leigh St. is bisected by an existing 14" High Pressure Steam (HPS) and 10" Pumped Condensate Return (PCR) which connect the main health center campus to the VCU steam plant. These HPS and PCR lines originate under the Leigh St. Bridge and travel above ground, between the 13th St. Visitor Parking Deck and the Health Sciences Library (HSL) and enter the basement level of the Critical Care Hospital (CCH). There is a 6" HPS and 4" PCR which connects to the main lines just outside of the CCH at Clay St. These lines are the origin of the "A-Line" steam service. Buildings connected to the A-Line include:
  a. Richmond Academy of Medicine (RAM)
  b. Health Sciences Library (HSL)
  c. Straus Research Lab (Currently Unoccupied)
  d. Health Sciences Research Lab
  e. Lyons Dental Building
  f. Dental Building 1
  g. Perkinson Building
  h. Alumni House
  i. Grant House
  j. Leigh House
  k. White House of the Confederacy
  l. Trauma Administrative Building (Previously Museum of the Confederacy)
- The A-Line piping is installed above ground from CCH to RAM where it is then installed below ground, around RAM, and enters HSL. A-Line piping travels through two tunnels. Tunnel X connects RAM and the White House of the Confederacy under Clay St. Tunnel M connects HSL to Health Sciences Research Hall under N 12th St. Steam piping crossing N 11th St. is buried under ground.
- The proposed site for the new central utility plant serving the new tower is north of Leigh St., between the Sadie Health building and Duval Street. There is an existing 12" HPS and 4" PCR routed above ground across this area. This steam piping is the N-Line and originates under the Leigh St. bridge, travels up along Duval St. and serves the following buildings:
  a. N-Deck Parking
  b. Larrick Gym (To be replaced by the new School of Dentistry)
  c. Larrick Center (To be replaced by the new School of Dentistry)
  d. Biotech #1
  e. College of Health Professions
  f. Adult Outpatient Facility

CHILLED WATER

- The Health Sciences Library (HSL) currently includes a chilled water plant in the sub-basement. This chilled water plant includes two centrifugal chillers, primary pumps, secondary pumps, condenser water pumps and cooling towers. The cooling towers are in the green space bounded by RAM, HSL, Visitor Parking Deck and Clay Street. The chiller plant includes one (1) 450 ton chiller and one (1) 960 ton chiller. Both chillers have recently been refurbished and are in excellent condition. These chillers provide chilled water to HSL, RAM, Strauss (unoccupied) as well as the Health Sciences Research Hall, Dental Building 1, Lyons Dental Building and the Perkinson Building via 12" chilled water supply and return lines which cross under 12th St. in Tunnel M.
- The RAM building currently uses chilled water for cooling through a network of 4-pipe chilled water fan coil units. There is no chilled water infrastructure inside of the RAM building, it is entirely supported by HSL.

FIRE PROTECTION

- One common fire water main is serving the Health Sciences Library and Richmond Academy Medicine

DOMESTIC COLD WATER

- One common city water main is serving the Health Sciences Library and Richmond Academy Medicine

DOMESTIC HOT WATER

- The Health Science Library building is housing domestic water heaters that serve multiple buildings including the Health Sciences Research Hall.
- Richmond Academy of Medicine has its own electric domestic water heater.

SANITARY

- Each building is served by individual building drains connected to the city sewer system.

POWER

- The Health Sciences Library (HSL) and Strauss Research Library are served by Dominion Electric and will have all electric services demolished. Coordinate with Dominion Energy to disconnect service as required.
- The Health Sciences Library service is located in the sub-basement and is fed by 10-4" conduits routed through a cable vault and below grade to the Dominion Energy transformer.
- The Strauss Research Library service is located in the basement and terminates in a Main Distribution Panelboard.
- The Richmond Academy of Medicine building is served by Dominion Energy with a 400A electric service that shall remain. This service appears to be 240V delta from the street and transforms within the structure to 120/208V, 3phase, 4wire via 112.5KVA dry type transformer.

TELECOMMUNICATION SYSTEMS

- All telecommunication systems found serving the RAM building, all other active buildings and buildings to be demolished, must first be inspected and verified by facility staff to ensure they are approved for demolition from source to destination. Existing cabling shall be protected in place from demolition until VCUHS staff can verify the cabling is not used (abandoned in place), or that the system functions have been refed from alternate sources.

Enabling Projects

STEAM

- Enabling work/projects will be required to establish a new path for the main steam line bisecting the project site. Shut down and crossover to the new pipe system will affect all buildings served by the VCU steam plant south of Leigh St., including but not limited to, Main Hospital and all adjacent buildings, Children's Tower, VDOT buildings and Capitol buildings. Additional enabling work is required to reroute A-Line service to Tunnel M serving buildings west of Clay Street as well as establishing a new connection to serve the RAM building.

- Enabling work/projects will be required to establish a new path for N-Line which will create space on the site for the construction of the new CUP building. This work will cause shutdowns and disruptions to steam services on N-Line which can be minimized but not avoided. The combination of the proposed CUP site, the proposed tower site and their combined adjacency to the steam infrastructure below the Leigh St. bridge will impact steam supply to all 52 buildings served by the VCU steam plant. Enabling work will be critically important to prepare the site for new construction and limit the impact on existing buildings.

CHILLED WATER

- The proposed demolition of the HSL building will leave the remaining buildings which are served by the chilled water plant without cooling. Enabling work/projects will be required to establish a new chilled water supply to the RAM, Health Sciences Research Hall and all three dental buildings. A new chilled water plant serving the HSRH and dental buildings will be required. The location of the new chilled water plant should be coordinated with the dental school master plan for future demolition and construction project requirements. It may be possible to install new chillers on an existing roof west of 12th St. and feed chilled water to the remaining RAM building via Tunnel M. If it is preferred to maintain RAM as a stand-alone chilled water system, a separate air cooled chiller will be required adjacent to the building in the remaining green space between RAM and CCH.

FIRE PROTECTION

- Enabling work HSL demolition will require a new fire city main water connection and associated meter/backflow preventer, FDC to serve the remaining RAM building. Exact scope and solution to be defined in the next design phase.

DOMESTIC COLD WATER

- Enabling work HSL demolition will require the installation of a new city water main connection and associated meter/backflow preventer to serve the remaining RAM building. Exact scope and solution to be defined in the next design phase.

DOMESTIC HOT WATER

- Enabling work for HSL demolition will require the installation of new water heaters inside of the HSRH mechanical room to support the hot water needs for the building.

FUTURE GROWTH

- The Central Utility Plant was designed with MEP infrastructure to accommodate future construction phases, including the infill of Phase 1 stilted floors, shelled spaces, and Phase 2 vertical expansion. This includes space for additional chillers/cooling towers, boilers, pumps and associated support equipment.

- In the future, if additional buildings are to be added to the site, the ability to handle these facilities from the CUP will be analyzed, however, additional capacity beyond the completed Bed Tower is not part of this conceptual design.

SYSTEM REDUNDANCIES

- **Cooling Systems:**
  a. The chilled water system will have three 1,500-ton high efficiency chillers added to be used as base load machines. Cooling towers are envisioned to also be added to serve these chillers. The chilled water system will be designed for N+1 redundancy.

- **Heating Systems:** N+1
- **Pumping Systems:** N+1
  a. Heating Water
  b. Chilled water
  c. Condenser Water
  d. Domestic Water

- **Medical Gas Systems:** N+1
- **Normal Power Systems:**
  a. New dual utility services from Dominion Energy 34.5KV grids.
  b. Main-Tie-Main arrangement at unit substations located in both the CUP and Bed Tower.

- **Emergency Power Systems:**
  a. Diesel generation at the CUP as well as the addition of two new generators in the existing generator plant to maximize capacity for emergency power at the new tower.
  b. Main-Tie-Main arrangement at unit stations located in both the CUP and Bed Tower

APPLICABLE CODES, GUIDELINES AND STANDARDS

- The MEP systems have been considered in accordance with the following codes, guidelines, and standards per the adopted codes as of the date of the issuance of this narrative. The next phases of design will need to comply with all applicable codes in effect at that time.
  a. Virginia Construction Code 2021
  b. Virginia Mechanical Code 2021
  c. Virginia Plumbing Code 2021
  d. Virginia Statewide Fire Prevention Code 2021
  e. Virginia Energy Conservation Code 2021
  f. National Electrical Code 2020
  g. FGI 2022 Edition
  h. ASHRAE Standard 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings
  i. ASHRAE Standard 62-2019 Ventilation for Acceptable Indoor Air Quality
  j. ASHRAE Standard 15-2019 Safety Standard for Refrigeration Systems
  k. ASHRAE Standard 170-2021 Ventilation of Healthcare Facilities
  l. National Fire Protection Association (NFPA) guidelines and standards including but not limited to the following:
    i. NFPA 13 – Installation of Sprinkler Systems
    ii. NFPA 14 – Installation of Standpipe and Hose Systems
    iii. NFPA-20 –Installation of Stationary Pumps and Fire Protection
    iv. NFPA 72 – National Fire Alarm Code
    v. NFPA 90A – Standard for the Installation of Air conditioning and Ventilating Systems.
    vi. NFPA-99 – Standard for Health Care Facilities
    vii. NFPA 101 – Life Safety Code
    viii.NFPA 110 – Standard for Emergency and Stand-by Power Systems

BUILDING MEP SPACE REQUIREMENTS

- Mechanical and Electrical spaces are envisioned to be provided inside the bed tower for the required equipment. The grouping of equipment will allow for common equipment access and maintenance.

- Mechanical floors within the Bed Tower (or penthouse in future vertical expansion) will house air handling units, domestic hot water exchangers, RO/DI systems, domestic booster pump, fire pump, medical gas source equipment, electrical substations and distribution equipment, uninterruptible power supplies, etc. The initial phase of construction will include a mechanical floor on Levels 1 and 2. This double height floor will serve levels above and below in the first phase. A fire pump room will also be provided.
- Separate duct shafts and branch electrical rooms are in multiple locations on each floor of the Bed Tower.

SEISMIC CRITERIA

- Based on the most recent Geotechnical Report, the Bed Tower is anticipated to fall under seismic classifications as follows:
  a. Bed Tower: Site Class C
  b. Site Importance Factor: 1.5
  c. Seismic Design Category C

- These should be verified with a current Geotechnical Report during the project design.

ENERGY CRITERIA

- The Bed Tower will be designed to maintain an energy use intensity (EUI) target between 150-200 kBTU/SF/year.

- The project as a whole will be designed to achieve a LEED Silver certification.

Mechanical Systems

CLIMATIC DESIGN CONDITIONS

- Summer
  a. Dry-Bulb Temperature = 94.9 °F
  b. Wet-Bulb Temperature = 75.5 °F
  c. CT Web-Bulb Temperature = 78.4 °F
- Winter:
  a. Dry-Bulb Temperature = 17.4 °F
- Building Envelope (Climate Zone 4A per VECC): Minimum values are as follows.
  a. Wall: R-13 + R-7.5 continuous.
  b. Roof: R-30, continuous.
  c. Glass: Fixed Fenestration: U value = 0.36 Btu/hr/ft2/°F; SHCG = 0.36

NOISE CRITERIA

- Target NC levels are envisioned to be based on FGI and ASHRAE recommendations. Equipment selections, duct design, and sound attenuation equipment will be provided based on standard design practice. Except air units serving Operating Rooms, no specific sound attenuation products are required.
- Cooling tower and generator noise criteria will be evaluated during design to be within the acceptable range for the neighborhood noise criteria. Cooling tower adjacency to the Sadie Hall Garden will be evaluated with sound mitigation measures, i.e. low sound fans, applied as required.

OCCUPANCY

- The occupancy heat rejection will be based on 2021 ASHRAE Handbook of Fundamentals, Chapter 29 for moderately active office work or:
  a. Sensible = 250 Btuh/person
  b. iLatent = 200 Btuh/person
- The number of occupants in each space will be based on the actual occupant density listed in the facility program.
- Occupancy Schedule - The mechanical systems are envisioned to be designed to operate 24 hours per day, 365 days per year.

INDOOR DESIGN CONDITIONS

All design conditions below are based on ASHRAE 170-2017 unless noted otherwise.

- **Patient Room**

Temperature (°F DB)	70-75
Relative Humidity (%)	Max 60
Air Change Rate Per hour	6

- **Intensive Care Unit (PICU, TICU, CICU) Special Requirements**:

Temperature (°F DB)	70-75
Relative Humidity (%)	30- 60
Air Change Rate Per hour	6
Pressurization	Positive to corridor
Special Requirements:	Humidistats should be located at the nurse stations. Humidity set point control should be through the central workstation. Humidification is from the central air handling unit which serves multiple areas. Indicating humidistats are required in each room.

- **Intensive Care Unit (ICU)**

Temperature (°F DB)	70-75
Relative Humidity (%)	30- 60
Air Change Rate Per hour	6
Pressurization	Positive to corridor
Special Requirements:	Humidistats should be in the ICU. Humidity set point control should be through the central workstation. Humidification is from the central air handling unit which serves multiple areas. Indicating humidistats are required in each room.

- **Cardiac Step-Down Unit (CSU)**

Temperature (°F DB)	70-75
Relative Humidity (%)	Max 60
Air Change Rate Per hour	6

- **GPC Medical-Surgical Unit**

Temperature (°F DB)	70-75
Relative Humidity (%)	Max 60
Air Change Rate Per hour	6

- **Airborne Infection Isolation Room (AII)**

Temperature (°F DB)	70-75
Relative Humidity (%)	30- 60
Air Change Rate Per hour	12
Pressurization	0.01" wg negative
Special Requirements:	Supply and exhaust air valves are used in pairs to keep room air quantity set points consistent irrespective of patient door position.

- **Protective Environment Room (PE)**

Temperature (°F DB)	70-75
Relative Humidity (%)	30- 60
Air Change Rate Per hour	12
Pressurization	0.01" wg positive
Special Requirements:	Supply and exhaust air valves are used in pairs to keep room air quantity set points consistent irrespective of patient door position. Local HEPA filtration to be provided.

- **Hematology/Oncology Unit (Hem/Onc)**

Temperature (°F DB)	70-75
Relative Humidity (%)	Max 60
Air Change Rate Per hour	12
Pressurization	0.01" wg positive

- **Blood and Marrow Transplant Unit (BMT)**

Temperature (°F DB)	70-75
Relative Humidity (%)	Max 60
Air Change Rate Per hour	12
Pressurization	0.01" wg positive
Special Requirements:	Supply and exhaust air valves are used in pairs to keep room air quantity set points consistent irrespective of patient door position.

- **Transplant Step-Down Unit (TSU)**

Temperature (°F DB)	70-75
Relative Humidity (%)	Max 60
Air Change Rate Per hour	6

- **Dialysis Unit**

Temperature (°F DB)	70-75
Relative Humidity (%)	Max 60
Air Change Rate Per hour	6

- **Surgery – Operating Rooms (Main, Day and CVOR)**

Temperature (°F DB)	62
Relative Humidity (%)	30- 60
Air Change Rate Per hour	20-25
Pressurization	0.01" wg positive
Special Requirements:	Humidity sensors should be in each return duct leaving the space. A humidity display will be located near the thermostat to display space relative humidity. Humidity set point should be controlled by room humidistat. Duct mounted trim humidifiers are envisioned to provide humidification to each room. HEPA Filtered air will be supplied to the operating table. Return air grilles will be mounted low on the wall.

- **Pre-Op**

Temperature (°F DB)	70-75
Relative Humidity (%)	30- 60
Air Change Rate Per hour	6
Pressurization	0.01" wg positive
Special Requirements:	Humidistats should be located at the main nurse station. Humidity set point control should be through the central workstation. Humidification is from the central air handling unit which serves multiple areas. Indicating humidistats are required in each room.

- **PACU**

Temperature (°F DB)	70-75
Relative Humidity (%)	30- 60
Air Change Rate Per hour	6
Pressurization	Humidistats should be located at the main nurse station.
Special Requirements:	Humidity set point control should be through the central workstation. Humidification is from the central air handling unit which serves multiple areas. Indicating humidistats are required in each room.

- **Cath/EP**

Temperature (°F DB)	66
Relative Humidity (%)	40- 60
Air Change Rate Per hour	20-25
Pressurization	0.01" wg positive
Special Requirements:	Humidity sensors should be in each return duct leaving the space. A humidistat will be located near the thermost at to display space relative humidity. Humidity set point should be controlled by room humidistat. Duct mounted trim humidifiers are envisioned to provide humidification to each room. HEPA Filtered air will be supplied to the operating table. Return air grilles will be mounted low on the wall.

- **Special Procedures**

Temperature (°F DB)	70-75
Relative Humidity (%)	20- 60
Air Change Rate Per hour	15
Pressurization	0.01" wg positive

- **Pharmacy**

Regulatory Requirements	USP: United States Pharmacopeia ISO: International Standards Organization
Temperature (°F DB)	68 Max
Relative Humidity (%)	30- 60
Air Change Rate Per hour	General non-compounding areas 4 (min) Compounding areas and ante rooms should have air quantities to achieve ISO Class 7. Minimum 30 ACH. Non-compounding and sterile work areas should have air quantities to achieve ISO Class 8
Pressurization	Hazardous Sterile Compounding – Negative per USP 800 Ante Room – Positive per USP797 Non-Hazardous Sterile Compounding – Positive per USP797 Sterile work areas – Positive per USP797
Special Requirements:	Compounding areas and similar spaces should comply with USP 797/800 Compounding areas should have air quantities to achieve ISO Class 7. Class B2 biosafety cabinets with thimble connected exhaust duct serving hazardous compounding areas should be served by special exhaust with dual fans and HEPA filters with bag-in/bag-out capability. Laminar flow, HEPA supply air devices are envisioned to be employed as required by UPS797/800 Temperature in the compounding suite will be 68 deg F max.

- **Resuscitation Room**

Temperature (°F DB)	70-75
Relative Humidity (%)	30- 60
Air Change Rate Per hour	15
Pressurization	Positive to corridor
Special Requirements:	Humidity sensors should be in each return duct leaving the space. A humidistat should be located near the thermostat to display space relative humidity. Humidity set point control should be through the central workstation. Humidity is from the central air handling unit which serves multiple areas. Indicating humidistats are required in each room.

- **Electrical & Telecomm Rooms**

Temperature (°F DB)	68-85

- **Mechanical Equipment Rooms**

Temperature (°F DB)	69-85

- **PCS and PTS Rooms**

Temperature (°F DB)	70-85

CHILLED WATER SYSTEM

- The Chilled water systems are envisioned to be generated in the CUP. The chilled water system will have three-1,500-ton high efficiency chillers (n+1). Cooling towers, three-1,500-ton, will be added to serve the chillers. The chilled and condenser water systems are envisioned to be connected to a header which will be sized to accommodate the addition of two more 1,500 ton chillers and cooling towers in the future.

- Heat Pump chillers that would reside within the CUP will be evaluated for a Return on Investment so VCUHS can determine if they will be included.

- Chilled water secondary distribution pumps are envisioned to be in the CUP and piped to the Bed Tower with new distribution installed under the Leigh St. bridge.

- The chilled water system is intended to serve all the air handling units in the mechanical spaces on the floor (TBD) or mechanical floor on Level 1 & 2 with capped valves for vertical expansion to a future penthouse.

- The chilled water system is intended to serve all the fan and coil units serving ancillary spaces including main electrical rooms and substation rooms.

- A tap will be provided at each floor for future connection and the riser will be extended up to the top floor.

- Special Chilled Water Systems
  - A chilled water system consisting of a three-way mixing valve and circulating pumps are envisioned to serve the condensers for dietary coolers and freezers.
  - The chilled water system will provide cooling for radiology equipment using heat exchangers and a separate piping loop. Imaging loop temperature is intended to be adjustable and coordinated with imaging vendors.

STEAM SYSTEM

- The steam will be generated on the mechanical floor on Level 1 & 2 and is limited in scope to sterilization and humidification process needs. No steam or condensate return connection to the VCU Steam Plant is anticipated.

- The steam piping will be Schedule 40 black steel and condensate return piping and fittings to be American manufactured Schedule 80 black steel pipe and fittings.

- Steam header that resides in the building to be oversized to accommodate surge load during times of high instantaneous use.

HEATING WATER SYSTEM

- Heating water systems are envisioned to be comprised of electric boilers located in the CUP.

- The heating water system will serve the preheat coil in the Air Handlers, reheat air terminal box needs, and the source of heat for the domestic heating water (via heating water to hot water instantaneous heat exchangers).

- The heating water pumping system will be variable flow. Secondary Pumps serving the Bed Tower will be in the CUP. Individual boilers are envisioned to include constant flow primary pumps to maintain the required minimum flow through the boiler.

O.R. SUB COOLING

- Air handling units serving the OR's are envisioned to have a Type III desiccant wheel, preheat and two cooling coils that will lower the dewpoint of the air supplied to the OR's to allow for 62° F at 50% RH OR rooms.

AIR HANDLING SYSTEMS

- System Description: Pre-treated outside air will be provided for all air systems serving the patient towers and diagnostic treatment areas (except for the AHU's serving OR's. The pre-treatment system may include an energy recovery system exchanging heat between the exhaust air stream and the outside air. The air units for the Bed Tower will be located on level 1&2, the mechanical floor. AHU location will allow for the cooling coil condensate to be collected under level 1. Cooling coil condensates are envisioned to be collected by hub drains adjacent to the AHUs and routed to a receiver located in the lower level and pumped to the CUP via a duplex pump arrangement with each pump sized for 50% of full flow. Recovered condensate is envisioned to be utilized as makeup for the cooling towers or irrigation systems.
  - Supply Air Systems
    - i. Each air handler is envisioned to include a fan array return fan, mixing box, pre-filters, heating coils, humidifier, cooling coils, fan array supply fans, and final filters.
    - ii. Supply air fan systems are envisioned to be variable volume with variable frequency drives on each fan motor. Supply air volume will be controlled by modulating the supply VFD in response to a duct static pressure sensor located near the end of the system. Control sequence is envisioned to include static reset based on VAV damper positions.
    - iii. Discharge air temperature control will be through modulating 2-way cooling coil control valve.
    - iv. Terminal units are envisioned to be single duct variable air volume units with double wall construction and integral hot water reheat coils. Terminal unit hot water valve is envisioned to be controlled by a terminal box discharge air temperature sensor with reset from the wall mounted room thermostat.
    - v. Systems are envisioned to be custom/semi-custom fabricated, single duct, variable air volume design, providing cooling, and additional humidification to the spaces as required. Systems are envisioned to operate continuously, year-round.
    - vi. Humidification control will maintain a minimum supply air relative humidity, reset based on average return air relative humidity measured in bulk return air stream.
  - Return Air Systems
    - i. Each air handling unit is envisioned to be furnished with fully ducted return air system with return fans.
    - ii. Return fans are envisioned to be of the fan array type.
    - iii. On air handling systems serving multiple floors an airflow measuring station and a motorized control damper is envisioned to be furnished at main tap for each floor to control floor pressurization.

- AHU Components
  - Air handling unit coils
    - i. Cooling coils are envisioned to be sized at a supply water temperature of 42°F with a 15°F temperature rise. All cooling coils are envisioned to have UV lights.
    - ii. Heating coils are envisioned to be sized at a supply water temperature of 130°F with a 30°F temperature fall for 100°F return water temperature.
    - iii. Hydronic coils are envisioned to utilize a modulating 2-way control valve at the header to the coil bank. Each coil is envisioned to have an isolation and flow fitting assembly.
    - iv. Air velocities through all coils should be limited to 500 FPM.
  - Fans
    - i. Air handling units are envisioned to employ fan array technology. Each fan array is envisioned to be capable of losing one fan and still deliver scheduled air quantities at required static pressure. Units should utilize individual VFD for each fan in the array. Please note this technology is not limited to one manufacturer.

- Filtration
  i. All ratings are based on ASHRAE Standard 52.2-2017.
  ii. Prefilters: MERV 8.
  iii. Final filters: MERV 14 for all units except surgery and imaging air units which will be MERV 17.

- Humidification
  i. High pressure atomization type distribution is envisioned to be used.

- AHU Casing
  i. Interior units are envisioned to have an insulation value of R-8 except surgery air units which will be R-12.

- Sound Attenuation
  i. Perforated panels at intake sections, fan sections, and discharge sections should be used for sound attenuation. A mylar, or equivalent barrier, would keep all fibers from the air stream.

- OR pressurization and airflow will be controlled via supply air and return air terminals variable air volume valves

- VAV Terminal Unit Quantities
  - Treatment and Diagnostics Area = 600 Square Feet per VAV Terminal Box
  - Patient Floor = 450 Square Feet per VAV Terminal Box

SUPPLY SYSTEMS

- This system is envisioned to be medium pressure duct with terminal boxes to control air quantities delivered to each zone. Manual balance dampers are envisioned to be used at low pressure taps to balance flow.

- Ductwork will be constructed in accordance with SMACNA Standards for 4" w.g. pressure class. Ductwork from air handler to smoke damper in shaft walls including risers are envisioned to be constructed to 6" w.g. pressure class.

- Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 1% of the design flow rate for high pressure ductwork and 2% of design flow rate for low pressure ductwork.

- Supply air ductwork will be externally insulated.

- Sound attenuators at the discharge of air terminal devices are envisioned to not be provided unless required to meet noise criteria. None are currently expected in the design.

- Duct Distribution Criteria
  a. Duct from the unit discharge and vertical risers may be 2,400 fpm or 0.2"/100 ft.
  b. Medium pressure maximum design velocity is 2000 fpm or 0.2"/ 100 ft.
  c. Low pressure maximum design velocity is 1200 fpm or 0.08"/ 100 ft.
  d. Note that these criteria are a maximum and the duct system will be engineered and sized to optimize cost, ceiling space, fan horsepower, and acoustics.

- Data rooms are envisioned to be served by VAV boxes and are envisioned to have dedicated chilled water fan coil units as back up cooling in the event of a failure of the fan system.
  - Main Electrical rooms (containing sub-stations) are envisioned to be served by small air handling units located outside of the electrical rooms and ducted through the wall.
  - Panel Electrical rooms (on each floor) are envisioned to be served by VAV terminal units located outside of the electrical rooms and ducted through the wall.
  - Any shell space conditioning will be from the base air handling unit system.

RETURN SYSTEMS

- This system is envisioned to be low pressure duct manual balance dampers at mains, branches, and taps to balance flow. Ductwork on units serving OR's are envisioned to be medium pressure return duct from return terminal units to return fan and low pressure up-steam of terminal units.

- Ductwork will be constructed in accordance with SMACNA Standards.
  a. Floor distribution and run-out ducts are envisioned to be constructed for +/- 2" w.g. pressure class.
  b. Ductwork in risers to the return air fans is envisioned to be constructed for -4" w.g. pressure class

- Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 2% of design flow rate for low pressure ductwork.

- Duct Distribution Criteria
  a. Low pressure maximum design velocity is 1400 fpm or 0.08" / 100 ft.
  b. Medium pressure maximum design velocity is 1800 fpm or 0.1" / 100 ft.

- On return systems serving multiple floors such as the patient floor units, an airflow measuring station and motorized damper are envisioned to regulate the amount of return air from each floor level.

EXHAUST SYSTEMS

- General
  a. Exhaust systems are envisioned to be located on the roof which is also a future floor. Exhaust fan systems are envisioned to have side inlets with roof mounted ductwork to facilitate future vertical expansion. In the future, new fans are envisioned to be located on the new roof and ducted down to the existing risers for tie-in.
  b. Ductwork will be constructed in accordance with SMACNA Standards for +/- 2" w.g. pressure class.
  c. Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 2% of design flow rate for low pressure. Ductwork is envisioned to be lined for the final 25' prior to equipment's intake.
  d. Duct Distribution Criteria
     i. Maximum design velocity is 1200 fpm or 0.08" / 100 ft.
     ii. Branch ducts and exhaust grilles in wet areas such as locker rooms are envisioned to be of aluminum.

- Isolation Exhausts
  - This system will service multiple Isolation Rooms on patient floors.
  - Two fans, each sized for 100%, are envisioned to serve a single isolation riser. Each fan will operate at 50% capacity. Upon failure of either fan or its associated VFD, the remaining fan is envisioned to ramp up to 100% capacity. The fans are envisioned to include a 10' duct stack and will maintain a 3000 fpm discharge velocity.
  - At each floor branch duct connection to the isolation duct riser a flow valve is envisioned to be provided and individual exhaust air valves at patient rooms to ensure proper constant flow.
  - Ductwork will be constructed in accordance with SMACNA Standards for appropriate pressure class.
  - Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 2% of design flow rate for low pressure ductwork.
  - Duct Distribution Criteria
    iii. Design velocity is 1200 fpm or 0.08" / 100 ft.

SPECIAL SYSTEMS

- Provide stairway pressurization fans with VFD on all high-rise stairwells. Provide a grille in every other stair landing for equalized airflow. Stairway fan pressure calculations will be performed; estimated capacity is 1,500 cfm per floor served.

- Grease Exhaust systems: Dedicated exhaust fans are envisioned to be provided for grease hoods in the kitchen and servery areas. One exhaust fan should be provided for each hood. Make up air will come from the central HVAC air handling systems.

- A dedicated exhaust fan system should be provided for the exhaust hood in the Pharmacy Chemo Room.

- Dishwasher exhaust system should be of stainless steel with dedicated fan and wrapped in 2-hour fire wrap from dishwasher discharge to building exterior.

- Dedicated exhaust fans should be provided for each laboratory hood or exhaust air valves are envisioned to be provided to gang multiple hoods on to one exhaust fan.

- Wet exhaust systems should be welded stainless steel with insulation. Sterilizer and cart washer exhaust should be considered wet exhaust. Exhaust systems are envisioned to be dedicated.

- Dedicated exhaust system for the dock area and ambulance canopy. The main dock area of the Bed Tower will be enclosed on all sides except one and will have a roof that covers some of the area to the front of the trucks. This will require a large volume exhaust/ventilation system to remove the exhaust from the trucks.

- An exhaust system should be provided for the emergency department. The fan should comply with all requirements of isolation exhaust systems. Airflow terminals are envisioned to be installed in all branch ducts serving an individual space on this exhaust system.

ENERGY RECOVERY SYSTEM

- An energy recovery pumping and piping system will be provided to recover energy from general exhaust fans to the minimum outdoor air intakes at air handlers in the mechanical floor.
- The system is envisioned to be filled with a glycol mixture to prevent freezing. The piping system is envisioned to serve the exhaust units on the roof and air handling units on level 1.
- General exhaust air passing through an energy recovery coil will be filtered with MERV 8 prefilters upstream of the glycol coil.
- Pumps and closed system maintenance such as glycol make-up, relief valve, and expansion tank, are envisioned to be located on the mechanical floor level.

FACILITY MANAGEMENT SYSTEM

- The Facility Management System (FMS) Control System Architecture will be used to monitor and control utility systems and HVAC systems through Direct Digital Control (DDC).
- The FMS system design will be modular and flexible. The major system components of the FMS include fully stand-alone, remote and application specific controllers and network controllers. Major equipment will be controlled by individual application specific controllers to ensure that failure of the network or any of the controllers do not cause catastrophic control system failure. The system will fully integrate into the existing building controls for monitoring, alarms, and remote access of control points.
- The FMS remote and application specific controllers are envisioned to be networked to share information and control the management functions without sacrificing stand-alone capability.
- One Operator Workstation will be provided in the control room for interface with FMS at the Building Level Network. Operator Workstations are envisioned to facilitate FMS programming and network maintenance. Operator Workstations are envisioned to include screens and Input/Output points as necessary to convey information to the operator. The screens displayed on the Operator Workstations are envisioned to include building floor plans, P&ID representations of each system showing indicating devices, operating status of each device, controlled variables, alarms, alarm history, trend data and other dedicated screens. Operator input will be via keyboard or mouse.
- Portable operator interface terminals may be connected to any of the controllers to operate the network locally. One portable operator workstation will be provided. Others are envisioned to be provided at the Owner's request.
- Alarm management will be provided to monitor, buffer, and direct alarm reports to the appropriate devices or memory files. Security levels are envisioned to be provided by using multiple level password access to allow user/management to limit workstation control, display and database manipulation capabilities as deemed appropriate for each operator, based upon assigned passwords. Operators are envisioned to be able to perform only those levels of command available for their respective passwords.
- Valve and damper actuators are envisioned to be electronic.
- Electrical power for air terminal controls and other field devices requiring 24 VAC, will be provided from transformer panels centrally located adjacent to control panels. The FMS contractor will be responsible for running 24 VAC wiring to field mounted air terminal controllers and other devices from these transformer panels. Number of transformers and number of field devices to be connected to each 24
- VAC branch circuit will be determined during future phase of the FMS control system design. All FMS equipment, including network controllers, unitary controllers, routers, gateways, operator workstation, etc., will be provided with backup power from local Uninterruptible Power Supplies (UPS) as needed to ensure vital control functions are not interrupted during loss of primary power.
- DDC controllers are envisioned to utilize distributed architecture and will not rely on "front-end" or higher-level controllers to perform required control sequences.
- Each DDC controller will have a minimum of 10% spare points of each type (DI, DO, AI and AO) at each panel. For universal points, the spares are envisioned to be divided evenly between the analog and digital types of points.
- Major equipment controllers (air handling units, exhaust fans, heat exchangers, pumps, etc.) will be arranged such that multiple equipment in the same system is not served by the same controller.
- All control panels and DDC controllers are envisioned to be served by standby power.
- All DDC system primary LAN controllers, PC's, communications equipment and local controllers that monitor and control life safety and critical points (biocontainment, fire alarm, elevator emergency, etc.) will be supported by emergency generators and UPS.
- Water meters are envisioned to include provisions for connection to the FMS.

LAYOUT OF ANTICIPATED SYSTEMS

- Refer to the Appendix Section of this package for the mechanical floor and CUP anticipated layouts based on concept system sizing and selections. These layouts were developed for reference only and should be revised and updated to match design changes as the project progresses.

Plumbing Systems

PLUMBING FIXTURES

1. Fixtures are expected to be of the highest quality available from major manufacturers.
2. All water closets are planned to be floor-mounted with wall outlets and flush valves. Flush valves in public and staff restrooms are intended to be 1.28 gallons per flush (gpf) type with hard-wired electronic sensors. Patient room water closets are anticipated to include 1.6/1.1 gpf dual-flush activated handles and pull-down bedpan washers.
3. Lavatories will be integral with the countertops. Electronic sensors are planned for staff and public toilets. Faucets in patient toilets and patient room hand sinks are intended to have wrist blade handles. All faucets are expected to include laminar flow outlets with a 1.0 gpm flow restrictor; public restroom faucets will have a 0.5 gpm laminar flow outlet.
4. Sinks in work areas will be drop-in stainless steel. Faucets in these areas are expected to be manually operated with 1.0 gpm laminar flow outlets. Sinks in break rooms, soiled and clean utility rooms, and Central Sterile are planned to include manual wrist blade faucets with a 2.2 gpm flow rate.
5. Specialty fixtures such as clinical sinks and mop sinks will be included where needed. These are not expected to include flow restrictors but will have laminar flow outlets and threaded hose ends. Hose connections for cleaning systems will include backflow preventers.
6. All public, multi-stall toilet rooms are assumed to include floor drains. Patient toilet rooms with showers will be evaluated on a case-by-case basis. All floor drains will include trap guards.
7. Showers are planned to be equipped with thermostatic pressure-balancing valves and removable hoses with pause-button shower heads. Flow restrictors will be set at 2.0 gpm. Shower stalls are anticipated to be constructed with built-up ceramic tile.
8. Electric water coolers are expected to be dual bi-level units with recessed chillers and bottle fill stations, in compliance with ADA requirements.

SANITARY SEWER AND VENT PIPING

1. The sanitary sewer piping is intended to be collected throughout the building and envisioned to exit at multiple locations, extending 5'-0" beyond the building's exterior walls. The main building drain is intended to exit at level B-4 and connect to the main on 13th Street. Beyond the 5'-0" point, these sanitary lines are anticipated to be extended to site utilities part of the Civil scope.
2. Two grease waste lines are envisioned to be routed from the kitchen. The primary line is intended to collect drainage from all major equipment, floor sinks, and floor drains. The secondary line is anticipated to collect discharge from garbage disposals and be routed through a solids interceptor before discharging into a grease interceptor (size TBD). The interceptor is proposed to be located in the docking area on the south side of the building.

3. Floor drains are envisioned to collect discharge from various equipment. For equipment with large discharges, such as water softeners and other major equipment in mechanical rooms, floor sinks are anticipated. Floor drains are also envisioned in all toilet rooms with more than one water closet, as well as in front of each ADA shower and staff-use shower. Linear trench drains are proposed for use in the Bed Tower patient room showers. Trap guards are envisioned to be used in lieu of trap primers where high-flow waste discharge is not expected.

4. Decontamination drainage system: A floor drain system is intended to be installed in the Decontamination Room and envisioned to discharge to an underground double-wall storage tank located outside the building. A high-water alarm on the tank is intended to be located at the Emergency Department nurse's station. A motorized valve with remote control is anticipated to be installed in the sanitary line to divert flow between the decontamination tank and the sanitary sewer. Details of the diverter valve will be coordinated with the AHJ.

5. The sanitary system is not intended to receive waste above 140°F. Equipment or processes discharging above this threshold are anticipated to include drain coolers prior to connection to the sanitary system.

6. The system is intended to be fully gravity-drained to avoid the use of sewage ejectors. This will be confirmed during design development based on final finished floor and invert elevations.

7. A sump pump is intended to be installed in a sump pit at the base of each group of elevator shafts. Per elevator code, this pump is anticipated to handle 50 gpm per elevator car and to include an oil-minder system. A dedicated discharge line is proposed to route the discharge to the nearest exterior sanitary manhole.

8. Cast iron piping is intended to be installed both above and below grade.

STORM DRAINAGE

1. The Roof drainage is intended to be collected from each roof level and routed through vertical shafts to below Level B4, where it will connect to the civil storm main on 13th Street. Beyond 5'-0" from the exterior wall, these storm lines are envisioned to be extended to site services, as indicated on the Civil drawings.

2. At each roof drain location, an emergency overflow drain with an internal dam is proposed. This drain is intended to be utilized in the event the primary roof drainage system cannot handle rainfall or becomes obstructed. The overflow drains are anticipated to be routed via common piping to exterior walls and discharged through downspout nozzle fittings at the building façade at street level.

3. Cast iron piping is intended to be installed both above and below grade.

4. A perimeter sub-soil drainage system is anticipated around the building foundation and each elevator bank, pending the findings of the geotechnical engineering report. A duplex sump pump system is proposed to manage subsurface perimeter and sub-soil drainage.

DOMESTIC WATER SYSTEM

1. The domestic water service is intended to enter the building at the north side, at the Ground Level.

2. The initial building construction is envisioned to include three pressure zones, each serving four to five floors, with capacity anticipated for expansion to accommodate up to three additional zones. Refer to the Appendix Section of this package for the proposed piping diagram.
   a. iThe lowest pressure zone is envisioned to serve levels B4, B3, B2, B1, and B. This zone is intended to maintain a maximum pressure of 80 psi at Level B4 and is envisioned to include a pressure-reducing valve (PRV) station. A dedicated domestic water heater is anticipated to serve these five floors.
   b. The second pressure zone is envisioned to serve levels G, 1, 2, 3, and 4. A PRV station is proposed to maintain a maximum pressure of 80 psi at Level G. This zone is also anticipated to have its own domestic water heater for these levels.
   c. The third pressure zone is envisioned to serve levels 5, 6, 7, and 8. A PRV station is proposed to maintain 80 psi at Level 5. This zone is envisioned to have its own domestic water heaters to serve the associated floors.

3. A variable frequency drive (VFD) quadraplex house booster pump is envisioned to be located on the Ground Level of the Bed Tower. The booster pump is intended to serve multiple pressure zones, delivering a minimum of 40 psi at the highest fixtures for the anticipated future vertical expansion. This booster system is envisioned to be a modular skid-mounted unit with expandable capacity and include a hydro-accumulation tank on the high-pressure riser to reduce pump short cycling.

4. The Central Utility Plant (CUP) is intended to have its own domestic water connection to the city main, with an associated backflow preventer. No booster pump is anticipated to be required for the CUP.

5. Full-building domestic water softening is not anticipated for this facility.

6. An emergency water connection is anticipated to be extended from the new domestic water backup treatment system located in the Main Hospital.

DOMESTIC HOT AND COLD WATER

1. The cold-water distribution system is intended to be served by three pressure zones, each covering four to five levels. A high-pressure riser shared by the upper two zones is envisioned and will be sized to support a proposed future vertical expansion.

2. Each pressure zone is envisioned to include a low-pressure cold-water riser serving the floors within that zone.

3. Domestic hot water for the Bed Tower is intended to be provided by three systems. Each system is envisioned to consist of three semi-instantaneous storage-type water heaters utilizing heating hot water to domestic hot water brazed plate heat exchangers specifically designed for domestic use. Each heat exchanger is anticipated to be sized for 50% of the system demand, with one unit serving as a backup. The heat exchangers are intended to generate and store domestic hot water at 140°F and distribute tempered water at 120°F through master thermostatic mixing valves to each floor.
   a. Procedures in accordance with ASHRAE Standard 188-2018, Legionellosis: Risk Management for Building Water Systems, are envisioned for Legionella control in lieu of copper-silver ionization systems.
   b. Maste mixing valves shall be digital.

4. The second pressure zone, which serves the kitchen and the Sterile Processing Department, is envisioned to have a dedicated hot water loop supplying water at 140°F to meet equipment and sanitation requirements.

5. The Central Utility Plant (CUP) is envisioned to be served by a separate electric instantaneous hot water heater.

6. All hot water systems are intended to be equipped with dual in-line recirculating pumps for continuous recirculation. Each system will include a backup pump and bypass valves to allow isolation and servicing of the primary pump without interrupting operation.

7. Automatic balancing valves are envisioned to be installed on each recirculation loop and sub-loop. Each valve will be sized appropriately to maintain proper flow rates and ensure consistent temperature throughout the system.

8. Domestic water piping is intended to be copper throughout.

9. Cold water serving the kitchen is envisioned to be softened prior to distribution.

SPECIALTY WATER SYSTEMS

1. Multiple RO/DI water systems are anticipated to be provided throughout the Bed Tower to support specialized functions. These systems are intended to serve the following areas:
   a. Laboratory
   b. iCentral Sterile
   c. Pharmacy
   d. Kitchen/Dishwasher

2. Refer to the Mechanical Narrative for information on the proposed RO/DI skid system(s).

3. All piping systems serving the RO/DI system are envisioned to be constructed of CPVC, with all plastic fittings and valves to maintain system integrity and water purity.

FUEL OIL SYSTEM

1. The fuel oil system is envisioned to be expanded within the Emergency Energy House to support the proposed new generators serving the Bed Tower. The system is intended to be sized to accommodate the full future vertical expansion of the facility.
2. A new fuel oil system envisioned to include pumps, storage tank(s), and a fuel polishing system is anticipated to be provided for the new generators located at the new Central Utility Plant (CUP).

NATURAL GAS

1. Natural gas service is intended to be provided for the kitchen. The utility gas meter is anticipated to be located on the exterior of the building, in accordance with local AHJ and utility requirements. Connection to the municipal gas main is proposed at 12th Street.
2. Gas piping 2" and smaller is intended to be steel pipe with threaded joints. Piping 2½" and larger is intended to be steel pipe with welded joints.

MEDICAL GAS SYSTEMS

1. **Medical Air System**
   The medical air compressor skid is envisioned to be a modular, oil-less scroll type with a single-point connection. It is intended to be sized at 48 SCFM for initial construction, with capacity expandable to 88 SCFM to support future vertical expansion. The system is envisioned to include duplex desiccant dryers and to be located on the mechanical floor level. Per NFPA-99, the system will be sized with one compressor on standby. The medical air intake is envisioned to be routed to allow extension when the vertical expansion is constructed. A louvered intake at Level 1 is also proposed as an alternate option. Final configuration will be defined during subsequent design phases.
2. **Medical Vacuum Systems**
   The medical vacuum pump skid is envisioned to be an oil-less "claw type" system with a single-point connection. It is intended to be sized at 180 SCFM initially, expandable to 260 SCFM for future expansion. The vacuum skid is envisioned to be located on the mechanical floor at Level 1. Per NFPA-99, one pump will remain on standby. The vacuum exhaust routing is envisioned to support future extension, with a louvered exhaust at Level 1 proposed as an alternative. Final setup will be determined in the next design phase.
3. **Oxygen Supply**
   Oxygen is intended to be extended from the VCUHS Bulk Oxygen System via the tunnel system through the Main Hospital and CCH.
   a. An Emergency Oxygen Supply is envisioned to be located at the loading dock on Level B4.
4. **Bulk and Bottled Gases**
   A manifold room is envisioned at the loading dock to house bulk and bottled gases.
   a. Manifolds are envisioned for Nitrous Oxide and Carbon Dioxide.
5. **Instrument Air:** A new compressor is envisioned to be provided and intended to be sized to serve medical equipment in the Surgery Suite and Sterile Processing Department.
6. **House Air**
   A separate compressor is envisioned to be installed in the Central Utility Plant (CUP) to serve facility-wide needs.
7. **Piping and Isolation**
   Medical gas piping is intended to be routed throughout the Bed Tower to each required location. In accordance with NFPA-99, Zone Valve Boxes will be provided to isolate individual rooms or grouped rooms. Additionally, locked isolation valves are envisioned at key branches to minimize the impact of system failure or renovations.
8. **Alarm Systems**
   Two Master Alarm Panels are intended to be provided, one located in the Engineer's Office within the Bed Tower, and one at the Emergency Room. These alarms will monitor each medical gas source for fault conditions. Area Alarm Panels are intended to be installed downstream of each Zone Valve Box and upstream of anesthetizing locations such as Operating Rooms.
9. **In Operating Rooms and Special Procedure Rooms** requiring ceiling booms, regulated instrument air is proposed to be used for boom brake operation.
10. Wherever Nitrous Oxide is administered, a **Waste Anesthetic Gas Disposal (WAGD) system** will be required and connected to the medical vacuum system.
11. **Quick disconnect connections** are envisioned to be installed at each location. All outlets are intended to match the existing facility's system for maximum interchangeability. The existing facility uses BeaconMedaes with Puritan Bennett-style connections.
12. **The quantity of outlets** is envisioned to align with user input and per FGI minimums. Medical gas layouts will be further developed during the next design phases, with coordination through user meetings and mock-up reviews. Outlets are anticipated to be mounted on a combination of owner-furnished booms, premanufactured headwalls, and contractor-furnished wall outlets. The anticipated outlet quantities for each typical room type are provided in the accompanying table.

ROOM TYPE	Gas Type								
	O	A	V	S	N	CO2		N2O	WAGD
GPC	3	2	3	3					
CICU	6	6	6	6					
PICU	6	6	6	6	1				
TICU	6	6	6	6	1				
ICU	6	6	6	6	1				
TSU	3	2	3	3					
Hem/Onc	3	2	3	3					
BMT	1	1	1	1					
ED Exam	1	1	1	1					
Pre-Op	6	6	4	4					
Prep/Recovery	6	6	4	4					
PACU	2	2	3	3					
Procedure Rooms	9	9	9	9	3	1		3	3
Operating Rooms	9	9	9	9	3	3		3	3

O = Oxygen	S = Slide	HeO2 = Heliox
A = Medical Air	N = Nitrogen	N2O = Nitrous Oxide
V = Medical Vacuum	CO2 = Carbon Dioxide	WAGD = Waste Gas

FIRE PROTECTION

1. One (1) 8-inch fire water service main is envisioned to be connected to the municipal water main on the north side of the building, at 12th Street.
2. One (1) fire pump is intended to serve the entire building. The pump shall have a minimum capacity of 750 GPM and a minimum rated pressure of 300 PSI. It is envisioned to be an electric-driven, centrifugal, horizontal split-case fire pump taking suction directly from the municipal water source. A hydro-accumulator is anticipated to be included to improve energy efficiency, minimize short cycling, and extend the pump's lifespan.
   a. The fire pump shall be capable of supplying the most demanding water-based fire protection system(s), including the most hydraulically remote sprinkler zones.
   b. The fire pump is intended to be located in a dedicated, 1-hour fire-resistance-rated enclosure with direct access from the ground level through an exterior door.
   c. All fire pump equipment and appurtenances are anticipated to be UL Listed and FM Approved.
3. The fire pump is envisioned to serve both the main Bed Tower and the Central Utility Plant (CUP).

4. The pumped fire line is envisioned to serve multiple wet-pipe standpipes located within stairwells. At each level, a 2½" fire hose valve will be provided for fire department use. Each stairwell standpipe will also serve floor control valves that feed the sprinkler systems on each floor. Lower-level floor control and hose valves are anticipated to be pressure-reducing type. A separate flow control valve is intended to be provided for each smoke compartment.

5. 3" drain lines are envisioned to be provided in each stairwell. A 3" test connection at each level will be required for fire hose valve testing. Additional drain connections are anticipated to be required for testing the flow switch at each floor control valve assembly. These drains are envisioned to discharge through the exterior walls of the building.

6. Quick-response sprinkler heads are envisioned to be required throughout the facility, in accordance with NFPA-13. A wet pipe system is anticipated to be used throughout the building, except in certain exterior and unconditioned spaces:
   a. A dry pipe sprinkler system is envisioned above the main and emergency entrance canopies. This system will be fed from the interior wet system and will include a dry pipe alarm assembly and dry pendent heads.
   b. A separate dry pipe sprinkler system is envisioned for the loading dock and all other canopy areas. This system will also be fed from the interior wet system and will require an nitrogen system and a dry pipe alarm assembly. Dry pendent heads will be used in this area.

7. Electrical rooms are intended to be protected using wet-type sprinkler systems.

8. Zurich is the anticipated insurance provider.

Electrical Systems

NORMAL POWER FOR BED TOWER AND CUP

1. The normal power service will originate from Dominion Energy via a new 34.5KV service. The entrance and size of the service is envisioned to be coordinated with Dominion Energy to provide for future capacity to provide a zero-carbon facility running on all electric service.
   a. A Dominion Energy load letter is attached in the Appendix Section of this package and will be shared with Dominion Energy. The load letter represents approximate loads for an all-electric service and is expected to be further coordinated with the Dominion Energy client representatives who at the time of this writing are:
      i. Utility Distribution Designer: Colby Ryan – colby.a.ryan@dominionenergy.com
      Customer Projects Designer III
      Dominion Power Delivery-Distribution
      7500 West Broad Street
      Henrico, VA 23294
      Cell: (571)643-9507

      ii. VCUHS Account Manager: Nakita Snead – Nakita.snead@dominionenergy.com.
      Key Account Manager II
      Customer Service and Strategic Partnerships
      Dominion Energy Virginia
      600 East Canal Street
      Richmond, Virginia 23261
      M: (804)205-0495

2. The two facilities are envisioned to be served by double-ended, 34,500V-480/277V 4000-5000A utility power unit substations due to selective coordination requirements and NEC demand factor criteria to serve the anticipated demand. Service voltage should be coordinated with Dominion Energy prior to the start of engineering design. The unit substations are envisioned to be NEMA 1 (indoor) construction, double-ended with primary loop feed circuit breakers and primary MV circuit breaker to feed a cast coil forced air cooling transformer, (Delta-Y, 34,500V Primary, 480/277V secondary). The secondary main buses are envisioned to each have a main circuit breaker, vertical feeder sections, and feeder circuit breakers. An automatic tie breaker transfer will be provided for service reliability.

3. The electrical service is to be fed from two independent grids provided by Dominion Energy. The Bed Tower substation is envisioned to be equipped with four services from the two available utility grids, each routed through two transformers on each side of the substation for maximum redundancy and reliability. The service entrance substation should be equipped with no less than five (5) 5KV breakers that will be used to provide power to the facility main-tie-main switchgear located on the basement, mid-level mechanical, and penthouse floors.

4. Each secondary (480/277V) line-up will be draw-out, rear-connected switchgear with 100%-rated main, tie, and feeder power circuit breakers. The fault current capacity of the switchgear and its circuit breakers are envisioned to be sized based on the calculated fault values. The main breaker will be electrically operated, provided with long-time, short-time, and ground fault (LSIG) solid state programmable trip units. The switchgear main-tie-main arrangement will allow both feeder line-ups to be fed off the alternate transformer, should a single transformer or associated primary feed fail. The tie circuit breakers are envisioned to be electrically operated and provided with long-time and short-time (LS) solid state programmable trip units. The ties between the switchgear will be bussed (or provided with a feeder busway if the switchgear is arranged facing each other rather than a single line-up). The switchgear distribution will consist vertical-bused feeder sections with draw-out breakers for each main and feeder breaker. Each feeder breaker in the main gear will be provided with long-time, short time, instantaneous, and ground fault (LSIG) solid state programmable trip units. A 100% rated, fully functional spare circuit breaker will be provided, as a replacement for a failed main or tie breaker. All the mains and feeders are envisioned to also include zone selective interlocking trip units for arc flash reduction. System to be designed to allow either end of the unit substation to serve the complete load. This is expected to be accomplished via a combination of caste coil transformers and forced air cooling loading.

5. Each normal power substation may be equipped with 1000-kVAR automatic switching capacitor banks complete with harmonic filter reactor for power factor correction. They will be located adjacent to each substation.
   a. Further review of harmonic impact from AHU's to be reviewed during design. Review options to limit harmonic impact on sensitive equipment.

6. The normal power system should be fully coordinated to 0.1 seconds.

7. Source equipment will be located in the building that it serves.

8. Equipment to be located above the 500-year flood plain if practical. The desire is for equipment (light fixtures, receptacles, breakers, other materials), to be sourceable from local distribution houses for replacement and maintenance.

ESSENTIAL POWER FOR BED TOWER AND CUP

1. The emergency power service to the Bed Tower will be provided from the existing generator plant.

2. 5KV cabling is envisioned to be provided between the existing generator plant and the new Bed Tower and routed underground through existing and new tunnels as required.

3. Two additional generators are envisioned to be installed at the existing generator plant to supplement the current emergency power supply. These two new generators are envisioned to complete the build-out of the emergency power plant. The plant itself requires new construction to house the two new generators and complete the lineup.

4. The existing generator plant line-up requires the addition of one generator breaker to accept the future generator number 6. Additionally, the gear will require an additional control section. The gear is manufactured by ASCO and the representative is Pat McCourt, pat.mccourt@ascopower.com, (410)-713-0910.

5. The CUP emergency 5KV, 6000A paralleling gear is envisioned to be provided with provisions to connect up to 4 parallel 3000KW diesel generators. The full build out of the CUP emergency power can be accomplished over time and track the progress of construction of the complete Bed Tower.

6. The two facilities are envisioned to have a double-ended, 5kV-480/277V emergency unit substation. The unit substations are envisioned to be NEMA 1 (indoor) construction, double-ended with primary loop feed fused switched and primary fused switches to feed a caste coil forced air cooling transformer, (Delta-Y, 5kV Primary, 480/277V secondary). The secondary main buses are envisioned to each have a main circuit breaker, vertical feeder sections, and feeder circuit breakers. An automatic tie breaker transfer will be provided for service reliability.

7. The CUP is envisioned to require (3) dedicated services 2000A-5000A, 5KV services tied together in a MTMTM configuration. The gear will also be served by (8)-3MW, 5KV generators necessary to provide back-up power for the (3) 10 MW all-electric boilers and chillers proposed for the CUP. The generators will be capable of on-board paralleling and will be connected directly to the 5KV service switchgear via protective breakers that will be used to connect/disconnect loads from the bus.

8. Each secondary (480/277V) line-up will be draw-out, rear-connected switchgear with 100%-rated main, tie, and feeder power circuit breakers. The fault current capacity of the switchgear and its circuit breakers are envisioned to be sized based on the calculated fault values. The main breaker will be electrically operated, provided with long-time, short-time, and ground fault (alarm only) (LS) solid state programmable trip units. The switchgear main-tie-main arrangement will allow both feeder line-ups to be fed off the alternate transformer, should a single transformer or associated primary feed fail. The tie circuit breakers are envisioned to be electrically operated and provided with long-time and short-time (LS) solid state programmable trip units. The ties between the switchgear will be bussed (or provided with a feeder busway if the switchgear is arranged facing each other rather than a single line-up). The switchgear distribution will consist vertical-bused feeder sections with draw-out breakers for each main and feeder breaker. Each feeder breaker in the main gear will be provided with long-time, short time, instantaneous, and ground fault (LSIG) solid state programmable trip units. A 100% rated, fully functional spare circuit breaker will be provided, as a replacement for a failed main or tie breaker. All the mains and feeders are envisioned to also include zone selective interlocking trip units for arc flash reduction.

9. Automatic transfer switches (ATS) will be provided to serve the emergency loads. ATSs are envisioned to be 4-pole with switched neutral (center-off). Critical and Life-Safety switches are envisioned to be make-before-break, closed transition type and provided with bypass isolation. Equipment transfer switches are envisioned to be delayed transition type. All transfer switches are envisioned to be provided with electronic metering capable of monitoring kW demand and will communicate with the building automation system as follows: "Normal Power Available," "Switch Connected to Normal", "Switch Connected to Emergency", and "Emergency Power On". Transfer Switches are envisioned to report status and start signals to the paralleling gear. They should also include a TJC (joint commission) reporting module for reporting purposes. Closed transition switches are desired from Atrium's standpoint. Coordination with Dominion Energy will be needed. System to be designed with Critical "A" and Critical "B" serving each patient care area. An Equipment "A" and Equipment "B" strategy to serve AHUs and other large strategic equipment from multiple ATS's. Elevator banks are to be split between multiple ATSs as well.

10. A Further discussion between electronically controlled breakers versus manual kirk key systems will need to be discussed as the project progresses forward.

11. Equipment to be located above the 500-year flood plain.

12. An Arc flash strategy to allow for maintenance and access to equipment to be executed. This will be a combination of arc flash reducing equipment and maintenance bypass switches.

13. The Essential power system should be fully coordinated to 0.1 seconds.

14. The following loads are envisioned to be connected to the essential power system:
    a. Life safety systems include egress and exit lighting; alarm and alerting systems; emergency Code required Life-Safety branch including egress lighting, fire alarm, medical gas alarms, mass communication systems, auto egress doors, elevator cab lighting and controls, etc.
    b. Code required Critical branch operations including task illumination and receptacles needed for effective Bed Tower operation, nurse call systems, IT equipment, medication refrigerators.
        i. Additional power and lighting for approximately 60-70 percent of the receptacles and lighting in the Bed Tower include headwalls, critical printers, computers, ice machine, monitoring and charting equipment, medication dispensing, and exam lighting.
        ii. Isolated power systems feed 100 percent of the power in the operating rooms.
        iii. Imaging equipment including a minimum of one of each modality per department.
        iv. Security systems.
        v. Kitchen cooking equipment.
    c. Code required Equipment branch systems include heating equipment (boilers and pumps), central sterile equipment, elevators, stair pressurization systems, fire pump, building automation, medical gas source equipment, kitchen hoods, exhaust systems for patient care areas, air handling units serving patient care areas, IT room HVAC equipment
    d. Additional systems include:
        i. Secondary chilled water pumps.
        ii. Pneumatic tube system blowers, transfer stations, and controls.
        iii. Pre-action and other fire protection systems.
        iv. Domestic water booster pumps and controls, sump pumps and sewage ejectors.
        v. Elevators and controls.
    e. New chillers, cooling towers, and pumps located in the central plant are envisioned to be connected to the emergency power via the current normal board back-feed.
    f. Source equipment is located in the building that it serves.
    g. As the project moves forward, requests assistance with performing the Risk Assessment of the Operating Room to determine the need for Isolation Panel boards.

DEDICATED SECURITY EQUIPMENT ROOM POWER

Security Equipment Rooms (SER) is envisioned to be provided with generator-backed UPS emergency power in order to provide power through any outage event.

UNINTERRUPTIBLE POWER SUPPLY SYSTEM (UPS) (TO BE EVALUATED DURING SD)

1. The Bed Tower will be provided with a centralized UPS to provide uninterrupted power to the facility information technology (IT) equipment. An option will be carried throughout design to increase the centralized UPS system to also include imaging equipment and clinical uses. The UPS system consists of a three phase, continuous duty, solid state uninterruptible power supply to operate in conjunction with essential power system to provide controlled power for critical loads. The system consists of parallel/redundant connected UPS modules for enhanced reliability. Each UPS module will support an equal share of the total load during normal, emergency, or recharge operation. Each UPS module will automatically disconnect and isolate from the system load in the event of a module failure with no interruption to the critical load.

2. The UPS is envisioned to include a system static switch cabinet, solid-state inverter, rectifier/battery charger, a low KVAR solid state input filter, a K-20 output transformer, a storage battery, a 100% rated for continuous duty static switch, and parallel control circuitry. The static switch cabinet is envisioned to contain the system static switch and bypass control circuitry. The battery system will include VRLA type with a minimum back-up time of 15-minutes to allow the generator system to start up and stabilize. Different technologies to be reviewed during the pre-design and SD phases.

3. The continuous output power rating of the UPS are envisioned to be:
   a. Base: One (1) 750 kVA at 0.8 lagging power factor with an input voltage of 480VAC, 3 phase, 3 wire plus ground. The output voltage will be 480VAC, 3 phase, 3 wire plus ground. The UPS is envisioned to be capable of operating at full load for 2-minutes at 0.8 power factor output and will be located in the Bed Tower interstitial mechanical floor.
   b. Option: One (1) 750 kVA unit for IT loads as described above plus three (3) 500 kVA paralleled units for imaging and clinical use. The UPS system will include multiple paralleled units with future expansion capabilities.

4. The following loads are envisioned to be connected to the uninterruptible power supply system:
   a. Base: MDF communication closet, IDF communication closets, all other misc. Data Rooms, and all SERs.
   b. Option: Imaging equipment, OR Isolation panel boards, and select receptacles serving patient care.

5. A more detailed discussion engaging all stakeholders regarding a central UPS is needed. The facility direction is to have a separate system for imaging due to vendor maintenance and performance requirements.

POWER DISTRIBUTION

1. The secondary switchgear of each double-ended substation will distribute power to distribution switchboards and panelboards for further distribution to branch equipment.

2. Each level of the Bed Tower is envisioned to have several branch electrical rooms. The electrical rooms are envisioned to be stacked to allow for vertical feeder risers through all levels of the building including life-safety feeders. If the rooms are not stacked, all life-safety feeders are currently required to be routed in a 2-hour shaft (horizontally and vertically) in accordance with high-rise requirements.

3. Feeder risers are envisioned to be routed from the main 480/277V switchgear vertically up and down through the building to feed panelboards located in the branch electrical rooms on each level. Feeders are envisioned to distribute power to switchboards and distribution panelboards at major load concentrations such as air handling areas and pump rooms. Switchboard and distribution panelboard are envisioned to be used on the mechanical floors. This equipment will distribute power to VFD's for floor air handlers and additional 480V equipment loads in the area.

4. Lighting and appliance panelboards and transformer are envisioned to be provided with each of the electrical rooms on each floor. Normal and critical branch panels (480/277 and 208/120) will occupy all rooms. Life safety, and equipment branch panels (480/277 and 208/120) will in general be provided in every other room).

5. UPS branch panels (208/120) will be in each Data room.

6. Surge protection devices (SPD) will be on all branches of the emergency panels (distribution and branch).

7. Provide color coordinated conduits based on electrical branches.

ISOLATED POWER (UNGROUNDED) SYSTEMS

1. All Operating Rooms, Trauma rooms, Cath Labs, and IR Cath room are envisioned to have one duplex isolation panel and one dual voltage isolation panel powered from separate Critical branch transfer switches (alternate from UPS system). LIM (Line Isolation Monitors) should report on the face of the panel and at the remote OR control station.

2. Provide XHHW copper stranded low leakage conductors for branch circuits served from isolation panelboards.

POWER MONITORING SYSTEM

1. Power monitoring for all mains and feeders including all the mechanical/plumbing equipment, surgery, kitchen, and Imaging usage for both normal and emergency power will be provided in the form of an electronic trip tied to a main power monitoring system. All trip unit are envisioned to be furnished with an Ethernet connection.

2. The following minimum metering is required:
   a. Volts (phase-to-phase and phase-to-neutral)
   b. Frequency
   c. Ampere demand (per phase and average three-phase)
   d. Kilowatt hours (re-settable)
   e. Kilowatt demand (three-phase) (re-settable)
   f. kVA demand (three-phase) (re-settable)
   g. Harmonic load content (percent THD)
   h. Power factor

3. Digital output from meters are envisioned to interface with the EMS.

BRANCH POWER

1. All receptacles throughout the Bed Tower in any public or patient areas (including corridors and restrooms) should be tamper resistant.

2. Receptacles with integral USB and USB-C charging device are envisioned to be used in all public areas, select staff break areas, and all patient rooms.

3. Receptacle layouts are envisioned to be further developed during the Design Development phase with User input and mock-up review. Devices may be on a combination of Owner furnished booms, premanufactured headwalls and contractor furnished wall outlets. The table below indicates the anticipated quantity of devices and branch circuits for each type of typical room.

Additional devices are envisioned to be located on all walls in each room in accordance with User needs and FGI requirements.

ROOM TYPE	Headwall Duplex Receptacles		Number of Circuits per Room	
	Normal	Critical	Normal	Critical
GPC	2	6	1	2
CICU	2	16	1	5
PICU	2	16	1	5
TICU	2	10	1	3
ICU	2	16	1	5
TSU	2	6	1	2
Hem/Onc	2	10	1	3
BMT	2	10	2	3
ED Exam	3	4	1	1
Pre-Op	3	4	1	1
Prep/Recovery	3	4	1	1
PACU	3	6	1	1
Procedure Rooms	0	36	N/A	Iso Pnl
Operating Rooms	0	48	N/A	Iso Pnl

LIGHTING

1. Lighting design will progress in concert with the client and architect's desired theme to be produced throughout the facility. The information below is a starting point to produce an environment conducive to work and healing that a Bed Tower requires.

2. Lighting levels in the facility will be in accordance with IES publications (Recommended Illuminance Categories and Illuminance Values for Lighting Design).

3. All lighting will be LED with 0-10V control. All light fixtures are envisioned to include on-board, fixture-integrated IoT network and intelligence for "Smart" connectivity.

4. Patient Areas:
   a. Nurse stations are envisioned to have a combination of cove soffit lighting around the perimeter of the edge of the desks, down lights above the transaction counter, and 2'x2' direct/indirect recessed LED fixtures in the middle. Approximately 50% of the fixtures are envisioned to be connected to the critical branch of the essential power system. Nurse stations are envisioned to have color tuned lighting system with override control panels.
   b. Patient rooms are envisioned to have healthcare specific lighting systems with override control panel located at each room entrance. General lighting will consist of two 1'x4' multi-function exam light fixture (exam and ambient) on either side of the patient bed, a linear element over the head of the bed for reading function (with relay interface for nurse call/patient bed control), a decorative sconce or downlight in a family area, a downlight fixture above each lavatory, a ceiling mounted fixture in the bathroom, and a ceiling mounted shower light. The exam light, night light, and bathroom light fixture will be connected to the critical branch.

c. Operating rooms are envisioned to be high output, 2'x4' lensed surgical troffers specifically approved for an OR environment and sealed surgical can lights around the perimeter. Fixtures are envisioned to be connected to the critical branch. Each OR will include a scene controller with multiple scenes and full dimming of all scenes controlled from each room entrance.
d. Exam and treatment rooms are envisioned to have 2x2 direct/indirect LED troffers. Fixtures are envisioned to be connected to the critical branch.
e. All corridors in patient care areas are envisioned to have a combination of continuous 1x4 direct/indirect linear fixtures and performance sconces. The corridor sconce lighting will be connected to the life-safety branch and will be sufficient to provide the required egress lighting. The corridors in patient care areas are envisioned to include color tuning fixtures.

5. Other Areas:
   a. Public elevator lobbies and public waiting areas are envisioned to have cove lighting and decorative pendants. Non-public elevator lobbies are envisioned to have direct/indirect troffers for the patient and service elevator lobbies. Back-of-house elevator lobbies and corridors are envisioned to have lensed troffers for the service elevator lobbies.
   b. Main lobby will be highly decorative with a combination of artistic pendants, sconces, cove lighting, children interactive wall lighting, etc.
   c. Public corridors are envisioned to have a perimeter indirect lighting system (cove or similar). Approximately one-third of the corridor fixtures are envisioned to be connected to life-safety.
   d. Conference rooms are envisioned to have direct/indirect troffers and a combination of downlighting and accent wall wash lighting with basic dimming and selective switching.
   e. Lighting in offices, reception areas, and administrative areas are envisioned to have 2'x4' direct/indirect troffers. Waiting areas are envisioned to have cove lighting and downlighting, with supplementation by 2'x4' direct/indirect troffers.
   f. Mechanical, electrical, telephone and other spaces without a ceiling will have four-foot long LED strip fixtures. Fixtures are envisioned to have wire guards and be chain hung.

6. Provide life-safety lighting in all exit paths in accordance with IES minimum foot-candle / Lux recommendations and AIA guidelines. Exit signs are envisioned to be LED.

7. Lighting at the automatic transfer switches, in all electrical rooms, in Operating Rooms, and in other anesthetizing spaces are envisioned to be provided with emergency back-up battery.

8. Exterior Lighting
   a. The parking areas and/or entrance drives are envisioned to consist of LED type pole mounted fixtures and decorative pedestrian and bollard fixtures closer to the building.
   b. All exits from the building will be provided with life-safety lighting. Where a canopy is present, recessed downlights are envisioned to be provided in the soffit. Where a soffit or canopy is not available, a decorative wall mounted sconce with two lamps and ballasts/drivers are envisioned to be provided.
   c. All exterior lighting will be controlled by a networked lighting control system with time of day and photocell inputs.

9. Façade Lighting
   a. The design intent is to highlight the vertical and horizontal elements of the building façade using high output LED strip type lighting with dimmable controls and RGB color changing.
   b. Canopy lighting will consist of decorative linear fixtures.
   c. Ground mounted fixtures are envisioned to be provided to highlight various features of the lower column type elements.

LIGHTING CONTROLS (TO BE EVALUATED)

1. Lighting control will include a low voltage distributed relay system for all fixtures. The fully integrated control system will combine time of day, daylight control, and sensor-based system to provide maximum flexibility. Fixtures are envisioned to be provided with networked relay/drivers for connection to the control system. Color tuning will be provided in areas such as patient rooms, patient floor corridors, NICU and nursery as described above if desired by the facility.

2. All requirements of the International Energy Conservation Code will be adhered to during the design of the lighting; this will include the use of automatic shut-off via time-of-day schedule, daylight harvesting, vacancy sensors and/or stepped dimming.

3. In addition to minimum code requirements, vacancy sensors are envisioned to be provided in all spaces with infrequent use (ex. storage rooms, housekeeping rooms, etc.) regardless of exemption from this code requirement.

4. Daylight harvesting: Throughout the spaces listed below, dimmable ballast in conjunction with indoor photocell controls are envisioned to be used to reduce electric light during hours where sufficient day lighting is available.
   a. Main Lobbies.
   b. Offices within 15 feet of exterior windows.
   c. Other areas subject to daylight except for the patient rooms.

5. Patient room lighting controls are envisioned to be integrated into a patient control system so the patient can control lighting and window shades from the patient's bed.

6. Areas with multiple zones are envisioned to include low voltage multi-button switching including:
   a. Patient Rooms
   b. Operating Rooms
   c. Dining/server areas
   d. Lobbies
   e. Corridors
   f. Nurse stations

LIGHTNING PROTECTION

1. An LPI Certified Lightning Protection system will be provided for the building.

ACCEPTANCE TESTING AND COMMISSIONING

1. This project will require complete electrical system acceptance testing and commissioning for all systems and system components. The testing should be performed by the Electrical Contractor, Manufacturer's Field Service, and commissioning agent in accordance with the applicable NETA tests.

FIRE ALARM

1. System to meet NFPA 72 and NFPA 99 for high-rise requirements. Include 2-hour survivability rated CI cable unless the Fire Alarm notification panels are all located within the electrical rooms located within smoke compartments to eliminate cross smoke compartment boundaries in order to minimize costly two-hour rated fire alarm cable systems to meet survivability requirements.

2. VCUHS should select the FA manufacturer when engineering commences.

3. System Description: The fire alarm system will be specified to meet the requirements of the Authority Having Jurisdiction and latest edition of NFPA 72 and NFPA 99. The system should be complete with detectors, manual fire alarm boxes (pull stations), audible and visual signal devices, a voice communication and firefighters' telephone system designed to meet the requirements for a high-rise occupancy.

4. The system is envisioned to be a network-based analog-addressable fire alarm system including Class A wiring and voice evacuation notification.

5. Control Panel: The main system will be located in the Fire Command Room with sub annunciator panels located at the 24-hour locations for this building including PBX and the Engineering Maintenance Office.

6. A firefighter's graphic control panel is envisioned to be provided in the Fire Control Room. This system will meet the requirements of the IBC and include signaling and control for the stair pressurization system and the manual smoke removal over-ride for the AHU's.

7. The Fire Control room is envisioned to include, as a minimum, the following:
   a. Controls for the voice alarm signaling system.
   b. Controls for the fire department communications system.
   c. Fire protective signaling system annunciator panels.
   d. Status indicators showing location of elevators in the hoist ways and switches to selectively turn on or off power to elevators.
   e. Controls for unlocking all doors simultaneously.
   f. Sprinkler valve, water flow detector and fire pump display panels.
   g. Emergency power, light and emergency system controls and status indicators.
   h. A telephone for fire department use with controlled access to the public telephone system.
   i. Generator and ATS supervising devices, manual start and transfer features.

8. Fire Alarm devices are envisioned to be provided as required by Code and the AHJ.
   a. Manual Fire Alarm Boxes are envisioned to be provided as required by Code and the AHJ. Manual Fire Alarm Boxes are envisioned to be located at all exits, at all doors leaving a floor and at nurses' stations on patient floors.
   b. System Smoke Detectors - Smoke detectors are envisioned to be located within five feet of all magnetically held doors and in any space open to the corridor.
   c. System Smoke and Heat Detectors for pre-action fire protection systems are envisioned to be provided for these areas.
   d. Duct-Mounted Smoke Detectors are envisioned to be installed in the supply and return of all air handling units and at each smoke and fire/smoke damper. Additional duct detectors and smoke detectors should be located as required for smoke control systems.
   e. Audible/Visual (A/V) alarms are envisioned to be located throughout the facility in accordance with the latest requirements of NFPA 72 and ADA. Wall-mounted speaker-strobes are envisioned to be the primary notification appliance used throughout the facility.
   f. Visual devices are envisioned to not be installed in Patient Rooms or Patient Treatment Areas (ex. Operating Rooms, Imaging Treatment Rooms, etc.) per exceptions allowed by ADA.
   g. Fire Suppression system (sprinkler) tamper switches, flow switches, and pressure indicating alarms (on dry and pre-action systems) will be connected to the fire alarm system.
   h. Smoke and Heat Detectors for Elevator Recall will be connected to the fire alarm system.

9. Fire alarm zoning should be per code requirements. Multiple electrical circuits and relays are envisioned to be provided to achieve proper zoning. A smoke compartment will be the notification zone. Upon activation of any manual or automatic alarm:
   a. All A/V alarms are envisioned to be activated throughout the facility. The system will be capable, thru programming, of floor-by-floor and compartment-by-compartment notification.
   b. All magnetically held doors are envisioned to be released.
   c. All air handlers and smoke dampers not used for a specialized smoke control scheme will close on a per zone basis.
   d. Automatic notification of the fire department will occur.

10. Include DAS type antenna system for fireman's radio booster equipment to meet NFPA requirements as required and designed by the low voltage consultant.

11. It is expected that CMC NBT and CR will have different addresses, however interconnectivity and communications is desired.

12. Overhead paging will be managed by the overhead public address system outlined in the Technology section below, however, voice messages should be considered during system design based on facility preferences.

13. Provide color coordinated conduit for various LV and separate electrical branch systems.

Data Communications and Voice Communications

SYSTEMS

1. Overview
2. Codes/Standards
3. Abbreviations
4. Topology
5. Telecommunications Bonding/Grounding
6. Telecommunications Spaces
7. Telecommunications Pathways
8. Cable media
9. Television Structured Cabling System
10. Nurse Call
11. Real Time Locating System
12. Patient Monitoring
13. Refrigerator Monitoring
14. Master Clock
15. Alert-Us Beacons
16. Identification
17. Telecommunications Active Equipment
18. Audio-Visual
19. Public Address
20. Elevator – Telecommunications Interface

OVERVIEW

1. This scope of work does not include any demolition work associated with the removal of existing buildings or associated re-routing of new telecommunications backbone cabling in support of the buildings being demolished.

2. Systems direct contracted by Owner which require base-build utility support (power, cooling, backboxes/conduit pathways, Ethernet cabling, firestopping, etc.) should be contracted within a schedule to run concurrent with the design schedule to avoid project engineering add services to revise the base-build designs with late arriving submittal requirements received outside the design schedule.

3. The building technology systems are envisioned to be designed in compliance with the Owner's technology expectations, Owner's specifications, industry standards, best engineering practices, building codes, site specific conditions and as determined by the Authority Having Jurisdiction.

4. The telecommunications infrastructure is envisioned to be designed as a structured, robust system of pathways and equipment spaces populated by an applications independent wiring plant.

5. The system is envisioned to be designed with sufficient capacity to accommodate multiple changes in technology over the life of the building with the goal of minimal cost and operational impact.

6. All telecommunications product types and design criteria should be as defined by Owner.

7. Phase 1/Phase 2
   a. Phase 1 includes the base-build scope for a new high rise Bed Tower (9 levels above grade and 6 levels below grade), new Central Utility Plant (CUP), connection to existing Parham data center and provision and connection to a new data center (TBD).
   b. Telecommunications scope is envisioned to include build-out as required to support phase 2.
   c. All TR's located in shell space should be partially built-out with full room construction to include card reader access door, fire-rated plywood on all walls, flooring, ceiling cap, lights, lighting controls, power, grounding, HVAC, fire alarm/fire suppression, minimum of 1 rack and associated vertical wire managers, room cable tray, all backbone cabling/conduit all termination components and minimal rack mounted patch panels and horizontal wire managers.
      i. The partial build-out of TR's in shell space should support any minimal systems required to support the build-out of the shell space, i.e. any elevator car visual communication devices and minimal PACS (Physical Access Control System) head end equipment to support perimeter monitoring of shelled space doors and card readers on TR's.

   d. Phase 2 includes the expansion of 11 new levels to include a rooftop helipad.

CODES/STANDARDS

1. In addition to all applicable codes, the telecommunications design is envisioned to comply with or exceed the most recent recommendations and requirements of:
   a. Owner standards
   b. ANSI/TIA/EIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces as revised and amended.
   c. ANSI/TIA/EIA-568.D Commercial Building Telecommunications Cabling Standard as revised and amended.
   d. ANSI/TIA/EIA-607-E Generic Telecommunications Bonding and Grounding (Earthing) and Bonding Standard for Customer Premises, and Addenda.
   e. Administration Standard for the Telecommunications Infrastructure of Commercial Buildings ANSI/TIA/EIA-606-D.
   f. American National Standards Institute (ANSI).
   g. Facility Guidelines Institute - Guidelines for Design and Construction of Hospitals_2022
   h. National Electrical Manufacturers Association (NEMA).
   i. Institute of Electrical & Electronics Engineers (IEEE).
   j. American Standards Association (ASA).
   k. Building Industry Consulting Service International (BICSI).
   l. Federal Communications Commission (FCC).
   m. American Society of Testing Materials (ASTM).
   n. National Fire Protection Association (NFPA)
   o. American Society of Industrial Security (ASIS)

ABBREVIATIONS

1. OFOI: Owner Furnished; Owner Installed
2. CFCI: Contractor Furnished; Contractor Installed
3. OFCI: Owner Furnished; Contractor Installed
4. FFE: Fixtures, Furniture Equipment
5. MPOE: Main Point of Entry
6. DC: Data Center
7. TR: Telecommunications Room
8. SOC: Security Operations Center
9. SER: Security Equipment Room
10. TBD: To Be Determined
11. SCS: Structured Cabling System

TOPOLOGY

1. This campus should be configured to support a completely redundant star topology with two separate Main Points of Entry (MPOE's), feeds from two separate Data Centers, two separate combination Building Distributor Rooms/ Telecommunications Rooms (BDR/TR's) and a series of Telecommunications Rooms (TR's).

2. The two separate MPOE's should allow redundant Service Providers backbone entry cabling as contracted and negotiated by the Owner.

3. Neither Data Center #1 or Data Center #2 will be constructed within the footprint of the new Bed Tower or Central Utility Plant (CUP). See description below for additional information.

4. There should be Primary and Secondary Building Distributor Rooms (BDR's) located in the new main Bed Tower. The BDR's are envisioned to be used to break-out and distribute large fiber strand counts to each of the respective buildings TR's.

5. There should be a series of Telecommunications Rooms (TR's) located as per FGI_2022, 2.1-8.5.2.3), on each level of the Bed Tower with quantity and location to allow all areas of the floors, walls, ceilings and overhead structures to be covered within the maximum allowable permanent link horizontal cabling distance of 90m, to include all vertical transitions and slack (service loop) requirements.

6. There should be redundant backbone cabling feeds from each of the (2) data centers to each of the two MPOE's, from each of the two MPOE's to each of the two BDRs and from each of the two BDR's to each TR.

7. There should be a single, non-redundant backbone cabling feed from MPOE2

TELECOMMUNICATIONS BONDING/GROUNDING

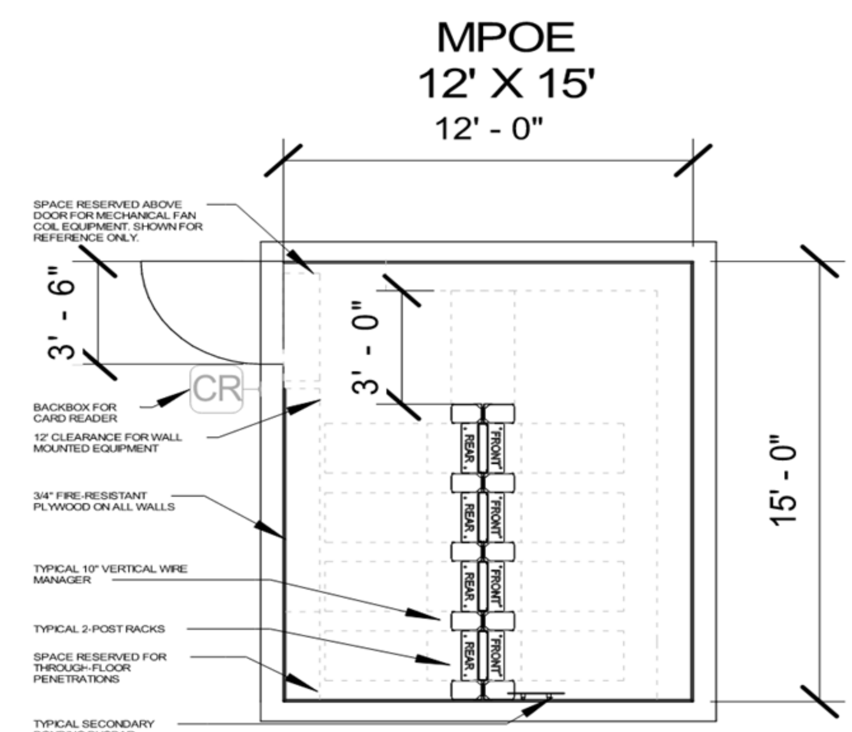
8. An ANSI TIA 607-E_2024 grounding system is envisioned to be provided connecting all Telecommunications Rooms grounding busbars with a standard compliant TBB (Telecommunications Bonding Backbone).

TELECOMMUNICATIONS SPACES

1. General
   a. Telecommunications Rooms (TR's) should be designed in compliance with Owner standards.
   b. There should be two separate Service Providers serving the Bed Tower building as contracted by VCUHS IT.
   c. Based on currently available architectural planning documents, there should be (2) vertical stacks of TR's in the Bed Tower, with two TR's on each floor from the lowest level to the highest phase 1 level, located to meet the maximum cable distance parameters to include cable routing within cable tray and cable verticality and slack.
   d. TR vertical stack pathways are envisioned to accommodate the future pathway requirements for phase 2.
   e. The minimum width and length dimensions of the telecom spaces are critical minimum dimensions and not combined square footage. Minimum width and length dimensions are necessary in order to lay out the infrastructure in the rooms with the minimum clearances as required.
   f. The functional spaces should not have columns obstructing the general layout. If columns cannot be avoided in the layouts of the rooms, additional clear space must be added to the overall space requirement to make up for the column obstructions.
   g. All technology equipment spaces described below should be located a minimum of 20' from electrical switchgear, transformers, mechanical equipment rooms, large pumps, machine-room-less elevator shafts, radio rooms or other potential sources of electromagnetic interference.
   h. Equipment spaces should be located away from potential sources of water intrusion, e.g., janitor closets, toilet rooms, supply, and waste pipes. Where separation cannot be achieved or is impractical, drip flashing and perimeter curbs with drains should be provided to the equipment room to mitigate the effects of potential flooding.
   i. System utilities not serving the TR are not permitted to be routed through the TR room.

2. Bed Tower Main Point of Entry #1 (MPOE1) and Main Point of Entry #2 (MPOE2)
   a. There should be two MPOE's, located on the ground floor. Each room should serve as a point of service entry for the new Bed Tower building for each of the two local exchange carriers (LEC), as well as competitive local exchange carriers (CLEC) and specialty carriers, other Internet Service providers, as determined by the Owner.
   b. Each of the MPOE's is envisioned to serve as the main cross connect to interconnect the Bed Tower with the respective Service Providers networks. Each of these two rooms are envisioned to also be connected to the campus topology with redundant backbone cabling.
   c. MPOE's incoming site pathways are envisioned to maintain a minimum of 66' separation to maintain redundancy/diversity as per ANSI TIA-942-A.
   d. Ladder rack should encircle the room and be routed over the racks.
   e. The MPOE's are envisioned to be configured in accordance with the following criteria:

Main Point of Entrance (MPOE)	
Facilities Location	Design Criteria Ground level, adjacent to the exterior perimeter wall, closest to the service provider's site facilities.
Minimum Size	12'x15' room size
Construction	1-hour rated if standalone room. Walls slab-to-slab construction with fire rated plywood mounted at 1'-0" to 9'-0"AFF on all walls
Lighting	Caged LED pendants to provide 50 foot-candles measured at 3- feet AFF.
Ceiling	No finished ceiling required. Underside of overhead structure slab sealed to reduce dust. The room should include a ceiling cap to allow minimum inside room clear dimension of 15'.
Flooring	Finished concrete
Door	42" X 84" outward opening.
HVAC	50-85ºF on a 24/7 basis
Security	Card reader control. Camera coverage to monitor egress/ ingress and cover activities around the racks.
Humidity (Relative)	30-55% RH on a 24/7 basis
Convenience Power	110VAC 20A normal power quad outlet at 6' on center on each wall
Fire Alarm/ Suppression	Fire alarm smoke detectors, wet sprinklers, ceiling mounted with caged heads
Support Hardware	(2) 19" open racks with wall mounted cable splice racking and overhead cable runway
Grounding	Telecom copper ground bar on insulated standoffs



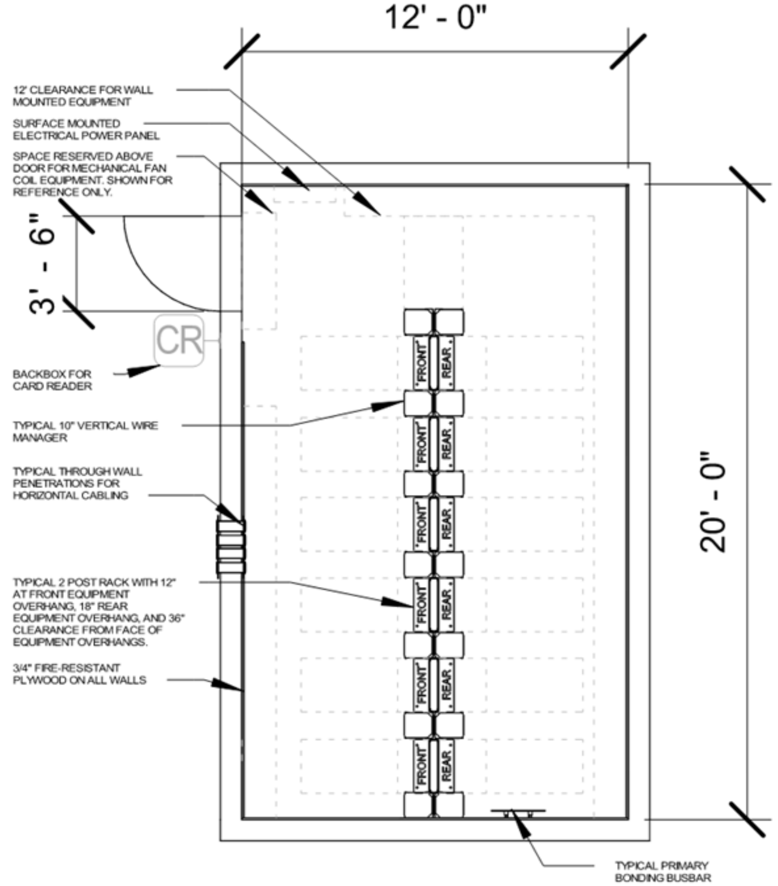
1. **Data Center #1 (DC1)**
   a. It is presumed that DC1 serving the new Bed Tower/CUP will be the existing VCU Health Parham Data Center, located at 7818 E. Parham Road, Suite 2037, Richmond, VA 23294.
   b. It is presumed there are existing spare/dark fibers routed from existing Parham data center to an existing manhole near to the new project site, however, exact location of existing fiber splice case and quantity of existing fiber strands available is TBD by VCUHS IT.
   c. This scope should presume sufficient spare fiber is available within existing splice case to extend (1) new 96 strand single mode cable from splice case to new Bed Tower MPOE1.
   d. It is presumed any new scope required within the existing Parham data center to facilitate the connection to the new Bed Tower/CUP will be contracted by VCU Health as part of a separate contract.

2. **Data Center #2 (DC2)**
   a. **Option #1** – Off-Site Logistics Center (OFLS) - PERMANENT SOLUTION
      i. DC2 serving the new Bed Tower/CUP could be located within a new OFF-SITE LOGISTICS CENTER (OSLC). However, the provision of a new off-site logistics center building was removed as part of the budget realignment and is not currently part of this scope.
      ii. It's important to still consider this option as ultimately, incorporation of a permanent solution with a shelled OFLC building with an active data center will still be less expensive than the construction of a temporary facility.
      iii. Telecom scope only - Provide a lump sum line item for CFCI (1) new 96 strand single mode fiber from a new DC2 (location TBD) to Bed Tower MPOE2 and (1) new 48 strand single mode fiber to CUP MPOE, to include means to support and terminate. Coordination of municipality right-of-way agreements should be coordinated by VCU Health and project civil engineer and will include but not limited to all street trenching/patching, telecommunications vaults at a maximum of 400' and no more than 180 degrees worth of bends between pull points, conduits and innerducts.
      iv. Project is envisioned to include a lump sum line item for CFCI build-out of a new Tier 3 data center within the new OSLC to include all disciplines in accordance with VCUHS IT criteria and ANSI TIA942-C_2024.
      v. Pros: As this is would be the permanent location, there will NOT be any additional cost to move it. The construction of this new data center could support all on-going VCUHS projects requiring network connectivity, not just the new Bed Tower/CUP. Build-out of a new data center will allow scheduled migration of existing servers and network functionality to a standard compliant Tier 3 data center.
      vi. Cons: The cost of this build-out would need to be considered and at least partially included in the project base-build cost.
   b. **Option #2** – CONNEX BOX DATA CENTER (shipping container) – TEMPORARY
      i. VCUHS IT notes the existing CSC data center is not capable of expansion. Provide a temporary data center in a Connex box outside and adjacent to existing CSC data center (or other location as determined by VCUHS IT), to serve as the temporary secondary/redundant DC2 connections for the new Bed Tower/CUP.
      ii. CFCI air conditioned Connex box, size to be determined, and is envisioned to be retrofitted to function as a temporary data center and data center support space, complete with HVAC, lighting, power, fire alarm/protection/suppression, interior insulation, flooring, wall boards, doors, concrete support pad, racks/cabinets, cable tray, grounding, access control, video surveillance etc. as required to support this function.
      iii. OFOI cabinets/racks, vertical/horizontal wire managers, active network equipment, rack mounted UPS's, power distribution units.
      iv. Pros: Less expensive.
      v. Cons: The location will need to be carefully coordinated and depending on exact location, physical security may be an issue. The functionality of this temporary location will need to be moved once the new permanent location of DC2 is determined by VCUHS IT. After construction of new permanent DC2, the existing backbone cabling feeds from this temporary DC2 location to the new Bed Tower MPOE2 and CUP MPOE/BDR/TR will need to removed and new backbone feeds provided from permanent DC2 location to these MPOE's. The Connex box will need to be removed.
   c. **Option #3** – LEASED SPACE
      i. VCUHS IT notes they have been trying to get away from the reoccurring costs associated with leasing space at data centers. However, leasing space at an existing data center may provide a temporary option if the project budget will not allow the build-out of a new data center at this time.

3. Combination Building Distributor Room/Telecommunications Room (BDR/TR)
   a. Bed Tower building will be provided with (2) redundant combination BDR/TR'S to allow large strand count fiber primary and secondary backbone cable distribution from each of the BDR's to each of the respective buildings TR's.
   b. CUP will be provided with a combination MPOE/BDR/TR.
   c. Each combination BDR/TR will be configured in accordance with the following criteria:

Combination Building Distributor Room/Telecommunications Room (BDR/TR)	
Facilities	Design Criteria
Location	Close to core and within cable distance limitations
Minimum Dimensions	12' x 20' room size.
Construction	2-hour rated walls slab-to-slab construction with fire rated plywood mounted at 1'-0" to 9'-0"AFF on all walls
Lighting	Caged LED, placed to provide 50 foot-candles measured at 36" AFF
Ceiling	No finished ceiling. Ceiling slab sealant-finished to reduce dust. The room should include 15' ceiling cap if required to allow minimum inside room clear dimension of 15'.
Floor Finish	ESD flooring
Doors	Single-door 42" X 84" outward opening, with card reader access control.
Temperature Range	50-85ºF on a 24/7 basis
Humidity Range	30-55% RH on a 24/7 basis
Convenience Power	Multiple 110VAC 20A normal power quad outlets on walls at a maximum of 6' on center.
Rack Power	One Normal Power 30A-250V L6-30 twist lock and one Emergency generator backed UPS Power 30A-250V L6-30 twist lock per each rack or cabinet.
Fire Alarm/ Suppression	Smoke Detector and wet sprinkler, ceiling mounted with caged heads
Equipment Support	(6) floor mounted 2-post equipment racks
Cable Support	Single level vertical and horizontal cable runway
Grounding	Telecom copper ground busbar on insulated standoffs, wall mounted

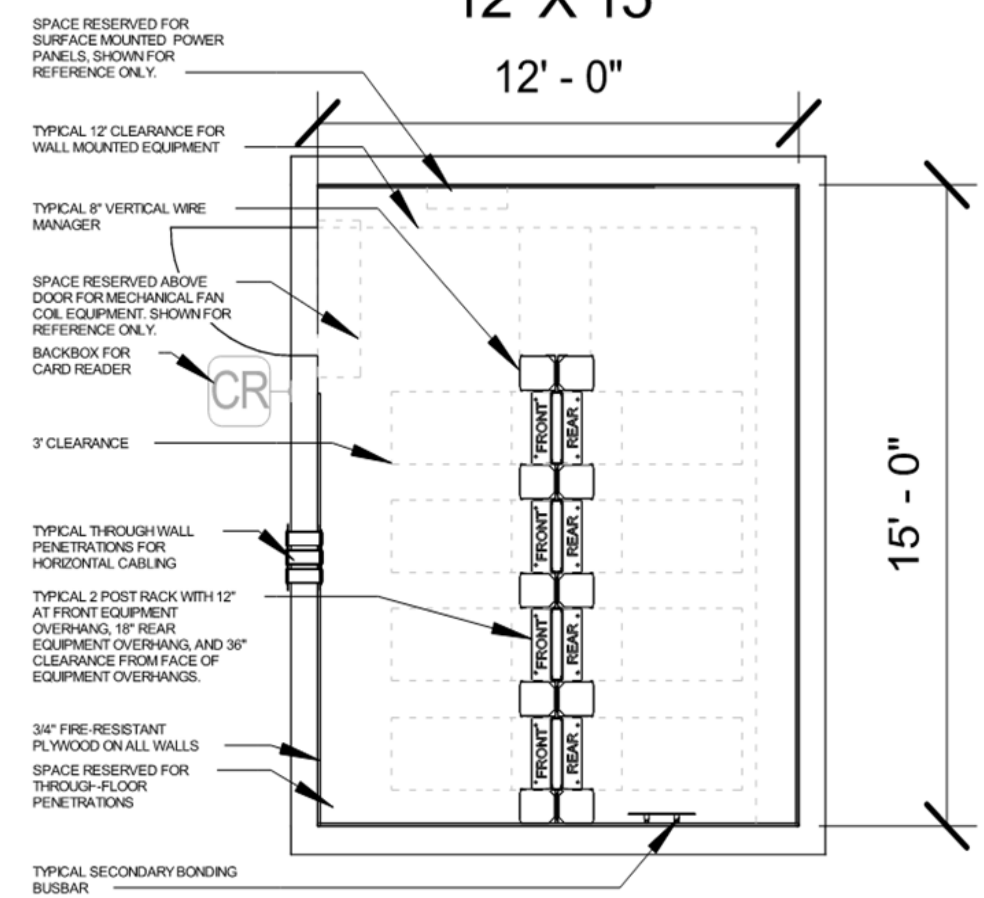
BUILDING DISTRIBUTOR ROOM/ TELECOMMUNICATIONS ROOM (BDR/TR) 12' X 20'



4. **Telecommunications Rooms (TR)**
    a. TR'S should be located central to the building, positioned to maintain maximum UPT cabling distance criteria, vertically stacked, and rated in a shaft style layout to accommodate manufactured fire rated structure penetrations for riser access.
    b. Each TR should serve as a termination point for backbone cables from each of the (2) data centers via the (2) BDR's as applicable.
    c. Each TR will be configured in accordance with the following criteria, unless otherwise noted:

Telecommunications Room (TR)	
Facilities	Design Criteria
Location	Close to core and within cable distance limitations
Minimum Dimensions	12′ x 15′ room size.
Construction	2-hour rated walls slab-to-slab construction with fire rated plywood mounted at 1′-0″ to 9′-0″AFF on all walls
Lighting	Caged LED, placed to provide 50 foot-candles measured at 36" AFF
Ceiling	No finished ceiling. Ceiling slab sealant-finished to reduce dust. The room should include 15′ ceiling cap if required to allow minimum inside room clear dimension of 15′.
Floor Finish	ESD flooring
Doors	Single-door 36″ X 84″ outward opening, with card reader access control.
Temperature Range	50-85ºF on a 24/7 basis
Humidity Range	30-55% RH on a 24/7 basis
Convenience Power	Multiple 110VAC 20A normal power quad outlets on walls at a maximum of 6′ on center.
Rack Power	One Normal Power 30A-250V L6-30 twist lock. One Emergency generator backed UPS Power 30A-250V L6-30 twist lock. Per each rack or cabinet.
Fire Alarm/ Suppression	Smoke Detector and wet sprinkler, ceiling mounted with caged heads
Equipment Support	(4) floor mounted 2-post equipment racks
Cable Support	Single level vertical and horizontal cable runway with high level segment of runway at cable entries to room to support slack loops.
Grounding	Telecom copper ground busbar on insulated standoffs, wall mounted

TELECOMMUNICATIONS ROOM (TR) 12' X 15'



5. **Telecommunications Pathways**
   a. All exterior telecommunications underground pathways/duct banks, not routed under building slabs, should have an underground traceable warning tape installed along the length of the feed and should not be shared with any other utilities.

   b. All exterior telecommunications underground pathways routed under loading docks, roadways and driveways should be rebar enforced, concrete encased for the portion of the pathway routed docks, roadways and driveways.

   c. All redundant exterior surface mounted pathways secured to pipe bridge (to CUP) should be mounted at opposite sides of pipe bridge structure to maintain a maximum separation with a minimum separation of 10′ and should not cross each other.

   d. All other redundant pathways should maintain a maximum possible separate minimum of 10′ separation and should not cross.

   e. All telecommunications pathways should be designed and constructed in accordance with the ANSI/TIA/EIA-569-E standard. Telecommunications conduit minimum bend radii should be in compliance with ANSI/TIA/EIA-569-E. Pathways should be designed to not allow more than 180 degrees worth of bends between pull points.

   f. Underground telecommunications conduits should be permitted to be routed under wall footings, but NOT column footings.

   g. MPOE pathways
      i. Primary service entry: (2) 4″ conduit pathways should extend from the MPOE1 into the nearest existing telecommunications manhole/vault/pedestal with existing fiber splice with dark/spare fiber to existing Parham data center. (4) 4″ conduit pathways should also be extended, stubbed and capped from the MPO1 to 5′ outside building perimeter in a location in coordination with incoming Service Provider #1 manhole/vault/pedestal.
      ii. Secondary service entry: (2) 4″ conduit pathways should extend from the MPOE2 into new data center #2 (location TBD) via new/existing telecommunications manholes. (4) 4″ conduit pathways should also be extended, stubbed and capped from the MPO2 to 5′ outside building perimeter in a location in coordination with incoming Service Provider #2 manhole/vault/pedestal.
      iii. Civil plans should design the inverts and exact locations of all exterior building conduits in consideration of all existing underground utilities which will ensure a maximum of 400′ between cable pull locations and not more than 180 degrees worth of bends.
      iv. The MPOE conduits should be routed to the inside perimeter wall of the MPOE and fitted with duct plugs.
      v. The MPOE conduits should be routed in an angled fashion between the MPOE and the exterior to eliminate the potential of water ingress into the MPOE.

   h. Riser backbone pathways
      i. Each TR stack should include quantity of ganged (4) 4″ through floor, intumescent, fire-rated, re-entrant penetrations paths to provide floor-to floor pathway with quantity and size as noted risers.
      ii. Backbone cable pathways located outside the protection of TR stacks should be routed in conduit and is NOT permitted to be routed in backbone cable tray.
      iii. All underground conduits should be sub-ducted with flexible fabric type multi-cell innerducts, unless otherwise noted.

   i. Horizontal cable pathways
      i. Horizontal cable pathways should be a floor, wall, ceiling, or overhead structure 4″ square backbox with 1″ minimum conduit pathway to nearest segment of wire mesh cable tray.
      ii. Wire mesh cable tray system should be provided concealed above ceiling or exposed if no ceiling, along all main corridor pathways/aisles. Cable tray pathway should be routed to nearest fire-rated through wall penetrations at each respective TR.
      iii. Wire mesh cable tray should be sized to accommodate 25% initial fill.
      iv. See Pathway Riser Diagram in the Appendix Section of this package.

CABLE MEDIA

1. **Backbone Cable Media**
   a. **General**
      i. Fiber backbone cables should be terminated on rack or cabinet mounted fiber distribution units.
      ii. Copper multi-pair backbone cables should be terminated on rack mounted copper patch panels via wall mounted fused copper primary protector blocks as required.
      iii. Coaxial backbone is not anticipated at this time.

   b. **Backbone Cable Media**
      i. Optical fiber backbone should consist of non-armored single mode and LOMM-OM4 optical fiber. Backbone cabling should be sized as required to support campus building systems.
      ii. Copper multi-pair backbone for base building systems should consist of non-armored Category 5E copper multi-pair cable. Backbone cabling should be sized as required to support campus building systems.
      iii. Backbone Cable Media (BMDF to each TR)
         1. Each TR should receive 24 strands of single mode fiber, 12 strands of LOMM-OM4 fiber, 50 pairs of Cat-5E UTP backbone cable sourced from a single BDR.
         2. There is no requirement for redundant copper backbone cabling to each TR from each BDR.
         3. See Copper Riser Diagram and Fiber Riser Diagram in the Appendix Section of this package.

2. **Structured Cabling System (TR to Work area Outlet)**
   a. Telecommunications Outlets should be provided in accordance with Owner standards.
   b. The horizontal Ethernet cabling infrastructure for all Wireless Access Points (WAP) should be (2) Category 6A U/UTP, CMP with MPTL connectors and 10′ of coiled slack loop.
   c. There is no requirement for WAP enclosures.
   d. All other Ethernet telecommunications and security systems structured cabling system should be Category 6 U/UTP, CMP and should include the entire channel link to include all faceplates, jacks, work area patch cords and jumper/patch cables from patch panels to Owner active network equipment.
   e. Typical workstation should have (1) Category 6 U/UTP, CMP with (1) Category 6 RJ-45 jack.
   f. Category 6 indoor/outdoor plenum rated cables should be used for all exterior Ethernet applications.
   g. Structured Cabling System should be routed in conduit to nearest segment of general use accessible wire mesh type cable tray designed in accessible main corridor pathways.
   h. Telecommunications Outlets should be provided to support all voice and data requirements. Where furniture systems are located directly adjacent to a wall, wall mounted Telecommunications Outlets should be provided in wall.
   i. Combined use Power/Data/Voice/AV flush floor boxes and/or poke through assemblies with Telecommunications faceplates with voice and data jacks should be provided in large open areas. One extra blank low voltage faceplate and (1) 1-1/4″ conduit stub routed to above accessible ceiling should be reserved in each floor box or floor poke-through for future audio/visual system connectors and cabling as applicable.
   j. Telecommunications Outlets located on OR suite booms should be Category 6 shielded

TELEVISION STRUCTURED CABLING SYSTEM

1. Television topology should be configured for IPTV, allowing the use of the LAN data for signal distribution, thereby negating the need for expensive coaxial backbone trunk cables and on-going maintenance involved with coaxial system rebalancing as part of building lifecycle. Design team will coordinate with Owner during design to confirm IPTV distribution requirements.

2. Television wall outlets should include (1) RJ-45 with UTP Ethernet cabling to Telecommunications Room patch panel.

3. Patient rooms should include television system structured cabling system to nurse call system interface as required.

4. All television source media content and leased programming should be as sourced and negotiated by Owner as part of a separate scope of work.

5. All televisions, electronic signage displays and associated mounting brackets should be OFCI. See AUDIO-VISUAL COMMUNICATIONS for additional information.

6. All Television field patch cables (from television to wall outlets) should be CFCI as part of this scope.

NURSE CALL

1. A full featured 2-way audio-visual Rauland Responder 5 nurse call system should be provided in accordance with codes and Owner standards.
2. Network connectivity should be provided to the existing CCH nurse call system as required.
3. Connectivity should be provided to the overhead paging system as required.
4. Nurse Call master station quantity and locations should be assigned based on needs assessment meeting with users.
5. It is currently understood that no bedside virtual care systems will be required.
6. Nurse Call system head end equipment, field devices, cabling, backboxes and conduit pathways should be CFCI as part of this scope.
7. Nurse station, patient tracker boards should be OFOI as part of the FFE scope of work. Tracker board network connectivity should be CFCI as part of this scope of work.

REAL TIME LOCATING SYSTEM (RTLS) FOR ASSET TRACKING

1. It is currently understood that Owner will contract with their RTLS integrator, to provide a system design for the entire Bed Tower in accordance with Owner standards.
2. RTLS head end equipment, field devices and non-Ethernet cabling should be OFOI as part of Owner's direct contract with the RTLS integrator contract.
3. RTLS pathways (backboxes, interconnecting conduit) and Ethernet cabling required to support the design should be CFCI in accordance with Owner standards.

PATIENT MONITORING/TELEMETRY

1. Owner will direct contract with their Patient Monitoring/Telemetry System integrator, to provide a system design for the entire Bed Tower, in accordance with Owner standards.
2. Patient Monitoring/Telemetry head end equipment, field devices and non-Ethernet cabling should be OFOI as part of Owner's direct contract with the Patient Monitoring/Telemetry integrator contract.
3. Patient Monitoring/Telemetry system pathways (backboxes, interconnecting conduit) and Ethernet cabling required to support the design should be CFCI in accordance with Owner standards.

REFRIGERATOR MONITORING SYSTEM

1. It is currently presumed that the refrigerator monitoring system should be specified as part of the FFE scope of work to include all head end equipment, field devices and any non-Ethernet cabling.
2. All system backboxes, conduit pathways and Ethernet system cabling should be CFCI.

MASTER SYNCHRONIZED CLOCK SYSTEM

1. A Primex (PoE) master synchronized clock system is NOT required.
2. All clocks should be battery powered and CFCI as part of the FFE package.
3. All OR suite clock systems to include all headend equipment, field devices and associated cabling should be CFCI as part of the separate FFE package. Any low voltage backbox and pathway requirements should be CFCI as part of this scope.

ALERTUS BEACONS

1. Alertus beacons and all associated backbox, conduit pathways and wiring should be CFCI in all high volume pedestrian areas.

IDENTIFICATION

1. An identification system compliant with ANSI/TIA/EIA-606-D Administration Standard with Owner amendments should be developed to uniquely identify each equipment rack/cabinet, pathway segment, equipment room, telecommunications space, rack, patch panel, cable, faceplate and device in the facility.

TELECOMMUNICATIONS ACTIVE EQUIPMENT

1. It is presumed all voice connectivity is VoIP.
2. All active (powered) data, VoIP Network equipment should be OFOI, to include but not be limited to servers, switches, hubs, routers, associated power supplies and any specialized/dedicated rack mounted UPS's.
3. All active (powered) Wireless Local Area Network equipment should be OFOI, to include but not be limited to servers, switches, hubs, routers, associated power supplies and any specialized/dedicated rack mounted UPS's.
4. All Wireless Access Points should be Owner Furnished, Contractor Installed (OFCI).
5. Owner will engage WLAN integrator to provide Wireless Local Area Network field heat map studies showing preferred locations of all Wireless Access Points. Telecommunications Outlets should be provided as required to support WLAN design. Preliminary and generic layout of WAP Telecom Outlet should be provided to assist with pricing only. Vendor contracted heat map study should assign all final WAP Telecom Outlet locations.
6. All rack mounted Power Distribution Units (PDU's)/plugstrips should be OFCI and should be anticipated with ATS (Automatic Transfer Switch – automatically transfer power from A power to B power) type, metered power, and metered receptacles. Horizontal PDU's are envisioned to be located in 2-post racks and vertical PDU's are envisioned to be located in 4-post racks and cabinets.
7. All Telecommunications workstations (KVM, CPU's) should be OFOI.
8. All VoIP desk handsets should be OFOI.
9. All VoIP wall handsets should be OFCI.
10. All weatherproof wall phones should be CFCI in locations as directed by Owner.
11. All VCUHS Police phones should be VCUHS Police Furnished and VCUHS Police Installed.

AUDIO-VIDEO COMMUNICATION

1. Audio/Visual
   a. VCUHS should engage VCUHS Media Support Services (MSS) Project Manager should provide an audio/visual systems design for the entire Bed Tower, in a time frame to coincide with the base-build design package deliverables.
   b. All active (powered) audio/visual head end equipment, field device components, mounting brackets, cabling, connectors, testing and commissioning should be OFOI by VCUHS MSS.
   c. Audio/Visual system pathways (backboxes, floor boxes, fire rated poke throughs, interconnecting conduit quantities and sizes as well as any specialty inset ceiling or wall boxes and any specialty flush floor boxes) required to support VCUHS MSS design should be CFCI in accordance with Owner standards and VCUHS MSS audio-visual design package.
2. Sound Masking
   a. Sound Masking system, backbox, conduit and associated cabling is NOT required as part of the low voltage base-build contract.

PUBLIC ADDRESS

1. An unsupervised and networked, 70V, overhead Public Address Speaker System by Atlas/IED should be provided in all pubic gathering spaces and all front-of-house and back-of-house corridors. Local volume control should NOT be required.
2. The fire alarm voice evacuation speaker system is NOT permitted to function as the building public address system.
3. Each floor should be a dedicated zone, and there should be an overall building ALL-CALL zone.
4. Rack mounted primary and backup amplifiers should be located in the Telecommunications Rooms.
5. Connection to existing hospital campus system in CCH building should be provided.

ELEVATORS – TELECOMMUNICATIONS INTERFACE

1. **Elevator cab audible two-way communication system:**
   a. Elevator cab audible communications devices and connection to elevator traveling cable should be furnished and installed as part of Division 14 scope of work.
   b. Elevator cab audible communication system master controller, power supply, UPS and all associated low voltage system cabling and backbox and conduit pathways on the secondary side of the elevator traveling cable should be CFCI. Design team should coordinate with Division 14 and Owner to confirm selected on-premise response and off- premises dial-out criteria.

2. **Elevator cab visual communication system:**
   a. Elevator cab visual communication devices and connection to elevator traveling cable should be furnished and installed as part of Division 14 scope of work.
   b. Base-build should provide 1-port telecom outlet at top level of elevator shaft door frame with (1) Cat. 6 UTP cable, backbox and conduit pathway to nearest TR.
   c. Division 14 and Owner should specify and negotiate off-site third-party monitoring service agreements as required.

ELECTRONIC SAFETY AND SECURITY (ESS)

1. **Systems**
   a. Overview
      i. Physical Access Control System (PACS)
      ii. Intrusion Detection System (IDS)
      iii. Duress Alarm (DA)
      iv. Video Surveillance System (VSS)
      v. Intercoms
      vi. VCUHS Police VSS
      vii. ERTS Emergency response phones

   b. Site Security
   c. ESS spaces
   d. Radio

2. **Overview:**
   a. Systems direct contracted by Owner which require base-build utility support (power, cooling, backboxes/conduit pathways, Ethernet cabling, firestopping etc) are envisioned to be contracted within a schedule to run concurrent with the design schedule to avoid project engineering add services to revise the base-build designs with late arriving submittal requirements received outside the design schedule.

   b. A security threat and vulnerability assessment report will NOT be required for this facility.

   c. The building security systems associated with the new Bed Tower building, CUP, building pedestrian tie-in locations to the existing CCH building will be designed by VCUHS Campus Card Services in compliance with VCUHS Campus Card Services, Owner's security standards, industry standards, best engineering practices, building codes, site specific conditions and as determined by the Authority Having Jurisdiction.

   d. VCUHS Campus Card Services will be responsible for coordinating the requirements of PACS with VCUHS Police Department, VCUHS fire and Life Safety, and any other areas that need to be involved.

   e. VCUHS Campus Card Services should coordinate with Architectural division 8 door hardware as required, to include but not be limited to door frame preparation.

   f. Code required elevator lobby and stairway two-way phone system is envisioned to be specified as part of the division 27 scope of work.

   g. It should be presumed that VCUHS Campus Card Services will NOT require a dedicated space for badging within this building.

   h. All aspects of the ESS (Electronic Security System), including all ACS servers, network PoE+ switches in support of ESS, should be on emergency generator backed, building UPS. up. The UPS should maintain system power for a minimum of 5 minutes to allow generator start-up.

   i. All Physical Access Control System (PACS), Intrusion Detection System (IDS), Duress Alarm (DA), Video Surveillance System (VSS) field devices, head end components, and associated security non-Ethernet cabling should be OFOI as part of the VCUHS Campus Card Service scope of work and should be coordinated with VCUHS police department as applicable.
      i. Card reader backbox and conduit pathways should be provided at locations as determined by Owner, as a minimum; Telecommunications Room, Mechanical equipment rooms, Electrical equipment rooms, plumbing closets, Elevator equipment rooms, Security Operations Center/Security Equipment Room, boundaries from front of house to back of house, Clean Utility rooms, main entries to OR suites and imaging suites.
      ii. All ESS backboxes and cable pathways should be CFCI, to include but not be limited to 12" x 12" x 4" junction box, above accessible ceiling on secure side at each door with ESS functionality.
      iii. Pharmacy is currently included in Phase 1 scope. It is presumed VCUHS Campus Card Service will direct the design of the Pharmacy dedicated video surveillance cameras, associated dedicated in-Pharmacy video surveillance monitoring station, dedicated NVR storage, a dedicated pharmacy Intrusion Detection System control panel with keypad over-ride, controlled door entry credential(s), door position supervision, motion detection system and all associated cabling. This project scope should provide backboxes and conduit pathways required to support VCUHS Campus Card Service design.
      iv. It is presumed Pharmacy area will include a master audio/visual intercom station to communicate with intercom audio/visual sub-stations located at door entries into Pharmacy and audio only sub-stations with hand-wave actuation at Pharmacy compounding area. It is presumed pharmacy door interlock controllers should be furnished and installed as part of Division 8 door hardware package.
      v. Duress Alarm pushbutton backboxes and conduit should be provided at locations as directed by Owner and as approved by VCUHS police, such as intake receptionist and any cashier locations.
      vi. All ESS Ethernet structured cabling system infrastructure (i.e. Video Surveillance System, intercom system, data connections for ACS controllers) should be CFCI as part of the Division 27 Telecommunications scope of work. It should be presumed that direct connect Modular Plug Terminated Link (MPTL) direct-connect connectors should be permitted for all interior IP cameras.
      vii. It is presumed Video Surveillance traffic should reside on the data LAN switches and NOT require a separate and dedicated physical video LAN.

   j. All PACS/IDS/DA and IP CCTV workstations and intercom master stations should be OFOI by VCUHS Campus Card Services.

   k. All building specific PACS data gathering/field processor equipment and associated locking power supplies are envisioned to be located in a dedicated Security Equipment Room, as per Owner security standards, as it is NOT permissible for ESS equipment to be co-located in the Telecommunications Rooms.

   l. This scope will NOT include any demolition/renovation scope related to renovations within existing CCH building.

   m. ERTS Emergency Response Phones should be CFCI at main entrance locations and at locations as defined by Owner.

   n. Elevators/Elevator lobbies/Stairways intercoms and ESS interface:
      i. Code compliant emergency 2-way communication devices should be CFCI in each elevator lobby and stairways at locations required by code, with master station located at Security Operations Center.
         1. Elevator landing 2-way communication system pathway is required to have 2-hour survivability and should be routed in a dedicated 2-hour vertical chases within elevator lobbies, transitioning to underground as needed to connect the various elevator landing stacks to the 2-way communications system master in the SOC, to avoid lateral 2 hour rated chases upon a given floor.
         2. Stairway landing 2-way communication system pathway is required to have 2-hour survivability and should be routed in a dedicated 2-hour vertical chases within the stairwells, transitioning to underground as needed to connect the various stairwell stacks to the 2-way communications system master in the SOC, to avoid lateral 2 hour rated chases upon a given floor.

      ii. All card access, video surveillance, code blue, helipad over-ride key switch requirements and associated interfaces to a "destination dispatch" type of elevator system should be coordinated with Owner and Division 14 during design.
      iii. Elevator cab audible two-way communication system and elevator cab visual communication system for hearing impaired should be noted in Telecommunications narrative.

3. **Site Security**
   a. Although new parking garage is excluded from this scope, there will be a new vehicular access ramp constructed from the new tower level G shell space to the existing parking deck D. It is currently understood that a parking garage integrator will not be engaged as part of this scope, and there will NOT be any backbox or conduit pathway requirements to support future card reader/intercom credential pedestals, security gates, automatic traffic arms, active vehicle barriers, barrier control systems or license plate cameras.

b. This scope should include all ESS backboxes and conduit pathway connections for any new ESS devices at each of the new multi-level pedestrian bridges to the existing CCH building.

c. Exterior video surveillance camera coverage should be designed by VCUHS Campus Card Services in compliance with Owner security standards.

d. ERTS Emergency Response Phones (wall or freestanding blue-light phones) and associated Ethernet cabling, backboxes and conduits should be CFCI at locations as defined by Owner.

e. Backboxes and conduit pathways should be provided for exterior card readers, Knox box, first responder box and video intercom station locations as defined by Owner.

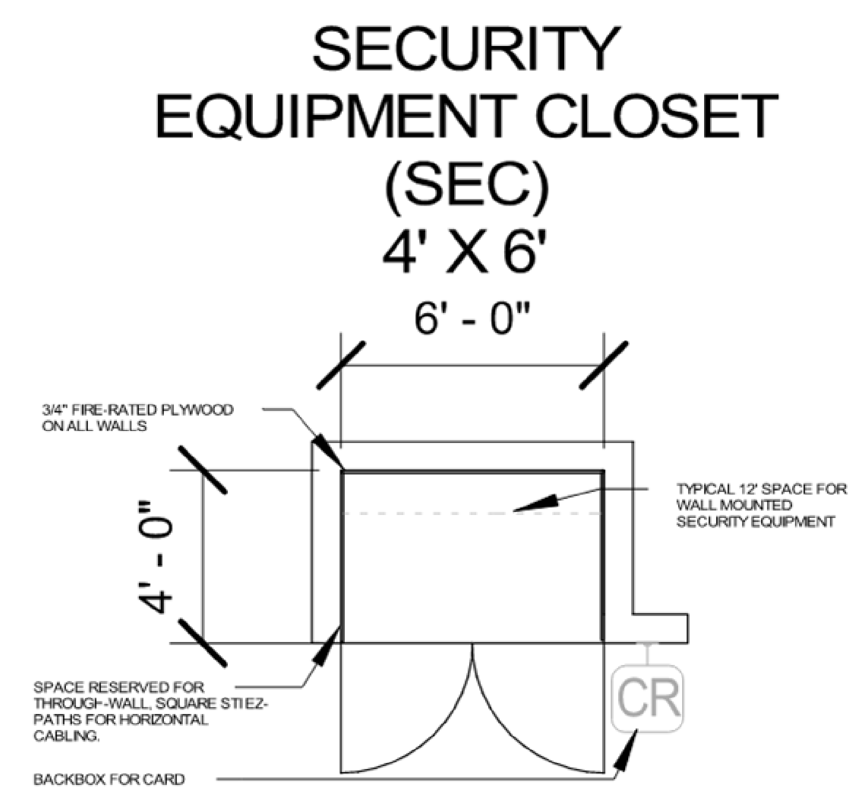
4. Electronic Safety and Security Spaces

a. Security Operations Center (SOC) –
   i. It is presumed a new building Security Operations Center will be required, which is a workstation area used to monitor and respond to all new Building Security Systems and is envisioned to be designed by VCUHS Campus Card Services.
   ii. This area is envisioned to contain monitoring/analyst workstation(s) to live monitor all building video surveillance cameras, respond to all required building elevator lobbies, stairway and building entry intercom calls, provide a charging location for handheld radios and an area to coordinate with VCUHS police as required.
   iii. SOC room headwall should have space for video surveillance displays as designed by VCUHS Campus Card Services.
   iv. The SOC room should have a dedicated HVAC unit and UPS backed emergency generator power for all systems and utility support functions.
   v. There should be one SOC low voltage equipment room located in a space directly adjacent to the SOC, which is separate from the building Telecommunications Room and the building Fire Command Center. This room should include a minimum of (3) 4-post open racks and all associated clearances, with one rack dedicated to building NVR's and ACS servers as well as the electrical distribution panels as required. See mechanical and electrical narrative for additional information.
   vi. The preliminary programming requirements for a Security Operations Center will be configured in accordance with the following criteria, however all final criteria should be as provided by VCUHS Campus Card Services:

Security Operations Center (SOC)	
Facilities	Design Criteria
Location	Ground level, adjacent to Bed Tower main entrance and Fire Command Center
Minimum Dimensions	TBD
Construction	2-Hour rated walls slab-to-slab construction
Lighting	Ceiling, dimmable LED, designed in consideration of the 24/7 viewing of displays.
Suspended Ceiling	Minimum of 18′ ACT ceilings to accommodate single level of wall mounted displays and single row of (2) workstations.
Floor Finish	-
Doors	Single-door 36″ X 84″ outward opening, with card access.
Temperature Range	64-81ºF on a 24/7 basis
Humidity Range	30-55% RH on a 24/7 basis
Electrical Design Load	Average 120 Watts/ft2 depending on room size and equipment layouts
Convenience Power	Multiple 110VAC 20A quad outlets on all walls
Fire Alarm/ Suppression	Smoke Detector and wet sprinkler, ceiling mounted

b. Security Equipment Closet (SEC) –
   i. The Security Equipment Closet is a vertically stacked closet area which should contain ¾″ fire resistant plywood mounted on 3 walls, and space for wall mounted ACS Intelligent Field Panels and associated UPS's.
   ii. One vertically stacked SEC should be located on each floor of the new Bed Tower and one new SEC in new CUP.
   iii. Each SEC will be configured in accordance with the following criteria:

Security Equipment Closet (SEC)	
Facilities	Design Criteria
Location	Vertically stacked with one SEC per level with adjacency to Telecommunications Room if possible.
Minimum Dimensions	6′ W X 4′ D.
Construction	1-Hour rated walls slab-to-slab construction with fire resistant plywood backboard installed on 3 walls.
Lighting	To match Telecommunications Room
Suspended Ceiling	None
Floor Finish	Finished concrete. Floor-to-floor penetrations should be provided to accommodate integrator designed cabling.
Doors	Double door 72″ W X 84″ outward opening, with card access.
Temperature Range	50-85ºF on a 24/7 basis
Humidity Range	30-55% RH non-condensing positive pressure on a 24/7 basis
Electrical Design Load	To match VCUHS Campus Card Services ESS equipment.
Convenience Power	One 110VAC 20A quad outlets
Fire Alarm/ Suppression	Ceiling mounted smoke detector, wet sprinkler, wall mounted, fire control module to drop power to ACS power supplies



5. **Radio**
   a. It is presumed there should be (3) functional radio systems.
      i. Code required Emergency Responder Communications Enhancement System (ERCES)
      ii. Facilities & Maintenance Security Radio System
      iii. Neutral Host Service Provider Cellular DAS (Distributed Antenna System).

   b. Owner will direct contract with their selected Radio system integrator to provide radio system designs for coverage of the new Bed Tower, multi-level pedestrian tie-ins to existing CCH building and new CUP.

   c. Code required Emergency Responder Communications Enhancement System performance/delegated design specifications, should be provided by Engineer of Record. All other radio system criteria should be defined by Owner.

   d. Dedicated and vertically stacked 2 hour-rated radio equipment room closet should be provided on each level of the Bed Tower and CUP of a size and configuration to match radio integrator's equipment design with 2 hour-rated vertical pathway from rooftop donor antenna to lowest level of building. In the absence of radio integrators' design criteria, radio equipment room stack can be space programmed to match the Security Equipment Closet parameters with the exception of the Bed Tower basement level main radio equipment room size will be increased to 12' x 15' to allow it to function as the main Radio Equipment Room. Owner contracted radio integrator should confirm all sizes during programming.

   e. All radio system field devices, head end components, grounding and associated cabling should be OFOI as part of the VCUHS radio integrator direct contract.

   f. Radio system backbox and conduit pathways should be CFCI in quantities and locations as directed by Owner, to include but not be limited to roof weather head.

SITE AND CIVIL ENGINEERING

Civil Codes and Standards

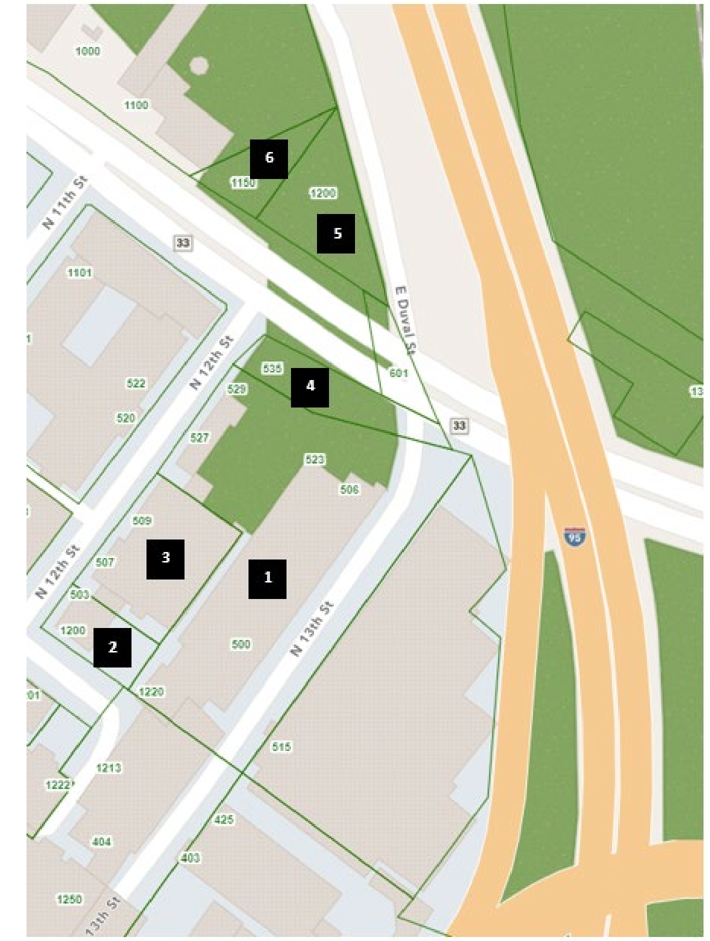
1. **National**
   a. Chapters 1 and 3 through 11 of Standards for Accessible and Usable Buildings and Facilities (ICC A117.1-2017) approved March 28, 2017
   b. NFPA Codes & Standards – Standards for site fire protection

2. **State**
   a. Virginia Erosion and Sediment Control Handbook (VESCH) – Erosion and sediment control standards
   b. Virginia Erosion and Sediment Control Regulations – Regulations for erosion and sediment control
   c. Virginia Stormwater Management Program (VSPM) Regulations – Regulations for stormwater management
   d. Virginia Waterworks Regulations – Potable water regulations
   e. VDOT Road and Bridge Standard is the VDOT 2016 Road and Bridge Standard (Revised March 2025) – Details / specifications for storm structures, curbs, and pavements

3. **Local**
   a. City of Richmond Water Distribution System Design Guidelines and Standard Specifications – Water system design within the City right-of-way
   b. City of Richmond Cross Connection Manual – Potable and fire water backflow prevention
   c. City of Richmond Permitting – Permitting for connections to City systems and work within the right-of-way
   d. International Plumbing Code (IPC) 2021 – City references this code for design of water, sanitary, and storm utilities

Civil Design Narrative

1. **Existing Site Conditions** – The project site is comprised of 5 parcels, 3 located in the area bound by N 13th Street, N 12th Street, Leigh Street (Bridge), and E Clay Street(Parcel IDs: E0000208009/E0000208019/E0000268011), and 2 parcels located in the area bound by E Duvall Street, Leigh Street (Bridge), and the VCU School of Nursing parcel (Parcel IDs: E0000268015/E0000268009), with a total site acreage of approximately 4.14 acres, is the current location of the 13th Street Parking Deck, the Strauss Research Laboratory, and the Health Sciences Library. Existing site features include the existing buildings/structures, sidewalks, parking, a loading/mechanical entrance/yard, and several landscaped areas. Site topography falls approximately 105 feet from southwest to northeast with the highest portion of the site around elevation 162 (at the 12th/Clay Intersection) and the lowest portion of the site around elevation 57 (intersection of 13th/Duvall Street and Leigh Street Bridge). The existing site consists of approximately 80% impervious land coverage. Note – N 13th/ Duvall Street are private roads owned by VCU, with public utilities within all. E Clay Street, N 12th Street, and E Leigh Streets are public right-of-way.



Parcel Ownership	
E0000208009	Virginia Commonwealth Univ Health Science Division
E0000208017	Virginia Commonwealth Univ Real Estate Svcs
E0000208019	Virginia Commonwealth Univ Health Science Division
E0000268011	Virginia Commonwealth Univ Health Science Division
E0000268015	Virginia Commonwealth Univ Health Science Division
E0000268009	Virginia Commonwealth Univ C/O Sr Real Estate Mgr

2. **Demolition –** There will be select site feature demolition and utility removal as part of the project. The site feature demolition will include the removal of a portion of all general site features including curbs, sidewalks, hardscape, parking/loading area, and landscape. Utilities to be removed and capped include storm, sanitary, potable and fire water services, telecommunications, electric, gas, and steam & condensate.

   Demolition of the existing buildings and parking structure will include the removal of the existing basement and preparation of subgrade for the proposed building and loading area. This may result in the need for sheeting and shoring to support the excavation for both the main building and the CUP. Dewatering of the excavation will also be necessary.

   Construction staging will be challenging due to limited open area around the perimeter of the site. Lane closures along N. 12th Street, N 13th Street/Duvall Street are anticipated to be necessary. The pedestrian walkways along the N, W, and S side of the site must be maintained for access to the adjacent buildings and allow for pedestrian travel between the nearby buildings and other parking structures. Lane closures along N 13th / Duvall Street across the frontage of the CUP will not be permissible. Access along N 13th / Duvall Street from the north and south to the D-Deck must be maintained throughout construction.

3. **Erosion Control –** Erosion and sediment from onsite construction activities will be managed employing standards from the Virginia Erosion and Sediment Control Handbook (VESCH) to trap, divert, and remove sediment from site runoff before entering adjacent undisturbed areas and storm conveyance systems. Temporary measures like construction entrances, silt fence, inlet protection, and sediment trapping devices will be installed and maintained throughout construction to maintain effectiveness. Dust will be controlled through wetting portions of the site during dry periods. Water from dewatering operations will need to be filtered prior to discharge into the City sewer system. Erosion control measures will be utilized until the site is fully stabilized.

4. **Earthwork –** The site will require grading and drainage structure in order to maintain positive drainage away from the building. Pedestrian paths will be graded to comply with the 2010 ADA Standards for accessible routes where feasible. The site earthwork will likely result in excess material, and exporting material will be required. There is a high probability of encountering blue marle soils that potentially result in acid sulfate producing conditions. Soils of this composition existing below water tables will require disposal within a regulated facility as the material is not classified as clean. Importing structural fill is also anticipated for areas beneath the building and proposed pavement.

5. **Site Improvements –** In addition to the proposed main building and CUP, several site features will be provided. Sidewalks and hardscape features will be proposed around the site. Curb and gutter and sidewalks will be needed for the drive through area that runs beneath the building. Access points to the building will be located off N. 12th Street, and N 13th/Duvall Street.

   The curbing and sidewalks surrounding the site will likely be damaged during construction. It will most likely need to be removed and replaced following heavy construction activities. Some curb around the perimeter of the site is granite. Where encountered, the curb shall be salvaged and returned to the City of Richmond. New curb and curb/gutter will be concrete.

   N 12th Street between Leigh St and Clay St will require modification to the eastern side, to standardize widths and provide access improvements into the main building. The eastern portion of the street and full sidewalk will be rebuilt following installation of the re-routed steam lines impacted by building construction.

   N 13th/Duvall Street will be modified along the entire main building frontage, under the Leigh Street bridge, and across the frontage of the CUP. The horizontal curve adjacent to the bridge will be adjusted, along with services entries into the main building and D-Deck entrances will be reconstructed including pavement, curbs, sidewalks, and hardscape/landscape.

   The N 12th Street/Leigh Street intersection will require signalization to allow traffic movements off N 12th Street in both the east and west directions. This signal will be fully automated, and in accordance with the City of Richmond DPW and VDOT standards and specifications and will be functional with the main building project access.

6. **Site Utilities**
   a. **Water Service –** Fire protection and domestic water will be required for the proposed building. There are existing water mains, owned and operated by the City of Richmond, on three sides of the site: an 8-inch line within N. 12th Street; an 8-inch line within Leigh Street and an 4-inch line within the Duvall/N 10th Street intersection. Given the site constraints and the proposed building layout, the most logical location to make the proposed fire protection and domestic water connection for the proposed building is along N. 12th Street near Clay Street, and for the CUP in the new waterline extension in N 13th / Duvall Street. Isolation valves shall be installed on either side of the tap.
   The 4″ water line within N 13th Street will require upgrade/upsizing to 8″ and extended north beyond the CUP to satisfy fire flow requirements along with associated fire hydrants. An interconnection to the line in Leigh Street may be required based on flow and pressure requirements.

   The fire supply for each individual building (Main and CUP) will have a detector meter/check and the domestic supply will have a meter. Both detector and meter will be installed in vaults behind the curb, meeting City of Richmond DPU standards and Specifications.

   The fire supply and domestic water services both will have RPZ Backflow preventers, installed above grade in insulated enclosures per ASSE 1060. The domestic water RPZ-BFP shall meet the requirements of ASSE 1013, and the fire service ASSE 1013.

   Domestic and Fire service waterlines shall be ductile iron, meeting the requirements of AWWA C151/A21.51.

   Adequate capacity within the City systems for flow and pressure is anticipated to be available. Fire flow tests must be conducted as part of the overall building and system design. Pressure boosters for fire and domestic services are expected to be required within the building.

   b. **Fire Hydrants –** Fire Hydrants will be provided along the project perimeter, meeting City of Richmond DPU and Fire standards and specifications.

   c. **Sanitary Sewer –** Sanitary sewer service will need to be provided for the proposed building and maintained for surrounding buildings. There are existing combined sewer lines within City streets along the boundary of the site. Given the site constraints, the proposed main building and CUP layout, and the fact that the lowest point in the combined sewer system is on the east side of the site, the logical sanitary outfall location is near the NW project site boundary, in N 13th/Duvall Street.

   Storm Sewer within Streets – manholes, inlets, and pipes shall be installed per VDOT Road and Bridge Standards and Specifications. Manholes and inlets may be precast or cast in place. Storm sewer pipe in streets shall be Class III RCP. All manholes shall meet H20 load rating. Connections/ outfalls to combined sewer shall utilize a trapped outlet structure.

   Storm Sewer within Landscape/Hardscape – inlets shall be Nyloplast or similar, with pipe being PVC or corrugated HDPE with smooth wall interiors (N-12 or similar). Connections to the existing combined sewer shall be through a trapped stormwater manhole outlet.

   All storm and sanitary outfalls from the lowest level shall pass through a backwater valve before discharge into the City systems. This BWV shall be located in a manhole for ease of access.

d. **Steam Infrastructure** – the existing steam line located across the CUP and main building site will be intercepted and relocated west, up to N 12th Street, and then south to interconnect with existing infrastructure in Clay Street (refer to MEP narratives). This line will utilize tunnels beneath the streets and sidewalks and will require adaptation/relocation of existing utility services along N 12th Street.

   A new steam line will be installed between the CUP and the main project building. This line will be above grade, and pass beneath the Leigh Street bridge, utilizing foundations and structural supports similar to the existing line along N 13th/Duvall Street. This line will require encroachment permitting through the City of Richmond DPW.

7. **Stormwater Management** – The project site is located within the combined sewer area of the City of Richmond. As such, the standard technical requirements from the Virginia Stormwater Regulations do not apply. The City has created their own requirement for discharge to the combined sewer system.

   Stormwater quantity will be addressed by an overall reduction in imperviousness and maintaining the outfall storm locations. If required, supplemental stormwater management will be achieved through providing on-site detention to attenuate post-developed 10-year flows down to pre-developed 10-year flows. Stormwater will be contained in an oversized underground detention pipe. Stored water will be released through a control device into the City of Richmond combined stormwater system near the NW project site boundary, in N 13th /Duvall Street. A trap manhole will be needed between the control structure and the connection to the City system.

   Stormwater quality control is not required within the combined sewer system.

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