Report No: CSIR/SP/FBI/II/2020

GWDMS No.: 000000

09 April 2020

Minimum infrastructure requirements for Alternate Care Sites for SARS-CoV-2

Interim guidelines

Edition 1

Prepared for:

Business for South Africa

Contact person: Kate Roper

Tel: +27 #

Email: Kate.Roper@aurecongroup.com

Prepared by:

Infrastructure Innovation Research Group

Smart Places Cluster: CSIR

+27 (0)12 841 3007/ (0)82 574 3700

pdejager@csir.co.za

DOCUMENT RETRIEVAL PAGE	
Report Title:	Minimum infrastructure requirements for Alternate Care Sites for SARS-CoV-2
Authors:	Coralie van Reenen, Jako Nice, Peta de Jager and Toby van Reenen
Date:	08 Apr 2020
Project No.:	60C4126
Client Reference No.:	CDC-RFA-GH16-1644
Abstract:	The global pandemic of COVID-19 caused by the coronavirus, SARS-CoV-2 is likely to result in a surge in need for medical care for Severe Acute Respiratory Syndrome (SARS) in South Africa. Considering the course of the pandemic in other countries, it is anticipated that South African hospitals will not have sufficient capacity to cope with the surge of persons requiring medical attention and that alternate care sites (ACS) will need to be established. These can be temporarily established in non-traditional environments, such as hotels, exhibition halls, community halls, and as field hospitals, on open spaces. In the context of this document, a quarantine site is a facility for patients who do not require continuous professional medical care, while an ACS is defined as a temporary facility that can provide continuous medical care for SARS. This document provides principles and considerations, high-level guidance for minimum requirements and examples for ACS.
Keyword(s):	Alternate Care Site, Field Hospital, COVID-19, Surge Capacity, Infrastructure, SARS
Competence Areas:	Smart Places

Note: Every effort has been made to ensure that this document is predicated on the best available information, and formulated to meet local conditions. It has been critically reviewed by leading, local experts. Yet, it has been crafted rapidly and in a time when additional data and information on the novel pathogen of concern and best practices is constantly emerging and improving. Therefore judicious application is recommended. The authors and affiliates advise that suitably qualified and experienced persons be engaged to respond in the provision of infrastructure for alternate care sites for the COVID-19 pandemic.

Acknowledgments

Contributors

Adriaan Vorster	Aecom
Amanuel Gebremeskel	Southern African Institute of Steel Construction (SAISC)
Avash Sunnylall	The Medihosp Group
Clive Albrecht	Albrecht Enterprises Consulting Services
Dirk du Preez	Helderberg Architects
Dolf Möhr	CSM Consulting Services
Duncan Rendall	Western Cape Provincial Government
Frik Lange	CSM Consulting Services
Hannah le Roux	Wits University
Johann T	JHSE
Kevin Bingham	South African Institute of Architects (SAIA)
Kevin Dane Poggenpoel	Mediclinic
Markus Meyer	CSM Consulting Services
Maronel Steyn	CSIR
Mofenyi Maimela	Independent
Mohamed Rawat	Dihlase Engineering
Philip Patrick Sun	MIAA Healthcare
Peter Peterson	Cato Ridge Electrical
Peter Schilder	Saftek
Pieter Jordaan	CSM Consulting Services
Rodriek Mushwana	MSB Engineering

Reviewers

Edwina Fleming	Sakhiwo Health Solutions
Janet Magner	Magner Risk Services
Jeremy Gibberd	CSIR
Kate Roper	Aurecon
Marianus de Jager	A3 Architects
Riaan van de Watt	REAF Consulting
Robin O'Reilly	Independent

Abbreviations

ACS	Alternate Care Sites
BSA	Business for South Africa
CDC	Centers for Disease Control and Prevention
CSIR	Council for Scientific and Industrial Research
CSSD	Central Sterile Supply Department
GiFA	Gauteng Institute for Architects
HCRW	Health Care Risk Waste
HEPA	High-efficiency particulate air filter
HVAC	Heating, Ventilation and Cooling
ICU	Intensive care unit
IUSS	Infrastructure Unit System Support
NHLS	National Health Laboratory Service
PEPFAR	Presidents Emergency Plan for AIDS Relief
PPE	Personal Protective Equipment
PUI	Persons under Investigation
SAIA	South African Institute of Architects
SAFHE	South African Institute of Hospital Engineers
SARS	Severe Acute Respiratory Syndrome
UVGI	Ultraviolet-Germicidal Irradiation
WHO	World Health Organisation

Table of Contents

Table of Tables

Table of Figures

Background

Business For South Africa (BSA) is the umbrella organisation now representing the vast majority of all business associations in South Africa including Business Unity South Africa (BUSA), Black Business Council (BBC), the Hospital Association of South Africa (HASA) and its members. BSA is responsible for assisting all its members and government, to the extent that government so requires, in ensuring the best, fastest and most effective reaction to COVID-19 in all areas. The BSA team includes the senior executives of the majority of major companies in South Africa including the CEOs of all of the major banks, industrial and mining houses, hospital groups, medical aids, consulting and other firms.

Task teams have been set up to proactively assess and implement business initiatives to deal with the impact of COVID-19 in health, the labour market and the broader economy, all three of which will be assisted by a communications task team. The health workstream is focused on mobilising resources to contribute to COVID-19 tracing, tracking, testing, monitoring and pathology labs; communicating around COVID-19; hospital responses and Personal Protective Equipment (PPE), medicines and medical devices; and support the National Health Department with capabilities to enable more specific demographic resource deployment.

The BSA workstream for DATA & ANALYTICS is assisting the national command council with guidance on temporary facilities during the pandemic, including identifying locations near to potential hotspots, facilities (public and private), providing minimum specifications, GIS mapping, etc. The need to fast-track preparation of specifications for field hospitals was flagged at the BSA COVID Health Response Workstream Leads call on 4 April 2020, resulting in the CSIR being invited to draft minimum infrastructure requirements for Alternate Care Sites – national norms and standards.

Kate Roper

Client Director, Health and Education,

Aurecon.

6 April 2020

Document roadmap

This document is intended to provide high level guidance for use by officials, investors, service providers and consultants who are establishing alternate care sites for COVID-19 in South Africa.

Section one: Sets out the scope of the document, rationale for provision of ACS and a strategic approach.

Section two: Provides initial project planning considerations and overarching principles for commissioning and establishing ACS infrastructure, focussing on health and safety.

Section three: Describes infrastructure requirements per functional area for clinical services, logistics and support services.

Section four: Stipulates environmental and engineering performance specifications.

References are provided as hyperlinks (when available) in footnotes, as well as full reference and additional resources in the bibliography. This document will be published on hillside wiki[1], where professional community feedback will be encouraged. The document will be dynamically updated, through this moderated site.

1 Section one

1.1 Purpose and approach

The global pandemic of COVID-19 caused by the coronavirus, SARS-CoV-2 is likely to result in a surge in need for medical care for Severe Acute Respiratory Syndrome (SARS) in South Africa. Considering the course of the pandemic in other countries, it is anticipated that South African hospitals will not have sufficient capacity to cope with the surge of persons requiring medical attention and that surge capacity via alternate care sites (ACS) will need to be established.

Surge capacity, contemplated here is not the frequent emergency department overcrowding experienced by healthcare facilities (e.g. Friday/Saturday night emergencies) or local casualty emergency that might overcrowd nearby facilities and have little to no impact on the overall healthcare delivery system. It is when a catastrophic event occurs and the affected population seek medical care from existing local healthcare facilities, causing healthcare infrastructure to become exhausted due to excess in demand. During a healthcare surge, the standard of care will shift from

[1] https://thehillside.info/index.php?title=Infrastructure_Guidance_for_COVID-19/Alternate_Care_Sites

focusing on patient-based outcomes to population-based outcomes, and providers should anticipate "a shift to providing care and allocating scarce equipment, supplies and personnel in a way that saves the largest number of lives in contrast to the traditional focus on saving individuals."[2]

Surge capacity can be temporarily established in non-traditional environments, such as hotels, exhibition halls, community halls, and as field hospitals, on open spaces.

In the context of this document, a quarantine site is a facility for patients who do not require continuous professional medical care, while an ACS is defined as a temporary facility that can provide continuous medical care for SARS. This document provides principles and considerations, high-level guidance for minimum requirements and examples for ACS.

While an extensive set of health facility guidelines does exist[3] , these are applicable for conventional facilities and thus include services and guidelines that are not necessarily relevant to the treatment of a novel, highly infectious pathogen, with pandemic effects. Moreover these do not provide well for the rapid and temporary establishment of facilities.

In order to formulate high-level guidance, the team reached out to professional industry bodies for inputs, in particular the South African Institute for Architects (SAIA), The Gauteng Institute for Architects (GiFA) and the South African Federation of Hospital Engineering (SAFHE), by inviting input via a 36-hour research charrette. Relevant historical and contemporary literature was consulted, precedents identified and critically reviewed. Material from the Infrastructure Unit System Support (IUSS), international literature and guidance and input gathered from the broader architectural, engineering and healthcare professional communities was synthesised and moderated by the CSIR team. The draft was reviewed by an expert review panel. Contributors and reviewers are acknowledged in text.

1.2 Scope and assumptions

ACSs as discussed in this document are dedicated, temporary facilities for triage, testing, diagnosis, on-referral and treatment of persons:

- suspected of having contracted SARS-CoV-2, (persons under investigation (PUIs)), who are symptomatic and/or are awaiting results,
- or are confirmed to be infected.

ACS will accommodate a variety of clinical, logistical, support and auxiliary services associated with

[2] Health Systems Research Inc., 2005

[3] IUSS, 2017

the render of care. ACS will currently not be licensed to provide healthcare services. Since the ACS will operate in a non-healthcare facility, it cannot fully replace a hospital setting and its prime objective is to manage the patient load until the local healthcare system can meet demands.

1.2.1 Exclusions

Quarantine facilities are accommodation facilities where a member of the community can remain for the duration of their isolation period. This is typically temporary housing for a cohort of people who do not need intensive medical attention but who cannot stay at home. Patients can take care of themselves and need limited monitoring by medical staff. Quarantine: Containing presumptive-case patients from each other and the general population.

Quarantine facilities – that is for asymptomatic persons who are in the community in self- or imposed isolation, but not displaying symptoms, or who are symptomatic, but are able to safely recover without clinical intervention and do not need continuous medical observation are not considered in this document.

1.2.2 Service regime

The following assumptions are made with respect to services under consideration.

- Temporary - limited to the part of the pandemic when the "conventional" hospital platform cannot meet demand. To be dismantled, thereafter.
- Uncomplicated, dedicated COVID-19 care. Patients with comorbidities, paediatrics will be prioritised for conventional facilities.
- 24 hour, 7 days a week operations.

1.2.3 Assumed mechanism of transmission

Transmission of SARS-CoV-2 is understood to be preferentially transmitted from person to person by the contact and droplet routes with opportunistic airborne transmission and negligible water transmission risks in special circumstances. Reclassification of transmission mechanisms may nullify some of the approaches presented in this guidance.

1.2.4 A call for strategic coordination

This document focusses on infrastructure requirements. These provisions are meaningless without staffing, equipping and resourcing. Whilst staffing, equipping and resourcing are not the focus of this document, these are likely to emerge as key constraining features. Resource constraints are likely to become acute during this pandemic. Doctors and nurses are already in critical short supply in South Africa and internationally, and are themselves susceptible to COVID-19 infection. Equipment and

consumables are in short supply with heightened global demand, reduced manufacturing capacity and limits in trade flows. This necessitates strategic coordination, proactive planning, options appraisal and prioritisation.

1.3 Status quo

1.3.1 Rationale and transmission status

According to the World Health Organisation (WHO), based on the largest cohort of COVID-19 patients, about 40% of patients with COVID-19 may have mild disease, where treatment is mostly symptomatic and does not require inpatient care. About 40% of patients have moderate disease that may require inpatient care; 15% of patients will have severe disease that requires oxygen therapy or other inpatient interventions; and about 5% have critical disease that requires the patient to receive mechanical ventilation. However, the evolution of the outbreak in some countries has shown a higher proportion of severe and critical cases and the need to rapidly increase surge capacity to prevent rapid exhaustion of biomedical supplies and staff. In some countries, doubling rates of cases every three days has been observed[4].

South Africa has a high burden of disease, with a high prevalence of HIV and TB. Although evidence is yet to emerge of the effect of SARS-CoV-2 on a population with these pre-existing conditions, there is reason to proceed with caution[5]. There is potential direct and indirect benefit of ACS to people living with HIV and TB, as well as to general public health and the health system preservation.

With the travel lockdown in place, and continued transmission, it appears that South Africa is on the cusp between cluster transmission and community transmission according to WHO's classification, shown in Table 1, indicating that preparation should include temporary hospital facilities and mass critical care.

[4] WHO, 2020 a

[5] The Conversation, 2020

Table 1: Key clinical and infection control activities for different transmission scenarios[6]

	No Case	Sporadic Case	Clusters of Cases	Community Transmission
Faculty Space, Including for Transmission	Usual Space. Enhanced Screening and triage at all points of first access to the health system	Dedicated COVID-19 patient care areas within health facility (e.g. infectious disease ward, isolation rooms in emergency or ICU wards).	More patient care areas re-purposed for COVID-19 within the health system, especially for severe cases	Expanded care for severe cases in new hospitals or temporary hospital facilities
Staff	Usual space. Enhanced screening and triage at all points of first access to the health system	Dedicated COVID-19 patient care areas within health facility (e.g. infectious disease ward, isolation rooms in emergency or ICU wards)	More patient care areas repurposed for COVID-19 within the health system, especially for severe cases	Expanded care for severe cases in new hospitals or temporary hospital facilities
Supplies	• On-hand supplies. Equip wards for COVID-19 treatment. • Identify essential equipment and supplies, including oxygen. • Prepare expanded local supply chain	• Expanded inventory of supplies with detailed protocols for use. • Activate expanded local supply chain. • Prepare national supply chain.	• Conservation, adaptation, selected re-use when safe. • Activate contingency planning and procurement for essential equipment and supplies. • National supply chain. • Prepare expanded supply chain at global level	• Activate contingency planning should critical equipment be in short supply. • Determine allocation of lifesaving resources for HCWs and patients. • Activate expanded global supply chain
Standard of Care	Usual care with enhanced awareness and recognition of immediate needs for first COVID-19 patients	Usual care and treatment for all patients, including those with COVID-19	Identify context-relevant core services. Shift service delivery platforms. Consider reduction in elective patient encounters, including elective surgical procedures.	Mass critical care (e.g. open ICU for cohorted patients).
Care areas expansion	No requirements for expansion	Designate 10 beds per suspected COVID-19 case	Expand COVID-19 patientcare areas by a factor of 35	Expand COVID-19 patient care areas by a factor of 58

1.3.2 Quantification of need

At this time there are various parallel initiatives aimed at forecasting the South African epidemic, quantifying the projected need for facilities, and shortfall in existing capacity. At this time, there is no consensus on this. This section will be updated as further data becomes available.

[6] WHO, 2020a

ACS will attend to mild to moderately affected COVID-19 patients where basic, targeted medical care will be provided. Should patients' needs evolve, requiring escalation of care, then transfer of patients from ACS sites to conventional sites of care will be needed as a matter of course, bringing with it logistical challenges and risks. The following pragmatic approach, aligned with the WHO recommended strategic approach, is suggested.

- ACS should be preferably identified with space for expansion. The set-up should be done so that levels of care can be upgraded to higher levels of care.
- This guidance makes the assumption that only uncomplicated COVID-19 cases will be treated at an ACS, entailing that patients with comorbidities, and paediatrics will be referred to conventional facilities. Depending on epidemic trajectory, it may be necessary to expand services to include a greater range of clinical services at ACS.

1.4 Strategic approach

According to WHO, clinical interventions must be put into place immediately, and then scaled up according to the epidemiologic profile.

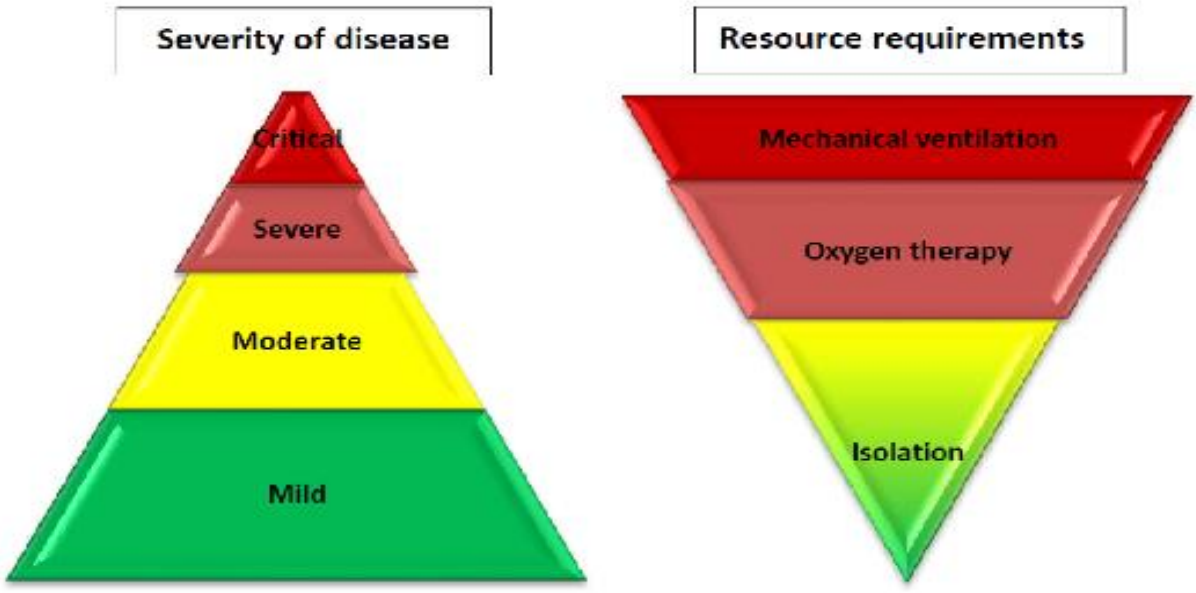


Figure 1: WHO Strategic approach clinical care.

UNDER THESE UNUSUAL CONDITIONS, the clinical care strategy which cannot be accommodated within existing facilities, can, on a temporary basis be hosted in ACS:

- Within and around existing healthcare facilities, via reconfiguration and/or augmentation.

- In existing non-healthcare buildings suitable for repurposing, such as universities, hotels and conference centres, warehouses, gyms, hostels etc.
- On open fields, including paved parking areas with rapidly constructed, dismountable structures, such as modular tented structures or using rapid modular construction techniques.

ACS will provide isolation, general (non-acute) care for patients with mild to moderate symptoms and as required, acute care for patients with severe symptoms. Containing confirmed-case patients from general population. Confirmed-case patients can be housed together en masse, while presumptive-case patients must be individually quarantined.

As shown in Figure 1, WHO recommends a range of services to meet patient need. General (non-acute) care ACS model is designed for minimal acuity patients requiring minimal activities of daily living support (e.g. COVID-positive with minimal symptoms or require <2L of oxygen). Acute care ACS model is designed for higher acuity patients requiring closer monitoring or respiratory support (e.g. COVID-positive with pneumonia or respiratory distress requiring ventilator support). Paediatric patients are to be accommodated in separate wards, where strictly controlled visitation may be allowed.

As a preliminary estimate, the following ratios of service is proposed:

The recommended strategy is that space allocations are provided to meet higher levels of care, with services and utilities rapidly upgradable to higher levels of care. This will allow a conservative but flexible approach to the provision of infrastructure.

2 Section two

2.1 Typology dictates

To meet the requirements set out in this guidance, prospective "host" sites should be carefully evaluated. The type of "host" site selected will strongly influence or dictate the choice of ACS service model. Some typological responses and service model are set out in precedent examples, shown in Table 2.

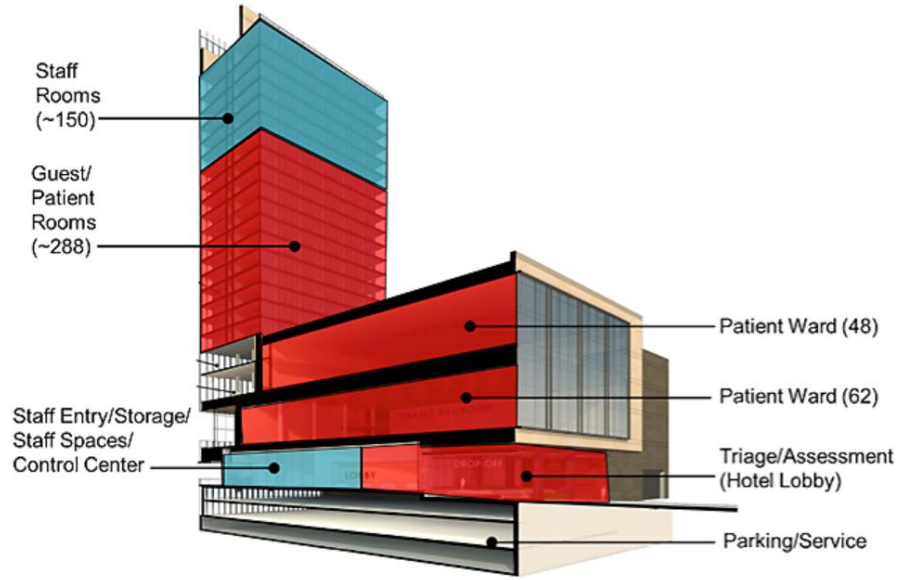
Table 2: SARS ACS precedents

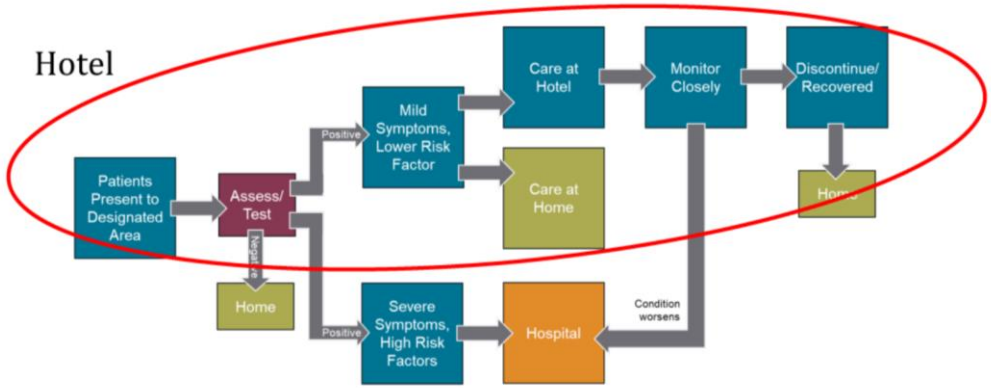
Site type:	Existing hospital	Conversion of existing non-isolation buildings to isolation wards for treatment of SARS patients. Steps for conversion and implementation described. Nosocomial infection rate 0.6% ascribed to non-compliance with procedures.
Typological response:	Minor adaptive reuse	
Service model:	Clustered cohort	
Precedent:	Sung-Shan Military Hospital Taipei[7]	Infrastructure steps taken: 1) Clear buildings of people & equipment. 2) Fans (commercial grade 3X1m blaes, 65W, 60Hz) above each window. 3) plug doors to create negative pressure relative to corridor (0.028-0.07 water gauge in rooms to 0.0 in corridors.) 4) Close stairways between floors. 5) creating three zones at the ground floor for entry A: clean zone for changing and administration; B: Intermediate zone for removing inner layer of PPE, showering; C: contaminated zone for removing outer layer of PPE; 6) cleaning regime described. 7) Patient transport described; 8) Treatment of SARS patients and handling of equipment described: Interesting: Centralize facilities to better control / train health care workers and nosocomial infections.

Site type:	Existing hospital	
Typological response:	Augmentation	
Service model:	Mass ICU	
Precedent:	A medical tent is stationed outside Richmond University Medical Center in West Brighton[8].	

[7] Fung et al, 2004
[8] Joseph Ostapiuk, 2020

Site type: Existing hotel
Typological response: Adaptive reuse
Service model: Obligate - Cellular/ single room
Precedent: Theory only…[9]

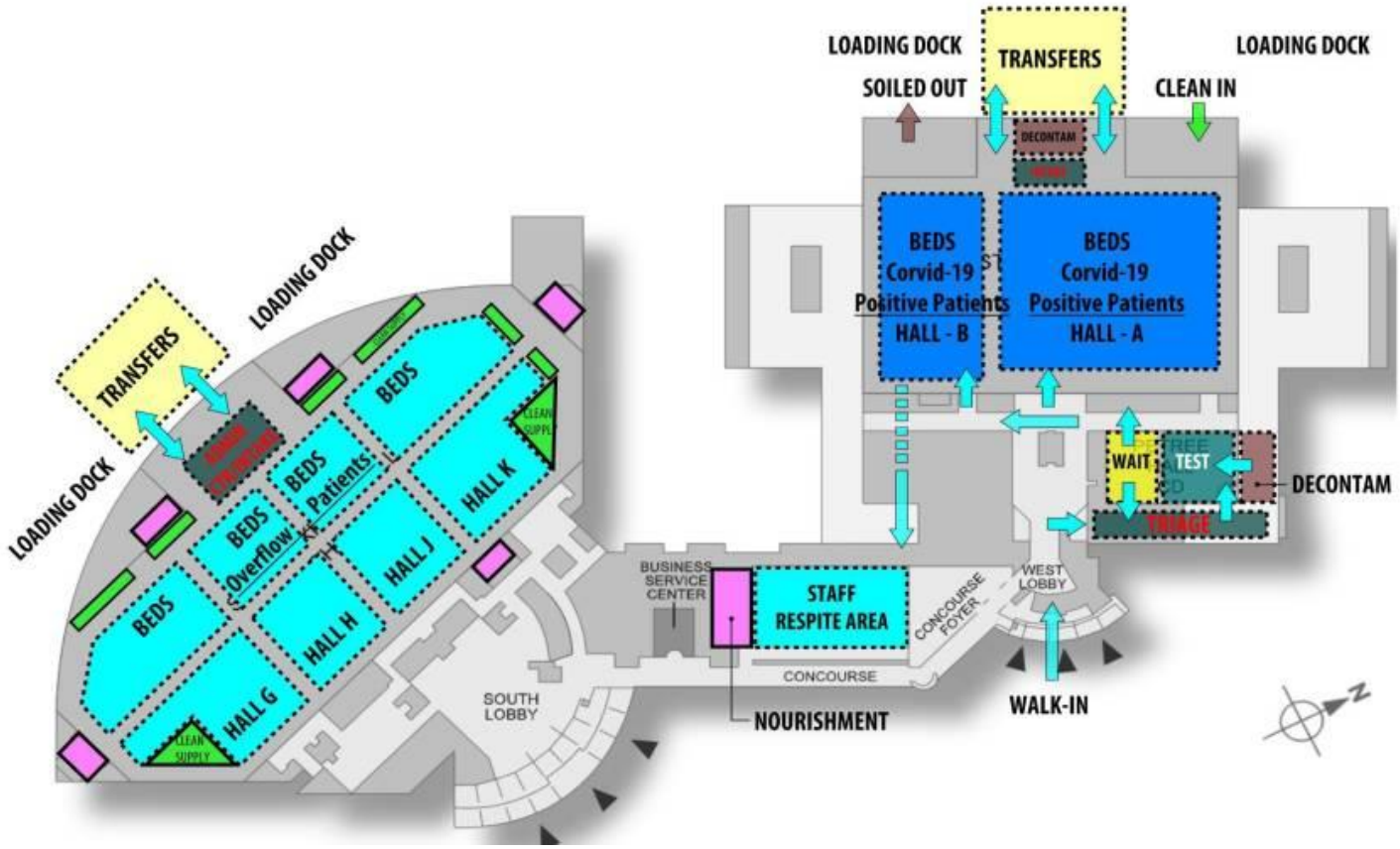




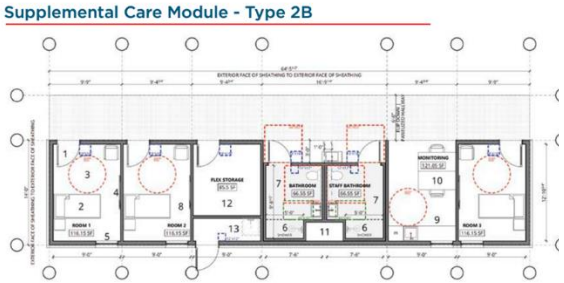
[9] Salus, 2020, Shroer, 2020

Site type:	Conference centre
Typological response:	Repurposing
Service model:	Mass ICU
Precedent:	NHS Nightingale Hospital London[10]
	Javits Center, New York[11]
	Los Angeles Convention Centre

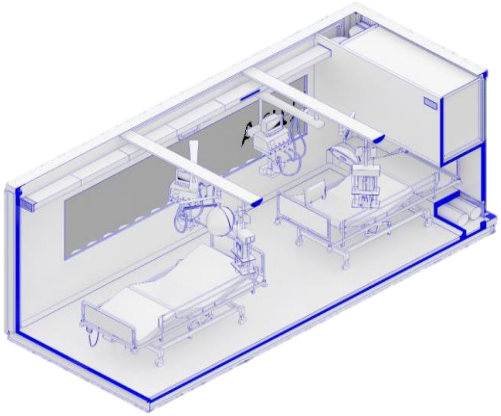
[10] BBC News, 2020
[11] Katherine Keane, 2020


LOADING DOCK
TRANSFERS
LOADING DOCK
SOILED OUT
CLEAN IN
DECONTAM
BEDS
Corvid-19
Positive Patients
HALL - B
BEDS
Corvid-19
Positive Patients
HALL - A
WAIT
TEST
TRIAGE
DECONTAM
LOADING DOCK
TRANSFERS
LOADING DOCK
BEDS
BEDS
Patients
BEDS
Overflow
HALL K
HALL J
HALL H
HALL G
BUSINESS
SERVICE
CENTER
STAFF
RESPITE AREA
CONCOURSE
FOYER
WEST
LOBBY
CONCOURSE
SOUTH
LOBBY
NOURISHMENT
WALK-IN
N

Site type: Open field
Typological response: Modular construction
Service model: Cellular/ single room
Precedents: Volumetric Building Companies (VBC) Philadelphia[12] (Linear format)
MAII – USA[13] (Clustered configuration)



Site type: Open field
Typological response: Repurposed shipping containers
Service model: Mass ICU
Precedent: CURA, Milan



[12] Beirne, 2020

[13] Courtesy Philip Patrick Sun

Site type:	Open field
Typological response:	Tented structure
Service model:	Mass ICU
Precedent:	Central Park, New Y[14]

[14] NBC news, 2020
08 Apr 2020

No site is likely to meet all requirements and recommendations set out in this document. Adaptations and compromises will be necessary. The examples set out above demonstrate that a variety of host settings are workable, provided that the appropriate utility can be contrived.

Services should be provided on site where it is pragmatic to do so, for example where similar services are provided. Outsourcing can also be practical/feasible for some services, such as laboratory services, catering and laundry, provided suitable logistical arrangements can be made.

2.2 ACS Planning Team

A planning team should be formalised to establish the minimum planning and operational requirements for the ACS and to liaise with the local community. The team should include individuals with expertise in the following areas (ideally with knowledge of healthcare delivery under emergency conditions):

- Disaster response / emergency management coordination,
- Clinical care and staffing,
- Facility set-up, operations and management,
- Security,
- Transport (patient, staff),
- Engineering and project management,
- Procurement and coordination of supplies, equipment and pharmaceuticals, and
- Community liaison to ensure that concerns of the adjacent population on understood an addressed.

It is important to ensure compliance with health, safety and building regulations, by ensuring the involvement of relevant local authorities. Stakeholder engagement should be formally documented. Concerns and grievances should be systematically addressed.

2.3 Site selection

When selecting a site, the National Department of Health *COVID-19 - Guideline Room List for Planning a Temporary Hospital* can be utilised to determine whether the site is suitable for a 100, 1000 or 2000 bed facility, as required. The following indicative minimum site sizes are needed:

- 100 Bed ACS/ hospital conversion, requires +- 4 300 m2
- 1000 Bed ACS/ hospital conversion, requires +- 17 600 m2

Evaluation should be done by examining plans (if available), satellite images, drone images, scans and by physical inspection (walkabout). A comprehensive photographic survey should be undertaken and retained for record purposes on the site inspection. This will serve as an audit record

and may assist in returning the site to its original function on ACS decommissioning and closure. When scrutinising documents and conducting site inspections to confirm suitability of a site to host an ACS, the following criteria should be taken into account.

2.3.1 Criteria

- Affordability (costs, including operational costs known and budget identified),
- Sufficient physical space and capacity to house the immediate need, with the potential to accommodate physical space requirements. For example, open site solutions should not be sloping,
- Legal rights and encumbrances, including renewal opportunity,
- Free from clear and present danger,
- Outside attenuation zones, floodplains,
- Outside high wind zones,
- Structure in good repair,
- Access to sufficient capacity for
    - potable water,
    - adequate drainage,
    - telephone and/or wifi,
    - electricity, and
- Likelihood of acceptance of hosting an ACS by the adjacent and local community.

2.3.2 Desirable

- A zone for cleaning, disinfection, and decontamination of equipment at least 15 metres away from occupied areas with access to water, a hard impervious surface and drying areas in the sun, with runoff discharge into the sewer and not into marine ecosystems or the environment.
- Capacity for expansion.
- Accessible to at least two roadways to provide continued access in the event that one roadway becomes blocked on inaccessible.

2.4 Infection prevention and control

Infection prevention and control in the context of COVID-19 should respond to transmission routes of primary concern for the pathogen of interest (contact and droplet transmission, and management of risk waste) as well as infection risk of a general nature (water and sewerage, airborne transmission – under high TB/HIV burden, and general waste).

In addition to satisfying standard precautions, transmission-based precautions should focus on three pillars: exposure reduction by spatial configuration, operational strategies, and personal protection.

2.4.1 Transmission-based precautions

Contact and droplet spread: Transmission of SARS-CoV-2 virus occurs via contact and droplet spread. The virus has been shown to persist on surfaces for extended periods of time and is known to be efficient at infecting people.

Medical waste and linen: As SARS-CoV-02 is carried in body fluids and faecal matter, disposal of contaminated items (tissues) and cleaning regimes (spaces, garments, linen) should be accommodated carefully in the workflow design and infrastructure provision. A site specific waste management plan should be formulated in accordance with a site-specific waste management plan with reference to SANS 10248.

2.4.2 Standard precautions

Water and sewerage contamination: The International Water Association (see appendix B) concluded that water and sewerage contamination is not considered to be a key risk factor for COVID-19. The panel expressed concern for "how waste and specifically wastewater (medical) would be handled by places (e.g., hostels, hotels) that are used to serve as interim COVID-19 quarantine or testing facilities or accommodation ([ACS]. These are places other than hospitals that are used in the interim for such purposes and do not usually handle wastewater from medical settings. Such facilities should be monitored carefully."

Airborne transmission: Under exceptional circumstances the risk of airborne transmission arises for SARS-CoV-2, as tabulated below.

As SARS-CoV-2 is not considered airborne, respiratory protection against airborne transmission is not considered necessary, except where aerosolisation of particles may be a risk.

According to CDC

- tracheal intubation,
- non-invasive ventilation,
- tracheotomy,
- cardiopulmonary resuscitation, or
- manual ventilation before intubation and bronchoscopy.

According to doctors in the field also when performing

- COVID-19 diagnostic sampling as patients can be induced to cough and sneeze.
- Suspected or confirmed comorbidity of TB is not an additional risk where correct COVID-19 PPE is applied.

South Africa has a high prevalence of TB and& HIV, and therefore, although the risk of COVID-19 transmission via the airborne route is not paramount, there is a high likelihood that undiagnosed TB infectious patients may present at the ACS for treatment. TB triage may be challenging in the ACS as there are symptoms in common (coughing) with COVID-19. This country specific risk is taken into account in this guidance.

2.4.3 Spatial strategies for infection prevention and control

2.4.3.1 Restricted access and zone control

The site will be arranged to ensure clear zoning, with a clear restricted zone protocol and access protection.

The public will not be permitted to visit patients at ACS sites, unless they are the parent of minor, or care giver of the elderly. Access to wards will be strictly controlled, and full donning and doffing will be required by the visitor.

2.4.3.2 Site layout and master-planning

Spatial configuration and layout can ensure unnecessary cross-over of function is avoided. This entails systematic separation of functions and managed transition between activities to facilitate consistency of care, an orderly, efficient work environment, less waste and reduced risk for improved outcomes. To achieve this, functional relationships should first be considered at the site level before

being considered at the building level.

Error! Reference source not found. and Figure 3 show worked examples of building and site layouts, which are configured with these principles, respectively.

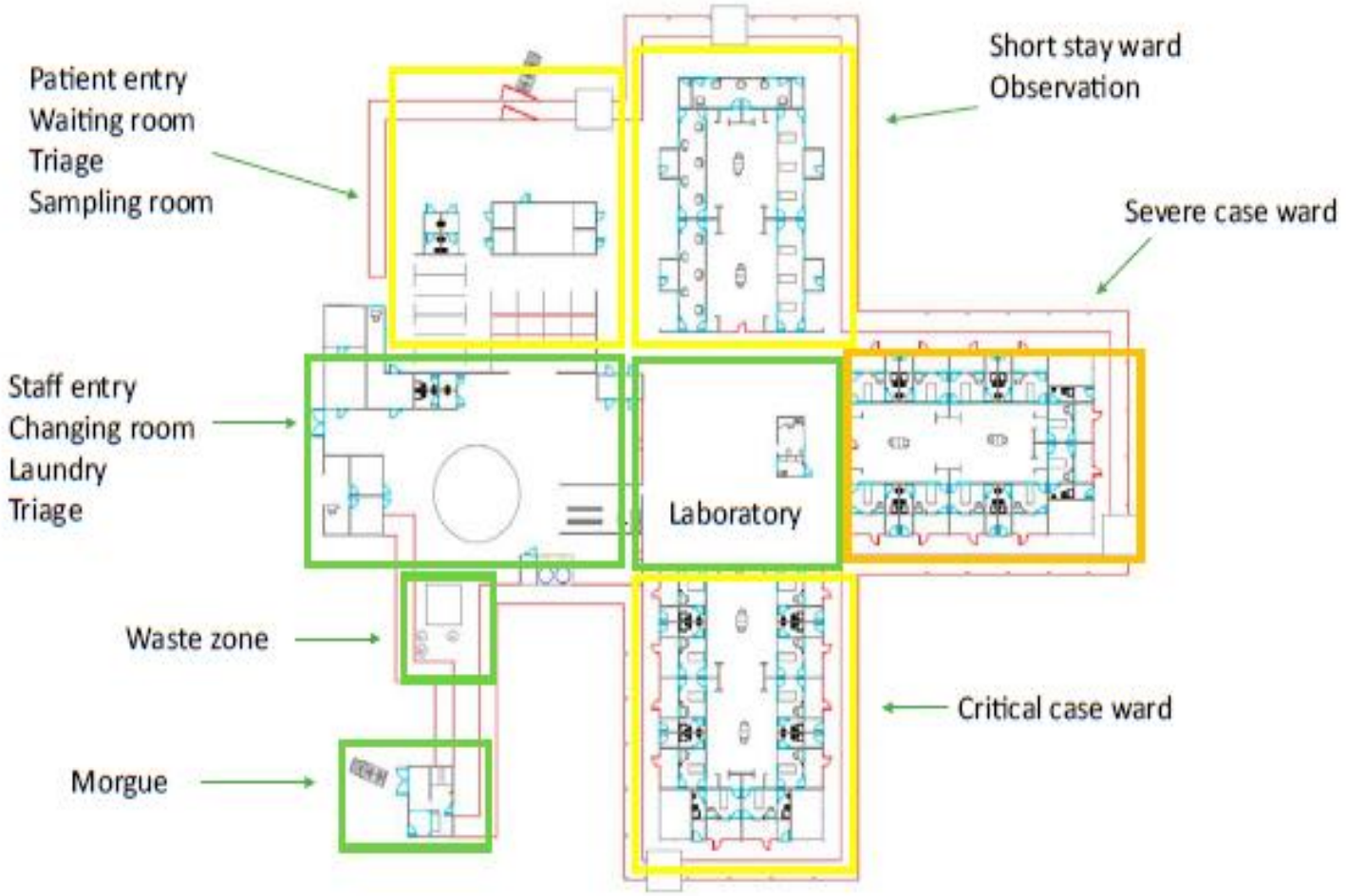


Figure 2: Layout for a SARS facility, clustering functions with minimised cross-over [15]

Figure 3: Tygerberg Hospital virus triage unit site layout [16]

[15] WHO: 2020 b
[16] Western Cape Provincial Government, 2020

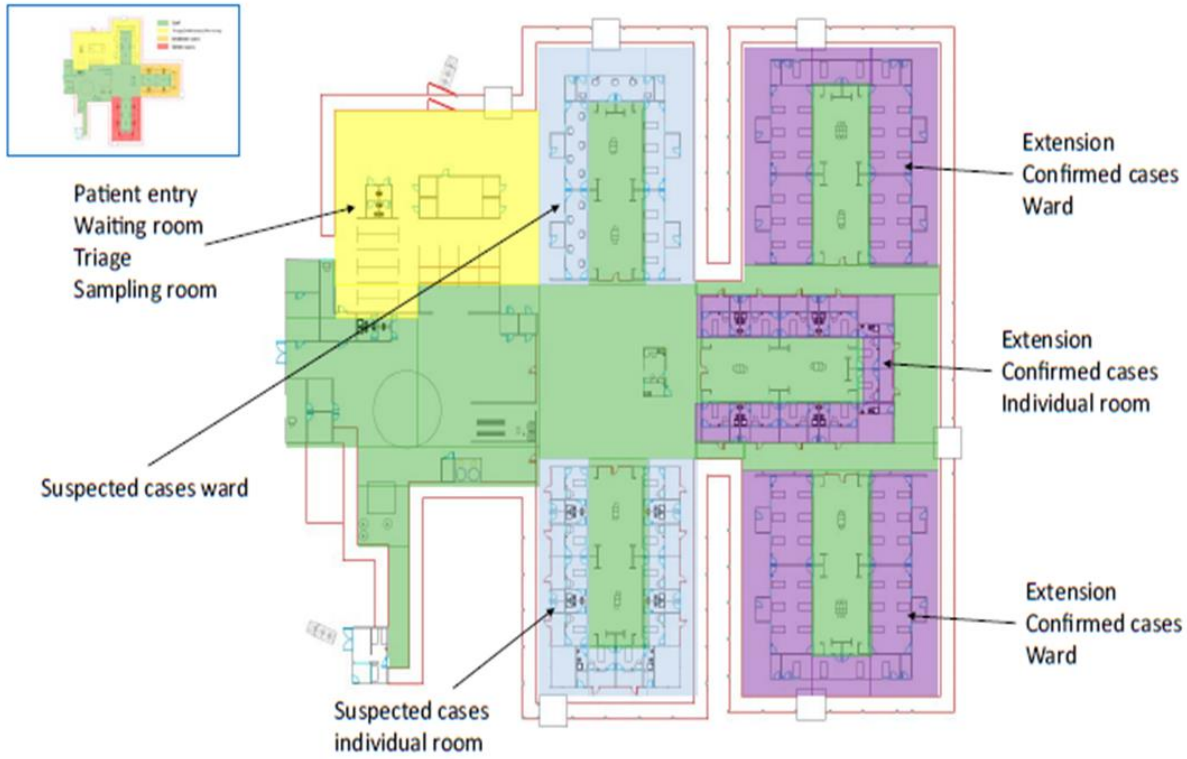


Figure 4: Patient cohorting strategy[17]

2.4.3.3 Cohorting

For this document, cohorting is defined as clustering patients with similar or compatible clinical needs together for risk reduction, acuity, efficiency and quality management, as illustrated in Figure 4.

[17] WHO: 2020 b

.

2.4.3.4 Workflow

Within individual functional zones, the workflow activities can be arranged to proceed from clean procedures, to contaminated procedures. In the example below, the staff arrival, PPE donning, doffing and patient flows are worked to have controlled interaction and minimised cross-over.

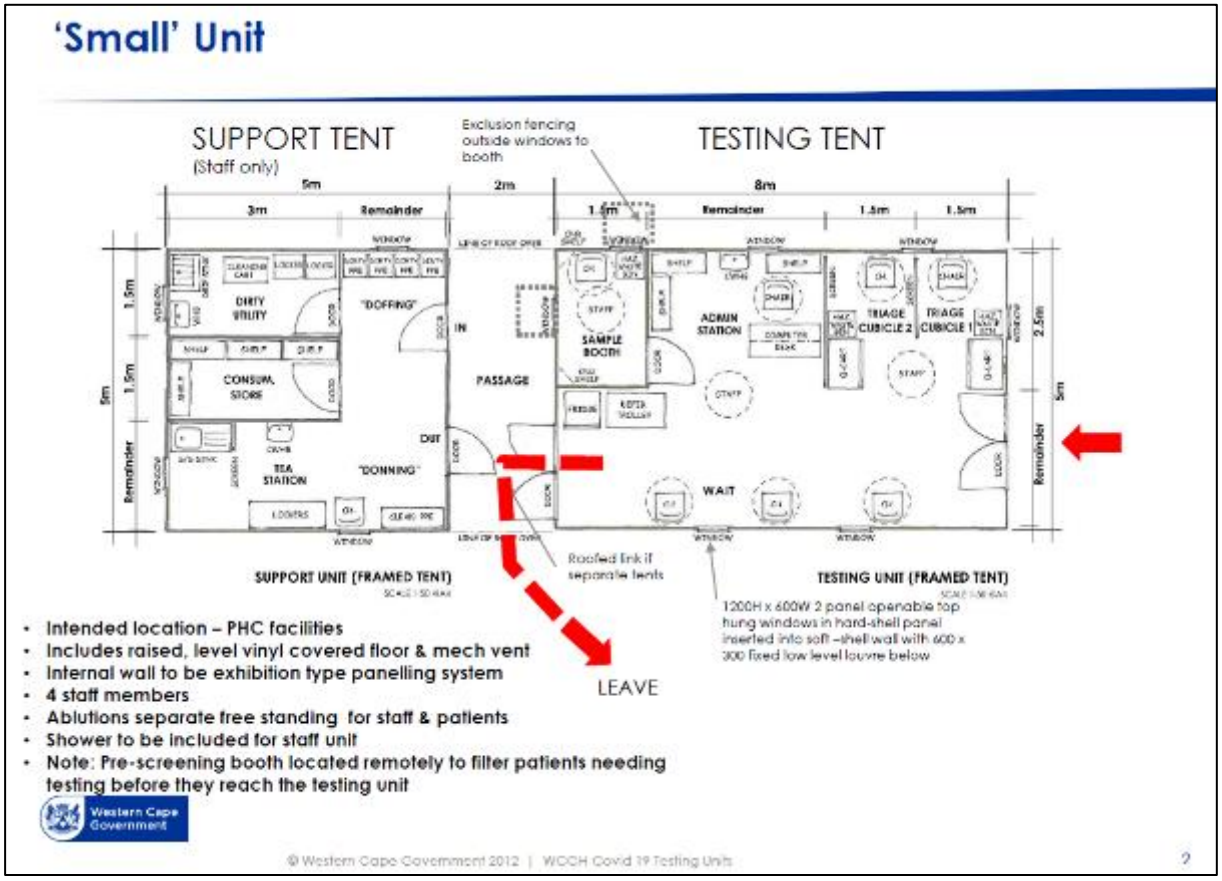
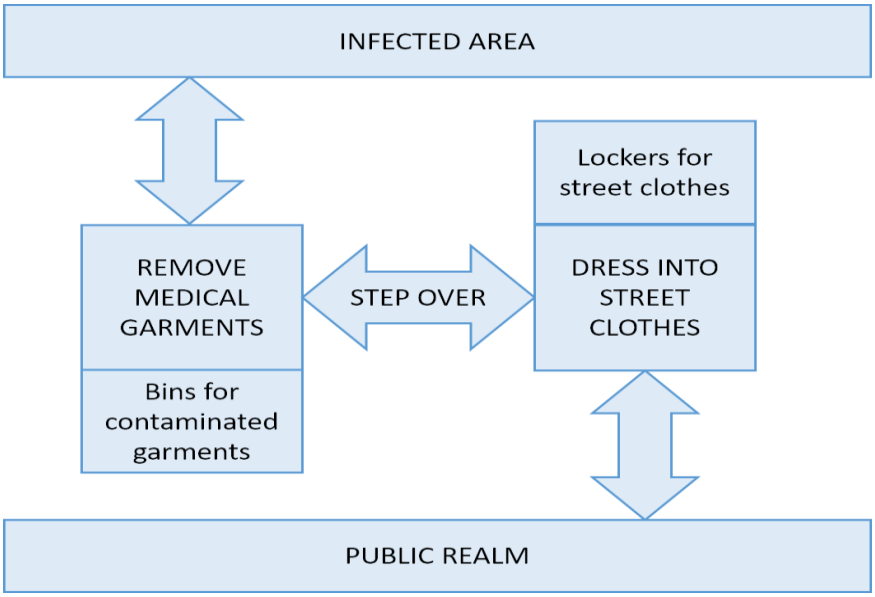


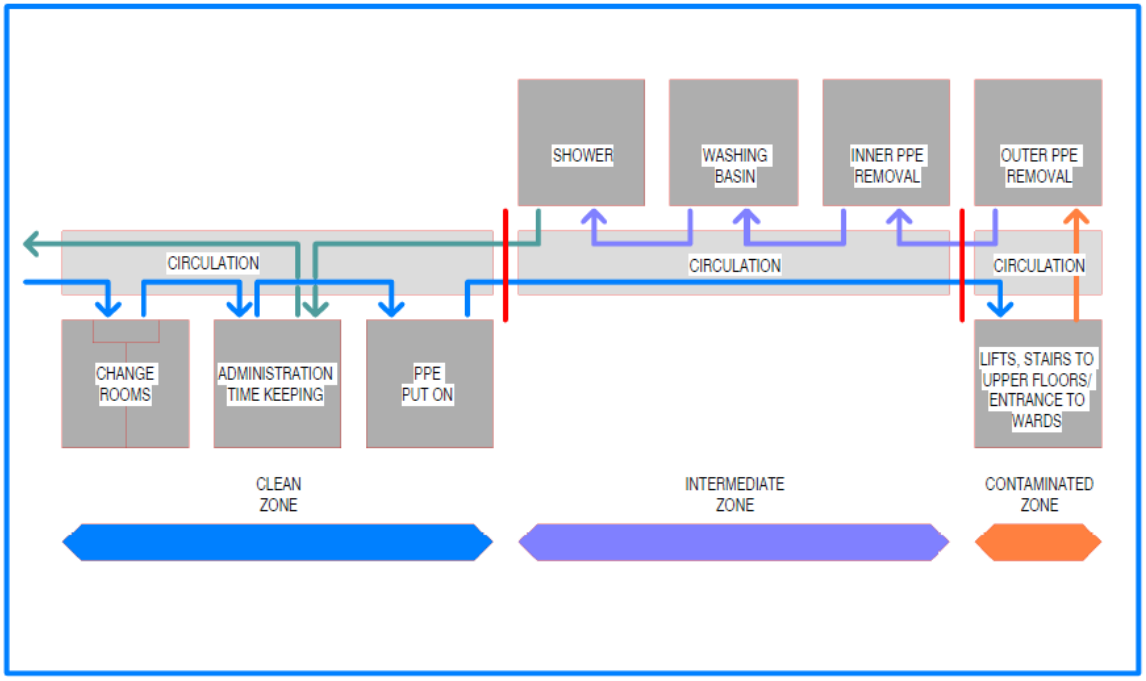
Figure 5: Workflow in small unit [18]

As far as possible, a single direction flow of clean to dirty is recommended for all processes: support services, supply and waste.

Figure 5 illustrates the recommended separation of access and exit, separate waiting seats, for persons who may be COVID19 infected. Separate spaces are provided for donning and doffing PPE. Staff change areas are provided.

[18] Western Cape Provincial Government, 2020





ACS LOBBY / GROUND FLOOR - HWC FLOW DIAGRAM

Courtesy: Helderberg Architects

Figure 6: COVID19 contact spread infection prevention and control recommend flow diagram

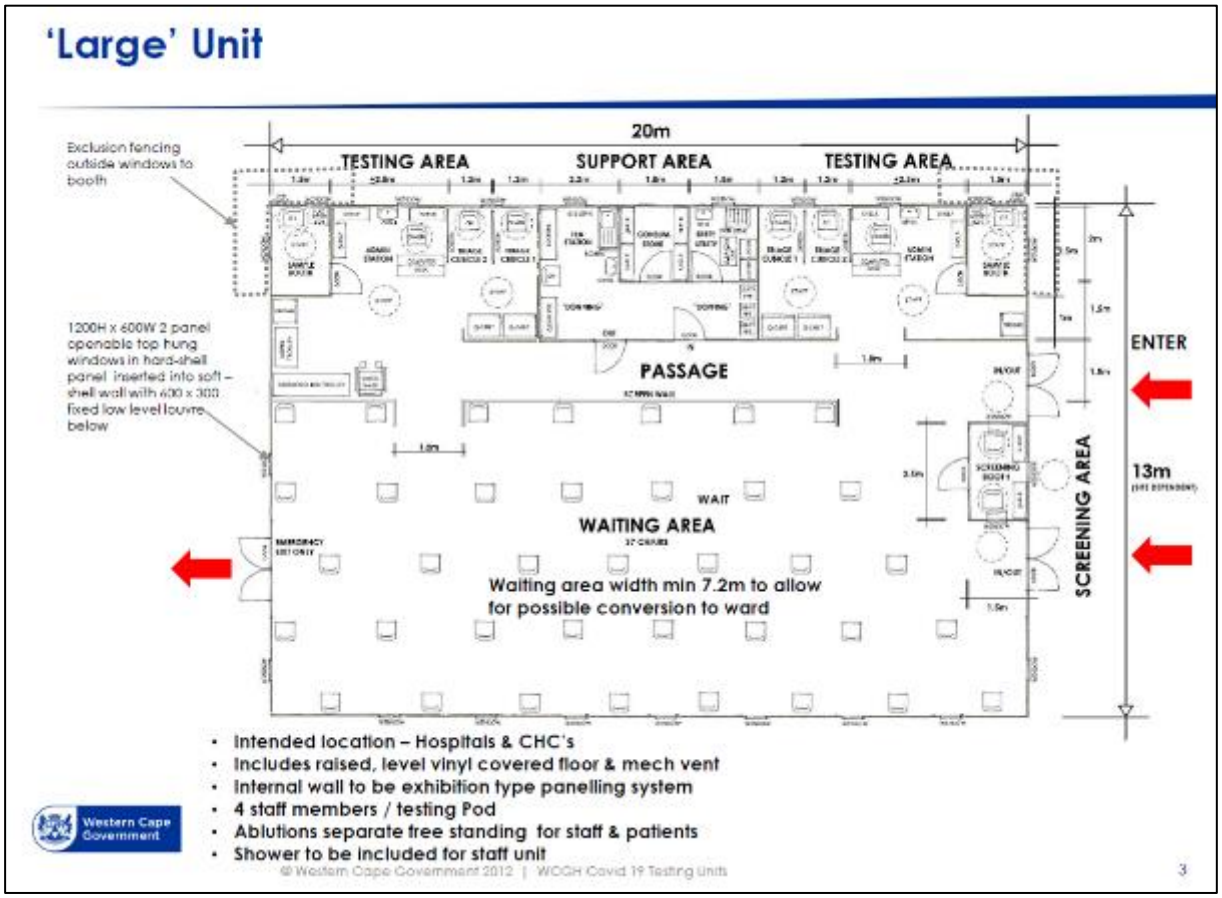


Figure 7: Workflow in large unit[19]

In Figure 7, there is clear separation between staff areas and patient areas. Waiting seats are set far apart to reduce transmission risk. Staff change rooms are be provided near the point of entrance to the facility for staff to change from street clothes into medical work clothes. To prevent work clothes worn inside the facility from contaminating street clothes, these are kept in separate lockers. A step-over bench from dirty to clean sides of the change room is helpful to enforce a mind-set of avoiding cross contamination. Bins for contaminated garments are to be provided in change rooms. Shower facilities are to be provided for staff.

2.4.4 Operational strategies

2.4.4.1 Cleaning, disinfection and decontamination

Surface and substrate specification, and detailing of all areas should, as far as possible, allow for frequent:

- Cleaning with detergent and water.

[19] Western Cape Provincial Government, 2020

- Disinfection with 75% alcohol solution (metal surfaces).
- Sodium hypochlorite (1,000 ppm)/ Household bleach.
- Disinfectants listed on the EPA[20] (for non-critical environmental cleaning).
- High intensity ultraviolet surface disinfection (UV-C).
- Decontamination and sterilisation of clinical equipment.

2.4.4.2 Goods and waste management

Remove any unnecessary furniture, equipment and paraphernalia from all patient care and clinical areas. Provide a clear, secure space for waste management. Any potentially infectious waste materials generated at the ACS should be considered and treated as medical waste (health care risk waste). Applicable legislation is:

- The National and Provincial *Health Care Risk Waste Management Regulations.*
- National Department of Health *COVID-19 Environmental Health Guidelines*[21]*.*

Waste disposal bins should be positioned near the exit inside each patient rooms or wards to make it easy for staff to discard PPE after removal, prior to exiting the room, or before providing care for another patient in the same room.

2.4.4.3 Materials and finishes

Floor materials must be:

- level,
- free of dust and oil,
- impervious and smooth,
- slip-resistant in wet areas (e.g. patient ablutions).

Smooth, cement screed floors are acceptable. Where hosting facilities have carpeted areas, a risk assessment of factors such as durability, hygiene and decontamination needs to be conducted. In cases where the acceptance of carpeted flooring is contradicted (but other factors make it a compelling option), temporary floor finishes or covering can be investigated.

[20] United States Environmental Protection Agency, 2020
[21] National Department of Health South Africa, 2020

2.4.5 Personal protection

2.4.5.1 Hand sanitation

Where wash-handbasins are not provided, clinical wash-handbasins should be installed, at the minimum rate of provision of one wash-handbasin per 5 beds. Clinical wash-handbasins (see Figure 8) have a variety of features not present in standard wash-hand basins, which are preferable for infection prevention and control. Where standard wash-handbasins are provided, an upgrade is not necessary. In all cases there should be no surfaces and no clutter in the vicinity of wash-handbasins, including surgical gloves.

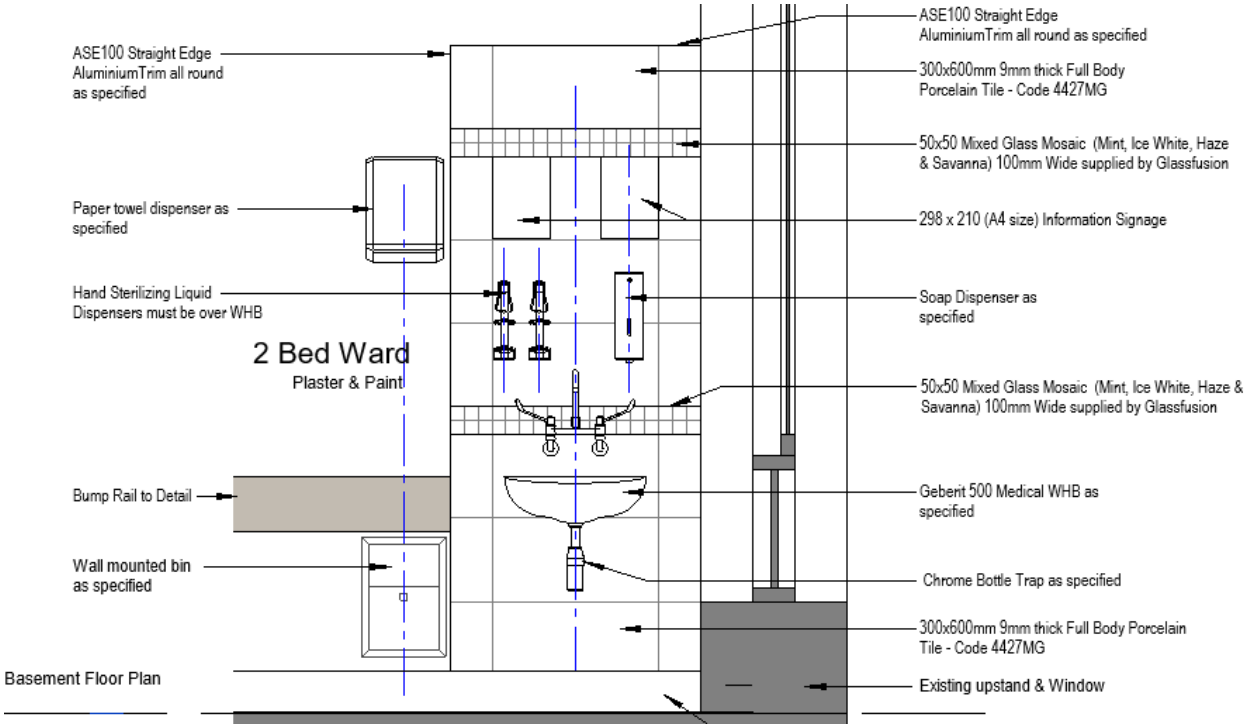


Figure 8: Clinical hand wash basin[22]

[22] IUSS, 2014a

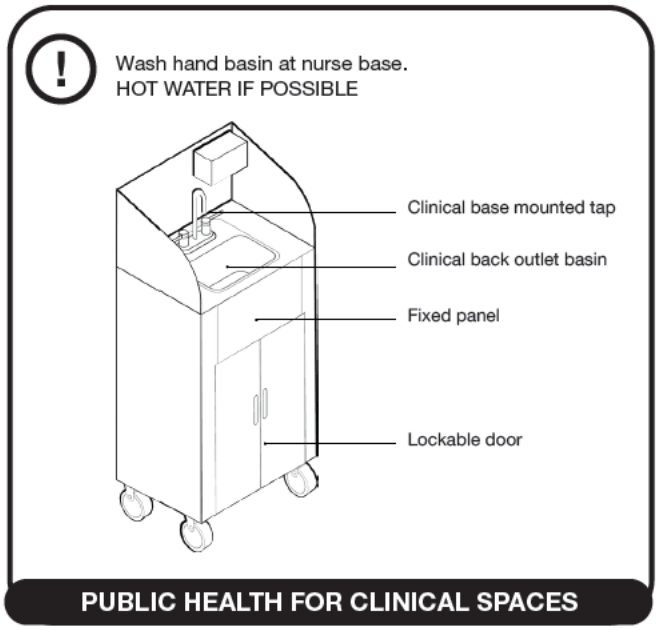


Figure 9: Portable hand wash basins can be provided in ACS [23]

Where hand wash basins are not available, portable units can be used, as shown in Figure 9.Mounted brackets for hand sanitisers are to be provided for every two beds, and at all common touch points such as entry points at ablution facilities, light switches, etc.

2.4.5.2 Personal protective equipment

Donning and doffing points for personal protective equipment, and convenient, safe disposal of consumables to be placed at critical key points when entering patient areas.

2.4.6 General transmission mitigation

2.4.6.1 Water and sanitation

To comply with National Building Regulations; Hazardous Biological Agents Regulations and National Department of Health *COVID-19 Environmental Health Guidelines*[24].

2.4.6.2 Airborne precautions

When designating areas for activities during which airborne transmission risk is high, the ventilation must be carefully considered to take into account downstream risk. In particular, the question should

[23] BDP, 2020
[24] National Department of Health South Africa, 2020

be raised as to where potentially contaminated air arising from aerosol generating procedures, is exhausted to. In general air exhausted directly to the outside is diluted and considered safe, unless there are openings to occupied spaces near the exhaust air outlet. In naturally ventilated settings, the patterns of exhaust of air to spaces (adjacent or in close proximity) may vary according to uncontrollable externalities (e.g. wind direction), and therefore is indeterminate.

In the event that potentially occupied spaces will receive partially diluted or undiluted contaminated air, or where this is indeterminate, the aerosolising activity should be designated to an alternate area. In the event that an alternative is not available, some treatment regime (air filtration or air disinfection) is necessary.

The application of Ultraviolet Germicidal Irradiation (UVGI) for room air disinfection is well understood and is proven to be effective in the disinfection of microorganisms including M. tuberculosis (TB) in air. UVGI should therefore be considered as a valid element in indoor airborne infection control strategy for high volume settings. Studies have demonstrated the importance of good vertical air mixing in the room, and safety of UVGI application. In areas where UVGI is indicated, the design and development of UVGI systems should be in accordance with the *Abridged UVGI guide*[25].

Detailed guidance on ventilation design is provided in section four of this document.

2.5 Structural integrity and operational responsibility

Structural modifications: ACSs are for temporary use and any modifications necessary for the establishment of the clinical and associated support services should be undertaken with minimum invasiveness to the structure so that restoration to the original function is considered.

Competent person: All structure, water, electricity, fire, and gas installations, whether temporary or permanent must be designed and installed by competent persons. Any modification to any existing structure must be undertaken with prior knowledge and express approval of a duly appointed competent person (such as a registered professional engineer or architect) who is to take responsibility to ensure structural integrity. Competent persons should be explicitly appraised of the nature of services to be rendered, have access to multi-disciplinary specialist support as required and have professional indemnity insurance covering the scope of work. Competent persons shall ensure that all temporary structures are adequately specified and fastened, and safe for use for the purpose they are installed.

Asset responsibility: Unless otherwise agreed, equipment provided to the ACS, will be presumed to be the property and responsibility of the supplier, (including consumables and maintenance) until

[25] Van Reenen et al, 2019

duly authorised evidence of asset transfer is documented.

2.6 Decommissioning and closure

Decommissioning: Decommissioning of the facility shall be assigned to the competent person discussed above. All residual structures upon decommissioning shall comply with the National Building Regulations. Upon decommissioning, removal of equipment shall be the responsibility of the owner.

Closure: Once all patients can be safely discharged or transported back to existing facilities for continued care and there are no ongoing healthcare surge capacity needs, the ACS can be closed. Shut down of an ACS will require decontamination and removal of equipment and termination of ongoing contracts or arrangements. Shut down should be expedited so that the facility can quickly be returned to the control of the existing owners and returned to its usual function.

Action checklist items for ACS closure should include, but not be limited to, the following:

- conduct a site walkthrough with the facility owner when shutdown activities are completed to ensure that removal of equipment and supplies, cleaning and other surge closure activities have been completed to the owner's satisfaction.
- perform medical records storage procedures.

2.7 Health, safety and well-being

In addition to the infection prevention and control measures discussed above the following should be provided for health, safety and wellbeing.

2.7.1 General provisions

- Minimised and controlled entry and exit points, with suitable control.
- Clearly identified, accessible and marked routes for patients, staff, goods and waste.
- Clear designation of restricted zones.

2.7.2 Site level provisions

- Safe staff parking and arrival of staff via planned and public transport.
- Clearly demarcated parking for people with disabilities.
- Arrival and departure point for patients via public transport, passenger vehicles, and emergency service.
- Supply of goods and removal of waste.
- Limited safe visitor parking.

2.7.3 Within and between buildings

- Clear entrances.
- Routes free of all hazards, for example, rubbish bins.
- All clinical, patient and support areas to be accessible by trolley.

Ramps should be of stable construction, capable of sustaining a mass of 300kg. They should incorporate side lips and the surface should be slip-resistant. Gradients should be as gentle as the circumstances allow. (Recommended maximum 1:20).

Small changes in floor levels are not desirable, but where these exist are to be clearly marked with reflective paint/ tape, and lit at night

Elevators between different floors, where patients need access (The recommended minimum lift size for patient trolley/stretcher movement is 1 400mm × 2 400mm, however this may not be possible).

Pathways to be lit at night, where used at night. Unless physical structure prohibits, 2 metre clear access ways.

Staircases must be well-lit at night with non-slip surfaces and secure balustrades.

Doors Double doors and automated or push-operated doors to all clinical areas are to be preferred, where these are newly installed or able to be retrofitted. Door closers are to be disabled, where not necessary to reduce touch surfaces. Hand sanitisers to be provided at thresholds where high touch common surfaces (e.g. door handles are unavoidable) within the patient areas.

2.7.4 Signage

Appropriate level of information to facilitate legibility, orientation and wayfinding. Minimum standards, signage to be:

- Clearly visible, simple font, font size, contrasting colours, placed in field of vision
- Washable
- Comprehensive safety signage - fire signage (exits, equipment etc.)
- Restricted areas clearly marked
- Identification signage - each patient space to be allocated a unique number and a whiteboard or perspex sheet for writing the patient's name

Signs should be posted immediately outside of patient rooms indicating appropriate IPC precautions and required personal protective equipment (PPE).

Signage of a temporary nature can be provided on laminated white A4 sheets attached eye-level. Text should be black sans-serif (for instance Arial) text at least 40point size and centrally positioned on the sheet. Detailed guidance on signage is provided in *IUSS Inclusive environments*[26] .

2.7.5 Safety and security

Upon identification of the ACS host site, a team should be convened to conduct a multidisciplinary safety and security analysis. These critical team members need to form the working committee responsible for undertaking the detailed assessment of the existing facility's security, analyse the data about the security system's condition and review existing security concerns or issues that are reasonably likely to become concerns in the near future. Figure 10 presents a , five zone approach to security, which is a recommended, systematic approach to security.

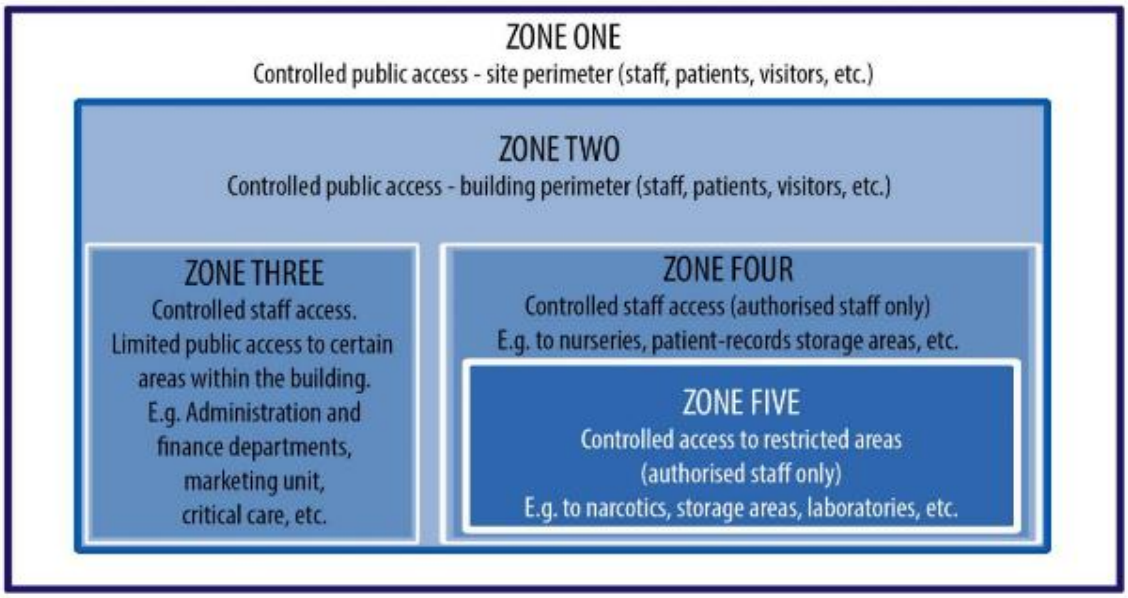


Figure 10: Zonal approach to security[27]

The security strategy should take into account that whilst clinical services and some logistical and support services will be required 24 hours a day, seven days per week, some support services, logistics services and auxiliary services may only be operational for the minimum periods required to meet demand. These functional elements should be capable of being secured, for example over weekends and at night, as the case may be.

Detailed guidance is available in *IUSS Security*[28]

[26] IUSS, 2014a
[27] IUSS, 2014b
[28] IUSS, 2014b

2.7.6 Comfort and dignity

Supplemental heating: Patient health and comfort is dependent on, amongst others, maintaining body temperature. The ACS structural technology must be selected to achieve the general indoor environment conditions discussed in a subsequent section for all clinical and occupied areas. As we are moving into South African winter supplemental heating may be required, especially in the evenings, in order to avoid hypothermia. Use of fans, bar, radiator or gas heaters should be prohibited. Unless clinical areas can be maintained above 18 degrees centigrade, patients should each have an infrared heater available, in addition to blankets. Personal/ donated blankets can be considered if they are laundered first and may be destroyed upon discharge.

Mobile screens should be available to provide privacy where necessary (e.g.. during consultations or procedures). Some solutions which address patient privacy and dignity are depicted in Figure 11.

Source: Ian Crozier, MD (used with permission)

Figure 11: Transparent barrier for observation with canvas blinds for patient privacy and separation [29]

2.8 Schedule of accommodation

Based on clinical needs of the ACS, a schedule of accommodation can be crafted capturing the clinical, clinical, logistical, support and auxiliary services associated with the render of care. When deriving a schedule of accommodation, the National Department of Health *COVID-19 - Guideline Room List for Planning a Temporary Hospital* tool can be used. Functions to be accommodated are:

Clinical services: Triage, rapid assessment of persons entering the facility, to expeditiously identify and render the appropriate service. Admissions and registration. Inpatient accommodation is to be organised according to cohorting principles, discussed above. Testing and diagnostics, including laboratories and x-ray. Safe storage and dispensing of drugs to patients.

Logistical services: Logistical services will entail management of flows of people, goods, services and information to and from the site, as well as within the site. It includes security and communication arrangements. Staff entry, preparations to transition from outside to clinical work environment, including pause areas for relief. Emergency services, visitors. Goods, supplies and storage and waste removal and/ or treatment.

Support services key to the provision of clinical services should be separated, so that the risks and associated with that particular activity can be managed. Support services are:

- Laboratory services
- Catering
- Laundry
- CSSD
- Maintenance and cleaning
- Mortuary

Support services can be provided off-site, in which case safe, secure and efficient transfer and logistical arrangements should be designed.

Auxiliary services: Auxiliary services are services which may be provided on or near the ACS site, but which are not directly related to core clinical care. This included overnight accommodation for staff who may not wish to return home to avoid exposing their families, or who need rest between shifts, or for discharged patients awaiting transport home, volunteers who have recovered from SARS-CoV-2.

[29] WHO, 2020b, p.49 and NHS, 2020b

Limited psychosocial services and allied health services may also be provided on or near ACS for example by approved partners.

Examples of schedules of accommodation for patient and support spaces for a protective isolation ward in shown in Appendix C and mild to severe cases Appendix D.

3 Section three

3.1 Clinical services

3.1.1 Triage

Confirmed COVID-19 cases and PUIs who are referred from a testing facility or a higher level of care, will enter the facility in a triage area to receive vital screening and initial assessment. They will be registered, and admitted for inpatient care. They will be assigned a ward based on disease status and acuity to isolation, the Mild & Moderate ward, or the Critical & Severe "wards". Patients should be clustered according to gender. As far as practicable, ablutions for each gender, isolation patients, paediatrics and staff shall be separately provided. Paediatrics patients, if admitted, are to be assigned a dedicated section.

As patients recover or deteriorate, they may be relocated to the appropriate ward.

Once the patient has sufficiently recovered and a negative test result is received they will be appropriately decontaminated and discharged, collecting medication from the dispensary on exit. Patient movement between various sections of the ACS will be restricted as far as possible, with mobile radiology units, in ward medication dispensing and in ward food service.

3.1.2 Inpatient ACS accommodation

Separate spaces for:

- suspected, unconfirmed cases, under observation (PUIs), to be accommodated in isolation facilities (separate rooms, if possible);
- patients with confirmed COVID-19 with mild to moderate disease, not requiring dedicated oxygen therapy;
- patients who require dedicated oxygen therapy;
- patients requiring mechanical ventilation; and
- recovered/ confirmed negative.

3.1.2.1 Protective isolation facilities

Suspected, unconfirmed cases, under observation – persons under investigation (PUIs) to be accommodated in protective isolation facilities (separate positive-pressure rooms, if possible). PUI are restricted to their rooms. All food and laundry services will be brought to the PUI rooms to reduce interaction and potential contamination. All waste will be collected by facility staff and taken to waste handling areas. Infection prevention and control measures are put in place for the handling of used

food utensil and laundry as well as waste collection. PUI areas will have restricted access, including for staff serving other inpatient sections, for confirmed cases. Inpatients accommodation for confirmed COVID-19

Inpatient facilities confirmed positive COVID-19 can be accommodated in large shared 'wards' with partitioning between patients. Partitioning is preferable to curtains found in conventional hospitals, as they are more conducive to daily cleaning. If only separate rooms are available, patient monitoring and surveillance will need to be accommodated. This phase of treatment has the lowest area/space requirement, as cross infection between patients is less of a concern. Shared ablution facilities are acceptable. It is recommended that, at least, two general accommodation ward areas be provided.

a) Mild and moderate patients, and

b) Serious and critical patients.

Room must have openable windows for ventilation if dedicated positive pressure ventilation system are not available. Ducted ventilation systems shall not be shared between PUI areas and confirmed COVID-19 patient areas.

Examples showing bed layout with bed spacing for protective isolation (Figure 12), a mild/ moderate patient (Figure 13), mild or moderate patient shared ward (Figure 14) and for a critical patient (Figure 15)

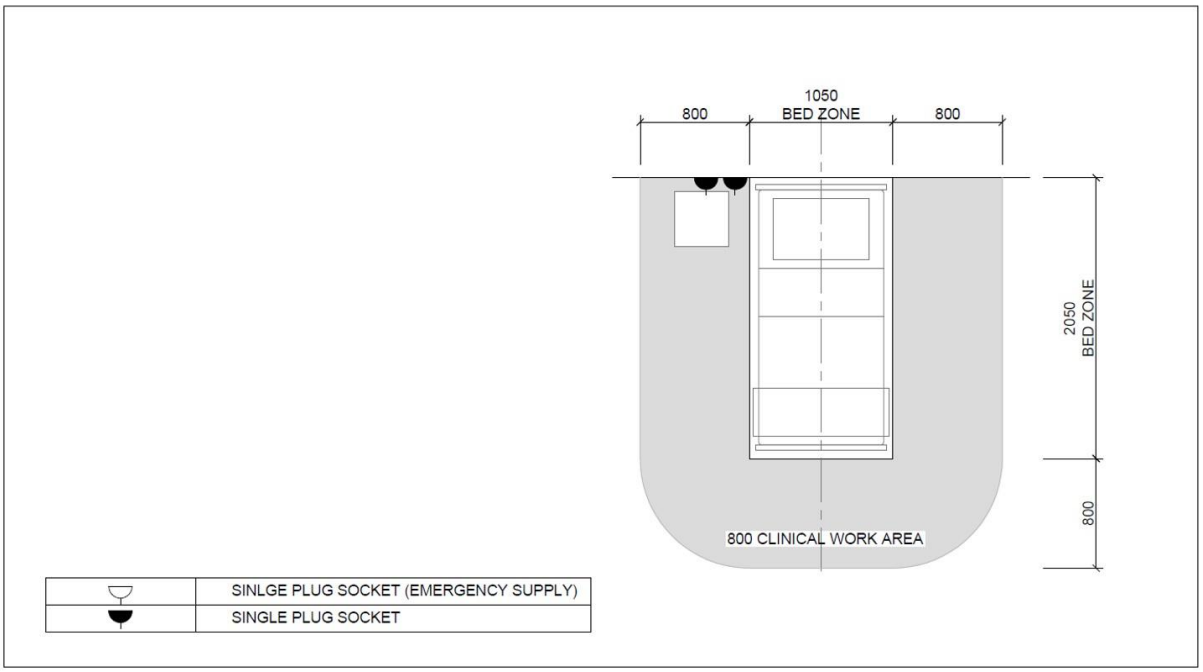


Figure 12: COVID-19 ACS - protective isolation – bed layout

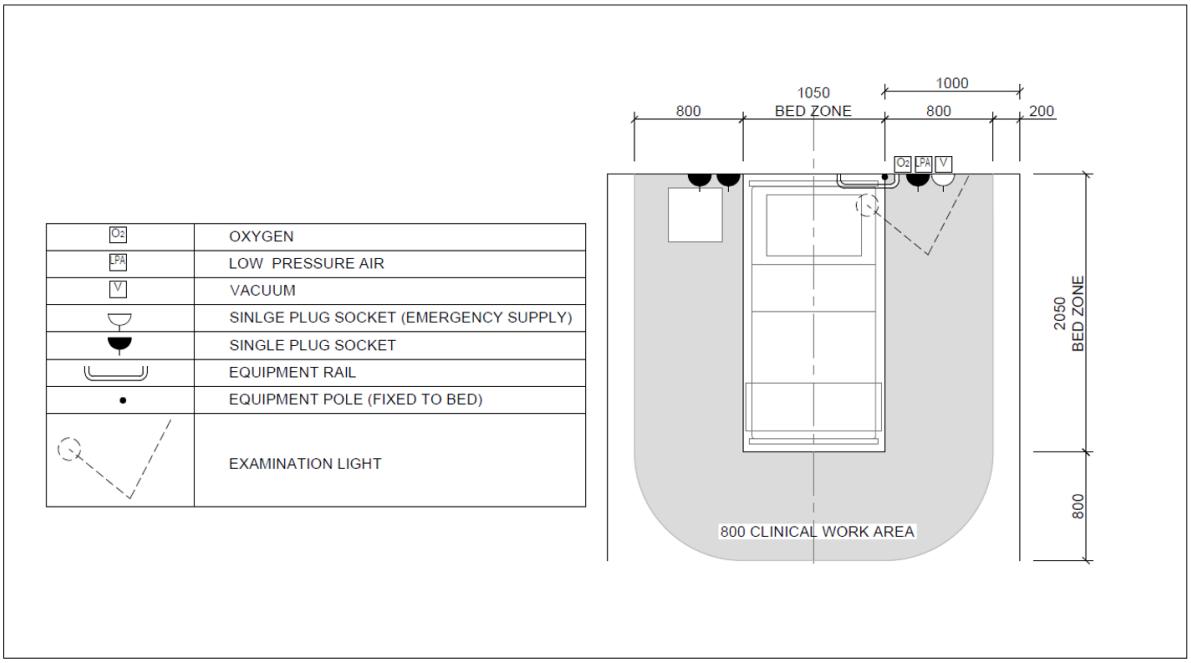


Figure 13: COVID-19 ACS – mild/ moderate patient bed layout

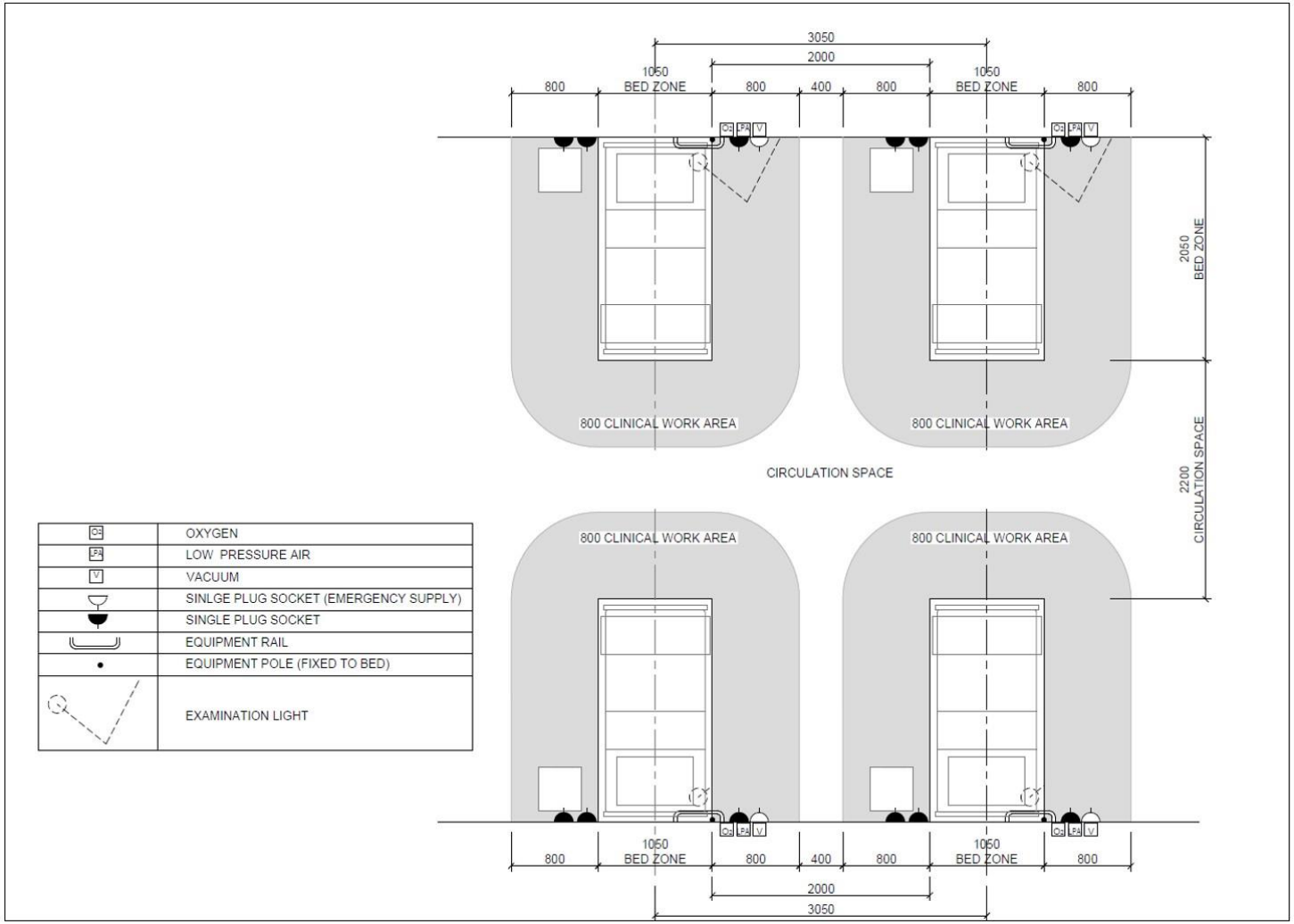


Figure 14: COVID-19 ACS – mild/ moderate patient shared ward layout

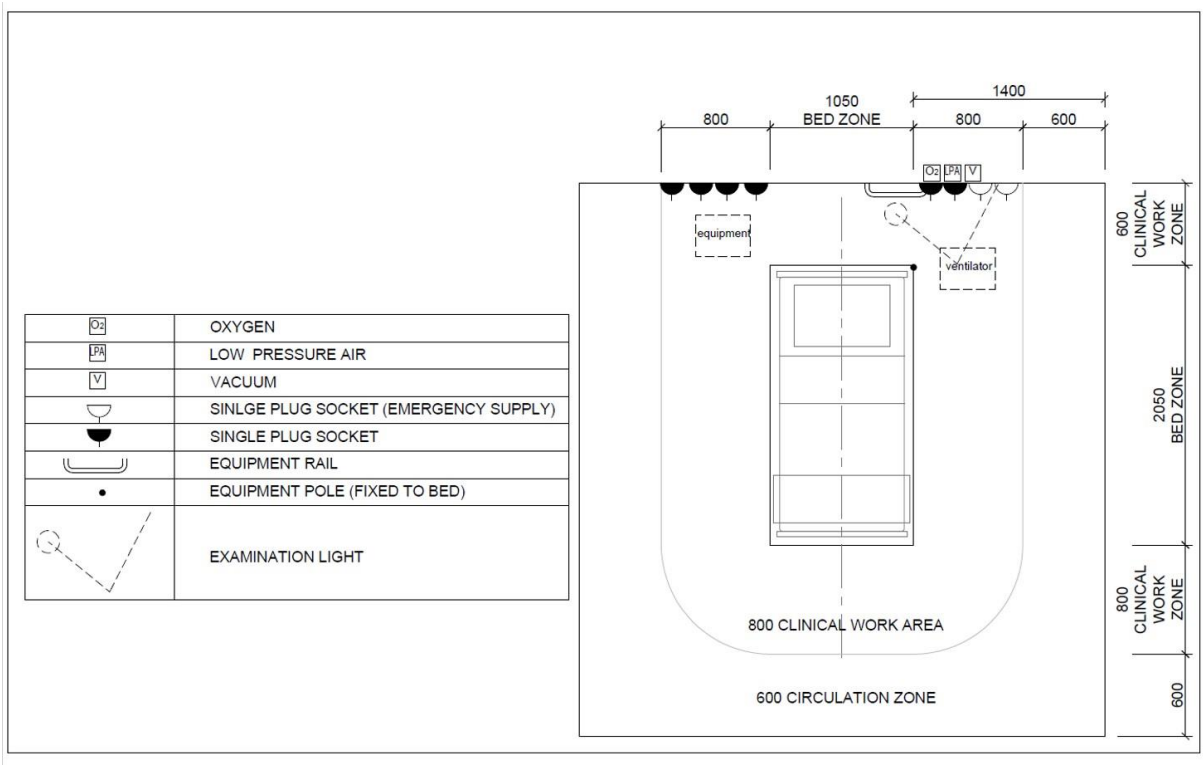


Figure 15: COVID-19 ACS – severe/critical patient shared ward layout

3.1.3 Patient services

Patients in ACS will not generally be ambulatory and will be relegated to their room, or cubicle in a bed. In general domestic beds, or hospitality industry (hotel) beds are not idea for patient care. These should only be used where a hospital-grade bed cannot be sourced, as hospital beds are designed for ease of cleaning and decontamination (for infection prevention and control) and with patient and ergonomics, safety and comfort taken into account (they prevent back injury for nursing staff and can help to prevent bedsores). The higher the specification of bed, the more suitable it is for the higher levels of care. The following are suitable:

- Repaired and refurbished beds from condemned hospital stocks.
- South African National Standard, SANS 521:2013 Edition 3.5, on Hospital beds and cots ISBN 978-0-626-28830-3.
- Beds listed on the National Treasury (See Appendix E).

The table below details the minimum services required at each patient bed. Details on these services is discussed in a subsequent section of the document.

Table 3:Patient services

Service/ Capacity	Triage	Isolation	Mild – moderate inpatient	Severe case wards	Critical case wards
Power – 16A 230V Single socket outlet	As needed	1 per bed	1 per bed	3 per bed	6 per bed
UPS Power – 16A 230V Single socket outlet	As needed	1 per bed	1 per bed	1 per bed	2 per bed
Medical Air* (LP)400kPa	No	Yes	No	Yes	Yes
Medical O_2 400kPa	Portable/shared	Portable/shared	No	One	Two
Vacuum -40kPa	No	Portable/shared	Portable/shared	Yes	Yes
Equipment rail				Yes	Yes
Upper room UVGI	Optional	Optional			Optional
Examination light	No	No	Yes	Yes	Yes
Ventilation rate	60 L/s per person	10 L/s per person	10 L/s per person	10 L/s per person	12 ACH

Notes:

**Mobile units recommended for intermittent use. 3 per 20 beds*

*** There are some ventilators which have built-in compressors allowing them to function without Medical Air. This is however, not the norm. With Ventilators probably being the most difficult medical device to obtain at present, it would be prudent to rather allow for Medical Air at each bed.*

Two additional 16A 230V single socket outlets and a worktop should be provided for each 32 beds (or part thereof), for:

- Electrocardiograph (ECG): Could be omitted if monitors have full 12 lead ECG function.
- Blood gas analyser: Could be omitted if a Lab Services are available.

Example of healthcare technology to be provided for critical care patients is shown in Appendix F. Severe patients may be provided CPAP. Emergency trolleys ("crash carts") are to be provided in patient areas with convenient access to patient beds, out of the passage of corridors, and is moved to the patient when needed. 1 crash cart for every 16 patients (or part thereof, with at least one dedicated for PUIs. An example of provisions for a crash cart are shown in Appendix G.

3.1.3.1 Patient ablutions

As discussed in Appendix B, SARS-CoV-2 is found in faecal matter, so careful management of patient body fluids is crucial and convenient, practical support for frequent cleaning of ablutions, especially shared ablutions is necessary. Dedicated ablutions (toilets and showers) are to be provided for patient use. Toilets and showers should be in separate rooms.

Hand wash basins and or/ hand sanitiser should be provided both inside and outside the toilet room so that patients can wash their hands on the way in and on the way out the room.

- 1 toilet for every 8 persons.
- 1 shower for every 8 persons.
- 1 disabled ablution for every 8 regular ablutions (or part thereof).
- 1 disabled shower for every 8 persons (or part thereof).

Critical and severe patients may be sedated and have a reduced need to access ablutions, ablution facilities proximity and provision can take this factor into account. Showers and wash hand basins should have hot and cold running water. Where possible ablution facilities must have openable windows for ventilation, if not possible the bathroom extraction and room ventilation system must be reviewed before admitting patient (see section four of this document).

Portable toilets and showers may be used, provided that suitable hand wash facilities are provided. These will need to be suitably located, preferably in decentralised clusters, so that patients can easily access them without needing to walk very far. Ablutions should be located and designed in such a way as to provide visual and acoustic privacy, dignity and avoid disturbance of other nearby patients when accessing, using or cleaning the ablutions. Separate ablutions are to be provided for PUIs and confirmed patients.

3.1.3.2 Makeshift sluice areas

In conventional hospital settings, sluice rooms are provided for cleaning and sanitation of soiled equipment, such as bedpans. In a temporary setting, such as an ACS, the establishment of a temporary sluice room may not be practicable, and there may not be facilities for emptying buckets, rinsing equipment etc.. The following is suggested:

Allocate a toilet, hand wash basin not in splash range and restrict access to it for draining buckets and install a macerator for disposal of disposable bedpans. Electrical, water and waste supply points required as per supplier specification.

3.1.3.3 Dedicated patient treatment areas

The following dedicated, private spaces per ward for clinical procedures are recommended:

- Counselling and consulting room (can be shared), as.shown in Figure 16.
- Minor procedures room, as per the example provided in Figure 17.

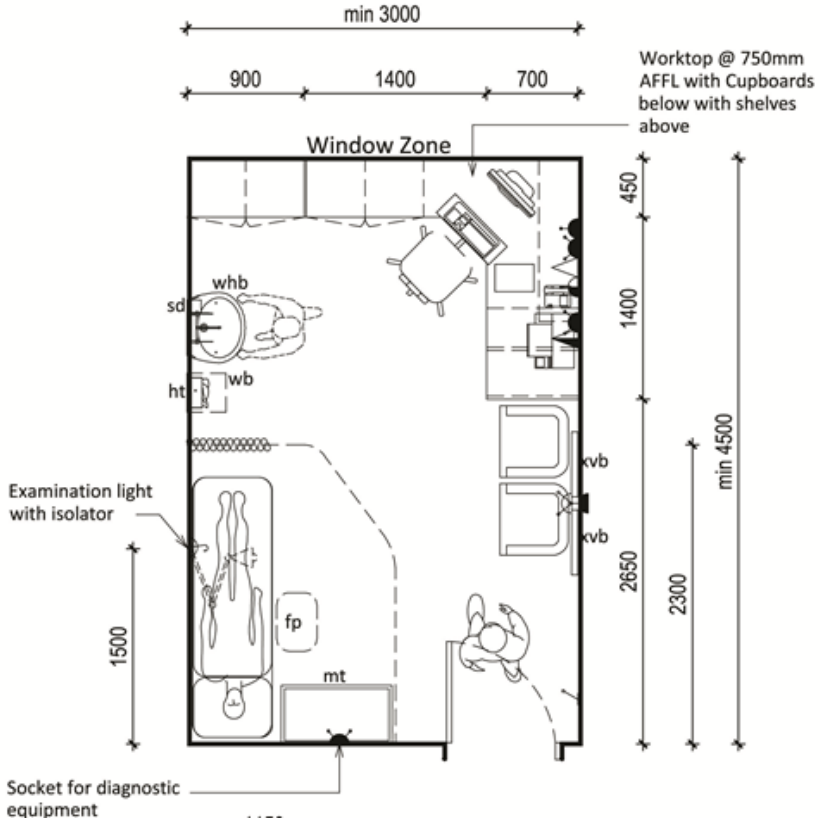


Figure 16: Consulting room example layout

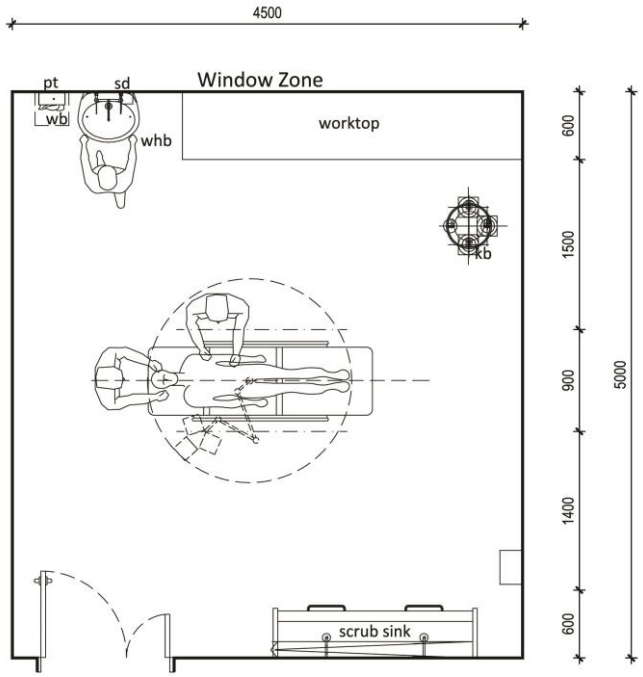


Figure 17: Treatment/ minor procedures room example layout

3.2 Logistical services

3.2.1

Electronic communication should be facilitated in all zones of the ACS by the provision of device charging stations, and wifi.

3.2.2 Visitors entry point

Visitors are strongly discouraged from entering the ACS.

- In paediatric wards, one parent may be accommodated to visit a patient. In such cases, direct access for the visitor should be provided so that the visitor does not need to pass through the general patient area. Appropriate PPE must be donned before entering the patient area and hand washing/sanitising must be done when exiting the area.
- Non-patients who are accompanying suspected patients to the facility for testing or admission must be accommodated in a well-ventilated, spacious waiting area. Signage in such waiting areas must inform visitors about symptoms, hand hygiene and PPE.
- Hand washing/sanitizing facilities.

3.2.3 Staff areas

3.2.3.1 Staff change rooms

A minimum of 9m^2 or 4m^2 for a single person, increasing by one m^2 for each additional person is required. The clean (street side) and dirty (contaminated facility side) of the change room should be separated by a step-over bench.

3.2.3.2 Staff rest areas

Staff rest areas within the main facility should be provided with access to kitchenette facilities and staff ablutions.

3.2.3.3 Staff auxiliary services

Staff overnight: Since staff may be required to work long hours, or may be required to be on-call, overnight sleeping facilities can be provided for staff, outside the clinical area, but in close proximity on the ACS site. An example is set out in Figure 18.

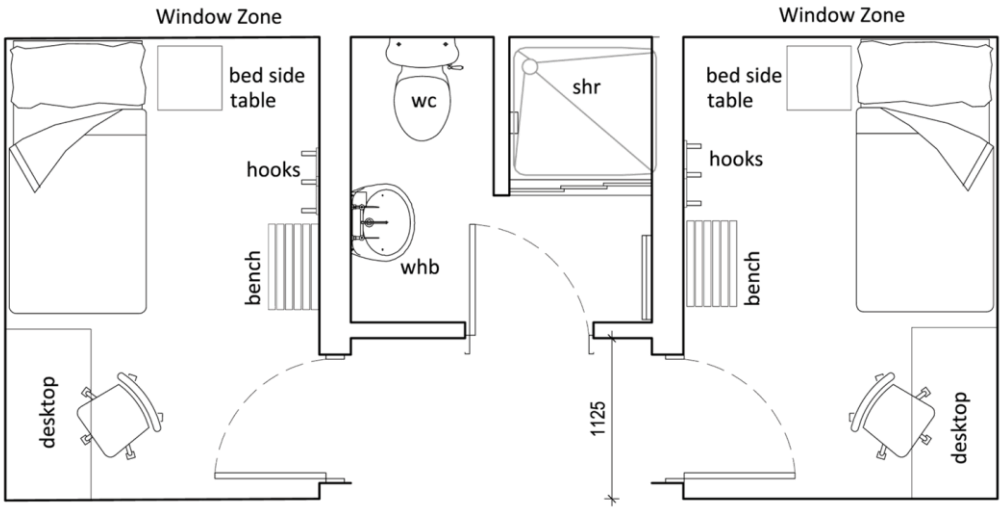


Figure 18: Example of overnight sleeping area for staff

Staff residence: Since staff who are in contact with infected patients are considered as having a high risk of contracting and spreading the disease, staff accommodation may be required for staff who are unable to self-quarantine in their homes. Staff residences, if provided, should be separate from the primary ACS facility and not be accessible by general users and the public.

3.2.1 Bulk storage

Lockable, clean, dry bulk storage space may be required, outside the contaminated zone, for consumables (such as PPE, toilet paper, speci-cans, folded boxes for waste etc.), bulky medical equipment not in use. An area for safe storage of chemical disinfectants may be required. The size will be dependent on delivery cycles and number of persons served at the ACS.

3.3 Support services

3.3.1 Workflow principle

Progressive workflow from “dirty” (that is contaminated) to “clean” linen is advisable to reduce risk of exposure to contaminated materials. The workflow diagram Figure 19, showing progression from the dirty linen receiving area, to the cleaning process, to decontamination and drying, and finally sorting and packing, and storage, illustrates this principle.

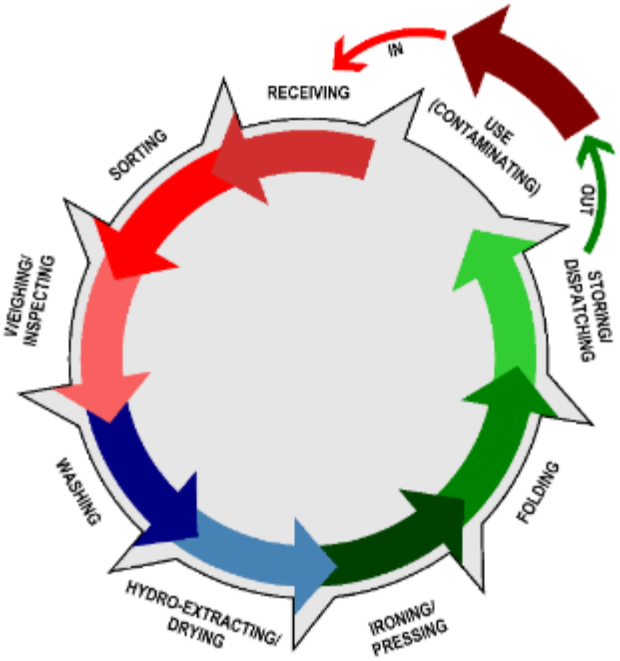


Figure 19: Linen processing cycle[30]

3.3.2 Laboratory

The WHO provided a diagnostic equipment list for COVID-19, which is shown in Appendix H.

1. Reception counter- receiving specimens
2. Testing with perspex/ glass screen
3. Receiving/Data capture
4. Specimen holding
5. Toilet - staff
6. Blood storage fridge

Can be provided as a mobile unit. An example of a layout is shown in Figure 20.

[30] IUSS, 2014c

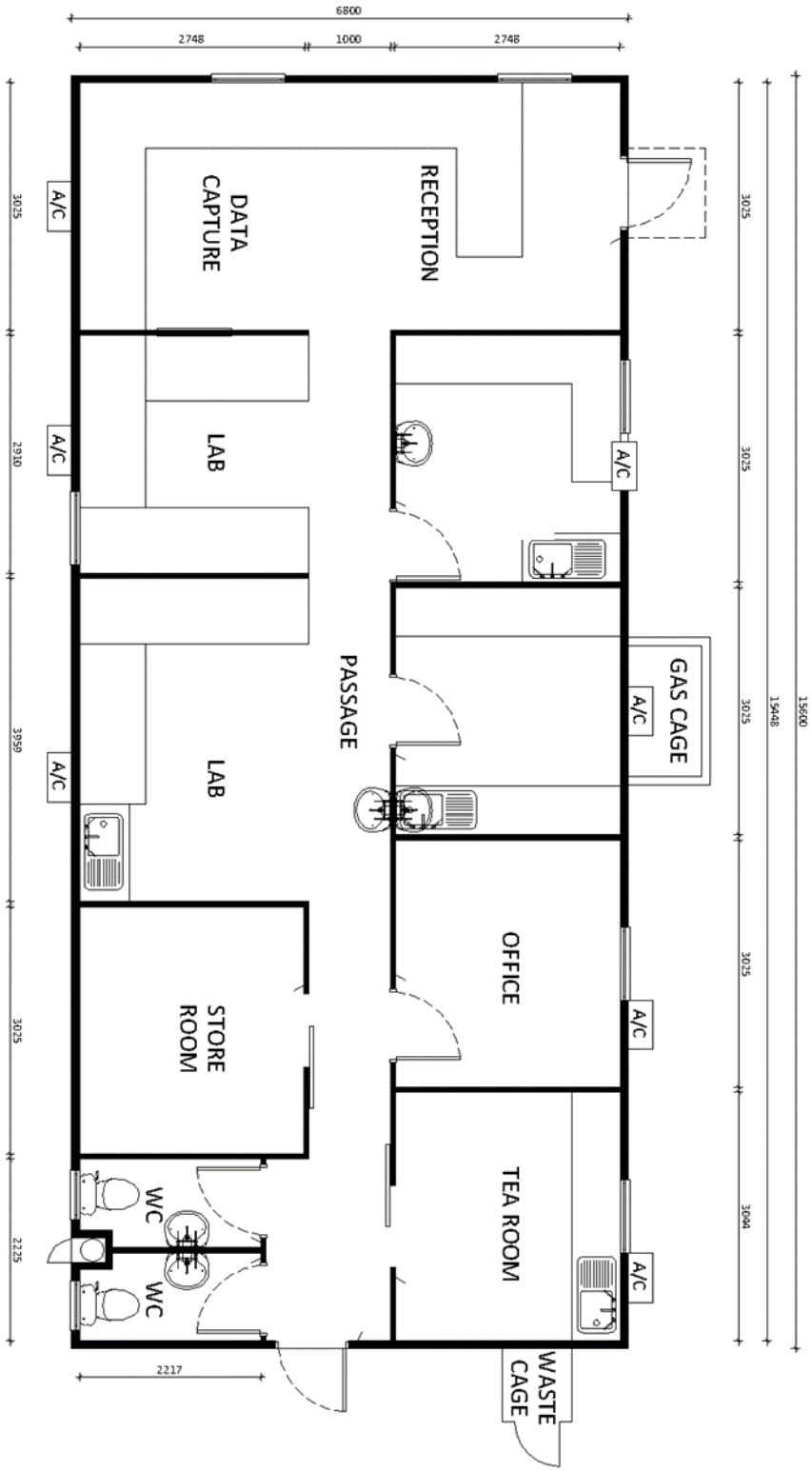


Figure 20: Example of modular laboratory

3.3.3 Pharmacy

The purpose of the pharmacy is to provide medicines needed for inpatient treatment and care.

All medical supplies should be stored in a secure, climate controlled area in close proximity to the patient treatment area. Pharmacy must have dry, lockable, climate-controlled storage of medications. Most pharmaceuticals are labelled with storage temperatures. Pharmacy should have adequate ventilation through openable window to prevent humidity building up in the room. Air-conditioning or mechanical ventilation can be provided, if necessary.

Dispensing areas must be well lit. Worktop in space for stock records and administration. Dispensing counters to have perspex or glass screens to serveries.

Can be provided in a mobile unit.

3.3.4 Radiology

The purpose of radiology services is to provide chest X-Ray services for COVID-19 diagnostics. In general, CT scans, bucky rooms etc. associated with some radiology equipment require specialised infrastructure and therefore is not suitable for ACS. Radiology services can be provide as a mobile floor standing unit, or containerised unit. Alternative technologies such as Lodox and hand-held ultrasound devices are being investigated as potential options and may be confirmed as suitable for use in due course.

3.3.5 Laundry services

All dirty linen should be handled for bagging or binning inside the patient room/cohort area[31] .The clean linen stock should be stored conveniently close to clinical areas, in a dedicated clean area in the uncontaminated zone. Used linen should be stored in a designated, safe, lockable holding area while awaiting collection. Interim storage areas for soiled linen at the wards is allowable; this may be in dirty linen/ utility room.

ny clean linen for PUI areas should be handled in spaces physically separate from dirty linen of confirmed patient areas. It may be necessary to completely separate PUI and confirmed patient linen streams. Soiled linen and clean linen bags and bins should be dedicated and not mixed.

Full laundry cleaning and drying services may be provided on site, or outsourced. If laundry cleaning and drying services were already rendered on or for the host site before it is repurposed as an ACS, then a suitability and risk assessment should be conducted to ensure that the volumes of laundry generated and infection prevention and control measures are conducive and modifications made as necessary. A new full laundry service may take time and resources to establish, and in general will not be established at a host site as a temporary solution. Where the site and circumstances advocate for the design of a new laundry or the upgrade of an existing laundry, the *IUSS Laundry Services for Hospitals* should be applied[32].

3.3.5.1 Siting and model selection considerations

When an existing laundry is being assessed for use, or a new one is contemplated the following considerations apply:

- Water and power capacity.
- Ease of access to the ACS's main corridors and internal transport routes.
- The noise factor of the facility and its impact on nearby patient care departments.

For outsourced departments:

- Delivery areas to allow sufficient space to ensure that vehicles can manoeuvre and park easily at the reception and dispatch bays.
- Access to the ACS service roads and public roads.

3.3.5.2 Functional requirements

The most basic equipment needed in a laundry include washing machines, tumble dryers and ironing

[31] NHS, 2020
[32] IUSS, 2014c

machines. Equipment requiring steam is not recommended for a temporary facility. The sizing of the laundry, equipment and engineering services can be modified based on the principles provided in the *IUSS Laundry and linen*.

3.3.6 Catering services

Kitchenettes, that is, areas for tea, coffee and snacks, mainly for staff, in staff pause areas are discussed elsewhere in this document.

Catering services (for staff and patients) may be provided on- or off-site. If the ACS is to be established with easy access to a suitable, existing, functional kitchen service (e.g. hotel, military or hospital catering) which can meet the additional demand of the ACS, then this should be used. If there is no suitable facility, catering should be outsourced via a suitable off-site supplier. Only in the event that no feasible or suitable, existing facility or local supplier is available, should a new catering service be established at the ACS. Detailed guidance for the sizing, design and layout of catering services can be found in the *IUSS Catering Services for Hospitals*[33].

The kitchen (for on-site catering) or preparation area (for off-site catering) should be located with easy access to the point of delivery and storage of food. Adequate food and equipment storage space must be provided.

It is recommended that patient and staff meals, where provided, be supplied in disposable, containers, suitable for incineration, and that these are disposed as risk waste immediately after use.

Where off-site catering is used, a suitable area for receiving should be provided. Space will be required for sorting meals for distribution and collecting and storing of dirty dishes, washing dirty dishes, if necessary, and disposing of left-over food and disposable containers and utensils. The size of the areas required for this will depend on the number of meals delivered.

3.3.7 CSSD

The primary function of a Central Sterile Supply Department (CSSD) is to provide an efficient, economic, continuous and quality supply of disinfected and sterilised items, when needed, to all patient-care service points in the ACS, and to receive returned contaminated items for cleaning.

CSSD with limited sterilisation capacity (autoclave) but sufficient disinfection capacity (instrument washing). Although use of disposable breathing circuits and accessories (masks) should be encouraged, the capacity to disinfect these items if disposable is not available, must be considered. An example is shown in Figure 21.

---

[33] IUSS, 2014d

1. Dirty receiving with Perspex or glass partitioning
2. Dirty utility
3. Decontamination and cleaning/wash area with throughput instrument washing
4. Trolley wash/Park – external
5. Store -linen and consumables
6. Clean Packing area
7. A table top autoclave
8. Instrument washer
9. Sterile pack store
10. Issue - Collection hatch with Perspex or glass partitioning

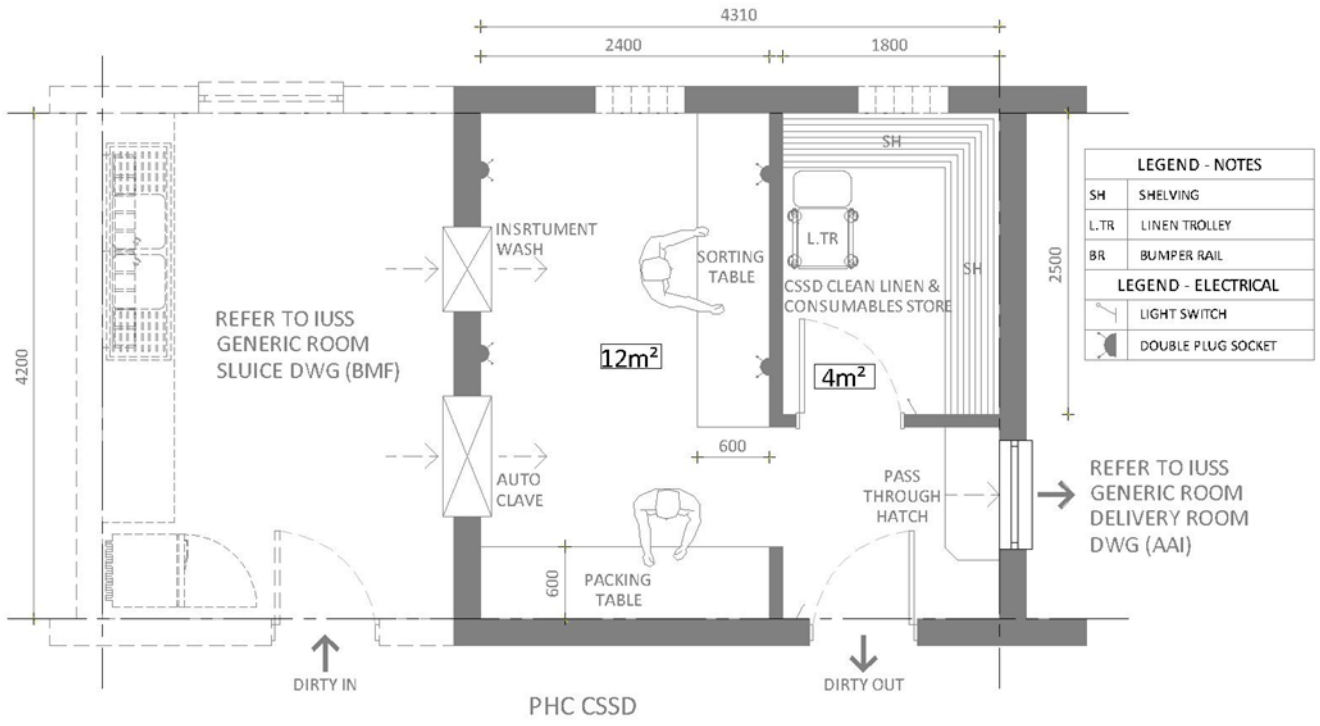


Figure 21: An example of a small CSSD facility[34]

[34] IUSS, 2014e

3.3.8 Maintenance and cleaning

Maintenance and cleaning services must be accommodated with offices located away from clinical areas.

3.3.9 Mortuary services

The National Department of Health has issued guidance on handling of dead bodies and infectious remains[35], should be applied to ACS. While some guidelines recommend that bodies of persons who have died from COVID-19 should only be held for a very brief period prior to cremation[36], the WHO holds the view (at the time of writing) that there is no evidence of persons becoming infected from exposure to bodies during normal ceremonial and burial activities. However, appropriate PPE should be used when handling such bodies with additional airborne precautions to be taken during autopsies [37].

Either body cabinets or a refrigerated room could be used for body storage.

3.3.9.1 Location and layout of mortuary service

It is likely that not all alternative care sites will have a mortuary. Those without a mortuary must have a holding room that is located away from general access areas. This holding room must be suitably sized and conditioned.

A mortuary should be located so that it is easily accessible to mortuary staff and related service providers and visitors without presenting either aesthetic, emotional or ethical problems for unrelated staff, patients or visitors. It should be separate from the general facility, allowing access for family to view a body without passing through any potentially contaminated area of the facility. The visitors' entrance should be external and completely separate from other access points.

Appropriate routes should be designated so that bodies are not moved through public-access areas.

3.3.9.2 Sizing of mortuary

The layout and size of a mortuary is largely determined by the number of bodies stored and whether body storage needs to be in cabinets or in refrigerated rooms.

---

[35] National Department of Health South Africa, 2020
[36] Zhejiang University, 2020
[37] WHO, 24 March 2020

3.3.9.3 Services

The following services are required in a mortuary:

- Hygienic floor drains that are resistant to corrosion from blood and chlorine should be provided in all "wet areas" of the mortuary and should be directly connected to the sewer system. These areas include body preparation, autopsy space, etc. These areas require thorough cleaning after every procedure, using large quantities of water and decontaminating and disinfecting chemicals and soaps.
- Sluicing facilities are to be provided in both the body-preparation and autopsy areas if they are not a common area.
- Open floor channels should be avoided. Where this is not possible, these should be covered by durable, flush-fitted stainless steel grids.
- No sewer connections external to the mortuary services should be made to the line between the wet area drains and the main sewer system in order to prevent backflow to other areas.
- The provision of hot and cold water in the facility is imperative, with all basins, sinks, ablution areas and autopsy tables being provided with both.
- Anti-backflow devices should be fitted to the water-supply lines serving mortuary table faucets to prevent backflow should supply water pressure fail.
- Electricity supply to the mortuary – particularly for refrigeration purposes – is to be provided from the essential supply system for the hospital. Alternatively, a back-up generator is to be supplied to allow for the maintenance of required temperatures in the cooling/freezing facilities in the mortuary.

3.3.9.4 Finishes

Wall and floor finishes should be impervious to liquids and easily cleanable.

4 Section four

4.1 Environmental controls

4.1.1 General indoor environment conditions

Existing environmental control systems should be modified to suit requirements in the facility. The following issues should be considered.

- Systems should be set to maximise the introduction of fresh air and maintain the pressure regime (see ventilation).

- The following internal temperature range should be maintained 19 - 24°C.
- Cooling systems should be able to cater for projected internal heat gains from people, lighting and equipment. Indicative heat gains in
- treatment areas are 8W/m2 from people, 15W/m2 from lighting and 3 W/m2 equipment and
- In critical care areas 16W/m2 from people, 15W/m2 from lighting and 60W/m2 equipment.
- As heat gain can vary widely between items of equipment, heat gain and utilisation rates for equipment should be obtained from the manufacturer to establish this more accurately.

4.1.2 Solid waste from ACS

According to the National Department of Health *COVID-19 Environmental Health Guidelines*[38]

"All solid waste from the facility should be regarded as potentially infectious material and therefore appropriate precautions should be taken. The management of healthcare risk waste (HCRW) in line with the SANS 10248-1 with regards to correct identification segregation, storage and disposal.

- HCRW is segregated at the point of generation and shall be containerized to minimize the risk of contamination.
- Waste generated from patients in isolation or quarantine in a designated facility health facility, is treated as health care risk waste (HCRW) as per SANS 10248-1-2008.
- The HCRW is properly packaged in sealed, leak and puncture proof containers/ boxes.
- The HCRW is labelled with the bio- hazard symbol/ sign and marked "Corona virus or COVID-19".
- The HCRW is stored separately from other waste generated.
- The collection, transportation, treatment and disposal is provided by only an appointed/ appropriate contractor/ service provider, however, ensure that waste is safely stored until the health care waste management company can pick it up and that the company knows and acknowledges that waste was generated by suspected or confirmed COVID-19.
- The waste management company collecting must ensure that and treated and disposal is conducted at license waste treatment/ disposal facilities .
- All personnel or staff in contact with patients must be geared with appreciate personal

[38] National Department of Health South Africa, 2020

protective equipment (PPE's) at all times to prevent exposure or risk to health.

- Monitoring should be done at such facilities.
- All, bags, bins and boxes must be adequately sealed, as not to leak any fluids, and must be wiped down with 0.05% chlorine solution.

Measures developed should consider the following.

- Develop a waste management plan following national guidelines and best practice standards for the disposal of medical waste (WHO, 2020).
- Establish procedures with medical waste service providers to regularly pick up the waste and dispose of this safely.
- Provision should be made for 5kg of solid waste per bed per day and this should be monitored and supplemented where it appears this may be inadequate.
- Ensure that access to waste is secure and controlled, for instance, by using lockable waste 1000l containers kept in a location that can only be accessed by health facility and nominated service delivery staff.
- Vermin control programs must be implemented throughout the site with HCRW collection points prioritised
- Provision for safe cleaning and disinfection of containers should be provided.
- Waste must not be allowed to accumulate or be stored inappropriate or unsecured containers.

4.2 Engineering services

Engineering services include patient services, ventilation, electrical power, water, medical gases, oxygen, compressed air, vacuum, lighting, and fire safety that support the needs of the patients and medical staff under normal and emergency situations. Good practice standards are provided in:

- IUSS Building Engineering Services[39].
- NHS Nightingale Instruction Manual [40].

The guidance below draws on these and other manuals and standards.

4.2.1 Ventilation

While SARS-CoV-2 has been detected in aerosol form, it is primarily spread through contact and

[39] IUSS, 2017
[40] BDP, 2020

droplet spread and the potential for airborne transmission is thought to be low.

However, the following advice is provided by ASHRAE regarding HVAC systems in general spaces (not specific to healthcare):

Effective high levels of ventilation must be achieved in the facility. Existing ventilation systems should be tailored to suit internal layouts and requirements and the following measures should be taken.

- Mechanical systems should be set to maximise fresh air supply to the facility. There should be no recirculated air without HEPA filtration or other validated decontamination process.
- A pressure regime should be established, as shown in figure 2, to 'push' air from clean areas, to dirty areas and then out of the building.
- A clean air supply of over 10 L/s per person should be targeted for odour control.
- Fresh air supply shall not be located near patient beds to avoid drafts in winter.
- Extraction points can be located near patient beds in isolation wards or at high level in long stay wards. Short circuiting of air between high level supply and extraction is a performance risk in winter.
- Noise from ventilation systems and fans shall be below 45 dBA
- Protected lobbies, internal partitions, door arrangements, fans and extracts should be used to maintain the pressure regime and airflow as indicated in Figure 21 below.

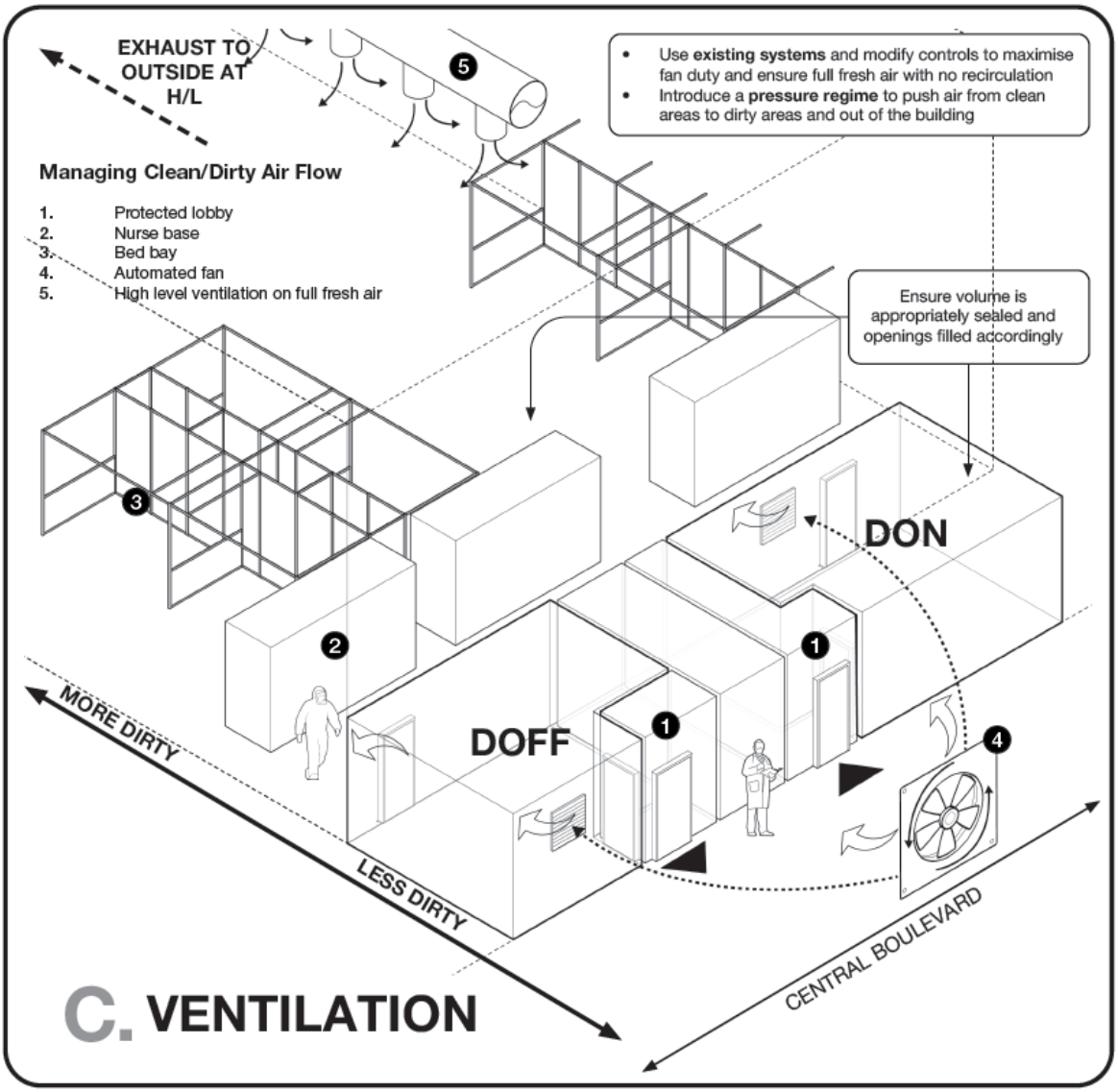


Figure 21: Ventilation in temporary facilities [41]

4.2.2 Electrical power

Sufficient and reliable power must be available at the facility for envisaged medical equipment, medical gases, lighting and ventilation equipment. Power installations for the temporary facility can be divided into three zones as indicated below. These are existing services, the temporary service zone and services in each bay.

The following should be considered by a competent engineering professional.

[41] BDP, 2020

4.2.3 Existing services

- Capacity: Evaluate whether sufficient power to accommodate envisaged medical equipment, additional lighting and heating, ventilation and air conditioning can be provided. If existing capacity is insufficient, investigate if it is possible to route additional power from additional locations/transformers around the site or from adjacent sites.
- Safety: The existing electrical distribution network must be able to supply the required equipment load. If this is insufficient/appears unreliable, identify how this can be supported.
- Resilience: Evaluate back-up power and a UPS capacity against essential services demand. If existing capacity is not sufficient, source and establish temporary service capacity.

4.2.4 Temporary service zones

- Identify locations for temporary service zones where equipment can be located.
- Ensure that equipment and maintenance access is safe and easy.
- Ensure that all distribution boards, circuit breakers and cables are clearly labelled.

4.2.5 Services in each bay

- Provide pre-wired power strips / trunking as per bay requirements.
- Check that these include sufficient plug points for envisaged equipment.
- Ensure that trunking will carry required equipment loadings. The IUSS *Building Engineering Services Guide* can be used to check requirements[42].

[42] IUSS, 2017

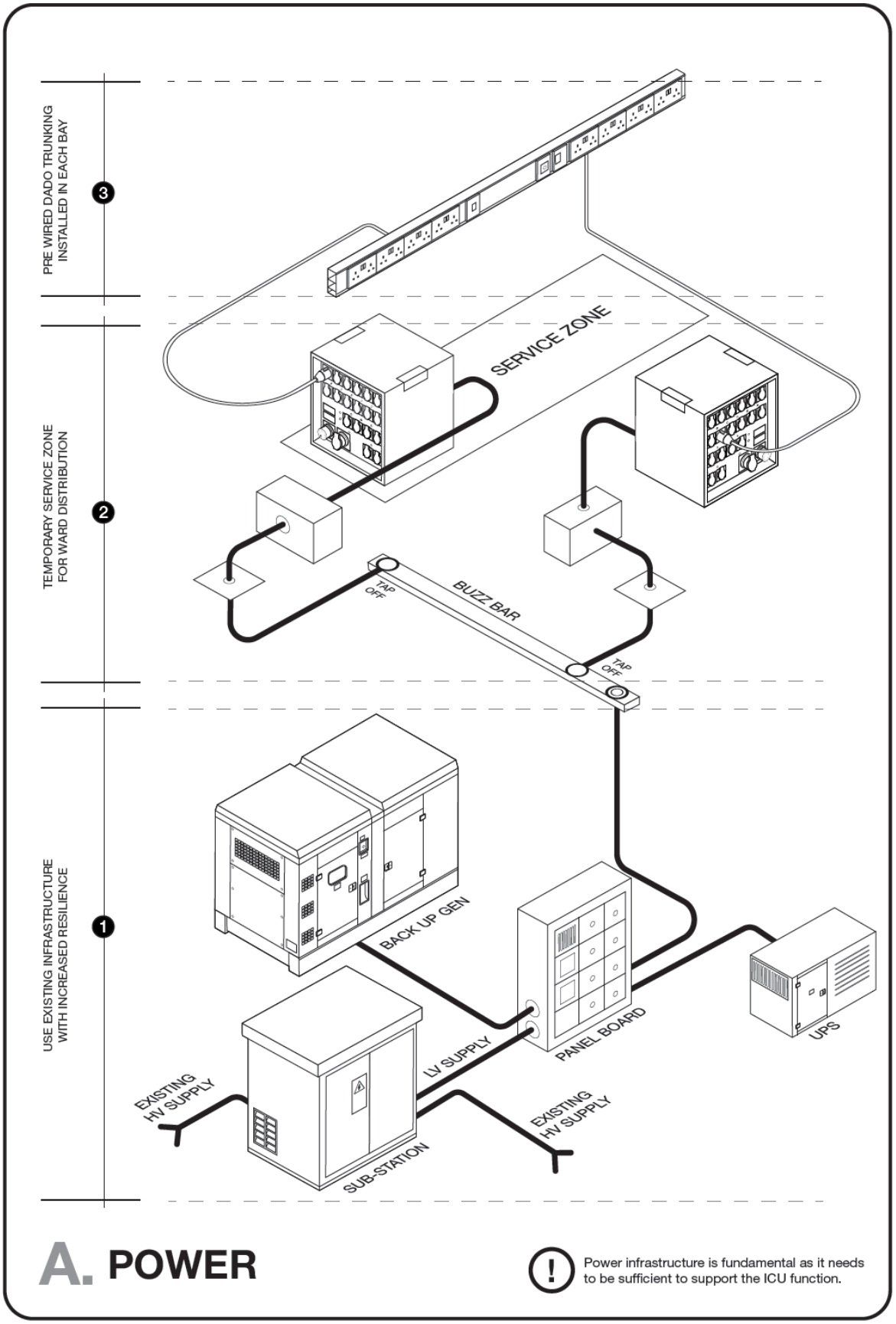


Figure 22: Layout of power in a temporary installation[43]

4.2.6 Water

Water points are needed for hand washing, showers and cleaning. The following issues need to be taken into account.

4.2.6.1 Supply

Onsite cold water storage, dedicated to the domestic water requirements of the facility, should be provided. A minimum usable volume of 500 litres per bed must be provided.

Hot water storage and consumption should be confirmed by engineer, as follows:

- Storage 25 L per bed.
- Consumption 180 L/bed.day W/O laundry; 250L /bed. day W laundry.

4.2.6.2 Hand washing

See infection control for clinical wash-hand basins

4.2.6.3 Showers

Showers for staff coming off shift should be available. Staff flow routes exiting contaminated treatment areas should pass through gowning and sower areas.

4.2.7 Medical gases, oxygen and vacuum (suction)

Medical gases, oxygen and vacuum services will be required in the facility. Mobile gas supply requires piping between supply and patient and clutter floor space. Preferably used fixed installations for patient rooms / cubicles, if possible.

System capacity and point of use pressures and consumption rates are to be ensured at all points. Figure 5 indicates a servicing strategy that can be used to install these. The following points should also be taken into account.

For centrally supplied medical gas and vacuum services, system resilience and availability must be ensured. Compressors, tanks, accumulators, VIEs, headers and controllers must be secured from uncontrolled access. Where possible, gas piping should be reticulated below floors or in ceilings to ensure protection from tampering, damage and ease of access. Where reticulation is within open areas, high level reticulation with point of use droppers is advised. Low level reticulation within rooms is to be avoided.

Flexible piping can be used, ensuring it does not present a contamination or fire risk and should comply with local regulations. Special care should be taken with flexible O_2 piping, keeping it to a minimum.

Vacuum piping may be contaminated, where point of use filtration and collection systems fail. Precautions should be taken when demounting or disconnecting temporary vacuum lines.

Ensure that oxygen pipelines are designed to provide sufficient flow to all oxygen points in the facility. In terms of utilities, oxygen and medical air would be required. Vacuum can be provided by mobile medical vacuum units distributed throughout the unit.

Mobile medical air supplies should be considered where reaching piped specifications are not feasible. Where flexible hoses are used for oxygen and medical air special precautions need to be taken. Flexible oxygen piping must be chemically safe for O_2 use. Where perishable flexible piping is used for medical air, terminal filtration at point of use may be required at point of use. Especially for long-term use.

Electrical and gas services can be reticulated against pipe racks or boards fixed to the bed-heads for head to head bed arrangements.

Gas service isolation valves should be carefully positioned for each clinical unit to avoid shutdowns of major sections.

Gas service outlets to be labelled and colour-coded with 3mm lettering.

SANS 7396-1 should be used to specify the requirements from design to commissioning of medical gas and vacuum systems.

Medical gas and vacuum pipelines shall be marked in accordance with SANS 7396-1 and ISO 5359, as applicable.

Colour coding of non-medical gas piping must be as per SANS 10140-3:2003.

SANS 1409, as amended, specifies the requirements for non-interchangeable outlet sockets and probes for specific medical (gas and vacuum) services used in hospitals.

Plain-ended copper tubing for low-pressure medical gas and vacuum shall comply with the requirements of SANS 1453 and SANS 1067-1 or SANS 1067-2, as deemed suitable.

Laboratory gas taps and valves shall be marked as described in SANS 10140-4.

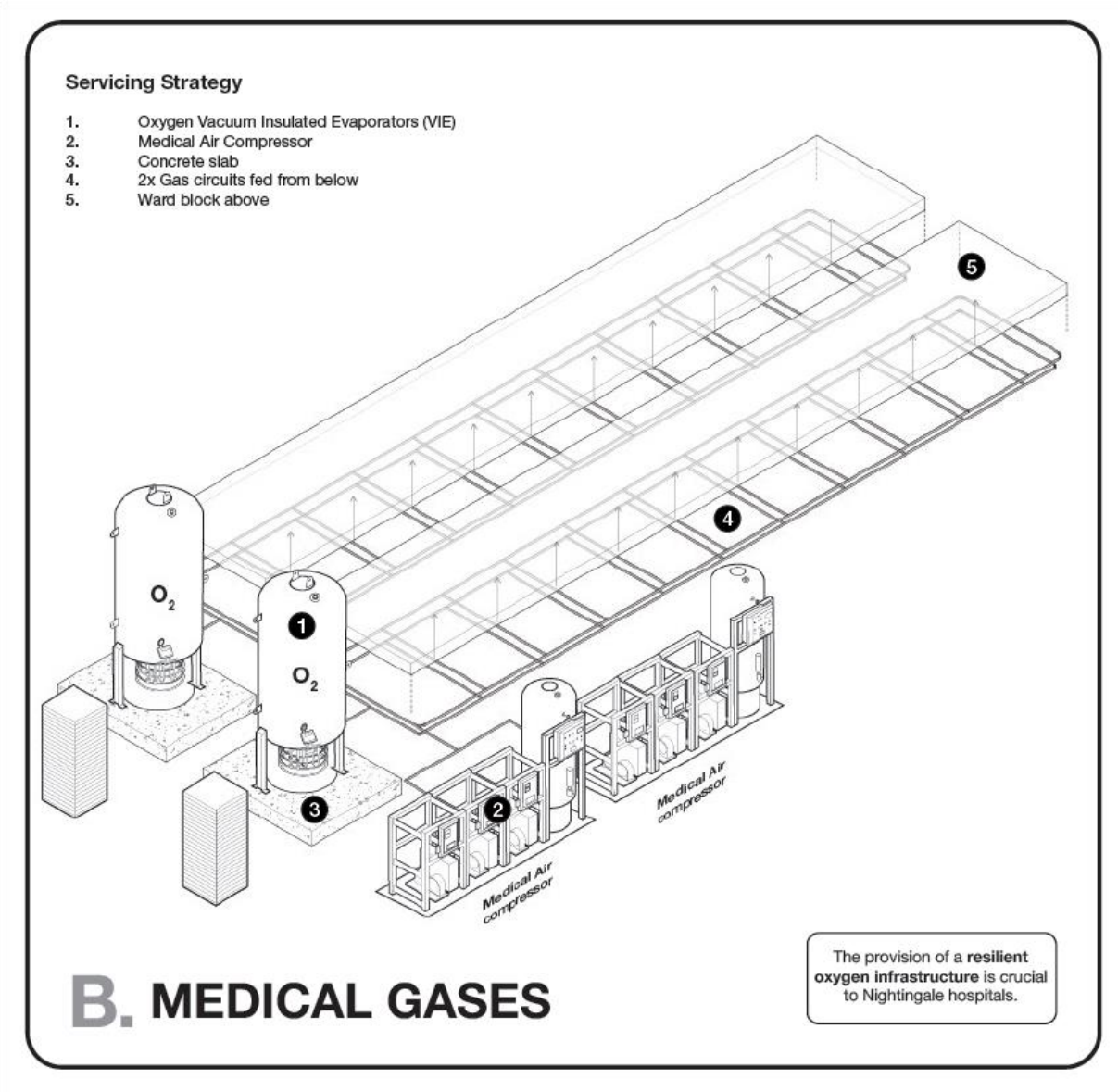


Figure 23: Medical gas service layout[44]

4.2.8 Lighting

Existing lighting systems may need to be modified to suit the clinical requirements in the facility. High bay lighting presents inadequate colour rendering quality for the accurate detection or easy diagnosis of certain clinical conditions. This needs to be evaluated in the selection of supplementary lighting systems.

- Lighting levels should be provided in line with the indoor lighting levels recommended in the Table 6 of IUSS *Building Engineering Services* [45].

[44] BDP, 2020
[45] IUSS, 2017

- Mobile task lighting systems may be adopted in the serious and critical stay wards to supplement incorrect lighting quality.
- Emergency lighting and illuminated emergency egress signage should be linked to the back-up power system.
- External security lighting in external parking areas and spaces around the building should be enhanced to ensure the security of medical staff who need to change shifts at night.

4.2.9 Fire safety

A functional fire alarm system should be available to support the patient care setting. Fire is a very real threat due to the possibility of an oxygen enriched atmosphere developing so ventilation is crucial.

The use of temporary facilities for medical care should note the following fire risks (NHS, 2020a):

- Patients may have a very high dependency.
- Areas are not specifically designed for patients and do not meet guidance on fire compartmentation and progressive horizontal evacuation.
- Large numbers of patients supplied with oxygen up to 10 litres per minute.
- Possibility of oxygen concentrations exceeding those generally found in the atmosphere- less risk if effective ventilation or large volume i.e. high ceilings.
- Staff who may not normally work together
- Staff who may not be familiar with the area
- Staff not trained in fire safety, progressive horizontal evacuation or oxygen isolation for the specific area.

These factors should be taken into account in fire risk assessments which should then address significant findings in an action plan. Fire assessments should be undertaken by a qualified person and shared with operations and building management staff within the facility. Measures developed should include:

- An automatic fire detection system
- An emergency egress plans are prepared that include patients who have a very high dependency.
- Signage, notices and lighting are installed and are working effectively.
- Management processes are in place to minimise the risk of fire from ignition sources, fuels and oxygen.

- Staff are trained and that fire safety guide sheet for staff is developed and issued.
- Emergency egress routes are kept clear.

References and bibliography

- AIA - Knowledge Net . (2020). *Academy of Architecture for Health*. Retrieved April 7, 2020, from AIA- Knowledge Net: https://network.aia.org/communities/community-home/digestviewer?communitykey=5ac54771-1122-4d1f-ac18-d2d12d6a94fb&tab=digestviewer

- ASHRAE. (2020, March 31). *COVID-19 (Coronavirus) Preparedness Resources*. Retrieved April 8, 2020, from ASHRAE: https://www.ashrae.org/technical-resources/resources

- Barbara Bannister, V. P. (2009, January). *Framework for the design and operation of high-level isolation units: consensus of the European Network of Infectious Diseases*. Retrieved April 8, 2020, from Lancet- Infectious Diseases : https://www.thelancet.com/journals/laninf/article/PIIS1473309908703049/fulltext

- BBC. (2020, March 31). *Coronavirus: Building NHS Nightingale Hospital London*. Retrieved April 7, 2020, from BBC News : https://www.bbc.com/news/in-pictures-52092253

- BDP, 2020. *NHS nightingale instruction manual*. Available at: http://www.bdp.com/globalassets/projects/nhs-nightingale-hospital/nhs-nightingale-instruction-manual.pdf [Accessed 7/4/2020].

- Beirne, M. (2020, March 30). *Modular Builders Mobilize to Deliver Prefab Modules for Coronavirus Care*. Retrieved April 13, 2020, from Probuilder: https://www.probuilder.com/modular-builders-mobilize-deliver-prefab-modules-coronavirus-care

- CDC- Center for Disease Control and Prevention. (2020, April 6). *Alternate Care Sites*. Retrieved April 7, 2020, from CDC - Coronavirus Disease 2019 (COVID-19): https://www.cdc.gov/coronavirus/2019-ncov/hcp/alternative-care-sites.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fhealthcare-facilities%2Falternative-care-sites.html

- CIBSE, 2020. CIBSE - Chartered Institution of Building Services Engineers. Available at: https://www.cibse.org/ [Accessed 8/4/2020].

- European Centre for Disease Prevention and Control . (2020, February 26). *Checklist for hospitals preparing for the reception and care of coronavirus 2019 (COVID-19) patients*. Retrieved April 8, 2020, from European Centre for Disease Prevention and Control : https://www.ecdc.europa.eu/en/publications-data/checklist-hospitals-preparing-reception-and-care-coronavirus-2019-COVID-19

- European Centre for Disease Prevention and Control. (2020, April 7). *Publications and Data* . Retrieved April 8, 2020, from European Centre for Disease Prevention and Control: https://www.ecdc.europa.eu/en/publications-data/checklist-hospitals-preparing-reception-and-care-coronavirus-2019-COVID-19

- Federal Healthcare Resilience Task Force . (2020, March 30). *Alternate Care Site* (ACS) Toolkit First Edition. Retrieved April 11, 2020, from https://files.asprtracie.hhs.gov/documents/acs-toolkit-ed1-20200330-1022.pdf

- Fung, C., Hsieh, T., Tan, K., Loh, C., Wu, J., Li, C., . . . Lee, C. (2004). *Rapid Creation of a Temporary Isolation Ward for Patients With Severe Acute Respiratory Syndrome in Taiwan*. Infection Control & Hospital Epidemiology, 25(12), 1026-1032. doi:10.1086/502339.

- Health Systems Research Inc. (2005, April). *Altered Standards of Care in Mass Casualty Events.* Retrieved April 13, 2020, from https://asprtracie.hhs.gov/technical-resources/resource/491/altered-standards-of-care-in-mass-casualty-events

- Health Systems Research, Inc. (2007, February). *Mass Medical Care with Scarce Resources.* Retrieved April 13, 2020, from A Community Planning Guide: https://www.calhospitalprepare.org/sites/main/files/resources/Mass%20Medical%20Care%20with%20Scarce%20Resources.pdf

- Institute of Medicine. (2010). *Medical Surge Capacity: Workshop Summary (2010).* Washington, DC: The National Academies Press.

- IUSS. 2014a. *Inclusive Environments*. Retrieved 16 April, 2020 from https://www.iussonline.co.za/norms-standards/healthcare-environment/34-inclusive-environments

- IUSS. 2014b. *Security*. Retrieved 16 April, 2020 from https://www.iussonline.co.za/norms-standards/healthcare-environment/40-security

- IUSS. 2014c. *Laundry and linen department*. Retrieved 16 April, 2020 from https://www.iussonline.co.za/norms-standards/support-services/30-laundry-and-linen-department

- IUSS. 2014d. *Catering services*. https://www.iussonline.co.za/norms-standards/support-services/23-catering-services-for-hospitals

- IUSS.2014e. *Central Sterile Supply Department*. Retrieved 16 April, 2020 from https://www.iussonline.co.za/norms-standards/support-services/24-central-sterile-service-department

- IUSS. (2017, January 23). *Building Engineering Services.* Retrieved April 8, 2020, from Improving South Africa's Healthcare Infrastructure: https://www.iussonline.co.za/norms-standards/healthcare-environment/60-building-engineering-servi

- Keane, K. (2020, April 02). *These Architects Are Addressing COVID-19 Health Care Infrastructure Capacity*. Retrieved April 02, 2020, from Architect: https://www.architectmagazine.com/practice/these-architects-are-addressing-COVID-19-health-care-infrastructure-capacity_o

- Ministry of Health- Singapore . (2019, December 27). *Being Prepared for a Pandemic*. Retrieved April 8, 2020, from Ministry of Health- Singapore: https://www.moh.gov.sg/diseases-updates/being-prepared-for-a-pandemic

- National Department of Health South Africa . (2020, March). *Covid- 19 Enviromental Health Guidelines* . Retrieved April 13, 2020, from https://www.nicd.ac.za/wp-content/uploads/2020/03/COVID-19-ENVIRONMENTAL-HEALTH-GUIDELINE-1.pdf

- New Zealand Government . (2020, April 8). *Key documents and legislation*. Retrieved April 8, 2020, from Unite against COVID-19 : https://COVID19.govt.nz/resources/key-documents-and-legislation/

- NHS 2020. Complete list of GOV.UK publications related to NHS estates. Available at: https://www.gov.uk/government/publications/complete-list-of-nhs-estates-related-guidance [Accessed 8/4/2020].

- NHS, 2020a. C0131 COVID-19 estates facilities fire risk assessment. Available at: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/C0131-COVID-19-estates-facilities-fire-risk-assessment.pdf [Accessed 8/4/2020].

- NHS. (2020, April)b. *Nightingale Cubicle Beds*. Retrieved April 13, 2020, from Archpaper: https://cdn.archpaper.com/wp-content/uploads/2020/04/NHS-Nightingale-Cubicle-Beds-2-copy-scaled.jpg

- Shroer, J. (2020, April 3). *What if...we used a hotel for patients?* Retrieved 9 April, 2020, form ASHE https://www.ashe.org/what-if-we-used-hotel-patients

- Steyn, M. (2020, April 8). Summary notes of the International Water Association (IWA) Webinar: "COVID-19: A Water Professional's Perspective".

- United States Environmental Protection Agency. (2020, April 9). *List N: Disinfectants for Use Against SARS-CoV-2*. Retrieved April 9, 2020, from Pesticide Registration: https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2

- van Reenen, T., Singh, T., Poluta, M. de Jager, P. 2019. *Implementation of upper room UVGI - an abridged guide*. Retrieved April 16, 2020 from https://www.tb-ipcp.co.za/tools-resources/uvgi-documents/national-guidelines-abridged

- Williams, A. (2020, March 23). *Shipping container-based ICU being developed for COVID-19 treatment.* Retrieved April 13, 2020, from New Atlas: https://newatlas.com/architecture/carlo-ratti-cura-shipping-containers/

- WHO. (n.d.). *Setting up an Ebola Treatment Centre (ETC)*. Retrieved April 8, 2020, from https://extranet.who.int/ebolafmt/sites/default/files/ETC_considerations_for_set_up.pdf

- WHO. (2020). *Hospital readiness checklist for COVID-19*. Retrieved April 8, 2020, from World Health Organization- Regional Office for Europe : http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-COVID-19/novel-coronavirus-2019-ncov-technical-

guidance/coronavirus-disease-COVID-19-outbreak-technical-guidance-europe/hospital-readiness-checklist-for-COVID-19

- WHO. (2020a). *Operational considerations for case management of COVID-19 in health facility and community*. Retrieved April 8, 2020, from Interim guidance: https://apps.who.int/iris/handle/10665/331492

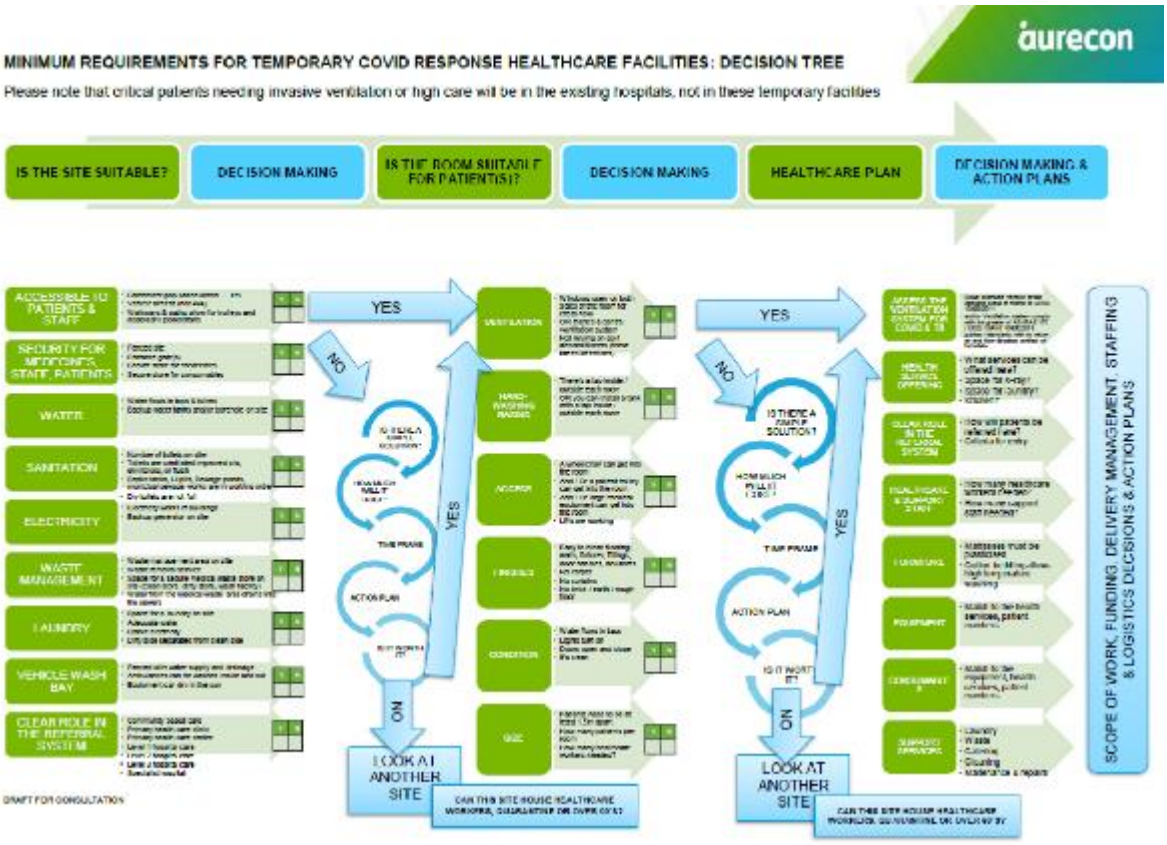
- WHO. (2020b). *Severe Acute Respiratory Infections Treatment Centre*. Geneva, Switzerland : WHO- World Health Organization .

- WHO, (2020c). Safe Management of Waste from Health Care Activities. Available at: https://apps.who.int/iris/bitstream/handle/10665/85349/9789241548564_eng.pdf;jsessionid=92BF582C7F14F2BE80E4987A5DAA7840?sequence=1 [Accessed 9/4/2020].

- Wong, E. (2020, March 24). *TB, HIV and COVID-19: urgent questions as three epidemics collide*. Retrieved April 8, 2020, from The Conversation : https://theconversation.com/tb-hiv-and-COVID-19-urgent-questions-as-three-epidemics-collide-134554

Appendices

Appendix A: Minimum requirements for temporary COVID Response healthcare facilities : decision tree



Appendix B: Summary notes of the International Water Association (IWA) Webinar: "COVID-19: A Water Professional's Perspective"

Date: 8 April 2020

Author: Maronel Steyn (member of IWA)

Panelists

· Joan B. Rose, Homer Nowlin Chair in Water Research, Depts of Fisheries & Wildlife and Plant, Soil and Microbiological Science, Michigan State University and Chairperson: IWA COVID-19 Task Force

· Charles (Chuck) Haas, Department Head, LD Betz Professor of Environmental Engineering, Civil, Architectural, and Environmental Engineering, Drexel University

· Rosina Girones, Professor of Microbiology of the University of Barcelona and Dean of the Faculty of Biology

· Gertjan Medema, Principal Biologist, KWR, The Netherlands

Does the corona virus (SARS-CoV-2) pose a particular risk to Water and Wastewater Treatment Plant Workers in terms of their risk of contracting COVID-19:

The panel concluded that no information is available that indicates a particular risk from COVID-19 to operators of waste water treatment works (WWTW). Wastewater does not pose additional risk to WWTW employees, but the importance of wearing the necessary personal protective equipment (PPE) was noted. The panel was of the opinion that SARS-CoV-2 should pose a similar risk to WWTW operators as all the other viruses that are usually in wastewater. They also mentioned that there was no additional risk or epidemiological evidence suggesting more infections noted amongst those workers to date. They concluded that there was not a particular risk to WWTW operators from SARS-CoV-2 based on epidemiological studies and other viruses.

Specific hot spots of concern at WWTW for occupational health risks:

The panel mentioned sewer sheds and headworks at WWTWs as places of particular concern for occupational health risks and mentioned that the correct PPE should be worn by staff (maybe mention what the correct PPE is). The panel further mentioned that bar screens and wet wells, and places where aerosols can be produced could be a potential source of SARS-CoV-2 and people need to be protected.

Medical waste / wastewater handling from COVID-19 facilities other than hospitals:

The panel expressed a concern for how waste and specifically wastewater (medical) would be handled by places (e.g., hostels, hotels) that are used to serve as interim COVID-19 quarantine or testing facilities or accommodation. These are places other than hospitals that are used in the interim for such purposes and do not usually handle medical wastewater. Such facilities should be watched carefully.

What do we know about the aerosilisation of viruses in general, their persistence in air and travel distances?

The lower the temperature, the more stable viruses will be. Other viruses were much more abundant in wastewater than the SARS-CoV-2 virus.

Monitoring COVID-19 in wastewater effluent, methodology, value of this as indicator, findings to date:

KWR has done excellent work on this to date and more information is available here: https://www.kwrwater.nl/en/actueel/what-can-we-learn-about-the-corona-virus-through-waste-water-research/ The panel member involved in this work mentioned that they used molecular methods. SARS-CoV-2is a RNA virus and that KWR did not look only at fragments as the virus will be unstable especially in sewage. They tested intact virus samples, purified the samples, extracted RNA and looked for specific gene fragments of SARS-CoV-2. They tested the fragments for 4 specific targets. The same method used in clinical setting – so their testing was aligned with clinical methodology. This method can however have a 100 – 1000 fold more fragments than the traditional culture methods (important to know this). They started testing before any infections were reported in the Netherlands and repeated it 6 days after the first case and again 2 weeks after many cases were reported. After the first infections were noted, they found clear signals of SARS-CoV-2 in the influent and after two weeks with many infections they found clear samples with all 4 targets in the influent. All effluent was negative to date (which showed them that the wastewater treatment works effectively removed SARS-CoV-2). The wastewater treatment works tested in the KWR study are all activated sludge systems as this is common practice in the Netherlands. They think that the SARS-CoV-2 screening of sewage water can be used as a tool to measure the virus circulation in a population (e.g. a city or a smaller municipality). If we can further substantiate and validate our method, the water sector will have a tool that provides valuable additional information about the spread of the virus in the population.

Sludge and survival:

No work has been done on SARS-CoV-2, COVID-19, sludge and degradation, but degradation should be fast as viruses are unstable. Studies on other viruses similar to COVID-19 found that they could survive at 4°C and for up to 14 days in the environment.

COVID-19 and groundwater

The panel do not expect SARS-CoV-2 to be found in groundwater. They mentioned that the further one moves away from wastewater into rivers and streams, the least one is to expect to find SARS-CoV-2. They therefore do not expect to find SARS-CoV-2 in groundwater.

Concluding remarks of importance:

WASH (Water Sanitation and Hygiene) principles are even more important now. We should make use of the signals in our WWTW as early warnings to help with community or public health. More data is needed.

The panel warned that as people emerge from lock-down, special attention should be given to large commercial buildings or blocks that were not occupied during lock down. Where plumbing was not used, there is cause for concern for other health impacts associated with biofilms or growth of microbes in plumbing that was not used for an extended period of time (e.g., showers and cooling towers and risk of Legionellae). More information is needed.

The panel mentioned that people can access more information from the World Health Organisation site, specifically on the WASH principles. They also mentioned that IWA serves as a hub for information and created a COVID-19 task force.

The panel was excited to see people collaborating and urged for even broader collaboration and sharing of knowledge, for people to act fast and for better preparedness next time.

While the panel thought the health risk for waterborne transmission of COVID-19 was very low,

it is still important to underpin this with facts. So much more information and research is needed (e.g., the infectivity of COVID-19 and the specific methods to determine this was mentioned).

Next Webinar to register for on the IWA site on the issue of COVID-19 will take place on 17 April 2020:

https://iwa-network.org/learn/a-utility-leaders-response-to-COVID-19/

COVID -19 Information sources on IWA Webpage:

https://iwa-network.org/news/information-resources-on-water-and-COVID-19/?ct=t%28EMAIL_IWA+Newsletter+Oct+2019_members_COPY_01%29

Appendix C: Examples of accommodation schedule for isolation ward

Patient spaces (based on work by Edwina Fleming)

Patient Spaces		
Room type	General description	Spatial requirement
Ward room	1 bed	1. All non-essential furniture to be removed for infection prevention and control purposes 2. Room must be under controlled access (lock or other). 3. Room selection should prefer rooms with impervious smooth floors for easy cleaning. 4. Room to be supplied wall mounted hand sanitiser 5. Standard hotel bedroom, or similar can be utilised. 6. Deep cleaning is required once the patient is discharged before a new patient is admitted. 7. Room must have openable windows for ventilation
Bathroom	Toilet, shower/bath, basin	1. Single use bathroom is recommended, not communal. 2. Bathroom to have either a shower or bath, basin and a toilet. 3. Deep cleaning is required once the patient is discharged before a new patient is isolated. 4. Room must have openable windows for ventilation, if not possible the extraction and ventilation system must

		be reviewed before admitting patient (see ventilation section of this document)
If rooms have access to external balcony, access can be granted, however if room balconies are adjoined, access must be restricted.		
If room have access to external garden, this must be restricted, unless external patio can be cordoned off.		

Service spaces for isolation ward

Shared Spaces		
Room type	General description	Spatial and other requirement
Linen store	General cupboard or room utilised for controlled storage and distribution of clean linen.	1. Must be once of decontaminated before use. 2. Must be under controlled access (lock or other). 3. Room selection should consider hard surfaces. 4. Room to be supplied with gloves, apron and surgical masks and wall mounted hand sanitiser
Surgical store	General cupboard or room utilised for controlled storage and distribution of surgical items. This room can be combined with the	1. Must be once of decontaminated before use. 2. Must be under controlled access (lock or other).

	temporary medicine store.	3. Room selection should consider hard surfaces. 4. Room to be supplied with gloves, apron and surgical masks and wall mounted hand sanitiser.
Medicine store	General cupboard utilised for controlled storage and distribution of medication, can be shared with surgical store. See above note	
Dirty linen room	General cupboard or room utilised for controlled storage of dirty/contaminated linen. Used linen to be stored in bags and bagged into waste bag for transport to laundry	1. Must be once of decontaminated before use. 2. Must be under controlled access (lock or other). 3. Room selection should consider hard surfaces. 4. Room to be supplied with gloves, apron and surgical masks and wall mounted hand sanitiser
Body hold room	In the event that a suspected patient becomes ill and dies prior to being transferred to a hospital site, a holding room is required for the body. This is an open room, preferably no windows and controlled access.	1. Must be once of decontaminated before use. 2. Must be under controlled access (lock or other). 3. Room selection should consider hard surfaces. 4. Room must have mechanical ventilation 5. Room to be supplied with body bags, gloves, apron and surgical masks and wall mounted hand sanitiser 6. Room to be clear of all furniture and body trolleys to be provided

		(sourced from hospital site)
No shared meeting or socialising area to be provided		
No shared dining area to be provided for patients, in room dining only		

Appendix D: Examples of accommodation schedule for ward for mild to severe cases

Patient spaces (based on work by Edwina Fleming)

Patient Spaces		
Room type	General description	Spatial requirement
Ward room 'Mild & Moderate' acuity	Large multi-bed ward.	1. Side cupboard 2. Room/ward must be under controlled access 3. Room selection should consider space with impervious floors and washable walls 4. Room to be supplied wall and bed side mounted hand sanitiser 5. Deep cleaning is required once the site is decommissioned 6. Room must have openable windows for ventilation or a temporary ventilation system

		installed as appropriate for the planned occupancy. Refer to the engineering section in this document. 7. Spacing between adjacent beds: o 1600mm Severe o 2200mm Critical 8. Bed spacing: 2200mm between foot of bed and opposite bed (minimum) 9. 600mm spacing between the bed head and wall.
Ward room 'Critical & Severe' acuity	Large multi-bed ward up.	1. Side cupboard 2. Room/ward must be under controlled access 3. Room selection should consider space with impervious, smooth floors and washable walls 4. Room to be supplied wall and bed side mounted hand sanitiser 5. Room must have openable windows for ventilation or a temporary ventilation system installed as appropriate for the planned occupancy. 6. Bed spacing: 2m between beds (minimum). 7. 600mm spacing required at the head of the bed. 8. Bed spacing: 2 m between foot of bed and opposite bed (minimum) 9. Area setup similar to in hospital

		ICU.
Ward room Recovery	Large multi-bed ward.	o To match requirements for 'mild & moderate' acuity cases
Bathroom	Toilet, shower/bath, basin	o Communal portable showers are acceptable, shared between green and orange status ward. Separate communal showers for the recovery ward o Communal portable toilets are acceptable, shared between green and orange status ward. Separate communal showers for the recovery ward o Deep cleaning is required once the patient is discharged before a new patient is admitted. o Room must have openable windows for ventilation, if not possible the extraction

		and ventilation system to engineer's design (see ventilation section of ACS guideline) o Minimum one disable toilet and shower should be provided. o Showers, toilets and wash basins to be provided at a ratio of 1 for every 8 patients. o Area requirement: per shower: 2 m^2, per toilet and hand wash basin: 3.5 m^2.
Standard bed service required per bed Nurse call One per bed Task light One per bed		
If rooms have access to external balcony, access can be granted, however if room balconies are adjoined, access must be restricted.		
If room has access to external garden, this must be restricted, unless external patio can be cordoned off.		

Service spaces (based on work by Edwina Fleming)

Shared Spaces		
Room type	General description	Spatial and other requirement
Utilities		

Linen store	Room utilised for controlled storage and distribution of clean linen.	○ Must be decontaminated before first use. ○ Must be under controlled access (lock or other). ○ Room selection should consider hard surfaces. ○ To be provided with shelving (e.g. 450mm depth, four-tier, 600mm running length per 10 beds) ○ Area requirement depends upon the number of beds served.
Clean utility Surgical store Medicine stores	Separate/ combined rooms to be utilised for controlled storage. Lockable. General cupboard utilised for controlled storage and distribution of medication, can be shared with surgical store. See above note	○ Must be once of decontaminated before use. ○ Must be under controlled access (lock or other). ○ Room selection should consider hard surfaces. ○ Room to be supplied with gloves, apron and surgical masks and wall mounted hand sanitiser ○ Clinical hand wash basin ○ Area requirement if combined 16 m^2
Housekeepers store		○

Dirty linen/utility room	Room utilised for controlled storage of dirty/contaminated linen. Used linen to be stored in bags and bagged into waste bag for transport to laundry. Wash hand basin.	○ Must be once of decontaminated before use. ○ Must be under controlled access (lock or other). ○ Room selection should consider hard surfaces. ○ Room to be supplied with gloves, apron and surgical masks and wall mounted hand sanitiser. ○ Area requirement 8 m^2.
Body hold room	Room utilised for the deceased patients, prior to collection by mortuary.	○ Must be under controlled access (lock or other). ○ Room selection should consider hard surfaces. ○ Room must have mechanical ventilation. ○ Room to be supplied with body bags, gloves, apron and surgical masks and wall mounted hand sanitiser.
Equipment store		○ Area requirement 12 m^2
Dirty utility/ waste combined	Storage and handling of waste, prior to collection	○ Urinate and defecation into bedpan. Treated with 5,000 ppm of sodium hypochlorite (1:10 dilution of bleach solution) for 30 minutes and then carefully disposed of into the

		sanitary sewer. ○ Area requirement 12 m²
Nurse station and records	Nurse record keeping and	○ Area requirement 12 m² ○ Clear/transparent screen between patients and nurses (from duty station to ceiling) ○ Crash cart bay ○ Clinical hand wash basin
Room type	General description	Spatial and other requirement
Clinical		
Consultation/counselling room/ can be dual function	For patient follow up and minor treatment not performed at bed side.	◦ Area requirement 14 m² ○ Services required: ○ Oxygen and power outlets. ○ Examination light (consultation), ○ Clinical hand wash basin, ○ Examination couch, ○ 1x consultation room for every ward
Emergency procedure room	For minor procedures that do not require theatre – Operating theatres are not provided at ACS sites	○ One single procedure room, central between all wards ○ Area requirement 31 m² ○ Services required: ○ Oxygen & medical gas, ○ Power outlets. ○ Examination light, ○ Hand wash basin

		○ Soap dispenser, Glove, Respirators, gowns and aprons. ○ Appropriate ventilation, refer to engineering services
Laboratory room	Room utilised for analysing samples in the GeneXpert, storage of samples, and data capturing. Autoclaves may be provided.	○ Area requirement 12 m^2
Room type	General description	Spatial and other requirement
Access		
Donning area for staff	Entrance room into the facility, for all staff donning	○ Staff access ○ Patient access ○ Controlled visitor access only ○ Floors and wall to be washable ○ All PPE to be provided (Gown, apron, respirator, visor, and gloves) ○ Medical waste dispensing to be provided ○ Wall mounted hand sanitised and mobile or fixed clinical hand wash basin. ○ Staff ONLY to access

		central locker area o Appropriate ventilation to be provided, (refer to ACS engineering services section)
Doffing area for staff	Exit room from the facility, for all staff doffing	o Staff exit o Patient discharge only o Controlled visitor exit only o The estimated area to be based on total facility staff. o Floors and wall to be washable o Medical waste dispensing to be provided o Bins for disposable PPE. Decontamination facilities for reusable PPE. o Wall mounted hand sanitised and mobile or fixed clinical hand wash basin. o Staff ONLY to access central locker area (refer to image 1) o Appropriate ventilation to be provided, (refer to engineering services section
Trolley wash area	Trolley wash area	o External area close

		proximity to ambulance drop off. ○ Water connection and water hose ○ Plumbing, consider fluid discharge to the sewerage system ○ Hard floor surface.
Wheelchair and porters	Storage area for distribution of wheel chairs to patients	○ Location is at the entrance of the facility. ○ Area to be provided, minimum of 4 m^2 ○ Wall mounted hand sanitised to be provided
Room type	General description	Spatial and other requirement
Staff		
Staff change room	Central between the entrance and exit room (Refer to donning and doffing area)	○ A minimum of 9m^2 or 4m^2 for a single person, increasing by one m^2 for each additional person is required. ○ Space provision should take into account peak numbers of full time staff, volunteers, students and visitors at any one time. ○ Estimate number of staff 60, SANS requirements, Male: Showers x4, toilet

		x2, urinals x3 and hand wash basins x3. Female: Showers x4, toilet x5 and hand wash basins x3. o Separate male and female. Total minimum area for staff change: 22 m^2 o SANS 10400 part S & P o Lockers to be provided
Staff rest rooms	o	o Staff rest areas must be provided with a kitchenette and accessible to staff change areas to reduce the number of ablution facilities. o Provision for 4-6 people at a time, depending on shared status and total staff o Electrical points, sink and hydroboil or smiliar
Room type	o General description	o Spatial and other requirement

	n	
Public		
24 Hour Help Desk	Basic information and public	○ Reception area for visitors and deliveries. ○ Recommended 9 m^2. ○ Room to be supplied with surgical masks and a wall mounted hand sanitiser ○ Perspex or glass screen
External waiting area	Waiting area for parents of ill children, and caretaker of elderly	○ Recommend a 30 m^2 area, 1.5 m^2 per person totals 15-20 people with an estimate waiting time of 15-30 minutes ○ Well ventilated room, or external under cover area. ○ Room to be supplied with surgical masks and a wall mounted hand sanitiser
Public Toilets	For waiting parent or caregiver only	○ Male, female and disabled ablution facilities to be provided in accordance with the National Building Regulations, refer to SANS 10400 part S & P.
No shared meeting or socialising area to be provided		
No shared dining area to be provided for patients, in room dining only		

Support Services		
Room type	**General description**	**Spatial requirement**
Central Sterilise Service Department (CSSD)		
o Dirty Receiving o Dirty Utility o Decontamination and cleaning/wash area o with throughput instrument washing o Trolley wash/Park – external o Store -linen and consumables o Clean Packing area o A table top autoclave o Instrument washer o Sterile pack store o Issue - Collection hatch o Female change room with toilet and shower o Male change room with toilet and shower		Total area required inclusive of circulation: 110 m^2
This is short-term temporary or mobile assembly requirement. Service required: water, electricity and sewer holding tank		
Room type	**General description**	**Spatial requirement**

Diagnostics (Radiology fixed and mobile)	
○ Records ○ Chest X-Ray (floor-standing, mobile/ Lodox) ○ Reporting/Viewing Room ○ Computer server room ○ Store ○ Staff toilet ○ On call room ○ On call ensuite ○ Dirty Linen/ Utility	Total area required inclusive of circulation: 95 m^2
This is short-term temporary or mobile assembly requirement. Service required water, electricity.	

Room type	**General description**	**Spatial requirement**
Pharmacy (discharge dispensing and bulk storage)		
○ Dispensing shelving area ○ Dispensing counter with glass/ ○ Perspex screens ○ Fridges area ○ Counter - data capture ○ Office - Pharmacy Manager ○ Wet Compounding cubicle ○ Dry Compounding cubicle ○ Store prepack manufacture ○ Ward med script preparation area		Total area required inclusive of circulation: 280 m^2

○ Enclosed delivery area with covered unloading platform ○ Receiving Desk ○ Unpacking area ○ Bulk Store - general ○ Flammable store ○ Cold Room and fridges ○ Schedule Drugs safe ○ Vaculiter store with mobile racking ○ Store Expired or waste medicines	
This is short-term temporary or mobile assembly requirement. Service required water, electricity and sewer holding tank. This is medicine storage and ward distribution, the only dispensing that will occur, is for discharged patients.	

Room type	**General description**	**Spatial requirement**
Laboratory services (testing and data capture)		
○ Reception counter- receiving specimens ○ Testing with perspex/ glass screen ○ Receiving/Data capture ○ Specimen Holding ○ Toilet - staff ○ Blood storage fridge		Total area required inclusive of circulation: 37 m^2

<table>
<tr><td colspan="3">This is short-term temporary or mobile assembly requirement. Service required water, electricity and sewer holding tank. This is a testing, and data capture local site service – supported by NHLS,</td></tr>
<tr><td>Room type</td><td>General description</td><td>Spatial requirement</td></tr>
<tr><td colspan="3">Administration</td></tr>
<tr><td colspan="2">o Open plan clerks office
o Meeting boardroom - command centre
o Cleaners Room
o Kitchenette
o Training Room
o Ablutions-Female Staff
o Ablutions- Male Staff
o Ablutions-Disabled Staff
o Medical records – Secure space for patient mediacl records. Should adhere to the same applicable legal authorities and guidance governing the routine collection, use, and storage, of personal information.</td><td>Total area required inclusive of circulation: 127 m^2</td></tr>
<tr><td colspan="3">This is short-term temporary or mobile assembly requirement. Service required water, electricity. This is only essential administration.</td></tr>
<tr><td>Room type</td><td>General description</td><td>Spatial requirement</td></tr>
<tr><td colspan="3">Bulk stores (all supplies)</td></tr>
<tr><td colspan="2">o Good receiving
o Dispatch area
o Secure store – surgical supplies
o Secure store – medical supplies</td><td>Total area required inclusive of circulation: 180 m^2</td></tr>
</table>

○ Secure store – soap and cleaning consumables ○ Secure store - Medical equipment store ○ Secure store - Toxic material store ○ Secure store - Flammable store ○ Dirty utility, with space for empty boxes	

This is short-term temporary or mobile assembly requirement. Service required water, electricity. This is bulk storage for all goods and the asset management and distribution thereof.

Room type	**General description**	**Spatial requirement**
Mortuary short term hold (Viewing included)		
○ Waiting ○ Office : Service manager ○ Body receiving area ○ Viewing room with complete glass/ perspex separation between body and viewing space ○ Cold room for 20 bodies (2 tier) + ○ Hearse loading area - covered and enclosed ○ Cleaners Room ○ Trolley Wash ○ Dirty Utility ○ Change room with toilet and shower - female staff ○ Change room with toilet and		Total area required inclusive of circulation: 148 m^2

shower -male staff		
This is short-term temporary or mobile assembly requirement. Service required water, electricity and sewer holding tank. This unit will not be freezing bodies, only refrigeration will be provided. Local mortuary services will be involved to ensure at 24hr service turnaround time, in line with Health ministers directive (08-04-2020).		
Room type	**General description**	**Spatial requirement**
Laundry, outsourced service model (Holding with basic sluicing only)		
o Manager`s Office o Contaminated side o Trolley wash area o Dirty Linen Receiving and Holding o Bulk Dirty Linen Sorting o Dirty linen collection - covered open area o Sluicing facilities may be required o Washing machines & dryers o Loading & unloading washing machines o Staff ablutions o Store - cleaning materials o Staff change, locker, shower and toilet o Clean linen receiving - open covered area o Clean linen issue		Total area required inclusive of circulation: 184 m^2

○ Trolley park ○ Change room with toilet and shower - female staff ○ Change room with toilet and shower -male staff	
This is short-term temporary or mobile assembly requirement. Service required water, electricity. This only a holding site, with outsourced local contractors as per local Health Department procurement	

Room type	**General description**	**Spatial requirement**
Kitchen, outsourced service model (Receive and Dispatch only)		
○ Goods receiving & off loading ○ Staff dining area with a servery to the delivery area ○ Food supervisor`s office ○ Store - Cleaning and equipment ○ Preparation area ○ Food Trolley park area ○ Food Trolley wash area ○ Tray stack area ○ External waste area		Total area required inclusive of circulation: 100 m^2
This is short-term temporary or mobile assembly requirement. Service required water, electricity. This only a holding and supply site, with outsourced local contractors as per local Health Department procurement		

Room type	**General description**	**Spatial requirement**
Engineering services and temporary plant		

o Electrical plant room(s): transformer, generator, switchgear o Water plant room(s): booster pump(s), water treatment, water storage o Sewage plant room(s): treatment plant, booster pump(s) if necessary for this site o Site medical gasses: storage for full and empty cylinders, medical gas manifolds & plant room, medical air compressors, vacuum system o Hot water: Gas heater/ Calorifier at each ward (geysers at each ablution in the ceiling void) o Life saving UPS • Cold room plant: Mortuary, kitchen o Ventilation (HVAC) where there is inadequate natural ventilation o Server room	Total area required inclusive of circulation: 440 m^2
This is short-term temporary or mobile assembly requirement. Provision of all essential series and short bulk connection to all municipal service.	

Room type	**General description**	**Spatial requirement**
Waste management, outsourced service model (Holding only)		
• Office - manager • Green, yellow, red bin wash area • Green, yellow, red storage area for clean bins		Total area required inclusive of circulation: 149 m^2

• Storage area for Green, yellow, red waste awaiting collection • Storage area for domestic waste skip • bins • Change room with toilet and shower - female staff • Change room with toilet and shower -male staff o General waste is stored in black bag or bin, Infectious waste in red, sharps in yellow and pharmaceutical in green Office - manager o Green bin wash area o Green bin storage area o Storage area for plastic waste o Storage area for domestic waste skip o Storage area medical waste waiting to be removed o Storage for clean medical waste boxes and sharp bins o Change room with toilet and shower - female staff o Change room with toilet and shower -male staff	
This is short-term temporary or mobile assembly requirement. Service required water, electricity. This only a holding site, with outsourced local contractors as per local Health Department procurement	

Appendix E: Hospital bed specifications

According to National Treasury RT

Bed, hospital, two section with Trendelenberg

To comply with the specifications in Appendix A, SEE ATTACHED.

Note: where the item offered differs from the specification in Appendix A, except for the items specified below, the supplier must indicate the deviation and supply relevant details

Must comply with IEC 60601-2-52 (Particular requirements for basic safety and essential performance of medical beds) paragraphs: 201.1, 201.3, 201.7, 201.9, 201.13, 201.15, annex BB and annex CC

Mild steel frame with epoxy/nylon powder-coated finish to comply with SANS 778 paragraph 5.2, proof of compliance must be submitted.

Epoxy/nylon powder coating colours: white, cream or grey

Bed must support a patient mass of 180 kg

Adjustable backrest with gas spring assist, suitable for 100 kg patient

To be fitted with castors, two swivel , two locking

Castors must comply with the latest issue of SANS 621, proof of compliance must be submitted.

Where castors are fitted into steel tubular legs, the tube shall be of wall thickness not less than 2,0mm and castors shall be fixed to the tube by one of the following methods:

a. Solid plug (long) complying with SANS 621 subsection 3.5.6 or

b. Screwed into 35mm long sleeves welded into the tubular members and locked in an acceptable manner

c. Rubber or plastic expanding sleeves for fitting castors are not acceptable

Removable head and foot ends (ABS material may be offered)

With collapsible safety sides, to comply with IEC 60601-2-52

Mattress support: mattress support other than weldmesh is required, provide details

The following accessories must be accommodated to fit on the bed. The price for these accessories must not be included on this item bid price.

a. Driprod

b. Patient lifting pole with chain or strap and handle, must support a mass of 75 kg

c. Traction pole with pulleys and weights

d. Bedding support according to specification in Appendix A, subsection 3.14

Item to be evaluated as series with item RT24-02-003,

Bed, hospital high-low

To comply with the latest issue of CKS 447

Note: where the item offered differs from the specification in CKS 447, except for the items specified below, the supplier must indicate the deviation and supply relevant details

Must comply with IEC 60601-2-52 (Particular requirements for basic safety and essential performance of medical beds) paragraphs: 201.1, 201.3, 201.7, 201.9, 201.13, 201.15, annex BB and annex CC

Mild steel frame with epoxy/nylon powder-coated finish to comply with SANS 778 paragraph 5.2, proof of compliance must be submitted.

Epoxy/nylon powder coating colours: white, cream or grey

Bed must support a patient mass of 180 kg

Hydraulically operated variable height operated by dual sided foot pedals

Adjustable backrest with gas spring assist, suitable for 100 kg patient

To be fitted with castors with a central castor locking system

Castors must comply with the latest issue of SANS 621, proof of compliance must be submitted.

Where castors are fitted into steel tubular legs, the tube shall be of wall thickness not less than 2,0mm

Removable head and foot ends (ABS material may be offered)

With collapsible safety sides, to comply with IEC 60601-2-52

Mattress support: mattress support other than weldmesh is required, provide details

The following accessories must be accommodated to fit on the bed. The price for these accessories must not be included on this item bid price.

a. Driprod

b. Patient lifting pole with chain or strap and handle, must support a mass of 75 kg

c. Traction pole with pulleys and weights

d. Bedding support according to specification in Appendix A, subsection 3.14

Bed, hospital intensive care, 4 section

To comply with the latest issue of CKS 447

Note: where the item offered differs from the specification in CKS 447, except for the items specified below, the supplier must indicate the deviation and supply relevant details

The mattress platform shall be in four sections allowing for a profiling action

Must comply with IEC 60601-2-52 (Particular requirements for basic safety and essential performance of medical beds) paragraphs: 201.1, 201.3, 201.7, 201.9, 201.13, 201.15, annex BB and annex CC

Mild steel frame with epoxy/nylon powder-coated finish to comply with SANS 778 paragraph 5.2, proof of compliance must be submitted.

Epoxy/nylon powder coating colours: white, cream or grey

The bed shall have a four section platform. The knee-break section adjustable via a manual mechanism

Bed must support a patient mass of 180 kg

Hydraulically operated variable height operated by dual sided foot pedals

Adjustable backrest with gas spring assist, suitable for 100 kg patient

To be fitted with castors with a central castor locking system

Castors must comply with the latest issue of SANS 621, proof of compliance must be submitted.

Where castors are fitted into steel tubular legs, the tube shall be of wall thickness not less than 2,0mm

Removable head and foot ends (ABS material may be offered)

With collapsible safety sides, to comply with IEC 60601-2-52

Mattress support: mattress support other than weldmesh is required, provide details

Oxygen cylinder holder

Extension of bed must comply to CKS 447, subsection 3.5

The following accessories MUST be offered to fit on the bed. The price for these accessories must not be included on this item bid price.

a. Driprod

b. Patient lifting pole with chain or strap and handle, must support a mass of 75 kg

c. Traction pole with pulleys and weights

Bed, hospital, obstetric, high-low, tilting, 2 section, complete with mattress

Bed and fittings must accommodate various labour and delivery positions

Must comply with IEC 60601-2-52 (Particular requirements for basic safety and essential performance of medical beds) paragraphs: 201.1, 201.3, 201.7, 201.9, 201.13, 201.15, annex BB and annex CC

Mild steel frame with epoxy/nylon powder-coated finish to comply with SANS 778 paragraph 5.2, proof of compliance must be submitted.

Epoxy/nylon powder coating colours: white, cream or grey

Mattress platform material

Bed must support a patient mass of 180 kg

Removable leg section

Adjustable backrest with gas spring assist (0 to 60 degrees) with quick release. Controls at both sides of bed

Hydraulically operated variable height operated by dual sided foot pedals

Height range (mattress platform): 500 to 750 mm (approximately)

Trendelenberg tilt, 12 degrees

To be fitted with 125 mm castors with a central castor locking system

Castors must comply with the latest issue of SANS 621, proof of compliance must be submitted.

Where castors are fitted into steel tubular legs, the tube shall be of wall thickness not less than 2,0mm

With collapsible safety sides, to comply with IEC 60601-2-52

Rubber buffer wheels at the corners of bed head end

Mattress, two section, for body and foot sections, with cover. Body section must be suitable for all profile angles

Mattress to comply with the latest issue of SANS 640 AND 1291-1 (type 2), except for thickness, as below, proof of compliance must be submitted.

Mattress must support a patient of at least 180 kg and return to original shape when not in use

To be constructed of flexible polyurethane foam complying with class 30, grade no.12 of SANS 640

Thickness: 150 mm (-0 and +5mm)

Manufacturer must supply a 5 year warranty on the mattress

Two lithotomy poles, height adjustable, swivel action, with leg support (not straps)

Douche fitting

Douche tray, stainless steel

Drip ro

Cot, adult, complete with mattress

To comply with the latest issue SANS 521, subsection 5.4, fig. 5

Note: where the item offered differs from the specification in SANS 521, except for the items specified below, the supplier must indicate the deviation and supply relevant details

Must comply with IEC 60601-2-52 (Particular requirements for basic safety and essential performance of medical beds) paragraphs: 201.1, 201.3, 201.7, 201.9, 201.13, 201.15, annex BB and annex CC

Mild steel frame with epoxy/nylon powder-coated finish to comply with SANS 778 paragraph 5.2, proof of compliance must be submitted.

Epoxy/nylon powder coating colours: white, cream or grey

Length: 2 045 mm (± 12 mm)

Width: 915 mm (± 6 mm) Mattress support: mattress support other than weldmesh is required, provide details Mattress must comply with specifications in item RT24-02-014 Item to be evaluated as series with item RT24-02-010, RT24-02-014 and RT24-02-015 in terms of paragraph 16.4 in the Special Conditions of Contract.
Cot, adult, with rising backrest and Trendelenberg, with mattress To comply with the latest issue SANS 521, subsection 5.4, fig. 5 Note: where the item offered differs from the specification in SANS 521, except for the items specified below, the supplier must indicate the deviation and supply relevant details Must comply with IEC 60601-2-52 (Particular requirements for basic safety and essential performance of medical beds) paragraphs: 201.1, 201.3, 201.7, 201.9, 201.13, 201.15, annex BB and annex CC Mild steel frame with epoxy/nylon powder-coated finish to comply with SANS 778 paragraph 5.2, proof of compliance must be submitted. Epoxy/nylon powder coating colours: white, cream or grey Rising backrest support. Trendelenberg and anti-Trendelenberg positions Length: 2 045 mm (± 12 mm) Width: 915 mm (± 6 mm) Mattress support: mattress support other than weldmesh is required, provide details Mattress must comply with specifications in item RT24-02-014

Appendix F: Example healthcare technology

Courtesy REAF Consulting

Bed (see appendix E) and pressure reducing mattress
Ventilator (with humidifier)
Multi-parameter Patient Monitor
Infusion Pump: The standard would be 4 Volumetric Pumps and 2 syringe drivers per bed but the exact requirement needs to be specified by the clinicians depending on their treatment protocol
Drip Stand
Wall suction unit

Stethoscope
Ambubag adult (Resuscitator)
O2 Flowmeters

Appendix G: Example crash cart healthcare technology

(Courtesy REAF Consulting)

Defibrillator

Mobile suction machine

ENT set

Laryngoscope with blades size 1,2,3,4 straight and curved

Ambubag adult

Ambubag pads

Ambubag neonatal

Oxygen gauge

Infrared Thermometer

Plaster Scissors

Forceps, Artery, Straight, 20cm

Forceps, Magills, 20cm

Video Laryngoscope (Difficult intubation)

Detector, Oesophageal Intubation (difficult intubation)

Inflator, Tracheal Tube Cuff

Disposable, consumable and drugs needs to be added.

4.3 Appendix H: WHO diagnostic equipment list

Lab screening test kit

Lab confirmation test kit

RT-PCR kit

Extraction kit

Cartridges for RT-PCR automatic systems

Swab and Viral transport medium