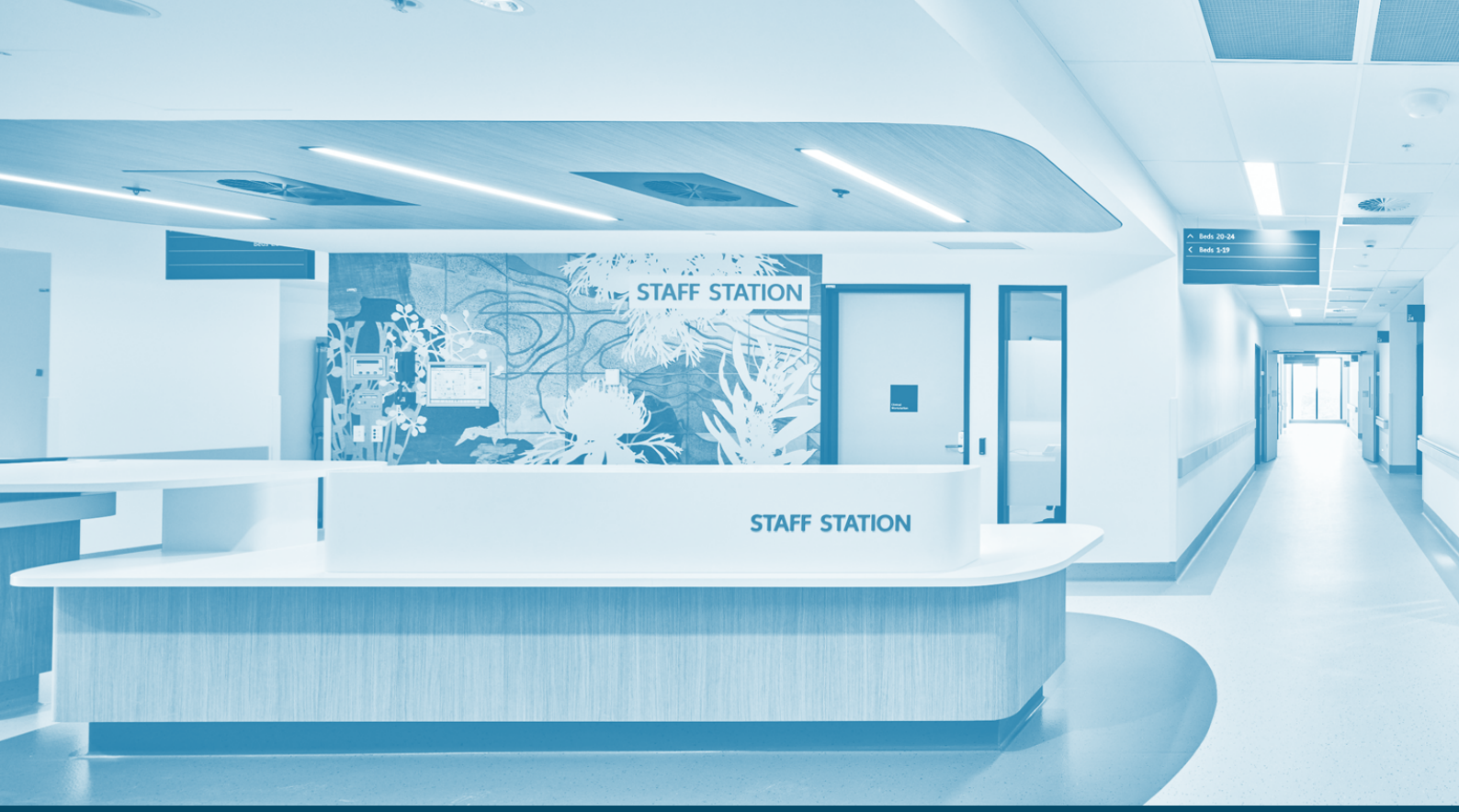

Australasian Health Facility Guidelines

HPU 620 Renal Dialysis Unit

Health Facility Briefing, Planning and Design

April 2026

Version **8**

AHIA australasian health infrastructure alliance
AusHFG Australasian Health Facility Guidelines

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Australasian Health Facility Guidelines

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Cultural Acknowledgement and Terminology

The Australasian Health Facility Guidelines (AusHFG) are developed in collaboration with stakeholders across Australia and Aotearoa, New Zealand.

Acknowledgement of Country

We acknowledge the Aboriginal people and Torres Strait Islander People as traditional owners and continuing custodians of the land throughout Australia and the Torres Strait Islands.

We acknowledge their connection to land, sea, sky and community and pay respects to Elders past and present.

Acknowledgement of Te Tiriti o Waitangi

Te Tiriti o Waitangi obligations have been considered when developing the AusHFG resources.

Terminology and Language in the AusHFG

Throughout the AusHFG resources, the term ‘Indigenous Peoples’ is used to refer to both the Aboriginal and Torres Strait Islander Peoples of Australia and Māori of Aotearoa, New Zealand. Where references to specific cultural requirements or examples are described, the terms ‘Aboriginal and Torres Strait Islander Peoples’ and ‘Māori’ are used specifically. The AusHFG respect the right of Indigenous Peoples to describe their own cultural identities which may include these or other terms, including particular sovereign peoples or traditional place names.

Contents

Acronyms

Acronym	Definition
AHIA	Australasian Health Infrastructure Alliance
AKI	Acute Kidney Injury
ANZDATA	The Australia and New Zealand Dialysis and Transplant Registry
ANZSN	Australian and New Zealand Society of Nephrology
ARTG	Australian Register of Therapeutic Goods
AS	Australian Standard
AusHFG	Australasian Health Facility Guidelines
CKD	Chronic Kidney Disease
EBCT	Empty Bed Contact Time
ESKD	End-Stage Kidney Disease
EMR	Electronic Medical Record
FF&E	Furniture, Fittings and Equipment
GAC	Granular Activated Carbon
HD	Haemodialysis
HDL	High Level Disinfection
HPU	Health Planning Unit
ICT	Information and Communication Technology
ICU	Intensive Care Unit
ISO	International Standards Organization
IPC	Infection Prevention and Control
KHNZ	Kidney Health New Zealand
MRO	Multi-Resistant Organisms
RDS	Room Data Sheets
RLS	Room Layout Sheets
RO	Reverse Osmosis
RPZD	Reduced Pressure Zone Device
RSA	Renal Society of Australasia
SC	Standard Components
SC-D	Standard Components - Derived
SSU	Sterilizing Services Unit
TGA	Therapeutic Goods Administration
UV	Ultraviolet
VSD	Variable Speed Drive
WHS	Work Health and Safety
WOW	Workstation on Wheels

1 Introduction

1.1 Preamble

The Australasian Health Facility Guidelines (AusHFG) (www.healthfacilityguidelines.com.au) are freely available resources for health services and project teams across Australia and New Zealand to support better planning, design, procurement and management of health facilities.

The AusHFG are an initiative of the Australasian Health Infrastructure Alliance (AHIA), a cross-jurisdictional collaboration of all health authorities across Australia and New Zealand. Part A of the AusHFG provides further information relating to the purpose, structure and use of these resources. It is acknowledged that the application of the AusHFG varies between jurisdictions across Australia and New Zealand.

This document is intended for new-build projects; however, refurbishment projects should adhere to these guidelines as far as is possible. It is acknowledged that meeting the recommended spatial allocation may not be achievable in a refurbishment project.

This AusHFG Health Planning Unit (HPU) has been developed by AHIA following an extensive consultation process completed in 2025.

1.2 Introduction

Dialysis involves filtering the blood of excess fluid and waste products normally filtered by the kidneys. Renal Dialysis Units manage patients with both acute and chronic renal failure; however, they are most commonly used for the treatment of end stage kidney disease (ESKD), which is an irreversible reduction in kidney function to the point where the patient cannot survive without dialysis or a kidney transplant.

This HPU outlines specific requirements for the planning and design of Renal Dialysis Units, including considerations relating to training for home dialysis, as provided by selected services.

The document should be read in conjunction with the Australasian Health Facility Guidelines (AusHFG) generic requirements and Standard Components described in:

- Part A: Introduction and Instructions for Use
- Part B: Section 80: General Requirements
- Part B: Section 90: Standard Components, Room Data and Room Layout Sheets
- Part C: Design for Access, Mobility, Safety and Security
- Part D: Infection Prevention and Control
- Pandemic Preparedness – Health Infrastructure Planning & Design Guidance

1.3 Policy Framework

Prior to undertaking a project, planners and project staff are encouraged to familiarise themselves with individual State and Territory specific policies (as detailed in 6.2 References and Further Reading) as well as local operational policies.

Renal services across Australia and New Zealand contribute to The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA). This data set includes a wide range of statistics which relate to the outcomes of treatment of those with ESKD.

1.4 Description

Those requiring renal replacement therapy have a range of options including:

- in-centre or hospital haemodialysis (HD) - usually associated with tertiary hospitals
- satellite or stand-alone unit haemodialysis
- facility based haemodialysis
- self-care or community-based haemodialysis

- mobile dialysis unit
- home dialysis, either peritoneal or haemodialysis.

This HPU is focussed on the operational and facility requirements associated with in-centre and satellite services, as well as home dialysis training as this may be provided in selected centres. Planning and design considerations relating to facility based and self-care HD are also addressed.

The target population is adults, however information relating to paediatric dialysis services is addressed in Sections 2.1.3 Paediatric Dialysis Services and 2.4.8 Paediatric Services.

Planning and design requirements to support the provision of dialysis services for patients in ICU and CCU is provided in AusHFG HPU 360 Intensive Care Unit; HPU 260 Cardiac Care Unit; and the AusHFG Intensive Care standard components.

Terminology

Term	Definition
Dialysis for Acute Kidney Injury (AKI)	A dialysis treatment for AKI, to filter blood and remove waste when kidneys temporarily fail. This may be performed for a few hours or days in hospitals, often in Intensive Care Unit (ICU) or specialised inpatient renal units. It may also be provided at some in-centre haemodialysis units, although less frequently. Dialysis for AKI typically involves more critically ill patients, typically cared for in beds rather than chairs and require closer observation and staffing ratio of 1:1 or 1:2.
Dialysis for Chronic Kidney Failure	Dialysis treatment for chronic kidney disease (CKD) when kidney function has been significantly reduced for more than three months. In advanced stages, CKD can progress to complete kidney failure, known as end-stage kidney disease (ESKD). At this stage, dialysis or a kidney transplant is essential to sustain life. The two main types of dialysis used for chronic kidney failure are haemodialysis or peritoneal dialysis.
Haemodialysis (HD)	A treatment for renal failure where the function of the kidneys, to remove substances from the blood, is replaced by a machine. Treatment requires the patient to be attached to the machine for three to six hours per day three days a week via an arteriovenous (AV) fistula, AV graft or central line catheter inserted into their neck or upper chest. This process may be undertaken in a purpose-built centre or using a machine installed in a patient's home.
On-line Haemodiafiltration (HDF)	The combination of haemodialysis and haemofiltration which combines the advantages of high diffusive elimination of small uraemic toxins with high convective removal of large uraemic toxins.
Facility based haemodialysis	Provided for patients who are unable to manage home haemodialysis but who live a significant distance from a satellite dialysis unit. To enable these patients to remain in their local community, dialysis may be provided within a local health service, e.g. community health centre, small rural hospital or Multipurpose Service (MPS), with support from the regional dialysis service. An appropriately equipped area in the health facility will need to be established to support haemodialysis. Staffing is provided by the facility and trained by the regional dialysis service.
In-centre haemodialysis units	Co-located in a hospital with other acute services and provide HD and HDF treatment for acute nephrological emergencies; those with significant acute medical or surgical illness not always directly related to their kidney disease; and other hospital inpatients. A high level of medical support is needed as patients are typically medically unstable. Plasma exchange services may also be provided in these units.
Peritoneal dialysis	Involves the exchange of fluid to and from the abdomen on several occasions each day either manually (Continuous Ambulatory Peritoneal Dialysis) or overnight with the assistance of a machine (Automated Peritoneal Dialysis). Peritoneal dialysis is performed at home but training in technique and problem solving may occur at a Renal Dialysis Unit.
Satellite haemodialysis units	Stand-alone dialysis units that may be located on a hospital site, a community health centre or other location. Patients are typically medically stable. Selected satellite services will also provide training for home dialysis, both haemodialysis and peritoneal dialysis.
Self-care or community-based haemodialysis	Provided for patients who can manage their own dialysis, however, in the event that they are unable to undertake it at home due to poor water supply, unsuitable accommodation etc. 'home haemodialysis' is undertaken by the patient in a local health facility through an arrangement with

Term	Definition
	the regional dialysis service. An appropriately equipped area in the health facility will need to be established and staffing is provided to the level of carer support.
Therapeutic Plasma Exchange	Also known as plasmapheresis is a process involving extracorporeal blood plasma being separated from the blood, processed, and then returned to the patient. This treatment is often used in conjunction with dialysis to treat certain kidney diseases, particularly those involving immune-mediated damage or severe AKI secondary to vasculitis. This treatment is often provided in in-centre haemodialysis units and intensive care units but may also be provided in satellite dialysis units in regional areas for people living outside of major cities.

For further glossary of terms relating to kidney health and dialysis, refer to:

- Kidney Health Australia
- The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA)

2 Planning

2.1 Operational Models

2.1.1 Models of Care

Dialysis services form part of a comprehensive renal service. As such, these services will often:

- act as a resource to other staff and the community regarding dialysis related issues
- participate in pre-dialysis information sessions to enable those progressing to ESKD to consider their future dialysis options
- promote involvement of patient in self-care by assisting the staff in settings dialysis sessions and involvement in care
- supervise patients who manage their dialysis at home.

Renal supportive care involves collaboration across multiple disciplines, requiring infrastructure that supports integrated, patient-centred care. A range of disciplines may be involved in the delivery of renal supportive care and will commonly include a clinical nurse consultant (CNC) or equivalent to occupy the central role in delivering care. The CNC is skilled in both renal and palliative care principles of care delivery. They may be supported by palliative care physician (or other medical/nursing practitioner) who can assist with the medical aspects of managing the high symptom burden of the patient, Aboriginal or Torres Strait Islander Health Practitioner or Aboriginal or Torres Strait Islander Health Worker, and dietitians and social workers, where available. Planning needs to consider the range of disciplines accessing the unit to inform requirements relating to staff workspace and staff amenities, as well as access to meeting rooms for patient, family/whānau and staff discussions. The models of care to be incorporated should be considered early in the planning process to inform the unit design.

The nature of kidney disease and links with other chronic diseases such as heart disease and diabetes, provide opportunities to consider a broader range of treatment options aimed at prevention. For example, diabetes is the leading cause of ESKD across Australia and New Zealand (ANZDATA 2019). This provides the opportunity for Renal Dialysis Units to provide additional services to address particular issues associated with diabetes.

Nursing staff ratios in a Renal Dialysis Unit will vary depending on the service model including whether home training services are provided; the level of patient acuity and dependency; and the proposed staffing model. The staffing model including nurse-to-patient ratio, as the provision of floating nurse or health care assistants and workforce flexibility across the service network will affect the planning and design of the unit. The staffing profile will need to be determined early in the planning process to inform planning and design requirements.

Some sites may have volunteers to assist with patient entertainment and support.

Nocturnal dialysis relates to patients managing their HD treatment overnight while they sleep. This is more commonly provided for patients undertaking home HD or facility-based home HD. Services may decide to operate a centre-based, nocturnal service to increase available options. This may also allow for services to be delivered using less treatment spaces as services operate over three shifts. The provision of nocturnal services needs to consider staff availability, security requirements relating to after-hours access by patients and staff, patient transport, storage needs for additional supplies and scheduling of downtime for reverse osmosis (RO) plants.

2.1.2 Operational Models

The operational service model for a dialysis unit will depend on its location, i.e. within a hospital building or a stand-alone service that may be located on a hospital site or within a community health or ambulatory care service.

Each location may affect the requirements for support such as reception, outpatient clinics, teaching and research and staff amenities. For example, where services are located in a stand-alone location, sharing of infrastructure such as reception and staff amenities, is not always possible.

In larger centres, services may co-locate other service components such as renal clinics and renal staff administration work areas.

2.1.3 Paediatric Dialysis Services

Paediatric dialysis is provided through in-centre HD or home-based peritoneal dialysis. Home HD is not appropriate for these patients, particularly given many receive transplants within a short time period. In-centre dialysis services are only provided in specialist children's hospitals and patient numbers are very small. For this reason, paediatric dialysis services are usually incorporated within a broader service, for example a medical day stay unit.

Staff ratios for paediatric dialysis services are usually 1:1 or 1:2.

Planning and design implications are included in Section 2.4.8 Paediatric Services.

2.2 Operational Policies

Operational policies have a major impact on facility requirements and the capital and recurrent costs of health facilities and must be established at the earliest stage possible. Users may be guided by local policies.

Unit specific operational policies are detailed below. For a list of general operational policies that may apply, refer to Part B: Section 80 General Requirements.

2.2.1 Operating Hours

Units typically operate between 7am and 9pm each day, allowing two sessions per machine per day. Some units will provide a twilight service that commonly operates from 7pm to 11pm.

Units will operate a varying number of days per week from three days in small rural centres to six or seven days in larger centres depending on demand.

On-call services may be provided to support acute hospital services and/or patients at home. Access to in-centre services may be required overnight for acute patients.

Selected services may offer nocturnal dialysis as outlined in Section 2.1.1 Models of Care.

The hours of operation are important to establish to ensure security requirements are appropriately addressed.

2.2.2 Patient and Visitor Amenities

A full range of amenities should be located within the unit or in close proximity for those receiving treatment and the carers accompanying them. These should include:

- waiting areas

  Patients and their carers can spend a significant amount of time each week in Renal Dialysis Units, and it is important that these areas are welcoming and comfortable. There will be activity peaks as patients come and go at scheduled times during each day.
- access to meeting rooms for patient and family/whānau meetings with staff
- toilets, including accessible toilets
- showers will be required on in-centre units and may be considered in satellite units
- space to store patient mobility aids and vehicles (including motorised wheelchair) while the patient is receiving treatment
- space to store personal effects at each dialysis treatment space
- space to accommodate a chair for a carer and other health service providers, e.g. podiatrist, while the patient is receiving treatment
- audio-visual entertainment in waiting areas and each patient treatment space
- access to Wi-Fi
- consideration for discreet entry and waiting of patients arriving from aged care or via patient transport services.

Units may need to consider culturally specific requirements such as separate dialysis bays and toilets for males and females. Consultation with cultural representatives is recommended to ensure the delivery of culturally appropriate facilities.

Proximal access to parking and drop off and pick up areas is essential given many patients are elderly, have mobility issues and/or low exercise tolerance.

2.2.3 Dialysate Preparation

Dialysate, also called dialysis fluid, is a solution of water, electrolytes, acid and caustic salts. It is prepared according to individual patient need to help regulate electrolyte and acid-base balance and remove metabolic waste products.

Contemporary practice is for the preparation of dialysate to occur at the patient's chair or bedside. This process is supported by the use of mobile trolleys that are prepared in advance of each shift. Dedicated bays will be required to accommodate these trolleys. Ensure compliance with Work Health and Safety (WHS) requirements and provide appropriate equipment to assist with handling and lifting large peritoneal dialysis fluid bags.

2.2.4 Medical Records Management

Medical records keeping and management will be based on local jurisdictional model. Increasingly, services will use an electronic medical record (EMR). Staff will access the record via workstations on wheels (WOW), fixed PCs located nearby or other mobile devices e.g. tablets. The proposed model for accessing electronic records requires confirmation to guide spatial and ICT infrastructure requirements such as data points or Wi-Fi provision.

HD machines also have the capability to collect a range of monitoring and reporting that can be linked to an EMR.

Where these systems are in use, one computer is usually provided for each nurse which will reduce the number of PCs required at staff bases.

Where a hard copy record is in use, these records will need to be securely stored.

2.2.5 Medication Management

Medication will be stored on the unit in accordance with jurisdictional policies. The volume of medications stored will depend on the service model and patient profile. The use of medication is significant in in-centre environments as the acuity of patients is high.

Consideration will need to be given to:

- the provision of automated dispensing cabinets which are becoming increasingly common on in-centre units
- the provision of a drug safe for the storage of controlled drugs within in-centre units. These may also be required on some satellite units
- the significant volume of refrigerated medications in comparison to other clinical units
- refrigerated vaccines to support blood-borne virus screening and management programs.

Medication and vaccine fridges will require 24/7 temperature monitoring. Ergonomic issues will need to be addressed given the frequent access by staff.

2.2.6 Cardiac Monitoring

Cardiac monitoring systems are not commonly required in satellite dialysis units and are not routinely provided in all in-centre units. However, they may be provided in a select number of in-centre treatment bays within hospitals that perform a significant amount of specialised cardiac surgery and that manage a high volume of patients with cardiac failure. This is due to the risk of cardiac arrhythmias caused by electrolyte imbalances.

For other in-centre units, cardiac monitoring systems may be transported with the patient where required to ensure that staff in the relevant critical care unit, i.e. ICU or CCU, can observe the patient via telemetry.

It is important to ensure that staff within the in-centre unit are appropriately trained to manage these patients with access to medical support as required.

Higher risk patients that are dialysed within in-centre units should have an option to be managed by ICU or CCU staff for access to appropriately skilled medical and nursing staff, where staff to patient ratios are less than 1:2.

The operational policy relating to the management of these patients will require confirmation to inform the requirements relating to cardiac monitoring.

2.2.7 Water for Haemodialysis

High-purity water is critical for HD to prevent patient harm from chemical and microbial contaminants. System design must adhere to ISO 23500 (a series of international standards providing guidance on the preparation, quality, and management of fluids for haemodialysis and related therapies) and ISO 10993 (a set of international standards for the biological evaluation of medical devices) standards, employing a multi-stage treatment process - pre-treatment, RO purification, and looped distribution.

Central RO systems are preferred for larger units (six chairs or more), while smaller or remote facilities may require portable RO units, guided by risk and cost-benefit analysis. Heat sanitisation protocols and monitoring practices must be integrated to ensure ongoing water safety. Environmental sustainability and equipment maintenance are key considerations in design and operation.

In remote areas using bore water for dialysis, additional treatment measures must be implemented to manage mineral and salt content, ensuring RO system performance and water quality.

Refer to 3.9.4 Water Treatment Services and Appendix 7.1 Water for Haemodialysis and 7.3 Water Treatment Services for more detailed discussions and further information.

2.2.8 Peritoneal Dialysis Fluid Storage and Disposal

Peritoneal dialysis treatment is generally provided within a pre-prepared bag containing the dialysis solution. This can be administered manually via a catheter several times a day, or automatically (generally overnight) via a machine.

Consider additional bulk peritoneal dialysis fluids storage on the unit depending on facility wide storage policies.

If peritoneal dialysis is performed within the unit (e.g., in the dialysis training area), the effluent can be discharged directly into the dialysis wall box, provided the wall box is designed to accommodate this function.

Refer to the HPU 360 Intensive Care Unit Section 7 Appendices table for design considerations regarding a peritoneal dialysis connection port integrated with the dialysis wall panel. This approach eliminates the need to manually transfer heavy effluent bags for disposal.

2.2.9 Maintenance

HD machines require routine and ad-hoc maintenance. A service contract is usually in place and renal technicians will visit the unit to undertake this work. A dedicated, body protected, room will be provided. This workroom will also store spare machines. Biomedical Technical Services (BTS) or Biomedical Maintenance Services (BMS) location should be considered for regular dialysis machine maintenance and RO plant room inspections.

While advanced RO piping systems are durable, they may need replacement if corrosion or biofilm develops. Design should enable easy pipe replacement with minimal disruption to the unit.

For maintenance of all dialysis plumbing and drain, also refer to AusHFG HPU 360 Intensive Care Unit sections 3.10.12 Dialysis and 7 Appendices.

2.2.10 Point-of-Use Reprocessing of Ultrasound Transducers

In Renal Dialysis Units, ultrasound is routinely used to guide vascular access needle placement, enhancing success rates and minimising complications. Conducting a risk assessment is recommended to determine the appropriate level of disinfection for the unit and to identify the necessary facilities to support this process. The ultrasound transducers (or probes) used are classified as reusable medical devices (RMDs) and are

generally considered as non-invasive medical devices as they do not penetrate the body during percutaneous procedure. However, uncovered transducers are classified as semi-critical if they come into contact with non-intact skin or blood during procedure.

An IPC risk assessment should inform decisions on point-of-use reprocessing of ultrasound transducers. Non-invasive transducers must undergo, as a minimum, low-level disinfection (LLD) or intermediate level disinfection generally at the point of use, whereas if they have become a semi-critical device during the procedure they have to undergo high-level disinfection (HLD) method between procedures. Where feasible, transducers requiring HLD should be sent to a central sterilizing services unit (SSU). However, given their delicate construction, these probes are frequently reprocessed at the point of use within the dialysis unit for HLD, rather than being sent to a central SSU.

When considering reprocessing to occur within the unit, the designated space for HLD must comply with the requirements outlined in AS 5369:2023, including:

- providing a dedicated area or room that is separate to the patient/clinical treatment area or room
- meeting the requirements for environmental control, effective segregation of clean and dirty activities, unidirectional workflows and facility fixtures and finishes (this should be informed by a process map or flow diagram to minimise the risk of cross contamination)
- access to appropriate hand hygiene facilities, including clinical hand basins (Type B)
- sufficient space to store accessories, chemicals and documentation
- surface finishes are smooth, non-porous and easily cleaned
- systems for the identification and traceability of the point of use reprocessing
- storage facilities for reprocessed transducers that protect them from the risk of contamination
- high level disinfection systems should be provided with reference to Therapeutic Goods Administration (TGA) requirements and included on the Australian Register of Therapeutic Goods (ARTG).

Refer to AusHFG HPU 190 Sterilizing Services and Endoscope Reprocessing Units, HPU 440 Medical Imaging Unit Section 4.2.5 Ultrasound Reprocessing Room for additional information and Australian Commission on Safety and Quality in Healthcare (ACSQHC) *Cleaning and disinfection of ultrasound transducers fact sheet*.

2.2.11 Storage

Large quantities of liquid substances, disposable consumables and other supplies are delivered on pallets to the unit on a regular basis. Dialysis units will require a significant amount of storage space in comparison to other clinical units.

Key storage requirements include:

- provision of an adequately sized main storeroom with sufficient aisle width to enable access by a pallet lifter

  The storeroom must be located on the perimeter of the unit with easy access from the loading dock and accessible by a pallet lifter. A roller door access may be required to provide adequate width to the entry into this space, especially for larger, stand-alone units. Where units are not provided on the ground floor, the lift must be of a sufficient size to accommodate a pallet lifter.
- heavy duty shelving to hold the large quantities of supplies in an organised and space efficient manner
- consideration for additional bulk peritoneal dialysis fluids storage if not provided in facility wide storage space
- storage for trolleys used to transport consumables to treatment areas
- temperature and light-controlled conditions to ensure the stability of liquid concentrates, especially those which are glucose-based, is maintained
- separation of general consumables from clinical and dialysis consumables

- selected consumables will be stored at the point of use, e.g. tape and gauze, although quantities should be kept at a minimum
- the delivery of supplies and other 'back of house' activity flows should be separate from public flows
- plan for future-proofed storage of dialysis fluids and consumables to accommodate growth in patient demand.

2.2.12 Food Services

It is usual to provide a light meal to people receiving treatment and have beverages available. Food will be prepared elsewhere and delivered to the unit.

A beverage bay should be provided for relatives and friends to prepare food and beverages for patients receiving treatment. As patients often bring their own food, they will need access to a refrigerator and microwave. This must be separate to the staff room.

2.2.13 Waste Management

Substantial quantities of waste both general and contaminated are generated by the unit. Renal Dialysis Units should be appropriately designed to support green dialysis practices. Clinical staff will generally use bins located within the dirty utility room to dispose of used items and linen.

A disposal room will be provided on the external perimeter of the unit to enable collection of used linen and waste. Disposal rooms should be lockable with external access given waste is usually collected after hours.

Waste should be streamed, and recycling optimised, in line with local policies.

Dialysate concentrate is disposed of in dirty utility rooms. It can be highly corrosive to stainless steel and so alternative materials should be used where they come into contact with dialysate. This may include the installation of a 'slop hopper' disposal unit within dirty utility rooms given these are made of porcelain rather than the more modern flushing rim sinks.

Also refer to The Australian and New Zealand Society of Nephrology (ANZSN), the Renal Society of Australasia (RSA) and Kidney Health New Zealand (KHNZ), 2023, Position Statement Environmental Sustainability & Kidney Care for additional information regarding environmental impact of healthcare sector including kidney health.

2.2.14 Wastewater

Sustainably engineered advanced RO systems can significantly minimise water and energy consumption in dialysis operations, supporting both environmental and operational efficiency. Key strategies include the application of the A_0 principle to limit energy use, integration of variable speed drive (VSD) pumps, and rapid in-line heating to replace conventional tank heating. Systems should achieve a minimum 75% water recovery rate and be carefully sized to meet clinical demand without excess capacity, minimising waste.

Sustainable practices also include reuse of RO reject water, where feasible, subject to appropriate treatment for its intended use - such as disinfection protocols for aerosol-generating applications or mineral content checks for irrigation. Design planning should encompass operational efficiencies, including reuse of permeate water and the use of renewable energy sources, supported by automated quality monitoring to ensure safety and compliance.

These wastewater strategies have been successfully implemented within a number of dialysis units across Australia, and it is strongly recommended that water saving infrastructure is incorporated into any new build dialysis unit.

To support the capture and reuse of rejected RO water, a second drainage point in the treatment areas and holding tank will be required.

For further information refer to:

- ANZSN Green Nephrology
- ANZSN Environmentally Sustainable Design (ESD) Guidelines for Kidney Care Facilities, September 2022, HIP V. HYPE Sustainability

- Environmental Sustainability and Renal Care Position Statement, June 2023, joint statement from ANZSN, RSA and KHA
- further reading references noted in Section 6.2 Further Reading
- Appendix 7.2 Wastewater for more detailed information.

2.2.15 Amenities - Staff

A range of amenities and services are required by staff. Depending on the size and/or location of the service, they may be provided within the unit or may be shared with another area adjacent to the unit. These will include staff work areas and related support space, toilets, a staff room, lockers and access to a meeting room.

The staff profile required to meet the service requirements of the unit will inform the range and size of amenities and work areas to be provided.

2.3 Planning Models

2.3.1 Unit Location and External Functional Relationships

Unit Location

The optimal location of a dialysis unit will depend on the service model being delivered.

For in-centre services, a priority requirement is to minimise travel distances between the dialysis service and relevant inpatient and critical care units. In-centre services are often co-located with renal inpatient units to support flexible staffing arrangements and other operational and spatial efficiencies associated with shared access to support areas. It is, however, acknowledged that some patients will still attend an in-centre service as a day case and therefore, ease of access to parking, patient drop off and pick up areas and transit lounge, where provided, is also required.

Satellite services may be located on a hospital site, a community health centre or other location and will require proximal access to parking, and patient drop off and pick up areas. For hospital-based services, consideration should be given to collocation with other services such as outpatient renal clinics and renal staff administration areas.

Access to natural light and external views should be optimised given the length of time patients attend the unit for treatment.

External Functional Relationships

Requirements for a satellite unit will be dependent on the location. Direct access to parking and patient drop-off and pick up areas (for private vehicles and patient transport) is essential. Ease of access to a transit lounge, where provided, and the loading bay and dock for deliveries of stock is also required.

The priority requirement for in-centre units is proximal access from inpatient and critical care units, depending on the operational arrangements in place. Ease of access for stock deliveries via the loading dock is also essential. Ready access to clinical support services, including pathology (this may be provided via pneumatic tube systems), medical imaging and pharmacy is also required.

Discreet and dignified entry of patients from inpatient units and those arriving from aged care or via patient transport services should be considered during planning and design.

Reference to the defined role delineation for the service, where provided, will also guide the functional relationship requirements.

Stand-alone units must be designed to accommodate ambulance access, ensuring efficient patient transport. Additionally, a designated access and unloading bay at the back of house is essential for the delivery of dialysis consumables, water treatment supplies, and bulk shipments. To streamline deliveries, consider incorporating a ramp or dock that enables delivery trucks to offload bulk supplies using a pallet jack.

2.3.2 Unit Configuration and Internal Functional Relationships

Unit Configuration

The scale of the renal dialysis service will influence the arrangement of space.

Patient treatment areas are provided as open bays that may accommodate a recliner chair or patient bed, as well as a number of enclosed patient rooms depending on service requirements. Enclosed rooms are commonly provided for infectious patients; patients who are immunosuppressed including transplant patients; patients with gastroenteritis symptoms/incontinence; and for cultural reasons.

Bays may be provided within a large open area surrounding a central staff station or they may be grouped in bays of 4 to 6 chairs depending on staffing ratios, with a staff base or WOW to ensure patient observation during dialysis treatment. This arrangement supports cohorting of patients, e.g. by age and gender, or for infection prevention and control (IPC) reasons. Patients are generally only able to see the other patients within their bay; however, the design of the unit should allow for optimal staff visibility across the full unit.

Dialysis patients typically undergo treatment over extended periods, and in rural or remote facilities they often develop social connections with fellow patients. The design of dialysis bays should therefore incorporate features that promote interaction, support socialisation, and foster a sense of community, whilst maintaining privacy when required.

Internal Functional Relationships

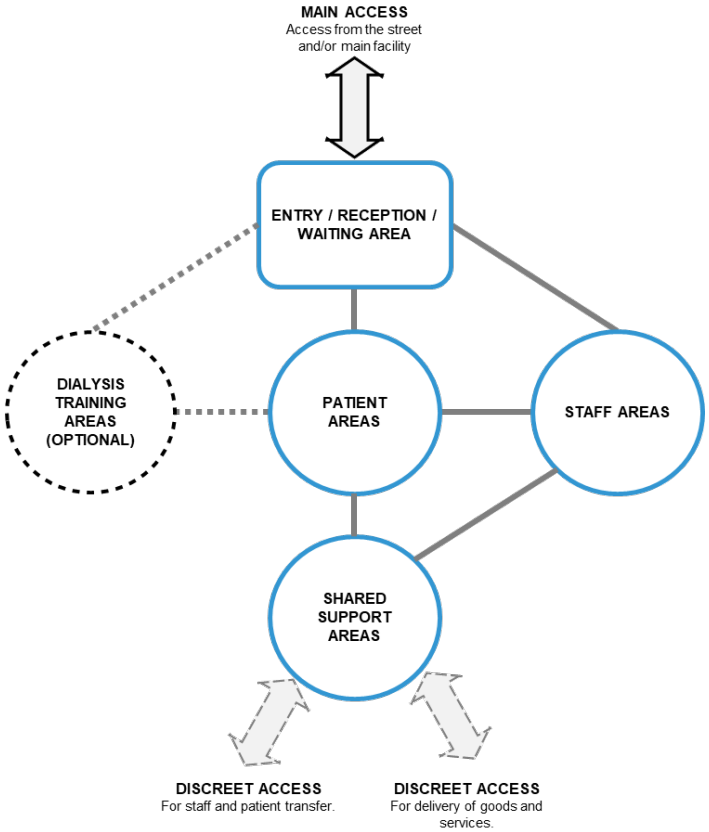
Easy access from the waiting area to the patient treatment area is essential for the movement of patients to and from treatment areas.

Where training facilities are co-located, these should be separated from treatment areas and organised to ensure that visitors for education and/or training cannot readily access these areas. This maintains the focus on training as an option.

Support areas must be directly accessible from patient treatment areas to ensure that staff travel is reduced.

2.3.3 Functional Relationships Diagrams

The following diagram sets out the relationships between zones in a Renal Dialysis Unit.



2.3.4 Unit Size

The number of dialysis treatment spaces to be provided will be informed by clinical services planning. This should include consideration of projected growth in demand to ensure that future expansion of the service, where required, can be readily achieved.

Where large units are provided, treatment spaces should be grouped into pods. Each pod may require its own staff station and support areas to ensure optimal patient observation, especially for patients who have falls risks and those who are in isolation rooms, and to minimise staff travel distances.

Also consider jurisdictional staff to patient ratios to assist with planning of a manageable sized unit/pods. The number of bays within each pod should support the staffing ratios proposed for the unit.

2.4 Functional Areas

2.4.1 Functional Zones

The unit includes clusters of spaces for the following:

- reception and waiting
- training areas, including outreach services (selected services only)
- treatment areas
- support areas
- staff areas.

Outpatient clinics may be co-located with satellite Renal Dialysis Units, but this depends on local service models and arrangements.

2.4.2 Reception and Waiting

A dedicated reception area may be provided, depending on the size of the unit and staffing profile. Where provided, the reception area should be located to provide oversight of the unit entry and waiting areas. It must be designed to support staff safety, including two points of egress to enable staff to retreat into the main unit if they feel unsafe. Evaluate the need for a duress alarm following the project's security risk assessment, considering available options and requirements. Barriers for IPC and security may also be considered in line with local jurisdiction requirement and informed by the project's security assessment.

The size of waiting areas will depend on a range of factors, including treatment scheduling (staggered treatment times will minimise the number of patients waiting); access to centralised hospital facilities for waiting with electronic notification systems; and the patient profile. Consideration needs to be given to the accommodation of patients with walking aids, motorised wheelchair users and carers that will often accompany patients.

In-centre services usually manage both inpatients and outpatients and will also require a waiting area and reception.

A beverage bay may be provided in this area. Consider staff visibility of this area if fluid intake management is important component of model of care.

Incorporate participatory arts engagement opportunities such as rotating community artwork and seasonal co-created displays supported by clear governance for content curation and ongoing maintenance. Entrances and waiting areas serve as key thresholds where first impressions and comfort levels are established; thoughtfully curated art can offer a culturally welcoming and inclusive experience for all visitors.

2.4.3 Training Areas

Although ideally provided as community-based to support engagement and self-management, home training areas will only be provided at selected sites, as detailed in clinical services plans. Space requirements will be dependent on the expected type (home dialysis, staff-assisted HD or peritoneal dialysis) and volume of training.

Where training requirements are infrequent, a treatment room may be used. In larger centres, dedicated training rooms for HD and peritoneal dialysis training may be provided. Training will usually be provided on a one-to-one basis or to two patients at one time. Consider providing one training space to be larger for training of patient and family members/carers.

The location of training rooms should be separated from the main dialysis treatment area; however, depending on operational policies, consideration should be given to the use of these rooms during urgent peaks in demand, including for additional isolation capacity. Training should be the primary function of these spaces, not as overflow dialysis areas.

Office space for training and outreach staff will usually be provided adjacent to training rooms.

A multifunction meeting room will also service for training and pre-dialysis and related education. Scheduling of activities in this space is an operational responsibility of the unit so it may also be used for staff meetings/education.

Storage for the accommodation of home dialysis machines, home RO machines and other items will need to be considered.

2.4.4 Treatment Areas

A weigh bay should be located in a central location, so that patients can weigh upon entry and exit. A weighing platform scale countersunk on the floor may be considered which can be used by wheelchair users or for weighing patients transported on a stretcher. The location of the weighing area should be within staff observation to troubleshoot and supervise patients who self-weigh and patients requiring assistance.

Staff bases will be designed such that patients and nursing staff can see each other, where possible. This will facilitate monitoring, patient wellbeing and interactions with staff. Many consumers report that these arrangements contribute to their satisfaction with Renal Dialysis Units.

As multi-resistant organisms (MRO) are common in Renal Dialysis Units, treatment spaces should also be organised to enable those with the same MRO can be cohorted. Depending on the patient profile, consideration may be given to the use of pods and/or physical separation between bays to prevent contamination between patients and support separation of patients by gender, age etc.

Apply biophilic design principles and incorporate locally relevant landscape references within pods and bays to promote orientation and a sense of calm, while ensuring finishes comply with IPC standards. As patients often attend dialysis regularly and may undergo lengthy treatments, an evolving program of music, art, and video can provide ongoing interest and engagement. Emerging technologies such as Quick Response (QR) codes, tablets, smartphones, and headphones can enable personalized content and interactive experiences.

2.4.5 Support Areas

Support space will include broad groups of rooms including:

- utilities, both clean and dirty, should be located near treatment areas to minimise staff travel
- access to a treatment room for minor procedures or medical consultations. The inclusion of a treatment room within the unit is optional as it may be accessed through a co-located outpatient or inpatient service. Where treatment or procedures are performed, consider an observation area prior to discharge, preventing these patients from occupying a dialysis space.
- access to a beverage bay to receive and issue patient meals and beverages
- storage for frequently used equipment and consumables, e.g. cannulation trolleys, WOWs, ultrasound machines, blood pressure (BP) machines, and other medical equipment, will be contained in equipment bays within the treatment areas
- bulk storage, the maintenance or technician's room and water treatment plant room will be located on the periphery of the unit to facilitate delivery of consumables and equipment.

Nursing staff are required to access the water treatment plant several times each day to conduct routine water testing, monitor, trouble-shoot and report its status. Therefore, ensuring direct, convenient, and unobstructed access from the treatment zone to the plant room is essential.

2.4.6 Staff Areas

A range of areas will be required to support the staff on the unit and include:

- staff work and administration areas should be allocated in accordance with local jurisdictional work policies
- staff amenities including staff room, toilets, lockers and a shower
- a meeting room for activities including education and training spaces for students and trainee nurses.

There should be consideration for clinical handover and training areas that are independent of the staff break room. Also consider accessibility for staff with disability such as inclusion of height adjustable workstations.

Provide artwork in staff stations and respite areas and a small reflective/creative space (e.g., quiet wall, pinboard gallery) to support wellbeing and belonging.

2.4.7 Facility Based and Self Care Haemodialysis

Small health facilities providing facility based and/or self-care HD will require the following:

- dialysis chair and machine (a minimum of two treatment spaces is recommended to justify the cost of implementing these services remotely)
- portable RO machine
- plumbing for water outlet and tundish drain (preferably with a second drain and storage tank for reuse of rejected RO water)
- access to a storeroom for storage of fluids and consumables
- close proximity to a nurses' station. For facility-based HD, the nurses' station should provide direct oversight of the dialysis chairs.

These service models would usually require a minimum of two patients and a maximum of six. Services with greater than six chairs would be deemed a satellite unit.

2.4.8 Paediatric Services

Key planning and design considerations relating to paediatric dialysis services are noted below.

- The location of the unit is an important consideration. Collocating dialysis treatment bays with a paediatric medical day stay service is a common arrangement to achieve an operationally efficient unit. This includes sharing of support areas including reception and waiting areas. Collocation with the core renal department, i.e. staff admin areas, is also beneficial to enable ready access for staff support.
- Where provided as an integrated unit with another service, a dedicated 'sub' staff station should be provided for the dialysis treatment spaces. Close observation of these patients is essential. Access to EMR should ensure that the nursing staff can access patient records while observing the patient at all times.
- Compared with adult dialysis services, there is a greater number of people per chair to be accommodated within the unit due to additional family members/whānau, Aboriginal extended family, staff (including other disciplines such as play therapists) and teachers.
- Given the small patient numbers, operational policies may be established to enable flexible use of dialysis treatment spaces for other services, e.g. for apheresis or renal biopsies. The ability to store all dialysis machines within a separate storeroom will promote greater flexibility of use.
- There is no requirement for drug safes as no controlled medications are used in paediatric units.
- Similar storage area per chair is required as per adult services, acknowledging that storerooms will usually be smaller on paediatric units due to the smaller number of treatment spaces. However, it is noted that a wide range of sizes of items, e.g. catheters is required to meet the requirements of all ages.

- Where possible, a separate store should be provided for dialysis services to accommodate dialysis fluids and consumables. Other support areas may be shared with a co-located unit, e.g. medical day stay service.
- Design must also consider play equipment, e.g. game console, toys (including storage) and a whiteboard for teaching etc.
- It is recommended that an RO plant is provided rather than the use of portable RO machines. Ideally this plant should be located to enable beds on intensive care and coronary care units to be plumbed and connected to the same RO plant.

3 Design

3.1 Access

The unit should be easily accessible to the public with all levels of mobility and disability. Covered drop-off areas, close to the entry point must also be considered as well as easy access by patient transport services. Refer to Section 2.3.1 Unit Location and External Functional Relationships for further detail.

There will be a single public entry point to the unit for access by outpatients. For relevant units, access for inpatient transfers should be via the internal hospital corridors without traversing public areas. Also consider the path of travel for patients who need to be cared for in an isolation room due to infection.

Separate access will be required for the delivery and collection of consumables, HD machines, food, linen and waste.

External access to the water treatment plant room is required for replacement of the RO equipment and deliveries of salt and media. Internal access is also required to the plant room for staff on the unit.

3.2 Parking

The majority of patients requiring regular treatment will arrive at the unit by vehicle. This may include private vehicle and transport services. Access to nearby parking, including accessible parking is needed.

A parking space or loading area will be needed for drop-off of machines where stand-alone units are provided.

Facility planning should support multi-modal transport by reducing car dependency and encouraging active travel. Key elements include links to public transport, secure bike parking, accessible pedestrian paths with rest areas, and clear wayfinding signage.

3.3 Disaster Planning and Major Incident Management

Environmental factors may influence demand for services. For example, where services are affected within a community, following a natural disaster, those on home dialysis may not have access to power and/or water and will need to visit their nearest Renal Dialysis Unit to continue treatment.

A failure in the RO plant may require the temporary use of portable RO units while the equipment is replaced. However, the unit's operational policies and strategies for dealing with disaster such as central RO plant malfunction must be well defined as portable RO units can only support a limited number of dialysis machines at any one time.

The design of the unit needs to ensure there are strategies available to manage urgent evacuation requirements.

The unit should consider incorporating an onsite backup potable water supply to maintain essential dialysis services in the event that the primary water supply is compromised. This may occur during natural disasters (e.g., floods), infrastructure failures, or other emergencies.

These and other matters should be considered as part of a business continuity plan.

3.4 Infection Prevention and Control

IPC involve identification of transmissible agents and intervention to minimise the spread of these infections. The design of all aspects of the unit should take into account the need to ensure a high level of IPC in all aspects of practice.

Key factors that should be taken into consideration are:

- the provision of pods that can be isolated from others to prevent contamination between patients
- the design should support high levels of hand washing by staff and other persons by the convenient and adequate placement of suitable hand wash basins at a rate of one per four treatment bays as well as in all separate treatment areas, utility areas, toilets and showers

- alcohol based hand-rub dispensers (ABHR) and personal protective equipment (PPE) should be at the entrance of each single bedroom and within each treatment bay or bedroom for easy access by staff. This is particularly important given staff are regularly managing vascular access for dialysis and wound dressings.
- class S isolation rooms should be provided in all units with total numbers dependent on local IPC requirements

  The requirement for ensuite bathrooms in the class S isolation rooms is optional based on local operational and IPC advice given they are rarely used by patients on HD and can be an IPC risk if only used sparingly. In-centre units will typically require a higher number of isolation rooms. Given the frequency of multi-resistant organisms in dialysis patients and when in satellite units, patients may be cohorted in isolatable pods. Isolating patients within pods rather than single rooms enables them to maintain social interaction while within the unit.
- minimal storage of consumables close to patients
- considering transparency boards providing information on health setup, IPC audits, and cleanliness to promote openness, harm-free care and assisting with patient compliance.

Further reference should be made to:

- jurisdictional policies and guidelines
- AusHFG Part D - Infection Prevention and Control
- AusHFG Pandemic Preparedness – Health Infrastructure Planning & Design Guidance
- Australian Guidelines for Prevention and Control of Infection in Healthcare (Australian Commission on Safety and Quality in Healthcare)
- National Safety and Quality Health Service Standards (second edition)

3.5 Environmental Considerations

3.5.1 Acoustics

Many functions undertaken in the unit require consideration of acoustic privacy and comfort including:

- meetings and interviews with patients and families
- use of patient entertainment systems within open bay areas
- noisy areas such as waiting rooms
- staff discussions regarding confidential matters.

Solutions to be considered include:

- selection of sound absorbing materials and finishes
- planning separation of quiet areas from noisy areas, e.g. separation of waiting areas from treatment areas
- use of patient earphones to contain noise from entertainment systems
- provision of appropriate spaces for private staff discussions.

When determining the placement of RO plants, noise levels must be considered. The location should be sufficiently distant to prevent noise disturbances in treatment areas.

Refer to the relevant AusHFG Standard Components for design requirements.

3.5.2 Natural Light and Views

The use of natural light should be maximised throughout the unit.

Natural light and a view to pleasant and interesting outdoor areas are of particular importance for people who spend long periods of time sitting in dialysis chairs. Every effort should be made to provide a view to all

treatment areas either by locating treatment bays adjacent to a window or enabling unobstructed sight lines through areas to an outdoor view.

Ensure effective control of sun and heat exposure, particularly for dialysis bays positioned near windows in warmer regions. Implement shading, insulation, or climate control measures to maintain a comfortable environment for patients.

3.5.3 Privacy

As many units operate an evening shift, lighting systems and window coverings should provide a level of privacy for patients.

Consider window location and treatments to maintain facility security and patient privacy from passers-by when on ground level or visibility from people on upper floors of adjacent buildings.

Many consumers of renal dialysis service report that social interaction is important, both with nursing staff and other patients. The design should seek to balance privacy, confidentiality and promotion of patient-to-patient interaction so that wellbeing is optimised.

3.5.4 Culturally Sensitive Design

Local cultural groups should be invited to input to the design of the unit to ensure the delivery of culturally appropriate facilities. All spaces should be designed to be welcoming, respectful, and culturally safe for Aboriginal, Torres Strait Islander or Māori patients, families, and visitors.

Co-design culturally embedded artforms such as visual storytelling and shared creative practices with Aboriginal and Torres Strait Islander peoples, Māori, and the wider diverse communities. Include participatory displays and ongoing commissioning to reflect local identity, especially at entrances where first and last impressions are formed.

This may include the following considerations:

- incorporating Aboriginal, Torres Strait Islander or Māori artwork to reflect cultural identity and connection to Country
- displaying culturally significant signs and symbols, such as an Acknowledgement of Country and a Statement of Commitment
- providing outdoor areas that support cultural practices, such as yarning circles or spaces for family gatherings
- separation of male and female areas including access to toilets, e.g. through the use of pods
- separation of age groups where relevant
- display of culturally relevant art and the use of culturally sensitive colour schemes
- specific unit layout to support cultural requirement of the cohorts such as location of food preparation areas, toilets and exits, and considerations for care of the deceased.

For projects in Australia, consult with national Aboriginal and Torres Strait Islands peak bodies i.e., National Aboriginal Community Controlled Health Organisation (NACCHO), state and local affiliates, and organisations that support culturally safe renal care, such as Kidney Health Australia.

For Aotearoa New Zealand health facility projects, consultation with local iwi is also important to ensure units are designed to be welcoming and adhere to local kawa and tikanga. Specific guidance to supplement the AusHFG for Aotearoa New Zealand health facility projects can be found in Te Whatu Ora – Health New Zealand, 2022, New Zealand Health Facility Design Guidance Note.

3.5.5 Interior Considerations

This includes style of design, furnishings, colour, textures, ambience, perceptions and identity. The décor of the unit should be welcoming, reduce an institutional atmosphere where possible and create a positive impression. This is challenging with the high degree of equipment, services and IPC conditions that are required to deliver the service.

Suggestions to achieve this balance include:

- avoiding some colours and busy, high contrast patterns can be disturbing to some patients. The colour scheme should be attractive, calming, non-institutional and assist with wayfinding.
- colour selection which does not negatively impact on clinical observation in consultation and treatment areas
- considering block colours providing contrast between vertical and horizontal surfaces to aid with accessibility
- biophilic design and calming visual elements such as natural scenes or view to outside may also be incorporated into the design of the facility.
- use of design features such as culturally appropriate colours and artworks to distract the sight from clinical areas
- engagement with local cultural representatives to incorporate cultural considerations into the planning and design of the unit inclusion of soft furnishings that act as a design feature such as screening, lounges in waiting areas and window treatments that can withstand required cleaning/disinfection regimes which may include multiple cleaning between patients in one day
- inclusion of corridors at the minimum recommended widths to meet the service need.

3.5.6 Arts Integration

Art strategies are therapeutic and operational, rather than decorative, supporting identity, orientation, and emotional regulation. As patients have longstanding relationships with the dialysis unit, an art strategy should be used across the unit to reduce stress and improved perceived control and belonging.

Provide visual art and nature imagery in waiting areas and treatment bays; include rotating community exhibitions and integrate Wi-Fi-enabled creative engagement options.

Any artwork commissioned should align with the AusHFG, Arts in Health Framework, 2022 and jurisdictional arts-led initiatives for healthcare facilities.

3.6 Safety And Security

3.6.1 Safety

The acuity of patients presenting to the unit will vary depending on whether the service is in-centre or a satellite. Issues that may need to be considered include:

- appropriate and effective staffing i.e., nurse-to-patient ratio
- systems of work should be designed to ensure that staff are located close to patients and observation is facilitated
- fail-safe connection systems where machines are attached to RO water outlets. This will prevent attachment to standard water outlets.
- specialised equipment, e.g. chairs, lifters etc., to manage weak and/or bariatric patients. Consider a risk assessment in the provision of these larger chairs/recliners for use with smaller patients as they may pose safety issues for their mobility or staff access during emergency.
- pallet lifters will be used to deliver supplies to the bulk store. Receipt and movement of these pallets will affect receiving points, circulation routes and door clearances.
- consumable storage should be arranged to ensure that regular access items are easily accessible. Some of the equipment is heavy and slide-out shelving units may be required.
- large pieces of equipment, e.g. HD machines
- furniture, e.g. patient chairs, must be selected for their ease of movement by staff as well as appropriate design features
- consideration for WHS relating to lifting heavy items such as large dialysis fluid bags and water softeners and salts.

3.6.2 Security

Depending on the location and hours of operation, renal dialysis services may need to consider a range of security issues including:

- the use of access control systems to all entries and staff-only areas
- provide video-intercom systems to ensure those visiting the service out-of-hours can be identified before access to the facility is provided
- minimisation of entry and exit doors. Where possible, locate receptions and staff bases to ensure that entry and exit points can be observed.
- providing staff with duress points at receptions and staff stations, if required
- locate the reception area to enable safe egress into the main unit if they feel threatened
- consideration of spaces for patients and security staff from the correctional systems, if included in the service provision.
- providing lockers for staff to secure personal belongings
- consideration of closed-circuit television (CCTV) to provide an adequate view of external areas
- adequate lighting to ensure that staff and patients can exit the facility at night safely
- consideration of location of RO plant rooms for staff to troubleshoot
- nearby parking for stand-alone facilities operating at night.

Refer to AusHFG Part C Design for Access, Mobility, Safety and Security, for further information.

3.7 Finishes

Refer to the AusHFG Part C and Standard Components for dialysis treatment areas for detailed information relating to recommended finishes.

Major pieces of equipment and consumables are moved throughout a Renal Dialysis Unit. The use of wall, door and corner protection will be extensive inpatient care and clinical support areas. Wall finishes in treatment areas should be impervious and easy to clean.

Floor finishes should suit the function of the space. In all clinical areas, long-run vinyl, slip resistant flooring with coved skirtings will be used. Slip resistant flooring is required due to the potential risks associated with water spills.

The type of flooring used in the dialysis bays have to withstand many years of exposure to acids and alkaline solutions used in dialysis.

Flooring in areas where pallets are delivered should be sturdy/heavy duty to resist damage.

Ceiling finishes should be selected with regard to appearance, cleaning, acoustics and access to building services. In most cases, acoustic ceiling tiles appropriate for clinical settings will be used.

Finishes and any adhesives, applied finishes, sealants, etc. should have low volatile organic compound (VOC) content.

3.8 Fixtures, Fittings and Equipment

Room Data and Room Layout Sheets in the AusHFGs define fixtures, fittings and equipment (FF&E). The FF&E specified for each clinical space should consider:

- generic approaches where possible to increase utilisation and flexibility
- specialist requirements that will influence fixed equipment and minimum dimensions of particular rooms.

Dialysis chairs that convert to beds are now available and recommended if nocturnal dialysis is provided.

Refer to the Room Data Sheets (RDS) and Room Layout Sheets (RLS) as well as Part C: Design for Access, Mobility, Safety and Security.

3.8.1 Dialysate Concentrate Disposal

FF&E selection should consider the impacts of the disposal of dialysate concentrate.

Refer to Section 2.2.13 Waste Management for further details.

3.9 Building Service Requirements

3.9.1 Air Handling Systems

Air-conditioning is required in all areas during standard operating hours. This includes the water treatment plant room due to large amount of heat generated by the equipment.

To ensure the reliable operation of water treatment equipment, the ambient temperature within the room must be maintained between 5°C and 30°C, with relative humidity below 95%, non-condensing. Temperatures above 30°C can reduce membrane efficiency and promote bacterial growth, risking water quality and patient safety.

Most RO units incorporate a feed water tank with integrated heating elements designed to elevate and maintain the incoming water temperature at approximately 15°C. This temperature control is critical for sustaining the design permeate flow rate, particularly during peak winter months when incoming town water temperatures may fall below 10°C. This feature should be considered essential for installations in colder regions such as ACT, Tasmania, and rural areas of Victoria and New South Wales etc., where low water temperatures can significantly impact RO system performance. In hotter regions, the challenge is reversed therefore, chiller systems should be considered to maintain dialysis water within the acceptable temperature range. This is essential to ensure patient safety and comfort during treatment.

RO plant room HVAC should be connected to Building Management System with alarmed temperature monitoring and redundant capacity.

Also refer to relevant jurisdictional guidelines regarding building and engineering services for health facilities.

3.9.2 Information Technology and Communications

The following communications systems will be included in the Renal Dialysis Unit:

- telephone - fixed and cordless for use by persons on dialysis
- computers to access EMR systems and other related information

  Solutions may vary and include both fixed and mobile computers. New dialysis machines may be networked usually with a data point connection or clinical Wi-Fi connection and linked to the EMR to record and range of patient data, e.g. fluid balance, weight, vitals. A network connection lets technicians check the machine remotely. They can troubleshoot issues, monitor maintenance needs, and adjust the clock for daylight saving time changes.
- wireless internet access to support equipment, e.g. WOW, and patients who choose to bring their own devices
- central monitor/screen at the Staff Station as part of the patient monitoring system
- systems for hospital-based units if part of the campus-wide communications system such as paging and intranet
- teleconferencing and/or videoconferencing capability if there is an identified need as part of the jurisdictional strategy or network
- some other telehealth modalities may also be required especially in remote and rural sites.

  Remote monitoring, clinical care cameras, and telehealth can enable the supervising tertiary hospital or on-call physician to assess patient status and provide troubleshooting support from a distance. This helps reduce clinic visits, patient travel and facilitate timely care both on-site and throughout the patient's episode of care.
- patient/nurse call system
- patient entertainment system, which may include features such as internet etc., depending on jurisdictional approaches

The ability to connect the patient entertainment system to ear/headphones will assist with keeping the noise level down in the unit.

- emergency and duress systems capability in accordance with jurisdictional policies.

3.9.3 Electrical Services and Lighting

Emergency power will need to be considered in patient areas and RO plant. Consider uninterrupted power supply (UPS) backup for dialysis machine supply circuits and control systems for the RO plant and confirm segregation per AS/NZS3003:2018 *Electrical installations - Patient areas*.

As the use of WOWs and other mobile devices continues to grow, it is essential to create designated battery recharging areas. These spaces help ensure that recharging does not encroach on desk space in critical zones like staff stations. Additionally, careful planning should account for electrical requirements, temperature control, and proper ventilation to maintain safety and efficiency.

An examination light is provided at each treatment bay for clinical activities such as cannulation.

Lighting systems should facilitate patient care, but patients may also need to adjust light for selected activities such as reading or computer work and can assist in supporting patients with cognitive impairment and neurodiversity.

Refer to the Room Data Sheets for the detailed electrical and lighting requirements of each specific space.

3.9.4 Water Treatment Services

Dialysis water systems must be carefully designed to protect patient safety by ensuring consistently high water quality. Pre-treatment stages involve temperature control, particulate filtration, softening, chlorine removal, ultraviolet (UV) disinfection, and fine filtration to protect RO membranes. RO units must be certified medical devices capable of heat sanitisation and redundancy where required. Correct flow, pressure, and system sizing are essential to avoid fouling and ensure effective performance and compliance with ISO 23500 standards.

To prevent biofilm formation and ensure compliance with ISO 23500, dialysis water systems must avoid RO water storage and instead deliver treated water directly to each machine. Heat sanitisation must maintain loop return temperatures between 80°C and 90°C, achieving an A_0 value of 12,000. Distribution systems must be built with high-grade materials, insulated for thermal efficiency, and incorporate certified aseptic connectors. Plant room and treatment bay design must support safe equipment handling, operational access, and hygiene. Water quality monitoring must follow national and ISO standards to maintain patient safety and system performance.

Refer to Appendix 7.3 Water Treatment Services for more a detailed discussion.

3.9.5 Drainage System

Drainage systems shall be implemented to capture all cold water from the pre-treatment filters and RO plant. Consideration to high temperature wastewater (post heat sanitisation cycles) shall also be given to ensure appropriate treatment in the form of material selection (stainless steel piping is preferred), provision of cooling pits and/or cold-water injection.

Drainage systems that are serving the patient bays shall consider the heat sanitisation discharge (1-2L) of the dialysis machines. Larger traps may be utilised to permit suitable mixing with cold water at each drainage point.

Drainage systems should be constructed of a chemically resistant material such as high-density polyethylene. Stainless steel pipework and flushing rim sinks (where dialysate collected in bags are commonly dispersed into) can be coated in polyvinylidene fluoride (PVDF) or polypropylene (PP) for added protection against corrosion.

To maintain hygiene and minimise maintenance, the waste outlet from each tundish must be designed to discharge directly into the drainage pipe, minimising contact with the panel surface. This configuration reduces the risk of scale accumulation, bacterial growth, and discolouration over time, noting reject water has been observed to crystallise, leading to the accumulation of glucose and human waste fats within the tundish

panel enclosure. This buildup can result in blockages. To mitigate this risk, routine cleaning and maintenance of the tundish and associated drainage components is essential. Regular flushing with hot water is particularly important to effectively dissolve and remove fat deposits that contribute to these obstructions.

Services that facilitate the drainage of waste fluids from the HD machines must be ventilated to prevent condensation and the subsequent growth of mould. This fact should be kept in mind when designing covers or screens for the drainage systems. Commercial models which comply with the relevant Australian Standards are available.

All treatment and maintenance areas should have sufficient floor waste drainage as disconnected systems can generate huge volumes of water in a short period of time.

3.9.6 Medical Gases

Patient treatment spaces and treatment rooms require access to oxygen and suction. Refer to the RDS and RLS for renal dialysis treatment bays/rooms for the detailed requirements.

4 Components of the Unit

4.1 Standard Components

Standard Components must comply with details in Standard Components described in these Guidelines; refer also to Standard Components Room Data Sheets and Room Layout Sheets.

Standard Components used in the Renal Dialysis Unit are identified in the Schedule of Accommodation. Rooms and spaces are defined as:

- standard components (SC) which refer to rooms and spaces for which room data sheets, room layout sheets (drawings) and textual description have been developed
- standard components – derived rooms (SC-D) are rooms, based on a SC but they vary in size. In these instances, the standard component will form the broad room 'brief' and room size, and contents will be scaled to meet the service requirement
- non-standard components which are unique rooms that are usually service-specific and not common.

The standard component types are listed in the attached Schedule of Accommodation. The current Standard Components can be found at: https://healthfacilityguidelines.com.au/standard-components.

4.2 Non-Standard Components

There are no Non-Standard Components for this HPU.

5 Schedule of Accommodation

The following schedules of accommodation provide indicative area allocations for Satellite and In-Centre Dialysis Units. The scenarios provided reflect a range of unit sizes and are based on common staffing profiles for the different types of units. However, the overall unit capacity will be determined through clinical services planning and will reflect the required staffing ratios, acknowledging that this may change over time depending on the patient profile.

Larger sized units will need to be scaled up in accordance with the guidance provided below relating to support areas.

The service model and patient profile will impact on the required spatial allocations, including consideration of the need for training facilities. The number of treatment spaces and the provision of training areas will be informed by detailed clinical services planning.

The 'Room Name' column describes each room or space within the unit. Some rooms are identified as 'Standard Components' (SC) or a corresponding room which can be derived from a SC. These rooms are known as 'Standard Components - Derived' (SC-D).

5.1 Entry, Reception and Waiting Areas

Room Code	Room Name	SC / SC-D	Satellite Unit				In-Centre Unit				Comments
			10 Chairs		20 Chairs		6 Chairs		12 Chairs		
			Qty	m^2	Qty	m^2	Qty	m^2	Qty	m^2	
WAIT-10 WAIT-20 WAIT-30	Waiting	SC/ SC-D	1	20	1	40	1	10	1	20	Area recommendation is indicative and will depend on the no. of people to be accommodated, opportunities to stagger appointment times and options for alternative approaches to waiting e.g. central hospital facilities/cafe. A high proportion of patients will have mobility aids and carers for support. 1.2m^2 recommended per seat, 1.5m^2 per wheelchair space. Smaller allocation for in-centre units given smaller number of outpatients. Refer to optional reception area below.
MEET-15 MEET-20 MEET-30	Meeting Room	SC/ SC-D	1	18	1	30	1	12	1	20	For family meetings, staff meetings, multidisciplinary meetings, community training and other functions. Videoconferencing required.
BMEQ	Bay - Mobile Equipment	SC/ SC-D	1	3	1	4	1	2	1	3	For storage of mobility aids and wheelchairs.
WCPU	Toilet - Public	SC	2	3	3	3	1	3	2	3	Directly access from the waiting room. Door location should not permit a view into the toilet.
Discounted Circulation			**25%**		**25%**		**25%**		**25%**		

5.2 Treatment Areas

Room Code	Room Name	SC / SC-D	Satellite Unit				In-Centre Unit				Comments
			10 Chairs		20 Chairs		6 Chairs		12 Chairs		
			Qty	m^2	Qty	m^2	Qty	m^2	Qty	m^2	
BHW	Bay - Weight	SC	1	2	1	2	1	2	1	2	Ensure design supports access for mobility aids e.g. scooters. Includes wheelchair scales. Consider stretcher access.
SSTN-10 SSTN-14	Staff Station	SC	1	10	2	10	1	10	1	14	Area to be adjusted depending on staff profile. Higher ratio of staff to patients on in-centre units. Space may need to be subdivided in larger units. Include electronic journey board (not visible to public).
BPTS	Bay - Pneumatic Tube Station	SC	1	1	1	1	1	1	1	1	
PTB-REN	Patient Bay - Renal Dialysis	SC	9	9	18	9	5	9	10	9	Mix of recliners vs bed bays within these units to be determined based on the patient profile. Bays may be arranged in pods for appropriate cohorting of patients. Refer to optional acute bed bay for in-centre units and high assistance bay below.
PTB-REN	Patient Bay - Renal Dialysis, Enclosed	SC-D	1	12	2	12	1	12	2	12	Enclosed room with handwash basin. Number of isolation rooms to be determined based on local infection control requirements. Refer to optional ensuite below.
BHWS-B	Bay - Handwashing, Type B	SC	3	1	5	1	2	1	3	1	One handwashing basin per four open bays or part thereof.
	Bay - PPE		1	0.5	1	0.5	1	0.5	1	0.5	A Personal Protective Equipment Bay (one shared between two rooms) outside the isolation room. PPE will also be provided within treatment bays.
WCAC	Toilet - Accessible	SC			1	6			1	6	For use by patients in open treatment bays.
ENS-ACC	Ensuite - Accessible	SC	1	7	1	7	1	7	1	7	For use by patients in open treatment bays. Shower required for ad hoc instances.
Discounted Circulation			**38%**		**38%**		**38%**		**38%**		

5.3 Support Areas

Room Code	Room Name	SC / SC-D	Satellite Unit				In-Centre Unit				Comments
			10 Chairs		20 Chairs		6 Chairs		12 Chairs		
			Qty	m^2	Qty	m^2	Qty	m^2	Qty	m^2	
CLN-10	Clean Store	SC-D	1	6	1	6	1	6	1	6	May be provided as a combined Clean Store / Medication Room depending on local jurisdictional policies.
MED-14	Medication Room	SC-D	1	8	1	8	1	8	1	8	May be provided as a combined Clean Store / Medication Room depending on local jurisdictional policies. Larger allocation per bay for in-centre units required due to higher volume of medications.
BLIN	Bay - Linen	SC	1	2	2	2	1	2	1	2	Cupboard or trolley bay to hold clean laundry.
BRES	Bay - Resuscitation Trolley	SC	1	1.5	1	1.5	1	1.5	1	1.5	Adjacent to staff station.
BMEQ	Bay - Mobile Equipment	SC/ SC-D	2	2	2	4	2	2	2	4	Consumable trolleys, IVs, BP machines, ultrasound, WOWs when not in use. Additional area per chair required on in-centre units.
BBEV	Bay - Beverage	SC/ SC-D	1	4	1	6	1	4	1	5	To receive and issue light meals and beverages for patients.
DTUR-S DTUR-10	Dirty Utility	SC	1	8	1	10	1	8	1	10	Appropriate disposal unit required for corrosive dialysate concentrate. Refer to HPU Section 2.2.13.
STBK	Store - Bulk	SC-D	1	18	1	34	1	14	1	22	For dialysis fluid storage. Must be placed on the perimeter of the Unit and be accessible by a pallet lifter. Shelving must have 100kg weight capacity and shelves need to be at least 400mm apart or adjustable.
PLNT-WT	Plant - Water Treatment	SC/ SC-D	1	18	1	22	1	18	1	18	Close to treatment areas to reduce piping runs. 18m^2 will support a unit of up to 12 chairs. 22m^2 will support a unit up to 24 chairs. Final arrangement will depend on type/manufacturer of RO equipment procured.
BIOMED-REN	Biomedical Workroom - Renal Dialysis	SC-D	1	12	1	20	1	8	1	15	For the servicing of dialysis machines. All machines require connection to power and plumbing. Where additional processing stations are required to meet services requirements, an additional 1.5m^2 per station is required.
STEQ-14	Store - Equipment	SC-D	1	8	1	13	1	5	1	10	This is usually combined with the Technician Room above. For storage of spare machines, portable RO units and other equipment. Area requirement will depend on need to store home dialysis equipment. All machines require connection to power and plumbing. Training machines may be stored with training areas if dedicated service provided.

Room Code	Room Name	SC / SC-D	Satellite Unit 10 Chairs Qty	Satellite Unit 10 Chairs m^2	Satellite Unit 20 Chairs Qty	Satellite Unit 20 Chairs m^2	In-Centre Unit 6 Chairs Qty	In-Centre Unit 6 Chairs m^2	In-Centre Unit 12 Chairs Qty	In-Centre Unit 12 Chairs m^2	Comments
	Disposal Bay / Room		1	3	1	5	1	3	1	5	Bay or room for waste. Size requirements for a Disposal Bay / Room will be dependent on a department's estimated waste output, the frequency of waste collection and local operational policies for waste management that may dictate the number of waste streams and minimum bin sizes.
CLRM	Cleaner's Room	SC	1	5	1	5	1	5	1	5	
	Discounted Circulation		**25%**		**25%**		**25%**		**25%**		

For dialysis units that routinely use ultrasound to guide vascular access needle placement which comes in contact with non-intact skin - and do not send probes to a central SSU - an on-site reprocessing area maybe required. Refer to section 2.2.10 Point of Use Reprocessing of Ultrasound Transducers and 5.5 Optional Areas for further details.

5.4 Staff Areas

Staff work areas and amenities will be allocated in line with local jurisdictional policies.

Room Code	Room Name	SC / SC-D	Satellite Unit 10 Chairs Qty	Satellite Unit 10 Chairs m^2	Satellite Unit 20 Chairs Qty	Satellite Unit 20 Chairs m^2	In-Centre Unit 6 Chairs Qty	In-Centre Unit 6 Chairs m^2	In-Centre Unit 12 Chairs Qty	In-Centre Unit 12 Chairs m^2	Comments
OFF-1P-9	Office - Single Person	SC		9		9		9		9	Number and area allocation will depend on staff profile and local jurisdictional policies.
OFF-WS	Office – Workstation	SC		4.5		4.5		4.5		4.5	Number and area allocation will depend on staff profile and local jurisdictional policies.
SRM-15	Staff Room	SC/ SC-D	1	10	1	14	1	10	1	14	Discreet section of the unit. Size will be dependent on staff profile. Larger staff ratio per chair for in-centre services. Direct access required as staff are unable to leave the unit.
WCST	Toilet - Staff	SC	1	3	2	3	1	3	2	3	Discreet location. Access to a shower may also be required. Access to accessible toilet also required.
BPROP	Bay - Property, Staff	SC/ SC-D	1	0.5	1	1	1	0.5	1	1	Discreet and secure location. Adjacent to Staff Room.
	Discounted Circulation		**25%**		**25%**		**25%**		**25%**		

5.5 Optional Areas

The inclusion of the optional areas below is dependent on the service scope and local clinical and/or operational requirements. The requirement for each area should be confirmed on a project-by-project basis and included where it is essential to meet the service need.

Where there is a developed program of training for home-based dialysis as approved in the Service Plan, a dedicated space is to be provided. For some services, a multi-function space may be appropriate that can be used for some training and/or selected procedural work such as the insertion of catheters etc.

The optional 12m^2 renal dialysis treatment bay may be provided for a proportion of bays within in-centre units to accommodate the additional equipment required to manage high acuity patients. The proportion of beds provided at this larger size will depend on the patient profile and the relative mix of inpatients and outpatients attending the unit.

Room Code	Room Name	SC / SC-D	Satellite Unit				In-Centre Unit				Comments
			10 Chairs		20 Chairs		6 Chairs		12 Chairs		
			Qty	m^2	Qty	m^2	Qty	m^2	Qty	m^2	
ENTRY, RECEPTION AND WAITING AREAS											
RECP-10	Reception	SC/ SC-D	1	8	1	10	1	6	1	8	**Optional for all scenarios.** Inclusion will be dependent on size of unit and resourcing. Design to ensure staff safety.
BMFD-3	Bay - Multifunction Device	SC	1	3	1	3	1	3	1	3	**Optional for all scenarios**. Adjacent to the reception/clerical area to hold printers, stationery etc.
ENTRY, RECEPTION AND WAITING AREAS											
CONS	Consult Room	SC	1	12	1	12	1	12	1	12	**Optional for all scenarios**. May be provided through collocated outpatient clinics.
INTV	Interview Room	SC	1	12	1	12	1	12	1	12	**Optional for all scenarios** depending on service need and potential to share with adjacent services.
TRMT	Treatment / Training Room	SC/ SC-D	1	14	1	14	1	14	1	14	**Optional for all scenarios** dependent on access to adjacent treatment/ procedure room in outpatient or inpatient services and provision of training. Where there is a developed program of training as approved in the Clinical Services Plan dedicated training space/s will be required (use PTB-REN as a starting point for dialysis wall connection).
OFF-WS	Office – Workstation	SC		4.5		4.5		4.5		4.5	**Optional for all scenarios**. Requirement will depend on staffing profile and provision of training services. Refer to local jurisdictional policies regarding staff work area allocations. Staff offices/ workstations also included under staff areas below.
WCAC	Toilet - Accessible	SC	1	6	2	6	1	6	1	6	**Optional for all scenarios.** May be located with adjacent service. Direct access from the waiting room. Door location should not permit a view into the toilet.
TREATMENT AREAS											
PTB-REN	Patient Bay - Renal Dialysis, Acute Bed Bay	SC-D					1	12	1	12	**Optional for 6 and 12-bed in-centre unit scenarios.** Larger sized bay for high acuity patients within in-centre units. Mix of recliners vs bed bays within these units to be determined based on the patient profile.
PTB-REN-HA	Patient Bay - Renal Dialysis, High Assistance	SC-D		10		10		10		10	Optional for all scenarios. This room allows for use of ceiling mounted or mobile lifter. Number of rooms to be determined based on the patient profile and model of care on project level.

Room Code	Room Name	SC / SC-D	Satellite Unit				In-Centre Unit				Comments
			10 Chairs		20 Chairs		6 Chairs		12 Chairs		
			Qty	m^2	Qty	m^2	Qty	m^2	Qty	m^2	
ENS-IN-OU ENS-NE	Ensuite	SC	1	5	2	5	1	5	2	5	**Optional for all scenarios.** Associated with isolation rooms, however these are rarely used for patients on haemodialysis and can be an infection control risk if used sparingly. Requirements will depend on local operational and infection control advice.
SUPPORT AREAS											
	Bay - Storage		1	1	1	2	1	1	1	1	**Optional for all scenarios**, only required if significant travel distance to bulk store.
	Reprocessing Room - High Level Disinfection		1	9	1	9	1	9	1	9	**Optional for all scenarios.** For reprocessing of ultrasound transducers. Ensure dirty to clean flow. Refer to HPU Section 2.2.10.

6 References and Further Reading

6.1 References

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6.2 Further Reading

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7 Appendices

7.1 Water for Haemodialysis

It is essential that treated water of appropriate quality is utilised where HD procedures exist within healthcare facilities. This means that consideration for the removal of key contaminants (among others) such as aluminium, chloramine, fluoride, copper, zinc, bacteria and endotoxins from the supplied water will be required by the designer. The International Organisation for Standardisation (ISO) provide minimum requirements for water quality used in the preparation of dialysis solutions. ISO 23500 Parts 1, 2 and 3 and ISO 10993 shall be referenced and applied in the system design.

ISO 10993 (Biological Evaluation of Medical Devices) provides guidance on conducting various biocompatibility tests, including cytotoxicity, sensitisation, irritation, and genotoxicity, to assess the potential for adverse effects from medical devices.

Treating water so that it is suitable for dialysis involves multiple stages of purification. The three main steps in the water treatment process include:

1) Pre-treatment - This typically includes sediment filters, water softeners, carbon filters, and UV irradiation to remove larger particles, chlorine and chlorinated byproducts, and organic matter.

2) Primary purification - Achieved through via reverse RO membranes, which remove dissolved salts, metals, microorganisms and other impurities.

3) Distribution - The purified water is circulated via a reticulation loop to individual connection points for dialysis machines, maintaining water quality and minimising stagnation.

Pre-treatment filters will generally need to be located within a plant room due to their size and service requirements. Subject to the system design, these are commonly co-located with a centralised RO treatment unit. In lieu of a centralised RO unit, individual portable RO devices can be used to supply dialysis machines in smaller dialysis units. In such cases, a risk and cost benefit analysis should be conducted to determine the most appropriate water treatment approach. The risk analysis should assess the quality of the incoming water supply, including both chemical and microbiological parameters. The cost benefit analysis must account for the expected frequency of RO membrane and filter replacement, including endotoxin retentive filters integrated into each dialysis machine, as well as the maintenance costs associated with individual portable RO devices.

At most hospitals, each portable RO unit must be paired with a dedicated pre-treatment trolley comprising of sediment filter cartridges and two granular activated carbon (GAC) tanks, each providing a minimum Empty Bed Contact Time (EBCT) of five minutes. The frequency of filter and component replacement should also factor in the associated environmental impact, particularly in relation to the healthcare facility's broader sustainability objectives.

The NSW Agency for Clinical Innovation (2018) recommends that a central RO water plant is utilised for dialysis units with six chairs or more to reduce costs associated with maintenance and repair of individual portable RO devices.

The arrangement of the system is subject to the clinical layout and functional brief requirements and therefore the required components will be determined through a consultation process with the users and RO water for dialysis experts during design. The water treatment plant room shall ideally be located as part of the Renal Dialysis Unit to keep pipework reticulation short for microbial control reasons and to make it easy for staff to monitor and service the water treatment systems.

It shall be noted that the RO water distribution system as well as the RO membranes should be designed to heat sanitise for microbial control purposes. The RO membranes should be restricted to maximum twice per week with the distribution system heat sanitised at least once per day. During this period, patients cannot be connected to systems due to the risk of loss of life. Therefore, in ICU settings where unplanned dialysis may be required and water is supplied via a centralised RO plant, the system must be designed with built-in redundancy and functionality that allows the Nurse Unit Manager (NUM) to interrupt the heat sanitisation cycle from the nurse's station. Additional design considerations should include configuring the RO unit in

accordance with the A_0 principle, ensuring that each heat sanitisation cycle, including the cooling phase, is completed within three hours. This approach not only enhances clinical responsiveness but also supports energy efficiency, aligning with broader sustainability targets.

The A_0 principle, defined in ISO 15883 *Washer-disinfectors*, is a standardised method for quantifying the cumulative microbicidal effect of a moist heat disinfection process. It expresses the equivalent time in seconds that a process would require at a reference temperature (typically 80°C) with a specified z value (commonly 10°C) to achieve the same level of microbial inactivation. The principle recognises that different combinations of temperature and exposure time can produce the same disinfection effect. For example, an A_0 of 600 can be achieved by holding at 90°C for 60 seconds (1 minute) or at 80°C for 600 seconds (10 minutes). The z value represents the temperature change needed to cause a tenfold (one log) change in the microbial inactivation rate.

There is strict safety standards for equipment used to purify water for dialysis, including the regular monitoring of both water and dialysis solution for chemical or microbiologic contaminants. For example, total and combined chlorine (e.g. chloramines, THMs) levels, should be checked at least twice daily. Dialysis patients must also be closely monitored for signs of haemolytic, pyrogenic, or other adverse reactions that may indicate contamination. The water used for the preparation of HD fluids need treatment to achieve the appropriate quality. This is provided by a water pre-treatment system, which includes various components including RO units. RO is the process of forcing water from one side of a semi-permeable membrane to the other, producing purified water by leaving behind the dissolved solids and organic particles.

RO systems may be accommodated within a plant room for water treatment or provided through individual portable RO devices attached to each dialysis machine. Many dialysis units will require a water treatment plant room, as well as several individual portable RO devices for mobile dialysis machines used in other clinical units, e.g. in ICU and CCU. The use of portable RO devices on other clinical units is generally recommended, given the high cost to install and maintain a separate RO plant, however this will depend on the projected utilisation of dialysis services, as well as proximity to and size of the central RO plant.

For smaller dialysis units, a cost benefit analysis should be undertaken to inform the optimal approach to water treatment. The NSW Agency for Clinical Innovation (2018) recommends that a central RO water plant is utilised for dialysis units with six chairs or more to reduce costs associated with maintenance and repair of individual RO devices.

The required system components will be determined through consultation with RO for dialysis experts during the design process.

The water treatment plant room is ideally located as part of the Renal Dialysis Unit to keep tubing runs short for IPC reasons and to make it easy for staff to monitor and service the water treatment systems.

While town water is the preferred option for dialysis, some remote facilities depend on bore water to meet the necessary supply. In such cases, careful planning must account for additional components to address the mineral and salt content, ensuring the functionality of RO membranes and the effectiveness of pre-treatment systems.

7.2 Wastewater

Advanced RO units designed with sustainability in mind can significantly reduce both water and energy consumption. Key design considerations include the application of the A_0 principle to minimise temperature hold times and reduce power consumption, along with the use of VSD pumps and rapid in-line heating in place of conventional storage tank heating.

RO systems should be designed to achieve at least 75% water recovery, ensuring that no more than 25% of the feed water is wasted. Oversizing the RO unit can inadvertently increase water wastage, particularly during standby periods. During treatment, each dialysis machine typically consumes between 500 and 800 mL/min, so the RO unit should be sized to deliver this flow rate per dialysis point. During heat sanitisation, water demand may temporarily increase to up to 1.5 L/min per machine; however, this is generally manageable due to the staggered operation of dialysis machines across the unit. This tailored sizing approach reduces the overall footprint of the RO unit while optimising both water and energy efficiency.

Where an RO unit operates at less than 70% recovery, the capture and reuse of RO reject water should be considered as a sustainability measure. However, since reject water is typically high in salts and may contain

microbial contaminants, it requires additional treatment to ensure it is suitable for its intended reuse application.

For example, if reused for toilet flushing or other applications with a potential for aerosol generation, appropriate disinfection protocols must be applied to mitigate occupational health, safety and environment (OHSE) risks. Disinfectant concentration and contact time should be validated based on the target microbial load and intended exposure scenarios.

If reused for irrigation, the dissolved mineral content must be assessed to ensure it is suitable for the specific plant genus, and only below-ground irrigation systems should be used to minimise human and environmental exposure.

It is essential that the planning and design process considers the implementation of operational practices that reduce the environmental impact of dialysis including:

- capturing and reusing RO reject water
- reducing excess power use and considering renewable power options
- improving waste management, including optimising waste recycling - for example, diluting the town water supply with unused RO permeate reintroduced into the treatment process to meet quality requirements. This reuse strategy must be based on automated analysis of the salt content, pH, hardness, peroxydisulfate (PDS) and metals of the blended water to ensure compliance with performance standards while reducing water wastage. This approach can significantly enhance overall water use efficiency.
- identification of appropriate end uses with regular high water needs (beyond irrigation and toilet flushing already mentioned in HPU could also mention wash down of hard surfaces
- consideration of plumbing requirements, backflow and cross connection management assessment of chemicals used for backwash and cleaning
- risk assessment processes
- ongoing management such as regular testing and inspection.

7.3 Water Treatment Services

There are several water treatment configurations available for producing water suitable for dialysis. Failure to ensure adequate water quality can have serious consequences for patient safety and welfare.

The pre-treatment process should generally follow the sequence outlined below, in consultation with filtration manufacturers and water quality experts:

- Plate heat exchangers or small chiller units to maintain water temperature entering the treatment stream below 25°C (ideally ≤20oC) is necessary to ensure that the final water temperature does not pose a risk to patients. Additionally, maintaining lower temperature supports better control of biofilm development within the system.
- Automatic backwash filters to remove particles larger than 10 microns, particularly in locations where high sediment loads and frequent manual filter replacement would otherwise be required.
- Where sediment loads are typically low, bag filters or multi-cartridge filters may be appropriate. The selection of filter type should be determined by a cost-benefit and risk analysis.
- Water softeners to remove scale forming elements, calcium and magnesium via sodium ion exchange process. Ensure adequate provision for salt storage, located in close proximity to the brine tanks.
- Auto-backwash GAC filters to remove free and combined chlorine, as well as dissolved organic compounds. Two carbon filters should be installed in series, each providing a minimum of five minutes EBCT, for a total EBCT of ten minutes.
- In critical or acute care areas (e.g. ICUs), two trains of two carbon filters in series must be installed to provide system redundancy.
- UV irradiation units with 254nm or 185nm wavelength lamps, depending on their intended purpose:
  - 254nm UV: For microbial inactivation
  - 185nm UV: For reduction of residual chlorine and organic compounds

- Where both wavelengths are required, recommended sequencing to maximise efficacy:
  - 254nm UV post water softener
  - 185nm UV post carbon filters
- 5-micron and 1-micron cartridge filters are required to protect the RO membranes. Two parallel trains of 5-micron and 1-micron cartridge filters are recommended for redundancy and consistent flow.

The RO unit must be a Class IIb medical device and registered with the TGA, with a valid ARTG number. It must be capable of performing automatic heat sanitisation of both the RO membranes and the distribution loop.

The use of chemical sanitisation methods for the RO membranes and distribution loop should be avoided due to the inherent risk of chemical residue exposure to patients.

Where it is required by the brief to ensure continuity of supply, redundancy should be provided through a dual-stage RO configuration, where each stage is independently capable of delivering water quality compliant with ISO 23500 standards.

A challenge tested and validated endotoxin retentive filter is recommended at the distribution loop return to further protect the RO membranes from biofouling. The heat sanitisation cycle of the distribution loop must include this filter to ensure effective microbial control.

The RO unit serves as the core component of the dialysis water purification system, using hydrostatic pressure to drive water across a semi-permeable membrane, effectively rejecting more than 97% of contaminants present in the feed water. The membranes are typically of spiral-wound design and housed within high-pressure vessels. Reverse osmosis is highly effective in removing ionic contaminants, bacteria, and endotoxins, ensuring that the treated water meets the stringent quality standards required for dialysis.

The diameter and configuration of each RO membrane element directly influence the permeate (product water) flow rate. To meet the water demand of a dialysis facility, multiple RO membrane elements are typically required. The feed water chemistry, including factors such as salt content, chlorine content, and fouling potential, and the hydraulic design of the RO unit play critical roles in determining membrane longevity. In a well-designed and properly maintained system, RO membranes generally have a service life of 3 to 5 years.

A minimum feed water pressure of 300 kPa is required at the inlet to the RO unit to ensure correct and reliable operation. To achieve this, sufficient pressure and flow must be maintained downstream of the Reduced Pressure Zone Device (RPZD). When factoring in pressure losses through the pre-treatment stages, including filters, softeners, and carbon beds, a minimum supply pressure of approximately 450 kPa is typically necessary. However, to protect downstream equipment, water pressure post-RPZD must be limited to a maximum of 600 kPa.

The flow rate downstream of the RPZD must be sufficient to support both the backwashing of each filter and the continuous supply of pre-treated water to the RO unit. The required flow rate and pressure must be confirmed by the RO plant supplier. If the available flow and pressure post RPZD are insufficient, a feed water break tank and pressure booster pump will be required. However, where adequate flow and pressure are available directly post RPZD, the use of a break tank should be avoided to minimise the risk of increased water age and associated microbiological growth.

Insufficient pressure or flow can result in inadequate membrane crossflow, which promotes premature membrane fouling. Fouling can occur as scaling (due to mineral precipitation) or biofouling (from microbial growth), both of which compromise system efficiency and membrane lifespan.

To minimise biofilm formation within the RO unit, an important consideration for patient safety, storage of RO water is not recommended. Instead, treated water compliant with ISO 23500 is delivered directly to each dialysis machine via the unit's integral high-pressure RO feed pump, ensuring the required flow and pressure are maintained at each dialysis point.

While some Class IIb systems use integral RO water storage tanks maintained at 65°C during dialysis to support heat sanitisation of the RO membranes and distribution loop, there are also Class IIb RO units available that feature integral inline heaters, providing an alternative to storage-based heating systems. In both configurations, whether using a storage tank or inline heaters, it is critical that, during heat sanitisation, the distribution loop return temperature is monitored and maintained between 80°C and 90°C. When the A_0

principle is applied, an A_0 value of 12,000 must be achieved and logged, in accordance with ISO 23500 requirements.

The RO water distribution loop must be constructed using either peroxide crosslinked polyethylene (PE-Xa) with crevice-free stainless steel or polyphenylsulfone (PPSU) crimped fittings, or alternatively, orbital-welded, electropolished stainless steel 316L tubing with a surface roughness (Ra) of ≤ 0.38 µm. To ensure adequate flow velocity and minimise the risk of biofilm attachment, the internal diameter of the distribution loop should be limited to either 20 mm or 25 mm nominal bore (NB). All piping must be insulated with a minimum of 25 mm insulation, having a thermal conductivity of ≤ 0.04 W/m·K. The insulation must be rated for thermal applications up to at least 110°C.

Water quality must be monitored and analysed in accordance with the parameters defined in ISO 23500. These requirements are further outlined and reinforced by the following national guidelines:

- NSW Agency for Clinical Innovation, 2018, Water for Dialysis - A Guide for In-Centre, Satellite and Home Haemodialysis in NSW
- Queensland Health, 2025, Water for Haemodialysis Handbook, Version 4
- SA Government, 2015, South Australian Haemodialysis Guidelines: Routine Water Testing and Reverse Osmosis Monitoring.

These documents provide detailed direction on testing frequency, sampling points, and acceptable limits for both chemical and microbiological contaminants. Adherence to these standards is critical to ensure patient safety and system performance.

The Plant Room for water treatment should ideally be located adjacent to or within the Renal Dialysis Unit to minimise the length of the RO water distribution loop and to facilitate convenient access for daily performance monitoring of the carbon filters. Where feasible, loop length should be limited to maximum 200m to maintain thermal efficiency and minimise the risk of microbial growth. The room must be constructed with an appropriate load bearing floor to support heavy equipment such as water softeners, salt storage, carbon filters and the RO unit. This room shall be fully enclosed and separate from other clinical or plant areas.

Further guidance on spatial requirements, access, and services is available in the AusHFG Standard Component – Water Treatment Plant Room. The layout and configuration of the space will depend on the specific RO system type and manufacturer. To support equipment servicing and deliveries, the room must include wide access (e.g., double doors) to allow safe and efficient passage of pallet jacks transporting salt, media, or water treatment equipment.

At each Treatment Bay, aseptic quick-connect/disconnect fittings are required for both the RO water supply to each dialysis machine and the corresponding drain line. It is important to note that various connector types and sizes are available on the market, depending on the dialysis machine manufacturer and model. While Swagelok fittings are commonly used, they are not inherently aseptic and may not meet stringent hygienic standards. Where compliance with ISO 10993 is required, certified aseptic connectors must be used, and the design and construction of the distribution loop must align with the relevant ISO standards.

The wall panel/tundish at each Treatment Bay must be designed and constructed from materials that minimise the risk of biofilm development and corrosion. While stainless steel has traditionally been used for this purpose, alternative panels made from plastics such as polyurethane (PUR) and acrylonitrile butadiene styrene (ABS) should also be considered. These materials are highly resistant to hospital-grade disinfectants, non-corrosive, and offer improved long-term durability, making them suitable for routine flushing with chemical disinfectants such as peracetic acid.