UWMC MEMBRANE REPAIR AND LANDSCAPE PRE-DESIGN REPORT

Project 206573
March 15, 2019
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EXECUTIVE SUMMARY

BACKGROUND
Water infiltration at the University of Washington Medical Center (UWMC) Northwest and Main Entry Courts and along seismic joints has had an adverse impact on operations and equipment. Within the past fifteen years, UWMC Operations and Maintenance has recorded approximately 775 leak-related work orders within the designated portion of UWMC’s campus. Leak-related events in these areas over the past five years have occurred at five times the rate as the previous decade, pointing to a failing membrane beyond its useful service life that has been compromised or is entirely absent in multiple locations.

While some of these leaks have been mitigated through various makeshift measures, these strategies are temporary solutions at best and do not address the source of the water infiltration. Mitigation attempts have cost UWMC an estimated $246,000 in 2018 alone, without providing a complete and long-term solution to the ongoing threat of water infiltration. This number addresses direct repairs by contractors alone and does not account for UW Facilities and Maintenance labor costs, or operational costs incurred by compromised or inaccessible building areas. These hidden costs and impacts to hospital function and patient experience are an ongoing challenge to UWMC.

OBJECTIVE
The intent of this report is to provide recommendations for the repair of the waterproofing membrane underneath the Northwest and Main Entry Courts, and to provide design strategies for the reconstruction and improvement of the courtyards to meet the broad array of needs for exterior use and to contribute to the campus experience. Each recommended repair option is intended to serve as a fifty-year solution implemented as one phased project or as a series of projects.

EXISTING CONDITIONS
The existing site includes critical functions for the Medical Center including vehicular and pedestrian access to the center, main entries to the building and courtyards serving a diversity of functions, including open space in a portion of the campus dominated by buildings.

LIMITATIONS AND RISKS
Elements of the building chronology are challenging to ascertain based on existing documentation. It is unclear whether the exterior subterranean walls of the building are protected in any way from thermal or water infiltration. Many portions of the building were unavailable for direct observation. Review of existing waterproofing from inside the building was limited due to the ongoing use of the hospital. While further exploration is possible if desired, already-observed conditions indicate clearly that the membrane is incomplete and in poor condition.
EXECUTIVE SUMMARY

PROCESS
SHKS Architects (SHKS) reviewed historic documents to establish a timeline for the development of the building envelope. This information paired with direct observation of the interior and exterior conditions develops a catalog of wall and slab assemblies and associated risk points. SHKS worked with Morrison Hershfield to develop an approach toward comprehensively repairing the membrane.

SHKS collaborated with Swift Company to identify design opportunities and define the exterior program, updating the UWMC courtyards and providing an inviting, accessible space that facilitates hospital operations. The proposed design addresses the quality of exterior space through circulation, landscape, and program to create an integrated campus experience.

RECOMMENDATION
The existing membrane is beyond its service life and failure has been an ongoing challenge to operations, equipment, and patient care. Complete replacement of the membrane and associated systems as a single construction project is recommended. Completing the full scope of work under a single contract is the most time-efficient approach and will allow for a single point of contact in subsequent membrane maintenance. This work presents a significant undertaking for UWMC as well as an opportunity to enhance faculty, staff, and patient experience by improving site access and programmatic function.

General conditions for the work include phasing and enabling work to maintain access to UWMC via Frontage Road throughout construction. Enabling work, performed at the beginning and end of each phase, also includes temporary relocation of infrastructure to maintain building functionality, as well as creation of temporary access routes, security, protecting or uncovering work from previous phases, ground investigation, and work that might be necessary to accommodate phase start-up and completion.

COST

Recommended Project Budget:
$36,514,634\textsuperscript{a}

Anticipated MACC:
As a single construction project implementing Option 1\textsuperscript{b} (Repair Existing + Add Similar to CETCO):
$21,386,000
+ 1,604,000 allowance for enabling work
$22,989,000\textsuperscript{c}

Alternates:
Option 2: Repair Existing + Add Similar to Laurenco (cold-applied) -$266,000

\textsuperscript{a} See Cost Estimate Details, Appendix D, for information on the total project budget including escalation and soft costs.

\textsuperscript{b} See Waterproofing Narrative, Appendix B, for full descriptions of waterproofing options.

\textsuperscript{c} See Cost Analysis, Appendix E, for a breakdown of the projected cost of work.
EXECUTIVE SUMMARY
LEVEL ONE AND TWO BELOW

MAIN ENTRY COURT

NE
CONSTRUCTION HISTORY

1. 1954 HEALTH SCIENCES BUILDING
Phase I of the University Hospital (now University of Washington Medical Center) was designed by Naramore, Bain, Brady, Johanson, McCellan, and Jones (now NBBJ). Construction began in 1947 and the building opened to clinical faculty in 1954. It provided 110,562 square feet of office and laboratory space across eight wings.

2. 1959 UNIVERSITY HOSPITAL
The eight-story University Hospital began construction in 1956, and opened to patients in 1959. It housed 291 beds.

3. 1976 ENTRANCE AND CANOPY
In 1976, NBBJ designed an addition to NN Wing that served as an entry vestibule. The exterior canopy associated with that entrance was the first portion of what is now a more extensive canopy system, and features a concrete column and cantilevered beam system. The addition is still existing, though it no longer serves as an entrance to UWMC.

4. 1981-1984 NN COURT ADDITION AND MAIN ENTRY COURT
The NN court is also referred to as the NW Court. For clarity, this will be referred to as NW Court throughout this report. Over the course of several years, Waldron Pomeroy Polk & Smith Architects designed both of the brick-paved exterior plazas and concrete canopies associated with the north side of the UWMC campus. The project also included extensive work to the below-grade first and second floors, featuring two skylights connecting NW Court to the interior spaces below.

5. 1984 UW MEDICAL CYCLOTRON FACILITY
The UW Medical Cyclotron Facility (UWMCF) was designed by John Hanway Architects and opened in 1984. Since then, the cyclotron has been in continual use delivering neutron therapy and supporting cancer research programs. Today, the cyclotron is maintained by a full-time staff of engineers and physicists, and is one of UWMC’s most valuable assets. This facility is located on the northernmost perimeter of the subterranean first floor of UWMC.

6. 1986 ROBERT H. MUILENBURG TOWER
A seven-story hospital expansion opened on the southeast side of the UWMC campus. The tower is now at the hospital’s core.
7. 2000 MAIN ENTRY WATERPROOFING REPAIR
HNTB addressed points of failure in the Main Entry Court adjacent to the NN Wing. The work included a new seismic joint cover as well as paving repair. New liquid applied waterproofing was installed beneath the joint cover to mitigate water infiltration.

8. 2003 SURGERY PAVILION
NBBJ designed the three-story addition to the east side of the UWMC campus. The Surgery Pavilion was designed for outpatient surgery and for surgery requiring specialized technical equipment. It is linked to the main UWMC structure by a glass-enclosed footbridge.

9. 2003 CYCLOTRON SEISMIC UPGRADE
Structural engineers AHBL provided seismic upgrades to the cyclotron room on the northwest portion of the first floor, impacting the slab.

10. 2009 NW COURT LANDSCAPING AND STAIR CANOPY
UW hired SHKS Architects to develop a project to repair the exterior stairs at UWMC NW Court, mitigate water migration into the stair shaft, and replace the stair shaft roof. The project scope was based on recommendations made in the Leakage Evaluation Report by Wetherholt & Associates. The completed canopy structure includes a steel structure with glazing infill.

11. 2012 MONTLAKE TOWER
A new 273,000 square foot tower, designed by NBBJ, linked the existing Muilenberg and Pacific Towers on the south side of UWMC. The tower increased patient capacity and houses oncology, radiology, and neonatal intensive-care units.
LEAK HISTORY

PRIOR AND EXISTING LEAKS

This diagram identifies areas of common and recurring leaks.
LEAK HISTORY

UWMC Operations and Management (O&M) identified the estimate of leak-related work orders over the past twenty years within the portion of the building addressed in this report.

1998-2003: Approximately 75
2003-2008: Approximately 100
2008-2013: Approximately 100
2013-2018: Approximately 500

O&M records indicate that leak-related incidents over the past five years have occurred at five times the rate as the previous decade. Many previous leaks have been addressed by interrupting the path of water with drip pans and tubing, but have not been resolved at their source. In some locations, gutter systems have been installed within ceiling space to redirect infiltrating water. Recurring leaks have resulted in valuable space within UWMC becoming unavailable, and present challenges for operations and patient care.

In 2018 alone, water mitigation work performed by Skanska cost $43,853. Mortenson has performed seismic joint work as well as the maintenance of drip pans within UWMC’s ceiling spaces, at a cost of $126,407. These projects collectively have cost UWMC $170,260 in construction costs, with estimated project costs of $246,000 factoring in soft costs but not accounting for operational inefficiencies or work lost.

Among those costs, $34,756 is specifically associated with interior gutter systems, drip pans, and cleanouts, all temporary workarounds to maintain basic levels of functionality and habitability without addressing the cause of water infiltration. This work will continue to be necessary until the membrane is fully repaired, and will not eliminate risks to the structure and building systems along the water’s path from its source to its appearance within the building. Maintenance costs are expected to rise over time as the membrane deteriorates.
LEAK HISTORY

FIRST FLOOR

Designated areas indicate locations of recurring complaints, as reported by UWMC O&M.

Building footprint on ground level.

Existing unexcavated area. UWMC would like to hold this space for a potential future addition.
Skanska is performing epoxy injection as part of Phase III of current water mitigation work. Leak may be plumbing-related.
SECOND FLOOR

A Leak believed to be the result of a plumbing issue, rather than infiltration of the membrane.

B Leak has been addressed, but water infiltration is suspected to continue to east and west of prior leak point.
A  Skansa vacuumed out this space, but did not provide repairs or mitigating measures.

B  Skansa provided mitigating measures in EA200 corridor.

C  Source of leak is unknown
A Snyder currently performing repairs.
Repairs performed by Snyder as part of Phase I of seismic joint work.
DESIGN CONSIDERATIONS

TECHNICAL (MEMBRANE RISK FACTORS)

PLANTINGS
Eliminate root interference with the new membrane.

BUILDING PERIMETER
Provide appropriate waterproofing terminations and flashing at exterior walls.

SITE STRUCTURES
Eliminate potential water infiltration at existing skylight structures, walls, shafts, and stairwells.

SURFACES
Provide new surfaces at both courtyards to protect waterproofing assembly.

CHARACTER OF UWMC COURTS

CIRCULATION
Increase bicycle and pedestrian access. Provide accessible path to building entries.

PROGRAM
Courtyards to provide for outdoor gathering as well as access and staging for those traveling to and from UWMC.

LANDSCAPE
Provide landscaping which contributes to site character and use, establishing an identifiable landscaped corridor along NE Pacific Avenue which is associated with the University.
TECHNICAL APPROACH

LEVEL ONE

LEVEL TWO

LEVEL THREE
TECHNICAL APPROACH

OBSERVATION
Leaks began shortly after installation of waterproofing in the 1980s. Nearly thirty years later, existing horizontal waterproofing is in poor condition and beyond its useful service life, evidenced by ongoing and recurring leaks into Levels One and Two spaces.

The existing entrance court waterproofing assembly consists of overburden, concrete, soil, rigid insulation (some locations), dimpled drainage mat with filter fabric (some locations), reinforced hot fluid-applied rubberized asphalt membrane including waterproofing materials, and the concrete structural decks. See waterproofing narrative, Appendix B.

Existing drains in planters and paver areas are insufficient to remove water quickly during heavy rain events. Many re-occurring leaks occur along the two seismic joints in the Level Three structural deck.

OBJECTIVE
Provide options to permanently stop current leaks and prevent new leaks.

RECOMMENDATION ALTERNATES
1) Repair existing hot rubber membrane and install a new reinforced asphalt-compatible thermoplastic membrane.
2) Replace existing waterproofing membrane with cold-applied waterproofing.
3) Install new asphalt-compatible composite thermoplastic membrane over existing hot rubber.
See Appendix B for full descriptions of these options.
CIRCULATION

OBSERVATION
The diverse range of circulation modes constitute the dominant and most complex programmatic function and therefore addressed separately from the other equally valuable program. The courtyards serve as multi-modal access points to UWMC. Vehicles, pedestrians, and cyclists all share limited space when approaching the building from NE Pacific Street, resulting in points of congestion and confusion.

Frontage Road provides vehicular access to the site. Parking spaces are present on either side of the road, and a valet booth allows visitors to drop off cars. The circle drive in the Main Entry Court is used for drop-off and pick-up. UW shuttles stop at the associated bus shelter. King County Metro buses stop west of the site.

Crosswalks, steps, and a ramp provide pedestrian access to the site. Brick paved walkways lead to the northwest entrance and the main entrance. There is no ADA compliant path to either entrance. Points of excessive slope, steps, and irregular paving pose obstacles throughout the site.

OBJECTIVE
Provide for increased pedestrian and bicycle movement throughout this area of campus in a manner which minimizes conflicts, congestion, and optimizes the use of valuable campus open space for a diversity of uses. Provide for ADA pedestrian access on site to building entries which are generally at the same level as the site.

RECOMMENDATION
The proposed design simplifies the courtyard surfaces and entry sequence, reducing areas of congestion and eliminating steps and non-compliant ramps for open-ended circulation. The valet booth moves to the west to avoid a bottleneck. The circle drive is reconfigured to expand the waiting area and improve sightlines to approaching vehicles. Coordination of work will require continued vehicle access on Frontage Road throughout construction.
EXISTING
The width and configuration of Frontage Road challenges pedestrians crossing the street.

PROPOSED
A new location and pull-off for the valet booth reduces conflict at the crosswalk.
EXISTING
Accessible routes to both entrances are indirect and interrupted. Pedestrian flow is restricted by walkway layout.

PROPOSED
An open and accessible pedestrian zone enhances site experience and reduces conflict and congestion by increasing options. Circulation paths follow natural lines of travel.
CIRCULATION - MAIN ENTRY COURT

ACCESSIBLE PATH
INTERUPTION OF ACCESSIBLE PATH
NON-ADA PEDESTRIAN PATH
ENTRANCE MEETING ADA STANDARDS
ENTRANCE NOT MEETING ADA STANDARDS
CONGESTION POINT

EXCEEDS 8.3% SLOPE
PROGRAM

OBSERVATION

The existing layout of the NW Court and Main Entry Court is dictated by the primary circulation axes of the site. Both courtyards are primarily focused on arrival and departure, and miss opportunities to provide space for contemplation and rest.

Designated waiting spaces are segregated from the primary vehicular circulation path, resulting in congestion of the walkway around the circle drive, which must serve both pedestrian circulation and those waiting for vehicle pick-up. Other programmatic activities include informal and formal gathering, wayfinding, sitting, bicycle parking, equipment staging, and contemplative viewing from above and within.

OBJECTIVE

Develop courtyards to serve UWMC patients and visitors, staff, and students. The exterior program must support UWMC identity and multimodal access, provide outdoor gathering areas, transitional areas to accommodate bike storage, comfortable waiting areas, and access to a contemplative garden experience.

RECOMMENDATION

The proposed study removes restrictions and obstacles, increasing options for building users by providing open and accessible pedestrian plazas. Expanding the waiting area in the Main Entry Court allows patients to relax while maintaining a clear sight-line to the vehicle drive. The primary circulation path remains aligned with Frontage Road. Various scaled gathering areas and meeting spaces are developed along with integrating the range of programmatic elements.
EXISTING
Linear walkways and raised planters restrict programmatic opportunities.

PROPOSED
Generous waiting and gathering spaces provide opportunities for building users to interact with nature and the community using the courtyards. Increased flexible space and sightlines to entries result in increased ease of use and wayfinding.
LANDSCAPE
LANDSCAPE

OBSERVATION
Mature plantings are found within elevated concrete planters and on grade. Many previously existing trees have been removed over time due to poor health. The remainder of the trees are large for their species, causing maintenance concerns and endangering the membrane. As with the rest of the campus, UWMC has limited staff available to maintain landscaping. Any redesign should respond to the need to limit maintenance.

OBJECTIVE
Provide landscaping which contributes to site character, develops the needed garden experience within the Medical Center, responds to the scale of the buildings and site, and establishes an identifiable landscaped corridor along NE Pacific which is associated with the University.

Develop pleasant views for building users both inside and outside the building.

RECOMMENDATION
All trees will be contained within free-standing planters which drain to the plaza surface or on grade.

Planter structures will contain adaptive plant species without invasive root systems.

A gravel buffer will protect the perimeter of the building from standing water or moisture build-up.

Site furniture, tables, bicycle racks, waste containers, and benches are essential in supporting the courtyard function and will signal to the user that these are welcoming spaces intended to be used.
APPENDIX A: SCOPING AND PHASING PLANS
2.3 DEMO (E) CONC WALL, SAWCUT AT STRUCTURAL SLAB

2.4 DEMO (E) CONC COL, SAWCUT AT STRUCTURAL SLAB, TYP.

2.50 DEMO APPROX 8" SOIL/OVERBURDEN DOWN TO EXISTING WATERPROOFING MEMBRANE

2.51 DEMO APPROX 3'-0" SOIL/OVERBURDEN DOWN TO EXISTING WATERPROOFING MEMBRANE

2.52 DEMO APPROX 3'-6" SOIL/OVERBURDEN DOWN TO EXISTING WATERPROOFING MEMBRANE

2.53 DEMO APPROX 4'-6" SOIL/OVERBURDEN DOWN TO EXISTING WATERPROOFING MEMBRANE

2.54 DEMO APPROX 12'-6" SOIL DOWN TO EXISTING WATERPROOFING MEMBRANE, SHORE AS REQ'D

2.55 DEMO APPROX 15'-0" SOIL DOWN TO EXISTING WATERPROOFING MEMBRANE, SHORE AS REQ'D

2.56 DEMO AND REPLACE (E) PLAZA DRAIN BODY, TYP.
PLANTINGS AND FILL REMOVED PRIOR TO SCOPE OF THIS PROJECT
EXCAVATED AREA, SHORE AS REQ'D

MAINTAIN (E) UNEXCAVATED SPACE

LEVEL ONE

LEVEL TWO

3.6 INSTALL APPROX 18" HIGH CONC CURB BETWEEN BOTTOM OF (E) FLOATING SLAB AND TOP OF STRUCTURAL SLAB, INSTALL WATERPROOFING ASSEMBLY APPROX 2'

7.1 WATERPROOFING TERMINATION AT CONC SURFACE

7.3 WATERPROOFING AT SEISMIC JOINT

7.4 MEMBRANE AT LEVEL ONE ROOF SLAB

7.5 MEMBRANE AT LEVEL TWO ROOF SLAB

7.6 WATERPROOFING TERMINATION AT STUCCO SURFACE, DEMO EXISTING COUNTERFLASHING, EXTEND STUCCO DOWN APPROX. 2", INSTALL COUNTERFLASHING OVER WATERPROOFING ASSEMBLY AT VERTICAL SURFACE

7.7 WATERPROOFING TERMINATION AT CONCRETE SURFACE, CONTINUE WATERPROOFING APPROX 4' ABV FINISHED GRADE, PROVIDE SHEET METAL CLADDING OVER WATERPROOFING ASSEMBLY

7.8 WATERPROOFING TERMINATION AT TERRA COTTA CLADDING, SALVAGE EXISTING TERRA COTTA CLADDING, INSTALL NEW WRB/FLEXIBLE FLASHING APPROX 2' AND COUNTERFLASHING, REINSTALL TERRA COTTA CLADDING, INSTALL WATERPROOFING ASSEMBLY

7.9 WATERPROOFING TERMINATION AT BRICK SURFACE, SALVAGE EXISTING BRICK, PROVIDE NEW BRICK AND NEW WRB APPROX 2' DOWN, INSTALL THROUGH-WALL FLASHING OVER WATERPROOFING ASSEMBLY AT VERTICAL SURFACE

7.10 WATERPROOFING TERMINATION AT TERRA COTTA CLADDING, PROVIDE NEW METAL CLADDING AND NEW WRB APPROX 2' DOWN, INSTALL THROUGH-WALL FLASHING OVER WATERPROOFING ASSEMBLY AT VERTICAL SURFACE
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COORDINATE WORK AT SIDEWALK WITH SDOT'S MONTLAKE HUB PROJECT

MATCHLINE

NE WING

NN WING

EA WING

EE WING

(E) ROOF

(E) ESCALATOR

(E) ELEVATORS

LEVEL TWO (BELOW)

LEVEL ONE (BELOW)

PLAZA SURFACE

SLOPES TO STREET

KEYNOTE LEGEND

MARK KEYNOTE TEXT

3.1 CIP CONCRETE SITE WALL

3.2 CIP CONCRETE CURB

3.3 STEPSTONE PAVER OR EQUAL

3.4 CIP CONCRETE W/ BROOM FINISH AND SAWCUT JOINTS

3.7 ASPHALT OR CIP CONCRETE ROAD SURFACE

3.8 CIP CONCRETE RAMP W/ METAL HANDRAILS

3.9 CONCRETE SIDEWALK

4.1 PROVIDE ALLOWANCE FOR REPAIR OF APPROX 114 SF OF ENTRANCE FOLLOWING DEMOLITION OF (E) CANOPY WOOD BENCH INTEGRATED INTO CONCRETE SEATING WALL

32.2 PLANTING ON STRUCTURE, IN PLANTER W/ MIN. 3'-0" SOIL

32.7 PLANTING IN NON-STRUCTURE AREA, SUBGRADE PREPARATION W/ 18" TIP TOPSOIL

32.9 1/8" GRAVEL BUFFER, TYP

32.11 ENTRY CANOPY SYSTEM

32.12 BOLLARD, TYP

32.13 FLAGPOLE W/ CONCRETE FOOTING
REPORT

University of Washington Medical Center Membrane Repair and Landscape Beautification

Seattle, Washington

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Report No. 1-1802044.00 February 22, 2019

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1. INTRODUCTION

Morrison Hershfield Corporation (MH) is providing this report to outline our recommendations for the waterproofing at the main entries of the Medical Center. The objective is to study options to permanently stop the leaks and prevent new leaks while also looking for opportunities to enhance the appearance of the entrance plaza.

2. BACKGROUND

SHKS Architects is designing a waterproofing membrane repair and landscape beautification for the University of Washington Medical Center (UWMC) in Seattle, Washington. We understand that the project will include a new entry canopy, new landscaping, replacement of the existing waterproofing assembly, and replacement of the tie-ins between the new waterproofing and the existing building envelope systems. Some of the existing horizontal waterproofing is in poor condition based on our observations and based on the reports that leaks into the Level 1 and 2 spaces have been an on-going issue since shortly after the installation of the waterproofing in the 1980s. Replacement of the existing waterproofing assemblies will necessitate exposing the existing horizontal waterproofing over Level 2 and at the Level 3 tie-ins.

There are two existing entrance courts. One to the north of the existing main entry and the other to the north of the entry to the Magnuson Health Sciences Center. Both are bounded on three sides by the existing hospital building complex to the east, south, and west. The waterproofing under discussion includes the horizontal waterproofing on the Level 3 structural deck (primarily), as well as possibly the Level 2 structural deck and below-grade walls at these locations, the waterproofing at horizontal and vertical seismic joints, and the transitions where the waterproofing turns up onto the above-grade walls or down onto the below-grade walls of the existing Medical Center.

SHKS Architects has retained MH to provide consulting engineering services to make recommendations to assist with the design of the repairs to the existing waterproofing assembly of the north courtyards that contain the (northeast) entrance for the general public to Medical Center and the non-public (northwest) entrance to the administrative offices and medical school, and the related landscape beautification work.

3. OBSERVATIONS

On 16 May 2018, MH met with representatives from the University of Washington (UW) and SHKS Architects to review the available information on the history and location of leaks. A partial history and location of leaks were discussed during the meeting. On that same day, MH performed a visual review of existing conditions from outside with representatives from the UW and SHKS Architects. On several subsequent dates, MH was also reviewed repair of the waterproofing in select areas as part of a separate scope of work (see MH Site Visit Report, at the end of this Appendix). Our review of the existing waterproofing from inside was limited due to the on-going use of the hospital, which prevented us from accessing some areas.

The existing entrance court waterproofing assembly consists of (from top to bottom, exterior to interior):
• Overburden, which is a combination of thin-set brick-tile pavers on mortar setting bed, concrete, soil (from a few inches to a few feet), and concrete planters.
• Dimpled-core drainage mat with filter fabric (some locations).
• Rigid insulation (some locations).
• Reinforced hot fluid-applied rubberized asphalt membrane including waterproofing repair materials. (Tom Berg of UW has indicated that coal tar pitch was used for waterproofing at the step in the northwest corner of west plaza.)
• Concrete structural decks (the original precast concrete waffle floor slab and newer precast concrete hollow-core slabs).

Drains were observed in the planters and in the paver areas. In some locations, there is little to no slope to drains and some drains are single-stage (meaning they drain water from the surface of the paving, not down at the level of the waterproofing). In at least one location the size of drains or the number of drains (or both) is insufficient to remove water quickly during heavy rain events.

There are two seismic joints in the Level 3 structural deck. Repairs to the waterproofing had been made previously at these seismic joints. At one of the seismic joints the repairs were intended to be a temporary solution and as such they were not designed to accommodate the designed-seismic movement of the structure. A system of galvanized sheet metal and stainless steel gutters, drains, and pumps have been installed below the Level 3 deck to intercept active leaks and prevent water from leaking into the occupied spaces of Level 2.

Waterproofing turns up the building walls and terminates behind sheet metal flashing. Sealant and gaskets around the fenestration systems are weathered and cracking, potentially exposing the waterproofing termination to water draining off the building walls and windows.

The existing waterproofing membrane is somewhat protected by the overburden so it would be reasonable to expect that some areas of the membrane are in good serviceable condition. However, some of the existing horizontal waterproofing is in poor condition because of damage caused by the roots of large trees and because leaks into the Level 1 and 2 spaces have been an on-going issue since shortly after the installation of the waterproofing in the 1980s. The on-going leak remediation at the seismic joints indicates the waterproofing at the seismic joints has failed.

The existing waterproofing systems appear to have been installed without the protection of a root barrier membrane. This may be causing some of the water intrusion into Levels 1 and 2. Root barrier membranes are now commonly included with waterproofing assemblies that include planted areas; however, the long-term effectiveness of a root barrier membrane that includes field seams is unknown when it comes to providing adequate protection against the roots of very large trees. Root barrier field seams are typically lapped seams sealed with adhesive tape. The long-term service life of the adhesive is unknown given that tree roots can increase significantly in size over time and could potentially overwhelm the adhesive ability of the seam tape.

4. DISCUSSION

Any waterproofing work will need to be performed without affecting the functioning of the hospital: not just in the below-grade spaces but also those spaces at-grade and above spaces adjacent the entrance courts. The risk of water intrusion into interior spaces is not acceptable
to the UWMC; therefore, any part of the Level 3 deck that is exposed will need to be protected from weather. The odor of new hot rubberize asphalt waterproofing during membrane repair or installation is anticipated to be obnoxious and intolerable, which will disrupt hospital activities unless odor mitigation is done. Removing existing overburden or waterproofing will create noise and vibrations that may impact functioning of the hospital in the spaces below.

Some areas of the courtyards have an overburden depth of only 4” from top of the structural concrete deck and the top of the finish paver surface with 2” extruded polystyrene insulation occupying half of this depth. At these locations, expansive waterproofing membranes containing bentonite (like CoreFlex 60, manufactured by CETCO) may not be adequately constrained by the overburden to activate their secondary line of protection (that is, the conferment of a leak if a breach in the primary membrane were to occur).

A number of courtyard perimeter locations have waterproofing membrane turn-ups at the exterior side of wall cladding assemblies. For some wall assemblies (like cast-in-place concrete), this condition may be unavoidable. But for other non-structural cladding assemblies (like brick veneer), the waterproofing system is generally more effective if it terminates at the building wall structure. This would require removal of the lower portion of the cladding material, installation of structural supports like a ledger angle to cladding material above the removed material and reinstallation of cladding material after the waterproofing system is installed.

The northern edge of the courtyards are being modified as part of the “Montlake Hub” project to improve transit connections and traffic flow at the entrance to the Medical Center. The modifications anticipate decreasing the number of parking spaces and increasing the width of the pedestrian corridors in front of the medical center to help relieve traffic congestion. This will likely result in the removal of some of the existing planter walls and some of the planted areas.

Budgetary constraints and access may require the work to be done in phases. MH recommends that, if at all possible, the work should be done as one comprehensive project or in phases that are as large as possible. This will reduce the overall cost of the project as it will reduce the amount of coordination and mobilization required to complete the work and will eliminate the need for long-term temporary tie-ins that will be removed as subsequent phases of the work are performed.

On past projects the University of Washington Capital Projects Office (UWCPO) has mandated that waterproofing below overburden be a hot fluid-applied reinforced rubberized asphalt membrane. MH supports UWCPO’s directive and agrees that such a membrane when fully adhered to the structural deck and properly protected is an appropriate membrane to install on decks with overburden. A fully adhered waterproof membrane applied directly on structural decks is the preferred method of waterproofing installation because should a breach develop in the membrane, the adhered membrane will prevent the leak from migrating to a location on the structural deck where water penetration through the deck can occur.

5. RECOMMENDATIONS

Based on the information available to date, we recommend considering the following two options. The waterproofing membranes discussed below should be installed by pre-approved applicators who are trained by the manufacturer. Regardless of which option is chosen a new seismic joint waterproofing system will be required (for more information see Section 6. Key Considerations).
5.1 Option 1 – Repair existing hot rubber membrane and install a new reinforced asphalt-compatible composite thermoplastic membrane (CETCO CoreFlex 60)

This option would provide the highest degree of redundancy in waterproofing of the courtyards by including complete removal of the overburden and installing a reinforced asphalt-compatible composite thermoplastic membrane (like CoreFlex 60 manufactured by CETCO) over the existing hot rubberized asphalt membrane after first repairing the existing waterproofing. The CoreFlex 60 thermoplastic membrane has an integral layer of bentonite polymer (called active polymer core) bonded to the underside of the membrane to provide confinement of lateral water movement if a breach in the primary membrane were to occur. The thermoplastic membrane would thus be installed in a non-adhered fashion, with the joints and seams of the thermoplastic heat welded together. Transition details can be accommodated with a variety Coreflash membranes—Coreflash 60 (reinforced membrane, for non-UV exposure locations), Coreflash NR (non-reinforced membrane, for UV exposure locations), and Coreflash UV (reinforced membrane, for UV exposure locations). Although this provides the highest degree of redundancy, there are some limitations compared with Option 2 that must be dealt with in the design and construction: (1) for phased construction the membrane is not inherently self-terminating and (2) where overburden is minimal, there may be insufficient compression to prevent water migration through the active polymer core in the event of a breach in the primary membrane. However if the project can be completed at one time and adequate overburden provided, this is our preferred product.

Pros:  
1. The addition of a new waterproof membrane would provide a new and independent layer of waterproof protection. 
2. The installation of the new membrane would also provide new seismic joint waterproofing, new flashings, and new terminations to existing building envelope systems. The detailing for the CoreFlex installation will need to comply with the manufacturer’s recommendations where feasible.

Cons:  
1. The minimal construction depth of 4” in some locations may limit the viability of this option. 
2. Phased construction will require the use of termination bars to confine horizontal expansion of the bentonite component, but may not be a viable in regards to attaching a termination bar to hollow-core, precast-concrete deck panels. Inclusion of curbs to separate phased construction areas should be considered with this option to allow terminations to be on vertical planes. 
3. The odors from the hot rubber kettle for repairs of the existing hot rubberized asphalt membrane will need to be mitigated.

To provide a backup layer of protection and to provide temporary waterproofing during construction, the existing waterproofing should be tested for leaks using electronic leak detection, the membrane repaired, the repair tested as well. The testing is to confirm the waterproof continuity and integrity of the existing waterproofing and to identify areas requiring repair. An electronic leak detection grid will need to be installed over the repaired hot rubber to provide an electrical “ground” to permit electronic leak detection of the CoreFlex 60.