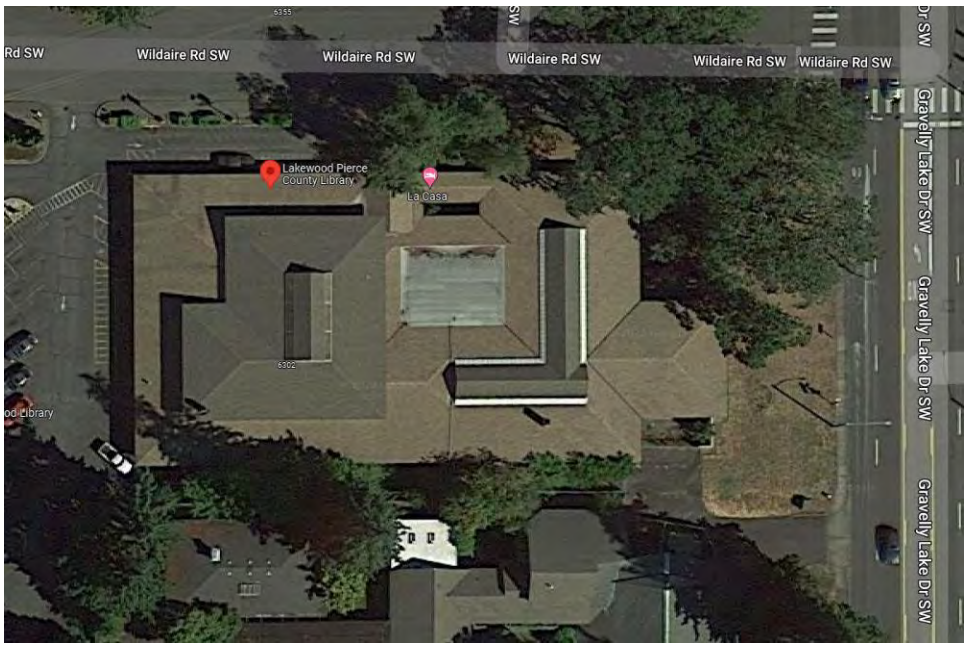
W E T H E R H O L T A N D A S S O C I A T E S , I N C .

LAKEWOOD LIBRARY
ROOF EVALUATION
MARCH 10, 2022



for

Pierce County Library System
3005 112th Street E
Tacoma, WA 98446

Attn: Kristina Cintron

April 1, 2022

2202-03A1

14715 NE 95th Street, Suite 100 • Redmond, WA 98052
Phone: 425-822-8397 • Fax: 425-822-7595

W E T H E R H O L T A N D A S S O C I A T E S , I N C .

April 1, 2022
2202-03A1

Pierce County Library System
3005 112th Street E.
Tacoma, Washington 98446

Phone #: 253 548-3454

Attn: Kristina Cintron

Sent via email: kcintron@piercecountylibrary.org

Ref: Lakewood Library
6300 Wildaire RD SW
Lakewood, WA

Greetings,

At the request of Kristina Cintron, this writer and Greg Guillen, CG Engineers met with Frankie Nickerson, PCLS; and Billy and Davis, Wayne's Roofing; on March 10, 2022 to review the roof and structure at the Lakewood Library.

Items of Understanding

The Lakewood Library building was constructed in 1963, expanded in 1974, and renovated in 1994 including an addition. The library was further remodeled in 2006. At an unknown date following the 1994 renovation, the roof was replaced in 2 phases, one of the phases may have coincided with the 2006 remodel. Historic information taken from the PCLS website History of Lakewood Pierce County Library and the Pierce County Assessors website.

Water intrusion was reported at the north and west lower-level steep slope roofs. Evidence of the water intrusion was visible in the soffit areas below the noted roofs. Two other locations of water entry were noted, but temporary repairs performed by Wayne's Roofing have stopped the water entry.

It is understood that Wayne's Roofing performs roof maintenance on the building.

Wayne's Roofing was retained to perform destructive openings to review the condition of the structure. CG Engineers was retained to review the roof structure.

Observations

The Lakewood Library is a 1.5 story structure with architectural laminate shingles manufactured by Tamko on the lower section of the roof, and unidentified architectural laminate shingles installed at the upper roof and skylight roofs. It was indicated that the shingles were installed at different times and by different roofing contractors. It was indicated that Wayne's Roofing installed the shingles at the upper and skylight roofs.

The roof system at the lower roof west half consists of the following from the top down as confirmed during the test openings. Architectural laminate shingles, asphaltic underlayment, plywood sheathing, polyethylene faced self-adhered membrane, and cementitious wood fiber substrate board. Cementitious wood fiber substrate board is known by the trade name Tectum. Cementitious wood fiber substrate board is constructed with cementitious binder and wood fiber filler.

The roof system at the lower roof east half and upper roof areas appears to consist of the following from the top down as indicated on the as-built drawings provided. Architectural laminate shingles, underlayment, plywood sheathing, and structural steel decking.

The low slope roof appears to consist of the following from the top down as indicated on the as-built drawings provided. A multi-ply built-up roof applied in hot asphalt, plywood sheathing, metal decking, and R-30 batt insulation secured directly to the underside of the metal deck with stick pins. Slope to drain is provided by structure and the cricket between the drains is wood framed. This roof area was added during the 1994 addition and remodel.

The 1994 as-built drawings indicate that the steep slope roof system at the time was clay tile. The roof has no provisions for venting, nor does there appear based on the provided drawings to be a vent cavity. A clay tile roof would not need to be vented in the same manner that a shingle roof would need to be vented.

The steep slope roofs positively slope at approximately 4:12 to the eave edges. At the lower roof areas there are external gutters and downspouts, and at the upper roof area there is external gutter and downspouts only at the bottom of the valley. Valleys at the lower roof are configured with sheet metal valley liners, and at the upper roof as closed cut valleys. The skylight roofs slope at approximately 5:12.

The low slope roof slopes to the north and is drained via 2 cast iron primary drains located in the northeast and northwest corners of the roof. Overflow drains consist of a drainpipe extending approximately 1-inch above the surface of the roof flashed with a lead integrated into the roof. This type of overflow is commonly known as a contractor style overflow. There is a dead valley behind a rising wall at the roof over the log. The dead valley drains to the west and north and then transitions to the steep slope roof.

Rising walls above the lower roof area clad with marblecrete. The marblecrete transitions to the steep slope roof with headwall flashing. The marblecrete terminates at the top of the roof. In some areas the marblecrete was reworked, and through wall flashing was installed, the marblecrete terminates approximately 4-nches above the surface of the roof. The marblecrete in the reworked areas differs in color than the adjacent marblecrete. In some areas the marblecrete is cracked or otherwise damaged.

At the east half of the lower roof and at the upper roof there are sloped skylights. The skylights consist of a fiberglass sandwich panel, situated between steep slope roofing. The ends of the skylights are clerestories with windows extending to the surface of the roof. At the upper roof the south clerestory is stripped into the shingles with fluid applied flashing.

Roof penetrations are minimal, pipe penetrations are flashed with leads, and the chimney penetrations are flashed with sheet metal flashing. At the rake conditions the shingles are integrated into the walls with step shingles counterflashed with through wall flashing.

At the south half of the roof between what is presumed to be the original building, and the 1973 addition is an area dividing wall. This may be an expansion joint that does not extend through the low slope roof that was installed in 1994.

Discussion and Recommendations

The lower steep slope roofs at the north and west portions of the building are in poor condition. It appears that water has passed beyond the shingles for an extended period of time. The wetting of the components beneath the shingles has deteriorated the underlayment, plywood, and in areas, the cementitious wood fiber substrate board. This is evidenced by the plywood and underlayment being in good condition in areas where the upper roof overhangs the lower roof and provides some protection from water. The lower steep slope roofs at the west half of the building are no longer serviceable and should be replaced.

The cementitious wood fiber substrate board is deteriorated in many areas, and likely not serviceable to maintain a solid substrate for a new roof system. Where observed cementitious binder was washed away leaving only the wood fibers. The lack of binder has caused the cementitious wood fiber substrate board to weaken and deflect. The deflecting substrate boards cause the shingles to deflect, further exacerbating water entry as water can travel laterally creating further water entry and damage.

The substrate at the steep slope roofs to the south and east of the second floor, the eastern roof section, and the upper roofs do not appear to have water damage. The substrate felt solid, and no deflection was observed. Water entry described at the north and west roof areas was not indicated in these areas.

The shingles at the upper roof areas and at the south and east roof areas below the second story, and the shingles at the east half of the building are in fair condition. With maintenance, repairs, and proper tenant improvements these roof areas should be serviceable for 3-5 more years at what point the roofs should be reevaluated for options for further repairs or replacement.

Cupping shingles were noted at the lower north sloping roof area adjacent to the second story, minor mineral granule loss, and cracked shingles were noted at the lower south slope roof areas. The cracking shingles should be carefully removed and replaced with matching shingles. Moss growth was observed at the perimeters of the upper roof areas, if desired the moss can be cleaned from the surface of the roof with a medium bristle push broom, removal of the moss is not necessary. Nails were observed backed out and penetrating the overlying shingles at the east sloping roof at the east half of the building. At the east sloping upper roof nails were observed to be backed out but not penetrating the overlying shingles. Backed out nails not penetrating the overlying shingles should be redriven and the overlying shingle hand tabbed down. Where nails have penetrated the overlying shingles, the nails should be redriven and the overlying shingle replaced with new to match the existing.

Trees are in close proximity to the roof at the north, south, and east sides of the roof. The trees should be trimmed back away from the roof. Organic debris on the roof should be removed from the roof on a regular basis.

The low slope roof is in fair condition, and with proper maintenance, repairs, and tenant improvement should remain serviceable for 3-5 years. The roof should be reevaluated in 5 years for options for repair or replacement. A leak was reported under the low slope roof which was patched by Wayne's Roofing prior to the site visit. Following the application of roof cement further water entry was not reported.

The low slope roof should be cleaned of organic debris, and the are where roof cement was applied should be patched with an application of Alsan RS. The surface of the roof should be prepped, and the patch should extend a minimum of 6-inches in all direction away from the damaged area. The approximate area of the temporary repair is marked with a 1 on the overview photo below.

A leak (marked with a 2) was reported in an area below the transition between the skylight and steep slope roof. Application of sealant at the skylight appears to be aged indicating that water entry in this location has likely occurred multiple times. A new application of roof cement at the bottom of the skylight by Wayne's Roofing prior to this writer's site visit has reportedly stopped the water entry. The skylight panels and area below can be cleaned and prepped and an application of Alsan RS can be applied over the area as a long-term patch.

The ends of the skylight roofs are configured as clerestories with aluminum framed storefront windows set at the same height as the roofing. Sheet metal flashing extends from beneath the window frames lapping over the shingles. At the south end of the upper roof skylight the base of the window has been stripped in with fluid applied flashing similar to the recommended repair above. The fiberglass skylight panels at the upper roof are darkened and have lichen growth on them.

Damaged marblecrete at the rising walls above the lower roof areas, should be cut out and patched with new marblecrete. Holes in the soffits should be covered or patched.

Recommendations above are temporary short-term repairs. The following options for long term repairs should be considered. The options include removal of a portion of the existing decking which may require temporarily closing the library or a portion of the library.

The lower roof areas to the north and west of the second story (west half of the building) are no longer serviceable. The existing roof system, plywood, and cementitious wood fiber substrate board should be removed to expose the steel structure. Any needed repairs to the steel structure should be performed once exposed. This scope of work will create a condition where the interior under the roof areas noted will be exposed to weather.

The remaining roof areas configured with cementitious wood fiber substrate board should be addressed in the same manner as recommended above. These areas are believed to be the roof areas to the south and east of the second story west of the addition. Further exploratory openings may need to be performed to confirm the make-up of these roof areas. If a full set of as-built drawings are located those drawings may show the make-up.

At roof areas where the cementitious wood fiber substrate board is removed to expose the steel framing, new steel pan decking should be installed to create a solid continuous substrate. The design of the new steel pan decking attachment, and gauge should be performed by a Structural Engineer.

The upper roof area, the east roof areas, and the skylight roofs should be replaced with a new vented roof assembly. The existing shingles and underlayment should be removed to expose the plywood sheathing. Replace any deteriorated plywood sheathing that is found.

A new vented roof assembly consisting of the following layers from the structural steel decking up should be installed. Plywood or gypsum substrate board, self-adhered underlayment, R-38 (or local code required insulation) polyisocyanurate insulation in a minimum of 2-layers, 2x wood sleepers spaced and gapped to create cross venting, plywood sheathing, 1 layer of self-adhered underlayment and 1 layer of synthetic underlayment over the entire roof, and new shingles. Roof related sheet metal, and the external gutters should be removed and replaced with new. Existing steel decking and plywood components, where installed, can remain in place. Insulation below the roof deck should be removed.

To accommodate the thickness of the new roof system, the single pane aluminum windows at the rising wall above the lower roof should be removed and replaced with new. The marblecrete should be removed and replaced with new architectural sheet metal or fiber cement board cladding. The skylights should be replaced with new sloped aluminum framed skylights integrated into the roof system. The clerestory glazing at the ends of the skylights will need to be replaced with new smaller framed windows to accommodate the thickness of the new roof system. The new windows at the rising walls, and at the clerestories should be configured a minimum of 8-inches above the finished roof surface and properly flashed into the roof and openings.

The low slope roof should be removed and replaced with a new torch applied roof system. The system should be configured with a gypsum substrate board, self-adhered temporary roof/vapor retarder, R-38 (or local jurisdiction required insulation) polyisocyanurate insulation in a minimum of 2-layers, gypsum coverboard, a self-adhered basesheet, a torch applied midply, and a torch applied mineral surfaced capsheet. The overflow drains should be reworked and configured with a cast iron drain body integrated into the new roof assembly. Insulation below the roof deck should be removed.

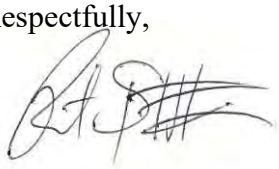
Rough order of magnitude (ROM) costs for replacement of the lower north and west roof areas only should be between $110-150 per square foot. The lower north and west sloping roof areas equate to approximately 5,800 square feet. Total pricing should be between $637,670 and $869,550. The full building has approximately 28,350 square feet of roofing. ROM costs for the full scope of work should be between $85-125 per square foot. Total pricing for the entire project scope of work should be between $2,409,750 and $3,543,750 The ROM costs do not include design costs or permitting fees.

The above recommended repairs and replacement options are extensive and general in nature. A licensed Architectural Firm should be retained to provide full design services. Wetherholt and Associates can be retained to provide consulting during design and inspection during construction. Recommended design firms can be provided upon request.

Enclosed are photographs and notes taken during our site visit for your review. These photographs and notes may provide additional information to that discussed above, and should be considered as part of this report.

We trust the above discussion has been of assistance. If you have any questions, or if we may be of further service, please do not hesitate to call.

Respectfully,



Pravat Sripranaratanakul, RRO, RRC, RWC
Senior Field Engineer
Wetherholt and Associates, Inc.

Alex Murphy, RRO
Field Engineer
Wetherholt and Associates, Inc.

Enclosures: photographs

Please note that this evaluation is provided at the request of Kristina Cintron, Pierce County Library System. No liability, warranty of merchantability, or guarantee of roofing, waterproofing, or building envelope service life is accepted or implied. Wetherholt and Associates, Inc., is a neutral roofing, waterproofing, and building envelope consulting firm specializing in resolving building envelope and moisture related issues.

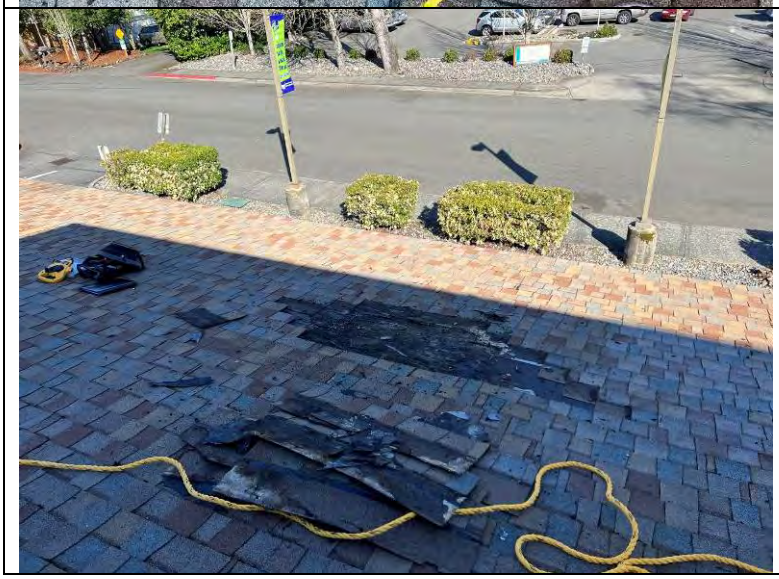
The area highlighted above are the north and west lower roof areas. The locations noted as 1 and 2 are the areas of water entry noted.

Photograph 1: Overview of the north elevation of the Lakewood Library.

Photograph 2: Overview of the area where test openings 1-3 were made by Wayne's Roofing personnel.

Photograph 3: Overview of the area where test opening 4 was made by Wayne's Roofing personnel.

	Photograph 4: Water staining at the soffit under the area where test openings were made.
	Photograph 5: Water staining at a light fixture in the soffit under the area where test openings were made.
	Photograph 6: Water staining at the soffit under the area where test openings were made.

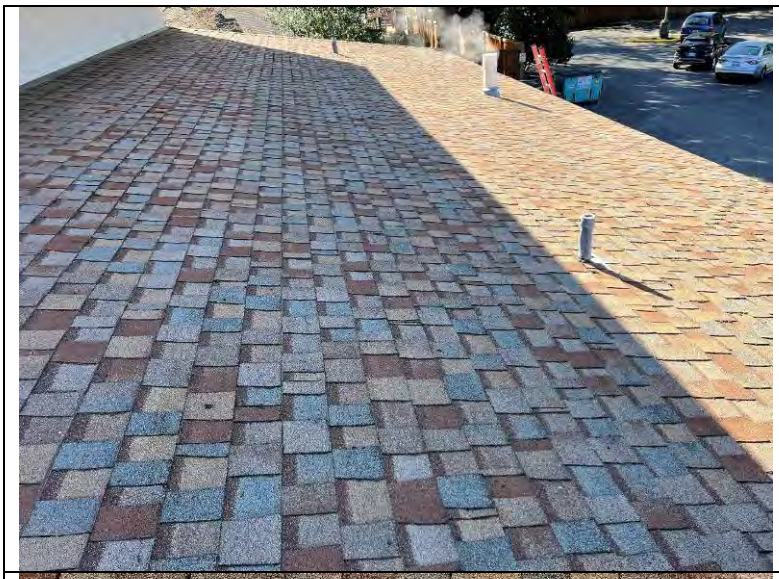
	Photograph 7: Water staining at the soffit under the area where test openings were made.
	Photograph 8: Test opening #1 was situated under the overhang from the upper roof. The plywood at this location appears light in color and solid. The underlayment was in good condition.
	Photograph 9: Overview of test opening location #2. The plywood at this location which was exposed is deteriorated and black in color. The underlayment was deteriorated.

	Photograph 10: Closer view of the area shown in Photograph 9.
	Photograph 11: Overview of opening location #3.
	Photograph 12: Closer view of the area shown in Photograph 11. Note the plywood sheathing and cementitious wood fiber are deteriorated.

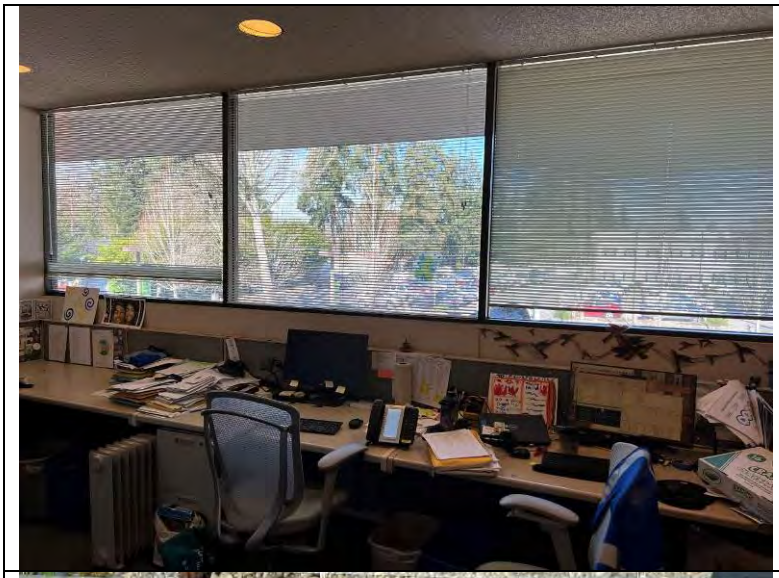
	Photograph 13: Portion of the cementitious wood fiber substrate was removed to provide visual access to the structure below. Note the cementitious wood fiber substrate board is deteriorated.
	Photograph 14: Closer view of the cementitious wood fiber substrate board at the test opening.
	Photograph 15: Asphaltic membrane with a polyethylene surfacing. The asphaltic membrane was situated over the cementitious wood fiber substrate board.

	Photograph 16: Alternate view of test opening #3.
	Photograph 17: Overview of test opening #4.
	Photograph 18: Cementitious wood fiber substrate board removed at test opening #4. Similar to test opening #3 the cementitious binder has washed away and only the wood fibers remained.

	Photograph 19: Closer view of test opening #4 showing the deteriorated cementitious wood fiber substrate board.
	Photograph 20: Alternate view of the area shown in Photograph 19.
	Photograph 21: Temporary roof repairs were made with self-adhered membrane integrated into the shingles in a water shedding manner. In locations where the plywood sheathing and cementitious wood fiber substrate board were deteriorated and could not support weight new plywood was placed over the opening prior to placing the patch. Where previously installed the tarp was repositioned.

	Photograph 22: Looking laterally across the Tamko architectural laminate shingles.
	Photograph 23: Closer view of the Tamko architectural laminate shingles.
	Photograph 24: Tamko label on the backside of one of the removed shingles.

	Photograph 25: Slight curling or cupping of the Tamko shingles was observed in various areas of the roof.
	Photograph 26: Looking east along the rising window wall at the north sloping roof area.
	Photograph 27: Windows at the upslope edge of the north sloping roof area. The windows sit less than 5-inches above the surface of the roof.

	Photograph 28: Windows shown in Photograph 27 as seen from the interior.
	Photograph 29: Closer view of the base of the windows shown in Photograph 27.
	Photograph 30: Closer view of the bottom of the windows shown in Photograph 27 as seen from the interior.

	Photograph 31: Typical marblecrete clad rising wall above the lower roof. The marblecrete comes down to the surface of the roof and transitions to the roofing with sheet metal flashing.
	Photograph 32: Roof to wall transition along a rake wall. The apparent different color in the marblecrete indicates that the marblecrete was reworked. The flashing height at this location differs from areas where the marblecrete was not reworked.
	Photograph 33: Closer view of the headwall flashing.

	Photograph 34: Typical pipe penetration flashed with a lead penetration flashing.
	Photograph 35: Cracked marblecrete at a rising wall corner transition.
	Photograph 36: Closer view of the damage shown in Photograph 35.

	Photograph 37: Closer view of the area shown in Photograph 35. Damage is likely due to age, settling, and differential movement.
	Photograph 38: Sheet metal cover over an area dividing wall. This is situated at the transition between the original building and the 1974 expansion.
	Photograph 39: Closer view of the sheet metal cover shown in Photograph 38.

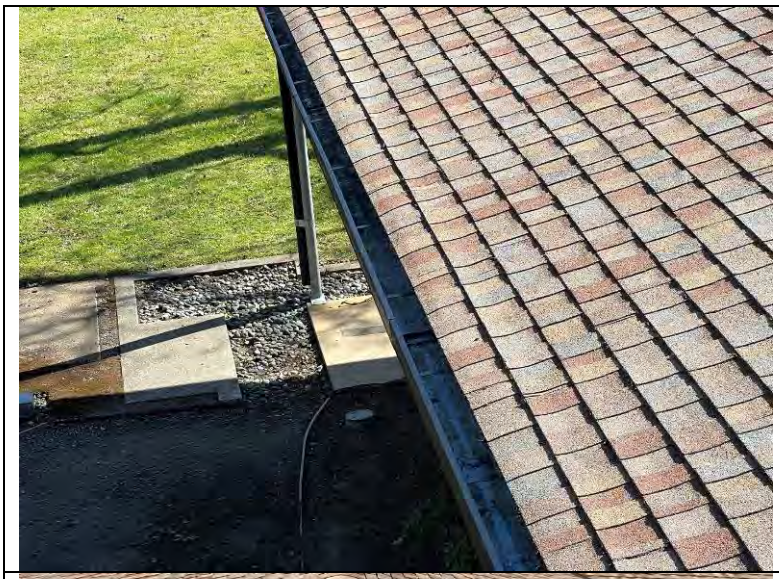
	Photograph 40: Overview of the south sloping roof and trees within close proximity of the roof.
	Photograph 41: Low roof to high roof transition at the translucent skylight panels.
	Photograph 42: Dead valley with mineral surfaced capsheet in the valley. Water drains through the channel indicated by the arrow. Note the valley lacks slope to drain and leaves are collecting in the dead valley.

	Photograph 43: Steep slope to low slope roof transition. The leading edge of the shingle roof is terminated with sheet metal flashing.
	Photograph 44: Opening in the roof at the north central side of the roof. The roof slopes to the draining edge and exterior hung gutter.
	Photograph 45: Roof to clerestory transition. Sheet metal flashing appears to be integrated under the clerestory windows. Note the clerestory windows sit at the same level as the roof.

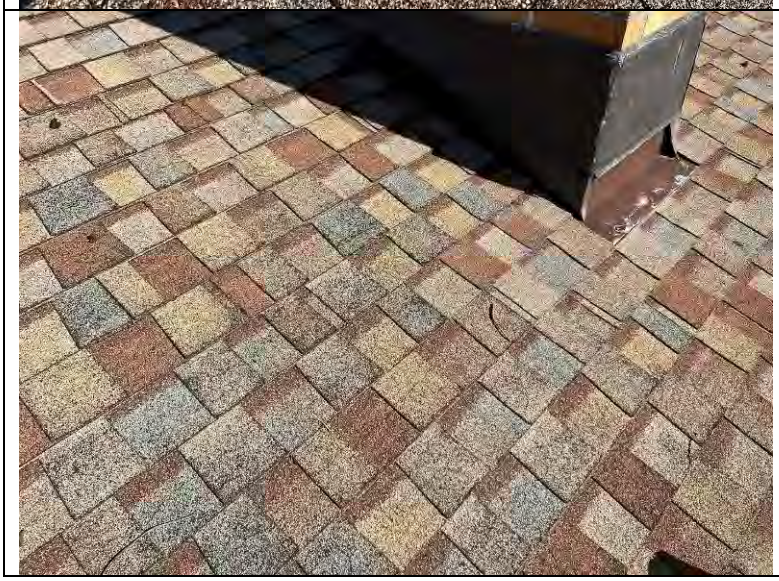
	Photograph 46: Hip condition, roofed with hip shingles. Note the backed-out nails (highlighted).
	Photograph 47: Closer view of the backed-out nails. Note Wayne's Roofing personnel drove the nails in and applied roof cement over the nail heads as a temporary measure.
	Photograph 48: Closer-up view of the backed-out nails.

	Photograph 49: Typical valley at the lower roofs configured with a sheet metal valley flashing.
	Photograph 50: Closer view of the sheet metal valley flashing.
	Photograph 51: Overview of a leak location temporarily sealed by Wayne's Roofing.

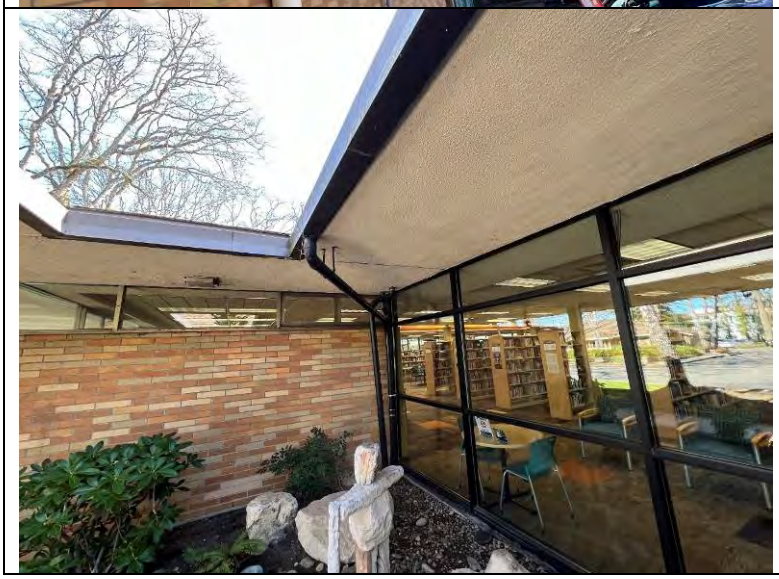
	Photograph 52: Closer view of the area shown in Photograph 51. Roof cement appears to have been applied in response to the previous water entry.
	Photograph 53: Sealant at this location is older and was likely applied in response to previous water entry.
	Photograph 54: Area below the area circled in Photograph 51. Arrows indicate apparent water staining on the ceiling.

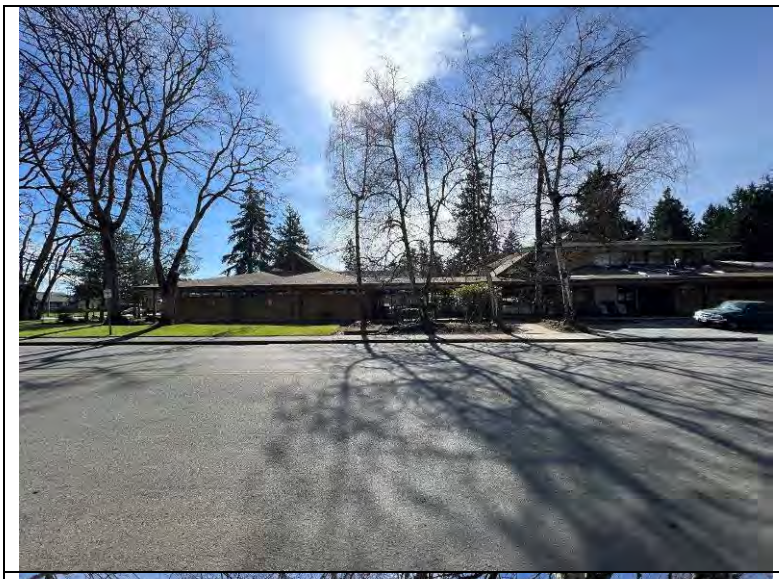
	Photograph 55: Typical drainage detail with external hung gutter.
	Photograph 56: Ridge to hip transition.
	Photograph 57: Chimney penetration flashed with sheet metal flashing.

	Photograph 58: Closer view of the chimney penetration shown in Photograph 57.
	Photograph 59: Trees in close proximity to the roof along the south side of the roof.
	Photograph 60: Trees in close proximity to the roof along the south side of the roof.

	Photograph 61: At the south sloping roofs, the mineral granules are eroding from the surface of the shingles.
	Photograph 62: Closer view of the surface of the shingles.
	Photograph 63: Alternate view of an area with displaced mineral granules.

	Photograph 64: Cracked shingles at the south sloping roof. (Arrows)
	Photograph 65: Boiler vent penetration. The PVC penetration is flashed with a b-vent, with a storm collar above the flashing. The storm collar is rusty.
	Photograph 66: Splash pad beneath the downspout from the upper roof.

	Photograph 67: Equipment mounted to the exterior wall through the marblecrete. The fastener penetrations are not sealed.
	Photograph 68: Damaged gutter (arrow) at the west side of the roof.
	Photograph 69: Gutter downspout.

	Photograph 70: Overview of the east end of the north elevation. This area appears to be the 1974 addition.
	Photograph 71: Area to the left of the red line appears t be the 1974 addition.
	Photograph 72: Overview of the repairs at the test openings.

Photograph 73: Overview of the low slope roof.

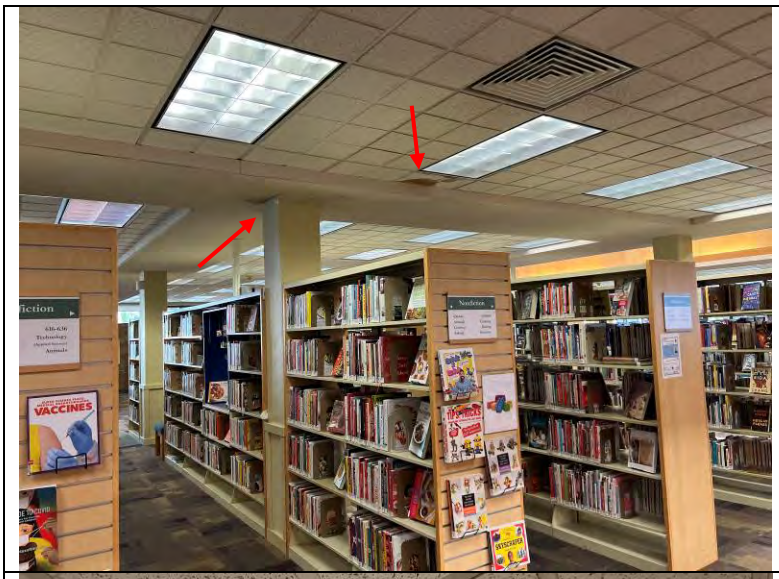
Photograph 74: Typical cast iron roof drain and adjacent contractor style overflow (arrow).

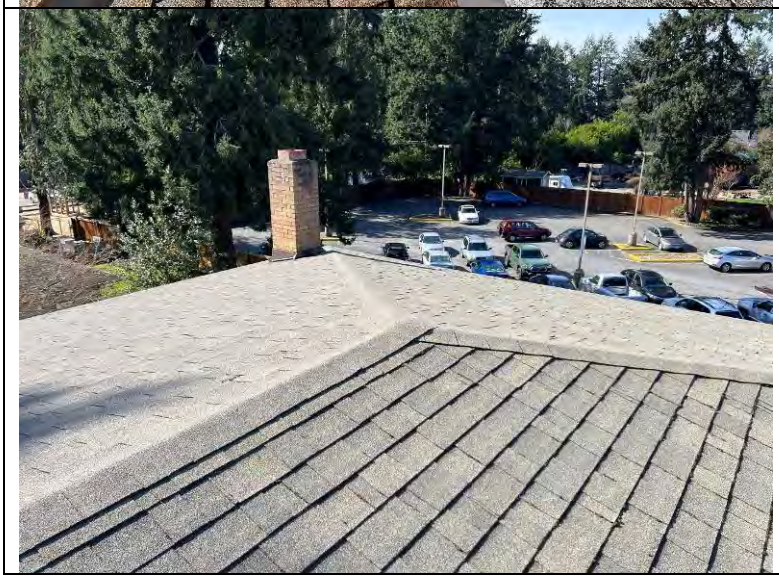
Contractor style overflows consist of a pipe stubbed above the roof flashed into the roof with a lead flashing.

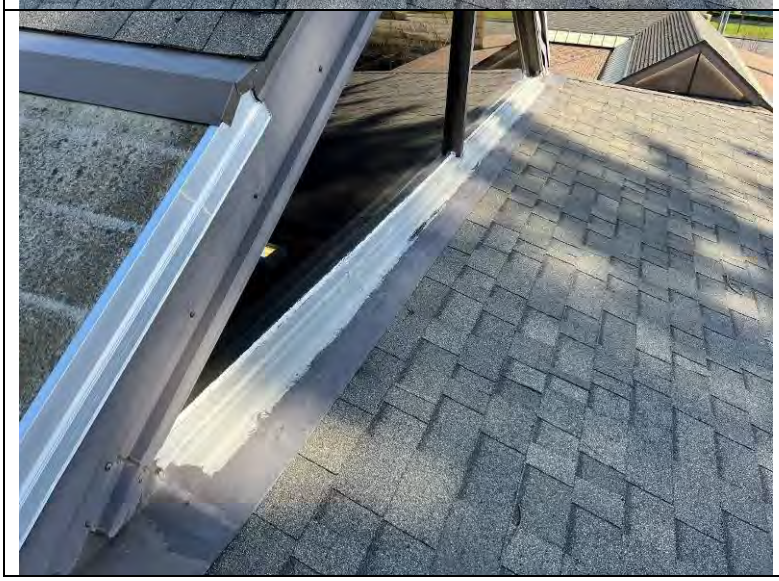
Organic debris is collecting on the surface of the roof.

Photograph 75: Closer view of a cast iron roof drain and contractor style overflow (arrow).

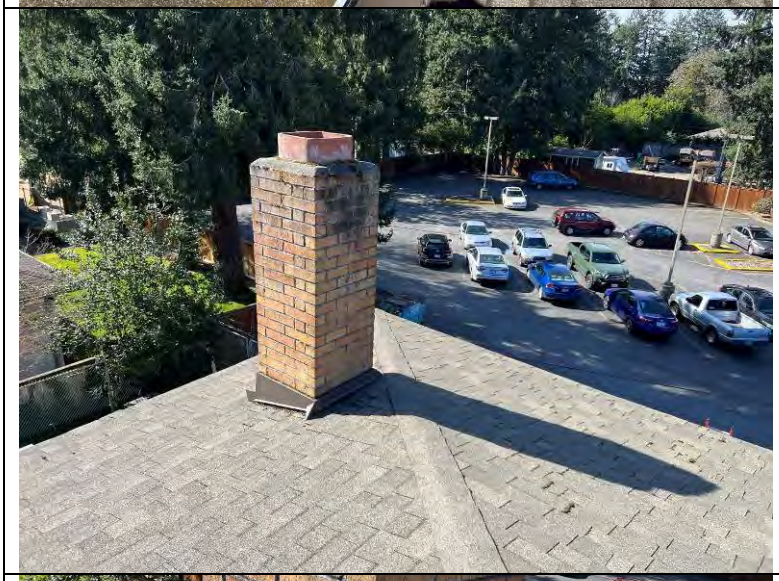
	Photograph 76: Closer view of the contractor style overflow.
	Photograph 77: Roof cement patch over an apparent location of damage.
	Photograph 78: Closer view of the roof cement patch circled in Photograph 77. Note the repair was performed by Wayne's Roofing in response to previous water entry.

	Photograph 79: Approximate area beneath the roof cement patch shown in Photographs 77 and 78.
	Photograph 80: Closer view of stained ceiling tiles shown in Photograph 79.
	Photograph 81: Closer view of the stained ceiling in the general area shown in Photograph 79.

	Photograph 82: Steep slope to low slope roof transition.
	Photograph 83: Closer view of the steep slope to low slope transition.
	Photograph 84: Overview of the upper roof.

	Photograph 85: Typical closed cut valley at the upper roof.
	Photograph 86: Roof to skylight transition.
	Photograph 87: Roof to clerestory transition. Note the fluid applied flashing at the base of the window. It is likely the fluid applied flashing was applied in response to water entry.

	Photograph 88: Overview of the skylights at the upper roof. Note the lichen growth on the surface of the skylight lenses.
	Photograph 89: Moss growth along the perimeter of the shingles.
	Photograph 90: Alternate view of the moss growth at the upper roof.

	Photograph 91: Looking laterally across the skylight. The skylight lens is discolored and has lichen growing on it.
	Photograph 92: Chimney penetration at the upper roof.
	Photograph 93: Closer view of the sheet metal chimney flashing.

	Photograph 94: Typical pipe penetration flashed with a lead.
	Photograph 95: Typical roof vent stripped into the shingle roof.
	Photograph 96: Closer view of the roof vent shown in Photograph 95.

	Photograph 97: Pipe penetration flashed with a lead flashing. Note the lead flashing does not extend to the top of the penetration and is topically sealed with sealant.
	Photograph 98: Draining edge and gutter at the upper roof.
	Photograph 99: Closer view of the gutter and draining edge shown in Photograph 98.

	Photograph 100: Downspout and splash pad. Repair to the marblecrete can be seen in the background of the photo. The darker colored marblecrete is the newer patched areas.
	Photograph 101: Eave edge without a gutter.
	Photograph 102: Soffit above the low roof. Arrow indicates a hole in the soffit.

	Photograph 103: Closer view of the hole indicated by the arrow in Photograph 102. Holes in the soffit should be covered to prevent rodent or insects from entering into the building.
	Photograph 104: Damaged shingle at the eave edge.
	Photograph 105: Arrow indicates an apparent nail backing out and lifting the overlying shingle.