Drainage Materials for Garden Roofs

RCI Region VI Meeting

Green Roof Issues

Gerson Bers

November 10, 2004

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Karim P. Allana, PE, RRC, RWC

- **Education:** B.S., Civil Engineering, Santa Clara University
- **Registration:** P.E., Civil Engineering, California, Washington, Nevada, and Hawaii
- **Certification:** Registered Roof Consultant (RRC), Roof Consultants Institute, and Registered Waterproofing Consultant (RWC)
- **Overview:**
  - CEO and Senior Principal at Allana Buick & Bers.
  - Former Turner Construction Employee (Project Engineering and Superintendent)
  - Over 37 years experience providing superior technical standards in all aspects of building technology and energy efficiency.
  - Principal consultant in forensic investigations of building assemblies, failure analysis, evaluation and design of building infrastructure and building envelope evaluation and design.
  - Expert in all aspects of building envelope technology.
  - Completed numerous new construction, addition, rehabilitation, remodel and modernization projects for public and private sector clients.
  - Specialization in siding, roofing, cement plaster, wood, water intrusion damage, window assemblies, storefronts, below grade waterproofing, energy efficiency, solar engineering and complex building envelope and mechanical assemblies.

ABBAE Firm Overview

- Allana Buick & Bers (ABBAE) is an Architectural Engineering firm specializing in Building Envelope Systems
- ABBAE is one of the 5 largest building envelope consultants in the country
- ABBAE has over 33 years of experience & over 12,500 projects
- ABBAE is also a leading Forensic Defect firm with hundreds of forensic projects (litigation)
- Locations – 16 offices across California, Nevada, North Carolina, Oklahoma, Oregon, Texas, Virginia, Washington, Colorado and Hawaii

Staff & In-House Expertise

- Licensed Professional Engineers – Civil, Structural, and Mechanical
- Registered Architects
- Building Enclosure Commissioning Process Providers (BECxPs)
- Registered Building Envelope Consultant (RBEC)
- Registered Roofing Consultants (RRCs)
- Registered Waterproofing Consultants (RWCs)
- Registered Exterior Wall Consultant (REWCs)
- Registered Roof Observers (RROs)
- Certified Exterior Insulation and Finish System (EIFS) inspectors
- Curtain Wall Specialists
- ICC Certified Building Inspectors
- Quality Assurance Monitors
- Water Testing Experts
- Leak Investigation and Diagnosis Experts
- Infrared Imaging and Nuclear Moisture Scanning Experts

ABBAE Building Expertise

- Building Envelope Systems
  - Roofing Systems
    - High-Slope/Low-Slope Roofs
    - Green/Garden Roofs
    - Drainage Systems
    - Pedestrian Plazas
  - Exterior Wall Systems
    - Wall Cladding/Siding/GFRC/pre-cast
    - EIFS/cement plaster/stucco
    - Sheet Metal Flashings
  - Windows and Glazing Systems
    - Punched Windows
    - Curtain Wall/Window Wall Systems
    - Sliding Glass Doors
    - Skylights

- Building Envelope Systems (cont'd)
  - Roofing & Waterproofing Systems
    - Deck/Balcony/Lanai Waterproofing
    - Podium Waterproofing
    - Pool/Spa Deck Waterproofing
    - Above-Grade/Below-Grade Waterproofing
    - All types of low and steep sloped roofing
  - Commissioning BECx
    - OPR/BOD/Commissioning Plan
- Mechanical/HVAC Systems
  - HVAC design
  - Plumbing systems
  - Commissioning and testing

ABBAE Core Services

- Consulting and third-party peer review services
- Engineer of record for building envelope systems
- Contract administration services
- Inspection services (usually direct with owner)
- Air and water performance testing
- Mock-up design, observation, and testing
- Building assessments and forensic investigations
- Litigation support and expert witness services
- Educational seminars with AIA credits

Overview

- Definitions
- Code Issues
- Surface Drainage
- Under Garden Drainage
- Final Thoughts…
- Q&A

Garden Roof Drainage

- Managing *excess* rain and irrigation water from the garden roof *system* to an appropriate building exterior outlet.
- Water introduced into the garden roof system that is *not required* to maintain the living system.
- Includes *both* surface drainage and under garden drainage.

Garden Roof Drainage and Building Codes (UBC-1997)

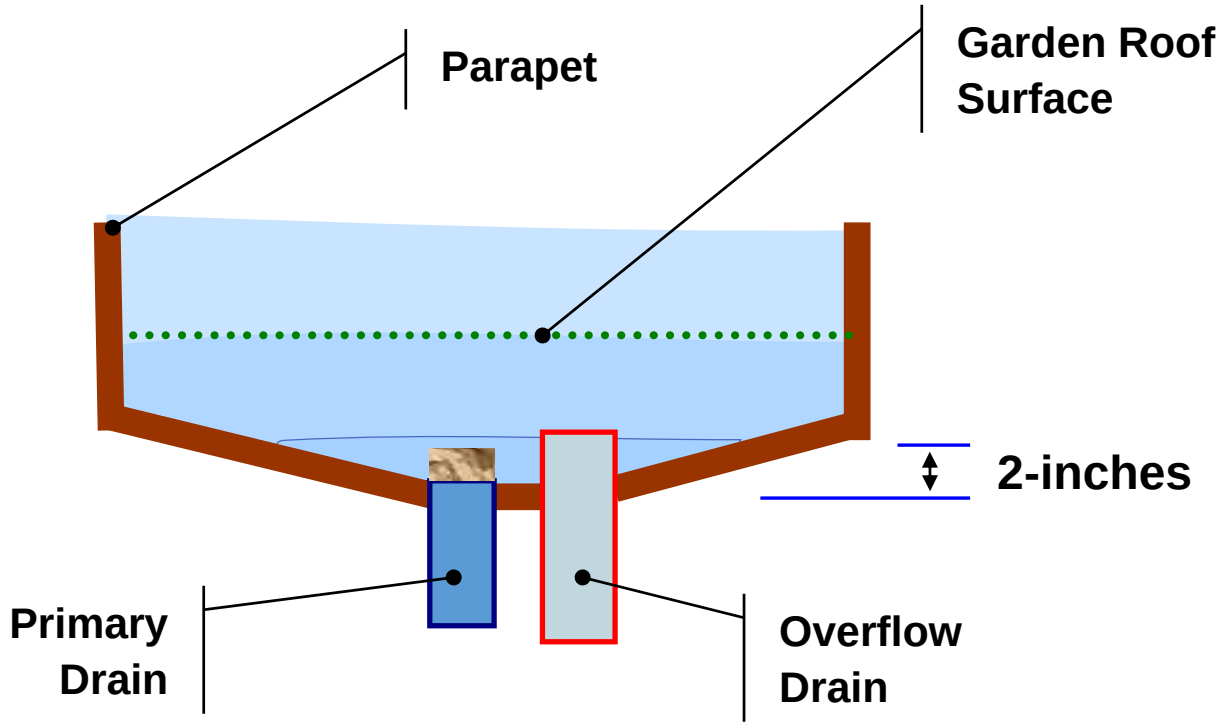
- 1506.0: Roof Drainage
- 1506.1: General
  - … “1 unit vertical in 48 units horizontal (2% slope) for drainage.”
  - *Unless*… “designed for water accumulation per Section 1611 *and* approved by building official.”
- 1506.2: Roof Drains
  - “Unless roofs is sloped to drain over roof edges, roof drains shall be installed at *each low point* of the roof.”
  - “Roof drains shall be sized and discharge in accordance with the Plumbing Code.”

Garden Roof Drainage and Building Codes (UBC-1997)

- 1506.3: Overflow Drains and Scuppers
  - "Where roof drains are required, overflow roof drains having the same size as the roof drains shall be installed with the inlet flow line located 2-inches above the low point of the roof…"
  - "*or*, overflow scuppers having three times the size of the roof drains and having the a minim opening height of 4-inches may
    be installed in the adjacent parapet walls with the inlet flow line
    2-inches above the low point of the adjacent roof."

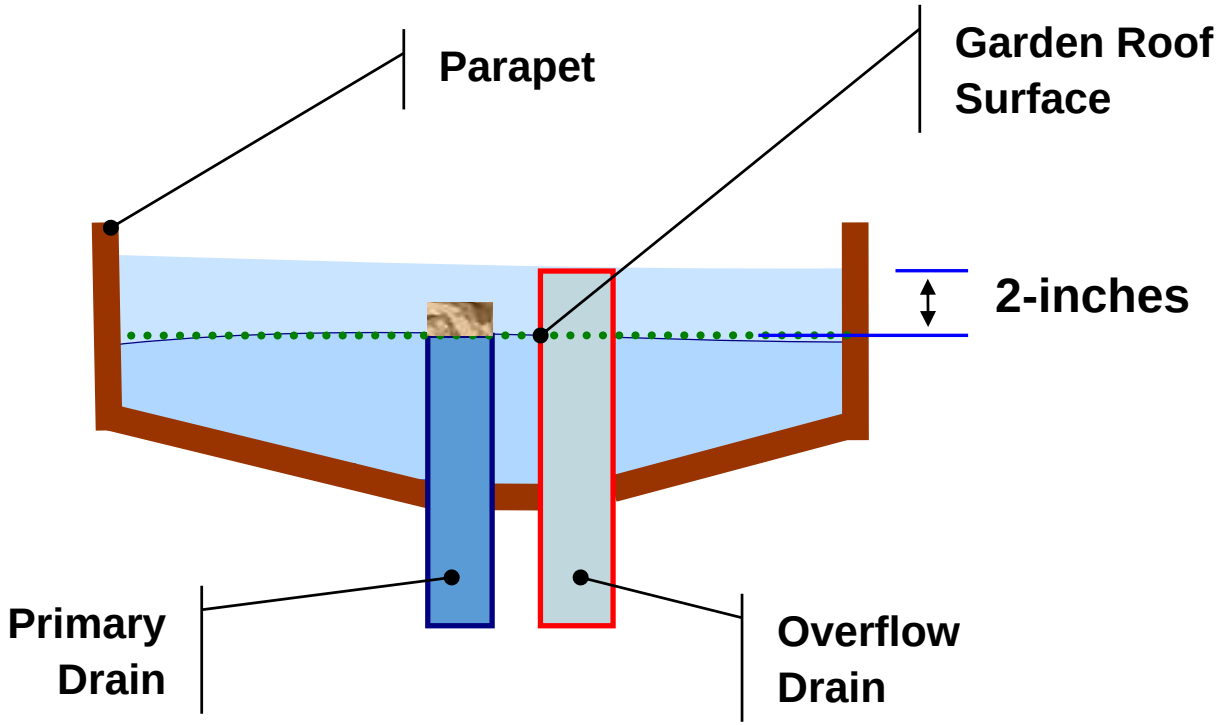
Garden Roof Drainage and Building Codes (UBC-1997)

Drainage at Roof Surface??



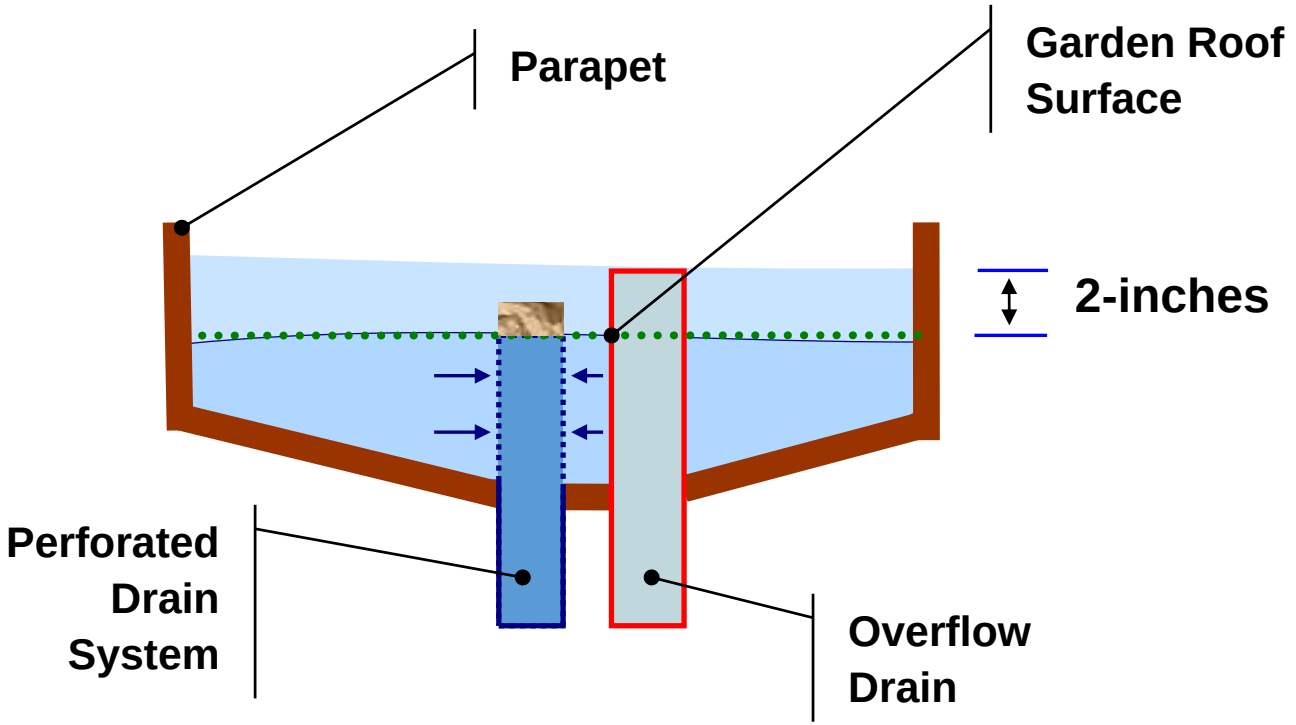
Garden Roof Drainage and Building Codes (UBC-1997)

Roof Drainage at Garden Surface??



Garden Roof Drainage and Building Codes (UBC-1997)

Drainage at Roof & Garden Surface ??



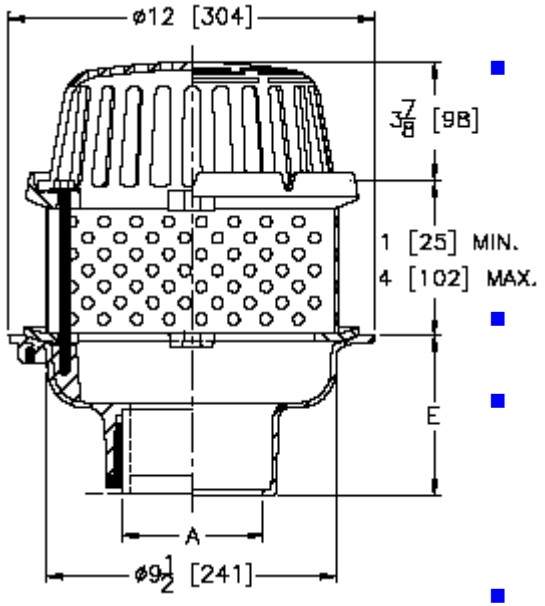
Garden Roof Drainage and Building Codes (UBC-1997)

- Remember 1506.1 General ???
- Unless… “designed for water accumulation per *Section 1611 and* approved by building official.” UBC 1997 1611.7
- The garden roof structure *must* be capable of supporting a dead load of the entire garden system *completely saturated* with water *and* an additional *2-inches* of standing surface water.

Surface Drainage

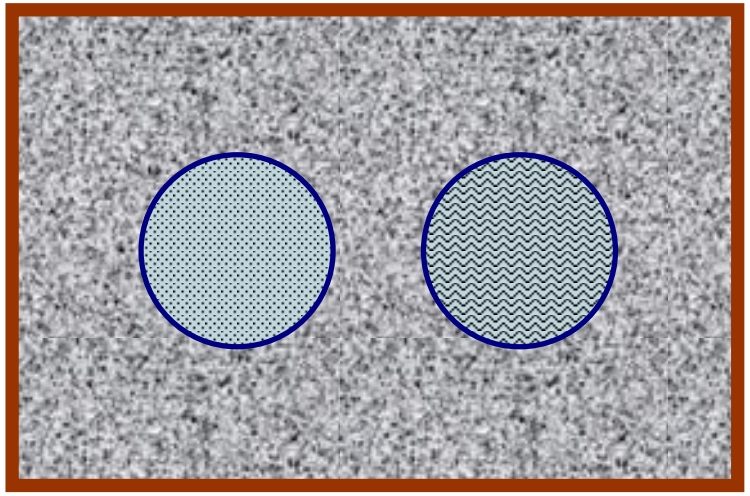
- Slope planting medium to surface drain inlets.
- Coordinate drain locations with landscape plan.
- Do not plant material with growth behaviors that can block drain inlets.
  - Trailing vines
  - Overhanging bushes
  - Debris generating plants

Surface Drainage



- **Typical primary roof drain for garden roof with perforated depth extension.**
- **Zurn Z-121 or similar.**
- **Wrap the perforated sleeve with geotextile filter fabric!**
- **Use all stainless hardware.**

Surface Drainage



- Use a 2 to 3-inch poorly graded gravel around the drains as a preliminary strainer.
- Confine gravel within open box fabricated from Trex or similar rot resistant material.
- Combine the primary and overflow drains in one location.

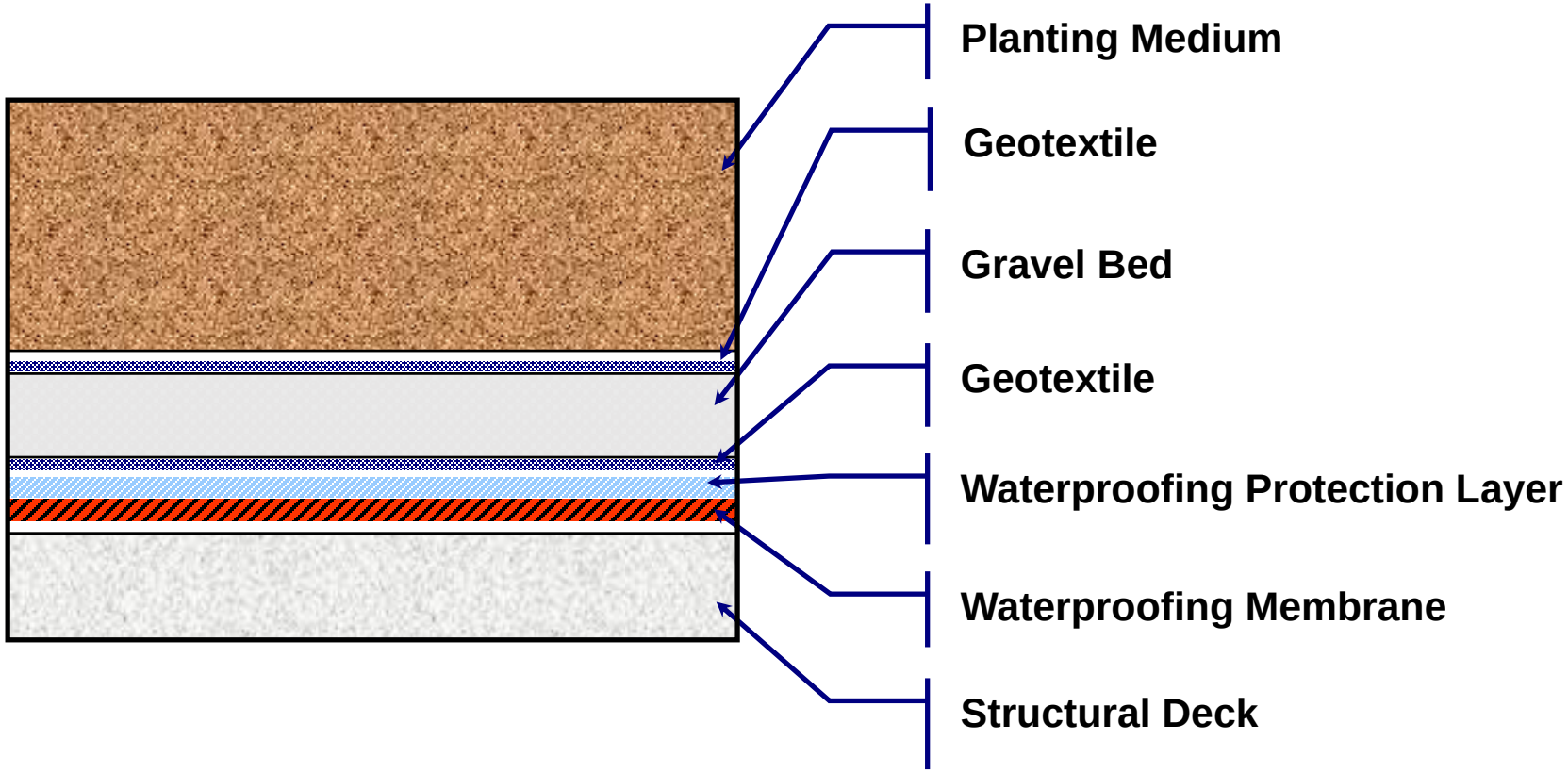
Under Garden Drainage

- Gravel Beds with Geotextile Protection
- Moisture Retention/Drain Systems
- Drainage Composites

Under Garden Drainage

- Gravel Beds with Geotextile Protection
  - Rounded 2 to 6-inch beds of poorly graded, washed 2 to 3-inch gravel.
  - Cover beds with geotextile fabric to prevent soil fines from filling the gravel pores and discourage root growth.
  - These are heavy relative to other options and therefore rarely used.
  - River washed rounded aggregate difficult to obtain in many parts of the U.S.

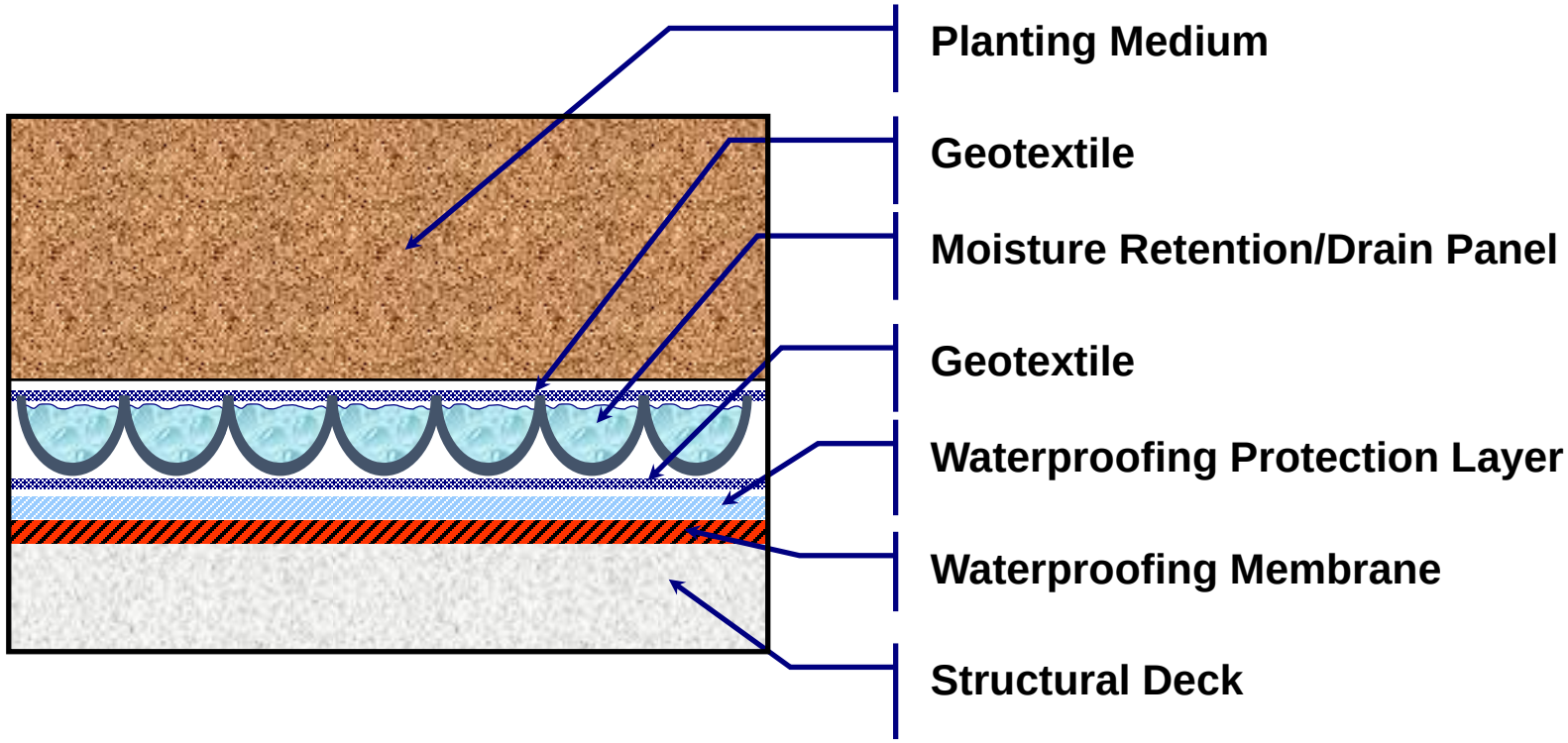
Gravel Drainage Bed



Under Garden Drainage

- Moisture Retention/Drain Systems
  - Formed plastic mats with water reservoir cups on upper surface and drainage path below .
  - High compressive strength.
  - Specific to each garden system and manufacturer.
  - Must have geotextile protection to prevent fines from filling drainage path and reservoir cups.

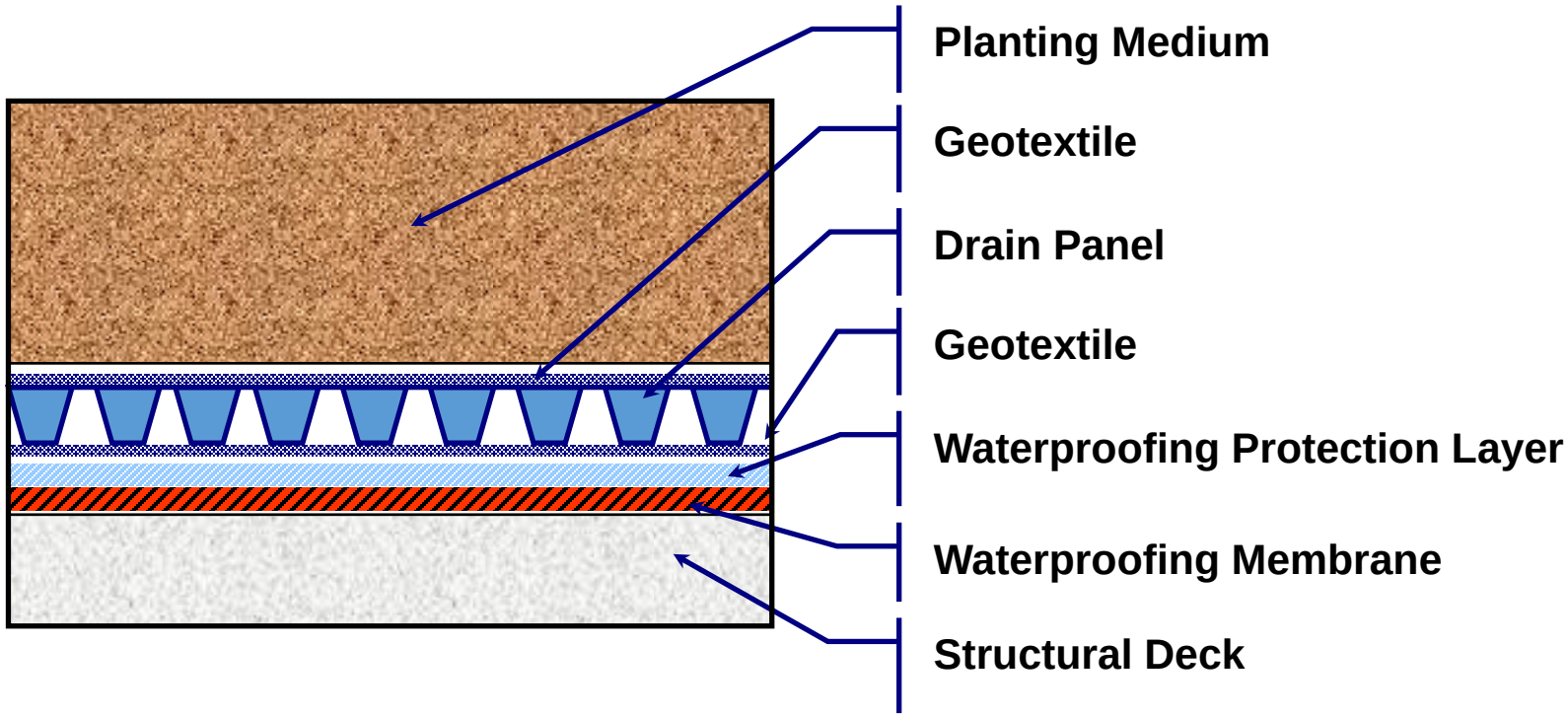
Moisture Retention System



Under Garden Drainage

- Drainage Composites
  - Formed rigid plastic mats that create a free drainage corridor.
  - High compressive strength.
  - Must have geotextile protection to prevent fines from filling drainage path.

Drainage Composite System



Final Thoughts…

- Have a drain cleanout available near each drain riser and make it easily accessible.
- Test the drain system prior to installing overburden.
- Select plant materials carefully.
- Encourage others to install garden roofs.

With thanks to the following Allana Buick & Bers, Inc. staff:

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