

# Drainage Plane Remediation

Applebrook Carriage Homes

Lot 28

323 Applebrook Drive





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# Overview of Findings

Beginning in October, 2004 it was discovered that there were damages from water infiltration in many of the homes throughout the Applebrook Carriage Home community. While testing revealed that some homes had no apparent damages, a thorough investigation was undertaken by the Carriage Home Builders field and management teams working in conjunction with a building science consultant and a professional engineer.

The most significant issue uncovered was at the exterior wall claddings, revealing some instances where the stucco subcontractor had utilized a non-specified type of asphaltic felt assembly as a weather resistant barrier underlayment. Destructive testing (stucco removal) revealed degradation of the asphaltic felt, thus allowing moisture infiltration.

Several minor issues were also encountered, including:

Exterior wall cladding revealed instances of workmanship defects where the through wall window flashings had been compromised during installation of the weather resistant barrier underlayment. The compromise resulted from mechanics using the outer edge of the flat window casings as a straight edge to guide a utility knife while cutting the asphaltic felt. The window flashings were cut along with the felt, thus compromising the drainage plane.

Exterior wall cladding revealed instances of workmanship defects where the asphaltic felt utilized as a weather resistant barrier underlayment was installed on top of the through wall flashings at the bottoms of windows. Incorrectly lapping the plies from one successive flashing to the next channeled water behind the asphaltic felt and onto the OSB sheathing.

Exterior wall cladding revealed instances of workmanship defects where the asphaltic felt utilized as a weather resistant barrier underlayment was installed on top of terminal step flashings at the intersection of roofs to side walls.



# Investigation Protocol

The following protocol for testing for moisture infiltration was developed with the assistance of industry experts. This protocol was used for testing each of the homes at the Applebrook Carriage Home community.

## Procedure

- Trained QA mechanic, project superintendent and/or the third party engineer with moisture meter, digital camera, drill, sealant, stucco and log sheet.
- An electric resistance moisture meter equipped with deep-wall-probes fitted to a slide type hammer is used to test all pre-determined locations.
- Two approximately 3/16" diameter blind holes are bored through the cladding to access the underlying substrate.
- After testing is completed the bottom of the blind test holes are filled with gun grade sealant and the balance of the hole is patched with a finish material and texture to match the adjacent surface as closely as possible.
- Reduced (11"x17") copies of exterior elevations for each model are used to record the exact locations of deep-wall-probe test locations and the moisture content.
- A spread sheet with the specific unit number and Owner formatted by elevation and location is used to log moisture test results.
- Remove individual sections or portions of areas clad in vinyl siding for inspection.
- Inspect existing Tyvek House Wrap for the following: contiguous coverage of the OSB sheathing, correct lapping of successive courses to ensure a weathering assembly, correct integration of House Wrap with window sill flashing at through wall penetrations, accidental tears, damage or large penetrations.
- Selective removal of the flat PVC window/door casings allows limited but finite inspection and testing of the underlying through wall flashings, their condition and integration with weather resistant barrier underlayments and direct access to the OSB sheathing. Selective casing removal will be undertaken at the discretion of the testing mechanic, the project superintendent and/or the third party engineer.

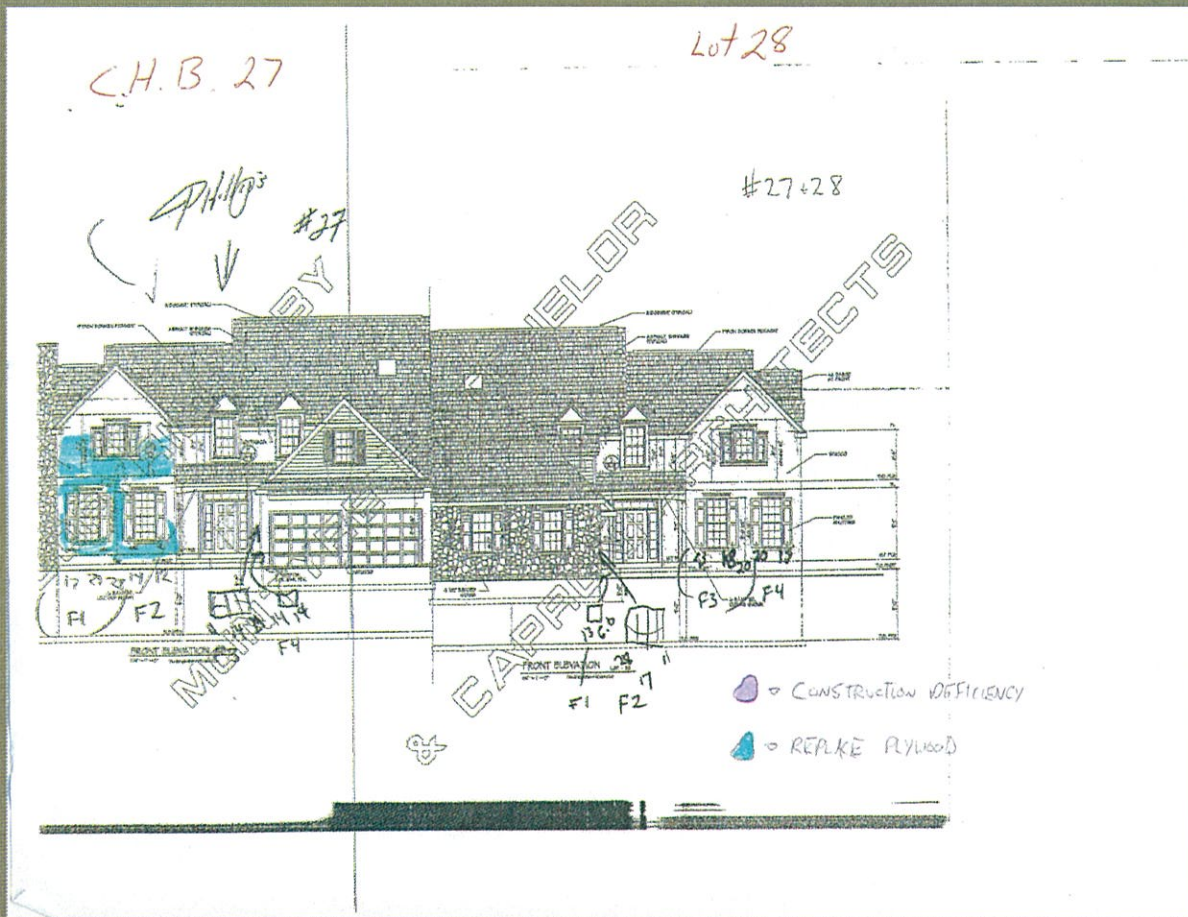
## Actions

- If moisture readings in substrate test specimens are generally 19% or greater, the Applebrook Drainage Plane Remediation Scope of Work will be applied to the dwelling.
- If moisture readings in substrate test specimens are generally 18.9% or less, then the Supplemental Exterior Cladding Surface Caulking/Sealing Program Scope of Work will be applied to the tested dwelling.
- If any deficiencies are detected in vinyl siding clad walls, repairs will be applied as directed in the specified scope of work.



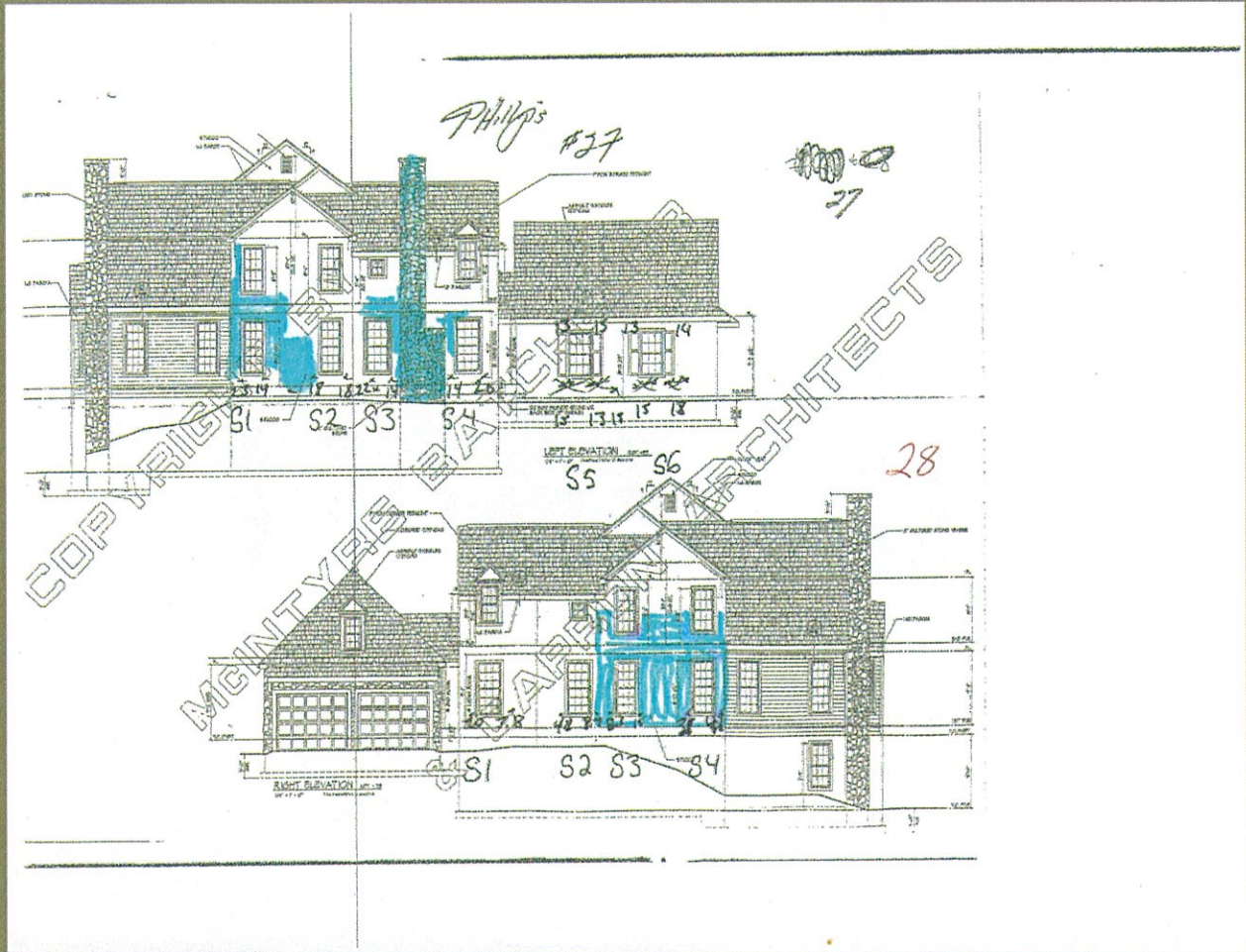
# Test Results

## 323 Applebrook Drive



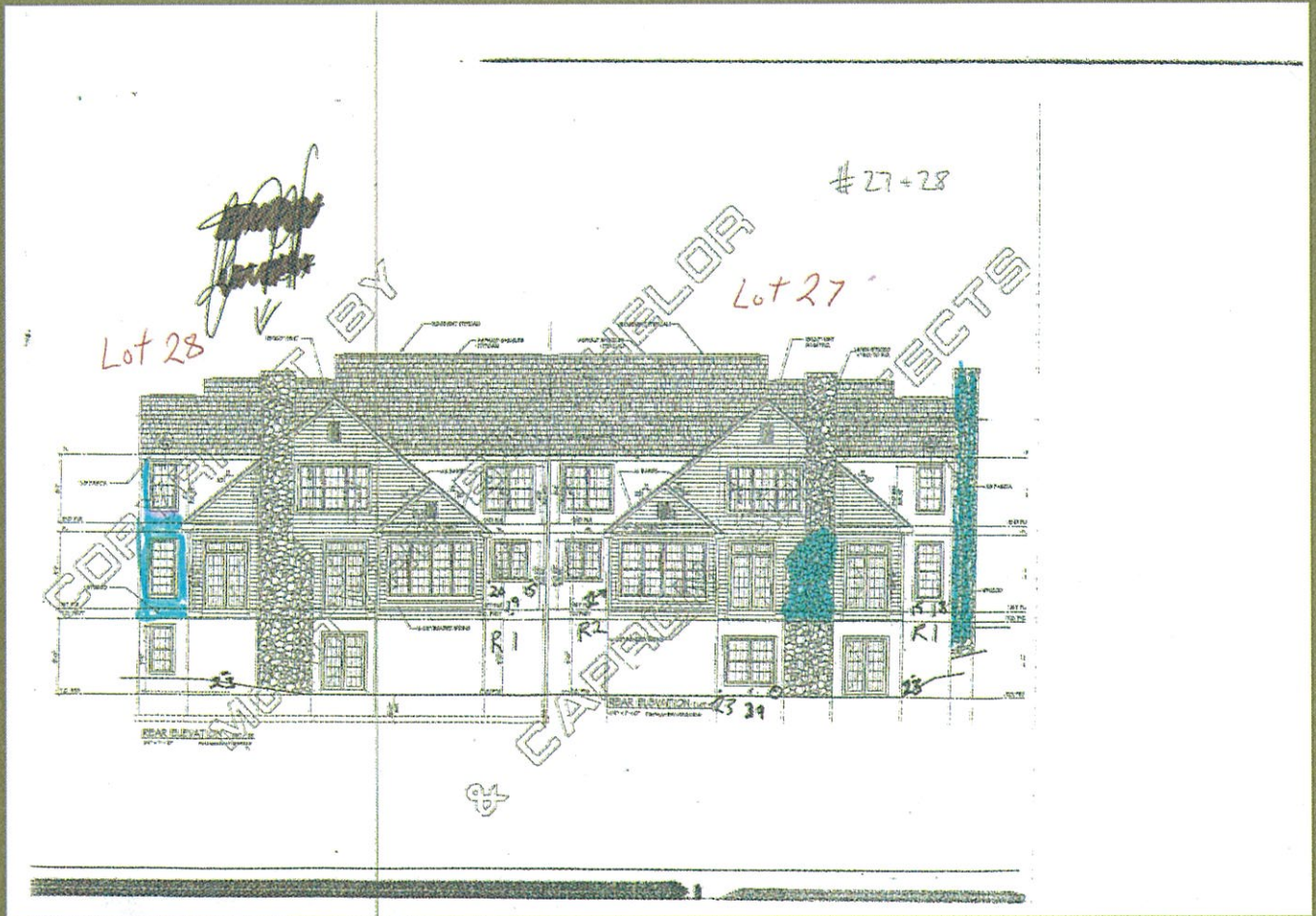


# Test Results (contd.)





# Test Results (contd.)





# Drainage Plane Remediation

## Scope of Work

323 Applebrook Drive

### OVERVIEW

#### General

The specific Drainage Plane Remediation is intended to replace the existing drainage plane with a composite drainage plane constructed using one layer of Tyvek Stucco Wrap overlaid with a double layer of #15 asphaltic felt. Existing through wall flashings are to be amended as delineated herein. The new composite drainage plane is to be integrated with existing amended through wall flashings.

This scope includes inspection and repair if necessary of the DuPont Tyvek House Wrap underlayment behind existing vinyl siding clad wall surfaces.

All stucco work is to meet or exceed the requirements of The Portland Cement Plaster Stucco Resource Guide as published by the Northwest Wall and Ceiling Bureau and the Stucco Manufacturers Association hereinafter referred to as (NWCB) and ASTM C 926 - 98a.

#### Third Party Inspections

Three engineering inspections are required as follows:

**Phase I Inspection- Flashing & Underlayment:** Independent Engineer shall inspect the installation and integrity of the drainage plane and flashing components. Inspection occurs before start of lath, casing bead and trim accessory joints.

**Phase II Inspection-Stucco Preparation:** Independent Engineer shall inspect the installation of lath, casing beads and control joints. Inspection occurs before the start of scratch coat stucco.

**Phase III Inspection-Final:** Independent Engineer shall inspect dwelling after completion of all stucco and caulking.



# Drainage Plane Remediation Scope of Work (contd.)

## PREPARATION

### **Mobilize**

### **Plant Removal & Storage**

Photograph foundation plantings, remove foundation plantings and transport to temporary storage.

### **Temporary Protection (Ground & Adjacent Surfaces)**

Cover Perimeter Foundation (runs concurrent with Appurtenance Removal & Scaffold Erection).

Excavate adjacent to perimeter of foundation, 4" deep x 12" wide for stucco removal/replacement.

Install OSB around perimeter of foundation, plastic sheeting and tarpaulins if applicable.

Furnish/install tarpaulin/OSB protection over existing asphalt driveway.

### **Appurtenance Removal**

Gutters and Downspouts removed as necessary to expedite the work.

Shutters removed.

Address plaques removed.

Exterior lighting fixtures removed.

Porch post removed adjacent to sidewalk.

All appurtenances to be stored on-site or in garage area as directed by CHB.



# Drainage Plane Remediation Scope of Work (contd.)

## **Scaffold Erection**

Furnish and erect scaffold, planking, leveling jacks, outriggers, ladders and safety rails in sufficient quantities to expedite the work.

## **Temporary Protection (Windows, Mechanical Systems & Roofing)**

Cover windows with polyethylene sheeting taped to window and OSB nailed off to existing window casing.

Cover electric meter, gas meter and HVAC equipment with OSB.

Also may include No.15 felt and/or painter's tarps on roof rakes adjacent to sidewalls where stucco will be removed.

# EXTERIOR CLADDING REMOVAL, REPAIR AND REPLACEMENT

## **Vinyl Siding Clad Walls**

Remove individual sections or portions of areas clad in vinyl siding for inspection.

Inspect existing Tyvek House Wrap for the following:

- Contiguous coverage of the OSB sheathing.

- Correct lapping of successive courses to ensure a weathering assembly.

- Correct integration of House Wrap with window sill flashing at through wall penetrations.

- Accidental tears, damage or large penetrations.

Repair accidental tears or damage with Tyvek Tape.

Remove and replace existing Tyvek House Wrap with new Tyvek House Wrap if incorrectly lapped or not applied as a contiguous underlayment.



# Drainage Plane Remediation Scope of Work (contd.)

## **Stucco / Cultured Stone Removal**

Grinder/Stucco/Cultured Stone.

    Cut stucco 8" away from chimneys and corners.

Ripper/Stucco/Stone (Mechanic with ripper shovel or electric demolition hammer peeling off sections of stucco).

Hammer/Stucco/Stone (Mechanic hammers off stucco directly adjacent to windows or appurtenances). (Mechanic with electric demolition hammer peels cultured stone free of sheathing.)

Clean/Stucco (Laborer places stucco in dumpster).

## **Remedial Carpentry**

OSB sheathing removal/replacement as needed.

Stud replacement if applicable.

Header repair/replacement if applicable.

Rim joist replacement if applicable.

Anti-fungal application.

Primer application.

Remove/replace insulation if applicable.



# Drainage Plane Remediation Scope of Work (contd.)

## Flash / Trim Windows – Construct Drainage Planes

Check foundation / sheathing alignment before starting drainage plane construction.

Seal and flash foundation to sheathing joint as required. (See detail sheet.) Flashing/sealant shall utilize Mel Roll by WR Grace with approved primer over pre-cleaned substrate.

Install weep screed 4" –to- 6" above existing earthen grade and 2" above any paved surface.

Cut existing black plastic window flashing back flush with PVC window casing.

Remove 5/4"x4" PVC window casing and capital head.

Remove nailing flange from bottom of window.

Remove nails from the nailing flange on both sides of window. Pry nails from face of flange (NOT from under flange.)

Carefully remove the staples securing the existing black plastic window flashing to the sheathing.

Leave nailing flange and nails at the top nailing flange (head of window) intact.

Starting on the weep screed install first course of Tyvek Stucco Wrap up and under the black plastic window sill flashing, tight to the window extrusion. (First course of primary or first drainage plane.) Saddle cut Stucco Wrap up and around the sides of the window approximately 4". Do not cut the existing black plastic window flashing when cutting the Stucco Wrap.

Install new nailing flange at bottom of window. DO NOT NAIL FLANGE AT THIS TIME.

Install 12" wide piece of Tamko No.15 UL or approved equal asphalt felt up and under the black plastic sill flashing and on top of Tyvek primary drainage plane. Felt must extend 12" past each side of window extrusion.

Install 9" wide piece of Tyvek Flex Wrap up and under the black plastic sill flashing and on top of 12" wide felt. Flex Wrap must extend 12" past each side of window extrusion.



# Drainage Plane Remediation Scope of Work (contd.)

## Flash / Trim Windows – Construct Drainage Planes (contd.)

Together the asphalt felt and Flex Wrap form a drainage apron beneath the existing window sill flashing. Fasten drainage apron by nailing off the new nailing flange at the bottom of the window. The drainage apron can be prefabricated.

Without removing the peel protection, slide a piece of 6" Protecto Wrap between the black plastic window flashing and the OSB sheathing on both sides of the window. Protecto Wrap must extend 6" above the top of the window and 6" below the bottom of the window onto the asphalt felt/Flex Wrap drainage apron. This piece of Protecto Wrap is to act as a self healing buffer for future nail penetrations.

Nail both nailing flanges at the sides of the window.

Install window manufacturers' nailing flange adhesive backed corner flashings at all four corners of nailing flanges.

Resume installation of Tyvek Stucco Wrap. Stucco Wrap should run up both sides of window short of nailing flange and past the top of the window head a minimum of 16", but no further than the second floor window sill.

Install 9" wide pieces of Protecto Wrap over the right and left side window nailing flange. Adhere the Protecto Wrap to the side window nailing flanges and onto the Tyvek Stucco Wrap. Extend side pieces 6" above head of window and 9" below bottom of window on top of the Protecto Wrap/felt apron.

Begin installation of double layer of Tamko No.15 UL or approved equal asphalt felt (secondary or second drainage plane) using cap head nails/staples. Stagger lap joints between Tyvek Stucco Wrap and Tamko No.15 UL asphalt felt to provide a weathering condition between the primary and the secondary drainage planes. Install asphalt felt to ensure a minimum 2" horizontal overlap in successive courses. Carry asphalt felt tight up and under the asphalt felt/Flex Wrap drainage apron and the black plastic window sill flashing.



# Drainage Plane Remediation Scope of Work (contd.)

## Flash / Trim Windows – Construct Drainage Planes (contd.)

Continue installation of double Tamko No.15 UL asphalt felt up wall on both sides of window. Install felt tight to the sides of the window extrusion. Stop felt approximately 12" above the top of the window.

After the primary and secondary drainage planes have been installed to the preferred height above the windows, begin installation of the window casing.

Measure the window height and add 3/8" to the dimension. The 3/8" is to allow for a 3/8" rodded and caulked joint at the bottom of the window between the window extrusion and the PVC window casing.

Install side casings and maintain a 3/8" gap between the window extrusion and the PVC window casing. Use a 3/8" spacer if necessary to maintain a uniform gap.

Measure the sill casing length from outside to outside of the two window side casings. Install the sill casing.

Install 6" Protecto Wrap onto window manufacturers' nailing flange at the top of the window and adhere onto the OSB sheathing. Carry 6" Protecto Wrap 9" past each side of the window.

Install field-bent aluminum drip cap onto the head of the window and across the top ends of the side window casings (3/8" x 1" x 2-5/8" white aluminum coil stock.) Install drip cap in continuous bead of caulk on top of window head extrusion. Turn down ends of drip cap at side casings to provide a weathering condition.

Install 6" Protecto Wrap onto the vertical leg of the aluminum drip cap and adhere the Protecto Wrap to the aluminum drip cap and the OSB sheathing.

Measure, cut and install the 5/4" x 4" window head casing or capital head. Embed head casing/capital head in caulk on top of drip cap.



# Drainage Plane Remediation Scope of Work (contd.)

## **Flash / Trim Windows – Construct Drainage Planes (contd.)**

Install field-bent aluminum drip cap onto the window head casing (3/8" x 1" x 2-5/8" white aluminum coil stock.) Bend and install drip cap with a 5 degree cant or slope out and away from the wall of the building. Turn down ends of drip cap at the end of the head casing to provide a weathering condition.

Install 6" Protecto Wrap onto the vertical leg of the aluminum drip cap and adhere the Protecto Wrap to the aluminum drip cap and the OSB sheathing.

Continue installation of Tyvek Stucco Wrap (primary or first drainage plane) in accordance with manufacturers' directions. Carry Tyvek Stucco Wrap tight up beneath existing soffit or rake trim.

Continue installation of double layer of Tamko No.15 UL or approved equal asphalt felt (secondary or second drainage plane). Carry Tamko No.15 UL asphalt felt tight up beneath existing soffit or rake trim.

Repeat trim and flashing details for first floor doors and second floor windows as detailed above.

At all locations where pitched roofs intersect a side wall furnish and install a powder coated or vinyl "kick out" type base flashing. The kick out flashing is intended to divert water flow away from the adjacent sidewall at the intersection of the pitched roof.

At all locations where casing bead lands on flagstone porch surfaces fabricate and install field bent flashing from aluminum coil stock. (See detail sheet.)



# Drainage Plane Remediation Scope of Work (contd.)

## **Stucco House**

Protect windows with polyethylene sheeting and tape.

Furnish and install 2.5#/SY self furring galvanized expanded wire lath.

Furnish and install grounds, stops, joints, weep screeds and related accessories at locations shown on accompanying detail sheets and in accordance with the Stucco Resource Guide as prepared by the NWBC and distributed by the Stucco Manufacturers Association.

Furnish and install proprietary factory pre-mixed fibrated scratch coat.

Furnish and install proprietary factory pre-mixed fibrated brown coat.

Furnish and install finish coat based on Penn Crete standard colors in accordance with manufacturers' instructions.

Batch, mix and install stucco in accordance with proprietary stucco manufacturers' instructions and Portland Cement Plaster Stucco Resource Guide as prepared by the NWBC and distributed by the Stucco Manufacturers Association and ASTM C 926 – 98a.

Furnish and install Sto Leveler 224 to exterior perimeter of concrete foundation wall from grade to weep screed.

## **Remove Scaffold**

Remove planking and scaffold.

## **Remove Temporary Protection (Windows, Mechanical Systems & Roofing)**

Remove coverings at windows.

Remove coverings at electric meter, gas meter and HVAC equipment.



# Drainage Plane Remediation Scope of Work (contd.)

## **Caulk**

Clean, rod, caulk and tool all joints between differential materials.

Caulk joints shall be located between stucco casing/stop bead and window casings, window casings and window extrusions, the juncture of casing and/or stop beads and soffits and expansion or control joints in stucco.

Weep tubes shall be furnished and installed on the rodded caulk joint at the top of the window head flashing.

Caulk shall be Sonnobourne, two part urethane, VLM 150 urethane, Dow Corning 790 Building Sealant or approved equal installed in accordance with manufacturers' directions and published industry practices.

## **Exterior Painting**

Paint all exterior trim including window casing, capital heads, exposed fascias, rakeboards, soffits and porch posts.

Window casings and capital heads to be prepared according to manufacturer's instructions and finished with 2 coats of MAB Seashore Exterior Latex Trim Enamel or approved equal.

All other exposed exterior trim shall be lightly sanded and cleaned as necessary and finished with 1 finish coat of MAB Seashore Exterior Latex Trim Enamel or approved equal.

Clean, prime and install MAB; Acra-Lastic, Dryvit; Revyvit or approved equal to portion of concrete foundation wall from finish grade to weep screed in accordance with manufacturers' directions.

## **Interior Drywall / Painters**

Drywall repair and paint touch-up associated with the stucco removal.

Drywall repair and re-painting of walls, window jamb extensions and trim associated with window removal and re-installation.



# **Drainage Plane Remediation Scope of Work (contd.)**

## **FINAL CLEANING**

### **Clean Windows / Exterior**

### **Clean House Interior**

### **Appurtenance Re-installation**

Gutters and Downspouts reinstalled or replaced as necessary.

Shutters reinstalled.

Address plaques reinstalled.

Exterior lighting fixtures reinstalled.

### **Clean House Exterior / Rake Lawn**

### **Plant Re-installation / Mulch Beds**

### **Power Wash Driveway**

### **Seal Coat Driveway**

### **Turf Amendments**

Aerate, over-seed & fertilize existing lawn areas as may be necessary.



# Remediation In-Progress

323 Applebrook Drive  
Stucco Removal





# New Drainage Plane





# New Stucco Finish Coat





# Completed Remediation





# Certification

JAN. 29. 2007 8:44AM

U T B & F 6106921379

NO. 5005 P. 17

## ENGINEERS' INSPECTION CERTIFICATION

FALCON ENGINEERING  
Consulting Engineers

### Applebrook Drainage Plane Remediation

Falcon Engineering has participated as a consultant in the development and review of the Applebrook Approved Protocol, and it has been prepared in general accordance with the NWCB, IBC and industry standards.

Unit Address \_\_\_\_\_ Applebrook \_\_\_\_\_ Lot # 28



Based upon visual inspections on the dates noted below, it appears all drainage plane materials have been installed in accordance with the Applebrook Approved Protocol for remediation work detailed herein and industry standards. Based on this statement, it is our opinion that the installation deficiencies that lead to the water infiltration and damage to the substrate have been corrected as a result of the new installation. Please note that these inspections were performed from the ground level and no materials were removed as part of these inspections.

#### Flashings and Underlayments Observed After Installation

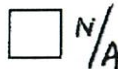
Date 11/15/05 Initials MJM

#### Casing Beads, Lath, and Control Joints Observed After Installation (Prior to stucco application)

Date 11/17/05 Initials MJM

#### Final Inspection Upon Completion

Date 8/16/06 Initials MJM



Based on the results of the testing performed in accordance with the Approved Protocol, Falcon Engineering finds that there appears to be no elevated readings at the time of testing, and approves of the sealing protocol for this unit.

Signature \_\_\_\_\_ Engineering Inspector - Mark McCann

Signature WILLIAM J PYZNAK Engineering Principal - William Pyznar PE

(Seal of Engineering)







September 13, 2007

Homeowner  
Applebrook Carriagehome Community Association  
Applebrook Drive  
Malvern, PA 19355

**Re: Drainage Plane Remediation completion.**

Dear Homeowner:

The Board is pleased to inform you that the Drainage Plane Remediation of the stucco on all homes in the Association is now complete.

Enclosed you will find the Drainage Plane Remediation book for your home. This is an important document and you will want to keep it with the other documents you have for the Association, such as your Declaration and By-laws.

The Board would like to thank everyone for their patience and cooperation over the last several years while the remediation was being executed.

If you have any questions regarding the above, please feel free to contact Barry Bauman at the Management Office at 610.353.4470, Voice Mailbox #170.

Best regards,

Barry T. Bauman, AMS, CMCA  
Regional Director  
Mid-Atlantic Management Corporation  
For the Applebrook Carriage Home Community Association Executive Board

cc: Board of Directors