

Replacement Reserve Study
MEADOWS AT MORRIS FARM

RSTUDY+
REPLACEMENT RESERVE STUDY

MEADOWS AT MORRIS FARM

Gainesville, Virginia

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August 16, 2012 and revised November 24, 2012



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August 16, 2012 and revised November 24, 2012

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Jessica Azzarano:

Pursuant to your acceptance of our Proposal on March 21, 2012, we have completed our evaluation of MEADOWS AT MORRIS FARM in Gainesville, Virginia, and have developed the enclosed RSTUDY+ Replacement Reserve Study. The Study includes the following components:

- **Replacement Reserve Report.** The *Report* contains a summary of the financial data calculated by the *Replacement Reserve Analysis*, a general description of the community, a summary of the conditions observed during our site evaluation, and information about the *Replacement Reserve Inventory*.
- **Replacement Reserve Analysis.** The *Analysis* is a tabular and graphical presentation of current Association funding of Reserves, and recommended Reserve Funding, calculated by both standard funding methodologies, the Cash Flow and Component Method.
- **Replacement Reserve Inventory.** The *Inventory* lists the common components of the community evaluated by the *Replacement Reserve Analysis*, and includes estimated replacement costs, normal economic life, and the remaining economic life for each component evaluated.
- **List of Recommended Repairs.** The *Repair List* itemizes defects we observed during our site evaluation. The repairs are categorized by building trade and include estimated costs.
- **Supplemental Photographs.** The photographs document observations made during the site evaluation.
- **Replacement Reserve Allocations.** The *Replacement Reserve Allocations* suggests allocation of the annual deposits to Replacement Reserves by the Cash Flow and Component Method. Cash Flow contributions are allocated based upon a chronological method recently developed by RSTUDY.
- **Appendix.** The *Appendix* contains definitions and standard procedures.

This Study should be reviewed by the MEADOWS AT MORRIS FARM, Board of Directors, those responsible for the management of the components included in the *Inventory*, and the accounting professionals employed by the Association. We are prepared to provide revisions to the *Replacement Reserve Analysis* and the *Replacement Reserve Inventory* upon the request of the Board of Directors. Revisions should be requested by the Board of Directors within three (3) months of the date of this Study. If you have any questions regarding this report, please contact Mr. Richard J. Schuetz at (703) 820-1790.

Sincerely,
RICHARD J. SCHUETZ, AIA
Architect

Wm Bruce Bennett

Wm. Bruce Bennett
Senior Reserve Analyst

Replacement Reserve Report

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REPLACEMENT RESERVE REPORT

MEADOWS AT MORRIS FARM

Gainesville, Virginia

August 16, 2012 and revised November 24, 2012

A. GENERAL INFORMATION

Intent. The intent of this RSTUDY+ Replacement Reserve Study is to provide MEADOWS AT MORRIS FARM (hereinafter called MORRIS FARM or the Association), with an inventory of the common community facilities and infrastructure components that require periodic replacement, a general view of the condition of these components, and an effective financial plan to fund projected periodic replacements.

- **Inventory of common components.** The attached *Replacement Reserve Inventory* lists the common components of the community that require periodic replacement, whose replacement is scheduled for funding from Replacement Reserves. Section D of this *Replacement Reserve Report* provides information about components excluded from the *Inventory*, whose replacement is not scheduled for funding from Replacement Reserves, and the basis of those exclusions.
- **Condition of common components.** The *Replacement Reserve Inventory* includes our estimates of the normal economic life and the remaining economic life for those components whose replacement is scheduled for funding from Replacement Reserves. Section C of this *Replacement Reserve Report* provides additional information about several of these components including recommendations for repairs, maintenance, and replacements.
- **Financial plan.** Because many components owned by the Association have limited life and require periodic replacement, it is essential the Association have an effective financial plan to provide funding for the timely replacement of these components, to protect the appearance and value of the community. In conformance with American Institute of Certified Public Accountant guidelines, the *Replacement Reserve Analysis* evaluates the current funding of Replacement Reserves as reported by the Association, and recommends annual funding of Replacement Reserves by two generally accepted accounting methods, the Cash Flow Method and the Component Method. The *Replacement Reserve Analysis* includes graphic and tabular presentations of these methods and current Association funding.

Scope. MORRIS FARM is a residential community of single family homes and townhomes in Gainesville, Virginia. The Request for Proposal submitted by the Association states that construction at the community began in 2002 and continues today. At completion, the community will consist of 660 residential units and associated improvements. We have assumed that all of these units are individually owned and are not the responsibility of the Association. These individually owned units and other components of the community not identified in the Request for Proposal as being the responsibility of the Association were not evaluated and were not included in the *Replacement Reserve Inventory* or *Replacement Reserve Analysis*.

REPLACEMENT RESERVE REPORT

We have identified community facilities and infrastructure components with limited life that require periodic replacement and whose replacement is the responsibility of the Association, based upon our review of the following:

- The Request for Proposal, submitted and executed by the Association.
- Our field evaluations and measurements.
- Memo from the Association on September 25, 26, and 27.
- Several severely deteriorated drawings discovered in the Community Center electrical equipment room.
- Aerial photographs acquired by Richard J. Schuetz, AIA.

We have divided the components whose replacement is the responsibility of the Association into two categories, based upon the source of funding for the needed replacement. The categories are:

- Funding from Replacement Reserves. Those components whose replacement is scheduled for funding from Replacement Reserves are listed in the *Replacement Reserve Inventory*. This is a comprehensive list and the funding of replacements other than those specifically listed in the *Replacement Reserve Inventory* will result in inaccuracies in the results calculated by the *Replacement Reserve Analysis*.
- Funding from other sources. Examples of components whose replacement is NOT to be funded from Replacement Reserves, are listed and discussed in Section D - Inventory, below. This is not a comprehensive list and we have assumed that the replacement of all components not specifically listed in the *Replacement Reserve Inventory* will NOT be funded from Replacement Reserves.

The major components included in the *Replacement Reserve Inventory* are the Community Center, swimming pools, tot lots, asphalt trails, retaining walls, retaining wall railings, streetlights (at the Community Center and Peacock Park only), trellis at sitting areas, benches, signage, and the stormwater system (excluding structures). We have also included the asphalt pavement, concrete sidewalks, and concrete curb & gutter at the townhouses, Community Center, and courtyards. **The components included in the *Replacement Reserve Inventory* have an estimated one-time replacement cost of \$2,901,546.**

Site evaluation. We conducted our site evaluation on August 13, 14, and 16, 2012. Our evaluation was visual and nondestructive.

Replacement Reserve Study - Level of Service. The *Replacement Reserve Study* has been performed as a Full Service *Replacement Reserve Study* as defined under the National Reserve Study Standards adopted by the Community Associations Institute. A complete component inventory was established based on information regarding commonly owned components provided by the Association and upon quantities derived from field measurement and/or quantity takeoffs from to-scale engineering drawings made available by the Association. The condition of all components was ascertained from a site visit and the visual inspection of each component by the analyst. The life expectancy and the value of components are provided based on these observations. The funding status (Replacement Reserves on Deposit) and funding plan (Current Annual Contribution to Replacement Reserves) have been provided by the Association.

REPLACEMENT RESERVE REPORT

B. FINANCIAL SUMMARY

Purpose. The purpose of the attached *Replacement Reserve Analysis* is to evaluate the current funding of Replacement Reserves as reported by the Association, and to recommend annual contributions to Replacement Reserves by two generally accepted accounting methodologies, the Cash Flow Method and the Component Method. All three evaluations are based upon the same 30-year Study Period, Replacement Reserves reported to be on deposit at the start of the Study Year, and projected expenditures for replacements of common elements shown in the *Replacement Reserve Inventory*.

Study Year and Study Period. The Association reports that they operate on a fiscal year which runs from November 1 to October 31. The first year evaluated by the *Replacement Reserve Analysis*, the "Study Year", is 2014. The *Replacement Reserve Analysis* evaluates funding in a 30-year period extending forward from November 1, 2013. This 30-year period is called the "Study Period".

Current Funding. The Association reports Replacement Reserves on Deposit of \$317,330 as of November 1, 2012, and annual deposits to Replacement Reserves totaling \$84,000. We have assumed a November 1, 2013 starting balance of \$401,330.

Projected Expenditures. We project that in the first five years of the study, from the Study Year, November 1, 2013, through October 31, 2018, the Association has a cash requirement of between \$293,142 and \$301,142. This is based upon \$279,142 of expenditures for replacements listed in the *Replacement Reserve Inventory* and \$14,000 to \$22,000 of repairs, maintenance, and miscellaneous small replacements outlined in the *List of Recommended Repairs*. Several of the projects associated with these expenditures are discussed in Section C below.

We have projected annual Association expenditures (not including the \$14,000 to \$22,000 of repairs, maintenance, and minor replacements outlined in *List of Recommended Repairs*) over the next 30 years, based upon the *Replacement Reserve Inventory*. This data is presented as a graph on page A-6 of the *Replacement Reserve Analysis*. **It shows that the average annual expenditure from Replacement Reserves over the next 30 years is \$115,653.**

List of Recommended Repairs - timing of repairs. The enclosed *List of Recommended Repairs* itemizes \$14,000 to \$22,000 of defects we noted during our site evaluation. The accuracy of the values used for the remaining economic life in the *Replacement Reserve Inventory* and thereby the entire *Replacement Reserve Analysis* is dependent upon the timely completion of these repairs, maintenance, and miscellaneous small replacements.

List of Recommended Repairs - funding of repairs. We have assumed that NO Replacement Reserves will be used to fund the correction of the defects outlined in the *List of Recommended Repairs*. The United States Tax Code grants very favorable tax status to Replacement Reserves, conditional on the expenditure of Replacement Reserves within specific guidelines. Funding maintenance, repair, and/or capital improvements from Replacement Reserves may have adverse tax consequences and should be done only after consultation with an accounting professional.

REPLACEMENT RESERVE REPORT

EVALUATION OF CURRENT ASSOCIATION FUNDING. Our evaluation of the current Association funding plan is based in part, on financial data provided to us by the Association.

\$84,000

Current Association Funding. The Association reports that they are currently contributing \$84,000 per year to Replacement Reserves (\$10.61 per unit per month). Based upon Replacement Reserves reported to be on deposit, and the *Replacement Reserve Inventory*, our evaluation of Current Association Funding shows that it results in the Association being unable to make scheduled replacements in 12 years of the thirty-year Study Period with a maximum shortfall of \$740,843 in 2039.

Projections of Current Association Funding are presented in graph and tabular format on page A-5 of the *Replacement Reserve Analysis*. These calculations assume that NO Replacement Reserves will be allocated to fund the \$14,000 to \$22,000 of repairs, maintenance, and/or minor replacements outlined in the *List of Recommended Repairs*. A more detailed explanation of the Current Association Funding calculations is contained in the *Appendix*.

STANDARD ACCOUNTING METHODOLOGIES. The enclosed *Replacement Reserve Analysis* calculates recommended funding of Replacement Reserves in each year of the of the 30-year Study Period, by two generally accepted methods, the Cash Flow Method, and the Component Method. Both calculations are based upon the same financial data, including the costs of the replacements scheduled in the *Replacement Reserve Inventory* and Replacement Reserves reported to be on deposit at the start of the Study. The Cash Flow Method and Component Method calculations and Replacement Reserve funding recommendations in 2013, the Study Year, are discussed below:

\$118,074

Cash Flow Method - Minimum Recommended Funding of Replacement Reserves in the Study Year (\$14.91 per unit per month). The Cash Flow Method calculates the minimum annual funding of Replacement Reserves that will fund Projected Annual Replacements from a common pool of Replacement Reserves and prevents Replacement Reserves from dropping below the Minimum Recommended Balance. Annual deposits to Replacements Reserves remain the same between peaks in cumulative expenditures called Peak Years.

Minimum Recommended Balance. We have established the Minimum Recommended Balance at \$145,077 or 5 percent of the one-time replacement cost of all of the components listed in the *Replacement Reserve Inventory*.

The Cash Flow Method calculations are presented in graph and tabular format on page A-3 of the *Replacement Reserve Analysis*. These calculations assume that NO Replacement Reserves will be allocated to fund the \$14,000 to \$22,000 of repairs, maintenance, and/or minor replacements outlined in the *List of Recommended Repairs*. A more detailed explanation of the Cash Flow Method is contained in the *Appendix*.

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\$206,703

Component Method - Recommended Funding of Replacement Reserves in the Study Year (\$26.10 per unit per month). The Component Method is a time tested and very conservative mathematical model developed by HUD in the early 1980's. The Component Method treats each component in the *Replacement Reserve Inventory* as a separate account and deposits are made annually to each of these individual accounts. A fence with a life of ten years and a value of \$1,000, will require a deposit of \$100 per year to Replacement Reserves. Based upon this funding formula, the Association should have \$985,147 on deposit (Current Funding Objective), but the Association reports to having Replacement Reserves totaling \$401,330 on deposit, approximately 40.74 percent funded.

The Component Method calculations are presented in graph and tabular format on page A-4 of the *Replacement Reserve Analysis*. These calculations assume that NO Replacement Reserves will be allocated to fund the \$14,000 to \$22,000 of repairs, maintenance, and/or minor replacements outlined in the *List of Recommended Repairs*. A more detailed explanation of the Component Method is contained in the *Appendix*.

FUNDING RECOMMENDATIONS:

We recommend the Association adopt an annual contribution to Replacement Reserves calculated by one of the standard accounting methods, either the Cash Flow Method or the Component Method, to insure that proper funding is available to make scheduled replacements throughout the entire 30-year Study Period.

We further recommend the Association fully fund the *List of Recommended Repairs* in the Study Year, and establish the necessary annual funding for the normal maintenance and repairs needed throughout the community.

REPLACEMENT RESERVE REPORT

C. SITE EVALUATION

General comments. MORRIS FARM is facing several large and expensive replacement, repair, and maintenance projects. The major replacement projects facing the Association in the first five years of the Study Period include:

- Tuckpointing of the precast simulated stone and brick pavement.
- Sealcoating of the asphalt pavement in the townhouse section of the community, at the Community Center and the asphalt alleys and pipestems.
- A hydrographic study of the stormwater impound facilities.
- Partial replacement/restoration of the wood fence at the entrance features and along Rollins Ford.
- Partial replacement of pool furniture.
- Partial replacement of the asphalt trails.
- Shuffleboard court surface.



These projects and several more minor projects are scheduled in the *Replacement Reserve Inventory* and have an estimated cost of \$279,142 in the first five years of the Study Period, through the October 31, 2018.

The *List of Recommended Repairs* outlines \$14,000 to \$22,000 of repairs, maintenance, and miscellaneous small replacements we observed throughout the community, which need correction now.

Safety defects. Several of the defects in the *List of Recommended Repairs* are safety hazards and should be repaired immediately to protect the residents from potential injury and to protect the Association from potential liability. We have identified safety hazards in the *List of Recommended Repairs* by printing them in **bold**. We do NOT warranty that all defects throughout the community that could be considered “safety defects” are identified in the *List of Recommended Repairs*.

Site plans and drawings. No site plans, drawings, or documents were made available to Richard J. Schuetz, AIA., for our review in conjunction with the preparation of this Replacement Reserve Study. We did discover limited drawing on the floor of the Community Center electrical equipment room which we will have scanned. The Association is responsible for the maintenance, repair, and replacement of hundreds of thousands of dollars of components. Attempting to accomplish these tasks without comprehensive site plans, drawings and documents places an unnecessary and expensive additional burden on the Association.



We recommend the Association acquire comprehensive site plans and drawings, detailing the construction of all common elements of the community. These documents should be scanned into an electronic format and posted to an Association web site, where they will be an excellent resource

REPLACEMENT RESERVE REPORT

for the residents, Board of Directors, and contractors working for the Association, in the coming years.

Comments on Site Evaluation. The *List of Recommended Repairs* provides a component by component discussion of defects we observe during our site evaluation. The following comments are not intended to restate these observations but address one of the following specific issues regarding the larger, more significant components at the community:

- Components that require specific comments because of the manner in which they have been treated in the *Replacement Reserve Analysis*.
- Comments on components that could not be properly addressed in the *List of Recommended Repairs*.

The comments on the following pages reflect the conditions found at the time of our site evaluation.

Asphalt pavement - general. We identified approximately 215,026 square feet of asphalt pavement (roadways and parking areas) in the townhouse section of the community, at the Community Center, and the alleys & pipestems that we understand is the responsibility of the Association. No information about the dates of installation or the specifications that were used to install the pavement was provided for our review. The asphalt pavement is generally in good condition but we observed no evidence of sealcoating, crack sealing, or other maintenance. We observed areas where defects in the asphalt pavement are allowing water to penetrate through the pavement.



Asphalt Pavement Maintenance Program. The Association will need to establish an Asphalt Pavement Maintenance Program if the pavement is to achieve the economic life shown in the *Replacement Reserve Inventory*. The Asphalt Pavement Maintenance Program should include the components discussed below:

- Crack sealing. All small cracks and defects in the asphalt pavement should be sealed with an appropriate sealing compound. If the cracks or defects are too large to be sealed with a sealing compound, or if the defects have resulted in displacement of the asphalt pavement, indicating damage to the base materials or bearing soils, defective areas of asphalt pavement, base materials, and bearing soils should be cut out and replaced. This repair should be done **annually**.
- Cleaning. Long term exposure to oil and gas breaks down asphalt. Automobiles leaking gas and/or oil should be removed from the community immediately and spill areas cleaned to prevent damage to the asphalt pavement. The maintenance of the asphalt pavement



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should include the cleaning of asphalt pavement damaged by oil and/or gas and the cutting out and replacement of deteriorated pavement. This should be done **annually** in conjunction with the crack sealing project discussed above.

- **Sealcoating.** Seal coating should be done **every three to five years**. For this maintenance activity to be effective in extending the life the asphalt, the crack sealing and cleaning of the asphalt discussed above, should be done first.
- **Striping.** After completion of the seal coating, install new striping in parking areas.

We have included funding for the asphalt pavement sealcoating in the *Replacement Reserve Inventory*. Funding maintenance and repair from Replacement Reserves may have adverse tax consequences for the Association. We recommend the Association review these expenditures with their accounting professionals prior to making any disbursements.

Asphalt trails. The community is served by an extensive network of asphalt trails at Peacock Park and in the open space in the southeast corner of the community. We have assumed that each of the replacement projects will address approximately 1/3 of the trails. We have further assumed that the asphalt trail along Rollins Ford is not the responsibility of the Association. The scope of the Asphalt Pavement Maintenance Program should include the correction of defects in the asphalt trails.



Concrete components. We identified approximately 11,260 square feet of concrete sidewalks at the townhouses & Community Center, 59,200 square feet of concrete pavement in the 25 courtyards, and 3,320 feet of concrete curb & gutter throughout the community that is the responsibility of the Association. There are defects in several of these components including components a deteriorated surface that is a potential trip hazard and we recommend that the defective components be replaced as soon as possible to protect the residents from potential injury and the Association from potential liability for those injuries. Several segments of curb & gutter will need to be replaced prior to, or in conjunction with, the asphalt replacement maintenance program to insure that the new asphalt pavement can be properly graded to direct water to the storm water system.



We have assumed that 10 percent of the concrete components will be replaced in conjunction with the asphalt pavement replacement project scheduled in 2023. Subsequent cycles of concrete component replacements are scheduled at 16 year intervals in the *Replacement Reserve Inventory*, to coincide with future asphalt replacement projects. We have accelerated the percentages of concrete components scheduled for replacement in future projects to reflect a normal aging pattern.



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Interim replacements will be necessary and in the *Replacement Reserve Inventory*, we have included a line item for annual replacements to be funded from Replacement Reserves.

Stormwater management system. An extensive stormwater system is installed throughout the community. No drawings detailing the components of the system were available for our review. The Request for Proposal submitted by the Association indicates that the stormwater system is the responsibility of the Association. A memo dated August 13, 2012 states that the Association is not responsible for the structures associated with the stormwater system. We have assumed that the structures include:

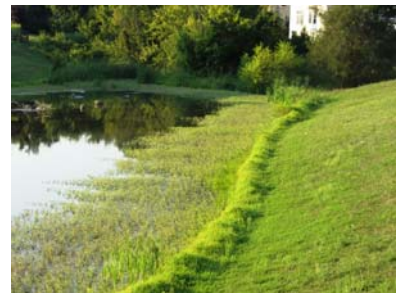
- Signage installed along the asphalt trails.
- Inlets and outlets.
- Fences.
- Rip rap filters.
- Subsurface piping.
- Overflow structures.
- Roads that provide access to the stormwater facilities.



Two major impound facilities are located at the community, a dry pond between Catbird and Woodpecker and a wet pond east of Barn Owl. Over time, the ponds accumulate silt and lose the ability to store stormwater at design level. This could result in damage to the facilities, overflows, local flooding, and damaged to adjacent properties.



Proper maintenance of the facilities requires regular evaluation and periodic dredging. We have assumed the “structures exclusion” cited above leaves the Association responsible for periodic hydrographic studies of the wet and dry ponds, dredging and the on-site disposal of dredge materials.



We have based the line items in the Replacement Reserve Inventory on "Maintaining Stormwater Systems, A Guidebook for Private Owners and Operators in Northern Virginia. We have used the information in this publication, including the average economic life and estimated costs. We have adjusted the costs for inflation and our recent experience on similar facilities in your area. A copy of this guidebook is attached to the electronic copy of this Study in Adobe (pdf) format and our assumptions are summarized below:

Mobilization and demobilization of machinery. \$6,000 per wet pond and \$4,000 per dry pond. We have assumed a savings from both facilities as a single project will result in a total mobilization cost of \$10,000.

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Dredging. We have assumed that the facilities will be dredged when the average depth of material to be removed is 12 inches at a cost of \$21 per yard.

Disposal. We have assumed that no hazardous waste is identified in the dredging and that on-site disposal will be possible. We have used a disposal cost of \$3 per yard in the Replacement Reserve Inventory.

Dredging frequency. "Maintaining Stormwater Systems, A Guidebook for Private Owners and Operators in Northern Virginia" states that wet ponds should be dredged every 5 to 15 years. Dry ponds are listed with dredging every 2 to 10 years. In the attached Replacement Reserve Inventory, we have included both the wet and dry ponds for dredging every 15 years. The timing and frequency of dredging should be modified to reflect the findings of the hydrographic evaluation outlined below.

Economic life of stormwater ponds. "Maintaining Stormwater Systems, A Guidebook for Private Owners and Operators in Northern Virginia" states that wet ponds should have an economic life of 20 to 50 years. Dry ponds are listed with the same 20 to 50 year economic life. In the attached Replacement Reserve Inventory, we have not included funding for an overall facility replacement. Such a line item may be necessary in the future because of deterioration or governmental regulation. The need for comprehensive replacement line item should be addressed in conjunction with hydrographic survey outlined below and the Replacement Reserve Inventory modified to reflect those findings.

Hydrographic survey. Estimated cost and frequency of dredging is a function of many variables including the volume of the pond, the siltation rate, the nature of the material being removed, the method of removal, and the haul distance to a site that will accept the spoil material. An accurate prediction will require a hydrographic survey and testing of the silt for contaminants, which is beyond the scope of our study. In the Replacement Reserve Inventory, we have included a line item of regular hydrographic survey every 5 years at a cost of \$4,000,

Stormwater system maintenance. Storm water systems require regular maintenance including but not limited to lawn care, removal of vegetation, road grading, painting, signage replacement, fence maintenance, etc. We have assumed these tasks are maintenance activities and that they will not be funded from Replacement Reserves.

Entrance features. Decorative features are installed at the intersection of Yellow Hammer & Rollins Ford and north and south of Rollins Ford at the east property boundary. The features consist of wood fencing, walls, and decorative structures. The walls and decorative structures are finished with a precast simulated stone veneer. Defects in the installation are discussed below.



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Precast simulated stone veneer. A precast simulated stone veneer has been installed on the entrance features, at posts along Rollins Ford at the east property boundary, at the trellis support posts, on the pool deck and in the facade of the Community Center. We received no information on the manufacturer of the product. We observed extensive defects in the installations and the installations are not in compliance with the installation specifications for “Culture Stone”, one of the leading manufacturers. The Association should identify the manufacturer of the product at the community and bring the installations into compliance with manufacturer recommendations. We have attached “Culture Stone” installation information.



Trellis. Decorative trellis structures are installed on the pool deck, at a sitting areas near the Community Center and the south end of Yellow Hammer, and at Peacock Park. The paint system on these structures is failing. We also observed that some of the materials used to construct these structures are not appropriate for exterior installation. We recommend that these materials be replaced with pressure treated lumber or one of the synthetic materials on the market, intended for exterior installation.



Segmental retaining walls. Five major segmental retaining walls are installed in the townhouse section of the community. These kind of walls are typically assumed to have an unlimited economic life but they may require periodic reconstruction and restacking. In the Replacement Reserve Inventory we have assumed that 5 percent of the walls will require reconstruction every 10 years. Correction of grading defects at the ends of several of the walls that is needed now is included in the List of Recommended Repairs.



Community Center. Discharge from the Community Center roof spills over the ends of wood structural members causing accelerated deterioration. This defect needs to be corrected before the deterioration wicks deeper into the structural members. After restoration of the wood members, the members should be clad and the water diverted from the area.



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Tot lots. We identified three tot lots that are the responsibility of the Association:

- South Tot Lot - adjacent to the Community Center.
- North Tot Lot - south of Catbird and east of Yellow Hammer.
- Peacock Park Tot Lot - in Peacock Park, south of Sharpshinned and east of Song Sparrow.



The *List of Recommended Repairs* outlines several defects we observed at the tot lots and recommends a comprehensive evaluation by a playground safety specialist. This evaluation should be conducted as soon as possible. The defects we have identified and those identified by the playground safety specialist should be corrected as soon as possible to protect those using the tot lot from potential injury and the Association from potential liability for those injuries.

Deck. A deck is installed in the Peacock Park Tot Lot. Defects in the railings are a potential hazard.



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D. INVENTORY

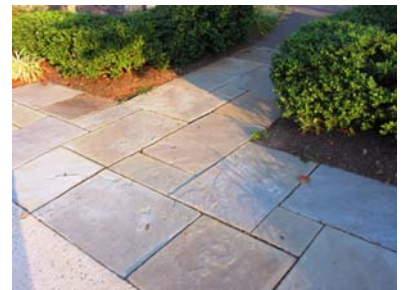
Basis. The data contained in the *Replacement Reserve Inventory* is based upon information provided by the Association and our field observations and measurements on August 13, 14, 1nd 16, 2012. No drawings or documents were provided for our review in conjunction with the preparation of this *Replacement Reserve Study*. We also utilized aerial photographs of the community. We confirmed the scale of the aerial photographs using field measurements.

Estimated Life Left. The values in the “Estimated Life Left in Years” column in the *Replacement Reserve Inventory* have been established by the Analyst based upon a visual evaluation of the components. The values are not based upon a mathematical formula directly related to “Estimated Economic Life in Years.” Some components may experience longer lives while others may experience shorter lives depending on many factors such as environment, quality of the component, maintenance, timeliness of repairs, etc.

Exclusions. The following items have been excluded from the *Replacement Reserve Inventory*. If any of these exclusions have been made in error, we will reinsert the component at the request of the Board of Directors:

Long-lived components. Components that when properly maintained, can be assumed to have a life equal to the property as a whole, are excluded from the *Replacement Reserve Inventory*. Examples of components excluded from the *Replacement Reserve Inventory* by this standard include:

- Foundations and structures of the Community Center, entrance features, and sitting areas.
- Metal grill in the openings in the two large entrance feature structures.
- Community Center and entrance feature metal roofs. Periodic coating will be necessary and the coating of the metal roof at the Community Center is included in the Inventory.
- Rip rap installed on a steep slope in the townhouse section of the community.
- Flagstone pavers at the sitting areas and at the entrances to Peacock Park
- Domestic water supply mains and sanitary sewers. A network of domestic water mains and sanitary sewers is installed throughout the community on property owned by the Association. No drawings detailing the components of the system were available for our review. We have assumed that any needed repairs/replacements of the components of this system will not be funded from Replacement Reserves.
- Precast simulated stone veneer. Periodic tuck pointing will be necessary and this is included in the *Replacement Reserve Inventory*.
- Decorative metal sculptures in the landscaped area near the entrance features.



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Value. For ease of administration of the Replacement Reserves and to reflect accurately how Replacement Reserves are administered, components with a dollar value less than \$1,000.00 have been excluded from the *Replacement Reserve Inventory*. Examples of components excluded from the *Replacement Reserve Inventory* by this standard include:

- Ground mounded light fixtures at the entrance features and Peacock Park.
- Coating of the metal roof systems at the entrance features.
- General signage throughout the community.
- Bike rack at the Community Center.
- Mulch trail to the North Tot Lot.
- Dog walk stations.
- Mailboxes in the townhouse section of the community.
- Electrical services at the entrance features and Peacock Park.
- Ground mounted light fixtures at the entrance features and Peacock Park.
- Pavers in the lead walk at the Community Center



Unit improvements. We understand that the elements of the project that relate to a single unit are the responsibility of that unit owner. Examples of components excluded from the *Replacement Reserve Inventory* by this standard include:

- Concrete lead walks behind the edge of the Association owned sidewalks, closest to the townhouses, including all replacements resulting from a differential in elevation between individual and community owned components.
- Concrete driveway aprons.
- Utility connections, including water, sewer, gas, and electrical, that serve a single unit, even when they are on property owned by the Association.
- Building exteriors and site improvements including the decks, concrete steps, fences, stoops, retaining walls and patios.

Utilities. Many improvements owned by utility companies are on property owned by the Association. We have assumed that repair, maintenance, and replacements of these components will be done at the expense of the appropriate utility company. Examples of components excluded from the *Replacement Reserve Inventory* by this standard include:

- Primary electric feeds and transformers.
- Telephone and cable TV systems.
- Pumping station.



Maintenance Activities. Maintenance activities are NOT appropriately funded from Replacement Reserves. Funding maintenance and repair activities from Reserves may have adverse tax consequences for the Association. Examples of components excluded from the *Replacement Reserve Inventory* by this standard include:

REPLACEMENT RESERVE REPORT

- Cleaning and janitorial services.
- Interior painting.
- Exterior painting.
- Landscaping, landscape maintenance and site grading.
- Asphalt pavement crack sealing, cleaning, and striping.

Streetlights. A network of streetlights is installed throughout the community. Most of these lights have markings that indicate that they are the responsibility of the local power company. We identified fixtures at Peacock Park and the Community Center that appear to be the responsibility of the Association.



Irrigation system. Multiple irrigation systems are installed in the landscaped areas that surround the Community Center, at the entrance features, and at Peacock Park. We have assumed that the Association will have the system professionally evaluated each spring when the system is brought on line and each fall when the system is shut-down for the winter. We have assumed that any needed repairs or replacements will be done in conjunction with these evaluations and that the costs associated with this work will not be funded from Replacement Reserves. We have included a renovation project and a replacement project in the Inventory.



Government. Site improvements that serve the community are located on property owned by the local or state government. These improvements are located in the following areas:

- Rollins Ford Road.
- All internal roads in the community except for a section of Catbird Drive in the townhouse section of the community that is south of the circle in front of 14184 Catbird Drive.



We have assumed that any needed repairs or replacements of components located in these areas are not the responsibility of the Association and costs associated with any work on these components will not be funded from Replacement Reserves.. They component located in these areas include but are not limited to those listed.

- Asphalt pavement.
- Asphalt trail (along Rollins Ford).
- Concrete sidewalks.
- Concrete curb & gutter.
- Stormwater management system components.
- Utilities, including electrical, sanitary sewers, domestic water mains, and natural gas.

REPLACEMENT RESERVE REPORT

E. METHODOLOGY

The site data used in this *Replacement Reserve Study* is based upon information provided by the Association and our visual survey of the property on the dates stated in the Report. We have estimated the normal economic life, remaining economic life, and replacement cost for each component listed in the *Replacement Reserve Inventory*. We have used Government standards, published estimating manuals, our experience with similar properties, and engineering judgment to develop these estimates.

Our visual survey of the property did not ascertain compliance with current building codes, but assumed that all components met building code requirements in force at the time of construction. This *Replacement Reserve Study* has been developed with care by experienced persons, but Richard J. Schuetz, AIA, Architect (and/or its representatives) makes no representations that the Study includes, evaluates, and estimates all appropriate components, or discloses all defects, concealed or visible. No warranty or guarantee is expressed or implied.

Actual experience in replacing components may differ significantly from the estimates in the Study because of conditions beyond our control. These differences may be caused by maintenance practices, inflation, variations in pricing and market conditions, future technological developments, regulatory actions, acts of God, and luck. Some components may function normally during our survey and then fail without notice.

The intent of this RSTUDY+ *Replacement Reserve Study* is to provide the Association with an inventory of the common elements of the community, a general view of the condition of these components, and an effective financial planning tool for the replacement of the community facilities and infrastructure components with limited life, for which, the Association is responsible. To be effective, this Study should be reviewed by the MORRIS FARM Board of Directors, those responsible for the management of the components included in the *Inventory*, and the accounting professionals employed by the Association. We are prepared to provide a revision to *Replacement Reserve Inventory* and the *Replacement Reserve Analysis* upon the request of the Board of Directors.

Respectfully Submitted,
RICHARD J. SCHUETZ, AIA
ARCHITECT

Wm Bruce Bennett

Wm. Bruce Bennett
Senior Reserve Analyst

REPLACEMENT RESERVE ANALYSIS

MORRIS FARM

November 2012

GENERAL INFORMATION:

2014	Study Year
\$401,330	Replacement Reserves reported to be on deposit at start of Study Year
\$2,901,546	Estimated value of all Components included in the Replacement Reserve Inventory
The information shown in this Summary does not account for interest earned on Replacement Reserves on deposit, nor does it include adjustments for inflation. For more information see the attached Appendix.	

REPORTED CURRENT FUNDING DATA:

\$84,000	REPORTED CURRENT ANNUAL CONTRIBUTION TO REPLACEMENT RESERVES
\$10.61	Per unit current monthly contribution to Replacement Reserves

CASH FLOW METHOD CALCULATIONS:

\$118,074	MINIMUM RECOMMENDED ANNUAL CONTRIBUTION TO REPLACEMENT RESERVES
\$14.91	Per unit minimum recommended monthly contribution to Replacement Reserves
\$145,077	Recommended minimum Replacement Reserve Funding Threshold (5.0 percent)
2039	First year Reserves fall to minimum recommended level (Design Year)

COMPONENT METHOD CALCULATIONS:

\$206,703	MINIMUM RECOMMENDED ANNUAL CONTRIBUTION TO RESERVES (IN STUDY YEAR)
\$26.10	Per unit minimum recommended monthly contribution to Replacement Reserves
\$985,147	Current Funding Objective
40.74%	Funding Percentage
\$583,817	One time deposit required to fully fund Replacement Reserves
\$129,189	Annual Contribution to Replacement Reserves if Reserves were fully funded.

PROJECT INFORMATION:

PROPERTY MANAGED BY:	MAJOR COMPONENTS IN ANALYSIS:	TYPE OF PROPERTY:
SEQUOIA MANAGEMENT	Asphalt pavement, concrete sidewalks,	Residential
Jessica Azzarano	Community Center, swimming pools, tot lots	# OF UNITS:
13998 Parkeast Circle	entrance features, retaining walls, fences, etc.	660
Chantilly, Virginia 20151	PROPERTY LOCATION:	YEAR BUILT:
	Gainesville, Virginia	2002 to present

NOTES:

This Analysis conforms to the National Reserve Study Standards of the Community Associations Institute adopted in 1998. This Association uses a fiscal year. The 2014 Study Year covers the period of November 1, 2013 to October 31, 2014. At completion the community will consists of 603 single family homes and 57 townhouses. 642 units were complete as of or August 2012 evaluation.

In a memo dated August 13, 2012, the Association reports Replacement Reserves on Deposit totaling \$317,329.72 on deposit on November 1, 2012 and monthly deposit of \$7,000.

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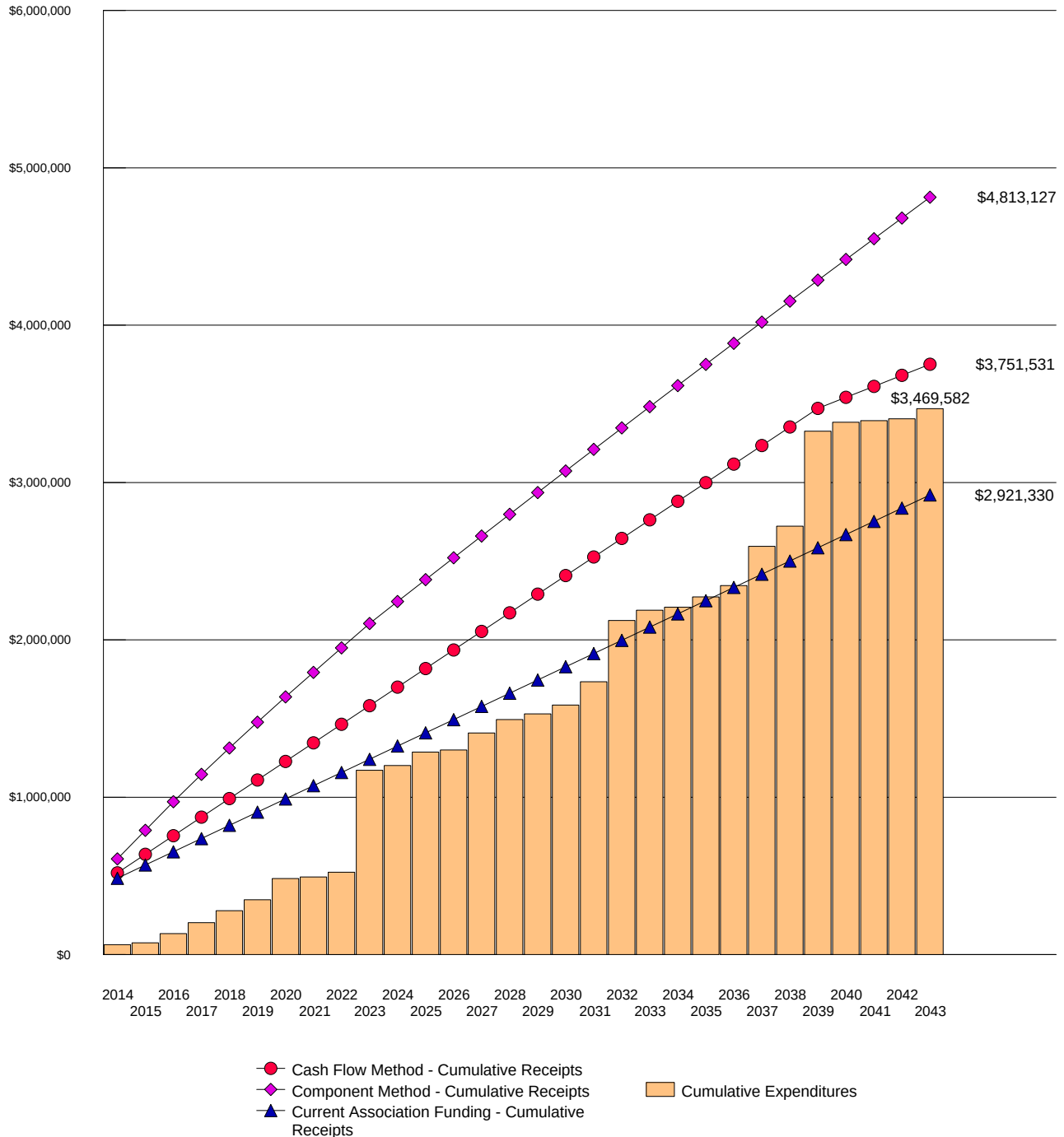
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REPLACEMENT RESERVE ANALYSIS

MORRIS FARM

November 2012

Funding Methods Comparison Graph - Cumulative Receipts and Expenditures



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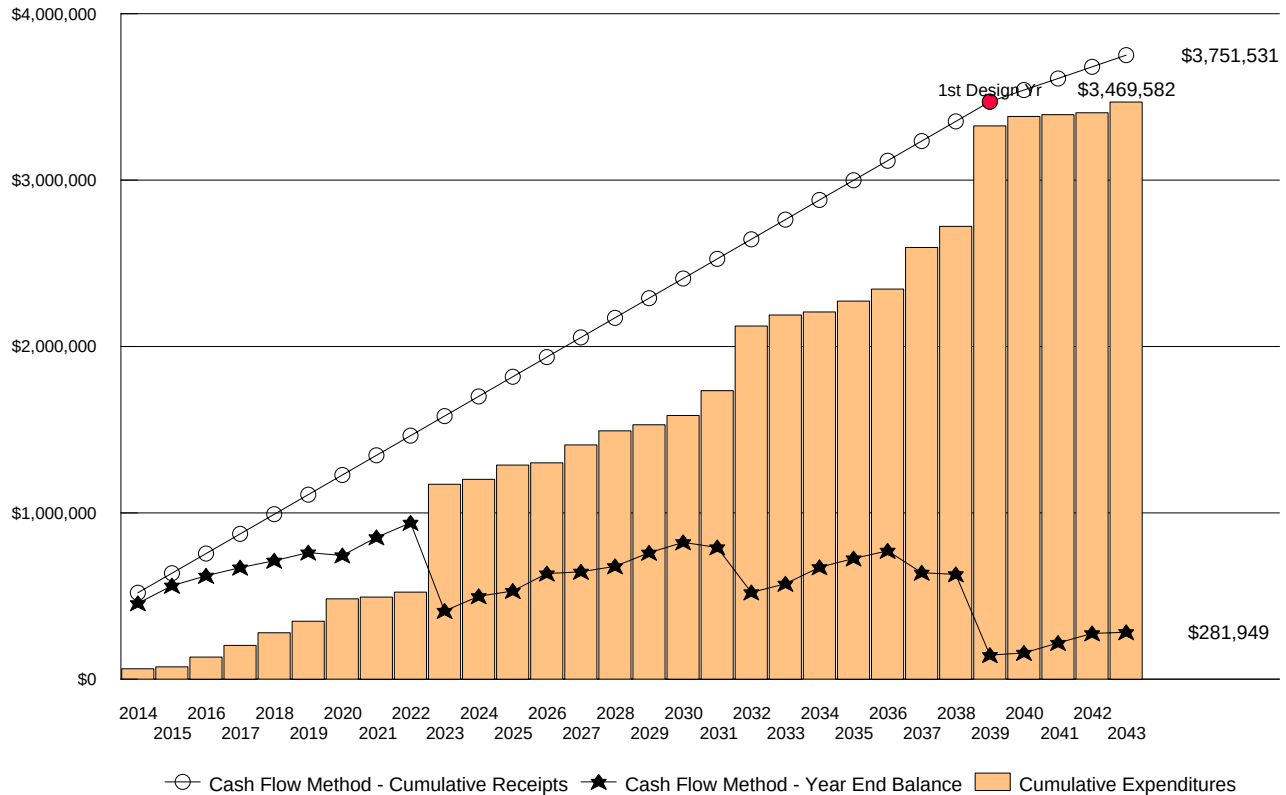
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REPLACEMENT RESERVE ANALYSIS

MORRIS FARM

November 2012

Cash Flow Method - Cumulative Receipts and Expenditures Graph



Cash Flow Method Data - Years 1 through 30

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	TEN YEAR SUMMARIES
Starting balance	\$401,330										
Annual deposit	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	Expenditures:
Expenditures	\$62,919	\$12,021	\$58,646	\$69,378	\$76,178	\$69,321	\$135,128	\$10,021	\$29,791	\$648,368	\$1,171,772
Year end balance	\$456,485	\$562,538	\$621,966	\$670,662	\$712,558	\$761,310	\$744,256	\$852,308	\$940,591	\$410,297	Receipts:
Minimum rec. funding lvl.	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$1,582,068
Cumulative expenditures	\$62,919	\$74,940	\$133,586	\$202,964	\$279,142	\$348,463	\$483,591	\$493,613	\$523,404	\$1,171,772	
Cumulative receipts	\$519,404	\$637,478	\$755,552	\$873,625	\$991,699	\$1,109,773	\$1,227,847	\$1,345,921	\$1,463,995	\$1,582,068	
Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	TEN YEAR SUMMARIES
Annual deposit	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	
Expenditures	\$30,031	\$85,720	\$13,421	\$107,340	\$85,263	\$36,339	\$55,927	\$148,771	\$388,805	\$65,778	Expenditures:
Year end balance	\$498,340	\$530,693	\$635,346	\$646,080	\$678,890	\$760,625	\$822,771	\$792,074	\$521,343	\$573,639	\$1,017,396
Minimum rec. funding lvl.	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	Receipts:
Cumulative expenditures	\$1,201,803	\$1,287,523	\$1,300,944	\$1,408,284	\$1,493,548	\$1,529,887	\$1,585,814	\$1,734,585	\$2,123,390	\$2,189,168	\$1,182,762
Cumulative receipts	\$1,700,142	\$1,818,216	\$1,936,290	\$2,054,364	\$2,172,438	\$2,290,511	\$2,408,585	\$2,526,659	\$2,644,733	\$2,762,807	
Year	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	TEN YEAR SUMMARIES
Annual deposit	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$118,074	\$70,070	\$70,070	\$70,070	\$70,070	
Expenditures	\$18,483	\$65,646	\$72,379	\$249,376	\$127,707	\$603,414	\$57,246	\$10,021	\$12,021	\$64,121	Expenditures:
Year end balance	\$673,230	\$725,658	\$771,353	\$640,051	\$630,418	\$145,077	\$157,902	\$217,951	\$276,000	\$281,949	\$1,280,414
Minimum rec. funding lvl.	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	\$145,077	Receipts:
Cumulative expenditures	\$2,207,651	\$2,273,297	\$2,345,675	\$2,595,051	\$2,722,758	\$3,326,173	\$3,383,418	\$3,393,440	\$3,405,461	\$3,469,582	\$990,758
Cumulative receipts	\$2,880,881	\$2,998,955	\$3,117,028	\$3,235,102	\$3,353,176	\$3,471,250	\$3,541,320	\$3,611,391	\$3,681,461	\$3,751,531	

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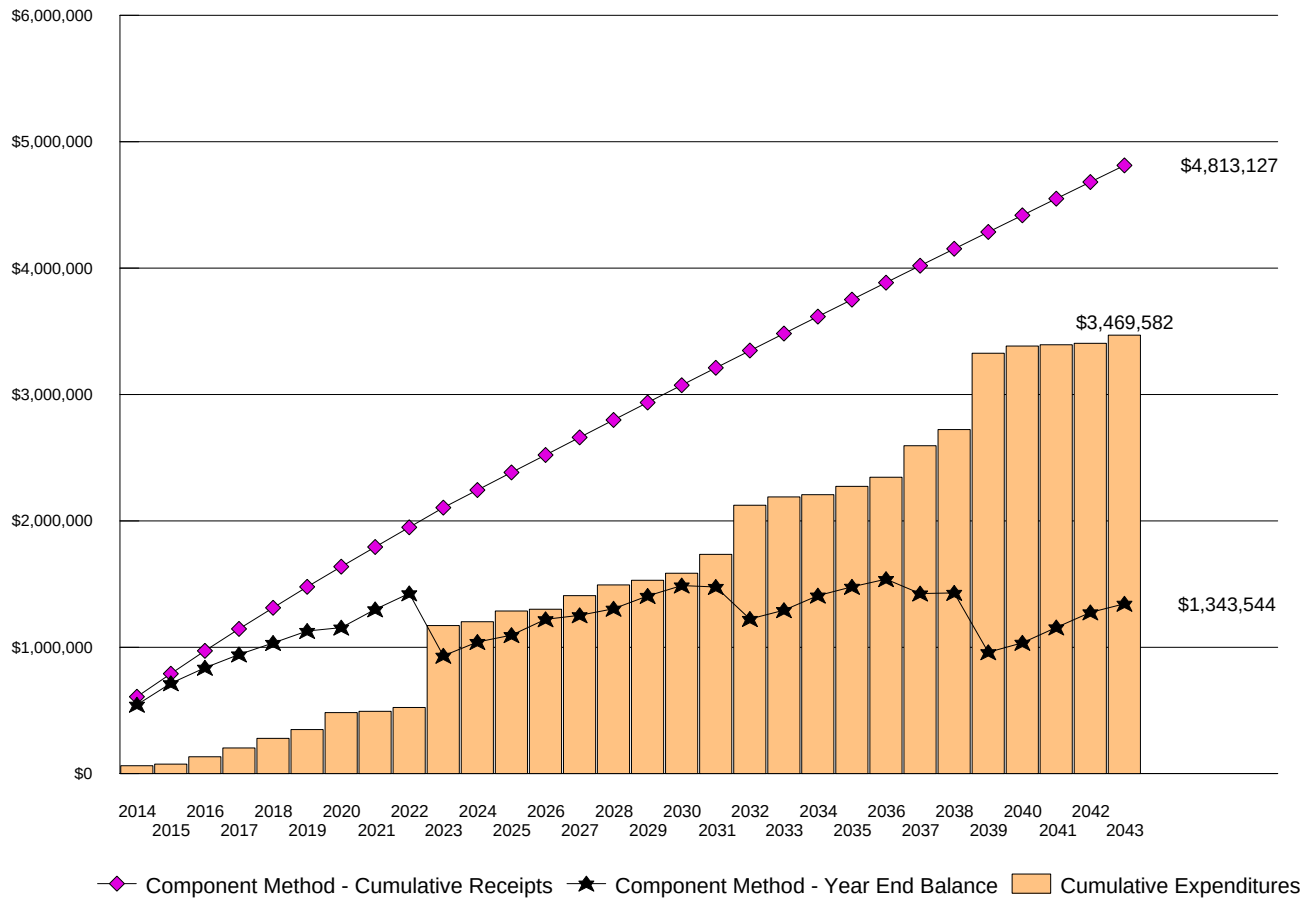
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REPLACEMENT RESERVE ANALYSIS

MORRIS FARM

November 2012

Component Method - Cumulative Receipts and Expenditures Graph



Component Method Data - Years 1 through 30

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	TEN YEAR SUMMARIES
Starting balance	\$401,330										
Annual deposit	\$206,703	\$182,053	\$181,270	\$173,955	\$167,382	\$164,904	\$160,721	\$155,496	\$155,496	\$154,966	
Expenditures	\$62,919	\$12,021	\$58,646	\$69,378	\$76,178	\$69,321	\$135,128	\$10,021	\$29,791	\$648,368	
Year end balance	\$545,114	\$715,146	\$837,770	\$942,347	\$1,033,551	\$1,129,134	\$1,154,727	\$1,300,201	\$1,425,906	\$932,505	
Cumulative Expenditures	\$62,919	\$74,940	\$133,586	\$202,964	\$279,142	\$348,463	\$483,591	\$493,613	\$523,404	\$1,171,772	Expenditures: \$1,171,772 Receipts: \$2,104,276
Cumulative Receipts	\$608,033	\$790,086	\$971,356	\$1,145,311	\$1,312,693	\$1,477,597	\$1,638,318	\$1,793,814	\$1,949,310	\$2,104,276	
Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	TEN YEAR SUMMARIES
Annual deposit	\$139,508	\$139,115	\$138,778	\$138,778	\$138,000	\$137,769	\$137,518	\$137,518	\$136,376	\$134,397	
Expenditures	\$30,031	\$85,720	\$13,421	\$107,340	\$85,263	\$36,339	\$55,927	\$148,771	\$388,805	\$65,778	
Year end balance	\$1,041,982	\$1,095,376	\$1,220,733	\$1,252,171	\$1,304,908	\$1,406,338	\$1,487,929	\$1,476,676	\$1,224,247	\$1,292,866	
Cumulative Expenditures	\$1,201,803	\$1,287,523	\$1,300,944	\$1,408,284	\$1,493,548	\$1,529,887	\$1,585,814	\$1,734,585	\$2,123,390	\$2,189,168	
Cumulative Receipts	\$2,243,784	\$2,382,899	\$2,521,677	\$2,660,456	\$2,798,456	\$2,936,225	\$3,073,743	\$3,211,261	\$3,347,637	\$3,482,034	Expenditures: \$1,017,396 Receipts: \$1,379,782
Year	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	
Annual deposit	\$134,397	\$134,397	\$134,397	\$134,397	\$133,368	\$133,368	\$131,692	\$131,692	\$131,692	\$131,692	Expenditures: \$1,280,414 Receipts: \$1,333,126
Expenditures	\$18,483	\$65,646	\$72,379	\$249,376	\$127,707	\$603,414	\$57,246	\$10,021	\$12,021	\$64,121	
Year end balance	\$1,408,781	\$1,477,532	\$1,539,550	\$1,424,572	\$1,430,232	\$960,186	\$1,034,632	\$1,156,303	\$1,275,974	\$1,343,544	
Cumulative Expenditures	\$2,207,651	\$2,273,297	\$2,345,675	\$2,595,051	\$2,722,758	\$3,326,173	\$3,383,418	\$3,393,440	\$3,405,461	\$3,469,582	
Cumulative Receipts	\$3,616,432	\$3,750,829	\$3,885,226	\$4,019,623	\$4,152,991	\$4,286,359	\$4,418,051	\$4,549,743	\$4,681,435	\$4,813,127	

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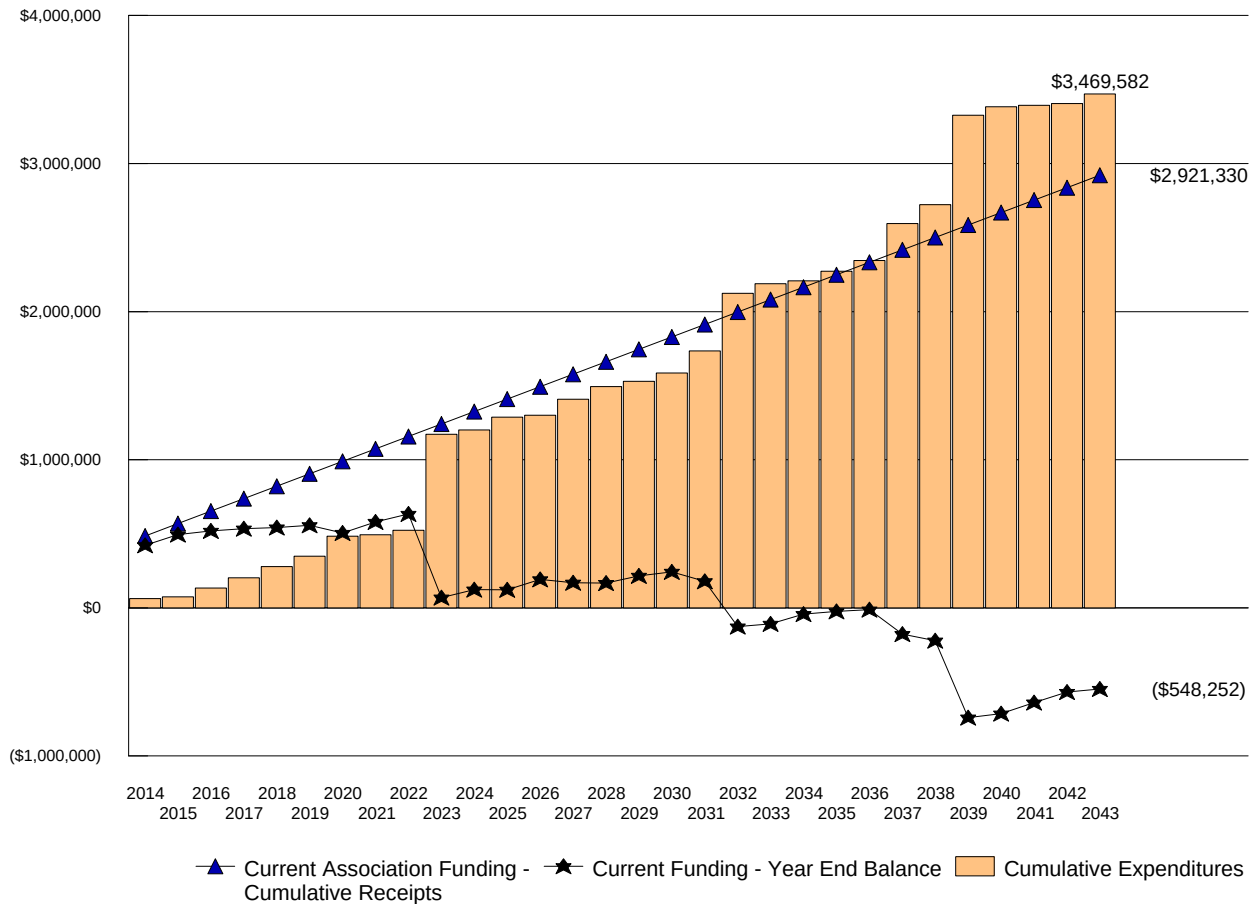
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REPLACEMENT RESERVE ANALYSIS

MORRIS FARM

November 2012

Current Association Funding - Cumulative Receipts and Expenditures Graph



Current Funding Data - Years 1 through 30

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	TEN YEAR SUMMARIES
Starting balance	\$401,330										
Annual deposit	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	
Expenditures	\$62,919	\$12,021	\$58,646	\$69,378	\$76,178	\$69,321	\$135,128	\$10,021	\$29,791	\$648,368	
Year end balance	\$422,411	\$494,390	\$519,744	\$534,366	\$542,188	\$556,867	\$505,739	\$579,717	\$633,926	\$69,558	
Cumulative Expenditures	\$62,919	\$74,940	\$133,586	\$202,964	\$279,142	\$348,463	\$483,591	\$493,613	\$523,404	\$1,171,772	Expenditures: \$1,171,772
Cumulative Receipts	\$485,330	\$569,330	\$653,330	\$737,330	\$821,330	\$905,330	\$989,330	\$1,073,330	\$1,157,330	\$1,241,330	Receipts: \$1,241,330
Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	TEN YEAR SUMMARIES
Annual deposit	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	
Expenditures	\$30,031	\$85,720	\$13,421	\$107,340	\$85,263	\$36,339	\$55,927	\$148,771	\$388,805	\$65,778	
Year end balance	\$123,527	\$121,807	\$192,386	\$169,046	\$167,782	\$215,443	\$243,516	\$178,745	(\$126,060)	(\$107,838)	
Cumulative expenditures	\$1,201,803	\$1,287,523	\$1,300,944	\$1,408,284	\$1,493,548	\$1,529,887	\$1,585,814	\$1,734,585	\$2,123,390	\$2,189,168	
Cumulative receipts	\$1,325,330	\$1,409,330	\$1,493,330	\$1,577,330	\$1,661,330	\$1,745,330	\$1,829,330	\$1,913,330	\$1,997,330	\$2,081,330	Expenditures: \$1,017,396
Annual deposit	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	\$84,000	TEN YEAR SUMMARIES
Expenditures	\$18,483	\$65,646	\$72,379	\$249,376	\$127,707	\$603,414	\$57,246	\$10,021	\$12,021	\$64,121	
Year end balance	(\$42,321)	(\$23,967)	(\$12,345)	(\$177,721)	(\$221,428)	(\$740,843)	(\$714,088)	(\$640,110)	(\$568,131)	(\$548,252)	
Cumulative Expenditures	\$2,207,651	\$2,273,297	\$2,345,675	\$2,595,051	\$2,722,758	\$3,326,173	\$3,383,418	\$3,393,440	\$3,405,461	\$3,469,582	
Cumulative Receipts	\$2,165,330	\$2,249,330	\$2,333,330	\$2,417,330	\$2,501,330	\$2,585,330	\$2,669,330	\$2,753,330	\$2,837,330	\$2,921,330	

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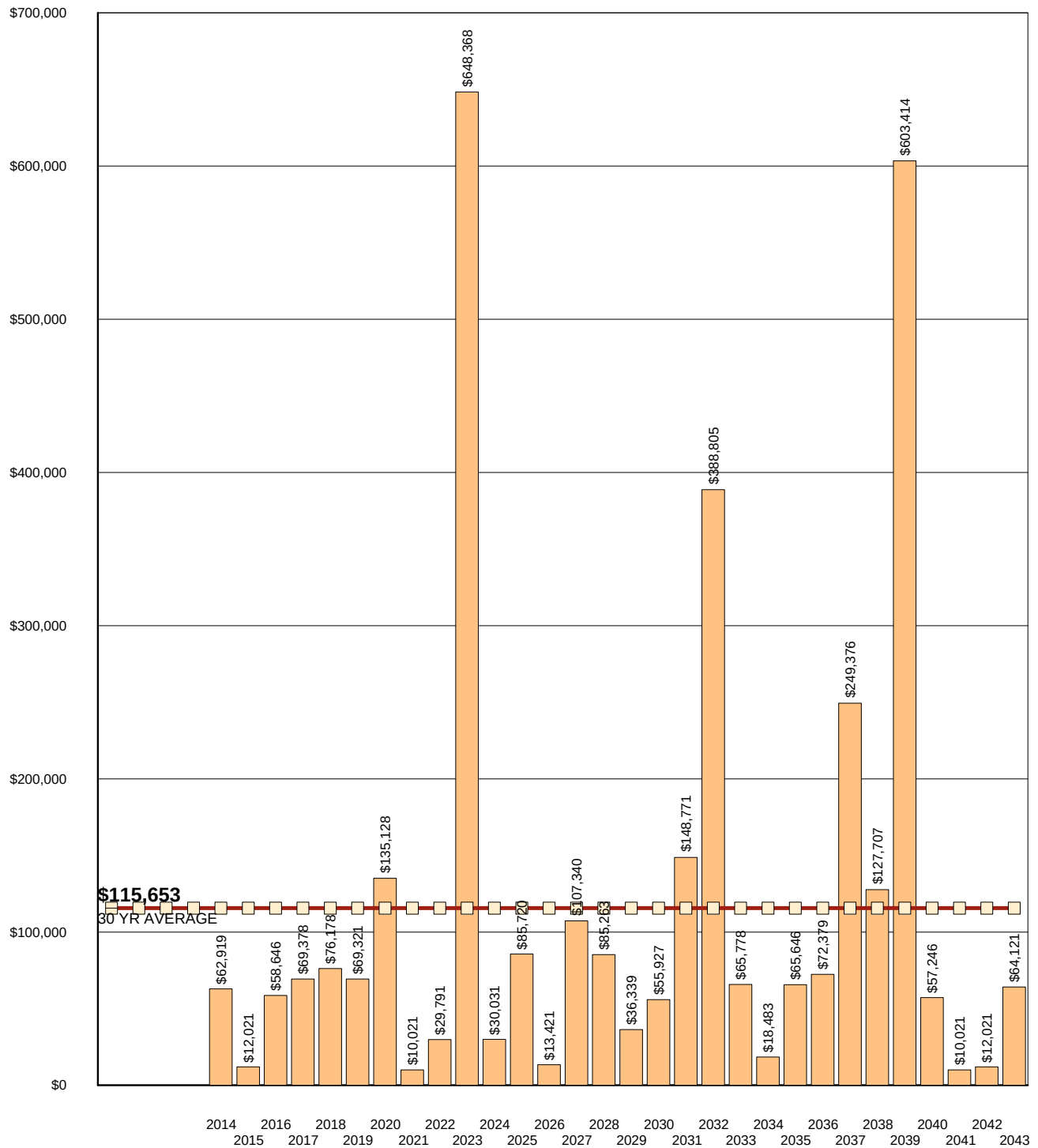
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REPLACEMENT RESERVE ANALYSIS

MORRIS FARM

November 2012

Graph of Annual Replacement Expenditures



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REPLACEMENT RESERVE INVENTORY

MORRIS FARM

November 2012

INVENTORY OF COMPONENTS - NORMAL REPLACEMENT

ITEM #		UNIT	NUMBER OF UNITS	UNIT REPLACEMENT COST (\$)	NORMAL ECONOMIC LIFE (YRS)	REMAINING ECONOMIC LIFE (YRS)	TOTAL REPLACEMENT COST (\$)
TOWNHOUSE CONCRETE COMPONENTS							
1	Concrete sidewalks - 1%	sf	113	\$8.50	1	none	\$957
2	Concrete sidewalks - 10%	sf	1,126	\$8.50	80	9	\$9,573
3	Concrete sidewalks - 15%	sf	1,689	\$8.50	80	25	\$14,359
4	Concrete sidewalks - 20%	sf	2,252	\$8.50	80	41	\$19,145
5	Concrete sidewalks - 25%	sf	2,816	\$8.50	80	57	\$23,932
6	Concrete sidewalks - 30%	sf	3,379	\$8.50	80	73	\$28,718
7	Concrete curb & gutter - 1%	ft	33	\$34.00	1	none	\$1,127
8	Concrete curb & gutter - 10%	ft	332	\$34.00	80	9	\$11,274
9	Concrete curb & gutter - 15%	ft	497	\$34.00	80	25	\$16,912
10	Concrete curb & gutter - 20%	ft	663	\$34.00	80	41	\$22,549
11	Concrete curb & gutter - 25%	ft	829	\$34.00	80	57	\$28,186
12	Concrete curb & gutter - 30%	ft	995	\$34.00	80	73	\$33,823

COMMENTS:

Common concrete components. These components are located in the townhouse section of the community, Community Center, and South Tot Lot.

Concrete components. We have assumed that major concrete sidewalk and curb & gutter replacements will be done in conjunction with the asphalt pavement replacement project in 2023 and every 16 years thereafter. We have included increasing percentages of components for replacement to reflect the normal aging of the materials. Interim replacements of concrete components will be necessary and we have assumed the Association will make annual replacements at the rate of approximately 1 percent per year, with a focus on components that are potential trip/safety hazards.

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM

November 2012

INVENTORY OF COMPONENTS - NORMAL REPLACEMENT

ITEM #		UNIT	NUMBER OF UNITS	UNIT REPLACEMENT COST (\$)	NORMAL ECONOMIC LIFE (YRS)	REMAINING ECONOMIC LIFE (YRS)	TOTAL REPLACEMENT COST (\$)
COURTYARD CONCRETE & BRICK PAVEMENT							
13	Concrete pavement - 1%	sf	592	\$8.50	1	none	\$5,032
14	Concrete pavement - 10%	sf	5,920	\$8.50	80	9	\$50,317
15	Concrete pavement - 15%	sf	8,879	\$8.50	80	25	\$75,475
16	Concrete pavement - 20%	sf	11,839	\$8.50	80	41	\$100,633
17	Concrete pavement - 25%	sf	14,799	\$8.50	80	57	\$125,792
18	Concrete pavement - 30%	sf	17,759	\$8.50	80	73	\$150,950
19	Tuckpoint brick pavement (25%)	sf	3,010	\$12.50	16	9	\$37,625
20	Tuckpoint brick pavement (1%)	sf	120	\$12.50	1	none	\$1,505

COMMENTS:

Common concrete pavement. These components are located in the 25 courtyards adjacent to Song Sparrow Drive, Sharpshinned Drive, and Screech Owl Court.

Concrete components. We have assumed that major concrete pavement replacements will be done in conjunction with the asphalt pavement replacement project in 2023 and every 16 years thereafter. We have included increasing percentages of components for replacement to reflect the normal aging of the materials. Interim replacements of concrete components will be necessary and we have assumed the Association will make annual replacements at the rate of approximately 1 percent per year, with a focus on components that are potential trip/safety hazards.

Brick pavement. 14 of the courtyards are constructed of a combination of concrete and brick pavement. We have assumed that major brick tuckpointing project will be conducted every 16 years in conjunction with the other pavement replacements and that the Association will conduct annual projects at the rate of approximately 1 percent per year.

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM

November 2012

INVENTORY OF COMPONENTS - NORMAL REPLACEMENT

ITEM #		UNIT	NUMBER OF UNITS	UNIT REPLACEMENT COST (\$)	NORMAL ECONOMIC LIFE (YRS)	REMAINING ECONOMIC LIFE (YRS)	TOTAL REPLACEMENT COST (\$)
ASPHALT PAVEMENT - ROADS & PARKING							
21	Asphalt pavement - townhouse	sf	37,558	\$1.74	16	9	\$65,351
22	Asphalt pavement - Community Cntr	sf	16,638	\$1.74	16	9	\$28,950
23	Alley - Barn Owl	sf	7,146	\$1.74	16	9	\$12,434
24	Alley - Yellow Hammer / Junco	sf	10,008	\$1.74	16	9	\$17,414
25	Alley - Indigo Bunting (2 locations)	sf	34,362	\$1.74	16	9	\$59,790
26	Alley - Catbird / Woodpecker	sf	10,278	\$1.74	16	9	\$17,884
27	Alley - Yellow Hammer / Woodpecker	sf	4,878	\$1.74	16	9	\$8,488
28	Alley - Yellow Hammer / Ruffed Grouse	sf	11,088	\$1.74	16	9	\$19,293
29	Alley - Yellow Hammer / Willet	sf	4,860	\$1.74	16	9	\$8,456
30	Alley - Brown Thrasher / Willet	sf	17,118	\$1.74	16	9	\$29,785
31	Alley - Yellow Leg / Song Sparrow	sf	16,452	\$1.74	16	9	\$28,626
32	Alley - Yellow Leg / Blue Heron	sf	17,496	\$1.74	16	9	\$30,443
33	Alley - Red Start	sf	5,850	\$1.74	16	9	\$10,179
34	Alley - Sharpshinned (2 locations)	sf	16,740	\$1.74	16	9	\$29,128
35	Alley - Ladderbacked	sf	4,554	\$1.74	16	9	\$7,924
36	Sealcoat pavement - Cycle 1	sf	215,026	\$0.22	16	none	\$47,306
37	Sealcoat pavement - Cycle 2	sf	215,026	\$0.25	16	3	\$53,757
38	Sealcoat pavement - Cycle 3	sf	215,026	\$0.29	16	6	\$62,358
39	Asphalt trails (33%)	sf	13,893	\$3.50	12	2	\$48,624
40	Asphalt trails (33%)	sf	13,893	\$3.50	12	6	\$48,624
41	Asphalt trails (33%)	sf	13,893	\$3.50	12	9	\$48,624

COMMENTS:

Common asphalt pavement. Common roadways and parking areas are located in the townhouse section of the community, the parking area adjacent to the Community Center, and 15 alleys (and pipestems).

Asphalt roadways and parking replacement. The cost shown above assumes that the pavement will be milled and that base repairs will be needed at 5 to 10 percent of the total area. We have assumed that all of the common pavement will be done as a single project to achieve economies of scale.

Asphalt trails. Asphalt trails (and access roads) are located at the Peacock Park and in the open space in the southeast corner of the community.

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM

November 2012

INVENTORY OF COMPONENTS - NORMAL REPLACEMENT

ITEM #		UNIT	NUMBER OF UNITS	UNIT REPLACEMENT COST (\$)	NORMAL ECONOMIC LIFE (YRS)	REMAINING ECONOMIC LIFE (YRS)	TOTAL REPLACEMENT COST (\$)
GENERAL SITE IMPROVEMENTS							
42	Tuckpoint ext. simulated stone (5%)	sf	143	\$12.50	10	none	\$1,792
43	Fence replacement project (33%)	ls	1	\$1,200.00	15	none	\$1,200
44	Fence replacement project (33%)	ls	1	\$1,200.00	15	5	\$1,200
45	Fence replacement project (33%)	ls	1	\$1,200.00	15	10	\$1,200
46	Sitting area trellis	ea	2	\$2,400.00	20	11	\$4,800
47	Benches & trash receptacles	ls	1	\$5,000.00	15	6	\$5,000
48	Trail signage - renovation	ls	1	\$1,400.00	5	2	\$1,400
49	Segmental retaining walls (5%)	sf	114	\$55.00	10	4	\$6,273
50	Retaining wall metal railings (33%)	ft	262	\$42.00	30	10	\$11,018
51	Retaining wall metal railings (33%)	ft	262	\$42.00	30	15	\$11,018
52	Retaining wall metal railings (33%)	ft	262	\$42.00	30	25	\$11,018
53	Community Center post lights	ea	7	\$2,400.00	30	23	\$16,800
54	Peacock Park post lights	ea	4	\$2,400.00	30	23	\$9,600
55	Metal street signs & posts	ea	282	\$850.00	25	18	\$239,700

COMMENTS:

Tuckpointing ext. simulated stone. We have consolidated the precast simulated stone at the entrance features, sitting areas, and stone piers located along Rollins Ford Road into this line item and assumed that 5 percent of the masonry will be tuckpointed every 10 years.

Segmental retaining walls. Five major retaining walls are installed in the townhouse section of the community.

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM

November 2012

INVENTORY OF COMPONENTS - NORMAL REPLACEMENT

ITEM #		UNIT	NUMBER OF UNITS	UNIT REPLACEMENT COST (\$)	NORMAL ECONOMIC LIFE (YRS)	REMAINING ECONOMIC LIFE (YRS)	TOTAL REPLACEMENT COST (\$)
COMMUNITY CENTER							
56	Metal roof coating	sf	3,110	\$3.35	10	13	\$10,419
57	Siding, doors, trim, windows, & louvers	sf	2,350	\$10.50	25	18	\$24,675
58	Tuckpoint facade simulated stone (5%)	sf	98	\$12.50	10	4	\$1,225
59	Locker room renovation	ls	1	\$28,000.00	20	13	\$28,000
60	Electrical service - renovation	ls	1	\$6,000.00	30	23	\$6,000
61	Hot water heater	ea	1	\$1,400.00	10	3	\$1,400
62	HVAC system	ea	1	\$4,200.00	15	8	\$4,200

COMMENTS:

Tuckpointing entrance features. We have consolidated the precast simulated stone in the Community Center facade and and the piers on the pool deck into this line item and assumed that 5 percent of the masonry will be tuckpointed every 10 years.

Hot water heater and HVAC equipment. The hot water heater should be replaced only at failure.

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM

November 2012

INVENTORY OF COMPONENTS - NORMAL REPLACEMENT

ITEM #		UNIT	NUMBER OF UNITS	UNIT REPLACEMENT COST (\$)	NORMAL ECONOMIC LIFE (YRS)	REMAINING ECONOMIC LIFE (YRS)	TOTAL REPLACEMENT COST (\$)
SWIMMING POOLS							
63	Concrete pool deck	sf	12,040	\$12.00	30	23	\$144,480
64	Pool deck fence - 6'	ft	506	\$55.00	30	23	\$27,830
65	Pool deck fence - 4'	ft	83	\$45.00	30	23	\$3,726
66	Shuffleboard court surface	ea	1	\$2,200.00	10	3	\$2,200
67	Pool deck trellis	ea	2	\$6,120.00	20	11	\$12,240
68	Pools - structure & brella feature	sf	5,510	\$70.00	50	43	\$385,700
69	Pools - finish coat (white coat)	sf	5,510	\$7.15	7	4	\$39,397
70	Pools - tile and coping	ft	380	\$54.00	21	14	\$20,520
71	Pools - pool covers	sf	5,510	\$3.75	7	4	\$20,663
72	Main pool - pump	ea	1	\$5,600.00	15	8	\$5,600
73	Wading pool - pump	ea	1	\$1,500.00	15	8	\$1,500
74	Pool features-pumps	ls	1	\$7,000.00	15	8	\$7,000
75	Filter systems & associated plumbing	ls	1	\$9,000.00	20	13	\$9,000
76	Pool furniture - 33%	ls	1	\$3,400.00	9	1	\$3,400
77	Pool furniture - 33%	ls	1	\$3,400.00	9	3	\$3,400
78	Pool furniture - 33%	ls	1	\$3,400.00	9	6	\$3,400

COMMENTS:

Pool deck. We have assumed that the project to replace the pool deck will include the replacement of all plumbing and electrical systems located beneath the pool deck.

White coat. We have established the remaining economic life of the white coat based on a visual evaluation.

Pool pumps. These pumps are normally only replaced at failure. The wading pool pump was not on site.

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM

November 2012

INVENTORY OF COMPONENTS - NORMAL REPLACEMENT

ITEM #		UNIT	NUMBER OF UNITS	UNIT REPLACEMENT COST (\$)	NORMAL ECONOMIC LIFE (YRS)	REMAINING ECONOMIC LIFE (YRS)	TOTAL REPLACEMENT COST (\$)
TOT LOTS & PEACOCK PARK							
79	South Tot Lot - MP equipment	ea	1	\$16,000.00	20	13	\$16,000
80	South Tot Lot - swing	ea	1	\$4,200.00	20	13	\$4,200
81	North Tot Lot - swing	ea	1	\$6,400.00	20	15	\$6,400
82	North Tot Lot - seesaw	ea	1	\$1,700.00	20	15	\$1,700
83	North Tot Lot - wood border	ft	205	\$14.00	12	8	\$2,870
84	Peacock Park - MP equipment	ea	1	\$24,000.00	20	13	\$24,000
85	Peacock Park - climb structure	ea	1	\$3,500.00	20	13	\$3,500
86	Peacock Park - wood border	ft	285	\$25.00	12	6	\$7,125
87	Peacock Park - deck & structure	sf	318	\$38.00	15	9	\$12,084
88	Peacock Park - railing	ft	104	\$32.00	15	9	\$3,328

COMMENTS:

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM

November 2012

INVENTORY OF COMPONENTS - NORMAL REPLACEMENT

ITEM #		UNIT	NUMBER OF UNITS	UNIT REPLACEMENT COST (\$)	NORMAL ECONOMIC LIFE (YRS)	REMAINING ECONOMIC LIFE (YRS)	TOTAL REPLACEMENT COST (\$)
STORMWATER & IRRIGATION SYSTEMS							
89	Hydrographic survey	ea	1	\$4,000.00	5	none	\$4,000
90	Dredge equipment - mobilization	ls	1	\$10,000.00	15	9	\$10,000
91	Dredging	cy	3,449	\$21.00	15	9	\$72,429
92	ON-SITE disposal of dredge material	cy	3,449	\$3.00	15	9	\$10,347
93	Irrigation system (minor renovation)	sf	111,000	\$0.50	24	5	\$55,500
94	Irrigation system (replacement)	sf	111,000	\$1.25	24	17	\$138,750

COMMENTS:

Stormwater system costs. We have used costs and economic life data in "Maintaining Stormwater Systems, A Guidebook for Private Owners and Operators", after making adjustments for inflation and our experience with similar communities in the area.

We have assumed that the ponds will be dredged every 15 years and that the project will remove an average of 12 inches of material. This assumption should be verified by a hydrographic survey, and the Replacement Reserve Inventory modified to reflect the findings and recommendations of the survey.

Irrigation systems. We have estimated the square footage of irrigation at Peacock Park, the Community Center, and along Rollins Ford Road. We have assumed the replacement project will address plumbing, heads, controllers, backflow preventers, covers, etc.

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM
November 2012
SCHEDULE OF REPLACEMENTS - YEARS ONE TO FIFTEEN

2014		2015		2016	
Sealcoat pavement - Cycle 1	\$47,306	Concrete pavement - 1%	\$5,032	Asphalt trails (33%)	\$48,624
Concrete pavement - 1%	\$5,032	Pool furniture - 33%	\$3,400	Concrete pavement - 1%	\$5,032
Hydrographic survey	\$4,000	Tuckpoint brick pavement (1%)	\$1,505	Tuckpoint brick pavement (1%)	\$1,505
Tuckpoint ext. simulated stone (5%)	\$1,792	Concrete curb & gutter - 1%	\$1,127	Trail signage - renovation	\$1,400
Tuckpoint brick pavement (1%)	\$1,505	Concrete sidewalks - 1%	\$957	Concrete curb & gutter - 1%	\$1,127
Fence replacement project (33%)	\$1,200			Concrete sidewalks - 1%	\$957
Concrete curb & gutter - 1%	\$1,127				
Concrete sidewalks - 1%	\$957				
Total Scheduled Replacements	\$62,919	Total Scheduled Replacements	\$12,021	Total Scheduled Replacements	\$58,646
2017		2018		2019	
Sealcoat pavement - Cycle 2	\$53,757	Pools - finish coat (white coat)	\$39,397	Irrigation system (minor renovation)	\$55,500
Concrete pavement - 1%	\$5,032	Pools - pool covers	\$20,663	Concrete pavement - 1%	\$5,032
Pool furniture - 33%	\$3,400	Segmental retaining walls (5%)	\$6,273	Hydrographic survey	\$4,000
Shuffleboard court surface	\$2,200	Concrete pavement - 1%	\$5,032	Tuckpoint brick pavement (1%)	\$1,505
Tuckpoint brick pavement (1%)	\$1,505	Tuckpoint brick pavement (1%)	\$1,505	Fence replacement project (33%)	\$1,200
Hot water heater	\$1,400	Tuckpoint facade simulated stone	\$1,225	Concrete curb & gutter - 1%	\$1,127
Concrete curb & gutter - 1%	\$1,127	Concrete curb & gutter - 1%	\$1,127	Concrete sidewalks - 1%	\$957
Concrete sidewalks - 1%	\$957	Concrete sidewalks - 1%	\$957		
Total Scheduled Replacements	\$69,378	Total Scheduled Replacements	\$76,178	Total Scheduled Replacements	\$69,321
2020		2021		2022	
Sealcoat pavement - Cycle 3	\$62,358	Concrete pavement - 1%	\$5,032	Pool features-pumps	\$7,000
Asphalt trails (33%)	\$48,624	Tuckpoint brick pavement (1%)	\$1,505	Main pool - pump	\$5,600
Peacock Park - wood border	\$7,125	Trail signage - renovation	\$1,400	Concrete pavement - 1%	\$5,032
Concrete pavement - 1%	\$5,032	Concrete curb & gutter - 1%	\$1,127	HVAC system	\$4,200
Benches & trash receptacles	\$5,000	Concrete sidewalks - 1%	\$957	North Tot Lot - wood border	\$2,870
Pool furniture - 33%	\$3,400			Tuckpoint brick pavement (1%)	\$1,505
Tuckpoint brick pavement (1%)	\$1,505			Wading pool - pump	\$1,500
Concrete curb & gutter - 1%	\$1,127			Concrete curb & gutter - 1%	\$1,127
Other Replacements	\$957			Other Replacements	\$957
Total Scheduled Replacements	\$135,128	Total Scheduled Replacements	\$10,021	Total Scheduled Replacements	\$29,791
2023		2024		2025	
Dredging	\$72,429	Retaining wall metal railings (33%)	\$11,018	Pools - finish coat (white coat)	\$39,397
Asphalt pavement - townhouse	\$65,351	Concrete pavement - 1%	\$5,032	Pools - pool covers	\$20,663
Alley - Indigo Bunting (2 locations)	\$59,790	Hydrographic survey	\$4,000	Pool deck trellis	\$12,240
Concrete pavement - 10%	\$50,317	Pool furniture - 33%	\$3,400	Concrete pavement - 1%	\$5,032
Asphalt trails (33%)	\$48,624	Tuckpoint ext. simulated stone (5%)	\$1,792	Sitting area trellis	\$4,800
Tuckpoint brick pavement (25%)	\$37,625	Tuckpoint brick pavement (1%)	\$1,505	Tuckpoint brick pavement (1%)	\$1,505
Alley - Yellow Leg / Blue Heron	\$30,443	Fence replacement project (33%)	\$1,200	Concrete curb & gutter - 1%	\$1,127
Alley - Brown Thrasher / Willet	\$29,785	Concrete curb & gutter - 1%	\$1,127	Concrete sidewalks - 1%	\$957
Other Replacements	\$254,004	Other Replacements	\$957		
Total Scheduled Replacements	\$648,368	Total Scheduled Replacements	\$30,031	Total Scheduled Replacements	\$85,720
2026		2027		2028	
Concrete pavement - 1%	\$5,032	Locker room renovation	\$28,000	Asphalt trails (33%)	\$48,624
Pool furniture - 33%	\$3,400	Peacock Park - MP equipment	\$24,000	Pools - tile and coping	\$20,520
Tuckpoint brick pavement (1%)	\$1,505	South Tot Lot - MP equipment	\$16,000	Segmental retaining walls (5%)	\$6,273
Trail signage - renovation	\$1,400	Metal roof coating	\$10,419	Concrete pavement - 1%	\$5,032
Concrete curb & gutter - 1%	\$1,127	Filter systems & associated plumbing	\$9,000	Tuckpoint brick pavement (1%)	\$1,505
Concrete sidewalks - 1%	\$957	Concrete pavement - 1%	\$5,032	Tuckpoint facade simulated stone	\$1,225
		South Tot Lot - swing	\$4,200	Concrete curb & gutter - 1%	\$1,127
		Peacock Park - climb structure	\$3,500	Concrete sidewalks - 1%	\$957
		Other Replacements	\$7,190		
Total Scheduled Replacements	\$13,421	Total Scheduled Replacements	\$107,340	Total Scheduled Replacements	\$85,263

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REPLACEMENT RESERVE INVENTORY

MORRIS FARM
November 2012
SCHEDULE OF REPLACEMENTS - YEARS SIXTEEN TO THIRTY

2029 Retaining wall metal railings (33%) \$11,018 North Tot Lot - swing \$6,400 Concrete pavement - 1% \$5,032 Hydrographic survey \$4,000 Pool furniture - 33% \$3,400 North Tot Lot - seesaw \$1,700 Tuckpoint brick pavement (1%) \$1,505 Fence replacement project (33%) \$1,200 Other Replacements \$2,085 Total Scheduled Replacements \$36,339	2030 Sealcoat pavement - Cycle 1 \$47,306 Concrete pavement - 1% \$5,032 Tuckpoint brick pavement (1%) \$1,505 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$55,927	2031 Irrigation system (replacement) \$138,750 Concrete pavement - 1% \$5,032 Tuckpoint brick pavement (1%) \$1,505 Trail signage - renovation \$1,400 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$148,771
2032 Metal street signs & posts \$239,700 Asphalt trails (33%) \$48,624 Pools - finish coat (white coat) \$39,397 Siding, doors, trim, windows, & l \$24,675 Pools - pool covers \$20,663 Peacock Park - wood border \$7,125 Concrete pavement - 1% \$5,032 Tuckpoint brick pavement (1%) \$1,505 Other Replacements \$2,085 Total Scheduled Replacements \$388,805	2033 Sealcoat pavement - Cycle 2 \$53,757 Concrete pavement - 1% \$5,032 Pool furniture - 33% \$3,400 Tuckpoint brick pavement (1%) \$1,505 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$65,778	2034 Concrete pavement - 1% \$5,032 Hydrographic survey \$4,000 North Tot Lot - wood border \$2,870 Tuckpoint ext. simulated stone (€ \$1,792 Tuckpoint brick pavement (1%) \$1,505 Fence replacement project (33%) \$1,200 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$18,483
2035 Asphalt trails (33%) \$48,624 Concrete pavement - 1% \$5,032 Benches & trash receptacles \$5,000 Pool furniture - 33% \$3,400 Tuckpoint brick pavement (1%) \$1,505 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$65,646	2036 Sealcoat pavement - Cycle 3 \$62,358 Concrete pavement - 1% \$5,032 Tuckpoint brick pavement (1%) \$1,505 Trail signage - renovation \$1,400 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$72,379	2037 Concrete pool deck \$144,480 Pool deck fence - 6' \$27,830 Community Center post lights \$16,800 Metal roof coating \$10,419 Peacock Park post lights \$9,600 Pool features-pumps \$7,000 Electrical service - renovation \$6,000 Main pool - pump \$5,600 Other Replacements \$21,647 Total Scheduled Replacements \$249,376
2038 Dredging \$72,429 Peacock Park - deck & structure \$12,084 ON-SITE disposal of dredge mat \$10,347 Dredge equipment - mobilization \$10,000 Segmental retaining walls (5%) \$6,273 Concrete pavement - 1% \$5,032 Pool furniture - 33% \$3,400 Peacock Park - railing \$3,328 Other Replacements \$4,815 Total Scheduled Replacements \$127,707	2039 Concrete pavement - 15% \$75,475 Asphalt pavement - townhouse \$65,351 Alley - Indigo Bunting (2 locations) \$59,790 Pools - finish coat (white coat) \$39,397 Tuckpoint brick pavement (25%) \$37,625 Alley - Yellow Leg / Blue Heron \$30,443 Alley - Brown Thrasher / Willet \$29,785 Alley - Sharpshinned (2 locations) \$29,128 Other Replacements \$236,421 Total Scheduled Replacements \$603,414	2040 Asphalt trails (33%) \$48,624 Concrete pavement - 1% \$5,032 Tuckpoint brick pavement (1%) \$1,505 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$57,246
2041 Concrete pavement - 1% \$5,032 Tuckpoint brick pavement (1%) \$1,505 Trail signage - renovation \$1,400 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$10,021	2042 Concrete pavement - 1% \$5,032 Pool furniture - 33% \$3,400 Tuckpoint brick pavement (1%) \$1,505 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$12,021	2043 Irrigation system (minor renovat \$55,500 Concrete pavement - 1% \$5,032 Tuckpoint brick pavement (1%) \$1,505 Concrete curb & gutter - 1% \$1,127 Concrete sidewalks - 1% \$957 Total Scheduled Replacements \$64,121

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LIST OF RECOMMENDED REPAIRS

MORRIS FARM

Gainesville, Virginia

August 16, 2012 and revised November 24, 2012

REPAIR CATEGORY AND REPAIR DESCRIPTION

PHOTOGRAPHS ESTIMATED REPAIR COST

SITE IMPROVEMENTS:

1. Asphalt maintenance program

From Reserves

- Asphalt pavement maintenance. Establish a comprehensive maintenance program for the asphalt pavement at the Community Center, in the townhouse section of the community, and the alleys & pipestems. The maintenance program in the initial year of the Study should include the tasks outlined below. See Supplemental Photographs #65, 75, 89 .



- Clean all asphalt pavement. Clean areas that have been damaged by oil/gasoline and if cleaning is ineffective, the damaged areas should be cut out and replaced.
- Crack seal all cracks and small defects in the asphalt pavement. Cracks and defects that are too large for effective crack sealing should be cut out and replaced.
- After completion of the maintenance and repairs discussed above, the asphalt pavement should be seal coated and the parking places striped.
- Areas of asphalt pavement that impound water should be cut out and replaced with asphalt pavement that is properly graded. Note that this repair may require the replacement of adjacent segments of concrete curb & gutter.
- All areas of displaced asphalt should be evaluated and where the base materials or bearing soils have been damaged, the defective materials should be cut out and replaced.
- Properly set utility access points in the asphalt pavement so they do not impound water.



LIST OF RECOMMENDED REPAIRS

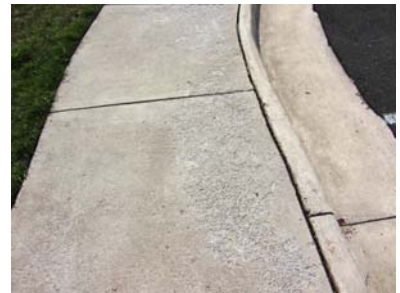
- Cut out and replace defective sections of asphalt trail. See Supplemental Photographs #19, 20, 22, 58, 78, 81.



2. Concrete components

From Reserves

- Concrete pavement. Replace defective segments of concrete sidewalk that are potential trip hazards. The segments that require replacement have one or more of the defects outlined below. See Supplemental Photographs #26, 76, 91.
 - **Displaced segments of concrete pavement (with a difference in elevation over 1 inch) which are trip hazards.**
 - **Spalling segments of concrete pavement with a loose or very rough surface that is a trip hazards.**
 - **Segments of concrete pavement that have been repaired by coating or patching, where the missing repairs have created a trip hazard.**
- Concrete curb & gutter. Replace defective concrete curb & gutter segments. The curb & gutter segments that require replacement have one or more of the defects outlined below. See Supplemental Photographs #77, 89, 91.
 - Segments that are displaced and impound water.
 - Segments with defects that allow water to penetrate into the base materials and bearing soils beneath the curb & gutter and adjacent asphalt pavement.
 - Segments that prevent the proper grading of the asphalt pavement.



LIST OF RECOMMENDED REPAIRS

3. Grading, drainage, and landscape.

\$3,000 - 5,000

- **Grade adjacent to concrete pavement and asphalt trails to prevent water, silt, and debris from being impounded on the components and/or to eliminate low areas and sink holes that could be trip hazards. See Supplemental Photographs #20.**
- Install a comprehensive system of subsurface down spout extensions to move all roof discharge from the Community Center to an appropriate component of the stormwater system or to a paved area that will direct the water to a stormwater system component. See Supplemental Photographs #.
- **Replace defective flagstone pavers that are a potential trip hazard. See Supplemental Photographs #23.**
- Establish proper ground cover on property owned by the Association. See Supplemental Photographs #13, 70.
- Grade at the segmental retaining walls in the townhouse section of the community that has been damaged by erosion. See Supplemental Photographs #85, 87.



LIST OF RECOMMENDED REPAIRS

4. Tot lot

\$1,000 - 2,000

- All of the tot lots including the, tot lot borders, tot lot ground cover, and tot lot equipment should be evaluated by a playground safety specialist for compliance with the Consumer Product Safety Commission, Handbook for Public Playground Safety. Defects identified by the playground safety specialist should be resolved to avoid injury to children and potential liability to the Association. The defects include but are not limited to those discussed below. See Supplemental Photographs #55, 56, 57, 61, 62, 63, 108, 109.
 - Restore damaged and deteriorated paint finish on tot lot equipment.
 - Replace missing signage.
 - Replace damaged plastic components.



5. Site Improvements - Miscellaneous

From Reserves

- Conduct a hydrographic evaluation of the wet and dry ponds. See Supplemental Photographs #59.
- Restore fences at the entrance features. See Supplemental Photographs #3, 93, 94.



LIST OF RECOMMENDED REPAIRS

6. Site Improvements - Miscellaneous

\$5,000 - 7,000

- Restore minor damage and deterioration of the signs throughout the community. See Supplemental Photographs #64.
- Restore finish on the mailboxes in the townhouse section of the community. See Supplemental Photographs #76.
- Properly mount irrigation controllers and repair defects in the irrigation system. See Supplemental Photographs #4, 51.
- Replace deteriorated wood components of the various trellis and entrance features.. Restore paint finish. See Supplemental Photographs #10, 17, 38, 41, 42, 100, 105, 106.
- Repair defects in the Peacock Park deck railings. See Supplemental Photographs #110, 111.



LIST OF RECOMMENDED REPAIRS

- Repair damaged ground mounted light fixture at the south entrance to Peacock Park. See Supplemental Photographs #103, 104.



- Repair damaged post lights near the south entrance to Peacock Park. See Supplemental Photographs #107.



- Evaluate exposed wire nut in the Peacock Park electrical service. Repair as necessary. See Supplemental Photographs #112.



7. Masonry

From Reserves

- Tuckpoint defects in the precast simulated stone installed at the entrance features, sitting areas, in the facade of the Community Center and the piers & walls on the pool deck. The defects that will require correction include but are not limited to those listed below. See Supplemental Photographs #2, 7, 8, 9, 11, 12, 19, 98
 - Replace damaged, deteriorated, and/or eroded mortar.
 - Replace cracked, damaged, or missing precast simulated stone.



/

LIST OF RECOMMENDED REPAIRS

- Properly install the precast simulated stone, eliminating the rusty wire used to secure the stone and exposed plywood.
- Correct defects in the masonry that are allowing water to penetrate into the building structure.
- Cleaning organic growth from the masonry.
- Seal around penetrations to prevent water, air, and insect penetration.
- Install a breathable waterproof coating on the precast components (including the property identification signage) to prevent further deterioration.



8. Community Center - miscellaneous

\$5,000 - 8,000

- **Securely Install drain covers on the pool deck to eliminate potential trip hazards. See Supplemental Photographs #43.**
- Properly install posts into the concrete pool deck in sockets that epoxy grout, mounded to prevent water being impounded against the posts. See Supplemental Photographs #44, 45.



LIST OF RECOMMENDED REPAIRS

- Restore deteriorated exterior wood structure and trim in the facade of the Community Center. After restoration, install cladding to prevent further deterioration. See Supplemental Photographs #28.
- Restore small heaters in the pool equipment rooms and relocate heaters to a location where they will not be damaged by moisture. See Supplemental Photographs #32, 36.
- Restore finish on Community Center doors. See Supplemental Photographs #46.



TOTAL COST OF RECOMMENDED REPAIRS

\$14,000 to \$22,000

NOTE: Defects that are potential safety hazards should be repaired immediately to prevent personal injury and to protect the Association from potential liability. We have identified safety hazards in the above List of Recommend Repairs by printing them in **bold**.



Photo #1. Start of photographs taken on August 13, 2012. General view of the entrance monument south of the Rollins Ford and Yellow Hammer entrance.



Photo #2. Missing precast simulated stone.



Photo #3. Minor defects in the wood fence at the Rollins Ford and Yellow Hammer entrance.



Photo #4. Irrigation controller is not properly mounted, Rollins Ford and Yellow Hammer entrance.



Photo #5. Electrical service at the Rollins Ford and Yellow Hammer entrance



Photo #6. Interior of entrance monument, Rollins Ford and yellow Hammer.



Photo #7. Rusty wire has been used to secure the precast simulated stone.



Photo #8. Deteriorated plywood extends from the upper surface of the structure.



Photo #9. Typical missing precast simulated stone, Rollins Ford and Yellow Hammer.



Photo #10. Failed paint system, Rollins Ford and Yellow Hammer.



Photo #11. Hairline cracking of the precast property identification signage, Rollins Ford and Yellow Hammer.



Photo #12. Typical missing precast simulated stone, Rollins Ford and Yellow Hammer.



Photo #13. Typical common property without proper ground cover.



Photo #14. Underground vault for sprinkler equipment, Rollins Ford and Yellow Hammer.



Photo #15. Start of photographs taken on August 14, 2012. Retaining wall and sitting area are east of the swimming pool.



Photo #16. Retaining wall and sitting area east of the swimming pool.



Photo #17. Trellis at the sitting area east of the swimming pool.



Photo #18. Typical missing precast simulated stone at the post supporting the trellis at the sitting area east of the swimming pool.



Photo #19. General view of the asphalt trail east of the swimming pool.



Photo #20. Defective grading adjacent to the asphalt trail and deteriorated asphalt trail east of the swimming pool.



Photo #21. Typical trail signage.



Photo #22. General view of the asphalt trail.



Photo #23. Deteriorated flagstone paver at the sitting area east of the swimming pool is a potential trip hazard.



Photo #24. Bike rack near the swimming pool.



Photo #25. Underground vault for sprinkler equipment near the swimming pool.



Photo #26. Typical deterioration of the concrete pavement near the swimming pool.



Photo #27. General view of the Community Center.



Photo #28. Deteriorated support beam at the Community Center.



Photo #29. Typical interior finishes at the Community Center.



Photo #30. Typical interior finishes at the Community Center.



Photo #31. Wading pool pump and filter.



Photo #32. Small electric heater in the wading pool pump room.



Photo #33. Main pool filter.



Photo #34. Main pool pump.



Photo #35. Pumps that serve the main pool umbrella and bubbler features.



Photo #36. Small electric heater in the main pool pump room.



Photo #37. Shuffleboard court.



Photo #38. Trellis on the pool deck.



Photo #39. Detailed view of pool coping.



Photo #40. General view of the rear of the Community Center.



Photo #41. Failed paint system on the pool deck trellis.



Photo #42. Deteriorated wood components of the pool deck trellis.



Photo #43. Loose drain cover near the wading pool is a potential trip hazard.



Photo #44. Fence posts are not properly installed into the concrete pool deck.



Photo #45. Fence posts are not properly installed into the concrete pool deck.



Photo #46. Minor rusting of the doors at the Community Center.



Photo #47. Pool covers.



Photo #48. Electric service is located in a separate room on the west side of the Community Center.



Photo #49. Construction drawings detailing some of the Community Center. We removed these drawings and will have them scanned.



Photo #51. Irrigation vault at the northwest corner of the Community Center.



Photo #53. Asphalt pavement installation at the Community Center is not complete and silt control is still in place.



Photo #50. Community Center compressor.



Photo #52. Lead walk at the Community Center.



Photo #54. Asphalt pavement installation at the Community Center is not complete and silt control is still in place.



Photo #55. General view of South Tot Lot, located across from the Community Center.



Photo #56. Failed paint system on the tot lot equipment, South Tot Lot.



Photo #57. Minor discoloration/damage to the tot lot equipment South Tot Lot



Photo #58. Asphalt trail leading from the Barn Owl cul-de-sac.

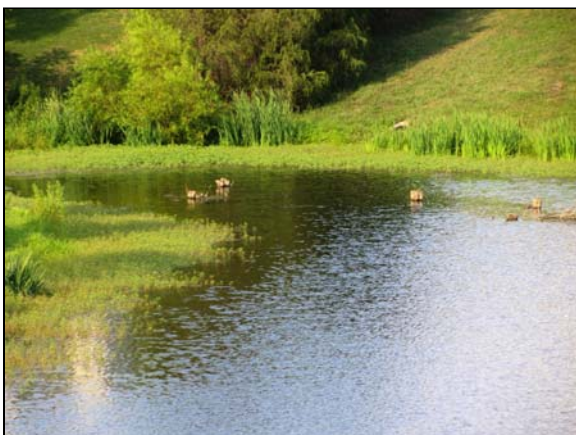


Photo #59. Stormwater pond east of the Barn Owl cul-de-sac.



Photo #60. General view of the North Tot Lot, east of Yellow Hammer and north of Willet



Photo #61. Swing at the North Tot Lot.



Photo #62. Seesaw at the North Tot Lot.



Photo #63. Wood border at the North Tot Lot.



Photo #64. Typical minor damage to signage.

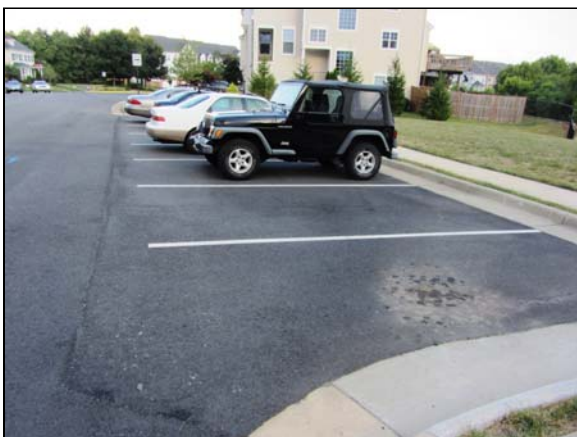


Photo #65. General view of a parking area off of Catbird Drive between the townhomes and the single family.



Photo #66. Typical dog walk station.



Photo #67. General view of Retaining Wall #5 located behind 14181-14203 Catbird Drive.



Photo #68. Excellent grading behind Retaining Wall #5.



Photo #69. Wood rail fence with wire surrounds the dry pond west and south of Catbird Drive.



Photo #70. Typical common property without proper ground cover.



Photo #71. Rip rap installed on a steep slope in the vicinity of 14181 Catbird.



Photo #72. General view of Catbird at the assumed dividing line between publicly owned pavement and the pavement that is the responsibility of the Association.



Photo #73. Typical mailbox installation.



Photo #74. General view of Retaining Wall #4 located behind 14153-14163 Catbird Drive.



Photo #75. Open crack in the asphalt pavement.



Photo #76. Deteriorated concrete pavement and deteriorated finish on the mailbox support post.



Photo #77. Concrete curb is not properly pitched to move water to the storm water system.



Photo #78. Asphalt trail leading from the south end of Catbird Drive.



Photo #79. Asphalt trail terminates near the south end of Catbird Drive.



Photo #80. Detailed view of the fence surrounding the dry pond south and west of Catbird Drive.



Photo #81. Typical crack in the asphalt trail.



Photo #82. Repeat of Photo #80.



Photo #83. Minor damage to the metal fence attached to the rail fencing surrounding the dry pond.

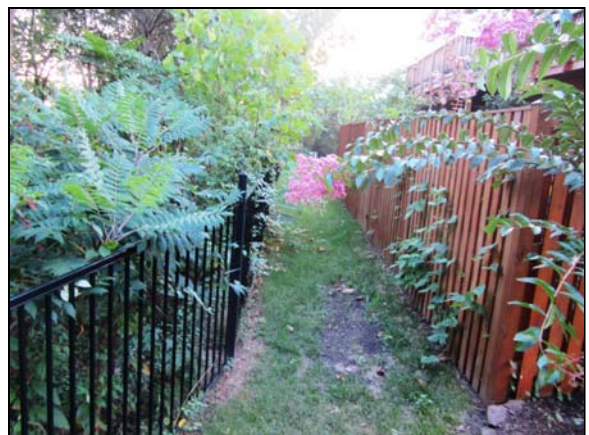


Photo #84. General view of Retaining Wall #3 located behind 14101-14105 Catbird Drive.



Photo #85. Typical erosion at the end of segmental retaining wall installations.



Photo #86. General view of Retaining Wall #2 located behind 14122-14132 Catbird Drive.



Photo #87. Typical erosion at the end of segmental retaining wall installations.



Photo #88. General view of Retaining Wall #1 located behind 14136-14146 Catbird Drive.



Photo #89. Asphalt pavement and concrete curb & gutter are not properly pitched to move water to the stormwater system.



Photo #90. Markings indicate that the streetlight is not the responsibility of the Association.



Photo #91. Concrete pavement and curb & gutter were repaired by patching and coating and they repairs have already failed.



Photo #92. Typical decorative signage.



Photo #93. Damaged fence north of the Rollins Ford and Yellow Hammer entrance to the community.



Photo #94. Missing fence north of the Rollins Ford and Yellow Hammer entrance to the community.



Photo #95. General view of the entrance feature north of the Rollins Ford and Yellow Hammer entrance to the community.



Photo #96. General view of the entrance feature east of the Rollins Ford and Yellow Hammer entrance to the community.



Photo #97. Start of photographs taken on August 16, 2012. General view of the sitting area south of Yellow Hammer.



Photo #99. Sitting area with benches, pavers, and wall at the sitting area south of Yellow Hammer.



Photo #101. Developer signage at the intersection of Yellow Hammer and Catbird.



Photo #98. Typical defective precast simulated stone veneer at the sitting area south of Yellow Hammer.



Photo #100. Detailed view of wood trellis at the sitting area south of Yellow Hammer.



Photo #102. North entrance to Peacock Park.



Photo #103. South entrance to Peacock Park. Note damaged ground mounted light fixture.



Photo #104. Damaged ground mounted light fixture at the south entrance to Peacock Park.



Photo #105. Typical trellis installation at the entrances to Peacock Park.



Photo #106. Detailed view of the trellis installation at the south entrance to Peacock Park.



Photo #107. Damaged light fixture on the south side of Piedmont Park near the entrance.



Photo #108. Tot lot equipment at the Peacock Park Tot Lot.



Photo #109. Tot lot equipment at the Peacock Park Tot Lot.



Photo #110. Deck in the Peacock Park Tot Lot area.



Photo #111. Defective deck railing in the Peacock Park Tot Lot area.



Photo #112. Electrical service at the Peacock Park Tot Lot indicates that the pole lights are the responsibility of the Association. Note wire nut above breakers.



Photo #113. Irrigation vault at Peacock Park.



Photo #114. Asphalt trail installed along Rollins Ford.

REPLACEMENT RESERVE ALLOCATION

MORRIS FARM

November 2012

CASH FLOW METHOD - THREE YEAR ALLOCATION OF REPLACEMENT RESERVES

		Estimated	Allocation	2014			2015			2016		
Item		Replacement	of Reserves			Year End			Year End			Year End
#	Component	Cost	on Deposit	Deposits	Expenses	Balance	Deposits	Expenses	Balance	Deposits	Expenses	Balance
NORMAL COMPONENTS												
TOWNHOUSE CONCRETE CC												
1	Concrete sidewalks - 1%	957	6,118	2,369	(957)	7,530	297	(957)	6,869	174	(957)	6,086
2	Concrete sidewalks - 10%	9,573					1,684		1,684	1,743		3,427
3	Concrete sidewalks - 15%	14,359										
4	Concrete sidewalks - 20%	19,145										
5	Concrete sidewalks - 25%	23,932										
6	Concrete sidewalks - 30%	28,718										
7	Concrete curb & gutter - 1%	1,127	7,206	2,790	(1,127)	8,868	350	(1,127)	8,090	205	(1,127)	7,168
8	Concrete curb & gutter - 10%	11,274					1,984		1,984	2,053		4,037
9	Concrete curb & gutter - 15%	16,912										
10	Concrete curb & gutter - 20%	22,549										
11	Concrete curb & gutter - 25%	28,186										
12	Concrete curb & gutter - 30%	33,823										
COURTYARD CONCRETE & I												
13	Concrete pavement - 1%	5,032	32,159	12,451	(5,032)	39,578	1,561	(5,032)	36,107	916	(5,032)	31,992
14	Concrete pavement - 10%	50,317					8,853		8,853	9,163		18,016
15	Concrete pavement - 15%	75,475										
16	Concrete pavement - 20%	100,633										
17	Concrete pavement - 25%	125,792										
18	Concrete pavement - 30%	150,950										
19	Tuckpoint brick pavement (25%)	37,625					6,620		6,620	6,852		13,472
20	Tuckpoint brick pavement (1%)	1,505	9,619	3,724	(1,505)	11,838	467	(1,505)	10,800	274	(1,505)	9,569
ASPHALT PAVEMENT - ROA												
21	Asphalt pavement - townhouse	65,351					11,498		11,498	11,901		23,399
22	Asphalt pavement - Community C	28,950					5,093		5,093	5,272		10,366
23	Alley - Barn Owl	12,434					2,188		2,188	2,264		4,452
24	Alley - Yellow Hammer / Junco	17,414					3,064		3,064	3,171		6,235
25	Alley - Indigo Bunting (2 locatio	59,790					10,519		10,519	10,888		21,408
26	Alley - Catbird / Woodpecker	17,884					3,146		3,146	3,257		6,403
27	Alley - Yellow Hammer / Woodp	8,488					1,493		1,493	1,546		3,039
28	Alley - Yellow Hammer / Ruffed	19,293					3,394		3,394	3,513		6,908
29	Alley - Yellow Hammer / Willet	8,456					1,488		1,488	1,540		3,028
30	Alley - Brown Thrasher / Willet	29,785					5,240		5,240	5,424		10,665
31	Alley - Yellow Leg / Song Sparro	28,626					5,037		5,037	5,213		10,250
32	Alley - Yellow Leg / Blue Heron	30,443					5,356		5,356	5,544		10,900
33	Alley - Red Start	10,179					1,791		1,791	1,854		3,645
34	Alley - Sharpshinned (2 locations	29,128					5,125		5,125	5,304		10,429
35	Alley - Ladderbacked	7,924					1,394		1,394	1,443		2,837
36	Sealcoat pavement - Cycle 1	47,306	47,306		(47,306)							
37	Sealcoat pavement - Cycle 2	53,757	53,757			53,757			53,757			53,757
38	Sealcoat pavement - Cycle 3	62,358	24,396	37,961		62,358			62,358			62,358
39	Asphalt trails (33%)	48,624	48,624			48,624			48,624		(48,624)	
40	Asphalt trails (33%)	48,624	19,024	29,601		48,624			48,624			48,624
41	Asphalt trails (33%)	48,624					8,555		8,555	8,855		17,410
GENERAL SITE IMPROVEME												
42	Tuckpoint ext. simulated stone (E	1,792	1,792		(1,792)							
43	Fence replacement project (33%)	1,200	1,200		(1,200)							
44	Fence replacement project (33%)	1,200	1,200			1,200			1,200			1,200
45	Fence replacement project (33%)	1,200										
46	Sitting area trellis	4,800										
47	Benches & trash receptacles	5,000	1,956	3,044		5,000			5,000			5,000
48	Trail signage - renovation	1,400	1,400	1,400		2,800			2,800		(1,400)	1,400
49	Segmental retaining walls (5%)	6,273	6,273			6,273			6,273			6,273
50	Retaining wall metal railings (33'	11,018										
51	Retaining wall metal railings (33'	11,018										
52	Retaining wall metal railings (33'	11,018										
53	Community Center post lights	16,800										

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1306.04

REPLACEMENT RESERVE ALLOCATION

MORRIS FARM

November 2012

CASH FLOW METHOD - THREE YEAR ALLOCATION OF REPLACEMENT RESERVES

Item #	Component	Estimated Replacement Cost	Allocation of Reserves on Deposit	2014			2015			2016		
				Deposits	Expenses	Year End Balance	Deposits	Expenses	Year End Balance	Deposits	Expenses	Year End Balance
54	Peacock Park post lights	9,600										
55	Metal street signs & posts	239,700										
COMMUNITY CENTER												
56	Metal roof coating	10,419										
57	Siding, doors, trim, windows, & i	24,675										
58	Tuckpoint facade simulated stone	1,225	1,225			1,225			1,225			1,225
59	Locker room renovation	28,000										
60	Electrical service - renovation	6,000										
61	Hot water heater	1,400	1,400			1,400			1,400			1,400
62	HVAC system	4,200		3,636		3,636	564		4,200			4,200
SWIMMING POOLS												
63	Concrete pool deck	144,480										
64	Pool deck fence - 6'	27,830										
65	Pool deck fence - 4'	3,726										
66	Shuffleboard court surface	2,200	2,200			2,200			2,200			2,200
67	Pool deck trellis	12,240										
68	Pools - structure & brella feature	385,700										
69	Pools - finish coat (white coat)	39,397	39,397			39,397			39,397			39,397
70	Pools - tile and coping	20,520										
71	Pools - pool covers	20,663	20,663			20,663			20,663			20,663
72	Main pool - pump	5,600		4,848		4,848	752		5,600			5,600
73	Wading pool - pump	1,500		1,299		1,299	201		1,500			1,500
74	Pool features-pumps	7,000		6,060		6,060	940		7,000			7,000
75	Filter systems & associated plum	9,000										
76	Pool furniture - 33%	3,400	3,400			3,400		(3,400)				
77	Pool furniture - 33%	3,400	3,400			3,400			3,400			3,400
78	Pool furniture - 33%	3,400	1,330	2,070		3,400			3,400			3,400
TOT LOTS & PEACOCK PARK												
79	South Tot Lot - MP equipment	16,000										
80	South Tot Lot - swing	4,200										
81	North Tot Lot - swing	6,400										
82	North Tot Lot - seesaw	1,700										
83	North Tot Lot - wood border	2,870		2,485		2,485	385		2,870			2,870
84	Peacock Park - MP equipment	24,000										
85	Peacock Park - climb structure	3,500										
86	Peacock Park - wood border	7,125	2,788	4,337		7,125			7,125			7,125
87	Peacock Park - deck & structure	12,084					2,126		2,126	2,201		4,327
88	Peacock Park - railing	3,328					586		586	606		1,192
STORMWATER & IRRIGATIC												
89	Hydrographic survey	4,000	8,000		(4,000)	4,000			4,000			4,000
90	Dredge equipment - mobilization	10,000					1,759		1,759	1,821		3,580
91	Dredging	72,429					12,743		12,743	13,190		25,933
92	ON-SITE disposal of dredge mat	10,347					1,820		1,820	1,884		3,705
93	Irrigation system (minor renovati	55,500	55,500			55,500			55,500			55,500
94	Irrigation system (replacement)	138,750										

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1306.04

REPLACEMENT RESERVE ALLOCATION

MORRIS FARM

November 2012

COMPONENT METHOD - THREE YEAR ALLOCATION OF REPLACEMENT RESERVES

		Estimated	Allocation	2014			2015			2016		
Item		Replacement	of Reserves			Year End			Year End			Year End
#	Component	Cost	on Deposit	Deposits	Expenses	Balance	Deposits	Expenses	Balance	Deposits	Expenses	Balance
NORMAL COMPONENTS												
TOWNHOUSE CONCRETE CC												
1	Concrete sidewalks - 1%	957	390	567	(957)		957	(957)		957	(957)	
2	Concrete sidewalks - 10%	9,573	3,412	616		4,028	616		4,644	616		5,260
3	Concrete sidewalks - 15%	14,359	3,948	400		4,349	400		4,749	400		5,150
4	Concrete sidewalks - 20%	19,145	3,705	368		4,072	368		4,440	368		4,808
5	Concrete sidewalks - 25%	23,932	2,681	366		3,047	366		3,414	366		3,780
6	Concrete sidewalks - 30%	28,718	877	376		1,254	376		1,630	376		2,006
7	Concrete curb & gutter - 1%	1,127	459	668	(1,127)	(0)	1,127	(1,127)	(0)	1,127	(1,127)	
8	Concrete curb & gutter - 10%	11,274	4,019	726		4,744	726		5,470	726		6,196
9	Concrete curb & gutter - 15%	16,912	4,650	472		5,122	472		5,594	472		6,065
10	Concrete curb & gutter - 20%	22,549	4,363	433		4,796	433		5,229	433		5,662
11	Concrete curb & gutter - 25%	28,186	3,158	432		3,589	432		4,021	432		4,452
12	Concrete curb & gutter - 30%	33,823	1,033	443		1,477	443		1,920	443		2,363
COURTYARD CONCRETE & I												
13	Concrete pavement - 1%	5,032	2,050	2,982	(5,032)		5,032	(5,032)		5,032	(5,032)	
14	Concrete pavement - 10%	50,317	17,936	3,238		21,174	3,238		24,412	3,238		27,650
15	Concrete pavement - 15%	75,475	20,754	2,105		22,859	2,105		24,964	2,105		27,068
16	Concrete pavement - 20%	100,633	19,473	1,932		21,406	1,932		23,338	1,932		25,270
17	Concrete pavement - 25%	125,792	14,092	1,926		16,018	1,926		17,944	1,926		19,870
18	Concrete pavement - 30%	150,950	4,612	1,978		6,590	1,978		8,567	1,978		10,545
19	Tuckpoint brick pavement (25%)	37,625	5,748	3,188		8,936	3,188		12,123	3,188		15,311
20	Tuckpoint brick pavement (1%)	1,505	613	892	(1,505)		1,505	(1,505)		1,505	(1,505)	
ASPHALT PAVEMENT - ROAD												
21	Asphalt pavement - townhouse	65,351	9,984	5,537		15,520	5,537		21,057	5,537		26,594
22	Asphalt pavement - Community (5%)	28,950	4,423	2,453		6,875	2,453		9,328	2,453		11,781
23	Alley - Barn Owl	12,434	1,900	1,053		2,953	1,053		4,006	1,053		5,060
24	Alley - Yellow Hammer / Junco	17,414	2,660	1,475		4,136	1,475		5,611	1,475		7,086
25	Alley - Indigo Bunting (2 locations)	59,790	9,134	5,066		14,200	5,066		19,265	5,066		24,331
26	Alley - Catbird / Woodpecker	17,884	2,732	1,515		4,247	1,515		5,762	1,515		7,278
27	Alley - Yellow Hammer / Woodpecker	8,488	1,297	719		2,016	719		2,735	719		3,454
28	Alley - Yellow Hammer / Ruffed Grouse	19,293	2,947	1,635		4,582	1,635		6,217	1,635		7,851
29	Alley - Yellow Hammer / Willet	8,456	1,292	716		2,008	716		2,725	716		3,441
30	Alley - Brown Thrasher / Willet	29,785	4,550	2,524		7,074	2,524		9,597	2,524		12,121
31	Alley - Yellow Leg / Song Sparrow	28,626	4,373	2,425		6,799	2,425		9,224	2,425		11,649
32	Alley - Yellow Leg / Blue Heron	30,443	4,651	2,579		7,230	2,579		9,809	2,579		12,388
33	Alley - Red Start	10,179	1,555	862		2,417	862		3,280	862		4,142
34	Alley - Sharpshinned (2 locations)	29,128	4,450	2,468		6,918	2,468		9,385	2,468		11,853
35	Alley - Ladderbacked	7,924	1,211	671		1,882	671		2,553	671		3,225
36	Sealcoat pavement - Cycle 1	47,306	19,271	28,034	(47,306)		2,957		2,957	2,957		5,913
37	Sealcoat pavement - Cycle 2	53,757	16,425	9,333		25,758	9,333		35,091	9,333		44,424
38	Sealcoat pavement - Cycle 3	62,358	14,289	6,867		21,156	6,867		28,023	6,867		34,890
39	Asphalt trails (33%)	48,624	14,856	11,256		26,112	11,256		37,368	11,256	(48,624)	
40	Asphalt trails (33%)	48,624	8,254	5,767		14,021	5,767		19,788	5,767		25,555
41	Asphalt trails (33%)	48,624	3,301	4,532		7,834	4,532		12,366	4,532		16,898
GENERAL SITE IMPROVEMENTS												
42	Tuckpoint ext. simulated stone (5%)	1,792	730	1,062	(1,792)		179		179	179		358
43	Fence replacement project (33%)	1,200	489	711	(1,200)		80		80	80		160
44	Fence replacement project (33%)	1,200	293	151		444	151		596	151		747
45	Fence replacement project (33%)	1,200	130	97		228	97		325	97		422
46	Sitting area trellis	4,800	782	335		1,117	335		1,452	335		1,787
47	Benches & trash receptacles	5,000	1,086	559		1,645	559		2,205	559		2,764
48	Trail signage - renovation	1,400	228	391		619	391		1,009	391	(1,400)	
49	Segmental retaining walls (5%)	6,273	1,278	999		2,277	999		3,276	999		4,275
50	Retaining wall metal railings (33%)	11,018	2,843	743		3,586	743		4,329	743		5,072
51	Retaining wall metal railings (33%)	11,018	2,095	558		2,652	558		3,210	558		3,768
52	Retaining wall metal railings (33%)	11,018	598	401		999	401		1,400	401		1,801
53	Community Center post lights	16,800	1,369	643		2,012	643		2,655	643		3,298

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REPLACEMENT RESERVE ALLOCATION

MORRIS FARM
November 2012
COMPONENT METHOD - THREE YEAR ALLOCATION OF REPLACEMENT RESERVES

Item #	Component	Estimated Replacement Cost	Allocation of Reserves on Deposit	2014			2015			2016		
				Deposits	Expenses	Year End Balance	Deposits	Expenses	Year End Balance	Deposits	Expenses	Year End Balance
54	Peacock Park post lights	9,600	782	367		1,150	367		1,517	367		1,884
55	Metal street signs & posts	239,700	23,436	11,382		34,818	11,382		46,200	11,382		57,583
COMMUNITY CENTER												
56	Metal roof coating	10,419		744		744	744		1,488	744		2,233
57	Siding, doors, trim, windows, & i	24,675	2,413	1,172		3,584	1,172		4,756	1,172		5,928
58	Tuckpoint facade simulated stone	1,225	250	195		445	195		640	195		835
59	Locker room renovation	28,000	3,422	1,756		5,178	1,756		6,933	1,756		8,689
60	Electrical service - renovation	6,000	489	230		718	230		948	230		1,178
61	Hot water heater	1,400	342	264		607	264		871	264		1,136
62	HVAC system	4,200	684	391		1,075	391		1,466	391		1,856
SWIMMING POOLS												
63	Concrete pool deck	144,480	11,772	5,530		17,301	5,530		22,831	5,530		28,360
64	Pool deck fence - 6'	27,830	2,267	1,065		3,333	1,065		4,398	1,065		5,463
65	Pool deck fence - 4'	3,726	304	143		446	143		589	143		731
66	Shuffleboard court surface	2,200	538	416		953	416		1,369	416		1,784
67	Pool deck trellis	12,240	1,995	854		2,848	854		3,702	854		4,556
68	Pools - structure & brella feature	385,700	18,855	8,337		27,193	8,337		35,530	8,337		43,867
69	Pools - finish coat (white coat)	39,397	4,586	6,962		11,548	6,962		18,510	6,962		25,472
70	Pools - tile and coping	20,520	2,388	1,209		3,597	1,209		4,806	1,209		6,015
71	Pools - pool covers	20,663	2,405	3,651		6,057	3,651		9,708	3,651		13,360
72	Main pool - pump	5,600	913	521		1,433	521		1,954	521		2,475
73	Wading pool - pump	1,500	244	140		384	140		523	140		663
74	Pool features-pumps	7,000	1,141	651		1,792	651		2,443	651		3,094
75	Filter systems & associated plum	9,000	1,100	564		1,664	564		2,229	564		2,793
76	Pool furniture - 33%	3,400	1,077	1,161		2,239	1,161	(3,400)		378		378
77	Pool furniture - 33%	3,400	769	658		1,427	658		2,085	658		2,742
78	Pool furniture - 33%	3,400	308	442		750	442		1,191	442		1,633
TOT LOTS & PEACOCK PARK												
79	South Tot Lot - MP equipment	16,000	1,955	1,003		2,959	1,003		3,962	1,003		4,965
80	South Tot Lot - swing	4,200	513	263		777	263		1,040	263		1,303
81	North Tot Lot - swing	6,400	521	367		889	367		1,256	367		1,624
82	North Tot Lot - seesaw	1,700	139	98		236	98		334	98		431
83	North Tot Lot - wood border	2,870	292	286		579	286		865	286		1,152
84	Peacock Park - MP equipment	24,000	2,933	1,505		4,438	1,505		5,943	1,505		7,447
85	Peacock Park - climb structure	3,500	428	219		647	219		867	219		1,086
86	Peacock Park - wood border	7,125	1,209	845		2,054	845		2,900	845		3,745
87	Peacock Park - deck & structure	12,084	1,641	1,044		2,685	1,044		3,730	1,044		4,774
88	Peacock Park - railing	3,328	452	288		740	288		1,027	288		1,315
STORMWATER & IRRIGATIC												
89	Hydrographic survey	4,000	1,630	2,370	(4,000)		800		800	800		1,600
90	Dredge equipment - mobilization	10,000	1,358	864		2,222	864		3,086	864		3,951
91	Dredging	72,429	9,835	6,259		16,095	6,259		22,354	6,259		28,613
92	ON-SITE disposal of dredge mat	10,347	1,405	894		2,299	894		3,193	894		4,088
93	Irrigation system (minor renovati	55,500	16,957	6,424		23,381	6,424		29,805	6,424		36,229
94	Irrigation system (replacement)	138,750	14,131	6,923		21,054	6,923		27,978	6,923		34,901

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REPLACEMENT RESERVE STUDY APPENDIX

1. COMMON INTEREST DEVELOPMENTS - AN OVERVIEW

Over the past 30 years, the responsibility for community facilities and infrastructure around many of our homes has shifted from the local government and private sector to Community Associations. Thirty years ago, a typical new town house abutted a public street on the front and a public alley on the rear. Open space was provided by a nearby public park and recreational facilities were purchased ala carte from privately owned country clubs, swim clubs, tennis clubs, and gymnasiums. Today, 60% of all new residential construction - townhouses, single family homes, condominiums, and cooperatives - is in Common Interest Developments (CID). In a CID, a homeowner is bound to a Community Association that owns, maintains, and is responsible for periodic replacements of the roads, curbs, sidewalks, playgrounds, street lights, recreational facilities, and other community facilities and infrastructure.

The growth of Community Associations has been explosive. In 1965 there were only 500 Community Associations in the United States. According to the U.S. Census, there were 130,000 Community Associations in 1990. Community Associations Institute (CAI), a national trade association, estimates there were more than 200,000 Community Associations in 2000, and the majority of new construction throughout the country is in CIDs.

The shift of responsibility for billions of dollars of community facilities and infrastructure from the local government and private sector to Community Associations has generated new and unanticipated problems. Although Community Associations have succeeded in solving many short term problems, many Associations have failed to properly plan for the tremendous expenses of replacing community facilities and infrastructure components with limited life. When inadequate funding results in less than timely replacements of failing components, homeowners are exposed to the burden of special assessments, major increases in Association fees, and a decline in property values.

2. REPLACEMENT RESERVE STUDY - RSTUDY+

The financial planning tool designed to provide an Association with the information to plan for the expenses of replacing community facilities and infrastructure components with limited life is a Replacement Reserve Study.

This Replacement Reserve Study format is called RSTUDY+. It is intended to provide an Association with the most effective financial planning tool available. RSTUDY+ consists of the following components:

- **Replacement Reserve Report.** The *Report* contains a summary the financial data calculated by the enclosed *Replacement Reserve Analysis*, a general description of the community, a summary of the conditions observed during our site evaluation, and information about the *Replacement Reserve Inventory*.

REPLACEMENT RESERVE STUDY APPENDIX

- **Replacement Reserve Analysis.** The *Analysis* is a tabular and graphical presentation of current Association funding and the Cash Flow and Component Method Replacement Reserve Funding calculations.
- **Replacement Reserve Inventory.** The *Inventory* lists the common components of the community evaluated by the *Replacement Reserve Analysis*, and includes estimated replacement costs, normal economic life and the remaining economic life for each component evaluated.
- **List of Recommended Repairs.** The *Repair List* itemizes defects we observed during our site evaluation. The recommended repairs are categorized by building trade and include an estimated cost.
- **Photographs and a Log of Photographs.** The photographs document observations made during the site evaluation.
- **Appendix.** This Appendix contains general information, definitions, and standard procedures.

The intent of the RSTUDY+ Replacement Reserve Study is to provide the Association with an inventory of the common components of the community, a general view of the condition of these components, and an effective financial planning tool to address the costs associated with the replacement of community facilities and infrastructure components with limited life.

- **Inventory of commonly owned components.** The *Replacement Reserve Inventory* lists the common components of the community which we have scheduled for replacement from the Replacement Reserves. Section D of the *Replacement Reserve Report* provides information about the basis of the *Replacement Reserve Inventory* and the components excluded from the Inventory.
- **Condition of common components.** The *Replacement Reserve Inventory* includes our estimates of the normal economic life and the remaining economic life. Section C of the *Replacement Reserve Report* provides additional information on several of these components including recommendations for maintenance and replacements.
- **Financial Plan.** Because many of the components owned by the Association have limited life and will require periodic replacement, it is essential the Association have an effective financial plan to provide for the timely replacement of these components, to protect the appearance and value of the community. In conformance with American Institute of Certified Public Accountant guidelines, the *Replacement Reserve Analysis* has calculated the minimum recommended contribution to Replacement Reserves by both the Cash Flow Method and the Component Method. The *Analysis* includes a graphic presentation of these methods and the Association current funding.

REPLACEMENT RESERVE STUDY APPENDIX

3. REPLACEMENT RESERVE INVENTORY

The work on a Replacement Reserve Study starts with the development of the Replacement Reserve Inventory. In theory, the Inventory is a detailed listing of each and every component that requires replacement, for which the Association is responsible. In function, the Inventory only includes components whose replacement will be funded from Replacement Reserves. Replacement of components not included in the Inventory should be funded from sources other than Replacement Reserves.

Identification of Reserve Components. The Reserve Analyst has only two methods of identifying Reserve Components, information provided by the Association and observations made at the site. It is important that the Reserve Analyst be provided with all available information detailing the components owned by the Association. It is our policy to request such information prior to bidding on a project and to meet with the individuals responsible for maintaining the community after acceptance of our proposal. After completion of the Study, the Study should be reviewed by the Board of Directors, individuals responsible for maintaining the community, and the Associations accounting professionals. We are dependent upon the Association for correct information, documentation, and drawings.

Exclusion of Reserve Components. Every effort has been made to identify all common components, which should be reasonably considered for inclusion in the Replacement Reserve Inventory. This may result in the inclusion of some components in the Inventory that may reasonably be deleted. We will make such deletions at the direction of the Board of Directors. The Board of Directors should understand that future replacement of the deleted components should be funded from sources other than the Replacement Reserves. Generally, three kinds of components are excluded from the Inventory:

- Small components. For ease of administration, relatively low cost components are normally funded from the annual operating budget rather than making disbursements from Replacement Reserves. An obvious example is a light bulb, but examples might also include benches, trash cans, or miscellaneous signage. Our policy is to assume the use of operating funds for replacement of any component with a replacement cost less than \$1,000, unless requested otherwise by the Association.
- Long lasting components. Some Inventories include components with estimated economic lives exceeding 40 years. Some analysts would omit these components from the schedule entirely on the basis that the economic life of these components approaches the property as a whole. We recommend these components remain in the Inventory because deletion would expose the Association to the potential of a large unfunded liability should the replacements be needed at some time in the future. An example of this type of component is a swimming pool shell.
- Components incorrectly included. In an effort to include all reserve components which could reasonably be considered as "common," it is possible some components have been incorrectly included.

REPLACEMENT RESERVE STUDY APPENDIX

Estimating. The final step in the development of the Inventory is the estimation of replacement costs, normal economic life, and remaining economic life for each component listed in the Inventory. In addition to observations made during the site evaluation, government standards, published estimating manuals, our experience with similar properties, and engineering judgment is used to develop these estimates.

4. REPLACEMENT RESERVE ANALYSIS

A Replacement Reserve Analysis is the financial evaluation portion of a Replacement Reserve Study. The enclosed Replacement Reserve Analysis calculates the minimum Recommended Annual Deposit to Reserves by two different methods, the *Component Method* and the *Cash Flow Method*. We recommended the Board of Directors discuss with their accounting professional, which method is more suitable for use by the Association.

- **Component Analysis.** We first calculate a Current Objective, which is the reserve amount that would have been accumulated by now had all of the components on the schedule been included from initial construction at their current replacement costs. We then distribute the actual reserves on hand, as reported by the Association, to the components on the schedule in proportion to the current objective figures. The annual deposit for each component is equal to the difference between the replacement cost and the reserves on hand, divided by the years of life remaining. The analysis is then repeated for as many future years as are covered by the study, assuming that replacements occur as forecasted. The Component Analysis ensures a regular buildup of reserves for every component on the schedule, but usually results in an annual contribution higher than that calculated by the Cash Flow Method.
- **Cash Flow Analysis.** We first determine a recommended Minimum Recommended Reserve Funding Level (defined below). We then distribute the estimated replacement costs for the next 50 years to the future years in which they are projected to occur, and calculate the minimum constant yearly contribution to the reserves necessary to keep the reserves on hand above the minimum reserve level. The Cash Flow Method assumes that the Association has the authority to use all of the reserves on hand for replacements as the need actually occurs. The Cash Flow calculated for annual contribution is normally somewhat less than that developed by the Component Method.

Interest and Inflation - Adjusted Component and Adjusted Cash Flow Analysis. It is possible to modify the Replacement Reserve Analysis to include inflation and interest calculations. Attempting to forecast future inflation and interest rates and the impact of changing technology is highly tenuous and we recommend that the Analysis be updated periodically, rather than attempt to project far into the future. We do, however, have the capability to produce an Adjusted Analysis. The inflation and interest rates used must be specified by the Association. We will provide more information on this type of analysis upon your request.

REPLACEMENT RESERVE STUDY APPENDIX

Repair and maintenance. The Replacement Reserve Analysis addresses replacements only, not repairs or maintenance. If we develop a repair list, the life left is based on the recommended repairs being accomplished within one year of the study.

Revisions. Revisions will be made to the Replacement Reserve Analysis in accordance with the written instructions of the Board of Directors. There is no fee for the first revision, if requested in writing within three months of the date of the Study.

Updating. We recommend the Replacement Reserve Analysis be updated annually, by the Board of Directors, to identify replacements which have actually occurred, the cost of actual replacements, and current Reserves on Deposit.

The Analysis should also be updated annually with information on current construction costs and changes in building technology. This update should be performed by independent, qualified individuals, experienced in the process of updating a Replacement Reserve Analysis. Updating an Analysis after a major replacement is made usually results in a significant reduction in the Minimum Recommended Annual Contribution to Replacement Reserves as calculated by the Component Method.

We also recommend the Board of Directors commission a new Analysis every three to five years. This analysis should be performed by independent, qualified individuals, experienced in the process of developing a Replacement Reserve Analysis.

5. LIST OF RECOMMENDED REPAIRS

List of Recommended Repairs. The List of Recommended Repairs identifies defects observed during the site evaluation. The repairs required to correct these defects are listed by trade and include the estimated cost of the repair.

Remaining Economic Life. The "Remaining Economic Life" listed for each component in the Inventory assumes that all repairs will be completed within the next 12 months, unless specifically stated otherwise. Failure to make timely repairs may result in significant inaccuracies in the Analyses.

Repair Funding. The Replacement Reserve Analysis assumes the costs of the repairs listed in the List of Recommended Repairs will NOT be funded from the Replacement Reserves. If the Association intends to fund these repairs from Replacement Reserves, the Analysis should be adjusted with the Replacement Reserves reduced by the funding used for the repairs.

Trade Grouping. Repairs are grouped by trade and cost estimates assume that all work by a given trade will be done together as a single project. If repairs are done piecemeal, the costs would be significantly higher.

REPLACEMENT RESERVE STUDY APPENDIX

Completion of Repairs. The Replacement Reserve Analysis assumes that all repairs will be completed within the next twelve months unless stated otherwise in the Study. Deletion of certain repairs or delays in the completion of the repairs may result in major inaccuracies in the Replacement Reserve Analysis.

Estimated Costs. We used standard estimating manuals. Contractor proposals or actual cost experience may be available to the Association. We will adjust the Inventory to conform to your proposals upon the written request of the Board of Directors.

Safety Issues. Should be given the highest priority and repairs done immediately.

Replacement Criteria for frequently observed defects:

- Concrete pavement:
 1. Tripping hazard (0.5" or more height difference)
 2. Severe cracking (numerous or over 1/8 inch wide)
 3. Severe spalling
 4. Uneven riser heights on steps
 5. Steps with risers in excess of 8.25"
- Asphalt pavement:
 1. Large cracks, settled or heaved areas. In relatively isolated areas, these should be patched by removing the affected asphalt, inspecting and repairing the substrate, and pouring a new top coat. If extensive (more than 60% of the pavement affected), it is probably more economical to replace the entire section. This situation would be the basis for an early projected replacement in the Replacement Reserve Schedule.
 2. Minor cracking. These cracks should be cleaned of debris and plant growth and then filled with an appropriate sealing compound to prevent water infiltration through the asphalt into the base. This repair should be done now and then on a yearly basis. Note that this is a different process from seal coating discussed below.
 3. Crankcase oil. Long term exposure to oil or gasoline breaks down asphalt. Spill areas should be cleaned, or if deterioration has penetrated the asphalt, patched.
 4. Seal coating. Seal coating should be done every three to five years. To be effective in extending the life of the asphalt, the repairs described above need to be done first. Seal coating is a maintenance item and is not normally included in the Replacement Reserve Inventory or on the List of Recommended Repairs.
- Roofing:
 1. Missing, badly worn or limited life shingles or surfaces
 2. Deteriorated fire resistant treated (FRT) sheathing
 3. Inadequate attic ventilation and insulation
 4. Problem gutters, roof drains and downspouts

REPLACEMENT RESERVE STUDY APPENDIX

6. DEFINITIONS

Complete Cycle - Years. (Interval Replacement only) The number of years after Initial Replacement required to achieve 100% replacement.

Current Objective. As of the study date, the dollars that would have been accumulated in the designated account of a component, had that component been included in the Replacement Reserve Inventory from the time of construction at the current replacement cost. Calculation:

$$\text{Total Replacement Cost} \times [\text{Normal Economic Life} - \text{Remaining Economic Life}]$$

Note that all three elements of this calculation are estimated.

The Total Current Objective is the sum of the current objectives for each component included in the Inventory and would be the Association's Replacement Reserve if they were fully funded by the Component Method.

Initial Replacement - Years. (Interval Replacement only) Estimated number of years until the replacement cycle is expected to begin.

Interval Replacement Component. An Interval Replacement Component is not replaced as a whole, but portions of the component are replaced at intervals.

Minimum Recommended Annual Contribution to Replacement Reserves. The requirement for annual contribution to reserves calculated by both the Component and Cash Flow Method.

Minimum Recommended Reserve Funding Level (Cash Flow Analysis only). The Cash Flow Analysis calculates a Minimum Recommended Annual Contribution to Replacement Reserves that will, based upon the Inventory, prevent Reserves from dropping below this prescribed level. This value is established as a percentage of the Estimated Value of All Reserves Components included in this Analysis by the Reserve Consultant, based on the conditions of the community and considering the effects of a high cost component having a shorter than estimated Remaining Economic Life.

Normal Economic Life. Estimated number of years that a new component should last until it has to be replaced.

Normal Replacement Component. A component of the property that, after an expected economic life, is replaced in its entirety.

Number of Years of the Study. In the Component and Cash Flow Methods, number of years into the future for which expenditures are projected and reserve levels calculated. This number should be large enough to include the projected replacement of every component on the schedule at least once. The RSTUDY+ Analysis projects data over a 50 year period. The graphical presentation includes the first 30 years of this data.

REPLACEMENT RESERVE STUDY APPENDIX

Remaining Economic Life. Estimated number of years from the Study Year until the component is expected to require replacement. In theory, this should be the difference between the Normal Economic Life and the age of the component. It may vary because of maintenance practices, solar orientation, technological development, regulatory action, acts of God, or other reasons.

Replacement Reserves Reported to be on Deposit. Amount of accumulated reserves available to the Association.

Replacement Reserve Study. An analysis of the components of the common property of the Association for which a need for replacement should be anticipated within the economic life of the property as a whole. The analysis involves estimation for each component of its replacement cost, economic life, and life remaining. The objective of the study is to calculate a recommended annual contribution to the Association's Replacement Reserves.

Total Replacement Cost. Total of the Estimated Replacement Costs for all components on the schedule.

Transition Year. In the cash flow analysis, a year in which the reserves on hand are projected to fall to the Minimum Recommended Replacement Reserve Funding Level.

Unit Cost. Estimated replacement cost for a single unit of a given component on the schedule. We use standard estimating manuals and judgement.

Unit of Measure. We use the following abbreviations:

EA: each LF: lineal feet LS: lump sum SF: square feet



CULTURED STONE®

CULTURED BRICK® THIN BRICK VENEER INSTALLATION INSTRUCTIONS

Building code requirements vary from area to area. Check with local authorities for building code requirements in your area. Carefully read all Installation Instructions before proceeding with your Cultured Brick® thin brick veneer product application. Observe safety precautions.

Estimating the Brick Required

A. Determine the amount of Cultured Brick® thin brick veneer products needed by measuring the area to be covered. Measure the length times the height to arrive at the square footage of flat brick needed. Subtract square footage for window and door openings. Measure the linear feet of outside corners to determine the amount of corner pieces needed. One linear foot of corner pieces covers approximately 1 square foot of flat area. Subtract the flat area covered by the linear feet of corner pieces from the square footage of flat brick required. You may wish to obtain some extra brick to allow for cutting and trimming.

B. One carton of Cultured Brick® thin brick veneer flat covers 10 square feet using a $\frac{3}{8}$ " mortar space (joint) between bricks.

C. One carton of Cultured Brick® thin brick veneer corner pieces covers 7 linear feet of outside corner using a $\frac{3}{8}$ " mortar space (joint) between bricks.

D. Cultured Brick® thin brick veneer products are not suitable for use on any area subject to foot traffic.

Helpful Tools



Sundry Material Requirements

A. MORTAR/GROUT

Using pre-mixed Type N mortar or components from Table 1, mix to a firm, moist consistency. Mortar that is too dry and crumbly will not provide proper bond. Mortar that is too wet will be weak and messy.

Table 1 – Proportions for Mortar				
Parts By Volume				
Mortar Type	Portland Cement or Blended Cement	Masonry Cement Type N	Hydrated Lime or Lime Putty	Aggregate
N	1 --	-- 1	1 --	4 1/2 to 6 2 1/4 to 6

B. MORTAR COLOR

Tinting mortar complements the color of the brick being installed. Example: Use tan mortar with earth-tone bricks. This will greatly enhance the appearance of the finished installation. Regular mortars can be tinted to complement your Cultured Brick® thin brick veneer products using iron oxide pigments available from your dealer.

C. WEATHER-RESISTANT BARRIER

Depending on local building code requirements, barrier shall be equal to U.B.C. Standard No. 14-1 for Kraft water-proof building paper or asphalt saturated rag felt or ASTM D 226, Type 1, No. 15 felt. **Note: Weather-Resistant Barrier must be used on all exterior and interior mortar applications except for those over masonry, concrete or stucco.**

D. METAL LATH

1. Minimum 2.5-lb. expanded metal lath (diamond mesh) galvanized. Black metal lath (rust inhibitive) may be used on interior applications.
2. Or 18-gauge galvanized woven wire mesh.
3. For metal buildings and open stud construction — minimum 3.4-lb. $\frac{3}{8}$ " rib expanded galvanized metal lath.
4. Or other code accepted mesh or lath.

E. FASTENERS

1. Galvanized nails, staples, concrete nails.
2. United States Gypsum Company's 1 1/4" type S-12 Pancake Head SuperTite screws. (Used for installation to metal surfaces.)

F. MASONRY SEALER

1. Silane-based breather-type sealer (if required).

Surface Preparation for Mortar Installations

Using the chart below, determine the correct surface preparation for your installation.

Table 2	
WALL SURFACE	INTERIOR & EXTERIOR PREPARATION REQUIRED
Rigid Backwall Wallboard Plywood Paneling Wall Sheathing Concrete Board Polystyrene Insulation Board Installed over a Rigid Backwall	Cover sheathing with a breather-type weather-resistant barrier, lap joints 4" shingle fashion. Then, in accordance with local building code, lap and install lath or mesh using galvanized nails or staples 6" on center vertically, penetrating studs a minimum of 1". Continuously wrap weather-resistant barrier and metal lath a minimum of 16" around all outside and inside corners. (Fig. A)
Clean & Untreated Concrete Masonry Stucco	No preparation needed. Examine newly poured concrete closely to ensure that its finished surface contains no release agents (form oil). If it does contain form oil, etch surface with muriatic acid, rinse thoroughly and/or score with a wire brush (Fig. B).
Dirty, Painted or Sealed Concrete, Masonry or Stucco	Sandblast or water blast to original surface (remove sandblasting dust by washing) or securely attach lath.
Metal Buildings	Lap and install paper-backed $\frac{3}{8}$ " rib expanded metal lath to metal cladding supports of 20 ga. to 12 ga. using United States Gypsum Company's 1 $\frac{1}{4}$ " type S-12 Pancake Head Super Tite screws. Screws must penetrate $\frac{3}{8}$ " beyond the inside face of metal surface. Screws are to be installed on centers equal to 1 screw/sq. ft. and shall not exceed 6" on center in one direction. Apply $\frac{1}{2}$ " to $\frac{3}{4}$ " scratch coat and allow to dry 48 hours.
Open Studs Polystyrene Insulation Board Installed over Open Studs	Lap and install paper-backed metal lath to studs using nails which penetrate a minimum of 1" at 4" on center. Apply $\frac{1}{2}$ " to $\frac{3}{4}$ " scratch coat and allow to dry 48 hours.

RIGID BACKWALL – WALLBOARD, PLYWOOD, PANELING AND WALL SHEATHING

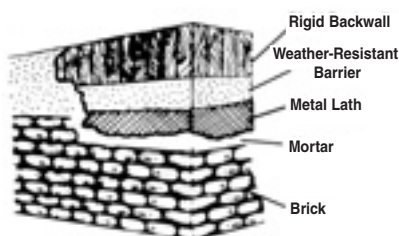


Figure A

CLEAN AND UNTREATED CONCRETE, MASONRY OR STUCCO

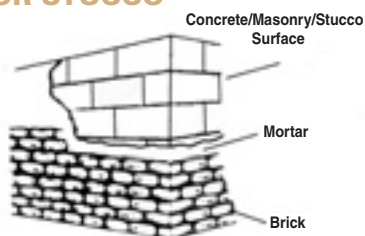


Figure B

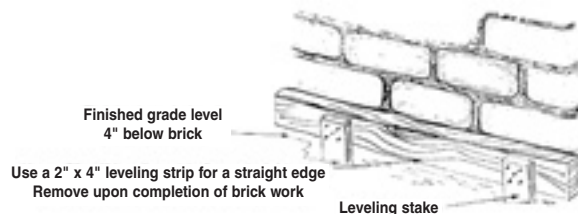
DIRTY, PAINTED OR SEALED CONCRETE, MASONRY OR STUCCO: Clean to original surface or, if unable to clean completely, attach lath with concrete nails.

Working with Mortar

(EXTERIOR AND INTERIOR APPLICATIONS)

INSTALL A TEMPORARY STARTER STRIP (Exterior Applications Only)

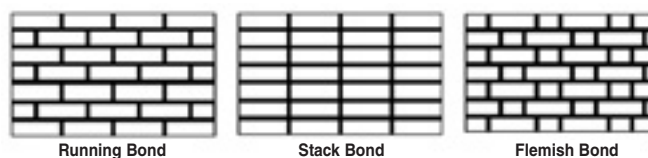
Install a temporary starter strip to ensure a level installation on the first course of bricks.



LAY OUT WALL AREA

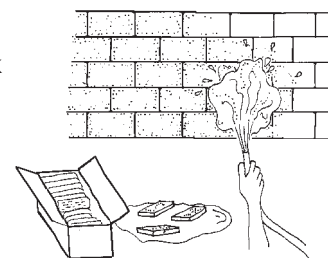
Choose the type of wall pattern desired. Allowing for a mortar joint of approximately $\frac{3}{8}$ ", calculate and mark off the number of courses required. Adjust joint size to minimize horizontal cutting. Run a level guide line to ensure proper placement of bricks.

Mix brick from several boxes at a time to achieve a pleasing blend of color and texture.



Wetting Exterior Walls. Dampen concrete, masonry or stucco wall surfaces with water prior to the application of the brick.

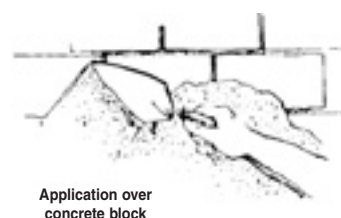
Wetting the Brick. The back of the brick should be completely damp, but free from surface water at the time of application.



METHOD 1:

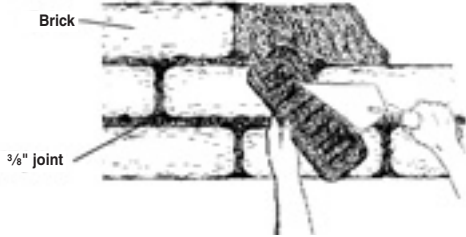
A. Applying Mortar to Wall

Using a plasterer's or mason's trowel, apply mortar $\frac{1}{2}$ " to $\frac{3}{4}$ " thick to prepared surface area. Do not spread more than a workable area (5 to 10 square feet) so that mortar will not "set up" before bricks are applied.



B. Setting the Brick

Completely cover the back of the brick with a $\frac{3}{8}$ " thick coating of mortar. Push the brick onto the mortared surface until mortar oozes out around the edges of the brick.



METHOD 2:

Applying Neat Cement

A paste of neat Portland cement shall be brushed on the wall surface area and the back of the brick. In addition, Type N mortar shall be applied to the wall surface area and the back of the brick. Sufficient mortar should be used to create a slight excess to be extruded out around the edges of the brick. Press brick into place to ensure a full mortar bed between the bricks and the wall surface area. The resulting thickness of mortar in back of the brick should be no less than $\frac{1}{2}$ " nor more than $1\frac{1}{4}$ ".

Grouting and Finishing

Wait until mortar is "thumb print" dry and crumbly, then compact and smooth mortar joints with a jointing tool. (See Grouting and Finishing Joints.)

Working with Masonry Adhesive (Interior Only)

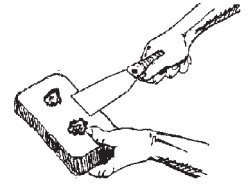
On some interior projects, the use of masonry adhesive offers a fast and easy alternative to mortar. **Note: Do not wet brick when installing with adhesive.**

Table 3 – Interior Surfaces Preparation Required When Using Masonry Adhesive	
Recommended Surfaces	Masonry adhesive may be applied over most clean and structurally sound interior surfaces such as plywood, drywall, concrete block and concrete.
Preparation	Wallpaper or other loose surface materials should be removed. Sanding may be required on very smooth surfaces to achieve a good bonding surface.
Alternatives	As an alternative, drywall sheathing fastened to the wall studs over existing or removed surface materials will provide an inexpensive and effective application substrate. Drywall joints and nail holes will not require taping or filling unless required by building codes.
Non-recommended Surfaces	Masonry adhesive is NOT RECOMMENDED for application over smooth textured tile, metal, wallpaper, some types of paint or surfaces that are continually damp.

MASONRY ADHESIVE WITH GROUTED JOINT

Setting Brick with Masonry Adhesive

Place adhesive as per adhesive manufacturer's instructions on the back of each brick. Press and wiggle bricks into place on wall surface until they bottom out. Set bricks level and plumb, completing one row at a time. Grout between bricks using a mortar bag.

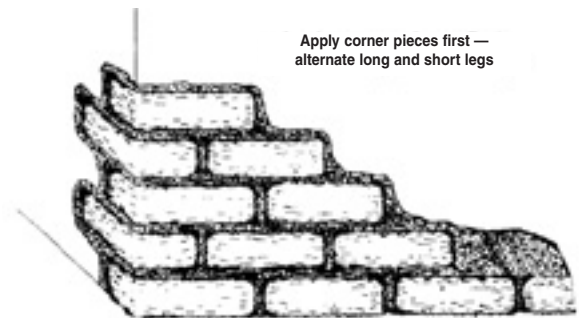


Applying Cultured Brick® Thin Brick Veneer Products

GENERAL INFORMATION FOR ALL METHODS OF INSTALLATION

A. To achieve a pleasing blend of color and texture, **use brick from several boxes at a time.**

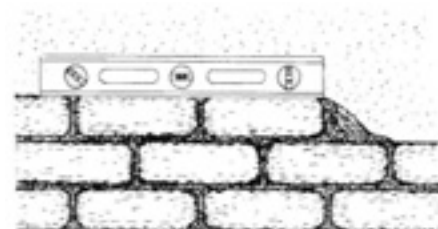
B. If your application requires corner pieces, **start each course by applying corner pieces first.** Notice that the corner pieces have a long and a short leg. Alternate these in opposite directions.



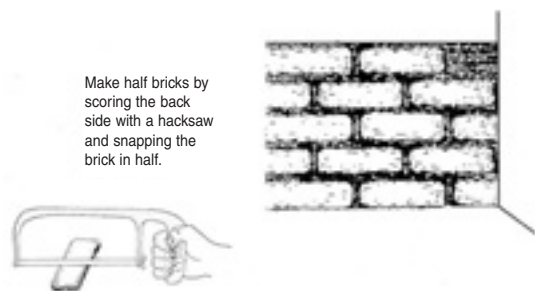
C. Inside corners – When using a running bond, set full bricks to half bricks at inside corners alternating lengths in each course.

D. Start at end of wall and complete one horizontal course of brick. If a running bond is desired, alternate full- and half-length bricks in relation to the course below.

E. Work across the surface area one row at a time. Adjust spacing to eliminate unnecessary trimming. Keep courses level and plumb by using a carpenter's level to check each course as it is laid.



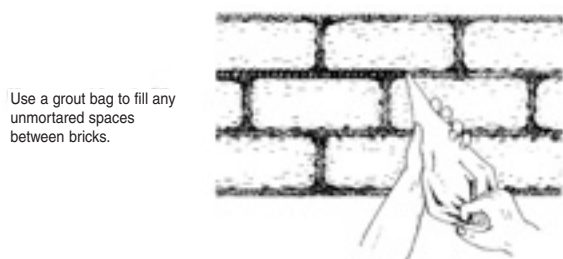
F. Cutting and trimming — Make half bricks by scoring the back side with a hacksaw and snapping the brick in half.



Grouting and Finishing Joints

A. GROUTING JOINTS WITH MORTAR

If required, use a grout bag to fill any unmortared spaces between the bricks.

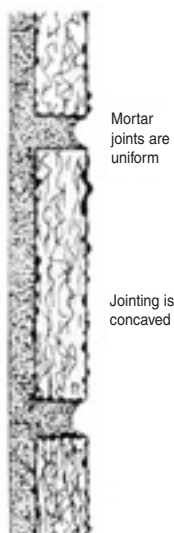


B. FINISHING JOINTS

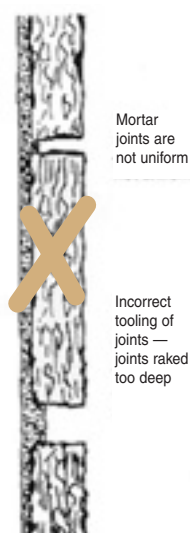
When the mortar joints have become firm “thumb print” dry, they should be pointed up with a metal jointing tool. Rake out excess mortar, compact and seal edges around bricks. (Setting time will vary depending on wall surface and climatic conditions.)



CORRECT



INCORRECT



Cleaning Finished Job

At the end of the work day, or when mortar is sufficiently set up, the finished job should be broomed or brushed to remove loose mortar and to clean the face of the brick. A wet brush should never be used to treat the mortar joints as this may cause staining that will be difficult, or impossible, to remove. Do not use acid or acid-based products to remove mortar.

Incorporate Good Building Practices

Make sure that the application of Cultured Brick® thin brick veneer products and the structure they are being applied to incorporate good building practices. On exterior applications, improper installation or absence of flashing, cant strips, gutters and downspouts may result in undesirable diversion of water run-off onto finished surface areas. Masonry and other building products subjected to these conditions may develop staining. When this is combined with severe freeze-thaw conditions, it may eventually cause damage. The application of Cultured Brick® thin brick veneer products under these conditions is not recommended.

RETAINING WALLS

All retaining walls must be waterproofed at the fill side. Wall construction should incorporate proper use of granular fill and provisions for good drainage. Cultured Stone® Capstones or poured-in-place concrete caps must be used to provide adequate run-off protection. Caps should extend 1" to 2" beyond finished brick surface.

CHIMNEY CAP

All chimney chases must be capped with a one-piece cap that extends 1" to 2" beyond the finished brick surface to prevent water from entering into the wall system. Chimney or chase construction should incorporate proper flashing.

For additional information on Cultured Stone® brand products and services, visit www.culturedstone.com or call 1-800-255-1727.

AUTHORIZED DEALER



OWENS CORNING WORLD HEADQUARTERS
ONE OWENS CORNING PARKWAY
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INNOVATIONS FOR LIVING™ www.owenscorning.com 1-800-GET-PINK

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CULTURED STONE®

INSTALLATION INSTRUCTIONS



CULTURED STONE® MANUFACTURED STONE VENEER INSTALLATION INSTRUCTIONS

Cultured Brick® Products Installation Instructions are available separately from your Dealer.

Building code requirements vary from area to area. Check with local authorities for building code requirements in your area. Carefully read all Installation Instructions before proceeding with your Cultured Stone® products application. Observe safety precautions. Cultured Stone® products are covered by a 50-Year Limited Warranty when installed in accordance with the manufacturer's Installation Instructions. See warranty on page 8.

Estimating the Stone Required

Determine the amount of Cultured Stone® products needed by measuring the area to be covered. Measure the length times the height to arrive at the gross square footage of flat stone needed. Subtract square footage for window, door and other openings. Measure the linear feet of outside corners to determine the amount of corner pieces needed. One linear foot of corner pieces covers approximately ¾ of a square foot of flat area. Subtract the flat area covered by the linear feet of corner pieces from the square footage of flat stone required. You may wish to obtain some extra stone to allow for cutting and trimming. In addition, be sure to verify whether the texture chosen is sold based on coverage with a ½" mortar joint or tight-fitted. Most texture coverages are listed for a ½" joint, the exceptions being Drystack LedgeStone, Carolina LedgeStone, European Castle Stone and Pro-Fit® LedgeStone.

Formula:

Length x Height = Wall Area

Window Width x Window Height = Window Area

Lineal Feet of Corners Required x .75 = Wall Area

Covered by Corners

Wall Area – Window Area – Wall Area Covered by

Corners = Square Ft. Flats Required

Tools Required

Choose the tools required for your installation — see page 7 for illustrations and appropriate use.

- Safety Glasses and other personal protective equipment
- Hammer or Staple Gun
- Wheelbarrow & Hoe
- Hock & Trowel
- Mason's Trowel
- Margin Trowel
- Masonry, Circular, Table Saw or Grinder with Carborundum or Diamond Blade
- Wide Mouth Nippers or Hatchet
- Dust Mask
- Level
- Metal Jointing Tool or Wood Stick
- Grout Bag
- Whisk Broom

Sundry Material Requirements

A. MORTAR COMPONENTS

1. Premixed: Type N mortar.
2. Mortar mixed: as per Table #2 on page 3.
3. Mortar color: iron oxide color (if desired).

Note: Additives should not be used unless approved by building official. Additives should meet the requirements of ASTM C 270 or CSA A179.

B. WEATHER-RESISTANT BARRIER

Depending on local building code requirements, barrier shall be equal to U.B.C. Standard No. 14-1 for Kraft waterproof building paper or asphalt saturated rag felt or ASTM D 226, Type 1, No. 15 felt. **Note: Weather-Resistant Barrier must be used on all exterior and interior mortar applications except for those over masonry, concrete or stucco.**

C. FLASHING

1. To maintain the weather-resistance of the exterior wall on which stone products are installed, rigid, corrosion-resistant

flashing and a means of drainage shall be installed at all penetrations and terminations of the stone cladding. Flashing type and locations shall be in accordance with the requirements of the applicable building code.

2. For additional recommendations regarding flashing refer to the following trade associations, standards and organizations:
 - a. ASTM E 2112
 - b. Asphalt Roofing Manufacturers Association (ARMA)
 - c. Brick Institute of America (BIA)
 - d. The American Plywood Association (APA)
 - e. Local building department
 - f. Architect or engineer

D. METAL LATH

1. Minimum 2.5-lb. galvanized expanded metal lath (diamond mesh) meeting the requirements of ASTM C 847, or min. 18-gauge galvanized woven wire mesh meeting the requirements of ASTM C 1032.
2. For metal buildings and open stud construction—minimum 3.4-lb. ¾" rib, paper-backed, expanded galvanized metal lath.
3. Or other code accepted mesh or lath.

E. FASTENERS

1. Galvanized nails, staples, concrete nails.
2. Corrosion-resistant, self-drilling, self-taping pancake head screw with 7/16" head, of 1¼" length or suitable to obtain ¾" penetration beyond inside surface of metal. (Used for installing to metal surfaces.)

F. MASONRY SEALER

1. Silane-based breather-type sealer (if required). See Note under General Information section on sealers (p. 7).

Surface Preparation for Mortar Installations

Using Table 1 on following page, determine the correct surface preparation for your installation.

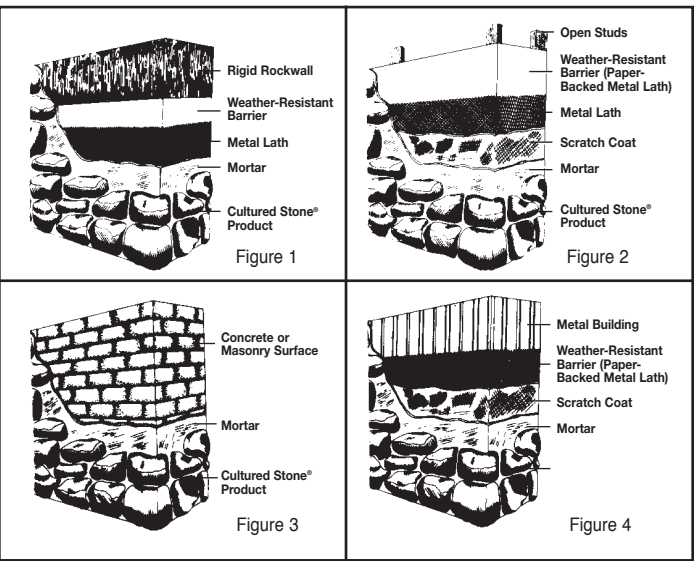
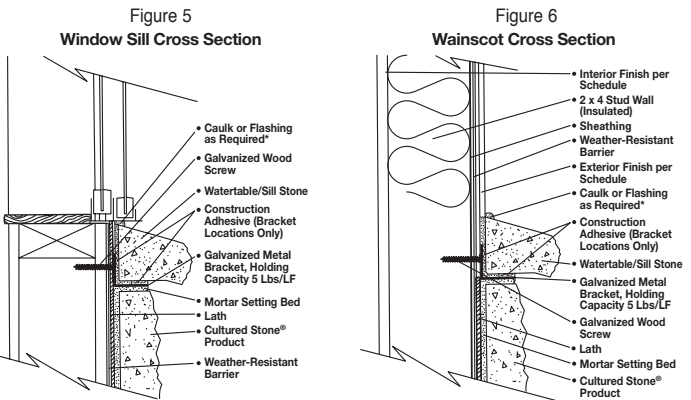


Table 1	
WALL SURFACE	INTERIOR & EXTERIOR PREPARATION REQUIRED
Rigid Backwall Wallboard Plywood Paneling OSB Concrete Board Polystyrene Insulation Board installed over a Rigid Backwall	Cover sheathing with a breather-type weather-resistant barrier, lap joints 6" at vertical joints and 2" at horizontal joints in shingle fashion. Then, in accordance with local building code, lap and install lath or mesh using galvanized nails or staples 6" on center vertically, penetrating studs a minimum of 1". Continuously wrap weather-resistant barrier and metal lath a minimum of 16" to next framing member around all outside and inside corners (Fig. 1).
Clean & Untreated Concrete Masonry Stucco	Examine newly poured concrete closely to ensure that its finished surface contains no release agents (form oil). If it does contain form oil, etch surface with muriatic acid, rinse thoroughly and/or score with a wire brush (Fig. 3). No further preparation needed.
Dirty, Painted or Sealed Concrete, Masonry or Stucco	Sandblast or waterblast to original surface (remove sandblasting dust by washing) or securely attach lath.
Metal Buildings	Lap and install 3.4-lb. ¾" rib, paper-backed, expanded metal lath to metal cladding supports of 20 ga. to 12 ga. using corrosion-resistant, self-drilling, self-tapping pancake head screw with 7/16" head, of 1¼" length or suitable to obtain ¾" penetration beyond inside surface metal. Screws are to be installed on center equal to 1 screw/sq. ft. and shall not exceed 6" on center in one direction. Apply ½" to ¾" scratch coat and allow to dry 48 hours (Fig. 4).
Insulation Board or Open Studs Polystyrene Foam Board	Lap and install 3.4-lb. ¾" rib, paper-backed, expanded metal lath to studs using nails which penetrate a minimum of 1" at 4" on center. Apply ½" to ¾" scratch coat and allow to dry 48 hours (Fig. 2).

Watertable/Sill Installations

Watertable/Sills provide a transition piece between a stone wainscot and other exterior finishes and for water runoff. They can also be used as a window sill. Install using galvanized metal support brackets (Simpson Strong Tie A-21 or other galvanized right angle bracket with holding capacity minimum 5 lbs./LF) fastened with galvanized nails or screws penetrating studs 1" at a minimum of 16" O.C. Use construction adhesive to bond stone at bracket locations. Caulk and flash as required at Watertable/Sill locations using an approved corrosion-resistive flashing that extends to the surface of exterior wall finish and installed to prevent water from re-entering the exterior wall envelope.



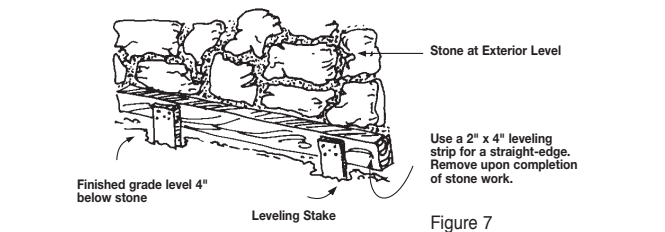
*Failure to properly caulk and/or flash as described in these installation directions may result in water damage to the structure.

Installing Stone at Ground Level

Keep the finished edge of the Cultured Stone® product a minimum of 4" above grade if earth or 2" above pavement. Use a 2" x 4" leveling strip (straight-edge) (Fig. 7).

This will:

- Provide drainage as required by applicable building code.
- Avoid possible staining of the stone by soils containing alkali or other minerals.



Prepare Your Work Area

Spread Cultured Stone® wall veneer out at the job site so you have a good variety of sizes, shapes and colors to choose from. Plan for some variety and contrast in the overall design. Use small stones next to large ones, heavy-textured pieces next to smooth, thick stones next to thinner ones. Mixing Cultured Stone® wall veneer from different boxes during application will allow you to achieve a desirable balance of stones on your finished project.

Mortar

NOTE: WEATHER CONDITIONS

If stone is being applied in hot or dry weather, the back of each piece should be moistened with a fine spray of water or a wet brush to adequately prevent excessive absorption of moisture from the mortar. If being installed over concrete, masonry or scratch coat substrate, the substrate surface area should also be dampened before applying mortar.

Applications should be protected from temperatures below 40°F as mortar will not set up properly under such conditions. Do not use antifreeze compounds to lower the freezing point of mortar. See International Building Code Section 2104.3 for cold weather construction requirements.

A. MIXING MORTAR/GROUT

Using Premixed Type N mortar or components from Table 2, mix to a firm, moist consistency. Mortar that is too dry and crumbly will not provide proper bond. Mortar that is too wet will be weak and messy.

Table 2 – Proportions for Mortar				
Parts By Volume				
Mortar Type	Portland Cement or Blended Cement	Masonry Cement Type N	Hydrated Lime or Lime Putty	Aggregate
N	1	–	1	4 ½ to 6
	–	1	–	2 ¼ to 3

B. MORTAR COLOR

Tinting mortar complements the color of the stone being installed. Example: Use tan mortar with earthtone stones. This will greatly enhance the appearance of the finished installation. Regular mortars can be tinted to complement your Cultured Stone® product using iron oxide pigments available from your dealer.

C. APPLYING MORTAR TO PREPARED SURFACE AREA

Using a plasterer's or mason's trowel (Fig. 8 and 9), apply mortar ½" to ¾" thick to prepared surface area. Do not spread more than a workable area (5 to 10 sq. ft.) so that mortar will not "set up" before stone is applied.

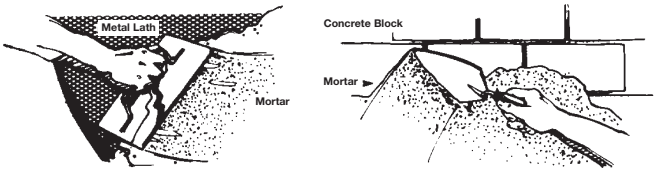


Figure 8 Applying mortar using a plasterer's trowel

Figure 9 Applying mortar using a mason's trowel

Applying Cultured Stone® Products

See page 5 for additional instructions concerning Pro-Fit® Ledgestone, Carolina Ledgestone and European Castle Stone.

A. STARTING POINT

Apply mortar and stone working from the bottom up, or most stones can also be applied from the top down. Working from the top down may help avoid splashing previously applied stone with dripping mortar. Ledgestone types should be installed from the bottom up.

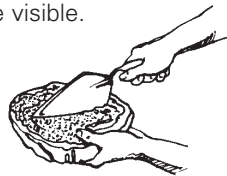
B. JOINT WIDTH

In order to obtain the most natural look, joints should be as narrow as possible. The average should not exceed 1/2" in width. An attractive look can also be achieved by fitting stones tightly together if desired. If using tight fit/dry-stack method, it is important to make sure scratch coat/backing has been covered completely by the setting bed of mortar. This will conceal the scratch coat/backing and prevent pockets from forming behind stones that could trap water.

C. SETTING THE STONES

Press each stone into the mortar setting bed firmly enough to squeeze some mortar out around the stone's edges. Apply pressure to the stone to ensure a good bond. **Ensure complete coverage between the mortar bed and back surface of the stone.** Mortar may also be applied to the entire back of the stone (Fig. 10). When stone is installed correctly, scratch coat/backing will not be visible.

Figure 10
Mortar applied to the entire back of the stone



Care must be taken to avoid smearing mortar on surface of stone. Accidental smears should be removed using a whisk broom only after mortar has become crumbly.

D. INSTALL CORNER PIECES FIRST

If your application requires corner pieces, apply these first. Notice that the corner pieces have a long and a short leg. Alternate these in opposite directions (Fig. 11).



Figure 11
Applying corners—
alternating long and
short legs in the
opposite direction

E. INSTALL FLAT PIECES

After the corner pieces are in place, flat pieces are applied working toward the wall center (Fig. 12).

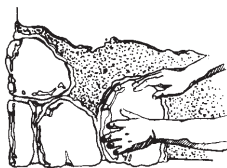


Figure 12
Applying flat pieces

F. KEEP YOUR MORTAR JOINTS CONSISTENT

Place the individual stones close together, creating uniform joints between them. Cut and trim as required to achieve consistent width in the mortar joints. Then trim and fit small pieces into any remaining voids (Fig. 13).

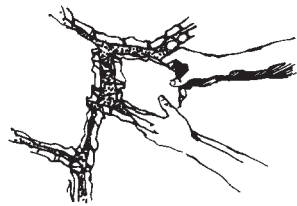


Figure 13
Position large pieces
first, then trim and fit
in smaller pieces

G. CUTTING AND TRIMMING

Stones can be cut and shaped for fit. Use wide-mouth nippers or a hatchet (Fig. 14 and 15). (Refer to page 7—Tools Required.) Some broken stones may be found in the box. These also may be used in filling gaps between large stones. For best finished appearance, coat cut or broken edges with mortar. If possible, position cut edges up when they are above eye level, down when below eye level. **SAFETY GLASSES AND A DUST MASK SHOULD ALWAYS BE WORN WHEN CUTTING ANY CULTURED STONE® PRODUCTS.**

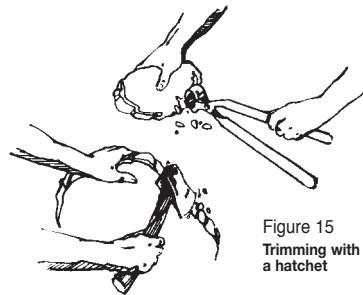


Figure 14
Trimming with wide-
mouth nippers

Figure 15
Trimming with
a hatchet

NOTES:

LEVEL AND PLUMB JOINT LINES

When applying Cobblefield® manufactured stone veneer, European Castle Stone, Limestone or Ledgestone, endeavor to maintain level and plumb joint lines. Also, long rectangular pieces will look most natural if applied horizontally.

RIVER ROCK AND STREAM STONE

When applying River Rock or Stream Stone, plan the placement of stones to minimize trimming and cutting to maintain the natural look of the rounded shapes.

LEDGESTONE TYPES

When applying ledgestone types keep joints as small as possible to maintain a natural look and install from the bottom up. Strike joints deeply, being careful not to expose the back edge of stones, or scratch coat/backing.

See page 5 for additional instructions regarding Pro-Fit® Ledgestone, Carolina Ledgestone and European Castle Stone.

Grouting and Finishing Joints

A. GROUTING JOINTS

If additional mortar is required, use a grout bag to fill in joints (Fig. 16). Care must be taken to avoid smearing mortar on surface of stone. Accidental smears should be removed only after mortar has become crumbly using a whisk broom or dry bristle brush. Never use a wet brush or wire brush.



Figure 16
Grouting joints

B. FINISHING JOINTS

When the mortar joints have become firm or thumb-print dry (setting time will vary depending on wall surface and climatic conditions), they should be pointed up with a wood stick or metal jointing tool. Rake out excess mortar, compact and seal edges around stones (Fig. 17).

Careful attention to proper and even jointing will result in a professional looking finish.



Figure 17
Finishing the job

C. CLEANING FINISHED JOB

At the end of the work day, or when mortar is sufficiently set up, the finished job should be broomed or brushed to remove loose mortar and to clean the face of the stone. **A wet brush should never be used to treat the mortar joints** as this will cause staining that will be difficult, or impossible, to remove. **Do not use acid or acid-based products.**

Additional Instructions For Pro-Fit® Ledgestone, Carolina Ledgestone and European Castle Stone

FIT THE JOINTS TIGHTLY

Install all these products with tight-fitted (mortarless) joints. Generally components should be placed butting each other and aligned for level and plumb. When installing, the backs of all these components must be wet. They should be noticeably damp, but free from surface water. Mortar must be tinted to match the color of the stone you are installing to help conceal the joint lines.

A. STARTING POINT

Products are applied starting from the bottom (first course) and working up. Start each course with the appropriate Ledgestone component or European Castle Stone. Continue horizontally and complete each course before starting the next. If required, cut the appropriate size component to fit at the end or top of the finish area (Fig. 20). Frequently check the installation for level and alignment.

B. INSTALL CORNER PIECES FIRST

If your application requires corner pieces, start by installing a corner piece first, followed by the adjoining flat pieces. Notice that the corner pieces have a long and short leg. Alternate these in opposite directions (Fig. 18).

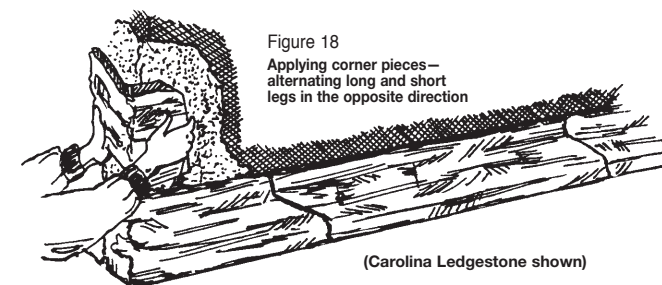


Figure 18
Applying corner pieces—
alternating long and short
legs in the opposite direction

C. SETTING THE STONES

Press each stone into the mortar setting bed firmly enough to squeeze some mortar out around the mortar groove at the back edge of component. Apply pressure to the component to ensure a good bond. **Ensure complete coverage between the mortar bed and back surface of stone.** Mortar may also be applied to the entire back of the stone. Check for level and plumb.

D. INSTALL FLAT PIECES

After the first corner piece is in place, the adjoining flat pieces of each course or pattern are applied. Using a trowel, strike off the excess mortar around the edges of the component prior to placing the next component. This will allow the next adjacent component to fit tightly (see Fig. 19). **Choose the correct length component to ensure that vertical joints do not line up.**

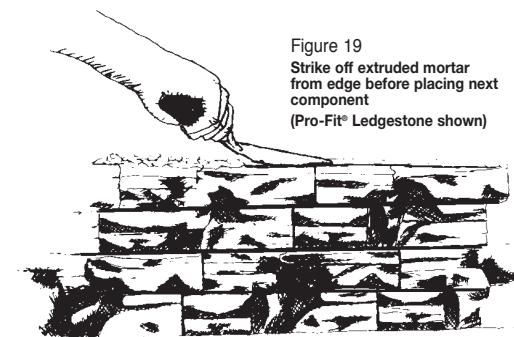


Figure 19
Strike off extruded mortar
from edge before placing next
component
(Pro-Fit® Ledgestone shown)

E. CUTTING AND TRIMMING

Vertical or horizontal cuts can be made using a table saw, circular saw or small grinder equipped with a dry cutting diamond or carborundum blade (See Fig. 20).

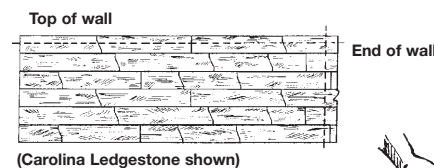


Figure 20
Small Grinder (left)
Circular Saw (right)

Cutting should be done outside as some dust will occur.

SAFETY GLASSES AND A DUST MASK SHOULD ALWAYS BE WORN WHEN CUTTING ANY CULTURED STONE® PRODUCTS. Stones can also be cut and shaped using wide-mouth nippers or a hatchet.

ADDITIONAL INFORMATION ON CUTTING AND FITTING

Finished Edges — Place finished edges at exposed areas.

Cut Edges — Place cut edges within courses.

FINISHING JOINTS

The design simplicity of Pro-Fit® Ledgestone, Carolina Ledgestone and European Castle Stone allows for easy installation of components and provides a finished, mortarless joint between the stones. This reduces the time required for cutting, grouting and jointing.

SURFACE CLEANING

Care must be taken to avoid smearing mortar on the surface of components. Accidental smears should be removed with a whisk broom or dry bristle brush only after mortar has become crumbly. **Do not use a wet brush or a wire brush.** Careful attention to proper jointing will result in a professional looking finish. **Do not use acid or acid-based products, power-washing, sandblasting or wire-brush cleaning.**

Installing Hearthstones

Hearthstones are not recommended or warranted for exterior use or as a surface area subject to foot traffic.Terra Craft® Pavers are available from your dealer for patios and walkways.

A. PLACE MORTAR

Place mortar ¾" deep in 3-inch wide strips 1 inch apart on prepared surface (Fig. 21).

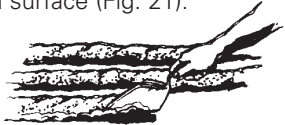


Figure 21
Placing mortar for
Hearthstone installation

B. INSTALL HEARTHSTONES

Place the first Hearthstone on to the mortar bed and level (Fig. 22). Place adjacent Hearthstones, aligning and leveling with the first piece.

If joints need additional mortar, fill joints using a grout bag. Tool and finish joints following previous instructions under “Grouting and Finishing Joints.” Ensure Hearthstones are set in a complete bed of mortar.

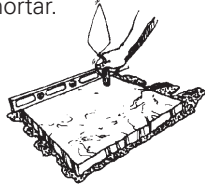


Figure 22
Placing Hearthstone

C. CUTTING AND TRIMMING HEARTHSTONES

Hearthstones can be cut as required using a circular saw fitted with a carborundum or diamond blade or using a mason’s brick or tile saw. Place finished edges at exposed areas. **SAFETY GLASSES AND A DUST MASK SHOULD ALWAYS BE WORN WHEN CUTTING ANY CULTURED STONE® PRODUCTS.**

NOTES: Hearthstone Installation

U.L. LISTED

Cultured Stone® manufactured stone veneer and hearth products are made from non-combustible materials (U.L. Listing #209T). They are listed by Underwriters Laboratories, Inc. for use as floor protectors and wall shields with stoves and on fireplace hearths. To comply with U.L. Listing, mortar joints must not exceed ½" in width and the mortar must be even with the top of the hearth surface.

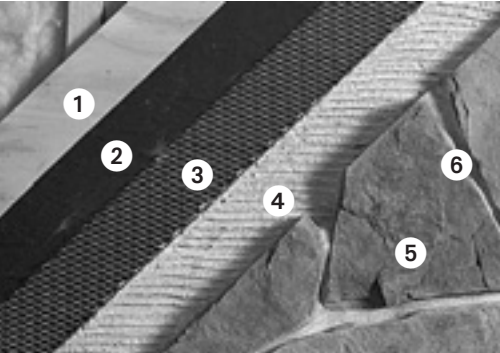
RAISED HEARTH

Do not cantilever or extend Hearthstones more than 1½" beyond direct support. When grouting the extended portion of a cantilevered Hearthstone, bring the grout to the front edge. Push a long galvanized nail horizontally into the grout to add support, then cover the nail with mortar.

SEALING FIREPLACES/HEARTH

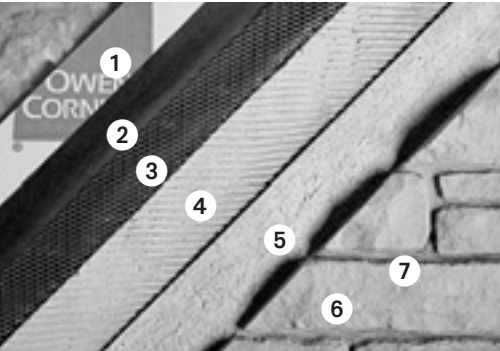
If desired, sealing the Cultured Stone® facing or hearth of a fireplace installation will assist in the removal of smoke and soot stains should they occur. See note in General Information section for more information on sealing (p. 7).

Typical Installations:
WOOD FRAME:



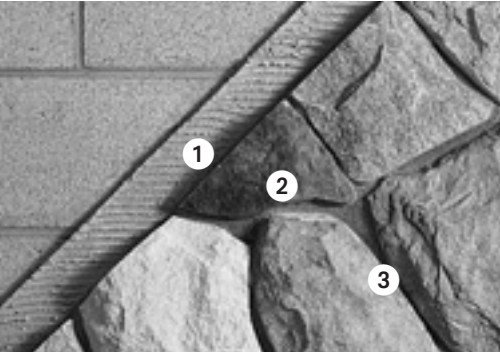
In sequence: (1) sheathing, (2) weather-resistant barrier, (3) galvanized metal lath, (4) mortar, (5) Cultured Stone® manufactured stone veneer, (6) mortar joint.

RIGID FOAM INSULATION:



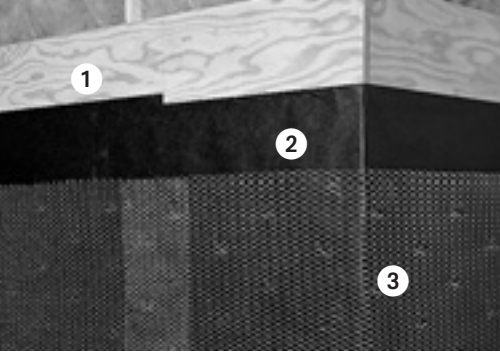
In sequence: (1) rigid foam insulation, (2) weather-resistant barrier, (3) metal lath, (4) scratch coat, (5) mortar setting bed, (6) Cultured Stone® manufactured stone veneer, (7) mortar joint.

MASONRY OR CONCRETE:



In sequence: (1) mortar applied directly to untreated, unpainted masonry, concrete or stucco, (2) Cultured Stone® manufactured stone veneer, (3) mortar joint.

CORNER PREPARATION:



Weather-resistant barrier and galvanized metal lath must continuously lap a minimum of 16" beyond outside and inside corners. Lap materials 4" on horizontal and vertical joints. (1) wall substrate, (2) weather-resistant barrier, (3) metal lath.

General Information
CLEANING

Dirt, etc., may be removed by using a strong solution of granulated soap or detergent and water with a bristle brush. **Do not use a wire brush** as it will cause damage to the surface. Rinse immediately with fresh water. For help with serious cleaning problems, contact your local dealer. **Do not attempt to clean using acid or acid containing products, power-washing, sandblasting or wire-brush cleaning.**

SALT AND DE-ICING CHEMICALS

Because all concrete and masonry are vulnerable to damage by salt, Cultured Stone® products are not warranted against damage incurred from salt or other chemicals used to remove snow or ice. Do not use de-icing chemicals on areas immediately adjacent to a Cultured Stone® manufactured stone veneer application.

SCUFFING

Scuffing occurs on all natural stone. Occasionally some scuffing will occur on the surface of Cultured Stone® products. This can enhance the natural appearance of your Cultured Stone® manufactured stone veneer installation. Some scuff marks can be removed by cleaning as described above.

EFFLORESCENCE

Efflorescence is a water-soluble salt that is deposited on the surface of stucco, concrete, brick and other masonry products by the evaporation of water that has penetrated the wall. On rare occasions efflorescence will occur on Cultured Stone® products. To remove efflorescence, allow the stone to dry thoroughly, then scrub vigorously with a stiff bristle brush and clean water. Rinse thoroughly—do not use a wire brush. For more difficult efflorescence problems, scrub thoroughly with a solution of 1 part white household vinegar to 5 parts water. Rinse thoroughly. For unusually difficult cleaning problems contact your local Cultured Stone® dealer.

SEALERS

Sealers are not necessary on Cultured Stone® products. However, some customers use sealers to help prevent staining in applications prone to smoke, soot, dirt or water splashing. If you choose to use a sealer, make sure it is a silane-based, breathable sealer. Take note that sealers may darken the color of the stone. A sealer may also slow the natural movement of moisture out of the stone and increase the possibility of efflorescence and/or spalling. For information regarding actual performance or application of sealers contact the manufacturer of the sealer directly.

SWIMMING POOLS

Cultured Stone® products should not be used below water level, as in swimming pool liners. Chlorine and other chemicals may discolor the Cultured Stone® products and other masonry materials.

Incorporate Good Building Practices
BUILDING CODE REQUIREMENTS

Building code requirements vary from area to area. Check with local authorities for building code requirements in your area. Carefully read all Installation Instructions before proceeding with your Cultured Stone® manufactured stone veneer application.

EXTERIOR APPLICATIONS

Make sure that the application of Cultured Stone® products and the structure they are being applied to incorporate good building practices.

Rigid, corrosion-resistant flashing shall be installed at all wall penetrations. Flashing type and locations shall be in accordance with the requirements of the applicable building code. On exterior applications, the incorrect installation or absence of flashing, cant strips, gutters and downspouts may result in diversion of water run-off onto finished surface areas. Masonry and other building products subjected to these conditions may develop staining, and when combined with severe freeze-thaw conditions, may eventually cause damage. The application of Cultured Stone® products under these conditions is not recommended.

CAPPING OFF THE EXPOSED TOP
OF EXTERIOR WALLS

To achieve a finished architectural look on horizontal or sloping top areas of exterior walls, piers, retaining walls or other surfaces, Cultured Stone® Capstones or a poured-in-place concrete cap must be used to provide adequate run-off protection to the wall areas. Caps should extend approximately 1"–2" beyond the finished stone surface. **Cultured Stone® corner pieces or flat pieces must not be used to cap walls.**

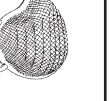
RETAINING WALLS

All retaining walls must be waterproofed at the fill side. Wall construction should incorporate proper use of granular backfill and provisions for good drainage. A continuous longitudinal drain along the back of the wall set in drain rock is recommended.

CHIMNEY CAP

All chimney chases must be capped with a one-piece cap that extends 1"–2" beyond the finished stone surface to prevent water from entering the wall system. Chimney or chase construction should incorporate proper flashing.

TOOLS REQUIRED

 Hammer/Staple Gun (Applying weather-resistant barrier and/or metal lath)		 Metal Jointing Tool/Wood Stick (Finishing joints)	
 Mason's Trowel (Applying mortar)	 Margin Trowel (Applying masonry adhesive)	 Grout Bag	
 Wheel Barrow and Hoe (Mixing mortar)		 Hock and Trowel	
 Masonry, Circular, Table Saw or Grinder with Carborundum or Diamond Blade		 Whisk Broom (Cleaning finished work)	
 Wide-mouth Nippers/Hatchet (Trimming stone)		 Dust Mask	 Safety Glasses (Use when cutting stones)



Code Acceptances, Reports and Listings

Tested or listed by Underwriters Laboratories, Inc., City of Los Angeles RR23744, HUD Materials Release No. 1316, Texas Dept. of Insurance Product Evaluation EC-21, ICBO Report ER-5749, National Evaluation Service NER-358 (showing compliance to 2000 International Building Code, 2000 International Residential Code, BOCA National Building Code/1999, 1999 Standard Building Code and 1997 Uniform Building Code) and Ontario BMEC Authorization #01-04-256.

Cultured Stone® 50-Year Limited Warranty

Cultured Stone® products are covered for a period of 50 years from the date of purchase when used on a structure which conforms to local building codes and when installed in accordance with the manufacturer’s instructions. Cultured Stone® will repair or provide, free of charge, new materials to replace any determined to be defective. This warranty is limited to the original purchaser and may not be transferred to any subsequent owner.

This warranty does not cover damage resulting from:

- Settlement of the building or other wall movement
- Contact with chemicals or paint
- Discoloration due to airborne contaminants
- Staining or oxidation

This warranty covers only manufacturing defects in Cultured Stone® manufactured stone products. Cultured Stone® is not responsible for labor costs incurred in removal and replacement of defective products. Hearthstones are not warranted for use on the ground or as a surface area subject to foot traffic.

AUTHORIZED DEALER



For additional information on Cultured Stone® brand products and services visit www.culturedstone.com or call **1-800-255-1727**.



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Maintaining Stormwater Systems

*A Guidebook for Private Owners and Operators
in Northern Virginia*



Northern Virginia Regional Commission

JANUARY 2007

The Northern Virginia Regional Commission (NVRC) is a regional council of local governments in Northern Virginia.

NVRC serves as a neutral forum where representatives of the member governments can discuss and decide how to approach problems that cross county, city, and town boundaries.

NVRC helps member governments share information about common problems; recognize opportunities to save money or to be more effective by working together; and take account of regional influences in planning and implementing public policies and services at the local level.

NVRC's programs and policies are established by a 25-member Board of Commissioners. The Board is composed of elected officials appointed by the governing bodies of NVRC's 14 member localities that include:

Counties

- Arlington
- Fairfax
- Loudoun
- Prince William

Cities

- Alexandria
- Fairfax
- Falls Church
- Manassas
- Manassas Park

Towns

- Dumfries
- Herndon
- Leesburg
- Purcellville
- Vienna



THIS GUIDEBOOK IS a resource on maintaining stormwater management facilities. However, it is not a set of rules and regulations or a manual that provides guidance on how to design or build a stormwater management facility.

For specific information regarding regulations, contact your local government agency.

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The Stormwater Story

While Webster's New Millennium Dictionary describes stormwater as "an abnormal amount of surface water due to a heavy rain or snowstorm," stormwater can be a valuable resource if properly managed.

Rainfall and snow melt keep gardens green, streams and rivers full, and wells from running dry. However, stormwater problems can occur when there is too much of a good thing, or when excessive pollution and changes in land use prevent natural infiltration and filtering processes from taking place.

Stormwater Challenges

Once rain reaches the ground, what happens next depends largely on land cover type. Rain falling in a forest is slowed, filtered, and absorbed as it makes its way into the ground or to the nearest stream, river, or reservoir. In contrast, hard, impervious surfaces such as roof tops and roads send stormwater rushing to the nearest ditch, culvert, storm drain, and stream.

This stormwater picks up pollutants, such as heavy metals, gas, oil, nutrients, and sediment, along the way. Uncontrolled stormwater erodes stream banks, causes flooding, and carries nutrients and sediment downstream. An excess of nutrients contributes to the expansion of oxygen-depleted "dead zones" in local waterways, the Potomac River, and the Chesapeake Bay.

Stormwater Solutions

To improve the quality and reduce the quantity of stormwater runoff, before it enters natural waterways, stormwater **Best Management Practices**, or **BMPs**, are prevalent throughout Northern Virginia's residential and commercial areas.

BMPs range from structural facilities, such as ponds, bioretention areas, and underground vaults to non-structural practices, such as street-sweeping and educational efforts.

Simple Things Residents Can Do

There are several simple things residents can do to ensure stormwater facilities function properly and the downstream aquatic environment is protected.

- Pick up after pets, always. Place their waste in the trash or flush it down the toilet.
- Place motor oil, paint and antifreeze in separate sturdy containers and recycle them at a local disposal facility.
Never pour them down the storm drain.
- Compost yard waste or bag it for municipal collection.
- Recycle or put litter in the trash.
- Fertilize in the fall, if at all, to reduce algal blooms.
- Call 9-1-1 if there is a visible oil spill or other liquid spill into a waterway.

The Stormwater Story

Over time, the approaches to managing stormwater have adapted to a variety of different challenges. The techniques used to control stormwater evolved from ditches and pipes that remove water quickly and reduce flooding to an intricate system of practices that retain water and improve its quality.

Short History of Stormwater “Solutions”

Pre-1900s - *Run It All in Ditches*

Everything (stormwater, kitchen waste, wastewater) drained to the nearest stream.

Early-1900s - *Run It All in Pipes*

All waste efficiently got to the stream through the same pipe. But, downstream neighbors became ill due to upstream-generated waste. It was then recognized that sewage and stormwater require different levels of water quality treatment.

From 1940s - *Run It in Separate Stormwater Pipes*

A system of catch basins and pipes was developed to get stormwater to the nearest stream.

Early-1970s - *Keep It From Stormwater Pipes*

Stormwater was detained in ponds. This approach worked in theory but not in practice, as too many detention ponds releasing water at a controlled rate at the same time caused downstream flooding and an increase in the frequency and duration of runoff events.

1970-80s - *Well, Just Don't Cause Flooding*

Stormwater Master Plans were developed. However, very few plans were actually completed as designed, and stormwater runoff was identified as a major pollution source.

Late-1980s - *Oh, and Don't Pollute Either*

Best Management Practices or ways to improve the quality of stormwater runoff were implemented. However, the lack of good data on **BMP** efficiency or comprehensive monitoring programs were problematic.

Early-1990s - *It's the Ecology*

Use of biological criteria and bioassessment protocols became a common parameter for determining the type of stormwater management practice. But there were still questions about which parameters actually contribute to solutions to runoff problems.

Late-1990s - *Water is Water is Watershed*

Planning was conducted according to where the water flows, a watershed approach. However, people didn't relate to watersheds, and the watershed approach may be too large in scale to have an impact at the site level or to be meaningful to residents, which is where political change begins.

Present - *Green and Bear It*

A range of approaches is considered to address basic issues and institutional practices associated with the way in which land is used or developed: green infrastructure, conservation development, low impact development (LID), better site design, etc. This paradigm returns to small-scale distributed approaches that will succeed if supported and enforced by local governments.

Adapted from Land and Water, May-June 2004, Andy Reese of Amec Earth and Environmental

Future - *A Vision of Comprehensive Stormwater Management*

Mimicking pre-development runoff characteristics will become increasingly important as regulations continue to encourage using watershed planning for expanded nutrient control and streambank preservation. Monitoring the effectiveness of green technologies at improving the quality and decreasing the quantity of stormwater runoff leads to improved designs and performance criteria. Stormwater is viewed as a resource as opposed to a waste product.

Key Points to Remember When Reading this Guidebook

A thorough inspection and maintenance program for any stormwater management facility will save time and money in the long term.

Identify Facility Characteristics and Maintenance Needs

Understand how the facility works and its specific maintenance needs. While this Guidebook includes general information on the maintenance needs of common stormwater management facilities, valuable information may also be gained by consulting with the local government.

Check the Maintenance Agreement

If there is a stormwater management facility maintenance agreement with the local government, consult it often to ensure that specific obligations are met.

Perform Routine Inspections

The frequency of required inspections may be found in the maintenance agreement, the technical guide provided by the manufacturer, or on the facility's design specifications. In some local jurisdictions, all inspections are conducted by staff, while maintenance is typically the responsibility of the owner.

Define Maintenance Tasks, Personnel, and Equipment

Defining maintenance tasks and who will undertake these tasks - along with establishing a regular inspection program - is the core of a successful stormwater management facility maintenance program.

Identify Costs and Allocate Resources

While routine maintenance costs can typically be predicted for an annual budget, some maintenance tasks will require infrequent but considerable expense. Non-routine expenses need to be identified, and a long-term fund allocation plan needs to be developed.

Involve the Community, if possible

Pollution treated by the stormwater management facility may be generated from surrounding yards, streets, and businesses. Implementing a pollution prevention program and educating neighbors on the purpose of the stormwater management facility is a cost-effective way to prolong its life and to protect water quality.

Establish a Record Keeping Procedure

Establishing a record keeping procedure will help to define chronic maintenance problems and aid in future budget preparation. A periodic examination of maintenance practices will assist in identifying persistent problems early.

Identify Facilities and Maintenance Needs

There are many types of stormwater management facilities, which are introduced over pages 5 through 16. Taking a moment to understand what kind of stormwater management facility you have and how it works, will help you to better plan for its maintenance needs.

If you do not recognize any of these facilities, call your local government.



Dry Pond



Wet Pond



Infiltration Trench



Sand Filter



Bioretention Facility



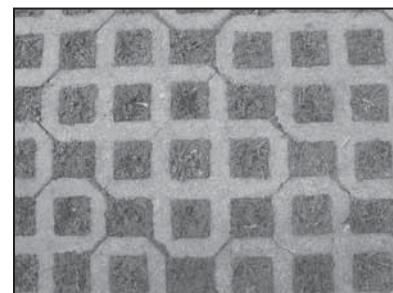
Vegetated Swale



Underground Detention



Vegetated Rooftop



Permeable Paving Material



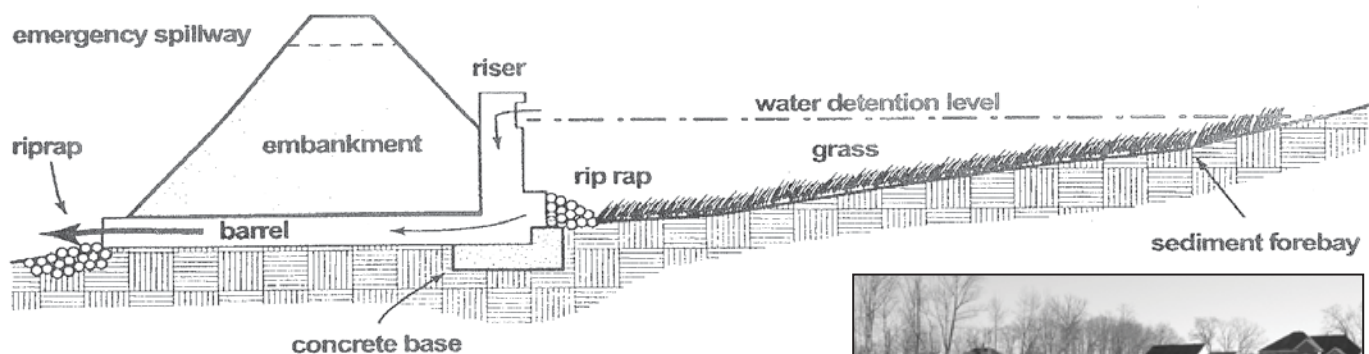
Manufactured BMP System



Non-Structural BMP

Extended Detention Basin - "Dry Pond"

Dry ponds retain water for a specified period of time (usually 48 hours) after a storm. Water is impounded temporarily to allow many of the pollutants time to settle to the bottom. The impounded water is discharged through an outlet that provides for prolonged release.



Dry ponds are the most common stormwater management facilities in Northern Virginia. Most do not contain a permanent pool of water and no water should remain if it is functioning properly.

Consult a local government representative to determine whether standing water is by design or a sign that maintenance is required.



Dry ponds are commonly found in residential and commercial areas throughout Northern Virginia.



Extended detention wetland basins, or two-stage detention ponds, incorporate a shallow marsh or wetland to increase pollutant removal.

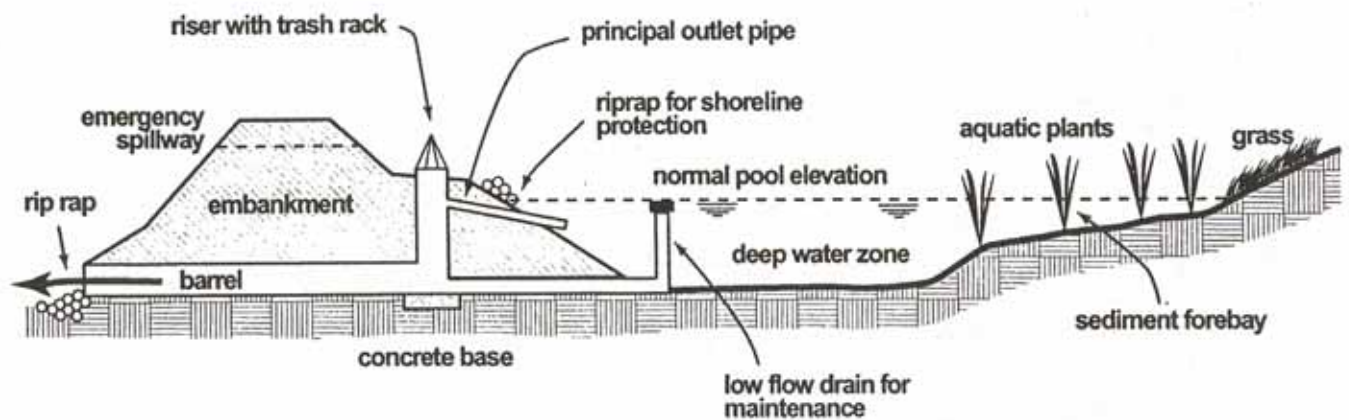
MAINTENANCE IS REQUIRED WHEN:

- Standing water is visible in inappropriate areas 72 hours after a rain event.
- Insects and/or odor become problems.
- Wetland vegetation emerges (unless the facility is specifically designed with a marsh or wetland area).
- There is visible damage to the embankment (such as sinkholes) or to the mechanical components.
- Animal burrows or trees present on embankment or near riser.
- Low flow orifice, forebay, or concrete trickle ditches blocked by trash, debris, or sediment.

Retention Basin - "Wet Pond"

Wet ponds are designed to contain a permanent pool of water much like a lake. Stormwater runoff is temporarily stored above the permanent pool and released at a controlled rate. The release is regulated by an outlet similar to that employed in a dry pond.

The advantages of a wet pond over a dry pond are higher pollutant removal and less chance that pollutants will be resuspended during a storm. However, wet ponds also pose a higher safety liability than other



MAINTENANCE IS REQUIRED WHEN:

- There are visible signs of sediment accumulation.
- Insects and/or odor become problems.
- Algae blooms occur in the summer months or the ponded areas become dominated by a single aquatic plant.
- There is visible damage to the embankment or to the mechanical components.
- There are visible seeps on the downstream dam face.
- Woody vegetation is growing on the dam.
- Beavers are present in the plunge pool.

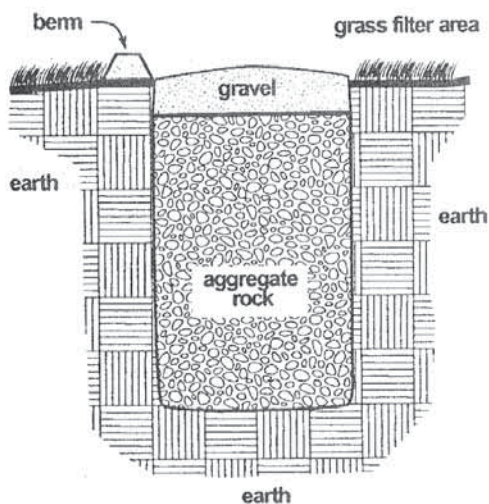
NOTE: If your wet pond is protected by perimeter fencing, periodic inspections of its integrity should be conducted.



Wet ponds and their surrounding vegetated buffers may also serve as an aesthetic or recreational amenity, as well as habitat for some wildlife.

Infiltration Trench

Infiltration trenches are gravel-filled excavations that temporarily store stormwater and allow it to sink into the underlying soil.



Infiltration trenches are classified in two ways:

In dispersed input facilities, runoff from impervious surfaces is directed over a gently sloping grass area before it reaches the facility, to remove large particles that otherwise might cause clogging.

In concentrated input facilities, runoff is transferred to the trench directly from curb inlets, gutters, and pipes.



The purpose of an infiltration trench is to retain water.

MAINTENANCE IS REQUIRED WHEN:

- Standing water is visible in the observation well 48 hours after a rain event.
- Insects and/or odor become problems.
- Wetland vegetation emerges.
- There is visible damage to the embankment (such as sinkholes) or to the mechanical components.
- Trash, leaves, and other debris are visible on the gravel surface.
- Runoff flows across, rather than into, the facility.

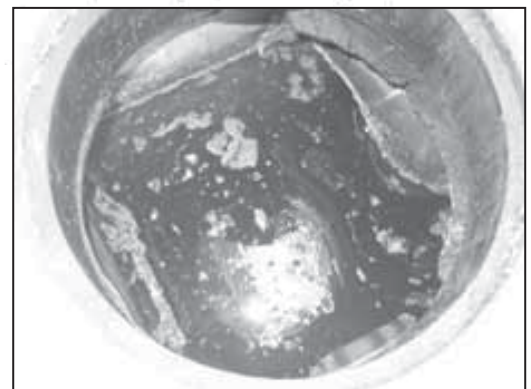
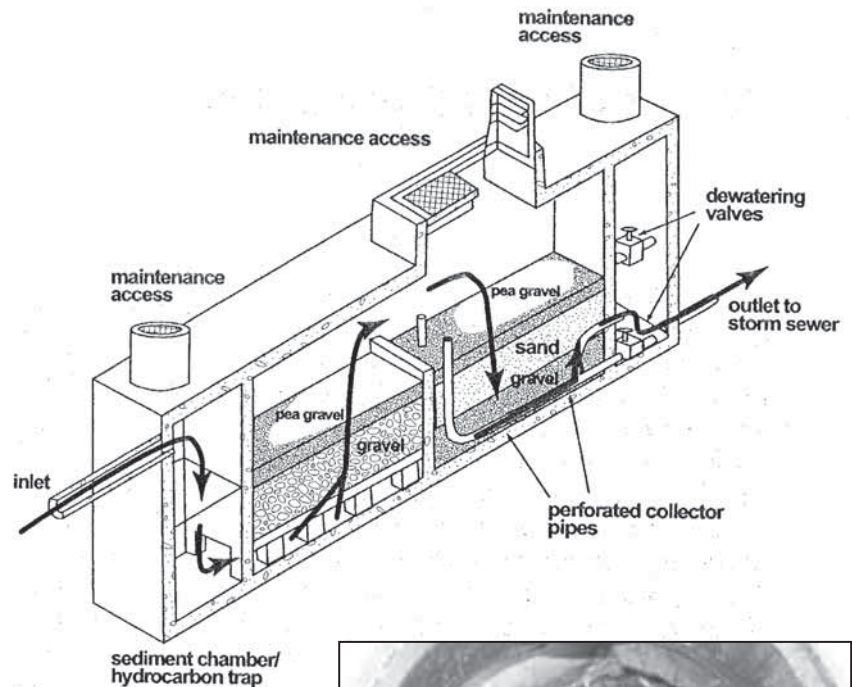
Sand Filtration System - "Sand Filter"

Sand filtration systems are used to treat runoff from highly impervious settings (commercial/office complexes and high density residential areas). To save space, sand filters are usually constructed inside a concrete shell and placed underground.

Sand filters consist of a series of chambers that remove heavy sediment, floatable debris, and oil, before slowly filtering stormwater through a layer of sand (and sometimes a sand/peat mix) where additional pollutants are removed when they become trapped between sand particles and other filter media. In some filters, microbes help remove metal and nutrient pollutants through biochemical conversion.



From the surface, some sand filters look like a series of manholes.



Sand filters are commonly used in areas where stormwater runoff has a high concentration of oil and grease.

MAINTENANCE IS REQUIRED WHEN:

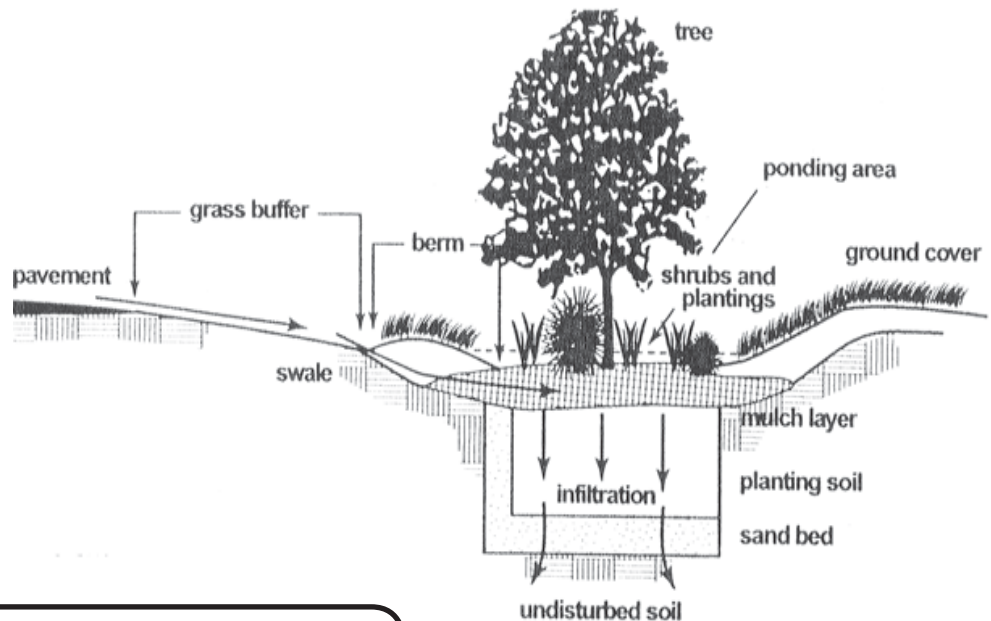
- The facility has reached its capacity for sediment accumulation, see the device's owners manual for specific amounts.
- Standing water is noticeable in the sediment and/or filter chambers.
- Excessive amounts of oil and trash are visible in the sediment chamber.
- Regular maintenance time interval has passed.

Bioretention Facility - “Rain Garden”

Bioretention facilities, or “rain gardens” are vegetated basins designed to mimic the conditions found in a mature forest floor. Configured to act as a sink and underlain with specific layers of soil, sand, and organic mulch, runoff is trapped and treated by vegetation and microbes.

The facility is planted with specific types of vegetation that can withstand both wet and dry weather extremes. Reference information for the *Plants for Bioretention Basins* list prepared by Fairfax County, may be found in the *Stormwater Resources Guide* on page 34.

In areas where the local soils do not support infiltration, a bioretention facility may be underlain with layers of sand or gravel and an underdrain that carries treated water to the storm drain network.



MAINTENANCE IS REQUIRED WHEN:

- Standing water is visible in the basin 72 hours after a rain event.
- Insects and/or odor become problems.
- Vegetation is wilting, discolored, or dying.
- Erosion is visible within the basin, on the **berms**, or on the slopes.
- Settling has occurred along the **berm**, if present.
- The overflow riser or grate is covered by debris.

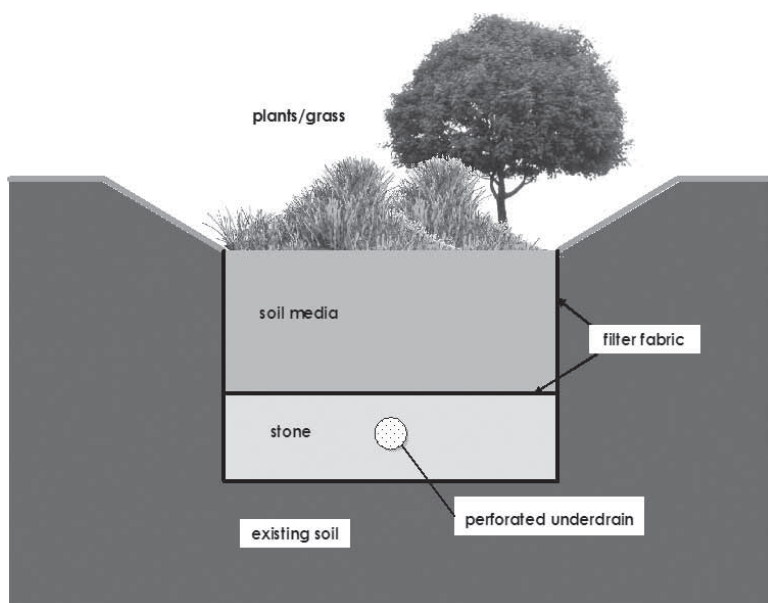


Bioretention facilities intercept stormwater runoff and use plants and soil layers to remove pollutants.

Vegetated Swale

Vegetated swales may be seen along many of Virginia's roadways, although they are not always designed to treat stormwater.

Typically, vegetated swales are concave, earthen conveyance systems designed to simply transfer runoff. Today they are constructed to serve a water quality purpose, trapping particulate matter in the vegetative groundcover and allowing stormwater to soak into the soil.



Vegetated swales serve a water quality purpose by trapping particulate matter in the vegetative groundcover.



Vegetated swales are often located along roadways, parking lots, and other impervious areas.

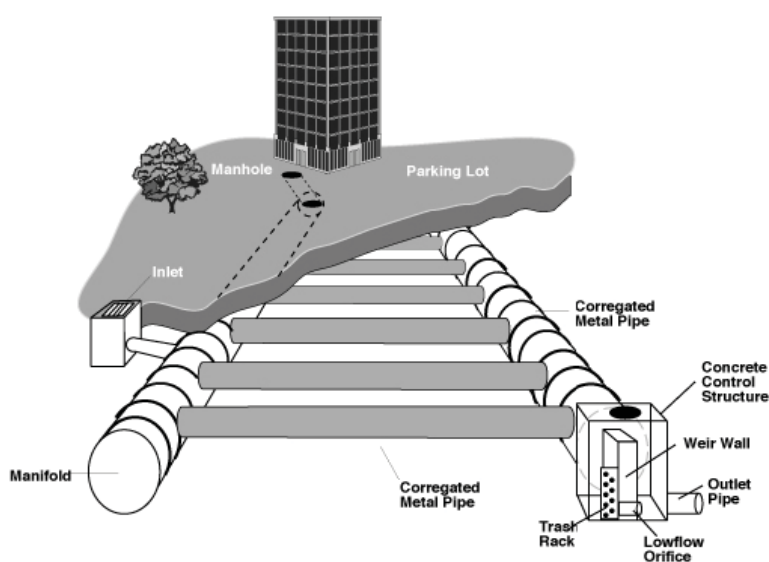
MAINTENANCE IS REQUIRED WHEN:

- Vegetation is bare in spots or appears unstable.
- Significant sediment has accumulated behind check dams*, if present.
- Erosion is visible in the bottom of the swale.
- Trash, grass clippings, leafy, and/or woody debris have accumulated.
- Standing water is visible after 48 hours.

*check dams are small **berms** built across a facility to slow water and create small areas of ponding.

Underground Detention

Underground detention consists of large underground pipes that provide storage and water quantity control through detention and/or extended detention of stormwater runoff.



Underground detention is often used in space-limited areas, such as parking lots, roadways, and paved areas in commercial, industrial, or residential developments, where adequate land for a surface **BMP** facility is not available.

Subsurface detention facilities are commonly associated with other manufactured pretreatment facilities to improve water quality before the stormwater is released into natural waters. For more information about manufactured BMPs, see page 17.

MAINTENANCE IS REQUIRED WHEN:

- Significant amounts of trash and/or sediment has accumulated in the vaults or tanks.
- There is visible damage to the inlets or outlets.



Trash and sediment can quickly accumulate in underground detention facilities, requiring frequent clean outs, by professionals.

NOTE: Since underground detention systems are enclosed subsurface structures, they are considered confined spaces and have specific safety requirements by the Occupational Safety and Health Administration (OSHA) that should be heeded when inspecting or maintaining your system.

Vegetated Rooftop - “Green Roof”

While vegetated rooftops, commonly known as “green roofs” have been used extensively in Europe for centuries, they are becoming popular stormwater management tools in urban areas throughout the United States.

Green roofs intercept stormwater and slow its flow off of rooftops. In addition to reducing the amount of stormwater runoff and improving its quality, green roofs also reduce the effect of city “heat islands” and provide micro-habitats for birds and insects.

Green roofs are classified as extensive or intensive, based on the depth of the growing medium and the types of vegetation and amenities in the design.



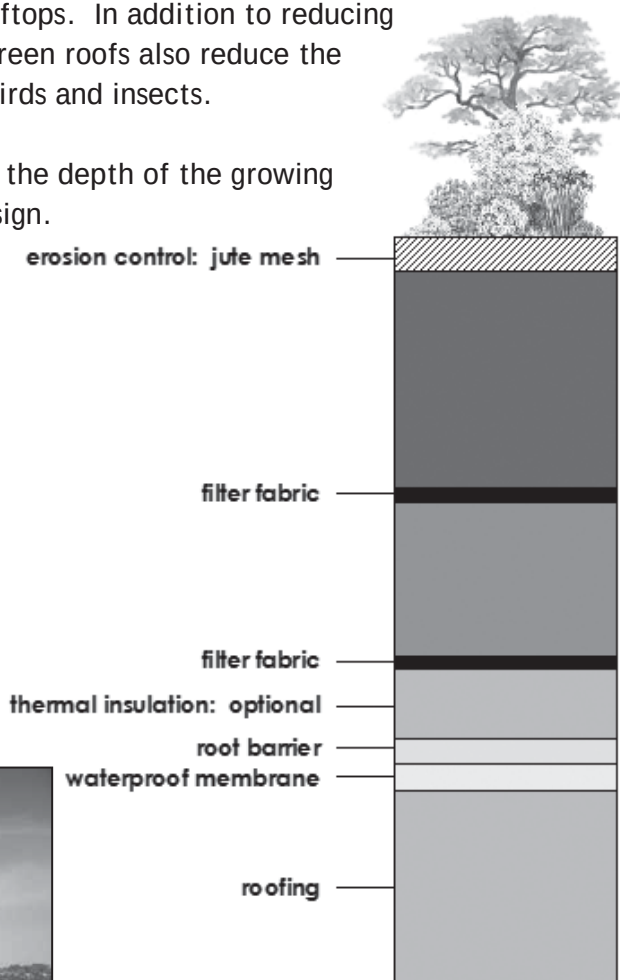
Extensive green roofs employ succulent low-growing plant species, such as sedums.

MAINTENANCE IS REQUIRED WHEN:

- Leaks occur.
- Unwanted vegetation appears
- Vegetation shows signs of stress.



Intensive green roofs, applied on sturdier roofing systems, can accommodate paths, perennial plants, and other amenities.

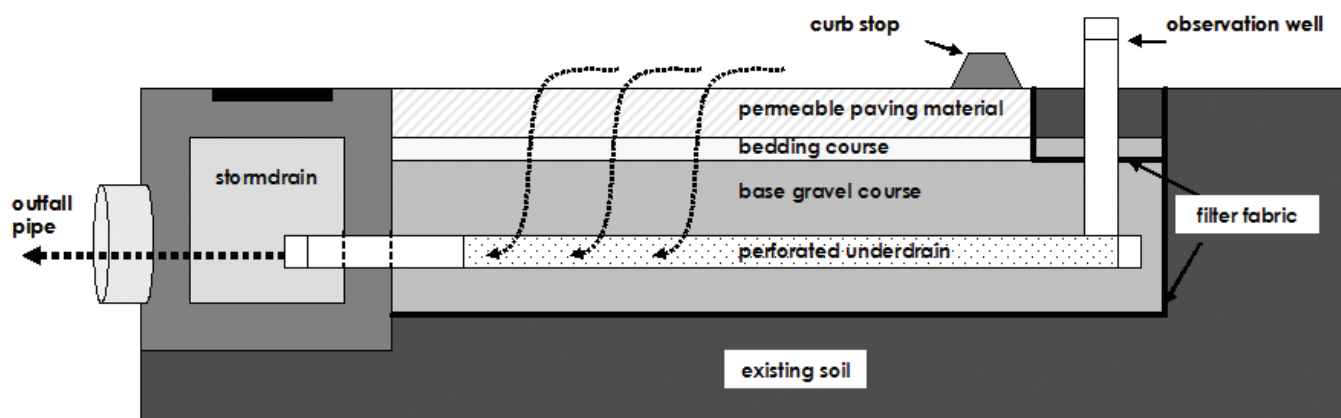


NOTE: A detailed structural analysis of the existing building is required to ensure it can adequately support the weight of a vegetated rooftop, before one can be constructed.

Permeable Paving Material

*P*ermeable paving materials consist of bricks, gravel, or other permeable materials that provide structure and stability yet allow water to infiltrate through to the ground's surface. They can be used in place of traditional asphalt in parking areas, sidewalks, and low traffic vehicular corridors.

Permeable paving materials appear in a variety of different forms. Brick pavers are commonly used in parking lots and other areas that may receive frequent use. Whereas paving systems that are cellular in nature and allow for vegetation to grow through them are commonly used in place of traditional concrete or asphalt, in low traffic areas.



MAINTENANCE IS REQUIRED WHEN:

- Puddling or ponding water is visible on the surface 48 hours after a rain event.
- Significant amounts of sediment have accumulated between the pavers.



Permeable paving materials are often used along streets, driveways, parking lots, sidewalks, paths, and other low traffic volume areas.

Manufactured BMP System

From the ground's surface, most manufactured BMPs look like inconspicuous manholes. However underneath is a single or series of vaults and chambers designed to remove common stormwater pollutants, such as sediment, oil, trash, and grit.

Manufactured BMP facilities use gravitational, hydrodynamic, absorption, biochemical, and/or filter techniques to remove pollutants.

They are regularly used in urban and ultra-urban areas for water quality enhancement, where space for large facilities, such as wet ponds, is not available. Since they are often the same size as a typical stormwater inlet, manufactured BMPs are a common retrofit option.



Manufactured BMPs are used solely for water quality enhancement in areas where space for surface BMPs is not available.

*left: Stormceptor™
right: Filterra™*



Examples of Manufactured BMP Systems:

- Aqua-Swirl™
- BaySaver™
- Downstream Defender™
- Filtrex SiltSoxx™
- Stormceptor™
- StormFilter™
- Vortechs™

MAINTENANCE IS REQUIRED WHEN:

- Sediment accumulation in the sediment chamber is over the manufacturer's recommended depth.
- Floating oil layer has reached an appreciable volume.
- Obstructions from trash or debris are visible in the inlet or outlet (vent).

NOTE: Consult the BMP's manufacturer or the operations manual.

For a comprehensive list and comparison of manufactured BMPs, visit:
www.epa.gov/region01/assistance/ceitts/stormwater/techs.html



Non-Structural Best Management Practices

Non-structural BMPs do not have a physical structure and are designed to eliminate or limit the amount of pollutants entering the stormwater system from the surrounding environment.

Non-structural BMPs involve educational efforts, management strategies, and planning alternatives and are often associated with the way land is used and managed. Limiting the frequency of fertilizer applications and reaching out to the community about how to reduce their contributions to stormwater pollution are just two examples that may be considered as non-structural BMPs.

Implementing these practices can have a long-lasting effect on the health of the local environment and can significantly reduce maintenance costs for structural BMPs.

Examples of Non-Structural BMPs

- Trash Pick-Ups
- Storm Drain Marking
- Educational or Informative Articles
- Biological Stream Monitoring
- Tree Plantings
- Street Sweeping
- Lawn and Garden Management Workshops
- Invasive Plant Removals
- Carwashing Stations



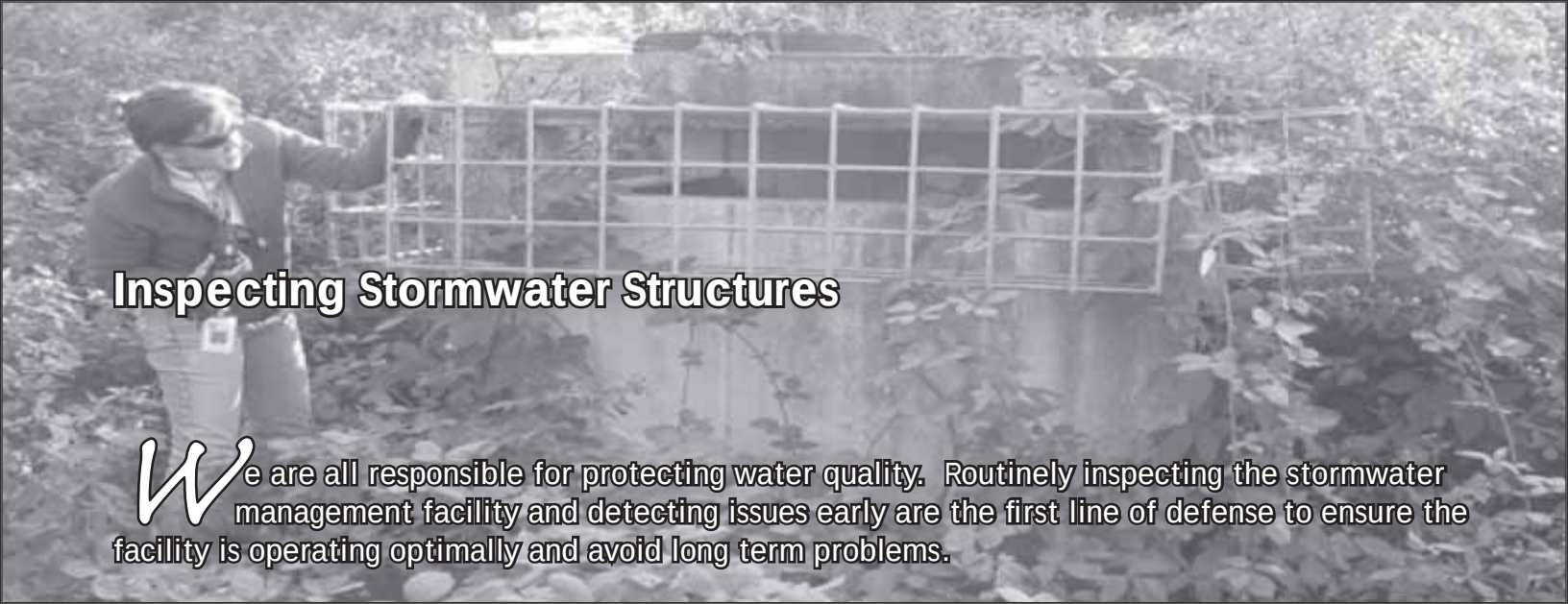
Conduct tours of gardens that are not only aesthetically pleasing, but also improve the local environment and water quality.



Erect disposal stations, with bags and a trash can, encourages the proper disposal of dog waste and reduces the amount of bacteria entering nearby waterways.



Host workshops on proper lawn care and gardening techniques to help reduce the amount of fertilizer and excess nutrients from entering the stormwater facility.

A black and white photograph of a person wearing a hard hat and safety glasses, inspecting a large, rectangular, grid-like stormwater structure. The structure is partially submerged in water and surrounded by dense vegetation.

Inspecting Stormwater Structures

We are all responsible for protecting water quality. Routinely inspecting the stormwater management facility and detecting issues early are the first line of defense to ensure the facility is operating optimally and avoid long term problems.

Who is Responsible for Inspections and Maintenance?

Many Northern Virginia local governments will maintain stormwater management facilities in residential areas under specific conditions. However, if a community or business is subject to a **BMP** maintenance agreement, that community or business is responsible for the maintenance of their **BMP**.

It is important to check the maintenance agreement to identify specific legal obligations. In the event that the maintenance agreement is unable to be located, consult a local government contact to determine who is responsible for conducting inspections and/or maintenance. Ask local government staff about the conditions of this agreement. Contacts can be found in the *Stormwater Resource Guide* on page 34.

STORM WATER DETENTION AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 19____, by and between

(hereinafter called the "Landowner") and the Board of Supervisors of Fairfax County, Virginia (hereinafter called the "County");

WITNESSETH, that

WHEREAS, the Landowner is the owner of certain real property, more particularly described as _____

as recorded by deed in the land records of Fairfax County, Virginia, in Deed Book _____ at Page _____ (hereinafter called the "Property"); and

WHEREAS, the Landowner is proceeding to build on and develop the property; and

Developing an Inspection Strategy

Depending on the specific stormwater facility, inspection requirements vary from jurisdiction to jurisdiction.

Some sand filtration systems require monthly or seasonal inspections while other **BMPs** can be inspected on an annual basis. Some localities conduct inspections of all facilities, while others require that the responsible party arrange for an inspection and send the results to the jurisdiction inspection manager for confirmation. **The local government should be contacted to determine specific requirements and for assistance in selecting a qualified inspector.**

It is unlikely that a lawn care or landscaping company has the knowledge or experience to perform a proper, comprehensive BMP inspection. A professional (engineer, landscape architect, surveyor, etc.), or someone who has had appropriate training, should be hired to perform inspections. Since there is no "**BMP** inspection" listing in the telephone book, call a local government for advice on hiring a skilled professional.

A maintenance agreement legally binds the facility owner and/or responsible party with performing maintenance on the BMP.

Sample Self Inspection Checklist

STRUCTURAL INTEGRITY

Yes No N/A

Does the facility show signs of settling, cracking, bulging, misalignment, or other structural deterioration?

Yes No N/A

Do embankments, emergency spillways, side slopes, or inlet/outlet structures show signs of excessive erosion or slumping?

Yes No N/A

Is the outlet pipe damaged or otherwise not functioning properly?

Yes No N/A

Do impoundment and inlet areas show erosion, low spots, or lack of stabilization?

Yes No N/A

Are trees or saplings present on the embankment?

Yes No N/A

Are animal burrows present?

Yes No N/A

Are contributing areas unstabilized with evidence of erosion?

Yes No N/A

Do grassed areas require mowing and/or are clippings building up?

WORKING CONDITIONS

Yes No N/A

Does the depth of sediment or other factors suggest a loss of storage volume?

Yes No N/A

Is there standing water in inappropriate areas, such as on filters or cartridges after a dry period?

Yes No N/A

Is there an accumulation of floating debris and/or trash?

OTHER INSPECTION ITEMS

Yes No N/A

Is there evidence of encroachments or improper use of impounded areas?

Yes No N/A

Are there signs of vandalism?

Yes No N/A

Do the fence, gate, lock, or other safety devices need repair?

Yes No N/A

Is there excessive algae growth, or has one type of vegetation taken over the facility?

Yes No N/A

Is there evidence of oil, grease, or other automotive fluids entering and clogging the facility?

Yes No N/A

In rain gardens, is there evidence of soil erosion, does mulch cover the entire area, are specified number and types of plants still in place, or is there evidence of disease or plant stress from inadequate or too much watering?

OTHER OBSERVATIONS

A yes answer to any of these items should result in corrective action or a call to a professional inspector.

NOTE: The intent of the checklist is to provide a general sense of the areas of concern and issues that should be considered when inspecting a stormwater facility. A local government contact may provide a more comprehensive checklist for a specific type of facility.

Planning for BMP Maintenance Costs

Routine maintenance costs can usually be predicted for an annual budget and may range from four percent of original capital construction costs per year for a dry pond to nine percent of original capital costs per year for an infiltration trench.

A general rule of thumb is that annual maintenance costs may run from \$100 per acre for minor maintenance, such as mowing, to \$500 per acre for more intensive maintenance including weed control, debris removal, etc.

Non-routine maintenance costs, however, can be substantial over the long run, especially when considering the possibility of eventual BMP replacement. To lessen the immediate financial impact of non-routine costs, it is advised that a BMP maintenance fund, with annual contributions, be established.

As an example, for dry ponds, which need to have sediment removed once every two to ten years, ten to 50 percent of anticipated dredging costs should be collected annually. In addition, the average dry pond has a life expectancy of 20 to 50 years. A separate fund that collects two to five percent a year should be established for replacement. Anticipated interest may be used to offset the effects of inflation.

Estimating and Planning for Non-routine Costs for BMPs

Costs for non-routine maintenance of BMPs are highly specific and will vary depending upon:

- the type, size, and depth of the facility;
- the volume of the sediment trapped in the BMP;
- the accessibility of the BMP; and
- whether or not on-site disposal of the sediment is possible.

Type of BMP	Sediment Removal Frequency	Facility Life Span*
Wet Pond	5 to 15 years	20 to 50 years
Dry Pond	2 to 10 years	20 to 50 years
Infiltration Trench	Monthly or as needed	10 years
Sand Filter	Every 6 months or as required	20 to 50 years
Bioretention System	5 to 10 years	10 to 25 years
Vegetated Swale	As needed	10 to 25 years
Underground Detention	Annually or as needed	10 to 30 years
Vegetated Rooftop	Every 5 years	25 years
Permeable Paving Materials	3 to 4 times per year	25 years
Manufactured BMP	Annually or as required	20 to 100 years

*Assumes the facility is maintained on a regular basis.

Planning for BMP Maintenance Costs

Wet and Dry Pond Sediment Removal

The technique used to remove sediment from a wet or dry pond is very site-specific. The information below provides an estimate of costs associated with the dredging process.

- Mobilization and Demobilization of Machinery

Associated Costs: \$1,000 to \$10,000

Large wet ponds or regional facilities will often require a waterborne operation during which an excavator or a crane must be mounted to a floating barge and moved into position. For smaller ponds, larger ponds that can be drained or dredged from the shore, and extended detention basins, a perimeter or dry operation will usually suffice. In this case, a backhoe, truck equipment, or crane may be used to scoop out the sediment. Additional costs for the construction and restoration of access roads for trucks and heavy equipment may be accrued.

- Dredging

Associated Costs: \$10 per cubic yard to \$20 per cubic yard

The cost of dredging a BMP depends on the volume of sediment removed. The cost (expressed by cubic yard) is largely influenced by the depth of the water and the distance between the excavation area and the “staging area” where sediment is transferred to trucks for removal. Another consideration is whether equipment can easily access the BMP bottom. The following equation can be used to estimate the volume of sediment in cubic yards.

Equation to Estimate the Volume of Sediment in a BMP (in cubic yards)

surface area _____ (acres) x depth of sediment _____ (feet) x 43,560 = _____ cubic feet

cubic feet _____ / 27 = _____ **cubic yards**

- Disposal

Associated Costs: \$5 per cubic yard - on-site to \$47 per cubic yard - off-site

The primary determinant of disposal costs is whether on-site disposal is an option. If on-site disposal is not available, then locating a landfill or large area to apply the spoils, such as a farm may prove challenging and transportation costs may increase considerably. Dredged materials will require special disposal if found to contain hazardous materials.

Additional costs that vary per jurisdiction, should be considered for permitting fees, grading plans, and erosion and sediment controls.

Adding the likely costs of the sediment removal components establishes a range in which an owner can expect to pay for sediment/pollutant removal. For a facility with a small surface area (0.25 acres) overall costs can range from \$4,000 to \$10,000+. For a large facility (10 acres) overall costs can range from \$170,000 to \$550,000+.

Planning for BMP Maintenance Costs

	Maintenance	Annual Associated Cost
Vegetated Facilities		
Bioretention Facility	Removal of sediments and replacement of some level of soil is required periodically. Mulch should be replaced annually, or as needed.	Between \$1,500 and \$2,000, depending upon the size and complexity of the facility.
Vegetated Rooftop	Repair leaks, as necessary. Replenish soil and plants, annually. If drought is a concern, installing an irrigation system or supplemental watering will be necessary.	Between \$500 and \$7000, depending upon the size of the facility and the amount of soil/planting area that needs to be replenished.
Vegetated Swale	Remove sediments, replace check dams (usually made of earth, riprap, or wood), reseed or sod (if grassed) or replace dead plants, every two years.	If located on a highway right-of-way, maintenance may be covered through state maintenance. Call the Virginia Department of Transportation at 703-383-VDOT to find out if the swale is on state property.
Infiltration Facilities		
Infiltration Trench	Remove the top six to 12 inches of gravel and to replace the filter cloth sediment barrier.	Between \$1,500 and \$2,000, depending on the size of the facility.
Permeable Paving Material	Vacuum sediments from surface, twice a year.	Between \$500 and \$1,000, depending on the size of the facility.
Underground Facilities		
Sand Filter	Remove the top filter cloth and remove/replace the filter gravel, when a semi-annual inspection reveals that it is necessary. Pump and refill the carbon trap every six months. Remove and replace the filter cloth and gravel every three to five years.	Between \$3,000 to \$10,000, depending on the type and size of the sand filter and the amount of impervious surface draining to it.
Underground Detention	Vacuum accumulated sediment and debris, twice a year.	Between \$1,000 and \$1,500 depending on the size and complexity of the facility.
Manufactured BMP	Vacuum accumulated sediment, oil, and debris, every six months, or as required.	\$500+, depending on the type, size, and location of the facility and the amount of sediment, oil, and debris that has accumulated.

If an oil sheen is present in the facility, it should be removed by a qualified oil recycler, which increases costs. Other expenses, such as removal of trash and hydrocarbons from water traps may also be required.

The owner should consult a local government representative to determine an appropriate funding level.



Removing sediment from stormwater facilities can be a considerable expense. Look for opportunities to reduce the amount of sediment entering the pond from the surrounding drainage area.

Maintaining Stormwater Structures

A consistent maintenance program is the best way to ensure that a stormwater structure will continue to perform its water quality functions. Actual maintenance needs will obviously vary according to the specific facility and site conditions.

Factors Affecting the Type and Frequency of Maintenance Required

Visibility of the Facility/Aesthetics

The needs and preferences of the surrounding community will determine to a large extent the amount of maintenance required for aesthetic purposes.

Landscaping

Maintenance needs will vary considerably depending upon the types of vegetation used in landscaping. Rain gardens, dry ponds, and vegetated rooftops in particular will require special attention to vegetation management.

Upstream Conditions

The condition of the surrounding watershed will significantly impact the amount of sediment and other pollutants the facility must manage. For example, erosion problems and high traffic areas upstream can dramatically increase the amount of sediment accumulation.

Safety

Since **BMPs** often involve the storage or impoundment of water, the safety of nearby residents or customers must be considered. This includes maintaining appropriate fencing and signs. Confined space training is required before entering underground facilities.

Need for Professional Judgement

BMPs are water treatment facilities. While some maintenance can be conducted by a non-professional, the advice of a professional should be consulted regularly.

Financing

The costs associated with non-routine **BMP** maintenance tasks can be considerable. A fund should be established to provide for the costs of long-term maintenance needs such as sediment removal.



Signs increase awareness of stormwater and explain the benefits of the BMP.

Maintaining Stormwater Structures

Routine maintenance will keep a **BMP** functioning properly and will pay off in the long run by preventing unnecessary repairs. Preventing pollutants from reaching the **BMP** will result in lower maintenance costs and cleaner water.

Common Routine Maintenance Needs for Most BMPs

Regular Inspections	Vegetation Management	Embankment & Outlet Stabilization	Debris & Litter Control	Mechanical Components Maintenance
Insect Control	Access Maintenance	Overall Pond Maintenance	Sediment/ Pollutant Removal	Components Replacement

Regular Inspections

Local governments require a specific schedule of inspections for a **BMP**. In many instances, an annual or semi-annual inspection, depending on the facility, is required. It will also be necessary to conduct an inspection after a large storm event during which the **BMP**'s capacity was surpassed.

Some **BMPs**, such as sand filters, may require more frequent inspections. Additional information on who needs to carry out inspections is provided under *Inspecting Stormwater Structures* on page 17.

Vegetation Management

Most **BMPs** rely on vegetation to filter sediment from stormwater before it reaches the **BMP**. Vegetation also serves to prevent erosion of the banks and stabilize the bottom of the facility. While turf grass is the most common groundcover, many **BMPs** are being retrofitted or designed with woody vegetation and wetland plants to increase pollutant removal.

- **Mowing.** Most grass is hardiest if it is maintained as an upland meadow, therefore mow no shorter than six to eight inches. Grass on embankments should be cut at least twice during the growing seasons and once during the summer.
- **Pest and Weed Control.** To reduce the amount of pollutants reaching the **BMP**, avoid overfertilization and excessive pesticide use.
- **Removing Sediment Build-Up.** Since the vegetation surrounding the **BMP** is designed to trap sediment, it is likely to become laden with sediment.

- **Stabilize Eroded Areas or Bare Spots.** Bare spots should be vigorously raked, backfilled if needed, covered with top soil, and seeded.
- **Unwanted Vegetation.** Some vegetation is destructive to a **BMP**. Keeping dams and bottom areas free of deep-rooted vegetation is critical as roots may destabilize the structure. Consistent mowing and monitoring will control any unwanted vegetation.
- **No Mow Zones.** For wet ponds, a ten foot vegetated buffer, around the perimeter of the facility (exclusive of the dam embankment) may be established to filter pollutants from adjacent properties and to help prevent shoreline erosion.

Embankment and Outlet Stabilization

A stable embankment is important to ensure that erosion does not contribute to water quality problems and that embankments are not breached - resulting in downstream flooding. Maintaining a healthy vegetative cover and preventing the growth of deep-rooted (woody) vegetation on embankment areas is an important component to stabilization.

Animal burrows will also deteriorate the structural integrity of an embankment. Muskrats and groundhogs in particular will burrow tunnels up to six inches in diameter. Efforts should be made to control excessive animal burrowing and existing burrows should be filled as soon as possible. Outlet structures are particularly prone to undercutting and erosion. Unchecked, a small problem can easily result in the need to replace the entire structure. A professional engineer should be consulted if

Maintaining Stormwater Structures

sink holes, cracking, wet areas around the outlet pipe, displacement, or rusting of the pipe are observed.

Debris and Litter Control

Regular removal of debris and litter can be expected to help in the following areas:

- reduce the chance of clogging outlet structures and trash racks;
- prevent damage to vegetated structures;
- reduce mosquito breeding habitats;
- maintain facility appearance; and,
- reduce conditions for excessive algal growth.

Special attention should be given to the removal of floating debris which can clog inlets, outlets, and low-flow orifices. If trash or dumping is particularly problematic, outreach to the local community can help (see *Involving the Whole Community*, page 27).

Mechanical Components Maintenance

Some **BMPs** have mechanical components that need periodic attention - valves, sluice gates, pumps, **anti-vortex devices**, fence gates, locks, and access hatches should be functional at all times. This type of routine maintenance is best left to a professional.

Insect Control

A healthy ecosystems actually promotes biological controls of mosquitoes. However, mosquito and other insect breeding grounds can be created by standing water. Though perceived as a significant nuisance, mosquitoes are not as big a problem as is often thought, and there are ways to address the issue.

The best technique is to ensure that stagnant pools of water do not develop. For **BMPs** that have a permanent pool of water, this means the prompt removal of floatable debris. It may also be possible in larger wet ponds to stock fish that feed on mosquito larvae. The Department of Game and Inland Fisheries can provide additional information on this management option (see *BMP Resource Guide*, page 34).

The development of a mosquito problem, particularly in dry ponds, infiltration trenches, and rain gardens, is usually an early indication that there is a maintenance problem, such as clogging. In such cases, the infiltration capacity of the **BMP** needs to be increased or sediment needs to be removed.

Access Maintenance

Most **BMPs** are designed so that heavy equipment can safely and easily reach the facility for non-routine maintenance. Routine maintenance of access areas is particularly important since one never knows when emergency access will be needed. Maintenance includes removal of woody vegetation, upkeep of gravel areas, fences, and locks.

Overall Pond Maintenance

An often overlooked aspect of maintenance, especially for wet ponds, is the need to ensure a healthy aquatic ecosystem. A healthy ecosystem should require little maintenance. An indicator of an unhealthy system is excessive algal growth or the proliferation of a single species of plant in the permanent pool of a wet pond. This may be caused by excess nutrients from fertilization practices (of a landscape company or surrounding neighbors), or by excess sediment.

Steps should be taken to reduce excess nutrients at their source and to encourage the growth of native aquatic and semi-aquatic vegetation in and around the permanent pool. The Department of Game and Inland Fisheries can provide additional information on overall pond maintenance practices (see *BMP Resource Guide*, page 34).

Maintaining Stormwater Structures

The non-routine maintenance of a **BMP**, while infrequent, can be a major undertaking and should always be performed by a professional. While tasks will vary by facility, they typically include sediment/pollutant removal and replacement of the facility's structural components.

Sediment/Pollutant Removal

Since the primary purpose of a **BMP** is to remove sediment and other pollutants (which are usually attached to sediment) from stormwater, sediment will accumulate in a **BMP** and need to be removed. Facilities vary dramatically so there are no universal "rules of thumb" to guide responsible parties in sediment removal requirements.

For instance, dry ponds should be cleared of sediment once a significant portion of the **BMP** volume (25-50 percent) has been filled. For wet ponds, a minimum water depth of approximately three feet is desirable.

Sediment and pollutants will need to be discarded. The best solution is to have an onsite area or a site adjacent to the facility (outside a floodplain) set aside for sediment. When sediment is stored near the facility, it is important to adhere to Virginia's Erosion and Sediment Control requirements for stabilization to protect the stockpile against erosion. If on-site disposal is not an option, transportation and landfill tipping fees can greatly increase sediment removal costs. Once the sediment is removed, the facility should be quickly restabilized, either through revegetation or, in the case of a sand filter, replacement of sand and other filter media.

Finally, wet sediment is more difficult and expensive to remove than dry sediment. In some cases, the entire facility can be drained and allowed to dry so that heavy equipment can remove sediment from the bottom. In other cases, it may be necessary to remove sediment from the shoreline or by hydraulic dredging from the surface. A permit may be required for removal and proper disposal of sediment. Contact your local government for assistance.

Stormwater Management Facility Component Replacement

Eventually, like most infrastructure, actual facility components will need to be replaced. Components may include:

- inflow and outflow pipes;
- trash racks and **anti-vortex devices**;
- valves, orifices, and aerators;
- concrete structures (such as the casing for a sand filter, or riser structures in ponds);
- pumps and switches;
- manhole covers and access hatches*;
- earthworks (such as embankments and side slopes); and,
- mulch and vegetation.

While most stormwater management facilities may last up to 100 years with proper maintenance, a community or business should plan long in advance for replacing these facilities.

**Many BMPs are located in parking lots. When the parking lot is repaved, ensure that the access areas are not covered.*

Who Should Carry Out Maintenance

In determining who should carry out maintenance activities, safety, cost, and effectiveness need to be balanced. Some activities can be undertaken effectively by a facility owner. Some examples of tasks that are appropriate for a facility owner may include landscaping and revegetating bare areas, education, and litter removal.

While engaging a community or business in routine maintenance is a great way to educate people about the facility's purpose, it is strongly recommended that a professional landscaping company be hired for more difficult work. Trained personnel may be able to identify problems in their early stages of development when it is most cost-effective to make repairs. Additionally, mowing and handling a wheelbarrow can be dangerous on sloping embankments. Filling eroded areas, and soil disturbing activities, such as resodding and replanting vegetation, are also tasks that a professional landscaping firm can manage.

Working with Lawn Care Companies

Communicate to a lawn care company that the stormwater management facility is a water treatment system that requires special attention. While most companies have the ability to perform special maintenance, many will not unless specifically asked.

Contact a company manager to discuss how their services can be tailored to help meet the stormwater management facility's maintenance objectives.

Tips for Working with Lawn Care Companies

COMMUNICATE that the facility is a water quality protection facility.

PROVIDE specific instructions on mowing and fertilization practices. For example, mowing at a higher level and perhaps not as frequently is preferred. Ask that heavy equipment be avoided where possible and particularly in vegetated areas.

INFORM land owners and landscape companies of the need to keep sediment from accumulating and the need to keep the facility clear of grass clippings.

REQUIRE that the company follows an integrated pest management (IPM) plan to minimize the application of pesticides and fertilizers.

An IPM plan can include the:

- use of pesticides only as needed and only on trouble spots;
- use of alternatives to pest controls or no pesticides; and/or,
- policy of not applying chemicals when rainfall is in the forecast.

If the company cannot oblige, consider switching to a lawn care company that will.

Who Should Carry Out Maintenance

Involving the Community

It is a common misconception that curbside storm drains go to a water treatment plant. In actuality, they lead to a stormwater facility or directly to a stream!

Educating and involving the community is a cost-effective way to prolong the life of the facility, prevent pollution, and make a difference in improving the local environment. Activities can range from organizing a clean-up day to developing a community-wide education program.

Numerous local organizations provide supplies, resources, and technical support to businesses and communities interested in developing a public education program or hosting an event.



A community activity, such as a cleanup or tree planting, will help increase appreciation for a facility and maintenance.

Questions to Ask When Developing a Public Education Program for a Community

What pollution problem(s) need to be addressed?

Determining the type of pollution that is causing an issue with a stormwater management facility can help with planning community activities to remediate the problem.

What activity or activities are responsible for pollution?

Locating possible sources of pollution are helpful in targeting educational messages, planning activities, and determining solutions.

Who can help implement a community education program?

Rallying the community together can make an activity much more successful. One suggestion is to involve an existing active group that is looking for opportunities to complete community service or volunteer hours.

How will the message reach the targeted community?

Publicizing the event or educational message using existing or new outlets, including websites, list serves, and newsletters, should be explored.

What alternatives to pollution generating activities should be encouraged?

Implementing solutions and providing alternatives for pollution prevention will greatly assist in reducing the amount of pollution entering a stormwater management facility and local streams.



A storm drain marking project will increase awareness that storm drains lead to streams.

Tips to Lessen Maintenance Costs

*I*f properly cared for, a stormwater management facility can work effectively for years without major maintenance costs. Neglected, it can potentially be a continual financial drain.

Businesses and homeowner associations can minimize costs and the potential liability of those responsible for the facility's maintenance by promoting and following these simple rules:

DO!!

- ☑ DO keep properties, streets, and gutters free of trash, debris, and lawn clippings.
- ☑ DO provide information to those who maintain their own automobiles on where to recycle oil and antifreeze.
- ☑ DO encourage residents to take dirty vehicles to a commercial carwash or select a location where soapy water will infiltrate into the ground and not enter a storm drain.
- ☑ DO put a pan underneath your car if it is leaking to catch the fluids until it is repaired. Spread an absorbent material, such as kitty litter, to soak up drippings and dispose of it properly.
- ☑ DO educate residents on where to properly dispose of hazardous wastes, including oil and latex paint.
- ☑ DO plan lawn care to minimize the use of chemicals and pesticides. Sweep paved surfaces of fertilizers and put the clippings back on the lawn.
- ☑ DO limit the amount of impervious surfaces. For patios, walkways, and landscaping, consider porous pavements such as bricks, interlocking blocks, or gravel.
- ☑ DO plant native trees, shrubs, and groundcovers to help the water soak into the ground. Replace turf with native plants. Select species that need little or no fertilizer or pest control and are adapted to specific site conditions.
- ☑ DO sweep up and dispose of sand and ice melting chemical residues in the winter. This will protect grass and other plants, as well as reduce the amount entering the storm drain network.

DO NOT!!

- ☒ DO NOT dump used motor oil, antifreeze or other oil and grease into storm inlets. This is a criminal offense and will greatly increase BMP maintenance costs.
- ☒ DO NOT dump grass clippings, leaves, soil, or trash of any kind into the stormwater facility or a storm inlet. Leaves and grass clippings release bacteria, oxygen consuming materials and nutrients. They will also clog the facility's components.
- ☒ DO NOT dispose of pet wastes in the storm system, including grassy areas near a facility. Animal wastes contain disease-causing bacteria and release oxygen consuming materials.
- ☒ DO NOT wash dirty vehicles on streets or driveways. Whatever comes off the car ends up in the stormwater facility or directly in streams.
- ☒ DO NOT overfertilize the lawn. Whatever washes off the lawn or impervious areas (such as driveways or sidewalks) drains into the stormwater facility and shortens its life-span.
- ☒ DO NOT leave bare areas unstabilized. Erosion from bare soil results in sediments that can quickly clog a stormwater facility.
- ☒ DO NOT dispose of left over paint or hazardous materials into the storm drain. These materials can kill vegetation and aquatic life. Dumping into the storm drain system is also a criminal offense.

SEDIMENT REMOVAL AND DISPOSAL

Impact on Facility Performance

The purpose of a stormwater treatment facility is to remove pollutants, including suspended solids, by capturing sediment. Sediment can include dirt, leaves, and litter. These materials can restrict or clog a facility. Timely removal of sediment will improve infiltration rates, water quality, and help prevent clogging and flooding.

Type of Facility This Applies To	Remove Sediment When
Vegetated Vegetated Rooftops, Bioretention Facilities, Ponds, Constructed Wetland Forebays, Swales, and Vegetated Filters	- Sediment depth is damaging or killing vegetation; or, - Sediment is preventing the facility from draining in the time designed (usually 48 - 72 hours).
Underground Manufactured Facilities, Sand Filters, Underground Detention	- At least once a year, or when - The basin is half-full of sediment, whichever comes first.
Infiltration Permeable Paving Materials (Grasscrete, permeable pavers, gravel), Infiltration Trenches	Sediment is preventing the facility from draining in the time required (usually 48 hours).

What to Do

For small facilities, sediment can be removed by hand. Large facilities and underground facilities will need to be cleaned with heavy equipment by trained professionals. For example, a vacuum truck may need to be used for confined spaces.

- Remove sediment during dry months when it is easiest to remove because it weighs less and creates fewer secondary environmental impacts, such as wet sediment running off the site.

Vegetated Facilities:

- Use rakes and shovels to dig out accumulated sediment.
- Avoid damage to existing vegetation. If sediment is deep, some plants may need to be removed to excavate sediment.
- Reseed, replant, and mulch disturbed area to prevent erosion.
- Excavate sand and gravel and clean or replace.

Underground Facilities:

- Use a vacuum truck to remove sediment from the vaults or chambers.

Infiltration Facilities:

- Infiltration Trenches:** Excavate sand or gravel and clean or replace.
- Permeable Paving Materials:** Remove accumulated sediment from the surface with a dry broom, vacuum system, or other hand tools. A vacuum truck or street sweeping equipment may also be used, with professional assistance.



A vacuum truck may be required to remove sediment from stormwater facilities located underground.

How To Reduce Sediment Accumulation in the Facility

- Minimize external sources of sediment, such as eroding soil upstream of the facility.
- Sweep surrounding paved areas on the property regularly.

VEGETATION MANAGEMENT

Importance to Facility Performance

Plants play an important role in stormwater facilities. They absorb water, improve infiltration rates of soil, prevent erosion by stabilizing soil, cool water, and capture pollutants. Plants create habitat for birds and other wildlife and provide aesthetic value to a property. Proper maintenance of vegetation improves the appearance and performance of the facility.

Type of Facility	Facility Needs Maintenance When
Vegetated Vegetated Rooftops, Bioretention Facilities, Ponds, Swales, and Vegetated Filters	• Areas of exposed, bare soil. • Vegetation is buried by sediment. • Vegetation appears unhealthy or has died. • Nuisance and invasive plants are present. • Vegetation is compromising the facility's structure by blocking inlets or outlets, or roots are intruding into the component of the facility. • Dropped leaves and other debris are contributing to sediment accumulation or are blocking inlets or outlets.

What to Do

Maintenance activities can easily be incorporated into existing site landscape maintenance contracts. Vegetation can be maintained with a formal or more natural appearance depending on your preference.

General maintenance:

- Remove dropped leaves, dead plants, grass and other plant clippings. Plant debris adds nutrient pollution as it breaks down and can clog facility piping and reduce infiltration.
- Avoid using fertilizers, herbicides, or pesticides in the facility. These products add to the pollution problems the facilities are designed to remedy.
- Use mulch to inhibit weed growth, retain moisture, and add nutrients. Replenish when needed. Ensure mulch does not inhibit water flow.
- Irrigate all new plantings as needed for the first two years.

Caring for desired vegetation:

- Plant in late-fall or early-spring so plant roots can establish during the cool, rainy seasons, before summer.
- Amend and aerate compacted soils before replanting by adding compost to increase nutrients and enhance soil texture.
- Protect young plantings from herbivory from deer and waterfowl.

Mowing:

- Grass facilities are designed for routine mowing. Mow at least twice a year.
- Grass should be mowed to keep it 4 - 9 inches tall. Grass that is at least 4 inches tall capture more pollutants and is hardier.

Nuisance and unwanted vegetation:

- Remove nuisance and invasive vegetation, such as English Ivy, before it goes to seed in the spring. Conduct additional weeding in the fall. Check the *Stormwater Resource Guide* on page 35 for a guidebook to invasive plants in the Chesapeake Bay Watershed.
- Immediately remove vegetation that is clogging or impeding flow into the facility.
- Remove potentially large and deep-rooted trees or bushes when they might impede the flow path or compromise facility structures.
- Provide erosion control on any soil exposed by vegetation removal.

EROSION, BANK FAILURE, AND CHANNEL FORMATION

Importance to Facility Performance

Stormwater flowing through a facility can cause erosion. Erosion can increase sediment build up, clog outlets, reduce water quality benefits, add to pollution, and cause facility components to fail. Eroded channels create an easy path for water to travel down reducing the ability of the facility to filter pollutants and infiltrate water.

Type of Facility	Facility Needs Maintenance When
Vegetated Vegetated Rooftops, Bioretention Facilities, Ponds, Swales, and Vegetated Filters	- The formation of flow restricting channels occurs in the bottom of the facility, around inlet pipes and curb cuts, or at overflows. - Undercutting, scouring, and slumping occur along banks and berms. - Channels and undercutting occur through check dams*. <i>*check dams are small berms built across a swale or channel to slow water and create small areas of ponding.</i>

What to Do

Any area with erosion more than two inches deep needs maintenance.

- Fill the eroded area with soil, compact it lightly, and cover with mulch, compost, seed, sod, or other erosion prevention materials.
- Plant banks with deep or heavily rooted plants to permanently stabilize soil.
- Plant the bottom of the facility with grass or grass-like plants to slow water and stabilize soil.
- Install or repair structures designed to dissipate energy and spread flow, such as splash blocks on downspouts, or riprap around inlet pipes and curb cuts.
- If erosion continues to be a problem, consult a professional to determine the cause and the solution.

POLLUTION YOU CAN SEE OR SMELL

Importance to Facility Performance

Stormwater facilities often collect a variety of trash and debris. Trash and debris, especially floating debris, can clog pipes or treatment media. It can also cause odors through decay or by collecting spilled or dumped materials. Stormwater facilities are designed to help prevent pollutants from entering rivers and streams. Any visible water quality pollutants may wash out of the facility spreading the pollution problem.

Type of Facility	Facility Needs Maintenance When
All Types of Facilities	Any unusual or unpleasant smells from sources such as: - Natural plant decay - Dying plants trapped under sediment. - A spill or a leak (e.g., gasoline or sewage). Visible pollution such as: - Sheens and discoloration - Turbid (cloudy) water - Other pollution on the surface of the water.

What to Do

Check monthly for trash and debris and look for opportunities to minimize the pollutant source.

- Regularly remove trash and plant debris.
- Remove accumulated sediment (see "Sediment Removal" in this guidebook).
- Make sure inlets and outlets are not clogged.
- Identify the source of trash, debris, or pollutant, such as a spill, leak, or illicit discharge.
- If there is evidence of a spill or leak, call 9-1-1. Use trained professionals for any cleanup or remediation.

Troubleshooting Guide

PONDING WATER

Importance to Facility Performance

Most facilities are designed to drain in a certain amount of time. This varies from two to 48 hours depending on the type of facility. Ponding water is usually a sign that the facility's filter or outlet is clogged or it is not infiltrating properly.

Type of Facility	Facility Needs Maintenance When
Vegetated Vegetated Rooftops, Bioretention Facilities, Ponds, Swales, and Vegetated Filters	• Clogging of overflows or outlets with debris, trash, or other obstructions. • Fine sediments filtering into the soil or other filtration media (like sand or gravel) that can prevent proper infiltration. • Water that has remained ponded for more than 72 hours. • Evidence of seepage at toe of slope on embankment (wet and dry ponds).
Underground Manufactured Facilities and Sand Filters	
Infiltration Permeable Paving Materials	

What to Do

Any area with erosion more than two inches deep needs maintenance.

- For surface facilities, first try raking the top few inches of soil to break up clogged sections and restore water flow.
- Clean out overflows and outlets with hand tools, if possible. Difficult or hard to access blockages may require professional contractors.
- Identify sources of sediment and debris and prevent them from entering the facility.
- Make sure the facility has adequate vegetation. Vegetation absorbs water and roots help keep soil loose so it can infiltrate water.
- Make sure there is a sufficient amount of mulch in vegetated facilities. This will also help to absorb excess water.

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Stormwater Lingo - A Glossary of Commonly Used Terms

A

Access Systems

Measures and devices that provide access to facility components by maintenance personnel and equipment.

Aeration

The process of introducing air space into soil.

Anti-Vortex Device

A device that promotes the settling of pollutants by preventing a whirlpool from occurring at the outlet device.

B

Berm

An elongated elevated ridge of material that is used to hold or direct stormwater.

Best Management Practice - BMP

A facility designed to reduce the impacts on local streams from pollutants and increased stormwater caused by development.

Bypass System

A system which allows maintenance by temporarily diverting stormwater or allowing it to flow through a facility during heavy rain events.

D

Dam/Embankment

The wall or structural fill that impounds runoff in the facility.

Dredge

The process of physically removing sediment from the bottom of a pond.

E

Emergency Outlet/Spillway

The structure that safely conveys overflows from the facility.

Emergent Plants

An aquatic plant that is rooted in sediment but whose leaves are at or above the water surface.

F

Filter Fabric/Geomembrane

A webbed fabric which serves to filter pollutants or to hold a filter medium such as gravel or sand in place.

I

Impervious Cover

Any hard surface that prevents water from infiltrating into the soil.

Integrate Pest Management Plan - IPM

A plan that minimizes the application of pesticides and fertilizers on vegetated or grassed areas.

L

Low Impact Development - LID

An integrated stormwater management design strategy to replicate pre-development hydrology. LID techniques promote storage, infiltration, and groundwater recharge.

P

Perimeter

The outward boundary of the BMP.

Principal Outlet

The structure that controls and conveys the facility's outflow.

Pump System

Electrical/mechanical components, including pipework, used to convey discharge under pressure.

R

Riprap

A layer or mound of large stones placed to prevent erosion.

Riparian

Habitat occurring along the banks of a water body.

Riser/Outlet

A vertical pipe extending from the bottom of a BMP that is used to control the rate of stormwater discharge.

S

Side Slopes

Slopes at dams, embankments, spillways, and the facility perimeter.

Swale

An elongated depression in the land used to channel runoff.

Stormwater Management - SWM

A system of structural and non-structural practices used to control the water quantity and water quality of stormwater runoff.

T

Trash Rack

Device placed upstream of the principle outlet or drain to intercept debris.

Trickle Ditch/Low Flow System

Measures that convey low and dry weather inflows to the principle outlet without detention.

V

Vegetative Cover

Vegetation used to stabilize surfaces and/or provide stormwater treatment.

Stormwater Resource Guide

Local Government Agencies - Information on facilities, maintenance agreements, and responsibilities.

Arlington County	Water, Sewers, and Streets Division	703-228-6485 www.arlingtonva.us
City of Alexandria	Transportation and Environmental Services	703-838-4334 www.alexandriava.gov
Town of Dumfries	Public Works	703-221-3400 www.dumfriesvirginia.org
Fauquier County	Community Development	540-347-8660 www.fauquiercounty.gov
Town of Leesburg	Engineering and Public Works	703-771-2790 www.leesburgva.org
Fairfax County	Maintenance and Stormwater Management Division	703-934-2800 www.fairfaxcounty.gov
City of Fairfax	Public Works, Stormwater Supervisor	703-385-7980 www.fairfaxva.gov
City of Falls Church	Public Works	703-248-5080 www.ci.falls-church.va.us
Town of Herndon	Public Works	703-435-6853 www.herndon-va.gov
Loudoun County	Building and Development	703-777-0397 www.co.loudoun.va.us
City of Manassas	Public Works	703-257-8378 www.manassascity.org
City of Manassas Park	Public Works	703-335-8820 www.cityofmanassaspark.us
Prince William County	Environmental Services	703-792-7070 www.co.prince-william.va.us
Town of Vienna	Public Works	703-255-6381 www.ci.vienna.va.us

Soil and Water Conservation Districts (SWCD) - Information on erosion and sediment control.

John Marshall SWCD	Fauquier County	540-347-3120 www.co.fauquier.va.us/government/departments/jmswcd
Loudoun SWCD	Loudoun County	703-771-8395 www.loudoun.vaswcd.org
Northern Virginia SWCD	Fairfax County	703-324-1460 www.fairfaxcounty.gov/nvswcd
Prince William SWCD	Prince William County	703-594-3621 www.pwsxcd.org

Virginia Cooperative Extension Offices - Information on vegetation and landscape management and soil testing laboratories.

Arlington County	703-228-6400 www.offices.ext.vt.edu/arlington
City of Alexandria	703-519-3325 www.offices.ext.vt.edu/alexandria
Fairfax County	703-324-8556 www.offices.ext.vt.edu/fairfax
Fauquier County	540-341-7950 www.offices.ext.vt.edu/fauquier
Loudoun County	703-777-0373 www.offices.ext.vt.edu/loudoun
Prince William County	703-594-3621 www.offices.ext.vt.edu/prince.william

Additional Contacts

Northern Virginia Regional Commission	703-642-4625 www.novaregion.org
Prince Georges County, Maryland	301-883-5935 www.goprincegeorgescounty.com
Virginia Department of Game and Inland Fisheries	804-367-1000 www.dgif.state.va.us
Virginia Department of Transportation	703-383-VDOT www.virginiadot.org

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Virginia Coastal Zone
M A N A G E M E N T P R O G R A M



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