

CRESTWYK ESTATES
STORM SEWER SYSTEM MAINTENANCE AGREEMENT

THIS STORM SEWER SYSTEM MAINTENANCE AGREEMENT is made this 21st day of May, 2020 by and between the City of Rochester Hills, a Michigan municipal corporation (the "City), whose address is 1000 Rochester Hills Drive, Rochester Hills, Michigan 48309, and Crestwyk Estates, LLC, a Michigan limited liability company ("Developer"), whose address is 14955 Technology Dr., Shelby Township, MI 48315.

RECITALS:

A. Developer is the owner of certain real property located in the City of Rochester Hills, Oakland County, Michigan, which real property is more particularly described in Exhibit A attached hereto and incorporated herein (the "Property").

B. Developer intends to develop the Property as a residential community to be known as Crestwyk Estates, a residential condominium development (hereinafter known as the "Development").

C. The Development will alter the natural flow of surface and storm water drainage.

D. Developer desires to extend to the future condominium unit owners within the Development the right to utilize and benefit from the storm water detention facilities and to provide a permanent method for the support and upkeep of said detention facilities.

E. Developer has proposed and the City has approved a storm water drainage and detention system, part of which is within the Gravel Ridge ROW, (the "Storm Sewer System") as shown in Exhibit B attached hereto and incorporated herein (the "Approved Plan") and both the Developer and the City will benefit from the proper operation, use and maintenance of the Storm Sewer System and desire to enter into this binding contract relative to the use and governance of the areas described and fully delineated in the development site plan (the "Condominium Subdivision Plan").

F. Developer also intends to bind the condominium unit owners in the Development to this Agreement so this Agreement is intended to run with the land;

NOW, THEREFORE, in consideration of the approval by the City of the Condominium Subdivision Plan and of the mutual promises contained herein, the parties hereto agree as follows:

1. **Storm Sewer System.** Pursuant to the Condominium Subdivision Plan, Developer hereby makes available and will grant to each of the condominium unit owners in the Development the right to utilize, maintain, replace and repair the Storm Sewer System, including but not limited to the detention basin areas and the storm sewer lines existing within the Development, and the portion within the Gravel Ridge ROW, and delineated in the Condominium Subdivision Plan. Components of the Storm Water System, including any and all water conveyance, detention facilities and devices, storm sewer pipe, catch basins, manholes, end-sections, ditches, swales, open water courses and rip-rap, shall be used solely for the purpose of conveying and detaining storm and surface drainage in the Development until such time as: (i) the City determines and notifies the Developer or Developer's successors and assigns, including the Association (as defined below), in writing that it is no longer necessary to convey, or detain the storm and surface drainage; and (ii) an adequate alternative for conveying and detaining storm and surface drainage has been provided which is acceptable to the City and which includes the granting of any easements to the City or third parties as may be required or necessary for the alternative drainage system.

2. **Condominium Association for Crestwyk Estates.** Control and jurisdiction over the Storm Sewer System shall be vested in the Crestwyk Estates Association (hereinafter referred to as "Association"). The Association is organized as a nonprofit corporation for a perpetual term under the laws of the State of Michigan. The Association was incorporated on October 18, 2019. Membership in the Association shall be mandatory for all of the condominium unit owners in the Development. The Association shall be responsible at its sole expense for the proper maintenance of the Storm Sewer System and for compliance with the terms of this Agreement. The Bylaws of the Association shall provide for a Board of Directors of no less than three (3) members and no more than five (5).

The Association members shall each bear their prorata share of the total costs of maintaining the Storm Sewer System (including without limitation, the real and personal property taxes assessed against it, if any, and insurance policies maintained with respect to it), which shall constitute a lien against each member's condominium unit. The prorated share of the cost shall be based on each condominium unit owner's percentage of value as set forth in the Master Deed for Crestwyk Estates. Each Association member shall be entitled to vote in accordance with the Master Deed for Crestwyk Estates.

The Association shall have the authority to make and enforce regulations pertaining to the use and maintenance of the Storm Sewer System, which regulations shall be binding upon all members of the Association.

3. Maintenance of Storm Sewer System. The Association shall be responsible for the proper maintenance, repair and replacement of the Storm Water System and all parts thereof as detailed in the Maintenance Plan attached hereto as Exhibit C (the "Maintenance Plan"). Proper maintenance of the Storm Water System shall include, but is not limited to, (i) keeping the bottom of the detention basin and at inlet pipes free from silt and debris; (ii) removing harmful algae; (iii) managing deleterious vegetative growth; (iv) maintaining the Storm Water System structures, end-sections and safety features; (v) controlling the effects of erosion; (vi) inspection of inlet and outlet pipes for structural integrity; (vii) inspection and replacement of rip-rap at inlet pipes; (viii) inspection and cleaning of storm sewer and catch basins upstream from the detention basin; (ix) inspection and replacement of stone around the outlet pipe; and (x) any other maintenance that is reasonable and necessary to facilitate and continue the proper operation of the Storm Water System. In no event shall the detention basin areas be utilized for any purpose other than detention of surface water without the prior written consent of the Association.

4. Failure to Maintain Storm Sewer System. In the event the Association fails at any time to maintain the Storm Sewer System (including without limitation the detention basins) in reasonable order and condition, the City may serve written notice upon the Association or upon its members setting forth the manner in which the Association has failed to maintain the Storm Sewer System in a reasonable condition and such notices shall include a demand that deficiencies of maintenance be cured within thirty (30) days thereof. The notice shall further state the date and place of a hearing thereon before the City Council or other such board, body or official to whom the City shall delegate such responsibility, which shall be held at least fourteen (14) days after the date of the notice. At such hearing, the City Council or other designated board, body or official may affirm or modify the list and description of maintenance deficiencies and, for good cause shown, may give an extension of the time within they shall be cured.

Thereafter, if the deficiencies set forth in the original notice, or in the modification thereof, shall not be cured within the time allowed, the City may maintain the same for a period of one (1) year. Such maintenance by the City shall not be construed as a trespass, constitute a taking of the Storm Sewer System, nor vest in the public any rights to use or enter the Storm Water System. Thereafter, if the Association does not properly maintain the Storm Water System, the City may, after providing similar written notice, schedule and hold another hearing to determine whether the City should maintain the Storm Water System for another year, and subject to a similar notice, hearing and determination in subsequent years.

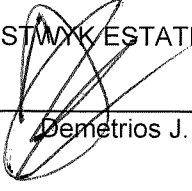
7. **Successors.** This Agreement shall constitute restrictions and covenants running with the Property. The parties hereto make this Agreement on behalf of themselves and their respective successors and assigns, and hereby warrant that they have the authority and capacity to make this contract.

8. **Recording.** This Agreement shall be recorded at the Oakland County Register of Deeds.

[Signatures and Acknowledgements on Following Page]

IN WITNESS WHEREOF, the parties have executed this agreement on the date first written above.

CRESTWYK ESTATES, LLC

By: 
Demetrios J. Polyzois

CITY OF ROCHESTER HILLS

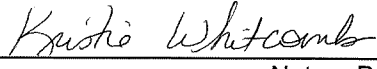
By: _____
Bryan K Barnett, Mayor

By: _____
Tina Barton, City Clerk

STATE OF MICHIGAN
COUNTY OF MACOMB

The foregoing instrument was acknowledged before me this 21st day of May, 2020, by Demetrios J. Polyzois, Managing Member of CRESTWYK ESTATES, LLC, a Michigan limited liability company, on behalf of and by authority of the company.

KRISTIE WHITCOMB
Notary Public, State of Michigan
County of Macomb
My Commission Expires 10-17-2021
Acting in the County of Macomb


_____, Notary Public
State of Michigan, County of Macomb
My commission expires: 10-17-21
Acting in the County of macomb

STATE OF MICHIGAN
COUNTY OF OAKLAND

The foregoing instrument was acknowledged before me this _____ day of _____, 2020, by Bryan Barnett, Mayor and Tina Barton, City Clerk, of the City of Rochester Hills, on behalf of and by authority of the City.

John Staraw
Approved 6/15/20

_____, Notary Public
State of Michigan, County of _____
My commission expires: _____
Acting in the County of _____

_____, Notary Public
State of Michigan, County of _____
My commission expires: _____
Acting in the County of _____

Drafted by:
Demetrios J. Polyzois
14955 Technology Dr.
Shelby Township, MI 48315

When recorded, return to:
Clerks Dept.
City of Rochester Hills
1000 Rochester Hills Drive
Rochester Hills, MI 48309

Exhibit A

1571 John R Rd, Rochester Hills, MI 48307
70-15-24-301-077

Legal:

T3N, R11E, SEC 24 FERRYVIEW HOMELANDS PART OF LOT 7 BEG AT PT
DIST N 89-41-00 W 430 FT FROM NE COR OF SD LOT 7, TH S 00-10-00 E 89
FT, TH N 89-41-00 W 300 FT, TH N 00-10-00 W 89 FT, TH S 89-41-00 E 300 FT
TO BEG 4-27-10 FR 056

1593 John R Rd, Rochester Hills, MI 48307
70-15-24-301-078

Legal:

T3N, R11E, SEC 24 FERRYVIEW HOMELANDS PART OF LOT 7 BEG AT PT
DIST N 89-41-00 W 430 FT & S 00-10-00 E 89 FT FROM NE COR OF SD LOT
7, TH S 00-10-00 E 89 FT, TH N 89-41-00 W 300 FT, TH N 00-10-00 W 89 FT,
TH S 89-41-00 E 300 FT TO BEG 4-27-10 FR 056

1615 John R Rd, Rochester Hills, MI 48307
70-15-24-301-079

Legal:

T3N, R11E, SEC 24 FERRYVIEW HOMELANDS PART OF LOT 7 BEG AT PT
DIST N 89-41-00 W 430 FT & S 00-10-00 E 178 FT FROM NE COR OF SD LOT
7, TH S 00-10-00 E 89 FT, TH N 89-41-00 W 300 FT, TH N 00-10-00 W 89 FT,
TH S 89-41-00 E 300 FT TO BEG 4-27-10 FR 056

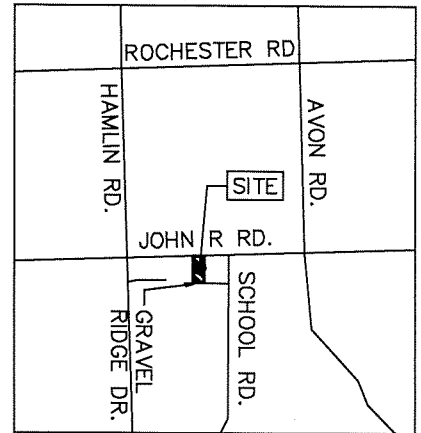
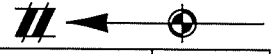
1570 Gravel Ridge Dr, Rochester Hills, MI 48307
70-15-24-301-080

Legal:

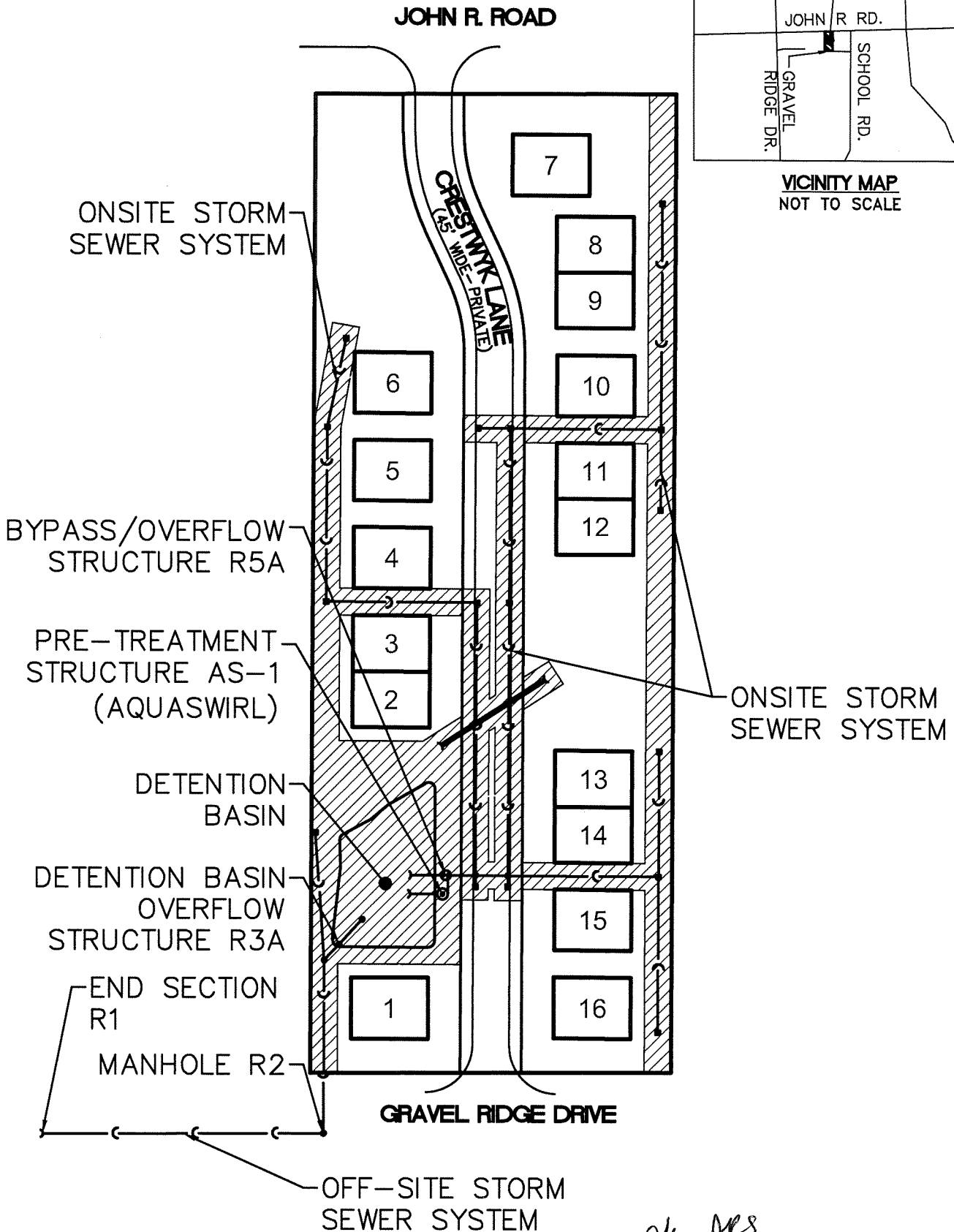
T3N, R11E, SEC 24 FERRYVIEW HOMELANDS PART OF LOT 7 BEG AT NE
COR OF SD LOT 7, TH S 00-10-00 E 267 FT, TH N 89-41-00 W 430 FT, TH N
00-10-00 W 267 FT, TH S 89-41-00 E 430 FT TO BEG 4-27-10 FR 056

Jenny M.
Approved 6/11/20

EXHIBIT B



VICINITY MAP
NOT TO SCALE



OK APS 11/6/19



CLIENT M2J1, LLC CRESTWYK ESTATES	JOB: 17000274	CH. REK	LEGEND  STORM SEWER SYSTEM
	DR. LEH	P.M. E.LORD	
EXHIBIT B: STORM SEWER	SHEET EX-B	DATE: 11-01-2019	
SECTION 24 TOWN 3 NORTH, RANGE 11 EAST CITY OF ROCHESTER HILLS OAKLAND COUNTY, MICHIGAN	 ATWELL 866.850.4200 www.atwell-group.com TWO TOWNE SQUARE, SUITE 700 SOUTHFIELD, MI 48076 248.447.2000		
SCALE: 1 INCH = 100 FEET			

EXHIBIT 'C'

OPERATIONS AND MAINTENANCE MANUAL

CRESTWYK ESTATES CONDOMINIUM
STORMWATER MAINTENANCE PLAN
ROCHESTER HILLS, MICHIGAN

PROPERTY OWNER:

M2J1, LLC
14955 TECHNOLOGY DRIVE
SHELBY TOWNSHIP, MI 48315

*JK ALS
11/8/19*

PREPARED BY:

ATWELL, LLC
12745 23 MILE ROAD, SUITE 200
SHELBY TOWNSHIP, MI 48315

OPERATION AND MAINTENANCE

MANUAL INTRODUCTION:

This manual identifies the ownership operation and maintenance responsibilities for all stormwater management systems including the detention system, underground storm sewer system, mechanical pre-treatment structure and outlet control structures as incorporated into and detailed in the approved Construction Plans as prepared by Atwell, LLC. In order to comply with the local best management practices (BMP) and requirements, this manual should serve as a minimum performance standard. This manual should be retained intact and read in its entirety by all parties responsible for the operation and maintenance of the on-site and off-site BMPs.

PROPERTY INFORMATION:

This Operation and Maintenance Manual covers the storm water systems located at the following subject property:

CRESTYWK ESTATES:

DESCRIPTION OF A 4.44 ACRE PARCEL OF LAND LOCATED IN THE WEST ½ OF THE SOUTHWEST QUARTER OF SECTION 24, T3N, R11E, CITY OF ROCHESTER HILLS, OAKLAND COUNTY, MICHIGAN. LOT 7, EXCEPT THE WEST 27 FEET AND EXCEPT THE EAST 5 FEET OF "FERRYVIEW HOMELANDS" AS RECORDED IN LIBER 27 OF PLATS, PAGE 22, OAKLAND COUNTY RECORDS.

TAX ITEM NO. 15-24-301-010

STORMWATER MAINTENANCE EXHIBIT:

Exhibit 'B' of the Storm Water Maintenance Agreement is the Storm Water System Plan which provides a clear presentation of all components of the storm water system. This system is subject to the long-term operation and maintenance responsibilities detailed in this manual. The system includes:

- On-site storm sewer pipes and off-site along Gravel Ridge Road ROW
- On-site Storm sewer structures (manholes, inlets, catch basins, etc) and both structures R-1 and R-2 within Gravel Ridge Road ROW.
- Outlet control structures
- Pre-Treatment Devices (Aquaswirl)
- Detention Basin

INSPECTIONS:

The frequency of system inspections outlined in the manual and attached exhibits should be considered the minimum, if no events warrant additional inspections. The frequency of inspections should be fine-tuned over time as system specific conditions are better known and the rate at which certain maintenance operations need to be performed is better understood. Maintenance Inspection Checklists are provided for each of the BMP's in this system. Inspections should be performed by personnel responsible for maintenance and may need to be certified for confined space entry, outlet control structures and pre-treatment devices may need to be inspected by a practicing civil engineer familiar with their operation.

Records of all routine inspections and any work performed on the system for maintenance, repair or replacement should be maintained by the owner and kept for a minimum of ten (10) years. A copy of all

records should be provided to the City of Rochester Hills Engineering Division. The records should be provided to the manual, all inspection sheets, approved construction plans and as-built documents, a maintenance log of work performed to the system(s) and contact information for the system inspector, civil engineer, landscape architect, geotechnical engineer and contractor involved with the system.

STORM WATER SYSTEMS MAINTENANCE

Regular inspections and maintenance of BMP's are necessary if these facilities are to consistently perform up to expectations. Stormwater systems are expected to perform quality and quantity control functions as long as the land use they serve exists. Failure to maintain these systems can create the following adverse impacts:

- Increased pollutants to surrounding surface water features
- Potential loss of life or property resulting from catastrophic failure of the facility
- Aesthetic or nuisance conditions, such as mosquitoes or reduced property values due to a degraded facility appearance.

Most of these impacts can be avoided through proper and timely inspection and maintenance. A major concern associated with these impacts is the general public's expectations related to the quality of life provided, in part, by construction of these systems. Inadequate maintenance means the general public may have a false sense of security. The most common cause of stormwater system failure is the lack of adequate and proper operation, inspection, maintenance and management.

Good design and construction can reduce subsequent maintenance needs and costs, but they can not eliminate the need for maintenance all together. Maintenance requires long term commitment of time, money, personnel and equipment. Monitoring the overall performance of the stormwater management system is a major aspect of any maintenance program.

The maintenance responsibilities for these systems lie with the current property owner and transfer with the property in perpetuity, understanding that upon buildout the Crestwyk Homeowners Association will assume responsibility. If maintenance of the system is not performed, the City of Rochester Hills reserves the right to enter the property and perform all necessary work at the property owners' cost. Refer to the *Agreement for Storm Water Systems Maintenance* for additional details.

GENERAL MAINTENANCE ITEMS

Grass Mowing and Maintenance

Mowing requirements within the condominium should be designed to the specific site conditions, grass types and seasonal variations in climate. Grassed areas require periodic fertilizing, de-thatching and soil conditioning to maintain healthy growth. Provisions will need to be made to reseed and reestablish grass cover in areas damaged by sediment accumulation, stormwater flow, erosion or other causes. Dead turf will need to be replaced after being discovered. Inspection of the grass areas and other landscaping features should be made annually.

Trash and Debris Removal

Removal of trash and debris from all areas of the property should be performed monthly. Removal of these items will prevent damage to vegetated areas and eliminate their potential to inhibit the operation of any of the stormwater management systems. Sediment, debris and trash that are removed

and collected should be disposed of according to local, State and Federal regulations at suitable disposal and/or recycling centers.

STORMWATER SYSTEM MAINTENANCE ITEMS:

The following narratives give an overview of the maintenance requirements of the different components of the stormwater system. The inspection checklist attached to this report offer a more complete listing of what should be inspected, when inspection should occur and the likely frequency of maintenance activities.

Storm Sewer and Structures:

Catch basins, inlets, manholes, and storm sewer pipes should be inspected for sediment accumulation and clogging, floatable debris, dead vegetation etc. The structures and sewers should also be observed during a wet weather event to ensure their proper operation. Accumulated sediment and debris should be removed on an annual basis or as needed based on observed conditions. Structural repairs or maintenance should occur as needed based on observed conditions such as cracks, spalling, joint failure, leakage, misalignment or settlement of structures. A civil engineer should be retained if problems are thought to exist.

Detention Basin Outlet Control Structure and Overflow Structure:

Both the outlet control and overflow structures and connecting pipes should be inspected for sediment accumulation, floatable debris, trash and any other foreign matter that may impede flow or restrict the devices from working properly. The stone jacket surrounding the outlet control structure should be inspected for sediment build up, and the holes at the base of the outlet control structure should be inspected to make sure they do not become blocked. The grates of the two structures should be inspected for structural integrity and build up of debris. The outlet control system should be inspected during a wet weather event to ensure all components are functioning properly. A civil engineer should be retained if problems are thought to exist.

Maintenance will include the removal of any debris, trash or sediment from the structures and/or pipe, cleaning of the stone jacket on the outlet control structure and removal of debris from the structure **grates**. The stone jacket may need replacement if cleaning does not adequately remove sediment build up.

Detention Basin

The inlet pipes to the basin should be inspected for structural integrity (pipes cracked, broken, spalled) and that the grates are free from debris. The area around and immediately downstream of the inlet pipes should be inspected for sediment build-up, erosion and the riprap should be inspected for the integrity and sedimentation. Maintenance of the inlet pipes would include removal of any sediment build-up and debris, repair or replacement of any components that are in need of attention and to restore any areas that have eroded.

The basin should be inspected for healthy grass growth, side slope erosion, and excessive sedimentation in both basins. The basin should be inspected during a wet weather event to ensure all aspects of the basin are functioning correctly. A civil engineer should be retained if problems are thought to exist or if the inspection personnel are not familiar with the operating conditions of the basin.

The planted vegetation within the basin should conform to that shown on the construction plans, and any invasive species should be removed. The vegetation should be inspected for healthy growth by a landscape architect if the inspection personnel are not familiar with the specific plantings inside the basin.

Any resident complaints regarding the basins aesthetics or operation should be investigated during inspections and wet weather operations.

Stormwater Pre-Treatment Devices:

Refer to the attached maintenance manuals from the manufacturer for all inspection and maintenance requirements for the pre-treatment structures.

The following pages include inspection checklists for the various devices and components listed above as well as the manufacturers manuals for the storm water pre-treatment structure.

EXHIBIT 'C'
STORMWATER SEWER SYSTEM

DATE/TIME OF INSPECTION: _____

INSPECTOR: _____

STORM-WATER SYSTEM MAINTENANCE AND TASK SCHEDULE – POST CONSTRUCTION

SYSTEM COMPONENTS

<u>Maintenance Activities</u>	<u>Catch Basin Inlets and Manholes</u>	<u>Storm Sewer Pipes</u>	<u>Rip Rap</u>	<u>Buffer Strip</u>	<u>Frequency</u>	<u>Comments</u>
<u>MONITORING/INSPECTIONS</u>						
Inspect for Sediment Accumulation	X	X			Annually	_____
Inspect for Floatables, dead vegetation and debris	X	X		X	Annually and after major rainfall	_____
Inspect for Erosion			X	X	Annually	_____
Inspect all components during wet weather and compare as-built plans	X	X			Annually	_____
Inspect inside of structures and pipes for cracks, spalling, joint failure, settlement, sagging and misalignment	X	X			Annually	_____
<u>PREVENTATIVE MAINTENANCE</u>						
Remove accumulated Sediment	X	X			Annually or as needed	_____
Remove floatables, dead vegetation and debris	X	X		X	Annually or as needed	_____
<u>REMEDIAL ACTIONS</u>						
Repair/stabilize areas of erosion			X	X	As needed	_____
Structural Repairs	X	X			As needed	_____
Make adjustments/repairs to ensure proper functioning	X	X	X		As needed	_____

SUMMARY:

INSPECTORS REMARKS: _____

OVERALL CONDITION OF FACILITY: _____

RECOMMENDED ACTIONS NEEDED: _____

DATES ANY MAINTENANCE MUST BE COMPLETED BY: _____

OUTLET CONTROL AND OVERFLOW STRUCTURES

DATE/TIME OF INSPECTION: _____

INSPECTOR: _____

OUTLET CONTROL AND OVERFLOW MAINTENANCE AND TASK SCHEDULE – POST CONSTRUCTION

SYSTEM COMPONENTS

<u>Maintenance Activities</u>	<u>Structures</u>	<u>Outlet Pipes</u>	<u>Rip Rap</u>	<u>Grates</u>	<u>Frequency</u>	<u>Comments</u>
<u>MONITORING/INSPECTION</u>						
Inspect for Sediment Accumulation	X	X	X		Annually	_____
Inspect for Floatables, dead vegetation and debris	X	X	X	X	Annually and after major rainfall	_____
Inspect for Erosion			X		Annually	_____
Inspect all components during wet weather and compare as-built plans	X	X	X	X	Annually	_____
Inspect inside of structures and pipes for cracks, spalling, joint failure, settlement, sagging and misalignment	X	X			Annually	_____
<u>PREVENTATIVE MAINTENANCE</u>						
Remove accumulated Sediment	X	X	X		Annually or as needed	_____
Remove floatables, dead vegetation and debris	X	X	X	X	Annually or as needed	_____
Replace or wash/clean stone filter jacket	X				As needed	_____
<u>REMEDIAL ACTIONS</u>						
Repair/stabilize areas of erosion			X		As needed	_____
Structural Repairs	X	X			As needed	_____
Make adjustments/repairs to ensure proper functioning	X	X	X	X	As needed	_____

SUMMARY:

INSPECTORS REMARKS: _____

OVERALL CONDITION OF FACILITY: _____

RECOMMENDED ACTIONS NEEDED: _____

DATES ANY MAINTENANCE MUST BE COMPLETED BY: _____

DETENTION BASIN

DATE/TIME OF INSPECTION: _____

INSPECTOR: _____

DETENTION BASIN MAINTENANCE AND TASK SCHEDULE – POST CONSTRUCTION

SYSTEM COMPONENTS

<u>Maintenance Activities</u>	<u>Rip Rap at Inlets</u>	<u>Overflow Spillway</u>	<u>Side slopes & Banks</u>	<u>Buffer Strip</u>	<u>Basins</u>	<u>Frequency</u>	<u>Comments</u>
<u>MONITORING/INSPECTION</u>							
Inspect for Sediment Accumulation	X	X			X	Annually	_____
Inspect for Floatables, dead vegetation and debris	X	X	X	X	X	Annually and after major rainfall	_____
Inspect for Erosion	X	X	X	X	X	Annually	_____
Inspect all components during wet weather and compare as-built plans	X	X			X	Annually	_____
Inspect for invasive plant species			X	X	X	Annually	_____
<u>PREVENTATIVE MAINTENANCE</u>							
Remove accumulated Sediment	X	X				Annually or as needed	_____
Remove floatables, dead vegetation and debris	X	X	X	X	X	Annually or as needed	_____
Professional application of herbicides for invasive species that may be present			X	X	X	Annually or as needed	_____
Repair Erosion and/or reseed bare areas	X	X	X	X	X	Annually or as needed	_____
<u>REMEDIAL ACTIONS</u>							
Repair/stabilize areas of erosion	X	X	X	X	X	As needed	_____
Structural Repairs	X	X				As needed	_____
Make adjustments/repairs to ensure proper functioning	X	X			X	As needed	_____
Excavate and reshape							_____

SUMMARY:

INSPECTORS REMARKS: _____

OVERALL CONDITION OF FACILITY: _____

RECOMMENDED ACTIONS NEEDED: _____

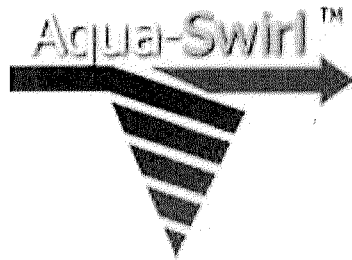
DATES ANY MAINTENANCE MUST BE COMPLETED BY: _____



Aqua-Swirl[®]

Stormwater Treatment System

Inspection and Maintenance Manual



AquaShield™, Inc.
2705 Kanasita Drive
Chattanooga, TN 37343
Toll free (888) 344-9044
Phone: (423) 870-8888
Fax: (423) 826-2112
Email: info@aquashieldinc.com
www.aquashieldinc.com

March 2013

© AquaShield™, Inc. 2013

Page 1 of 15

Table of Contents

	<u>Page(s)</u>
• AquaShield™ Stormwater Treatment Systems	3
• Aqua-Swirl® Stormwater Treatment System	4 – 9
• Inspection and Maintenance Worksheets	10 – 14
• Aqua-Swirl® Tabular Maintenance Schedule	15

AquaShield™, Inc.
2705 Kanasita Drive
Chattanooga, Tennessee 37343
Toll free (888) 344-9044
Fax (423) 870-2112
www.aquashieldinc.com



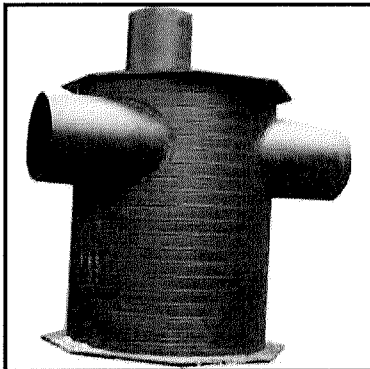
AquaShield™, Inc **Stormwater Treatment Solutions**

The highest priority of AquaShield™, Inc. (AquaShield™) is to protect waterways by providing stormwater treatment solutions to businesses across the world. These solutions have a reliable foundation based on over 20 years of water treatment experience.

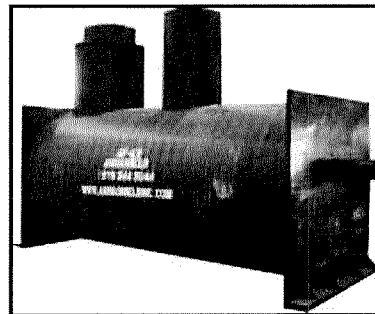
Local regulators, engineers, and contractors have praised the AquaShield™ systems for their simple design and ease of installation. All the systems are fabricated from high performance, durable and lightweight materials. Contractors prefer the quick and simple installation of our structures that saves them money.

The patented line of AquaShield™ stormwater treatment products that provide high levels of stormwater treatment include the following:

- **Aqua-Swirl® Stormwater Treatment System:** hydrodynamic separator, which provides a highly effective means for the removal of sediment, floating debris and free-oil.
- **Aqua-Filter™ Stormwater Filtration System:** treatment train stormwater filtration system capable of removing gross contaminants, fine sediments, waterborne hydrocarbons, heavy metals and total phosphorous.



**Aqua-Swirl® Stormwater
Treatment System**



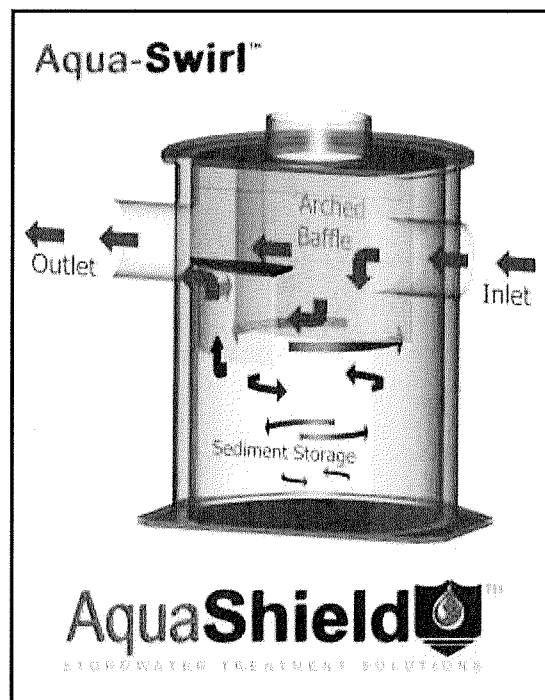
**Aqua-Filter™ Stormwater
Filtration System**



Aqua-Swirl[®] Stormwater Treatment System

The patented Aqua-Swirl[®] Stormwater Treatment System is a single chamber hydrodynamic separator which provides a highly effective means for the removal of sediment, free oil, and floating debris. Both treatment and storage are accomplished in the swirl chamber without the use of multiple or “blind” chambers. Independent laboratory and field performance verifications have shown that the Aqua-Swirl[®] achieves over 80% suspended solids removal efficiency on a net annual basis.

The Aqua-Swirl[®] is most commonly installed in an “off-line” configuration. Or, depending on local regulations, an “in-line” (on-line) conveyance flow diversion (CFD) system can be used. The CFD model allows simple installation by connecting directly to the existing storm conveyance pipe thereby providing full treatment of the “first flush,” while the peak design storm is diverted and channeled through the main conveyance pipe.



The patented Aqua-Swirl[®] Stormwater Treatment System provides a highly effective means for the removal of sediment, floating debris, and free oil. Swirl technology, or vortex separation, is a proven form of treatment utilized in the stormwater industry to accelerate gravitational separation.



Floatable debris in the Aqua-Swirl®

Each Aqua-Swirl® is constructed of high performance, lightweight and durable materials including polymer coated steel (PCS), high density polyethylene (HDPE), or fiberglass reinforced polymer (FRP). These materials eliminate the need for heavy lifting equipment during installation.



System Operation

The treatment operation begins when stormwater enters the Aqua-Swirl® through a tangential inlet pipe that produces a circular (or vortex) flow pattern that causes contaminants to settle to the base of the unit. Since stormwater flow is intermittent by nature, the Aqua-Swirl® retains water between storm events providing both dynamic and quiescent settling of solids. The dynamic settling occurs during each storm event while the quiescent settling takes place between successive storms. A combination of gravitational and hydrodynamic drag forces encourages the solids to drop out of the flow and migrate to the center of the chamber where velocities are the lowest.

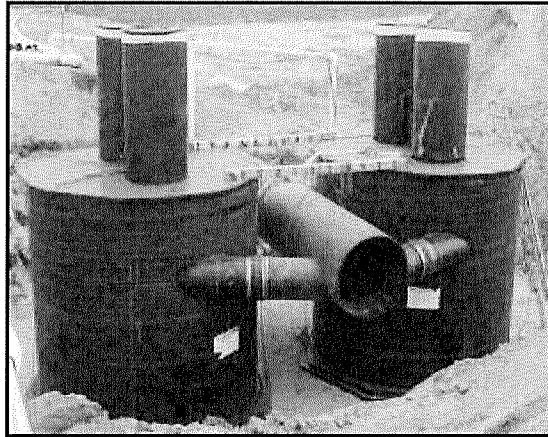
The treated flow then exits the Aqua-Swirl® behind the arched outer baffle. The top of the baffle is sealed across the treatment channel, thereby eliminating floatable pollutants from escaping the system. A vent pipe is extended up the riser to expose the backside of the baffle to atmospheric conditions, preventing a siphon from forming at the bottom of the baffle.



Custom Applications

The Aqua-Swirl® system can be modified to fit a variety of purposes in the field, and the angles for inlet and outlet lines can be modified to fit most applications. The photo below demonstrates the flexibility of Aqua-Swirl® installations using a “twin” configuration in order to double the

water quality treatment capacity. Two Aqua-Swirl[®] units were placed side by side in order to treat a high volume of water while occupying a small amount of space.



Custom designed AS-9 Twin Aqua-Swirl[®]



Retrofit Applications

The Aqua-Swirl[®] system is designed so that it can easily be used for retrofit applications. With the invert of the inlet and outlet pipe at the same elevation, the Aqua-Swirl[®] can easily be connected directly to the existing storm conveyance drainage system. Furthermore, because of the lightweight nature and small footprint of the Aqua-Swirl[®], existing infrastructure utilities (i.e., wires, poles, trees) would be unaffected by installation.



AquaShield[™] Product System Maintenance

The long term performance of any stormwater treatment structure, including manufactured or land based systems, depends on a consistent maintenance plan. Inspection and maintenance functions are simple and easy for the AquaShield[™] Stormwater Treatment Systems allowing all inspections to be performed from the surface.

It is important that a routine inspection and maintenance program be established for each unit based on: (a) the volume or load of the contaminants of concern, (b) the frequency of releases of contaminants at the facility or location, and (c) the nature of the area being drained.

In order to ensure that our systems are being maintained properly, AquaShield[™] offers a maintenance solution to all of our customers. We will arrange to have maintenance performed.



Inspection

All AquaShield™ products can be inspected from the surface, eliminating the need to enter the systems to determine when cleanout should be performed. In most cases, AquaShield™ recommends a quarterly inspection for the first year of operation to develop an appropriate schedule of maintenance. Based on experience of the system's first year in operation, we recommend that the inspection schedule be revised to reflect the site-specific conditions encountered. Typically, the inspection schedule for subsequent years is reduced to semi-annual inspection.

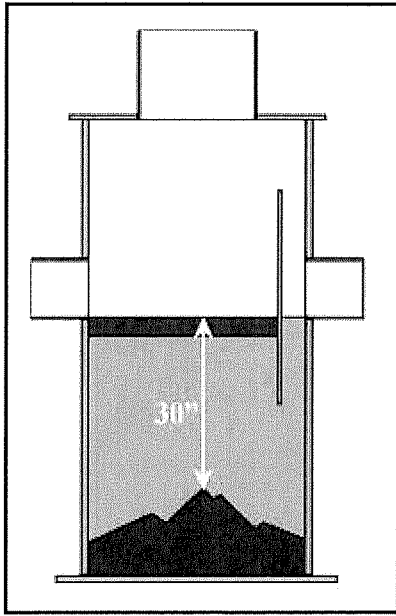


Aqua-Swirl® Maintenance

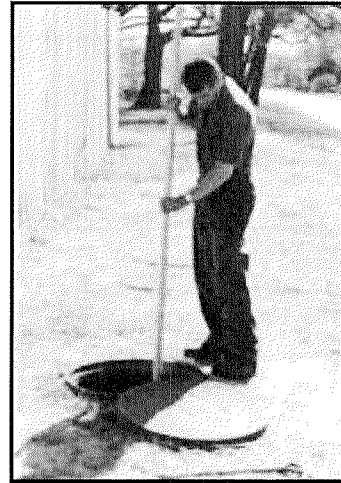
The Aqua-Swirl® has been designed to minimize and simplify the inspection and maintenance process. The single chamber system can be inspected and maintained entirely from the surface thereby eliminating the need for confined space entry. Furthermore, the entire structure (specifically, the floor) is accessible for visual inspection from the surface. There are no areas of the structure that are blocked from visual inspection or periodic cleaning. Inspection of any free-floating oil and floatable debris can be directly observed and maintained through the manhole access provided directly over the swirl chamber.

Aqua-Swirl® Inspection Procedure

To inspect the Aqua-Swirl®, a hook is needed to remove the manhole cover. AquaShield™ provides a customized manhole cover with our distinctive logo to make it easy for maintenance crews to locate the system in the field. We also provide a permanent metal information plate affixed inside the access riser which provides our contact information, the Aqua-Swirl® model size, and serial number.



Maintain system when sediment is 42-48 inches below water surface. Maximum sediment storage capacity reached when sediment is 30 inches below water surface.



Sediment inspection using a stadia rod in a single chamber

The only tools needed to inspect the Aqua-Swirl[®] system are a flashlight and a measuring device such as a stadia rod or pole. Given the easy and direct accessibility provided, floating oil and debris can be observed directly from the surface. Sediment depths can easily be determined by lowering a measuring device to the top of the sediment pile and to the surface of the water. When the sediment pile is within 42 to 48 inches of the water surface (or sediment pile thickness is 18 to 24 inches as measured from the base), the system should be maintained. The maximum sediment storage capacity of the Aqua-Swirl[®] is reached when the sediment pile is within 30 inches of the water surface (or sediment accumulation is 36 inches thick as measured from the base).

It should be noted that in order to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the *top* of the sediment pile. Keep in mind that the finer sediment at the top of the pile may offer less resistance to the measuring device than the larger particles which typically occur deeper within the sediment pile.

The Aqua-Swirl[®] design allows for the sediment to accumulate in a semi-conical fashion as illustrated above. That is, the depth to sediment as measured below the water surface may be less in the center of the swirl chamber; and likewise, may be greater at the edges of the swirl chamber.

Aqua-Swirl[®] Cleanout Procedure

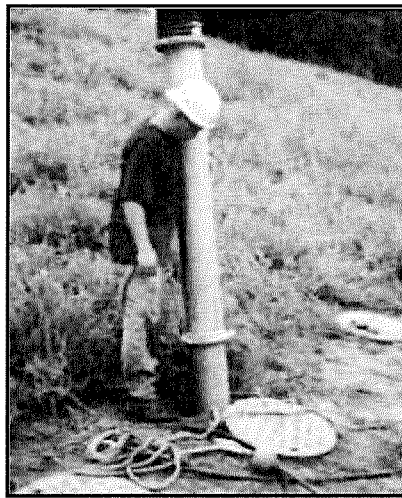
Cleaning the Aqua-Swirl[®] is simple and quick. Free-floating oil and floatable debris can be observed and removed directly through the 30-inch service access riser provided. A vacuum truck is typically used to remove the accumulated sediment and debris. An advantage of the

Aqua-Swirl[®] design is that the entire sediment storage area can be reached with a vacuum hose from the surface (reaching all the sides). Since there are no multiple or limited (hidden or “blind”) chambers in the Aqua-Swirl[®], there are no restrictions to impede on-site maintenance tasks.

Disposal of Recovered Materials

Disposal of recovered material is typically handled in the same fashion as catch basin cleanouts. AquaShield[™] recommends that all maintenance activities be performed in accordance with appropriate health and safety practices for the tasks and equipment being used.

AquaShield[™] also recommends that all materials removed from the Aqua-Swirl[®] and any external structures (e.g, bypass features) be handled and disposed in full accordance with any applicable local and state requirements.



**Vacuum truck quickly cleans the Aqua-Swirl[®]
from a single chamber**

***Aqua-Swirl[®] Inspection and Maintenance Work Sheets
on following pages***

Aqua-Swirl[®] Inspection and Maintenance Manual

Work Sheets

SITE and OWNER INFORMATION

Site Name: _____

Site Location: _____

Date: _____ Time: _____

Inspector Name: _____

Inspector Company: _____ Phone #: _____

Owner Name: _____

Owner Address: _____

Owner Phone #: _____ Emergency Phone #: _____

INSPECTIONS

I. Floatable Debris and Oil

1. Remove manhole lid to expose liquid surface of the Aqua-Swirl[®].
2. Remove floatable debris with basket or net if any present.
3. If oil is present, measure its depth. Clean liquids from system if one half (1/2) inch or more oil is present.

Note: Water in Aqua-Swirl[®] can appear black and similar to oil due to the dark body of the surrounding structure. Oil may appear darker than water in the system and is usually accompanied by oil stained debris (e.g. Styrofoam, etc.). The depth of oil can be measured with an oil/water interface probe, a stadia rod with water finding paste, a coliwasa, or collect a representative sample with a jar attached to a rod.

II. Sediment Accumulation

1. Lower measuring device (e.g. stadia rod) into swirl chamber through service access provided (Figure 1). From a reference point at the top of the service access:
2. Record distance to top of sediment pile (Figure 2): _____ inches
3. Record distance to top of water surface: _____ inches
4. Calculate distance to sediment minus distance to water: _____ inches
5. Schedule cleaning if value in Step #4 is 48 to 42 inches or less. The sediment storage capacity is exceeded when the depth to sediment is within 30 inches of the water surface and maintenance should be performed immediately.

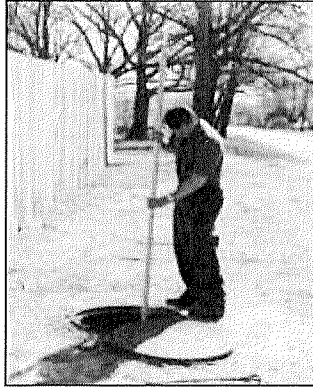


Figure 1. Measuring sediment in swirl chamber using stadia rod. Inspections are performed from the surface through the manhole access cover.

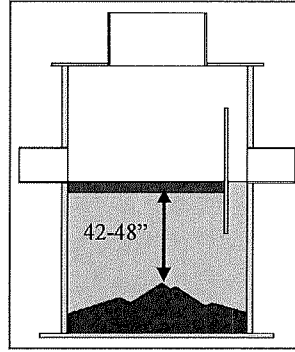


Figure 2. Maintain system when sediment is 42 to 48 inches below water surface to ensure proper system operation and performance. Maximum sediment storage capacity is reached when sediment is 30 inches below water surface.

III. Diversion Structures (External Bypass Features)

If a diversion (external bypass) configuration is present, it should be inspected as follows:

1. Inspect weir or other bypass feature for structural decay or damage. Weirs are more susceptible to damage than off-set piping and should be checked to confirm that they are not crumbling (concrete or brick) or decaying (steel).
2. Inspect diversion structure and bypass piping for signs of structural damage or blockage from debris or sediment accumulation.
3. When feasible, measure elevations on diversion weir or piping to ensure it is consistent with site plan designs.
4. Inspect downstream (convergence) structure(s) for sign of blockage or structural failure as noted above.

CLEANING

Schedule cleaning with local vector company or AquaShield™ to remove sediment, oil and other floatable pollutants. The captured material generally does not require special treatment or handling for disposal. Site-specific conditions or the presence of known contaminants may necessitate that appropriate actions be taken to clean and dispose of materials captured and retained by the Aqua-Swirl®. All cleaning activities should be performed in accordance with property health and safety procedures.

AquaShield™ always recommends that all materials removed from the Aqua-Swirl® during the maintenance process be handled and disposed in accordance with local and state environmental or other regulatory requirements.

MAINTENANCE SCHEDULE

I. During Construction

Inspect the Aqua-Swirl[®] every three (3) months and clean the system as needed. The Aqua-Swirl[®] should be inspected and cleaned at the end of construction regardless of whether it has reached its maintenance trigger (42 to 48 inches below water surface), sediment storage capacity (30 inches below water surface).

II. First Year Post-Construction

Inspect the Aqua-Swirl[®] every three (3) months and clean the system as needed.

Inspect and clean the system once annually regardless of whether it has reached its sediment or floatable pollutant storage capacity.

III. Second and Subsequent Years Post-Construction

If the Aqua-Swirl[®] did not reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Swirl[®] reached full sediment or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months and cleaned as needed. The Aqua-Swirl[®] should be cleaned annually regardless of whether it reaches its sediment or floatable pollutant capacity.

IV. Bypass Structures

Bypass structures should be inspected whenever the Aqua-Swirl[®] is inspected. Maintenance should be performed on bypass structures as needed.

MAINTENANCE COMPANY INFORMATION

Company Name: _____

Street Address: _____

City: _____ State/Prov.: _____ Zip/Postal Code: _____

Contact: _____ Title: _____

Office Phone: _____ Cell Phone: _____

ACTIVITY LOG

Date of Cleaning: _____ (Next inspection should be 3 months from this data for first year).

Time of Cleaning: Start: _____ End: _____

Date of Next Inspection: _____

Floatable debris present: Yes No

Notes: _____

Oil present: Yes No Oil depth (inches): _____

Measurement method and notes: _____

STRUCTURAL CONDITIONS and OBSERVATIONS

Structural damage: Yes No Where: _____

Structural wear: Yes No Where: _____

Odors present: Yes No Describe: _____

Clogging: Yes No Describe: _____

Other Observations: _____

NOTES

Additional Comments and/or Actions To Be Taken	Time Frame

ATTACHMENTS

- Attach site plan showing Aqua-Swirl® location.
- Attach detail drawing showing Aqua-Swirl® dimensions and model number.
- If a diversion configuration is used, attach details showing basic design and elevations (where feasible).

Aqua-Swirl®

TABULAR MAINTENANCE SCHEDULE

Date Construction Started: _____

Date Construction Ended: _____

During Construction

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* The Aqua-Swirl® should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity. In addition, the system should be cleaned at the **end of construction** regardless of whether it has reach full pollutant storage capacity.

First Year Post-Construction

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* The Aqua-Swirl® should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity.

Second and Subsequent Years Post-Construction

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Inspect and Clean as needed												X*
Inspect Bypass, maintain as needed												X*
Clean System*												X*

* If the Aqua-Swirl® did **not** reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Swirl® **reached** full sediment or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months or more frequently if past history warrants, and cleaned as needed. The Aqua-Swirl® should be cleaned annually regardless of whether it reaches its full sediment or floatable pollutant capacity.