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Utah Department of Transportation  
Right of Way, Fourth Floor  
Box 148420  
Salt Lake City, UT 84114-8240

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Rashelle Hobbs, Recorder, Salt Lake County, Utah  
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RIGHT OF WAY, FOURTH FLOOR BOX 148420 SALT LAKE CITY, UT 841148240

## UTAH DEPARTMENT OF TRANSPORTATION DRAINAGE AGREEMENT

Salt Lake County

Tax ID No. 22-23-426-001

This Drainage Agreement made and entered into this 7 day of March  
2022 between Utah Department of Transportation ("Department") and  
AJ Rock, LLC ("Permittee"), who owns the property described in Exhibit A.

### RECITALS

The Permittee (property owner) desires to construct a drainage system and a drainage connection within the Department Right of Way subject to the requirements and conditions described in the Permit.

Department's Policy 08A-06 requires the Permittee to sign the Drainage Agreement as part of the permitting process for a drainage connection.

The parties agree as follows:

(1) **COMPLIANCE:** Permittee must comply with the conditions in the permit and applicable state and federal statutes, regulations and rules. The Department may perform inspection of Permittee's drainage system to monitor compliance with the Permit and with state and federal statutes, regulations, and rules. Permittee grants the Department access to the Permittee's property for inspection or to perform any repairs to prevent damage to the Department's Right of Way. The Department's inspection does not relieve the Permittee of its responsibilities in meeting the Permit conditions. The Permittee is responsible for the Department's inspection costs. Permittee's responsibilities include:

- a) Permittee is responsible for repairing and restoring any portion of the Department Right of Way and drainage systems located therein that may be damaged as a result of making the drainage connection or as the result of any subsequent drainage originating from the Permittee's property.
- b) Permittee must not increase its drainage discharge into the Department's drainage system without the written permission of the Department.
- c) A bonded contractor must apply for the required permit to install drainage systems in the Department Right of Way prior to the commencement of any such work.
- d) The Permittee is responsible to obtain environmental clearances, permits, or other approvals from any other local, state or federal agency that may have regulatory jurisdiction or oversight.

(2) **MAINTENANCE**: Permittee's drainage system must at all times be maintained, repaired, constructed, and operated by and at the expense of the Permittee. The drainage system will be serviced without access from any interstate highway or ramp. The Department may notify the Permittee of any maintenance requirements if the Permittee fails to maintain the drainage system. The Department reserves the right, without relieving the Permittee of its obligations, to reconstruct or make repairs to the drainage system, as it may consider necessary, and the Permittee must reimburse the Department for its cost if the Permittee fails to comply with the Department's written notification and complete the required maintenance.

(3) **FUTURE IMPACTS**: The Department has the right to change its drainage system for any future transportation project. If the Department's drainage system is reconstructed or modified, the Department reserves the right to hold the Permittee responsible for the cost to reconnect to the Department's drainage system. The Department is not responsible for any costs the Permittee incurs due to the drainage system being reconstructed or modified.

(4) **LIABILITY**: Pursuant to R930-7-6(2)(b), the Permittee is required to guarantee satisfactory performance under this Permit. The Department may proceed against Permittee to recover all expenses incurred by the Department, its employees, or contractors in repairing the sections of roadway damaged by the Permittee or its drainage system, including the failure to restore the Right of Way to Department standards. The Permittee will be liable for all costs the Department incurs under this agreement.

The Permittee will indemnify, defend, and hold harmless the Department, its employees, and the State of Utah from responsibility for any damage or liability arising from Permittee's construction, maintenance, repair, or any other related operation of the drainage system pursuant to the Permit issued under this agreement.

The Permittee will not hold the Department liable for damages resulting from any back-up or flow into the Permittee's drainage system or property. The Permittee accepts all risks associated with the connection to the Department's drainage system. The Permittee is responsible for all liability resulting from the discharge of pollutants into the Department's drainage system from its property or drainage system.

**(5) CANCELLATION OF PERMIT:** Any failure on the part of Permittee to comply with the terms and conditions set forth in the Permit or this Agreement may result in cancellation of the Permit. Failure of the Permittee to pay any sum of money for costs incurred by the Department in association with inspection, reconstruction, repair, or maintenance of the drainage system may also result in cancellation of the Permit. Non-compliance with either the Permit or Agreement may result in the Department removing the drainage system and restoring the highway and Right of Way at the sole expense of the Permittee. The Department will notify the Permittee in writing prior to any cancellation, setting forth the violations, and will provide the Permittee a reasonable time to correct the violations to the satisfaction of the Department. The Department may order the Permittee to remove its drainage system if the violations are not corrected.

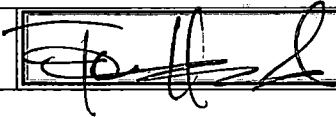
**(6) SUCCESSORS AND ASSIGNS:** All covenants, obligations and agreements will be binding upon the parties, their successors and assigns and run with the land as described in Exhibit A until the drainage connection is removed from the Department's Right of Way.

**(7) MISCELLANEOUS:**

- a) Each party agrees to undertake and perform all further acts that are reasonably necessary to carry out the intent and purpose of the Agreement at the request of the other party.
- b) This Agreement does not create any type of agency relationship, joint venture, or partnership between the Department and Permittee.
- c) The failure of either party to insist upon strict compliance of any of the terms and conditions, or failure or delay by either party to exercise any rights or remedies provided in this Agreement, or by law, will not release either party from any obligations arising under this Agreement.

- d) This Agreement shall be deemed to be made under and shall be governed by the laws of the State of Utah in all respects. Each person signing this Agreement warrants that the person has full legal capacity, power and authority to execute this Agreement for and on behalf of the respective party and to bind such party.
  
- e) If any portion of this Agreement is held to be invalid or unenforceable for any reason by a court of competent jurisdiction, such invalidity or unenforceability shall not affect any other provision, and this Agreement shall be construed as if such invalid or unenforceable provision had never been included.

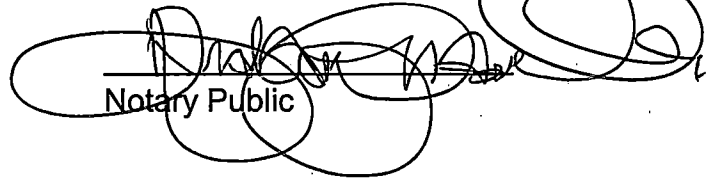
IN WITNESS WHEREOF, the parties hereto have executed this Agreement the day and year first above written.

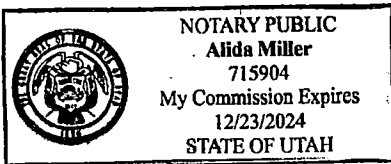
CURRENT PROPERTY OWNER/PERMITTEE		
Name Printed:	Tom Hendrix	Signature: 

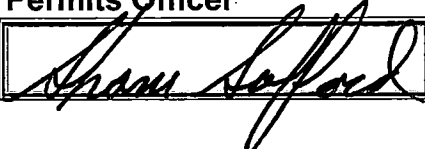
State of Utah)  
County of Salt Lake

On this 18<sup>th</sup> day of April, in the year 2022, the owner of the property personally appeared before me as the signer of this agreement, who duly acknowledged to me that he/she executed this agreement pursuant to the authority delegated to him/her as the current property owner of said property. Witness my hand and official seal.

(NOTARY SEAL)

  
Notary Public

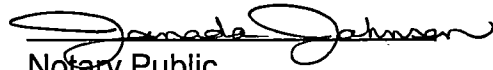


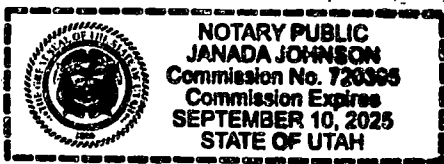
UTAH DEPARTMENT OF TRANSPORTATION – Region Permits Officer		
Name Printed:	Shane Safford	Signature: 

State of Utah)  
County of Salt Lake

On this 1<sup>st</sup> day of April, in the year 2022, the owner of the property personally appeared before me as the signer of this agreement, who duly acknowledged to me that he/she executed this agreement pursuant to the authority delegated to him/her as the current property owner of said property. Witness my hand and official seal.

(NOTARY SEAL)

  
Notary Public



**EXHIBIT A (Legal Description of Permittee's Property)**

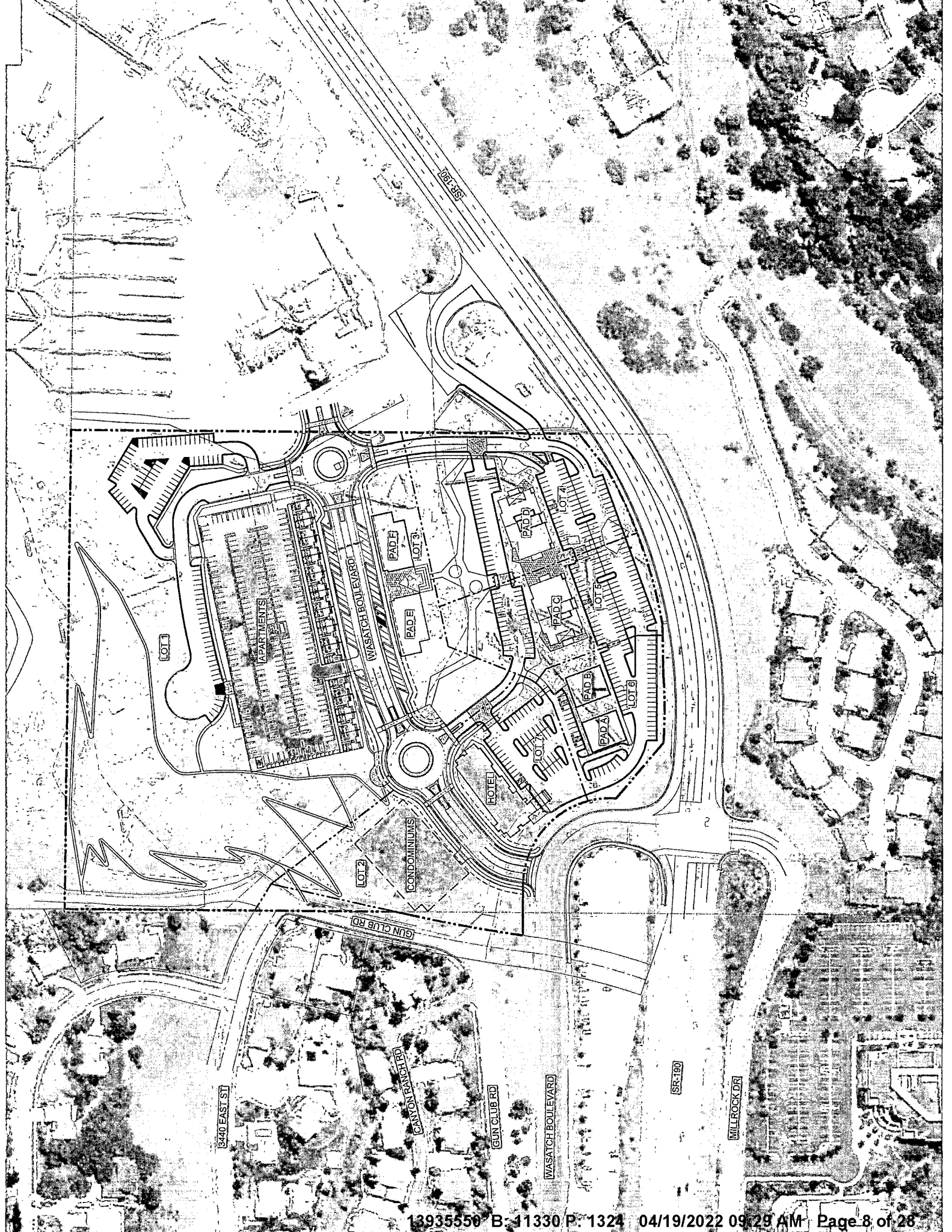
WASATCH ROCK LEGAL DESCRIPTION

BEGINNING AT THE EAST QUARTER CORNER OF SECTION 23, TOWNSHIP 2 SOUTH, RANGE 1 EAST, SALT LAKE BASE AND MERIDIAN AND RUNNING THENCE SOUTH 00°46'20" WEST 900.00; THENCE NORTH 89°32'44" WEST 964.02 FEET; THENCE NORTH 38°09'16" WEST 90.25 FEET TO A POINT ON A NON-TANGENT 915.00 FOOT CURVE TO THE RIGHT; THENCE NORTHWESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 19°06'20" A DISTANCE OF 305.11 FEET (CHORD BEARS NORTH 19°45'45" WEST 303.70 FEET); THENCE NORTH 01°09'41" WEST 93.83 FEET TO A POINT ON A NON-TANGENT 905.00 FOOT CURVE TO THE RIGHT; THENCE NORTHWESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 08°14'24" A DISTANCE OF 130.15 FEET (CHORD BEARS NORTH 00°12'48" WEST 130.04 FEET); THENCE NORTH 40°52'29" EAST 137.43 FEET TO A POINT ON A NON-TANGENT 166.00 FOOT CURVE TO THE LEFT; THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 93°35'45" A DISTANCE OF 271.17 FEET (CHORD BEARS NORTH 47°06'26" EAST 242.01 FEET); NORTH 00°18'34" EAST 49.85 FEET; THENCE NORTH 00°01'04" EAST 42.55 FEET TO A POINT ON A NON-TANGENT 2718.45 FOOT CURVE TO THE RIGHT; THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 04°40'37" A DISTANCE OF 221.90 FEET (CHORD BEARS SOUTH 79°50'18" EAST 221.84 FEET); SOUTH 77°30'00" EAST 24.59 FEET; THENCE SOUTH 89°32'57" EAST 627.09 FEET TO THE POINT OF BEGINNING.

CONTAINS: 944,842 SQUARE FEET OR 21.691 ACRES

**EXHIBIT B**

(include drainage plan showing state route, mile post and location of all drainage systems and drainage calculations)





# DRAINAGE REPORT

for

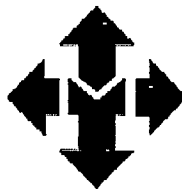
## WASATCH ROCK

6695 Wasatch Blvd  
Cottonwood Heights, UT

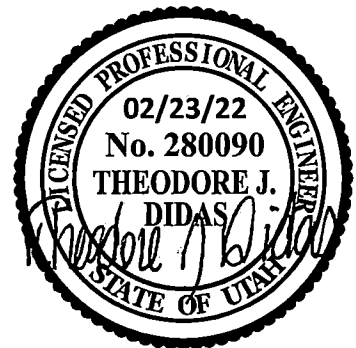
Prepared For:

ROCKWORTH COMPANIES  
4655 S 2300 E, Suite 205  
Holladay, UT 84117

Prepared By:



McNeil Engineering  
8610 South Sandy Parkway  
Sandy, UT 84070  
Phone: (801) 255-7700  
Fax: (801) 255-8071



Contact: Ted Didas, P.E.

February 23, 2022

**PROJECT LOCATION**

- Project address: 6695 Wasatch Blvd, Cottonwood Heights, UT

**RAINFALL DATA**

100-Year Storm Event from NOAA Atlas 14, Cottonwood Weir (42-1759) – see Appendix

**DRAINAGE BASIN DESCRIPTION**

The existing site consists of a retired gravel pit. The property generally drains west towards SR190.

The long-term project includes the development of a mixed-use village including multi-family housing and commercial uses. The project also includes development of proposed public roadway and roundabouts for Upper Wasatch Blvd as well as private site improvements (parking, walks, landscape, etc). While this storm drain report is for Phase 1, the proposed storm drain detention analysis contemplates the full build-out of the project. The storm drain infrastructure with Phase 1 will include the proposed subsurface StormTech Chamber detention system along with the outfall discharge to the public storm drain along SR190.

Proposed Drainage Area (Full Build-Out):

Hardscape:	256,806 SF
Roof:	178,875 SF
<u>Landscape:</u>	<u>509,035 SF</u>
TOTAL AREA:	944,716 SF = 21.69 Ac.

Proposed Drainage Area – Phase 1 Only:

Hardscape:	155,897 SF
Roof:	103,422 SF
<u>Landscape:</u>	<u>685,397 SF</u>
TOTAL AREA:	944,716 SF = 21.69 Ac.

The proposed future phases are estimated to eliminate 176,362 SF Landscape and add 100,909 SF Hardscape + 75,453 SF Roof

**CITY DRAINAGE REQUIREMENTS**

Cottonwood Heights City requires storm drain detention to accommodate the 100-year storm event with a peak release rate of 0.10 CFS/Acre (the site is within the sensitive lands area).

**STORM DRAIN DETENTION CALCULATIONS**

Storm drain detention calculations were completed for 100-year storm event. These calculations are attached in the Appendix of this report.

100-Year Detention Storage Volume Required: 76,590 CF

### **STORM DRAIN DETENTION SUMMARY**

This Phase 1 project includes a storm drain collection system including inlet boxes and piping system to collect and route storm water runoff to the proposed storm drain detention system. The collection system collects runoff from the proposed development as well as the proposed public road. The proposed detention system consists of StormTech chambers installed under the parking area along the west edge of the project site (adjacent to SR190).

Detention Storage Provided: 76,604 CF (see Appendix for summary)

The project will discharge to a storm drain box in the east side of SR190. The peak discharge from the project site will be restricted by an orifice plate with 5.80" diameter opening. The peak discharge rate = 2.17 CFS

### **STORM WATER QUALITY – BMP'S IMPLEMENTED**

The project includes a large multi-family apartment project. While many apartment projects include large surface parking areas that are open to sediment and debris and possible contaminants from vehicles that would typically route to the storm drain system. This project utilizes a covered parking garage in lieu of surface parking. The benefit of this application is that the storm water tracked into the parking garage is routed through an oil/water separator to the sanitary sewer system. The storm water runoff from the roof tops and amenity decks has considerably less exposure to contaminants.

The storm drain boxes within the piping system all include sumps in the bottom of the boxes. These sumps provide for storage of sediment and silt most common in the smaller storm events.

As discussed, this project also includes the use of StormTech Chambers for storm drain detention storage. However, Cottonwood Heights City is concerned infiltration from this site may migrate west under SR190 and create problems on the downstream slope, and so the project will incorporate an impervious liner to prevent infiltration. The primary purpose of the chambers is to provide the detention storage volume. And while the project will not incorporate infiltration, the chambers also provide storm water treatment. As shown in the Appendix of this report, the use of the isolator rows in the StormTech Chamber system has the following removal efficiency:

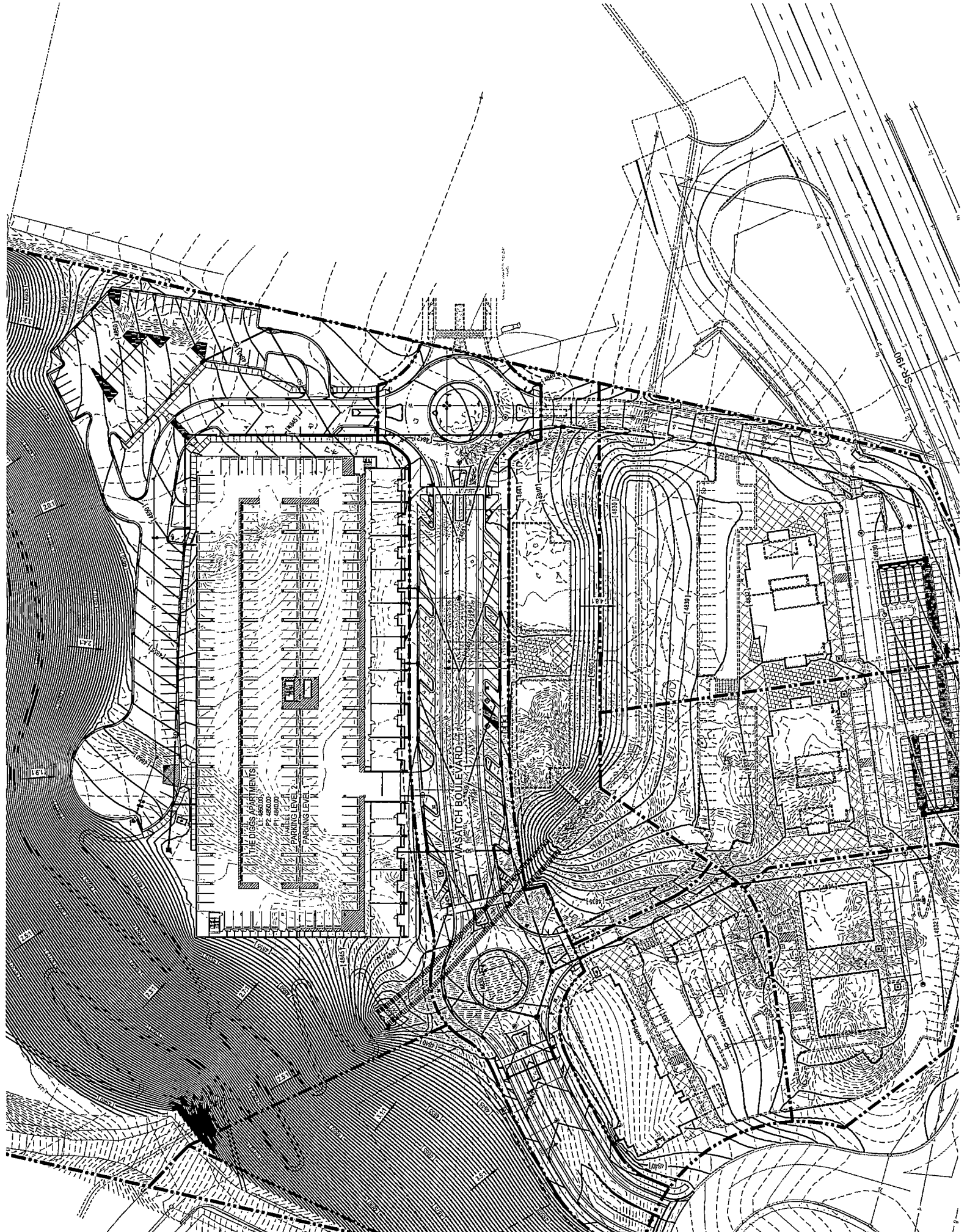
Total Suspended Solids (TSS) = 80%  
Phosphorous = 49%  
Total Petroleum Hydrocarbons= 90%  
Zinc=53%

The project includes an oil/water separator to treat storm water for the 10-year storm event. Since the subsurface detention system has a liner (preventing infiltration) the oil/water separator is located on the downstream side of the StormTech Chamber systems. The project includes an Aqua-Swirl Concentrator. The Aqua-Swirl Concentrator unit that has met the certification for New Jersey CAT program – copy of the approved list is included in the Appendix of this report.

10-Year Storm Peak Flow Rate – since the oil/water separator is downstream of the orifice plate the peak flow will be less than 2.17 CFS.

This project will utilize the AS-4 model which can treat up to 3.2 CFS with effective removal for 80% of TSS. Additional information on this product is attached in the Appendix of this report.

APPENDIX A  
SITE DRAINAGE EXHIBIT



THE DIGGS APARTMENTS  
 PT. 182000  
 PT. 182000  
 PARKING LEVEL 1  
 PARKING LEVEL 2

WASATCH BOULEVARD  
 (EAST SIDE)

100' S.P. 100'

APPENDIX B

RAINFALL DATA FROM NOAA ATLAS 14

COTTONWOOD WEIR

Station ID: 42-1759

Location name: Salt Lake City, Utah, USA\*

Latitude: 40.6189°, Longitude: -111.7833°

Elevation:

Elevation (station metadata): 4960 ft\*\*

\* source: ESRI Maps

\*\* source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps & aeriels](#)

PF tabular

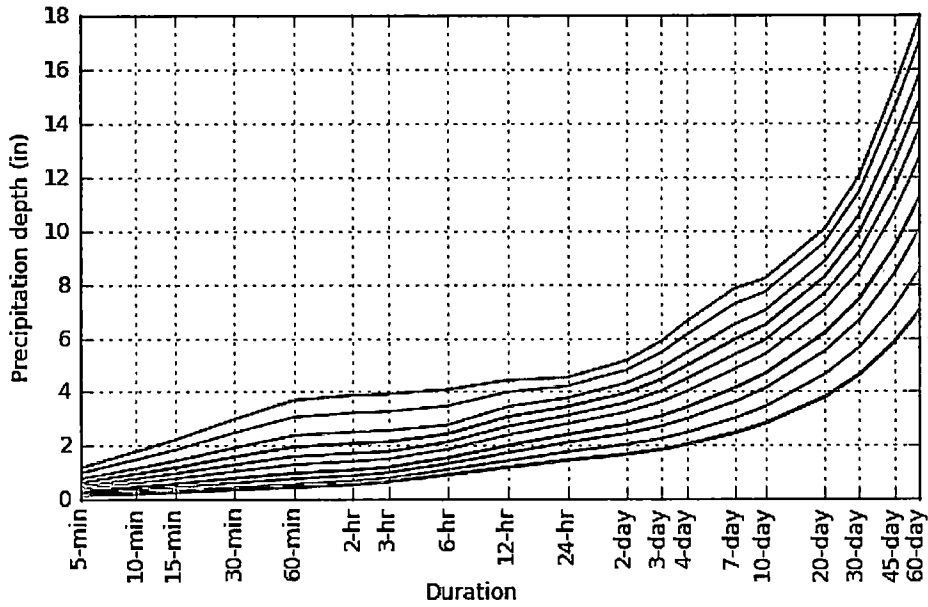
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.146 (0.129-0.168)	0.184 (0.163-0.211)	0.250 (0.221-0.288)	0.313 (0.272-0.363)	0.413 (0.350-0.485)	0.509 (0.416-0.603)	<del>0.619</del> (0.490-0.747)	0.752 (0.568-0.927)	0.969 (0.688-1.23)	1.17 (0.790-1.53)
10-min	0.223 (0.197-0.256)	0.279 (0.248-0.322)	0.380 (0.335-0.438)	0.477 (0.415-0.552)	0.628 (0.533-0.738)	0.774 (0.634-0.919)	<del>0.943</del> (0.745-1.14)	1.14 (0.865-1.41)	1.48 (1.05-1.88)	1.78 (1.20-2.33)
15-min	0.276 (0.244-0.316)	0.346 (0.307-0.398)	0.471 (0.416-0.543)	0.591 (0.514-0.685)	0.778 (0.660-0.915)	0.959 (0.786-1.14)	<del>1.17</del> (0.924-1.41)	1.42 (1.07-1.75)	1.83 (1.30-2.32)	2.21 (1.49-2.89)
30-min	0.371 (0.329-0.426)	0.466 (0.414-0.537)	0.634 (0.560-0.731)	0.796 (0.692-0.922)	1.05 (0.889-1.23)	1.29 (1.06-1.53)	<del>1.57</del> (1.24-1.90)	1.91 (1.44-2.36)	2.46 (1.75-3.13)	2.98 (2.01-3.89)
60-min	0.459 (0.407-0.527)	0.577 (0.512-0.664)	0.785 (0.693-0.905)	0.985 (0.857-1.14)	1.30 (1.10-1.53)	1.60 (1.31-1.90)	<del>1.95</del> (1.54-2.35)	2.36 (1.79-2.92)	3.05 (2.16-3.87)	3.68 (2.48-4.81)
2-hr	0.561 (0.516-0.626)	0.703 (0.641-0.777)	0.903 (0.821-1.00)	1.10 (0.988-1.23)	1.42 (1.24-1.61)	1.72 (1.45-1.96)	<del>2.07</del> (1.69-2.43)	2.49 (1.94-3.00)	3.20 (2.35-3.99)	3.86 (2.69-4.94)
3-hr	0.665 (0.613-0.732)	0.813 (0.751-0.887)	1.01 (0.932-1.11)	1.20 (1.09-1.32)	1.50 (1.34-1.68)	1.77 (1.54-2.00)	<del>2.13</del> (1.78-2.45)	2.54 (2.06-3.03)	3.25 (2.50-4.03)	3.91 (2.88-4.99)
6-hr	0.918 (0.857-0.990)	1.12 (1.04-1.21)	1.34 (1.25-1.46)	1.55 (1.43-1.69)	1.86 (1.70-2.05)	2.13 (1.90-2.36)	<del>2.42</del> (2.11-2.73)	2.75 (2.35-3.16)	3.46 (2.85-4.07)	4.08 (3.27-5.04)
12-hr	1.19 (1.10-1.30)	1.45 (1.34-1.59)	1.74 (1.60-1.92)	2.00 (1.83-2.21)	2.38 (2.14-2.66)	2.70 (2.39-3.05)	<del>3.05</del> (2.65-3.49)	3.42 (2.91-3.98)	3.97 (3.27-4.75)	4.42 (3.55-5.40)
24-hr	1.45 (1.36-1.55)	1.78 (1.66-1.91)	2.12 (1.98-2.28)	2.41 (2.25-2.58)	2.80 (2.61-3.00)	3.11 (2.88-3.34)	<del>3.43</del> (3.16-3.68)	3.75 (3.44-4.04)	4.18 (3.80-4.80)	4.52 (4.07-5.45)
2-day	1.68 (1.57-1.79)	2.06 (1.93-2.20)	2.46 (2.30-2.63)	2.79 (2.61-2.98)	3.24 (3.02-3.47)	3.59 (3.33-3.84)	3.94 (3.65-4.23)	4.30 (3.96-4.64)	4.79 (4.37-5.19)	5.15 (4.66-5.61)
3-day	1.85 (1.74-1.98)	2.27 (2.13-2.44)	2.73 (2.55-2.93)	3.10 (2.90-3.33)	3.62 (3.37-3.89)	4.03 (3.74-4.33)	4.44 (4.10-4.78)	4.87 (4.45-5.26)	5.44 (4.93-5.91)	5.88 (5.28-6.42)
4-day	2.03 (1.91-2.17)	2.49 (2.34-2.68)	3.00 (2.81-3.23)	3.42 (3.20-3.67)	4.00 (3.73-4.31)	4.46 (4.14-4.81)	4.94 (4.55-5.34)	5.43 (4.95-5.88)	6.09 (5.49-6.63)	6.60 (5.90-7.23)
7-day	2.46 (2.31-2.62)	3.02 (2.83-3.23)	3.62 (3.40-3.88)	4.13 (3.87-4.42)	4.82 (4.50-5.16)	5.36 (4.98-5.76)	5.91 (5.47-6.37)	6.47 (5.94-6.99)	7.23 (6.57-7.87)	7.82 (7.05-8.56)
10-day	2.81 (2.64-3.00)	3.45 (3.24-3.70)	4.13 (3.88-4.42)	4.67 (4.38-4.99)	5.38 (5.04-5.75)	5.91 (5.51-6.32)	6.45 (5.99-6.91)	6.98 (6.44-7.51)	7.67 (7.04-8.28)	8.19 (7.46-8.88)
20-day	3.79 (3.56-4.02)	4.65 (4.38-4.94)	5.51 (5.18-5.85)	6.17 (5.80-6.56)	7.02 (6.59-7.45)	7.63 (7.15-8.11)	8.23 (7.70-8.76)	8.80 (8.20-9.39)	9.52 (8.82-10.2)	10.0 (9.24-10.8)
30-day	4.62 (4.35-4.89)	5.66 (5.34-6.01)	6.66 (6.28-7.08)	7.44 (7.00-7.91)	8.45 (7.93-8.98)	9.17 (8.60-9.76)	9.88 (9.22-10.5)	10.6 (9.82-11.3)	11.4 (10.6-12.2)	12.0 (11.1-12.9)
45-day	5.83 (5.50-6.19)	7.13 (6.73-7.58)	8.38 (7.91-8.90)	9.37 (8.83-9.95)	10.6 (10.0-11.3)	11.6 (10.9-12.3)	12.5 (11.7-13.3)	13.4 (12.4-14.3)	14.5 (13.4-15.5)	15.3 (14.1-16.4)
60-day	6.95 (6.54-7.39)	8.53 (8.01-9.08)	10.0 (9.42-10.7)	11.2 (10.5-11.9)	12.6 (11.8-13.4)	13.7 (12.8-14.6)	14.7 (13.7-15.7)	15.7 (14.6-16.8)	16.9 (15.6-18.2)	17.8 (16.3-19.1)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

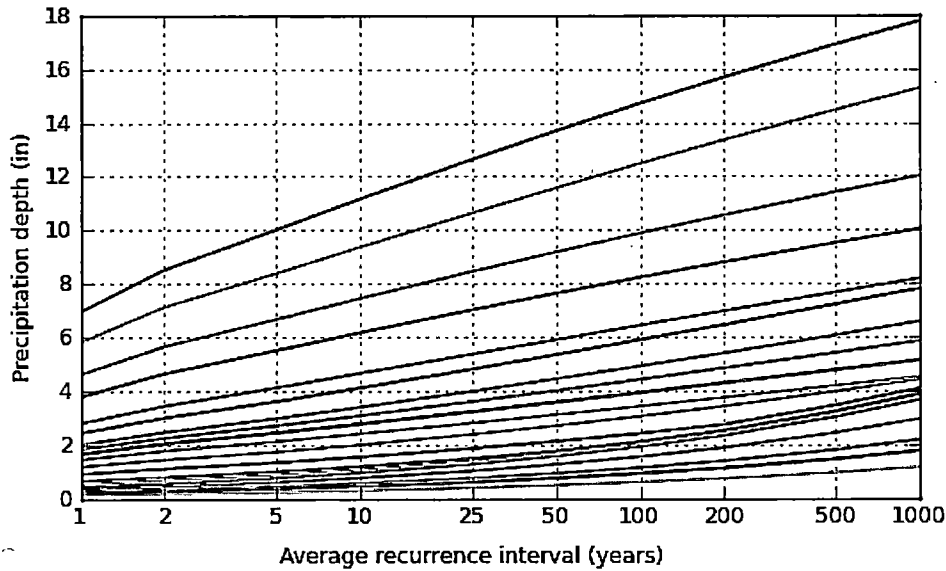
[Back to Top](#)

PF graphical

PDS-based depth-duration-frequency (DDF) curves  
 Latitude: 40.6189°, Longitude: -111.7833°



Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000



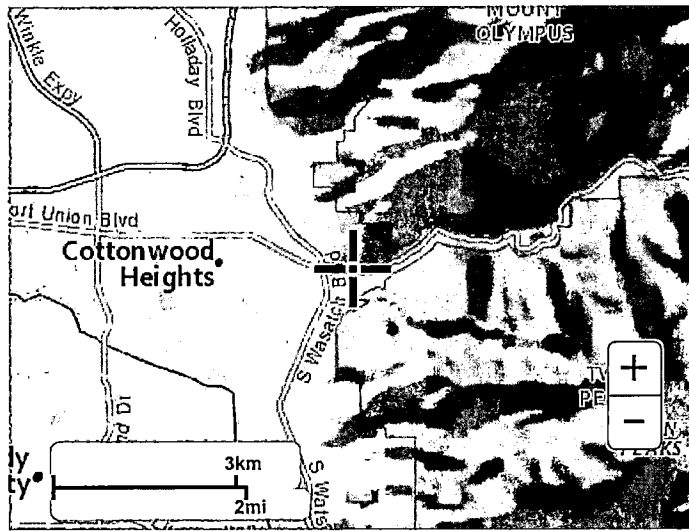
Duration	
5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	

[Back to Top](#)

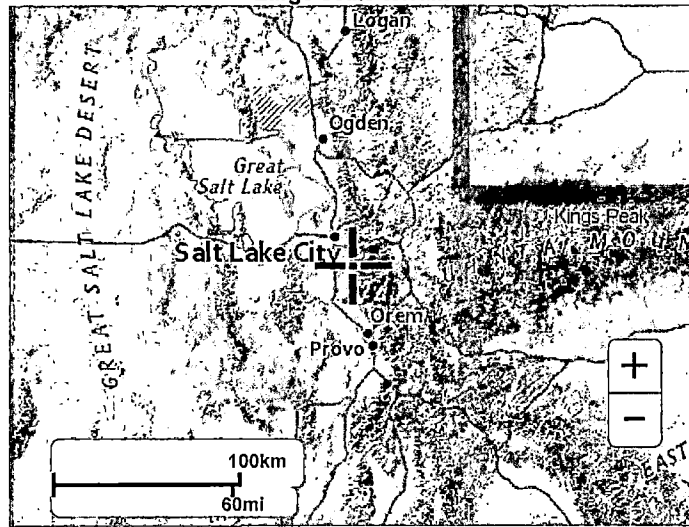
**Maps & aerials**

**Small scale terrain**

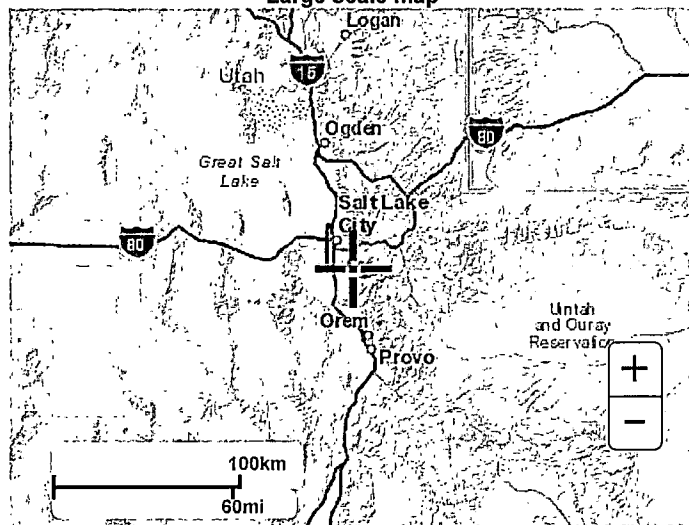




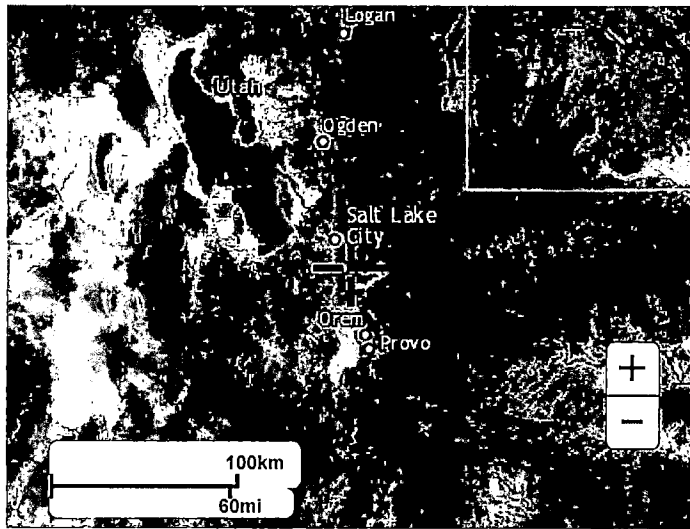
Large scale terrain



Large scale map



Large scale aerial



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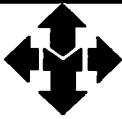
[US Department of Commerce](#)  
[National Oceanic and Atmospheric Administration](#)  
[National Weather Service](#)  
[National Water Center](#)  
1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

[Disclaimer](#)

APPENDIX C

STORM DRAIN DETENTION CALCULATIONS

Vertical line indicating a section or page boundary.



McNeil Engineering  
8610 S Sandy Pkwy, Sandy, UT 84070

STORM RUNOFF  
**CALCULATION SHEET**

Project No.  
21650

Title : Wasatch Rock	
Scope : Site Drainage Design	
<b>Detention Facilities</b>	
Engineer : TJD	Check: TJD
Authority : Cottonwood Hts.	Rev. No.: 0

**Design Philosophy:**

Estimate detention volume required for 100-year storm with peak allowable discharge rate of 0.10 CFS/acre. Rainfall data from NOAA Atlas 14, Cottonwood Weir (42-1759).

**Wasatch Rock**

	(A)		(C)	=	(C*A)
Paved	256,806 sf	(5.90 ac)	0.90	=	231,125 sf
Roof Area	178,875 sf	(4.11 ac)	0.90	=	160,988 sf
Landscaped	509,035 sf	(11.69 ac)	0.25	=	127,259 sf
<b>Total</b>	<b>944,716 sf</b>	<b>(21.69 ac)</b>	<b>0.55 (ave)</b>		<b>519,372 sf</b>

100-Year Storm: NOAA Atlas 14 - Cottonwood Weir							Peak Discharge=	(2.17cfs)
Time (min)	Rate (in/hr)	Rainfall (Inches)	Q in (cfs)	Add'l Q in (cfs)	Total Q in (cfs)	Q out (cfs)	Storage (cf)	
5	7.43	0.619	89.30	0.00	89.30	2.17	26,140	
10	5.66	0.943	68.02	0.00	68.02	2.17	39,513	
15	4.68	1.170	56.27	0.00	56.27	2.17	48,687	
30	3.14	1.570	37.75	0.00	37.75	2.17	64,047	
60	1.95	1.950	23.44	0.00	23.44	2.17	<b>76,590</b>	
120	1.04	2.070	12.44	0.00	12.44	2.17	73,976	
180	0.71	2.130	8.54	0.00	8.54	2.17	68,766	
360	0.40	2.420	4.85	0.00	4.85	2.17	57,894	
720	0.25	3.050	3.06	0.00	3.06	2.17	38,315	
1440	0.14	3.430	1.72	0.00	1.72	1.72	0	

**Total Detention Required : 76,590 cf**  
**Total Detention Provided : 74,500 cf (via subsurface detention)**

The orifice is designed upon the following data:

Drainage Area: 21.69 acres  
 Allowable discharge: 2.17 cfs (0.10 cfs/ac)  
 Max head (center orifice to hw): 6.00 ft  
 Diameter for new orifice: 5.8 inch (max. size)

←  $Q = C_d A_o \sqrt{2gh}$

APPENDIX D

STORM DRAIN DETENTION PROVIDED SUMMARY



Chamber Model -	MC-7200	
Units -	Imperial	
Number of Chambers -	232	
Number of End Caps -	32	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	4819.25	ft
Amount of Stone Above Chambers -	12	in
Amount of Stone Below Chambers -	9	in
Area of system -	19022	sf Min. Area - 14976 sf min. area

**StormTech MC-7200 Cumulative Storage Volumes**

Height of System (Inches)	Incremental Single Chamber (cubic feet)	Incremental Single End Cap (cubic feet)	Incremental Chambers (cubic feet)	Incremental End Cap (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch, EG and Stone (cubic feet)	Cumulative System (cubic feet)	Elevation (feet)
81	0.00	0.00	0.00	0.00	634.07	634.07	76604.24	4826.00
80	0.00	0.00	0.00	0.00	634.07	634.07	75970.14	4825.92
79	0.00	0.00	0.00	0.00	634.07	634.07	75336.07	4825.83
78	0.00	0.00	0.00	0.00	634.07	634.07	74702.01	4825.75
77	0.00	0.00	0.00	0.00	634.07	634.07	74067.94	4825.67
76	0.00	0.00	0.00	0.00	634.07	634.07	73433.87	4825.58
75	0.00	0.00	0.00	0.00	634.07	634.07	72799.81	4825.50
74	0.00	0.00	0.00	0.00	634.07	634.07	72165.74	4825.42
73	0.00	0.00	0.00	0.00	634.07	634.07	71531.67	4825.33
72	0.00	0.00	0.00	0.00	634.07	634.07	70897.61	4825.25
71	0.00	0.00	0.00	0.00	634.07	634.07	70263.54	4825.17
70	0.00	0.00	0.00	0.00	634.07	634.07	69629.47	4825.08
69	0.06	0.01	13.78	0.42	628.39	642.58	68995.41	4825.00
68	0.19	0.03	44.12	1.09	615.98	661.19	68352.82	4824.92
67	0.28	0.05	63.84	1.66	607.87	673.37	67691.63	4824.83
66	0.36	0.07	82.88	2.11	600.07	685.06	67018.27	4824.75
65	0.46	0.08	106.35	2.66	590.46	699.47	66333.20	4824.67
64	0.74	0.11	172.06	3.37	563.89	739.33	65633.73	4824.58
63	1.10	0.13	254.36	4.24	530.63	789.22	64894.41	4824.50
62	1.32	0.16	305.89	5.15	509.65	820.69	64105.18	4824.42
61	1.50	0.19	347.59	6.04	492.62	846.24	63284.49	4824.33
60	1.65	0.22	383.84	6.99	477.73	868.57	62438.25	4824.25
59	1.79	0.25	416.20	7.90	464.43	888.53	61569.68	4824.17
58	1.92	0.28	445.36	8.81	452.40	906.57	60681.16	4824.08
57	2.04	0.30	472.69	9.66	441.13	923.47	59774.59	4824.00
56	2.15	0.33	497.72	10.48	430.79	938.98	58851.11	4823.92
55	2.25	0.35	521.47	11.34	420.94	953.75	57912.13	4823.83
54	2.34	0.38	543.61	12.28	411.71	967.60	56958.38	4823.75
53	2.43	0.41	564.56	13.09	403.00	980.66	55990.78	4823.67
52	2.52	0.44	584.42	14.11	394.65	993.19	55010.12	4823.58
51	2.60	0.47	603.33	15.00	386.73	1005.07	54016.93	4823.50
50	2.68	0.50	621.39	15.85	379.17	1016.41	53011.87	4823.42
49	2.75	0.52	638.60	16.66	371.96	1027.22	51995.46	4823.33
48	2.82	0.54	655.04	17.42	365.08	1037.54	50968.24	4823.25
47	2.89	0.57	670.81	18.14	358.49	1047.43	49930.69	4823.17
46	2.96	0.59	685.88	18.83	352.18	1056.89	48883.26	4823.08
45	3.02	0.61	700.35	19.52	346.12	1065.99	47826.37	4823.00
44	3.08	0.63	714.24	20.23	340.28	1074.75	46760.38	4822.92
43	3.14	0.64	727.62	20.58	334.79	1082.98	45685.63	4822.83
42	3.19	0.68	740.49	21.67	329.20	1091.37	44602.64	4822.75
41	3.25	0.70	752.84	22.39	323.97	1099.21	43511.28	4822.67
40	3.30	0.72	764.75	23.12	318.92	1106.78	42412.07	4822.58
39	3.35	0.74	776.18	23.80	314.07	1114.06	41305.28	4822.50
38	3.39	0.76	787.20	24.46	309.40	1121.07	40191.23	4822.42
37	3.44	0.79	797.81	25.14	304.89	1127.84	39070.16	4822.33
36	3.48	0.80	808.03	25.69	300.58	1134.30	37942.32	4822.25
35	3.53	0.82	817.88	26.24	296.42	1140.54	36808.03	4822.17
34	3.57	0.84	827.35	26.83	292.39	1146.58	35667.49	4822.08
33	3.61	0.85	836.50	27.24	288.57	1152.31	34520.91	4822.00
32	3.64	0.86	845.29	27.50	284.95	1157.74	33368.60	4821.92
31	3.68	0.89	853.75	28.46	281.18	1163.39	32210.86	4821.83
30	3.71	0.90	861.88	28.94	277.74	1168.56	31047.47	4821.75
29	3.75	0.92	869.70	29.35	274.45	1173.50	29878.92	4821.67
28	3.78	0.92	877.19	29.43	271.42	1178.04	28705.42	4821.58
27	3.81	0.94	884.39	30.19	268.23	1182.82	27527.38	4821.50
26	3.84	0.96	891.27	30.60	265.32	1187.19	26344.56	4821.42
25	3.87	0.97	897.88	31.00	262.52	1191.39	25157.37	4821.33
24	3.90	0.98	904.20	31.40	259.83	1195.43	23965.98	4821.25
23	3.92	0.97	910.24	31.08	257.54	1198.86	22770.55	4821.17
22	3.95	1.00	916.00	32.10	254.83	1202.93	21571.69	4821.08
21	3.97	1.01	921.49	32.36	252.53	1206.38	20368.76	4821.00
20	3.99	1.02	926.73	32.65	250.31	1209.70	19162.39	4820.92
19	4.02	1.03	931.70	32.97	248.20	1212.87	17952.69	4820.83
18	4.04	1.04	936.40	33.24	246.21	1215.85	16739.83	4820.75
17	4.06	1.05	940.86	33.48	244.33	1218.67	15523.98	4820.67
16	4.07	1.05	945.06	33.73	242.55	1221.34	14305.30	4820.58

APPENDIX E

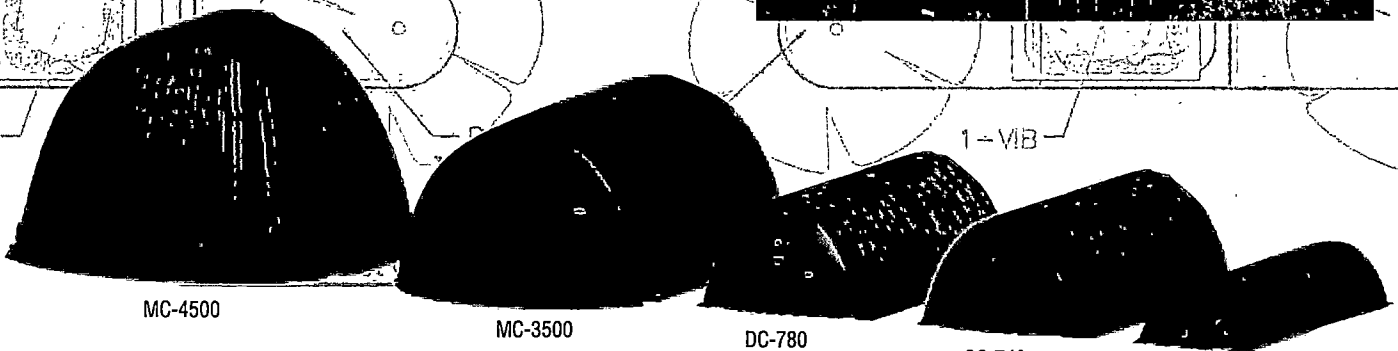
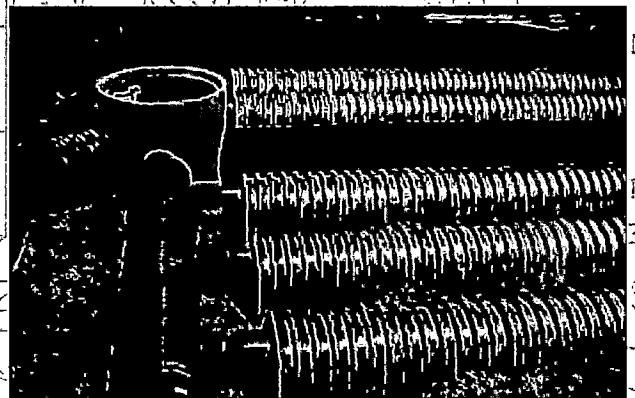
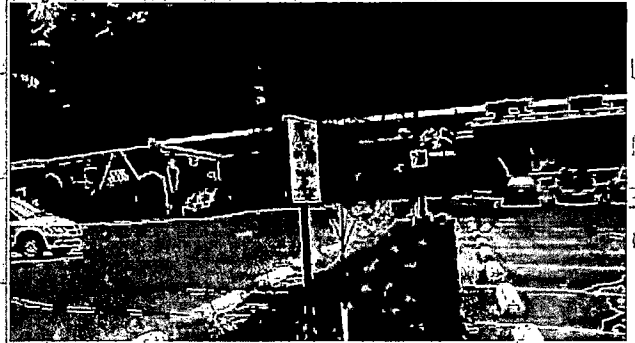
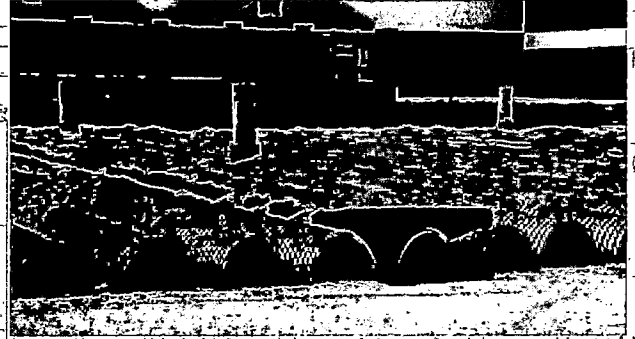
STORM WATER QUALITY – STORMTECH CHAMBERS

PARKING LOT  
TREES BY OTHERS

# StormTech® and Green Infrastructure

## Key Benefits of StormTech

- Volumetric Reduction of Stormwater Through Infiltration
- Stormwater Quality Through Patented Isolator™ Row (TSS, TP and TPH removal)
- Reduction of Thermal Impacts
- Proven, Third Party Verified Performance
- Easily Constructed, Inspected and Maintained
- Meets ASTM product standard
- Designed to ASTM & AASHTO specifications



[www.stormtech.com](http://www.stormtech.com)

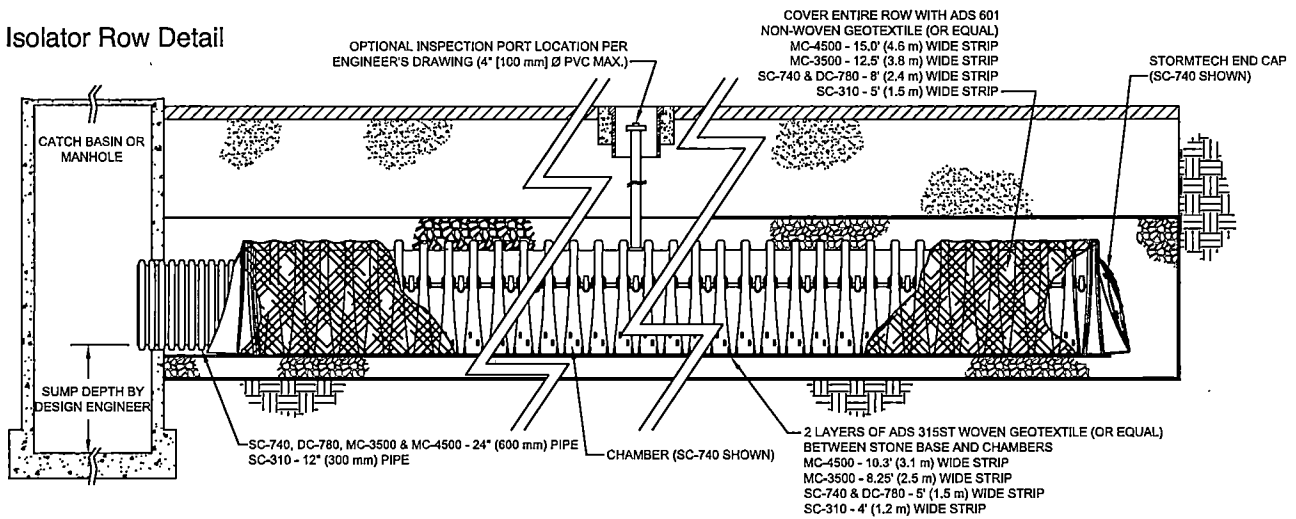




# StormTech and Stormwater Quality

StormTech's patented Isolator™ Row is a row of chambers wrapped in a geotextile which filters the stormwater trapping pollutants in the row. The Isolator Row provides a way to inspect and maintain the system.

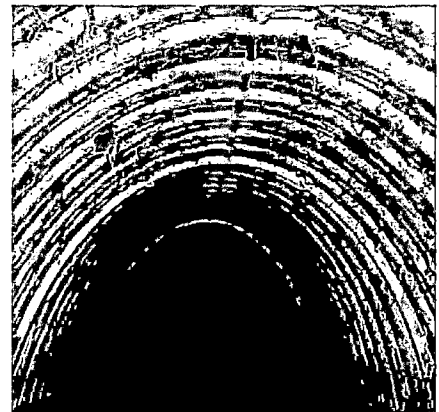
## Isolator Row Detail



**Note:** For many applications, the non-woven geotextile over the DC-780, MC-3500 and MC-4500 Isolator Row chambers can be eliminated or substituted with the AASHTO Class 1 woven geotextile. Contact your StormTech representative for assistance.

## Isolator Row Field Verification Testing at the University of New Hampshire Stormwater Center

- Field testing (TARP tier II protocol) of the Isolator Row has been ongoing since December 2006.
- Removal efficiencies for TSS have improved as the filter cake has built up on the bottom fabric of the Isolator Row.
- Current data shows a TSS removal efficiency which exceeds 80%.



**This system achieves a removal efficiency of 80% for TSS which meets most municipal recommended levels for water quality treatment.**

### Removal Efficiency Results:

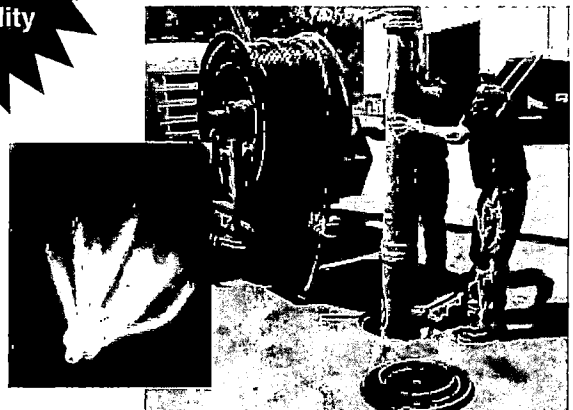
- Total Suspended Solids = 80%
- Phosphorous = 49%
- Total Petroleum Hydrocarbons = 90%
- Zinc = 53%

### Inspection and Maintenance

The Isolator Row can be inspected through the upstream manhole or optional inspection port.

Maintenance is easily accomplished with the JetVac process.

The frequency of inspection and maintenance varies by location. Contact StormTech for assistance with inspection and maintenance scheduling.



APPENDIX F

STORM WATER QUALITY – AQUA-SWIRL CONCENTRATOR UNIT



# Aqua-Swirl<sup>®</sup> Sizing Chart

Aqua-Swirl <sup>™</sup> Model	Swirl Chamber Diameter (ft.)	Maximum Stub-Out Pipe Nominal Diameter (in.)		Water Quality Treatment Flow <sup>2</sup> (cfs)	Oil/Debris Storage Capacity (gal)	Sediment Storage Capacity (ft <sup>3</sup> )
		On/Offline	BYP <sup>1</sup>			
AS-2	2.50	8	15	1.1	37	10
AS-3	3.25/3.50	10	21	1.8	110	20
<b>AS-4</b>	<b>4.25/4.50</b>	<b>12</b>	<b>27</b>	<b>3.2</b>	<b>190</b>	<b>32</b>
AS-5	5.00	12	30	4.4	270	45
AS-6	6.00	15	36	6.3	390	65
AS-7	7.00	18	42	8.6	540	90
AS-8	8.00	18	48	11.2	710	115
AS-9	9.00	21	54	14.2	910	145
AS-10	10.0	24	60	17.5	1130	180
AS-11	11.0	24	66	21.2	1422	222
AS-12	12.0	24	72	25.2	1698	270
AS-13	13.0	27	78	29.6	1986	310
AS-XX	Custom	--	--	>29.6**	--	--

\*See representative for larger pipe diameters available

\*\*Higher water quality treatment flow rates can be designed with multiple swirls.

- 1) The Aqua-Swirl<sup>®</sup> Internal Bypass (BYP) provides full treatment of the "first flush," while the peak design storm is diverted and channeled through the main conveyance pipe. Please refer to your local representative for more information.
- 2) Many regulatory agencies are establishing "water quality treatment flow rates" for their areas based on the initial movement of pollutants into the storm drainage system. The treatment flow rate of the Aqua-Swirl<sup>™</sup> system is engineered to meet or exceed the local water quality treatment criteria. This "water quality treatment flow rate" typically represents approximately 90% to 95% of the total annual runoff volume.

The design and orientation of the Aqua-Swirl<sup>™</sup> generally entails some degree of customization. For assistance in design and specific sizing using historical rainfall data, please refer to an AquaShield<sup>™</sup> representative or visit our website at [www.AquaShieldInc.com](http://www.AquaShieldInc.com). CAD details and specifications are available upon request.

About Us

Verification Process

Stormwater Technologies: Laboratory Verified and NJDEP Certified

Company	Product	Verification Date	Link to Report
AquaShield Inc.	Aqua-Filter Stormwater Filtration System with Perlite Media	June 2018	Download
AquaShield Inc.	AquaFilter Stormwater Filtration System Model AF-3.48 Round	March 2017, revised June 2018	Download
AquaShield Inc.	Aqua-Swirl Xcelerator Stormwater Treatment System	June 2019	Download
AquaShield, Inc.	Aqua-Swirl Concentrator Stormwater Treatment System	November 2016	Download
BaySaver Technologies, LLC	BayFilter Enhanced Media Cartridge	December 2017	Download
BaySaver technologies, LLC	BaySaver Barracuda Hydrodynamic Separator	September 2017	Download
Bio Clean Environmental Services	Kraken Membrane Filtration System	April 2016	Download
Bio Clean Environmental Services	SciClone Hydrodynamic Separator	December 2017	Download
Bio Clean Environmental Services Inc.	Debris Separating Baffle Box (DSBB) Stormwater Treatment Sys	May 2019	Download
Contech Engineered Solutions	Cascade Separator	September 2019	Download
Contech Engineered Solutions LLC	Stormwater Management StormFilter with Perlite Media	November 2016	Download
CONTECH Stormwater Solutions	Continuous Deflective Separator (CDS)	September 2014, Updated January 2017	Download
CONTECH Stormwater Solutions	Filterra Bioretention System	May 2014	Download
Environment 21 LLC	StormPro Stormwater Treatment Device	October 2014, Updated January 2017	Download
Hydro International	Up-Flo Filter 285R (Ribbon Membrane)	December 2016	Download
Hydro International Inc	First Defense HC	February 2016, Updated January 2017	Download
Hydro International Inc.	Downstream Defender	August 2015, Updated January 2017	Download
Hydro International Inc.	Up-Flo Filter 450R (Ribbon Membrane)	June 2018	Download
Hydroworks LLC	HydroStorm Hydrodynamic Separator	February 2018	Download
Jensen Stormwater Systems	Jensen Deflective Separator (JDS)	February 2019	Download
Lane Enterprises Inc.	StormKleener Filter Cartridge System	May 2018	Download
Oldcastle Precast Inc.	BioPod Biofilter with StormMix Media	May 2018, Updated December 2018	Download
Oldcastle Precast Stormwater	Oldcastle PerkFilter System with ZPC Media	May 2017	Download
Oldcastle Stormwater Solutions	Dual Vortex Separator (DVS)	July 2015, Updated January 2017	Download
Storm Trap LLC	SiteSaver Stormwater Treatment Device	March 2019	Download
Suntree Technologies Inc.	Nutrient Separating Baffle Box with Hydro-Variant Technology	October, 2016	Download
Terre Hill Stormwater Systems	Terre Kleen Hydrodynamic Separator	January 2017	Download