# Culvert Calculations Report 

Ameresco<br>Sturbridge Site Proposed Solar Array<br>Sturbridge, MA

Official: June 4, 2018


Harrisburg, PA

## INTRODUCTION

The purpose of this submittal is to provide watershed and hydraulic calculations for two proposed culverts for the Ameresco - Sturbridge solar array site. The site is located between Charleton Road (MA Route 20) and Interstate 84 in Sturbridge, Massachusetts. The project will consist of the installation of a $36^{\prime \prime}$ CMP culvert and a 13'x3' concrete box culvert for two separate stream crossings.

## Culv-1

Culv-1 is a proposed 36 " CMP. At a $1.0 \%$ pipe slope the pipe has a carrying capacity of 26 cfs. The watershed for Culv-1, as calculated by Streamstats, has a 100-year surface runoff of 13.6 cfs. Therefore, the proposed culvert is adequate to carry the flow.

## SD-1

SD-1 is a proposed $13^{\prime} \times 3$ ' concrete box culvert with a natural stream bottom. At a $0.5 \%$ slope, the culvert has a carrying capacity of 549 cfs . The watershed for SD-1, as calculated by StreamStats, has a 100-year surface runoff of 487 cfs . Therefore, the proposed culvert is adequate to carry the flow.

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## CULV-1 CALCULATIONS

## StreamStats Report - Structure Culv 1



Basin Characteristics

| Parameter Code | Parameter Description | Value | Unit |
| :--- | :--- | :--- | :--- |
| DRNAREA | Area that drains to a point on a stream | 0.0365 | square miles |
| ELEV | Mean Basin Elevation | 647 | feet |
| LCO6STOR | Percentage of water bodies and wetlands determined from the NLCD 2006 | 15.34 | percent |

Peak-Flow Statistics Parameters [Peak Statewide 2016 5156]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit |
| :--- | :--- | :--- | :--- | :--- | :--- |
| DRNAREA | Drainage Area | 0.0365 | square miles | 0.16 |  |
| ELEV | Mean Basin Elevation | 647 | feet |  |  |
| LCO6STOR | Percent Storage from NLCD2006 | 15.34 | percent | 19 | 8 |

Peak-Flow Statistics Disclaimers [Peak Statewide 2016 5156]

| One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors |  |
| :--- | :--- |
| Peak-Flow Statistics Flow Report Peak Statewide 2016 5156] |  |
| Statistic | Value |
| 2 Year Peak Flood | 2.64 |
| 5 Year Peak Flood | 4.67 |
| 10 Year Peak Flood | 6.4 |
| 25 Year Peak Flood | 9 |
| 50 Year Peak Flood | 11.2 |
| 100 Year Peak Flood | 13.6 |
| 200 Year Peak Flood | 16.3 |
| 500 Year Peak Flood | 20.2 |
| $\mathrm{ft}^{\wedge} 3 / \mathrm{s} 3 / \mathrm{s}$ |  |
| Peak-Flow Statistics Citations |  |
| $\mathrm{ft}^{\wedge} 3 / \mathrm{s}$ |  |
| $\mathrm{ft}^{\wedge} 3 / \mathrm{s}$ |  |
| $\mathrm{ft}^{\wedge} 3 / \mathrm{s}$ |  |



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## StreamStats Report - Structure SD-1

| Basin Characteristics |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Parameter Code | Parameter Description | Value | Unit |
| DRNAREA | Area that drains to a point on a stream | 4.14 | square miles |
| ELEV | Mean Basin Elevation | 687 | feet |
| LCO6STOR | Percentage of water bodies and wetlands determined from the NLCD 2006 | 18.2 | percent |

Peak-Flow Statistics Parameters [Peak Statewide 2016 5156]

| Parameter Code | Parameter Name | Value | Units | Min Limit | Max Limit | 0.16 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| DRNAREA | Drainage Area | 4.14 | square miles | 512 |  |  |
| ELEV | Mean Basin Elevation | 687 | feet | 8 |  |  |
| LCO6STOR | Percent Storage from NLCD2006 | 18.2 | percent | 1948 |  |  |

Peak-Flow Statistics Flow Report [Peak Statewide 2016 5156]

| Statistic | Value | Unit | PII | Plu | SEp |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 2 Year Peak Flood | 110 | $f t^{\wedge} 3 / \mathrm{s}$ | 56 | 216 | 42.3 |
| 5 Year Peak Flood | 185 | $\mathrm{ft}^{\wedge} 3 / \mathrm{s}$ | 92.6 | 368 | 43.4 |
| 10 Year Peak Flood | 245 | $f t^{\wedge} 3 / \mathrm{s}$ | 120 | 500 | 44.7 |
| 25 Year Peak Flood | 334 | $f t^{\wedge} 3 / \mathrm{s}$ | 158 | 705 | 47.1 |
| 50 Year Peak Flood | 408 | $f t^{\wedge} 3 / \mathrm{s}$ | 187 | 890 | 49.4 |
| 100 Year Peak Flood | 487 | $\mathrm{ft}^{\wedge} 3 / \mathrm{s}$ | 216 | 1100 | 51.8 |
| 200 Year Peak Flood | 573 | $f t^{\wedge} 3 / \mathrm{s}$ | 247 | 1330 | 54.1 |
| 500 Year Peak Flood | 698 | $f t^{\wedge} 3 / \mathrm{s}$ | 287 | 1700 | 57.6 |

Peak-Flow Statistics Citations

Zarriello, P.J.,2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016-5156, 99 p. (https://dx.doi.org/10.3133/sir20165156)


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