Outline

- Population
- Land Use
- Water Quality
  - DO, Bacteria, N, P, TSS
  - Temporal/Spatial
  - Seasonality
  - Turbidity
  - Water Temperature
- Streamflow
  - Drought
  - Flood
Population
Population in the Brandywine-Christina, by Watershed
2000 - 2013

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Brandywine Creek</td>
<td>221,413</td>
<td>246,702</td>
<td>257,313</td>
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<tr>
<td>Christina River</td>
<td>166,435</td>
<td>174,196</td>
<td>187,490</td>
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<tr>
<td>Red Clay Creek</td>
<td>42,630</td>
<td>46,893</td>
<td>45,877</td>
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<tr>
<td>White Clay Creek</td>
<td>118,577</td>
<td>123,504</td>
<td>124,480</td>
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Land Use
Land Cover Change in the Brandywine-Christina (Square Miles) 1996 - 2010

- Brandywine: -3.2 (Forest/Water/Wetland), -15.9 (Agriculture), 19.0 (Developed)
- Christina: 0.0 (Forest/Water/Wetland), -1.9 (Agriculture), 1.8 (Developed)
- Red Clay: -0.2 (Forest/Water/Wetland), -3.1 (Agriculture), 3.2 (Developed)
- White Clay: -0.5 (Forest/Water/Wetland), -4.2 (Agriculture), 4.6 (Developed)
- Total: -25.0 (Forest/Water/Wetland), -3.9 (Agriculture), 28.5 (Developed)
Water Quality
Brandywine-Christina DNREC STORET Water Quality Monitoring Stations
Brandywine Creek
Water Quality Trends
1995 - 2015
Brandywine Creek
(Short Term)

No. of Stations

Parameter

DO  Entero  Total N  Total P  TSS  Brandywine Cr.

3  3  1 1 1  1  2  8  5  2

Improved  Constant  Degraded
Red Clay Creek
Water Quality Trends
1995 - 2015
Red Clay Creek at Barley Mill Road, Ashland

![Graph showing dissolved oxygen levels over time from 1995 to 2015. The graph includes points for median, 5-year median, WQ standard, and a linear trend for dissolved oxygen (DO).]
Red Clay Creek at Barley Mill Road, Ashland

Enterococcus (cfu/100 ml)

- Median
- 5 yr Median
- WQ Standard
- Linear (Enterococcus)
Red Clay Creek at Barley Mill Road, Ashland

- **Total Phosphorus (mg/l)**

- Median
- 5 yr Median
- WQ Standard
- Linear (Total Phosphorus)
White Clay Creek
Water Quality Trends
1995 - 2015
Christina River
Water Quality Trends
1995 - 2015
Enterococcus Bacteria (Median 2011-2015)
Brandywine-Christina Watershed

- Brandywine Cr. at Smith Bridge: 47
- Brandywine Cr. at New Bridge: 59
- Christina River at Footbridge: 36
- Christina River at Nottingham Rd: 117
- Christina River at Sunset Lake Rd: 182
- Christina River at Smalley's Dam Rd: 92
- Red Clay Cr. at Ashland: 140
- Red Clay Cr. at Woodale: 93
- Red Clay Cr. at Stanton: 71
- White Clay Cr. at Chambers Rock Rd: 65
- White Clay Cr. at McKees Lane: 90
- White Clay Cr. at Delaware Park: 77
Total Nitrogen (Median 2011-2015)
Brandywine-Christina Watershed

<table>
<thead>
<tr>
<th>Location</th>
<th>Median Nitrogen (mg/L)</th>
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</thead>
<tbody>
<tr>
<td>Brandywine Cr. at Smith Bridge</td>
<td>3.00</td>
</tr>
<tr>
<td>Brandywine Cr. at New Bridge</td>
<td>3.00</td>
</tr>
<tr>
<td>Brandywine Cr. at Footbridge</td>
<td>3.09</td>
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<tr>
<td>Christina River at Nottingham Rd.</td>
<td>2.48</td>
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<tr>
<td>Christina River at Sunset Lake Rd.</td>
<td>1.70</td>
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<tr>
<td>Christina River at Smalley's Dam Rd.</td>
<td>1.40</td>
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<tr>
<td>Christina River at Rte. 141 Newport</td>
<td>2.25</td>
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<tr>
<td>Red Clay Cr. at Ashland</td>
<td>3.98</td>
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<tr>
<td>Red Clay Cr. at Wooddale</td>
<td>3.46</td>
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<tr>
<td>Red Clay Cr. at Stanton</td>
<td>3.28</td>
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<tr>
<td>White Clay Cr. at Chambers Rock Rd.</td>
<td>4.21</td>
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<tr>
<td>White Clay Cr. at McKees Lane</td>
<td>4.04</td>
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<tr>
<td>White Clay Cr. at Delaware Park</td>
<td>3.47</td>
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Total Phosphorus (Median 2011-2015)  
Brandywine-Christina Watershed

<table>
<thead>
<tr>
<th>Location</th>
<th>Median (mg/L)</th>
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</thead>
<tbody>
<tr>
<td>Brandywine Cr. at Smith Bridge</td>
<td>0.070</td>
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<tr>
<td>Brandywine Cr. at New Bridge</td>
<td>0.090</td>
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<tr>
<td>Christina River at Footbridge</td>
<td>0.080</td>
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<tr>
<td>Christina River at Nottingham Rd.</td>
<td>0.030</td>
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<tr>
<td>Christina River at Sunset Lake Rd.</td>
<td>0.040</td>
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<td>Christina River at Smaller's Dam Rd.</td>
<td>0.065</td>
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<tr>
<td>Christina River at Rt-141 Newport</td>
<td>0.090</td>
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<tr>
<td>Red Clay Cr. at Ashland</td>
<td>0.085</td>
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<td>Red Clay Cr. at Wooddale</td>
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<td>Red Clay Cr. at Stanton</td>
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<tr>
<td>White Clay Cr. at Chambers-Rock Rd.</td>
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<tr>
<td>White Clay Cr. at McKees Lane</td>
<td>0.060</td>
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<tr>
<td>White Clay Cr. at Delaware Park</td>
<td>0.060</td>
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Turbidity
Brandywine Creek @ Foot Bridge (1995-2014)

Total Suspended Solids (mg/L) vs Streamflow ft³/s

\[ y = 1 \times 10^{-5}x^2 + 0.0126x + 0.3855 \]

\[ R^2 = 0.37126 \]

- Total Suspended Solids
- Poly. (Total Suspended Solids)
Turbidity (2013)
Brandywine Christina Watershed

0 10 20 30 40 50
4/1/13 5/1/13 5/31/13 6/30/13
Brandywine at Chadds Ford
Brandywine at Wilmington
East Branch Brandywine
Turbidity
Brandywine Creek at Wilmington, DE

Turbidity (NTU)

1/1/2012 1/1/2013 1/1/2014 1/1/2015 1/1/2016

17 days 32 days 37 days 35 days 20 days
Turbidity
White Clay Creek near Strickersville, PA

Turbidity (NTU)

1/1/2012  1/1/2013  1/1/2014  1/1/2015  1/1/2016

15 days  34 days  28 days  38 days  16 days
Turbidity
Red Clay Creek near Kennett Square, PA

Turbidity (NTU)

1/1/2012  1/1/2013  1/1/2014  1/1/2015  1/1/2016

7 days  44 days
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<tr>
<th>Stream</th>
<th>Water Purveyor</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Mean</th>
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<tr>
<td>Brandywine Cr. at Wilmington, DE</td>
<td>City of Wilmington</td>
<td>17</td>
<td>32</td>
<td>37</td>
<td>35</td>
<td>20</td>
<td>28</td>
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<tr>
<td>White Clay Cr. near Stricknersville, PA</td>
<td>City of Newark</td>
<td>15</td>
<td>34</td>
<td>28</td>
<td>38</td>
<td>16</td>
<td>26</td>
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<tr>
<td>Red Clay Cr. near Kennett Square, PA</td>
<td>SUEZ DE</td>
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<td>44</td>
<td>44</td>
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<tr>
<td>EB Brandywine Cr. below Downingtown, PA</td>
<td>AQUA PA and Downingtown</td>
<td>55</td>
<td>52</td>
<td>45</td>
<td>48</td>
<td>30</td>
<td>46</td>
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<td>WB Brandywine Cr. at Modena, PA</td>
<td>PA American Water Co.</td>
<td>57</td>
<td>76</td>
<td>73</td>
<td>69</td>
<td>46</td>
<td>64</td>
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Water Temperature
Brandywine Creek at Chadds Ford
Water Temperature, 1995-2016