GIS Hydrology, Optimizer, Stormwater Harvesting, and Drones in Stormwater Management

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GIS Hydrology
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Soils – NRCS Web Soil Survey

Land Use – USGS National Land Cover Dataset
GIS Hydrology
## GIS Hydrology

### Description and Curve Numbers from TR-55

<table>
<thead>
<tr>
<th>Land Use Description on Input Screen</th>
<th>Cover Description</th>
<th>Curve Number for Hydrologic Soil Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Impervious Areas</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>-------------------</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Agricultural</td>
<td>Row Crops - Straight Rows = Crop Residue Covers: Good Condition</td>
<td>64</td>
</tr>
<tr>
<td>Commercial</td>
<td>Urban Districts: Commercial and Business</td>
<td>85</td>
</tr>
<tr>
<td>Forest</td>
<td>Woods[2][3] - Good Condition</td>
<td>30</td>
</tr>
<tr>
<td>Grass/Pasture</td>
<td>Pasture, Grassland, or Range[3] - Good Condition</td>
<td>39</td>
</tr>
<tr>
<td>High Density Residential</td>
<td>Residential districts by average lot size: 1/3 ac or less</td>
<td>65</td>
</tr>
<tr>
<td>Industrial</td>
<td>Industrial district: Industrial</td>
<td>72</td>
</tr>
<tr>
<td>Low Density Residential</td>
<td>Residential districts by average lot size: 1/2 ac or less</td>
<td>23</td>
</tr>
<tr>
<td>Open Spaces</td>
<td>Open Space (lawns, parks, golf courses, cemeteries, etc.)</td>
<td>49</td>
</tr>
<tr>
<td>Parking and Paved Spaces</td>
<td>Impervious areas: Paved parking lots, roads, driveways, etc. (excluding right-of-way)</td>
<td>100</td>
</tr>
<tr>
<td>Residential 1/3 ac</td>
<td>Residential districts by average lot size: 1/3 ac or less</td>
<td>65</td>
</tr>
<tr>
<td>Residential 1/4 ac</td>
<td>Residential districts by average lot size: 1/4 ac</td>
<td>38</td>
</tr>
<tr>
<td>Residential 1/5 ac</td>
<td>Residential districts by average lot size: 1/5 ac</td>
<td>30</td>
</tr>
<tr>
<td>Residential 1/6 ac</td>
<td>Residential districts by average lot size: 1/6 ac</td>
<td>23</td>
</tr>
<tr>
<td>Residential 1/8 ac</td>
<td>Residential districts by average lot size: 1/8 ac or less</td>
<td>20</td>
</tr>
<tr>
<td>Residential 2 acres</td>
<td>Residential districts by average lot size: 2 ac or less</td>
<td>12</td>
</tr>
<tr>
<td>Water: Wetlands</td>
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<td></td>
</tr>
</tbody>
</table>

### LUValue, USGS_Desc, CN_Desc, A, B, C, D

<table>
<thead>
<tr>
<th>LUValue</th>
<th>USGS_Desc</th>
<th>CN_Desc</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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</thead>
<tbody>
<tr>
<td>11</td>
<td>Open Water</td>
<td>Water</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<tr>
<td>90</td>
<td>Developed, Open Space</td>
<td>Open Space (Fair)</td>
<td>49</td>
<td>69</td>
<td>79</td>
<td>84</td>
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<tr>
<td>22</td>
<td>Developed, Low Intensity</td>
<td>Low Density Residential (average 1/2 ac lots)</td>
<td>54</td>
<td>70</td>
<td>80</td>
<td>85</td>
</tr>
<tr>
<td>23</td>
<td>Developed, Medium Intensity</td>
<td>High Density Residential (average 1/8 ac lots)</td>
<td>77</td>
<td>85</td>
<td>90</td>
<td>92</td>
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<tr>
<td>24</td>
<td>Developed, High Intensity</td>
<td>Commercial</td>
<td>89</td>
<td>92</td>
<td>94</td>
<td>95</td>
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<tr>
<td>41</td>
<td>Deciduous Forest</td>
<td>Forest</td>
<td>30</td>
<td>55</td>
<td>70</td>
<td>77</td>
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<tr>
<td>81</td>
<td>Pasture, Hay</td>
<td>Grass/Pasture</td>
<td>39</td>
<td>61</td>
<td>74</td>
<td>80</td>
</tr>
<tr>
<td>82</td>
<td>Cultivated Crops</td>
<td>Agricultural</td>
<td>64</td>
<td>75</td>
<td>82</td>
<td>85</td>
</tr>
</tbody>
</table>

### Notes

1. Hydrologic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetation areas, (b) amount of maintained cover; (c) amount of grass or clover-covered legumes, (d) percent of residue on the land surface (good=20%), and (e) degree of surface roughness.
2. Good: Woods are protected from grazing, and litter and brush adequately cover the soil.
3. Fair: >75% ground cover and lightly or only occasionally grazed.
4. CN’s shown are equivalent to those of pasture. Composite CN’s may be computed for other combinations of open space cover type.
Spatial Analyst Hydrology Tools

- Capable of building subbasin areas and longest flow path
- Not perfect for use in built environments
Optimizer

- Infrastructure Planning Tool
- Acts as an extension to traditional hydraulic modeling
- Analyses thousands of planning options to optimize for cost and performance
- Input the full range of possible improvements and let optimizer site and size needed upgrades
Optimizer
Optimatics

- Cloud-based
- Run times vary from a couple of hours to days
- The faster your model, the faster your optimization
Northbrook Wescott Park – Rainwater Harvesting

Ten homes flood in 25-year storm event
Overall Project

- 23.7 ac-ft Underground Detention
- 42” Storm Sewer
- High capacity inlets
- Irrigation System
StormTrap DoubleTrap

- Modular, precast concrete system
- Height: 2' - 2.5' to 11 - 4'
- Can be configured into any footprint
- 50-year warranty
Rainwater Harvesting System

1. Pre-Treatment Filtration
2. Storage in StormTrap
3. Pump from StormTrap
4. UV Sanitization System
5. Irrigation
System Controls and Automation

- Utilizes real-time weather forecast data
- Pumps water to downstream sewer in advance of large storms
- Online dashboard to monitor system
Storage Configuration

Sump Area

Pros
- Lowest cost
- Additional volume
- Failure condition not critical

Cons
- Does not drain by gravity
Storage Configuration

- 11'-4" DOUBLETRAP UNITS
- SUMP AREA IN BOTTOM OF 11'-4" DOUBLETRAP UNITS
- 10'-0" DOUBLETRAP UNITS
Construction Photos
Project Facts

**StormTrap**
- Total Capacity: 7.73 million gal
- Sump capacity: 177,415 gallons
- Height: 10’-0” to 11’-4”, Footprint: 2.51 acres

**Construction**
- Approximately 6,500 truckloads of excavated material
- Start of construction: March 2016
- Substantial completion: November 2016

**Cost**
- Total cost of project: $9,315,000
- Cost of StormTrap work: $4,720,000
UAV– Flooding Assessment
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UAV– Streambank Assessment
UAV– Streambank Assessment
UAV– Bridge Inspection
UAV– Bridge Inspection
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