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

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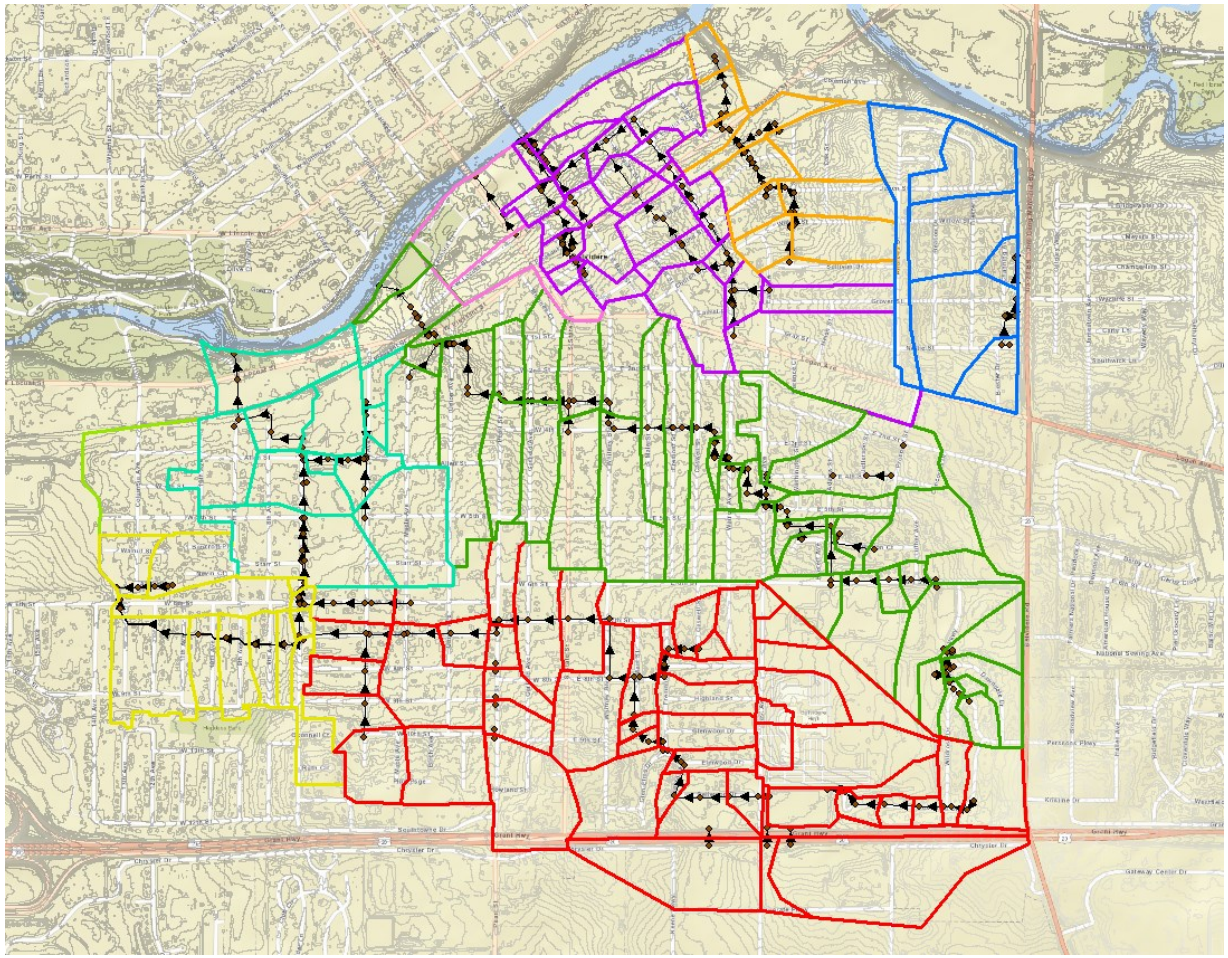
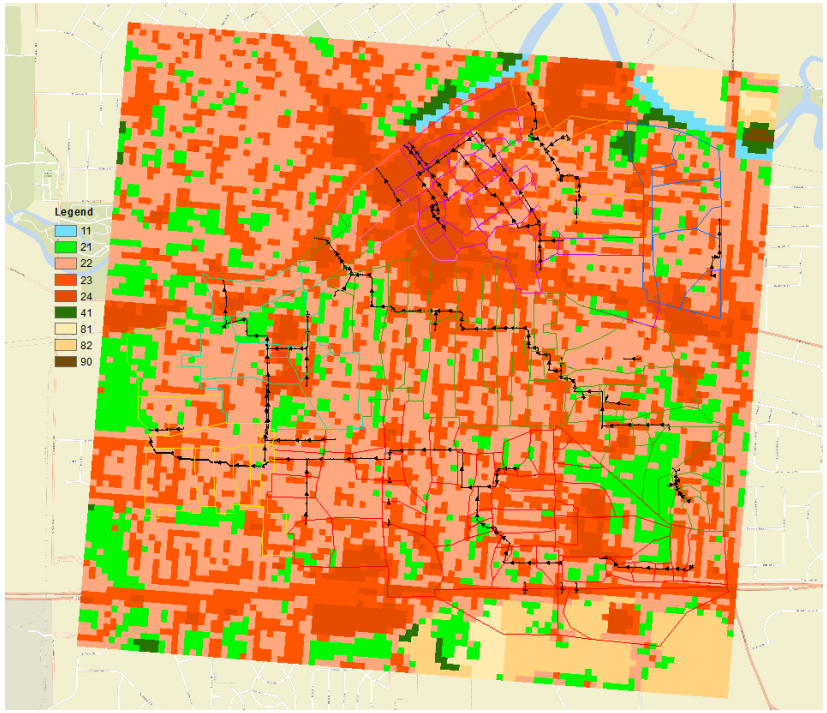
GIS Hydrology

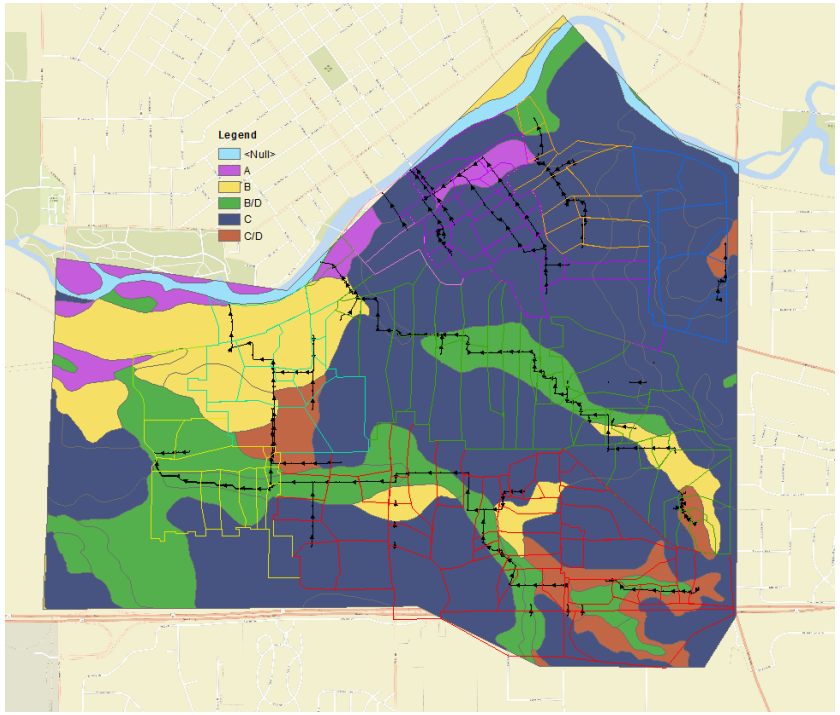


GIS Hydrology

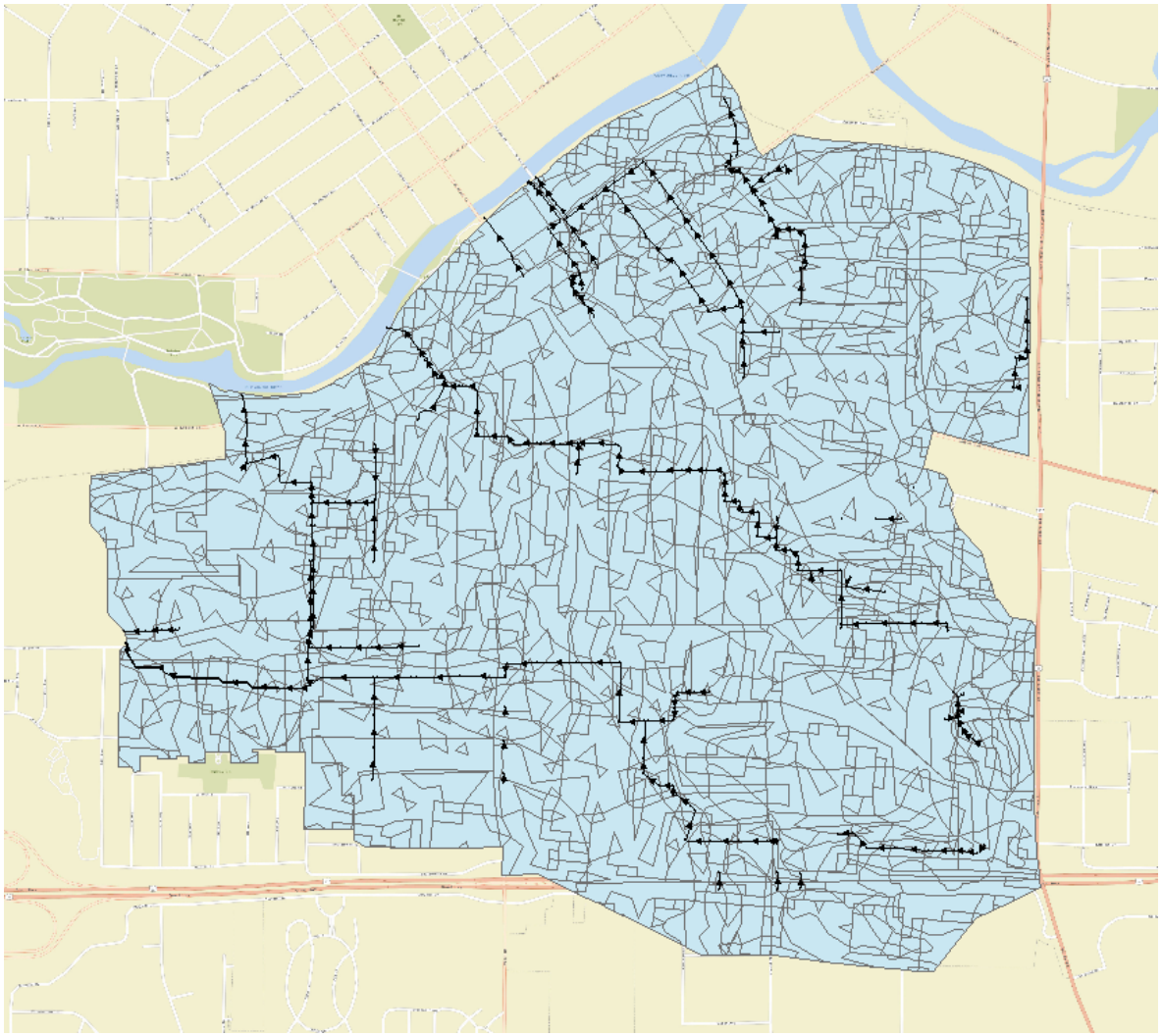
Land Use – USGS National Land Cover Dataset



Soils – NRCS Web Soil Survey



GIS Hydrology



GIS Hydrology

Land Use Description on Input Screen	Description and Curve Numbers from TR-55					
	Cover Description		Curve Number for Hydrologic Soil Group			
	Cover Type and Hydrologic Condition	% Impervious Areas	A	B	C	D
Agricultural	Row Crops - Staight Rows + Crop Residue Cover- Good Condition (1)		64	75	82	85
Commercial	Urban Districts: Commerical and Business	85	89	92	94	95
Forest	Woods(2) - Good Condition		30	55	70	77
Grass/Pasture	Pasture, Grassland, or Range(3) - Good Condition		39	61	74	80
High Density Residential	Residential districts by average lot size: 1/8 acre or less	65	77	85	90	92
Industrial	Urban district: Industrial	72	81	88	91	93
Low Density Residential	Residential districts by average lot size: 1/2 acre lot	25	54	70	80	85
Open Spaces	Open Space (lawns, parks, golf courses, cemeteries, etc.) (4) Fair Condition (grass cover 50% to 70%)		49	69	79	84
Parking and Paved Spaces	Impervious areas: Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	100	98	98	98	98
Residential 1/8 acre	Residential districts by average lot size: 1/8 acre or less	65	77	85	90	92
Residential 1/4 acre	Residential districts by average lot size: 1/4 acre	38	61	75	83	87
Residential 1/3 acre	Residential districts by average lot size: 1/3 acre	30	57	72	81	86
Residential 1/2 acre	Residential districts by average lot size: 1/2 acre	25	54	70	80	85
Residential 1 acre	Residential districts by average lot size: 1 acre	20	51	68	79	84
Residential 2 acres	Residential districts by average lot size: 2 acre	12	46	65	77	82
Water/ Wetlands		0	0	0	0	0

Color Key

Basic Input Value	Detailed Input Value	Basic and Detailed Input Type Value

Notes

(1) Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue on the land surface (good>=20%), and (e) degree of surface roughness.

(2) Good: Woods are protected form grazing, and litter and brush adequately cover the soil.

(3) Good: >75% ground cover and lightly or only occasionally grazed.

(4) CN's shown sre equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

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

GIS Hydrology

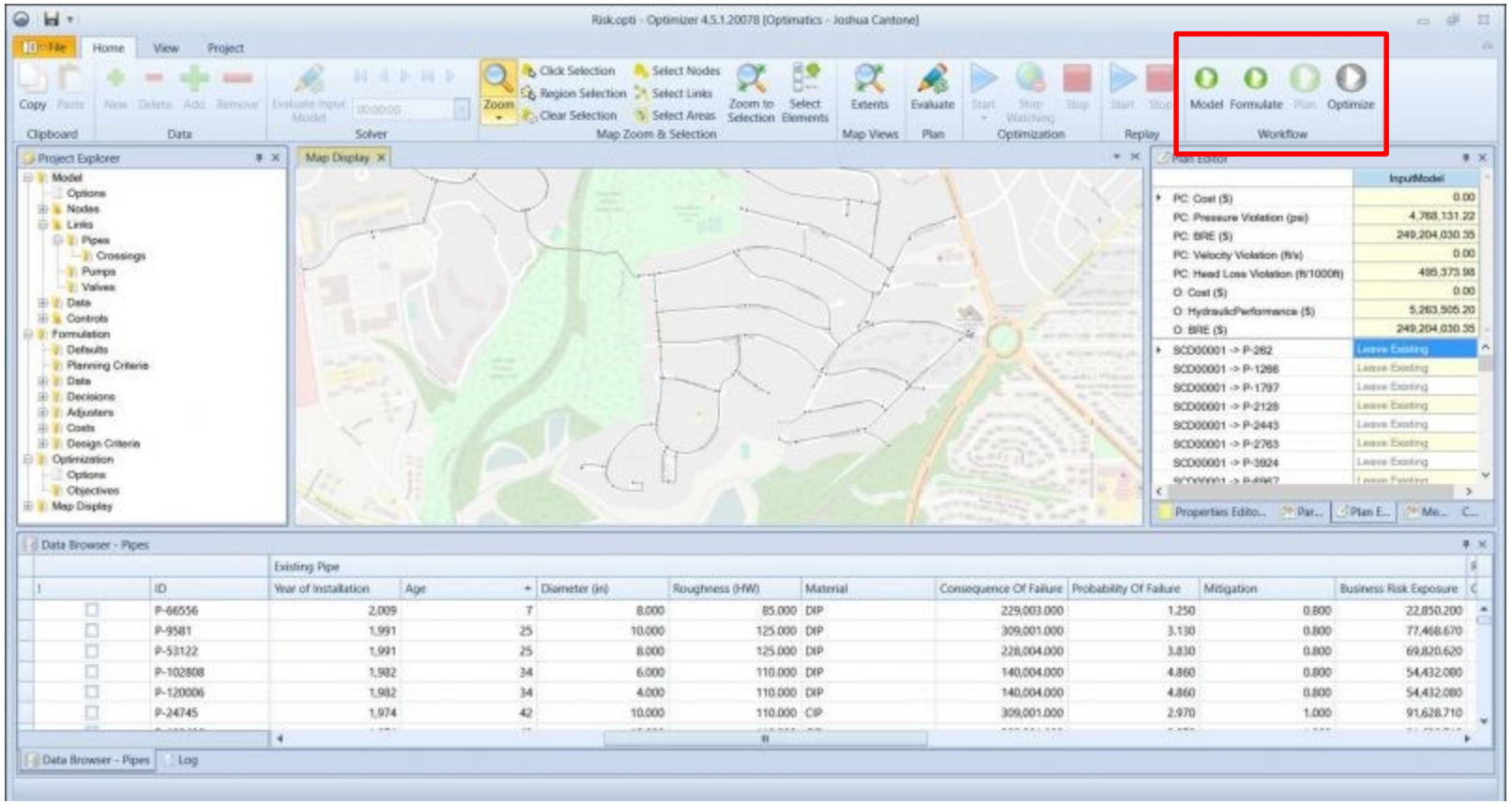
Spatial Analyst Hydrology Tools

- 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

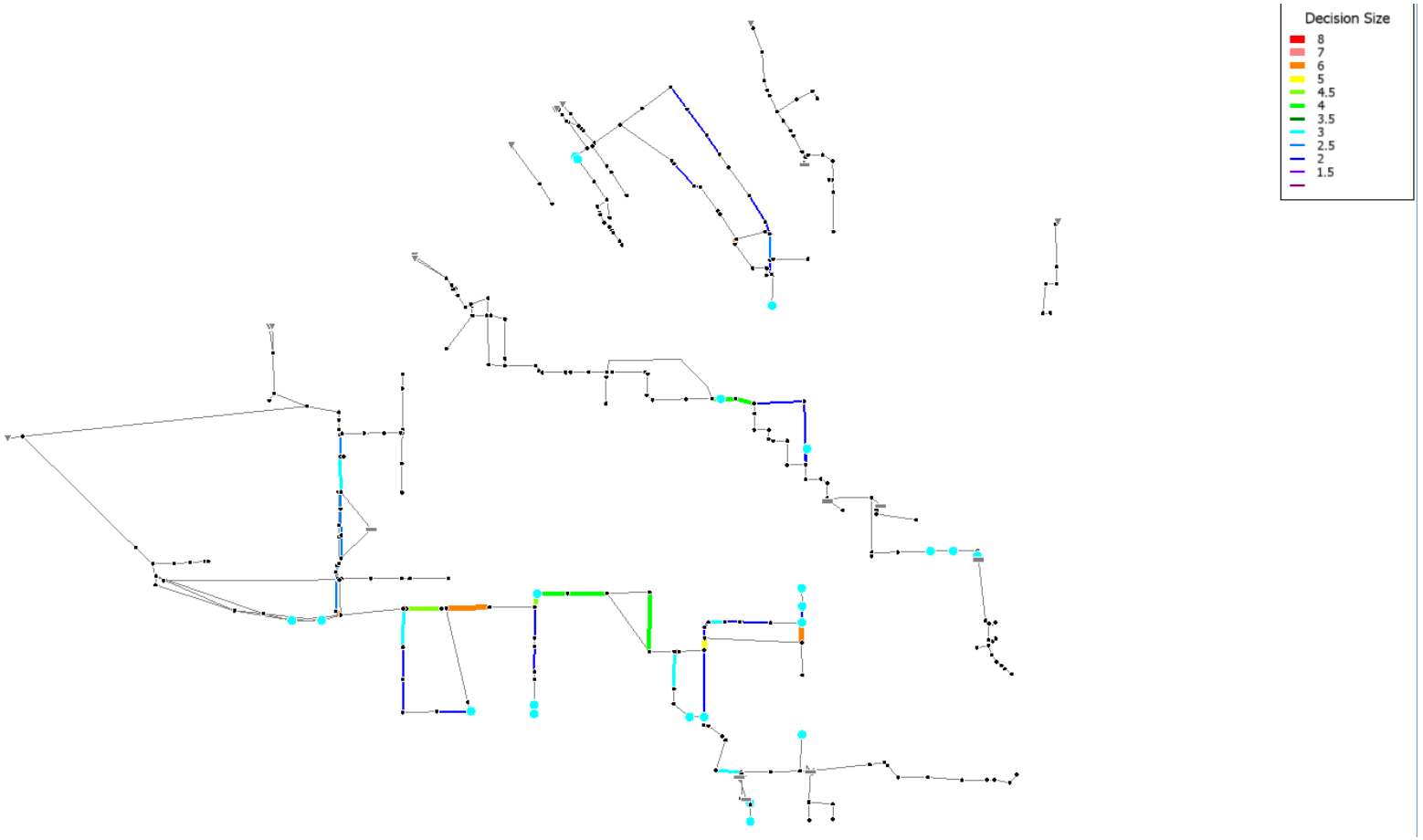
Optimizer


Risk.opti - Optimizer 4.5.1.20078 [Optimatics - Joshua Cantone]
File
Home
View
Project
Copy
Paste
New
Delete
Add
Remove
Clipboard
Data
Evaluate Input Model
Solver
Zoom
Click Selection
Region Selection
Clear Selection
Select Nodes
Select Links
Select Areas
Zoom to Selection
Select Elements
Map Zoom & Selection
Extents
Map Views
Evaluate
Plan
Start
Stop Watching
Stop
Optimization
Start
Stop
Replay
Model
Formulate
Plan
Optimize
Workflow
Project Explorer
Model
Options
Nodes
Links
Pipes
Crossings
Pumps
Valves
Data
Controls
Formulation
Defaults
Planning Criteria
Data
Decisions
Adjusters
Costs
Design Criteria
Optimization
Options
Objectives
Map Display
Map Display
Plan Editor
InputModel
PC Cost ($) 0.00
PC Pressure Violation (psi) 4,768,131.22
PC BRE ($) 249,204,030.35
PC Velocity Violation (ft/s) 0.00
PC Head Loss Violation (ft/1000ft) 495,373.98
O Cost ($) 0.00
O HydraulicPerformance ($) 5,263,505.20
O BRE ($) 249,204,030.35
SCD00001 -> P-282 Leave Existing
SCD00001 -> P-1288 Leave Existing
SCD00001 -> P-1797 Leave Existing
SCD00001 -> P-2128 Leave Existing
SCD00001 -> P-2443 Leave Existing
SCD00001 -> P-2763 Leave Existing
SCD00001 -> P-3924 Leave Existing
Properties Edito...
Par...
Plan E...
Me...
C...
Data Browser - Pipes
Existing Pipe
ID
Year of Installation
Age
Diameter (in)
Roughness (HW)
Material
Consequence Of Failure
Probability Of Failure
Mitigation
Business Risk Exposure
P-66556 2,009 7 8.000 85.000 DIP 229,003.000 1.250 0.800 22,850.200
P-9581 1,991 25 10.000 125.000 DIP 309,001.000 3.130 0.800 77,468.670
P-53122 1,991 25 8.000 125.000 DIP 228,004.000 3.830 0.800 69,820.620
P-102808 1,982 34 6.000 110.000 DIP 140,004.000 4.860 0.800 54,432.080
P-120006 1,982 34 4.000 110.000 DIP 140,004.000 4.860 0.800 54,432.080
P-24745 1,974 42 10.000 110.000 CIP 309,001.000 2.970 1.000 91,628.710
Data Browser - Pipes
Log

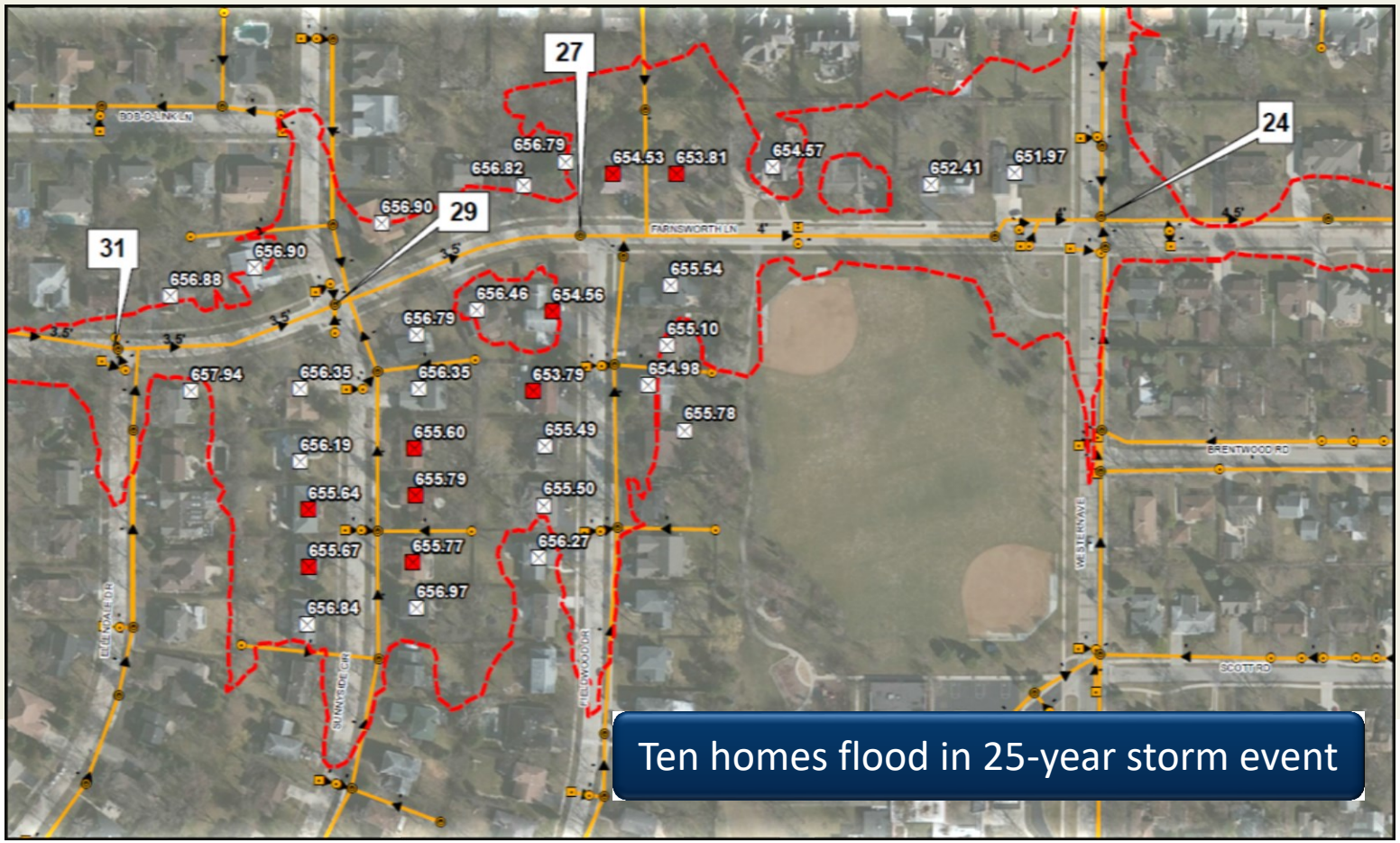
Optimatics

- Cloud-based
- Run times vary from a couple of hours to days
- The faster your model, the faster your optimization

Optimatics



Northbrook Wescott Park – Rainwater Harvesting



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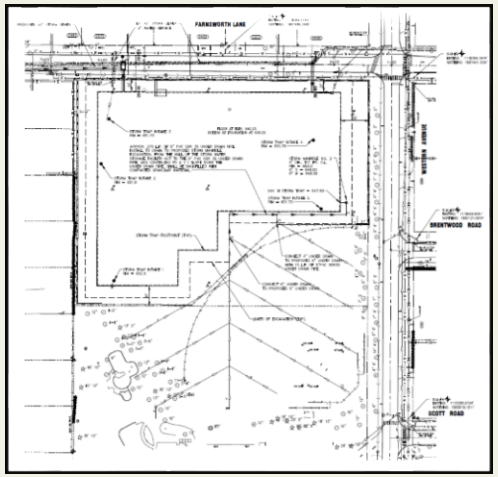
Overall Project

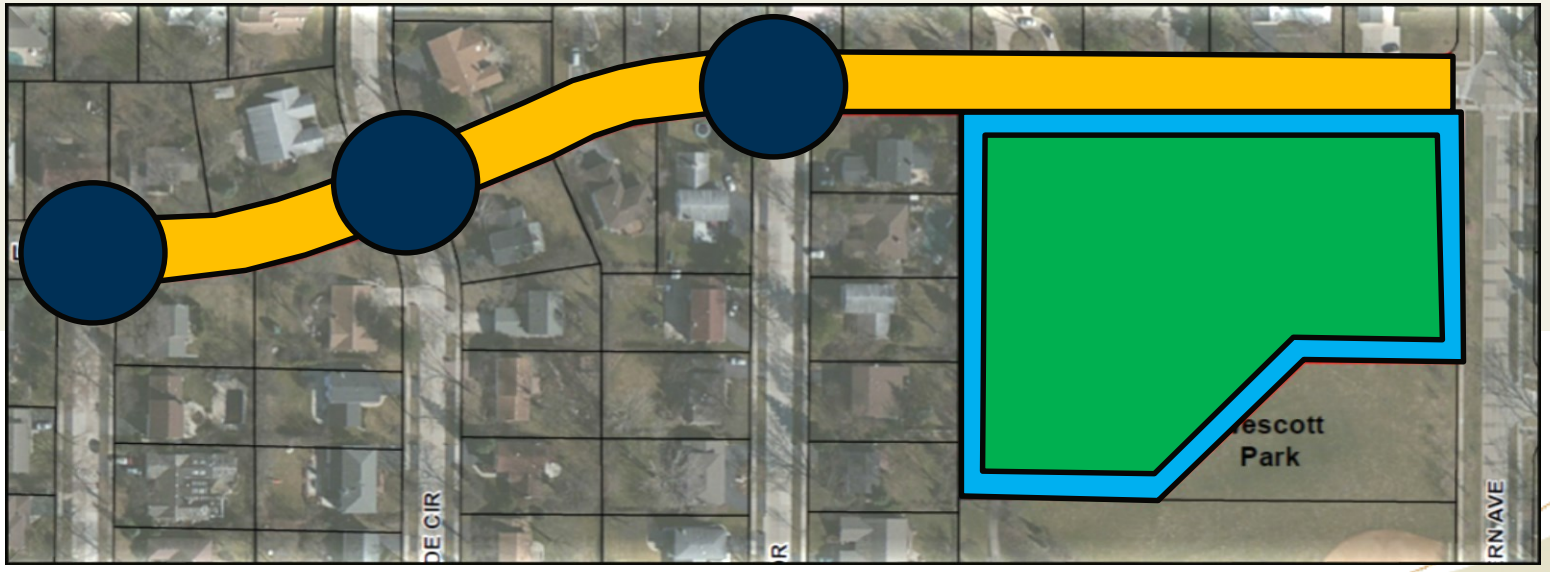
23.7 ac-ft Underground Detention

42” Storm Sewer

High capacity inlets

Irrigation System





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StormTrap DoubleTrap

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50-year
warranty

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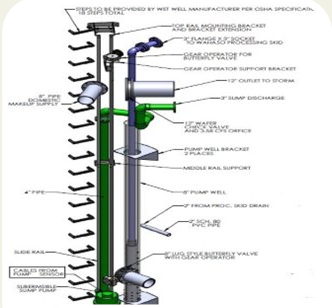
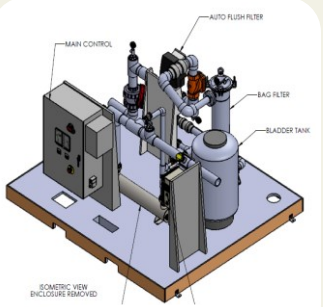
Rainwater Harvesting System

Pre-Treatment Filtration

Storage in StormTrap



Pump from StormTrap



UV Sanitization System

Irrigation

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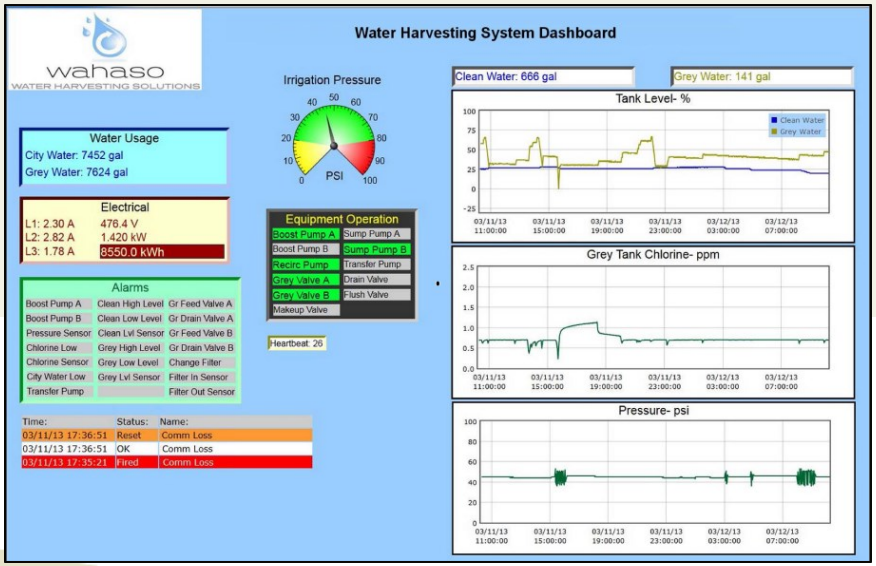
System Controls and Automation

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



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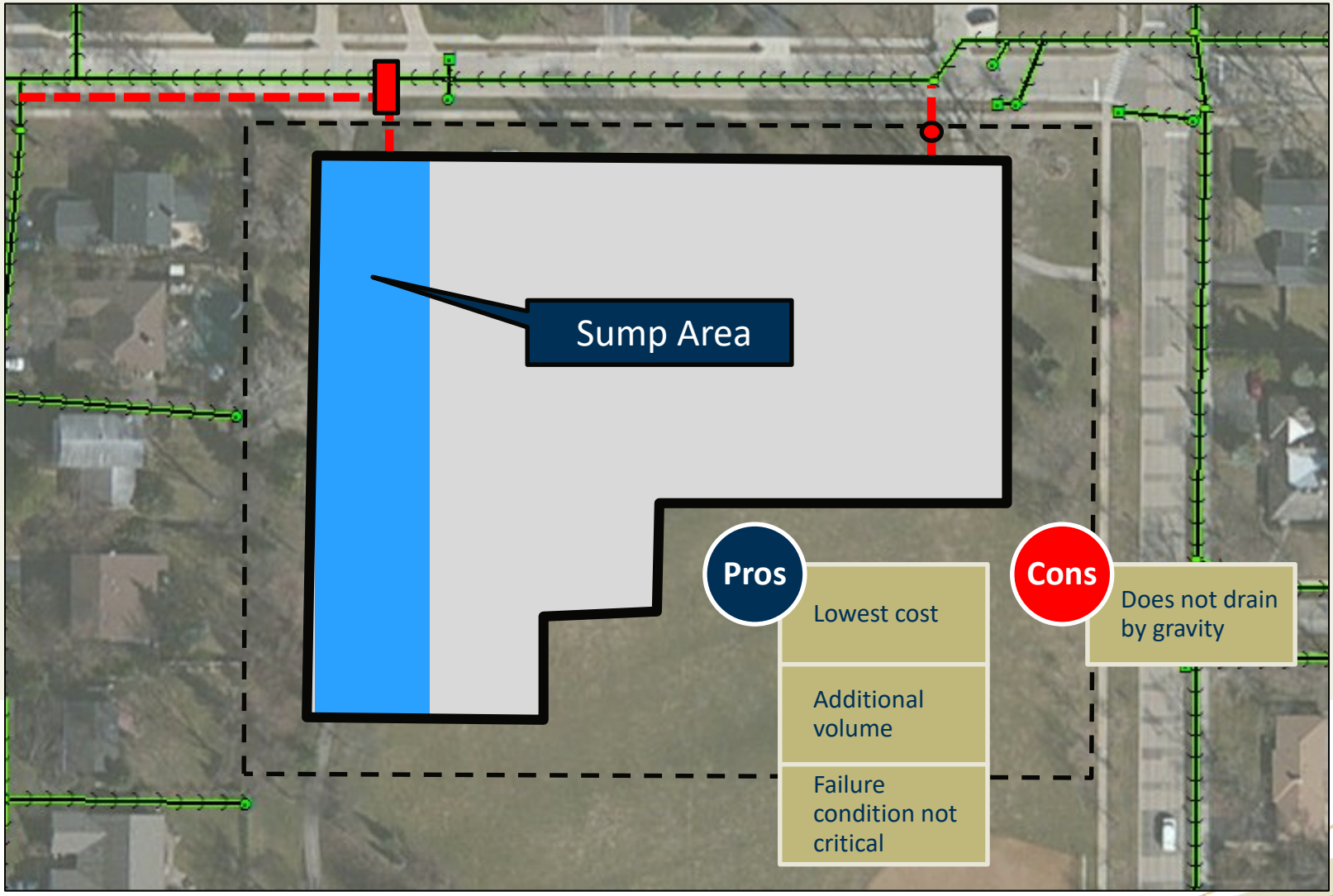
Storage Configuration



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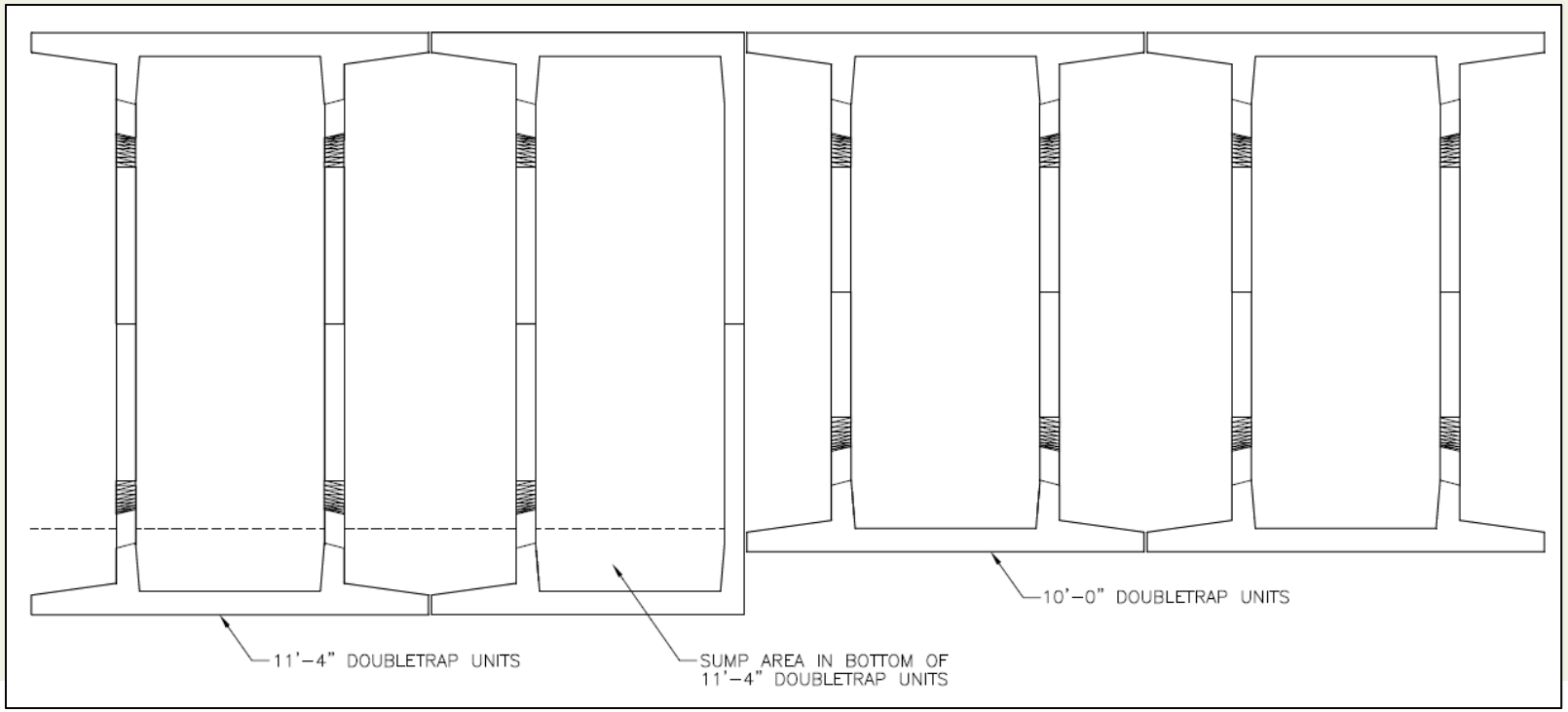
Storage Configuration



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Construction Photos

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Construction Photos

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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

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UAV– Flooding Assessment

UAV– Flooding Assessment

UAV– Flooding Assessment

UAV– Streambank Assessment

UAV– Streambank Assessment

UAV– Bridge Inspection

UAV– Bridge Inspection

UAV– Bridge Inspection

UAV– Bridge Inspection