When Your Offsite Tributary Area Dwarfs the Project Area

A Case for "Back to Basics"



Steve Kaminski, pe, cfm Mackie Consultants, LLC

March 2019

Who's Here Today?

- Consultants
- Government Agencies
- Architects / Planners
- Developers

Word Association

What comes to mind when I say "Low Impact Design?"

What's the crucial first step?

What's the crucial first step?

Comprehensive Environmental Inventory

What's the crucial first step?

Comprehensive Environmental Inventory

No amount of headliner LID practices can substitute for this.

Part 1: Maps

- USGS Hydrologic Atlas (or Streamstats)
- Wetland Maps (NWI or ADID)
- NRCS Soil Maps
- FIRM and local flood maps
- Aerial Photography and GIS contours



USGS Hydrologic Atlas



ADID Wetland Map



NRCS Soil Map







2015 Aerial Photo



Part 2: Site Walk

- Observe and note significant features
- Provide direction to surveyor doing topographic survey
- Watch for special environmental factors

Part 3: Topographic Survey

- **Part 4: Drain Tile Inventory**
- **Part 5: Wetland Delineation**

Part 6: Tree Inventory

(or simplified means of identifying priority trees)

Part 7: EcoCAT

The order here depends on the site size and complexity.

Be flexible, but think it through.

Part 8:

Soil & Water Conservation District Land Use Opinion

Often required for a subdivision, so get it done early when it can help you design the plan, not at the end as a checklist item.



Comprehensive Environmental Inventory Land Planning Participation

Step 2

Land Planning Participation



Convince the developer to involve you in land plan design, so you can include LID concepts

Convince the developer to involve you in land plan design, so you can include LID concepts

How to fail:

"Let's save the Earth together!"

Convince the developer to involve you in land plan design, so you can include LID concepts

How to fail:

"Let's save the Earth together!"

How to succeed:

"Let's do this smarter so that it's easier and faster to get permits and cheaper to build."

Provide an environmental inventory exhibit to the land planner showing all significant onsite and adjacent resources identified in Step 1.

Coordinate with land planner and developer on project goals and include suggested detention locations and approximate sizing.

Land Planning Exhibit Example



Iterative and collaborative process among developer, land planner and engineer.

Establish balance of priorities:

- 1. Development Economics
- 2. Development Aesthetics
- 3. Environmental Preservation
- 4. Environmental Enhancements

Municipal constraints:

Agency attitudes towards LID practices

Political considerations

Code constraints

Comprehensive Environmental Inventory Land Planning Participation Implement LID practices



Implement LID Practices

Implement LID Practices

- 1. Review inventory results to date to prioritize LID practices desired.
- 2. Concept design and developer buy-in.
- 3. FINALLY: Implement your great ideas!



Case Study: South Pointe Subdivision

60 acre property

Former Sand & Gravel mine

Extensively mined below water table

Currently a CCDD fill site



South Pointe Subdivision Environmental Inventory

- No mapped flood plain, but 320 acres upstream routed through site in a 72" storm sewer (undocumented).
- 2. ADID wetland along west side of property and extensive standing water internally.
- 3. Prairie Path spur along East line and IDNR state park land east of the path.
- 4. Endangered: Blandings Turtle, Yellow-Headed
 Blackbird, Rusty Patched Bumble Bee.

South Pointe Subdivision Environmental Inventory

- 5. No existing interior trees (mined), mostly buckthorn and cottonwood on perimeter.
- 6. NRCS Groups A and B soils indicated, but not applicable since mining removed them down to clay (Group D), so little infiltration capacity.
- 7. Drain tiles destroyed by mining, but mapped where tiles enter site from upstream.
- 8. Village water available along frontage, but sanitary requires a lift station reconstruction.

South Pointe Subdivision Land Planning

Developer goals:

- 1. Single family lots. Size not important as long as 3 car garage fits.
- 2. 3.5 acre park site desired.
- 3. Minimize wetland mitigation costs.
- 4. Permit a Prairie Path connection to interior walks.
- 5. Minimize construction costs (as always!).

1. Accidental LID:

Reclaiming mined land instead of leaving it as a pit lake.

CCDD rarely involves controlled fills that allow residential construction, so this site gets 3 uses instead of 1. A 67% greenfield sprawl reduction!

 Wetland consultant found that only the ADID wetland along the west line is regulatory. Other wet areas are forced by mining activities (not abandoned), so not regulated.

As a result, avoidance allows smaller Kane buffers than Corps buffers. Design for zero impacts.



- 3. Eliminate poorly situated 72" storm sewer and restore natural hydrology to IDNR and Prairie Path sites.
 - This item creates a large volume control effect because it routes offsite runoff through unmined sand and gravel areas.



4. Route offsite area through detention instead of bypass pipe to improve regional treatment train.



Some designers and agencies still are sizing pond restrictors based only on site area and only sizing the overflow weir for the total area flows.

Some designers and agencies still are sizing pond restrictors based only on site area and only sizing the overflow weir for the total area flows.

WRONG!

Calculate detention based on disturbed area in a "theoretical model." Then size restrictor based on <u>entire</u> tributary area, then check "Actual Proposed" model to verify required volume actually fills.

Over-choking the restrictor causes the pond to fill up before the hydrograph peak arrives. If that happens, no attenuation benefit occurs and the entire detention system is a waste of land and money.

Comparative Hydrographs



CFS

HOURS

Check ordinances for things like volume safety factors and maximum on/offsite area ratio limits.

Excessive offsite area can result in the same problem of volumes that fill before the peak arrives.

In such cases, try splitting offsite flows such that low flows are online and flood flows bypass. Actual Proposed model can get complicated.

South Pointe had 320 acres and 5 offsite reservoirs to model.

Use permit records and GIS contours to simplify data gathering and approximately model offsite detention.



 Configure detention system across drainage route to reduce conveyance system costs, improve naturalized shoreline contact time and avoid building homes on constantly wet soils.



 Utilize trade areas to maintain diffused hydrology for preserved wetlands on west side <u>BONUS:</u>

> Developer gets premium walkout basement lots, but still lower peak discharges there.



The Punchline

Did you notice that this case study has none of the cutting edge LID techniques we discussed at the beginning?

No green roofs, no permeable pavers, no rain gardens, no cisterns.

The land plan itself is straight up 1978, no LID there.

No Sizzle...

Lots of Steak



South Pointe Subdivision <u>The Results</u>

Volume Control for 1", 24 hour storm: Onsite net: +0.08 ac ft (incl. 50% Kane VC) Offsite net: -0.25 ac ft (Due to restored overland flow in sand and gravel areas)

Net reduction of 0.17 ac ft in total watershed runoff volume.

South Pointe Subdivision The Results

Peak Runoff Rates:

Q2: 19.6 cfs Pre / 14.7 cfs Post-ProjectQ100: 105 cfs Pre / 88 cfs Post-Project

Over the 381 acre watershed, that's 0.04 cfs/ac and 0.23 cfs/ac, respectively.

Not too bad for a suburban subdivision!

South Pointe Subdivision <u>The Results</u>

Other Achievements

- 1. Total wetland avoidance and average buffers in excess of Kane County minimums.
- 2. Restored surface hydrology improves water quality from Agricultural tributary area.
- 3. Regional detention in series treatment train reduces TSS and nutrient load.
- 4. Use of trade areas disperses runoff to adjacent wetland instead of concentrating entire watershed to one point discharge.
- 5. Small animal habitat connection to Prairie Path / IDNR

Moral of the Story

LID isn't primarily about using "magazine practices" but about actually minimizing environmental impacts.

Proper <u>site environmental inventory</u> and <u>your applied</u> <u>creativity</u> are what determines how much impact your design has on the environment.