Green Infrastructure
The Bottom Lines

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AMEC Environment & Infrastructure

Buckle up
USA Today today

- High volume builders
- Major high-demand market shift
- For baby boomers
- Abandoned downtown parcels
- Small 1 to 2 story SFR - walkable
- With green space
“Green” is popping up everywhere

- MS4 Compliance
- TMDL Mandates
- Park and Recreation Planning
- CSO Consent Decrees
- Livable Cities
- Water Supply Protection
- Federal Facilities
- Groundwater Replenishment
- “Sustainable” Popularity
- LEED or Other Ratings

It's now EASY being green!
Green Infrastructure is...

- Parks
- Walking trails
- Open space plans
- Conservation areas
- Urban forests
- Water features
- Stream preservation
- Recharge zones
- Cisterns
- Bioretention ponds
- Tree planters
- Infiltration sites
- Pervious pavement
- Retention ponds
- Wetlands
- Rain barrels
- Green roofs
- Rain gardens
As we move from individual site-based controls to coordinated neighborhood consideration the cost and value of GI become defining variables.
Planned Green Infrastructure

Source: Laurence Aurbach

- Retrofit designs for redevelopment will include shared green infrastructure
- This will require new ideas of ownership and funding

How much is Green Infrastructure worth and who says so?
TSS is getting bad !!

We are desperate for

Green Infrastructure!
Valuation Models
“What’s it worth… to me, not you!”

- **3 Ways to value GI**

  1. **Absolute Valuation**
     Return on investment
     “What will it cost & will I get a monetary return in a reasonable time?”

  2. **Relative Valuation**
     Cost of alternatives
     “If I must then what is the best effective alternative?”

  3. **Intrinsic Valuation**
     Value to “mankind”
     “Is a green approach a good thing for our city?”

- **Assigning Value**

  - Market costs (e.g. water cost)
  - Non-market (squishy costs):
    - Revealed Preference: Infer value from characteristics of GI
    - Stated Preference: Poll people
    - Avoided Cost: Marginal cost of providing same service another way

- **Value is skewed in a non-free market environment**

  - Is it voluntary or is it required?
  - Are there drivers that have little to do with economics?
1. Absolute Valuation - Businesses

- Some properties may want to build green
- If value > cost
- Measured by:
  - return on investment
  - net present value
  - break even time frame

Return on Investment (ROI)
The discount rate at which present costs equal present benefits of the investment. It is an indicator of the efficiency, quality, or yield of an investment. Same as IRR.

Net Present Value (NPV)
Using actual discount rate, the current value of the sum of a series of incoming and outgoing cash flows over a time period or the life of the project.


## ROI/NPV/BE Analysis

### Inputs:
- Discount Rate 6%
- Loan Rate 4%
- O&M Inflation 3%
- Fee Increase 6%
- O&M 1.7% CIP
- Loan Term 20 years
- Marginal Tax Rate 40.59%
- Equity 20%
- Depreciation 39 years
- Stormwater Fee Rate
- Stormwater Credit Rate
- Stormwater Grants

### Outgo –
- Equity Contribution
- O&M Cost
- Loan Payment

### Income –
- Stormwater Credit
- Tax Deductions
- Grants and Incentives
# GI ROI Calculator

**Assumptions**
- **Discount Rate**: 6%
- **Loan Rate**: 4%
- **Inflation of O&M Costs**: 3%
- **Stormwater Fee Increase Rate**: 6%
- **O&M**: 1.7% of CP
- **Loan Term**: 20 years
- **IA Rate**: $4,169
- **GA Rate**: $0.528
- **Unit of IA/GA**: 500 sf
- **Marginal Aggregate Tax Rate (PA, US)**: 49.59%
- **Depreciation Term**: 39 years

**Per Greened Acre Values - YR 1**
- **$133,000 Cost per Greened Acre**
- **88 IA Units Treated**
- **($2,261) O&M**
- **($7,029) Loan Payment**
- **$4,960 Credit**
- **$2,082 Credit Tax Reduction**
- **$3,112 Tax deductions**
- **$64 Total**

**Site Information**
- **Total IA**: 43,560 sf
- **Total GA**: 43,560 sf
- **treated IA**: 43,560 sf
- **SMP Construction Cost**: $133,000
- **Equity contribution**: $26,600 (20% fixed)
- **percent IA Available**: 100%
- **percent GA Available (under IA area)**: 100%

**Net Present Value (over 20 years)**: $(14,553)
- **Internal Rate of Return (over 20 years)**: 0.19%
- **Break-even Years**: > 20 Years

**Loan Calc**
- **Loan Beginning of Year**
<table>
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<th>Years</th>
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<td>$106,460</td>
<td>$102,827</td>
<td>$99,111</td>
<td>$95,246</td>
<td>$91,227</td>
<td>$87,047</td>
<td>$82,760</td>
<td>$78,179</td>
<td>$73,477</td>
<td>$68,587</td>
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</table>
- **Interest**
  |       | $4,256 | $4,113 | $3,964 | $3,810 | $3,649 | $3,482 | $3,368 | $3,127 | $2,939 | $2,743 |
- **Loan Balance End of Year**
  |       | $102,827 | $99,111 | $95,246 | $91,227 | $87,047 | $82,760 | $78,179 | $73,477 | $68,587 | $63,501 |

1. **Equity**
   - **CP Equity Contribution**: $4,960

2. **Credit**
   - **Stormwater Credit Savings (IA charge)**: $2,261

3. **O&M**
   - **O&M Cost**: $7,029

4. **Loan**
   - **Loan Payment**: $6,262
     - **a**. **Interest Deduction**: $1,728
     - **b**. **Depreciation Deduction**: $1,364
   - **c**. **Tax consequences from Credit, O&M and Loan Payment**: $2,082

5. **Tax (a+b+c)**
   - **Total Tax Consequences**: $4,883

**Sum 1-5**
- **Cash Flow To (From) Property Owner**: $(26,600)
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<th>Years</th>
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<td>$322</td>
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<td>$533</td>
<td>$652</td>
<td>$781</td>
<td>$921</td>
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*Note: This calculator is designed to provide a general understanding of the potential ROI of green infrastructure investments. It is not intended as a substitute for professional financial advice. The accuracy of the results may vary depending on specific project circumstances.*

The Philly Business Decision

Business Case - Green Infrastructure

1 Acre IA
All treated

Can Offset Costs with Incentive Grants
Incentives to Change the Equation

- Development
  - Zoning upgrade
  - Expedited permitting
  - Reduced requirements
  - Floor area ratio
- Fee Discounts
  - Stormwater credits
  - Property tax reduction
  - Sales tax exemption
  - Reduced development fees
- Recognition
  - Signage
  - Free advertising, etc.
  - Certification
- Assistance
  - Consulting
  - Review team
  - Resources

In developer meetings the greater the bottom line change the greater the support

Duh!!
1. Absolute Valuation - Cities

- What are the real, LOS life-cycle costs for cities?
- How can I reduce them?
- Cost Categories:
  - Capital Cost
  - Rehabilitation Cost
  - Operation and Maintenance Cost
  - Administrative Cost

Cities use: creative contracting, advanced technology, cost leveraging, strict specifications and construction inspection, asset management systems, asset preservation incentives, private investment and multi-objective revenue streams to help.
If you **have** to do it then you normally use **relative** valuation:

“ok… THAT’S too expensive.

What else can we try?”
2. Relative Valuation

- What is the cost of Green Infrastructure compared to traditional methods?

**RISK:**
- Who is suspicious of Green Infrastructure and needs convincing?
- What are the "imponderable" examples:
  - Cistern vs. water use
  - Green storage vs. gray storage for CSO
  - Green flood reduction vs. sewer upsizing
  - Green street vs. pavement vs. sewer

Happens all the time: Portland OR, Kansas City, MO, Chicago, IL, Portland, ME.

*Imponderable: unforeseen, impacting and out of my control*

May, 2012
Special Edition

"It would be a shame for something to happen to that nice green infrastructure of yours"
## EPA LID Relative Valuation Study

<table>
<thead>
<tr>
<th>Project</th>
<th>Conventional Development Cost</th>
<th>LID Cost</th>
<th>Cost Difference$^b$</th>
<th>Percent Difference$^b$</th>
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<tbody>
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<td>2nd Avenue SEA Street</td>
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<td>$217,255</td>
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<td>Auburn Hills</td>
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<tr>
<td>Bellingham City Hall</td>
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<tr>
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<td>Gap Creek</td>
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<td>$3,942,100</td>
<td>$678,500</td>
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<tr>
<td>Garden Valley</td>
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<td>$260,700</td>
<td>$63,700</td>
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<tr>
<td>Kensington Estates</td>
<td>$765,700</td>
<td>$1,502,900</td>
<td>–$737,200</td>
<td>-96%</td>
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<td>Laurel Springs</td>
<td>$1,654,021</td>
<td>$1,149,552</td>
<td>$504,469</td>
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<tr>
<td>Mill Creek$^c$</td>
<td>$12,510</td>
<td>$9,099</td>
<td>$3,411</td>
<td>27%</td>
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<td>Prairie Glen</td>
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<td>Tellabs Corporate Campus</td>
<td>$3,162,160</td>
<td>$2,700,650</td>
<td>$461,510</td>
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Relative Valuation - Philly

- It costs Philadelphia $200k to build a greened acre downtown
- They have to build greened acres
- Any private source of volume storage is theoretically worth up to $200k/acre to them
3. Intrinsic Valuation
Total Economic Value

- **Use Value**
  - Direct Use
    - Recreation
    - Mobility
    - Production
  - Indirect Use
    - Environmental function
    - Health risk avoidance
    - Living condition effects

- **Non-Use Value**
  - Existence
    - Support of biodiversity
    - Property values
  - Legacy
    - Preservation for future generations
  - Altruistic
    - General well being and benefit

- **Investment Value**
  - Job creation
  - Land and facility value
Ecosystem “Services”

- **Regulating and Supporting**
  - Climate, water
  - Disease regulation
  - Pollution
  - Soil formation
  - Nutrient recycling and decomposition

- **Cultural Services**
  - Educational
  - Aesthetic
  - Cultural heritage
  - Recreation
  - Tourism

- **Provisioning**
  - Food, water,
  - Fuel, fiber
Europe’s VALUE System

**ECONOMIC GROWTH AND INVESTMENT**
- Businesses attract and retain more motivated staff in greener settings

**LAND AND PROPERTY VALUES**
- Views of natural landscapes can add up to 18% to property values

**LABOUR PRODUCTIVITY**
- Green spaces near workplaces reduce sickness absence, increasing productivity

**TOURISM**
- Rural tourism supports 37,500 jobs in the Northwest

**PRODUCTS FROM THE LAND**
- 40,000 people work in agriculture in the Northwest

**HEALTH AND WELLBEING**
- Green infrastructure reduces pollution which leads to asthma and heart disease

**RECREATION AND LEISURE**
- Footpaths, cycle paths and bridleways enable healthy, low-cost recreation

**QUALITY OF PLACE**
- Community-owned green spaces can create jobs and local pride

**LAND AND BIODIVERSITY**
- Green infrastructure provides vital habitats and jobs managing the land

**FLOOD ALLEVATION AND MANAGEMENT**
- Urban green spaces reduce pressure on drainage and flood defences

**CLIMATE CHANGE ADAPTATION AND MITIGATION**
- Green infrastructure can counter soaring summer temperatures in cities
## CNT Valuation Approach

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This amounts to a 23:1 return on investment Green Infrastructure over Grey Tunnel.
Two Bottom Lines

Old Grey Engineers

- “We know grey infrastructure works”
- “Who will maintain green infrastructure?”
- “If it fails we are out of compliance”
- “We still need to build for flood control”
- “It’s all so natural – I don’t trust it!”

Young Green Persons

- “Studies show green is overall superior”
- “Most requires little maintenance”
- “Regulators have made allowance”
- “GI reduces the in flood control costs”
- “It’s all so natural – I love it!”
The Green Infrastructure Business Plan (in 3 easy steps)

It is best to do this together…

1. **Drivers** Why do you want to (have to) do GI – what is your compelling case? What do you mean by GI?

2. **Vision** What is our vision for the end game – what does attractive success look like to everyone who must have a voice?

3. **Plan** What is our (appropriately inclusive and detailed) institutional and technical roadmap to get from here to there – including players, actions, milestones, and funding?
“Supporting the work of local communities to... build greener, more economically vibrant communities is a key Administration priority. Green infrastructure is a win-win-win approach and a fundamental component of the U.S. EPA’s sustainable community efforts.”