Low Impact and Green Infrastructure Practices for Stormwater

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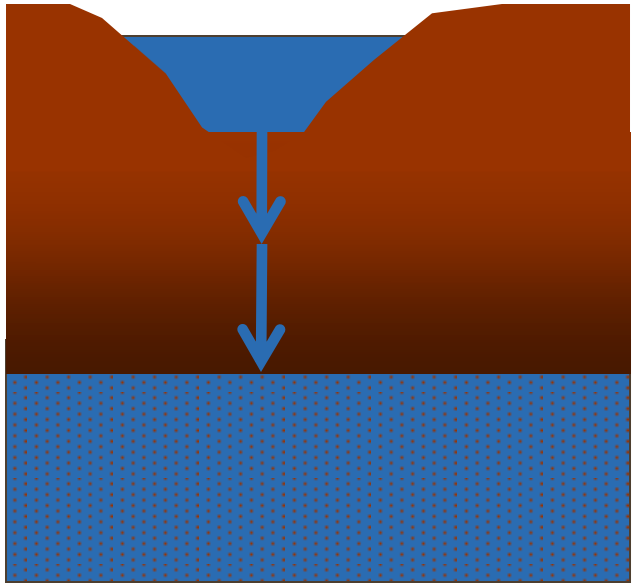
PIMA COUNTY
FLOOD CONTROL

Local Drought Impact Group
January 14 - 2015

Recharge vs Capture

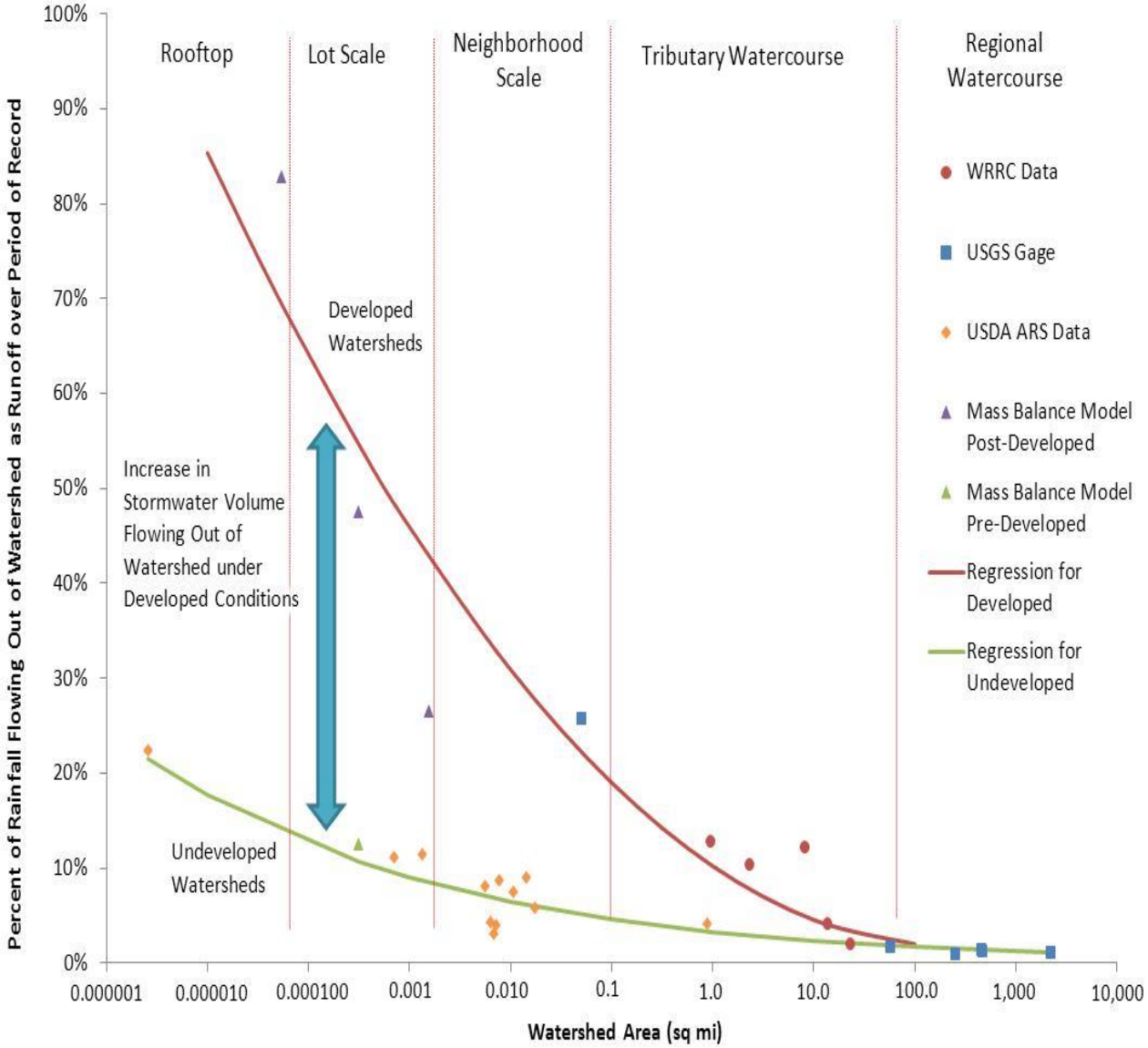
Recharge - Infiltrate to the regional aquifer for future use.

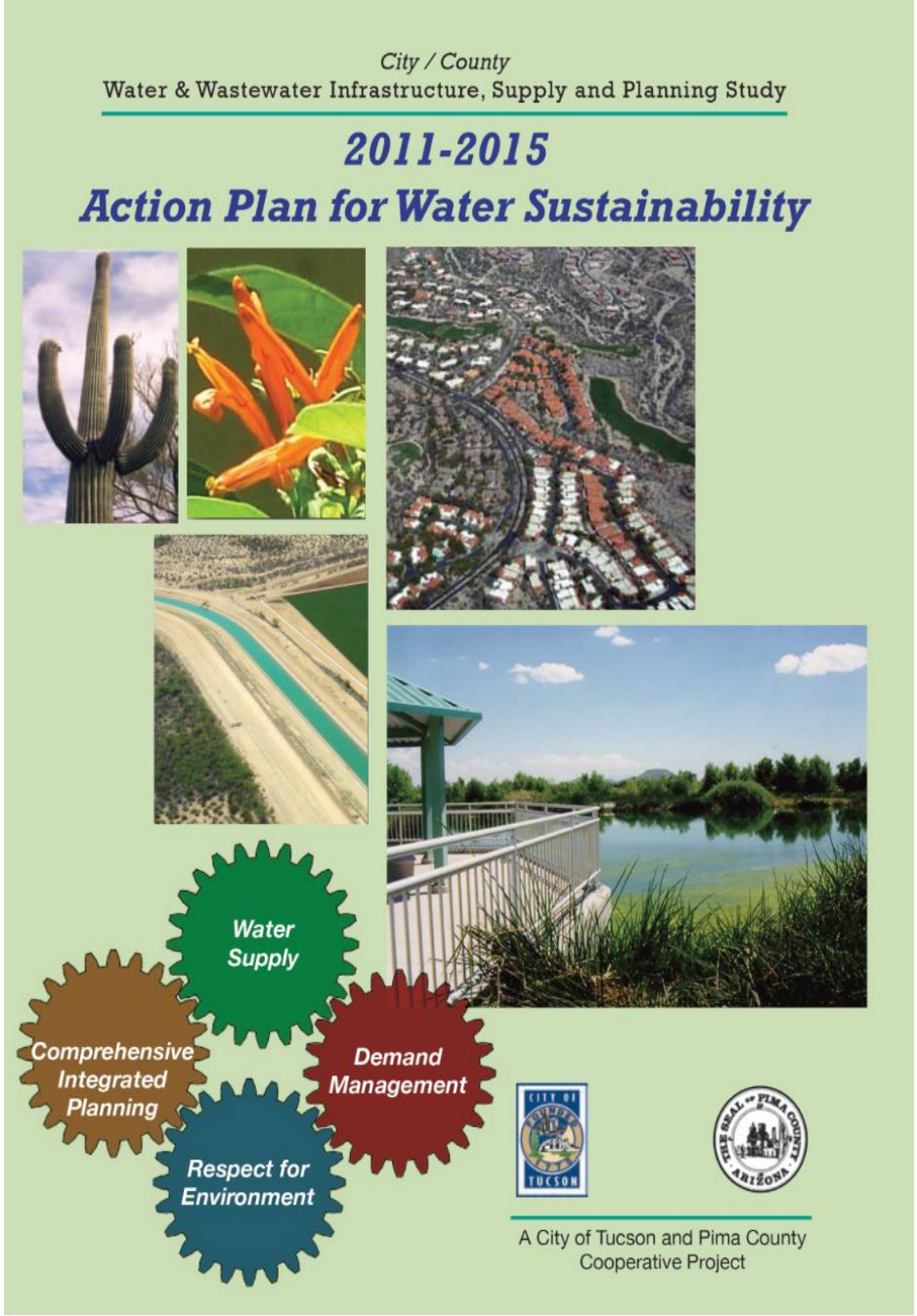


Capture – store for use in the near term.

'Harvestable Water' (Rainwater/Stormwater)

i.e. water yield





Applicable Goal

Demand Management Goal #5: *Increase the use of rainwater and stormwater to reduce demands on potable supplies.*

Action Plan

Demand Management Action Plan #7: *Develop Design guidelines for neighborhood stormwater harvesting to encourage the creation of habitat and water efficient landscapes.*

Low Impact Development and Green Infrastructure Guidance Manual

December 2014

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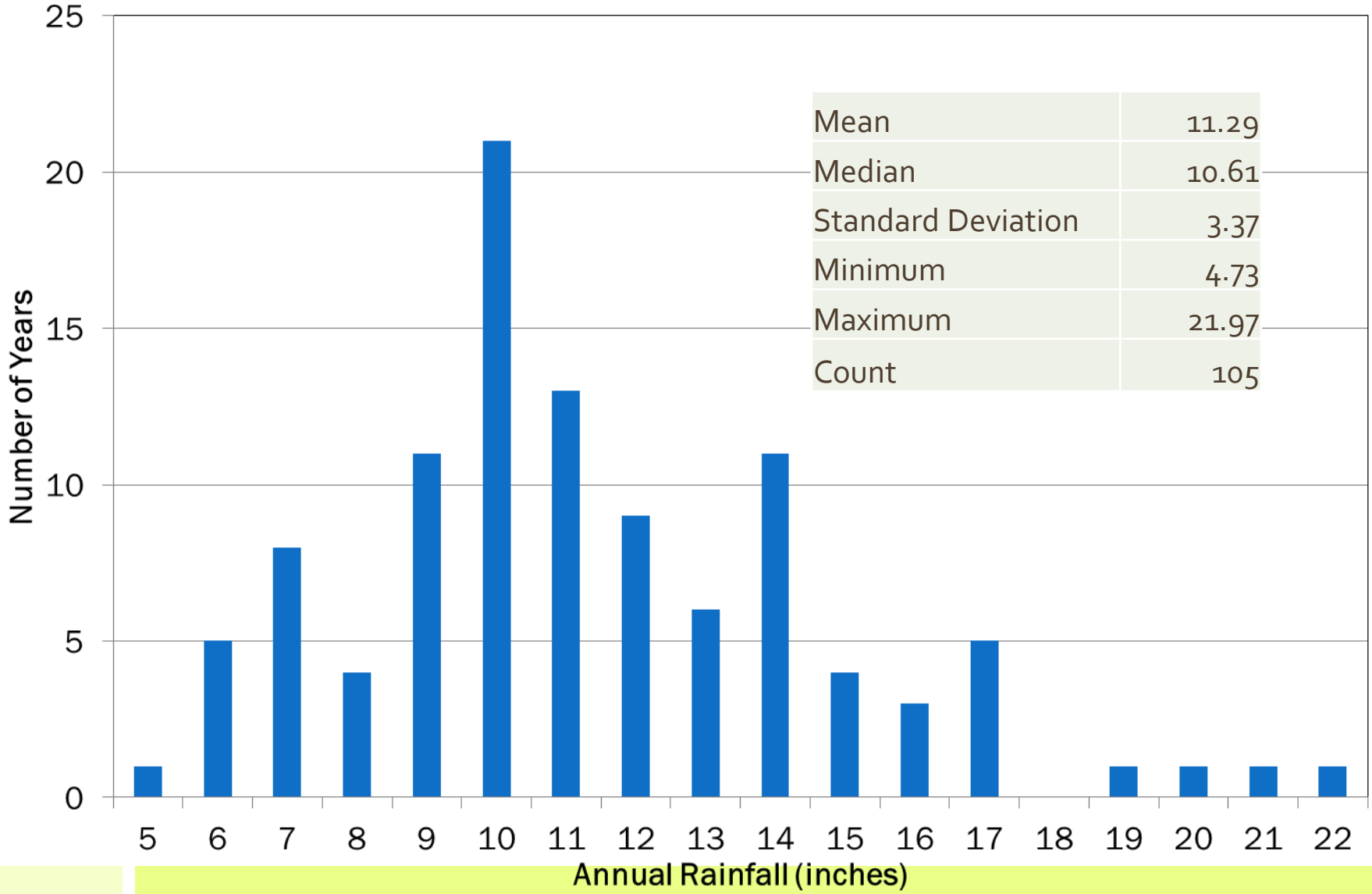
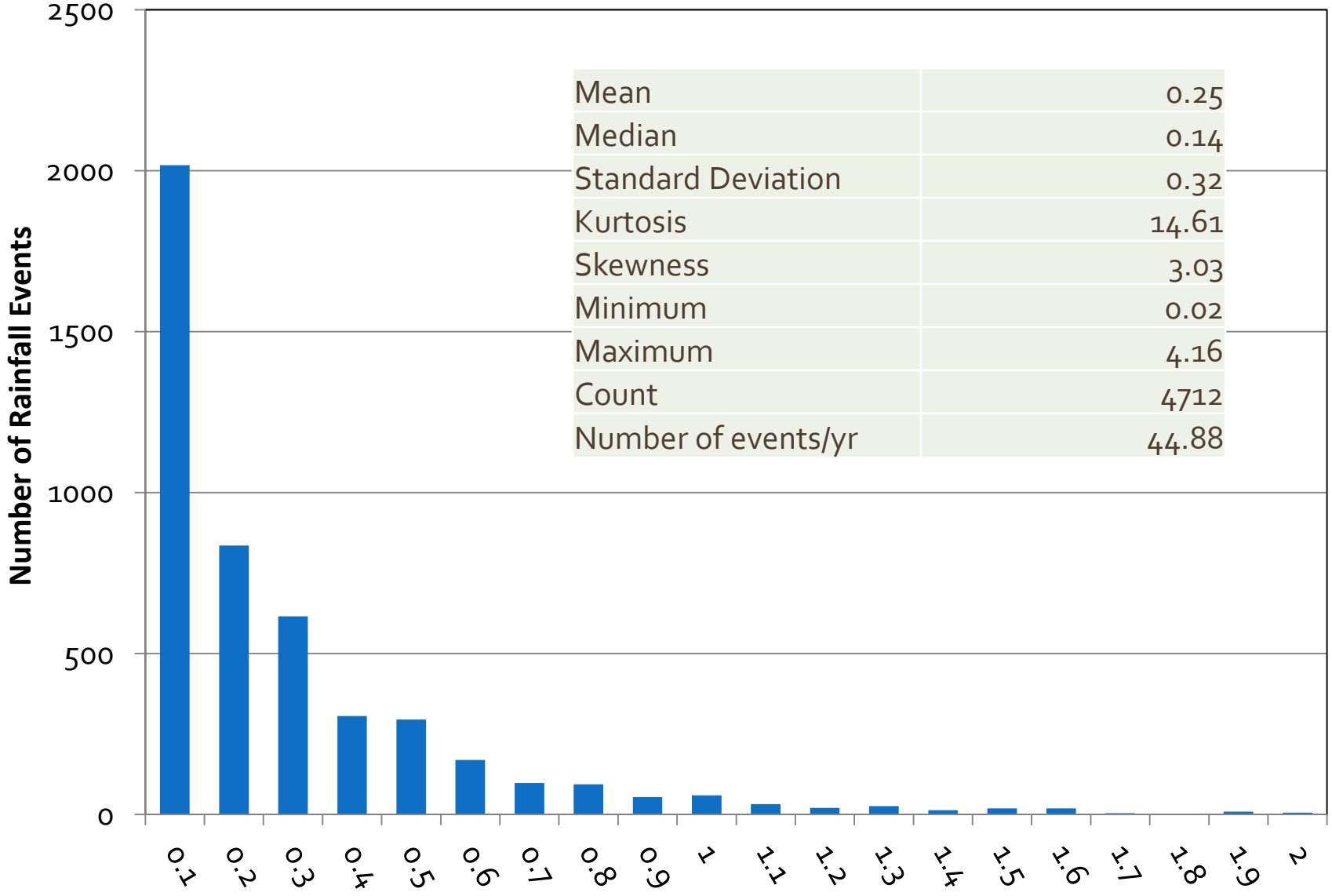
Histogram of Annual Rainfall
University of Arizona 1896-2000 (water years)



Mean	11.29
Median	10.61
Standard Deviation	3.37
Minimum	4.73
Maximum	21.97
Count	105

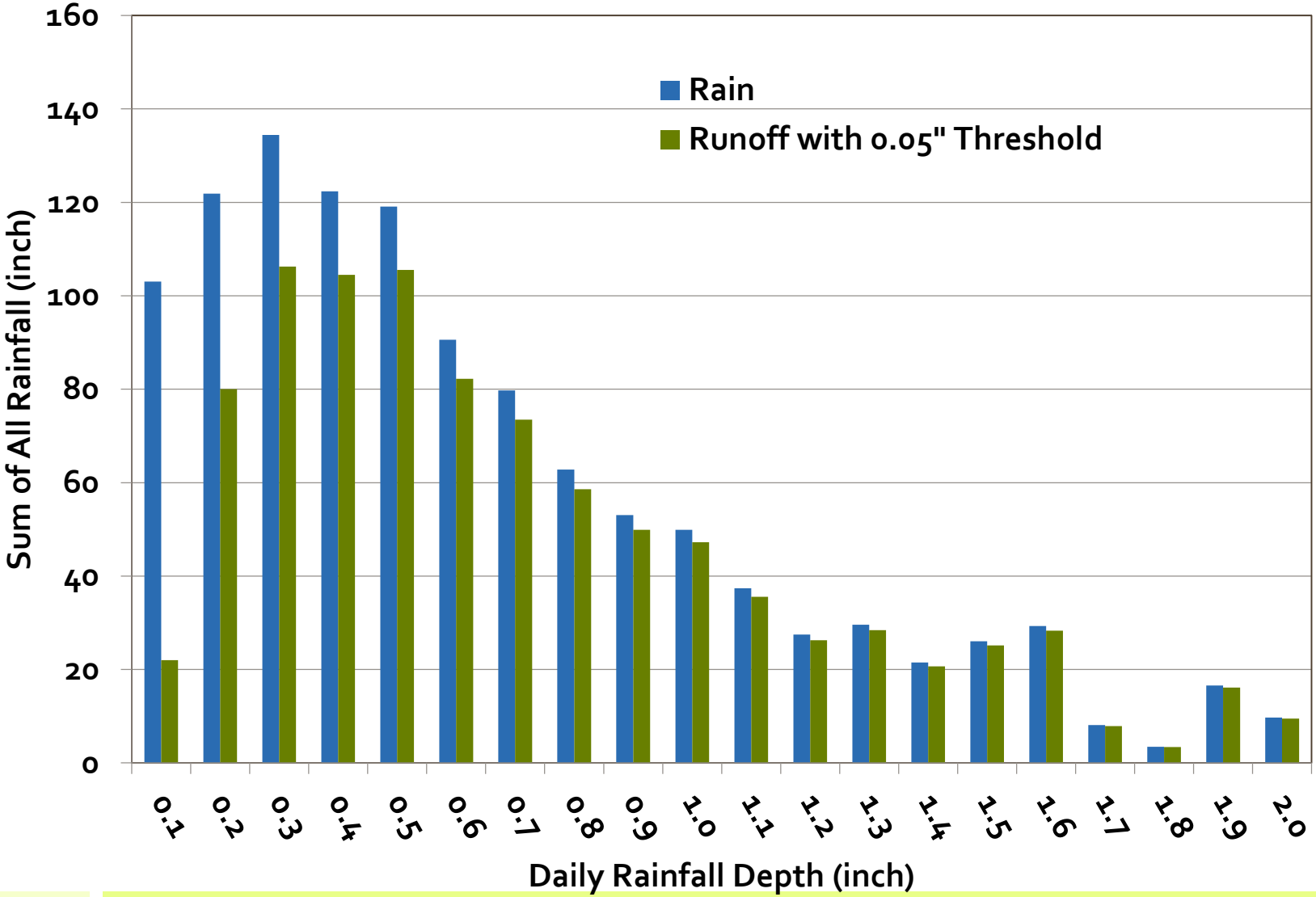
Histogram of Daily Rainfall (1895 to 2000, University of Arizona)



Mean	0.25
Median	0.14
Standard Deviation	0.32
Kurtosis	14.61
Skewness	3.03
Minimum	0.02
Maximum	4.16
Count	4712
Number of events/yr	44.88

Impervious Doesn't Mean a Roof Sheds 100% of the Rain

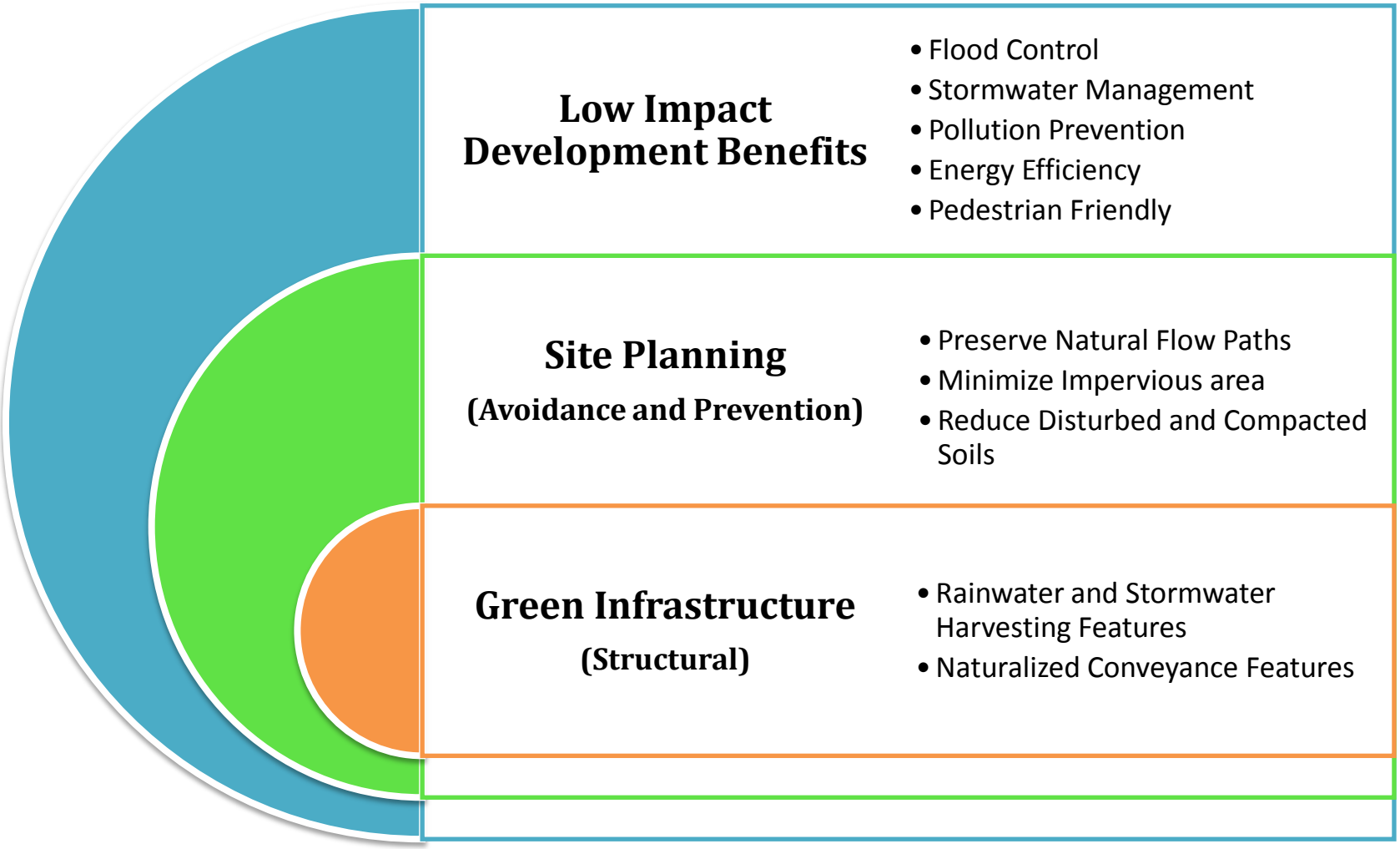
Total Volume of Rainfall and Runoff with 0.05" Threshold (1895 to 2000, University of Arizona)

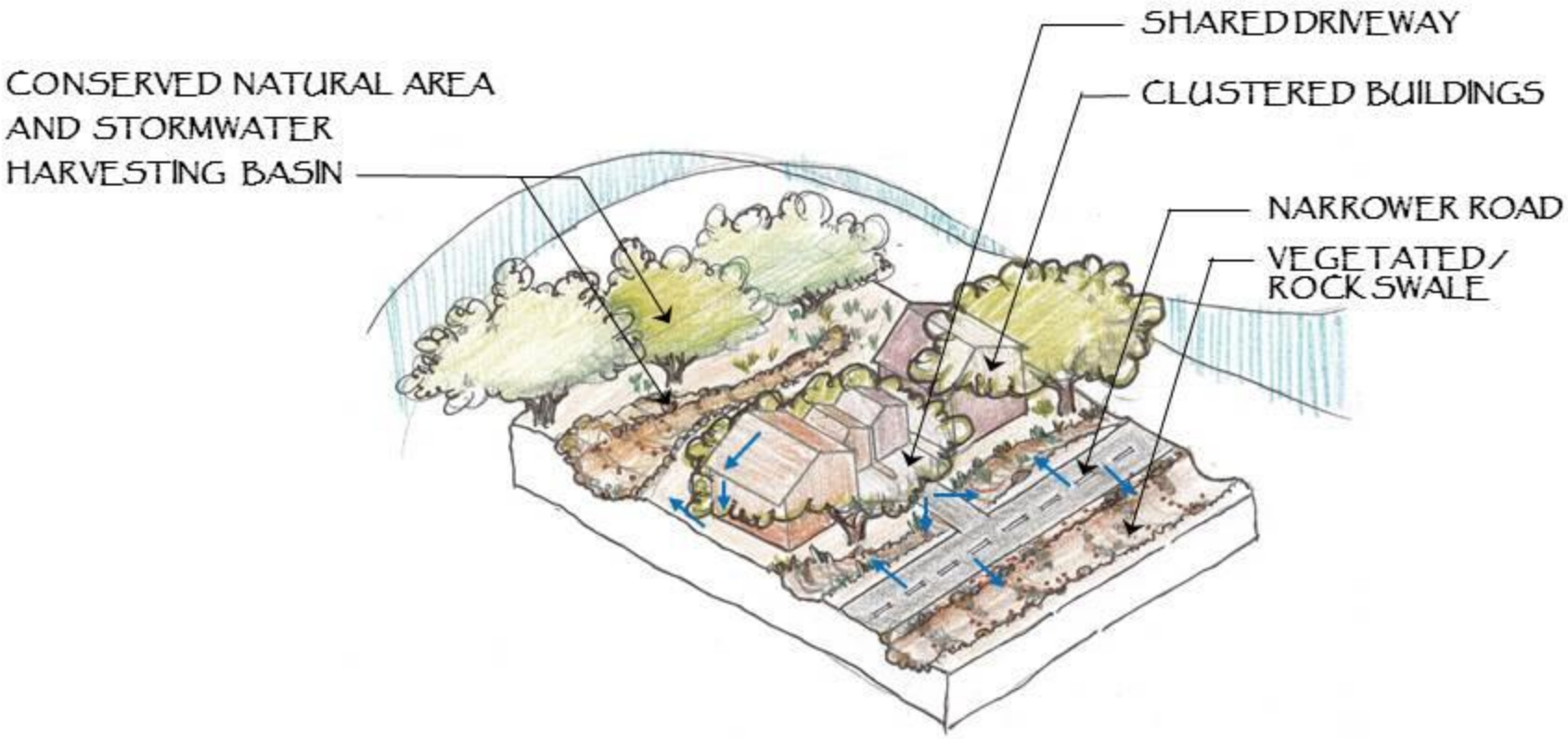


Neighborhood-Scale Water Harvesting Manual

Local Priority	Type: Pretreatment	Bioretention	Filtration	Infiltration	Runoff Volume Minimization	End of Pipe	Agency / Jurisdiction / Document / Date of Publication	Research Team Member Assignments	City of Santa Barbara / SW BMP Guidance Manual / 2008
high							Best (LID) Site Design Practices (Non Structural BMPs)		X
high					O		Natural/Sensitive Area Conservation/Restoration	Stantec (JT)	O
high					O		Impervious Area Disconnection		O
high					O		Minimize Impervious/Disturbed Areas		O
high					O		Cluster Development (Minimize Construction Footprint)		
high					O		Minimize Soil Compaction		
high				O			Protect/Use Natural Flow Paths and Buffers		O
high				O			Promotion of Open Space Design/Natural Infiltration		
high	O						Implement Source Controls		
medium	X		X				Media Filters / Filtration Devices	Eric	X
high	X		X				Sand Filter and Gravel Filters		X
medium	X						Hydrodynamic / Solids Removal Devices		X
medium	X						Oil and Water Separators		
high		X					Bioretention / Rain Gardens	Dave	X
high		X					Tree Pits / Tree Box Filters / Planters	Irene	X
high			X				Xeriscaped Buffers / Filter Strips / Swales	Evan	X
high				X			Dry Wells	Evan	X
high				X			Infiltration Basin / Systems	Stantec (JT)	X
high				X			Infiltration Trench or Gallery		X
high				X			Soil Amendments / Structural Soils	Irene	X
high					X		Porous/Pervious Pavements	Irene	X
high					X		Rainwater Harvesting for Use (Rain Barrel / Cistern)	Irene	X
high					X		Self-Treating Areas (Zero Discharge Microbasins)	Dave	X
high					X		Downspout Disconnection / Redirection	Stantec (JT)	X
high						X	Detention Basin / Gallery / Dry Ponds	Stantec (JW)	X
high						X	Retention Basin	Stantec (JW)	
medium							Diversion Structures / Flow Splitters / Green Outlets	Stantec (JT)	X
high							Source Controls (Non Structural BMPs)		X
?					O		Runoff Volume Minimization	Stantec (JT)	O
?	O						Manage Potential Stormwater Hotspots		
?	O						Roof Runoff Protection		
?	O						Runoff Quality Protection		O

LID Planning Practices Should Be Considered Before Structural Practices





DISCONNECTION IMPERVIOUS AREAS AND THE COMPATIBILITY WITH OTHER LID PRACTICES

LID Planning Practices

GI/LID Non-Structural Practices / Benefits	Stormwater Runoff		Improves Community Livability			Regulatory
	Reduces Flooding	Improves Stormwater Quality	Reduces Urban Heat Island & Associated Energy Use	Can Provide Shade for Passive Recreational Use	Provides Wildlife Habitat	Riparian Protection*
Conserving or Restoring Sensitive Natural Areas	●	●	●	●	●	●
Preserving Natural Flow Paths	●	●	●	●	●	●
Preserving Natural Open Space	◒	◒	●	●	●	●
Minimization of Disturbed Areas and Soil Compaction	●	●	◒	◒	◒	◒
Disconnection of Impervious Areas	◒	●	○	○	○	○

Based on Table from American Rivers, "The Value of Green Infrastructure", 2010.

● Yes ◒ In Some Cases ○ No

*Ordinance No. 2010 FC5 Title 16 Chapter 16.30

Alternative Site Design

TRADITIONAL: Channelized Drainage

LID: Drainage through Natural Open Space

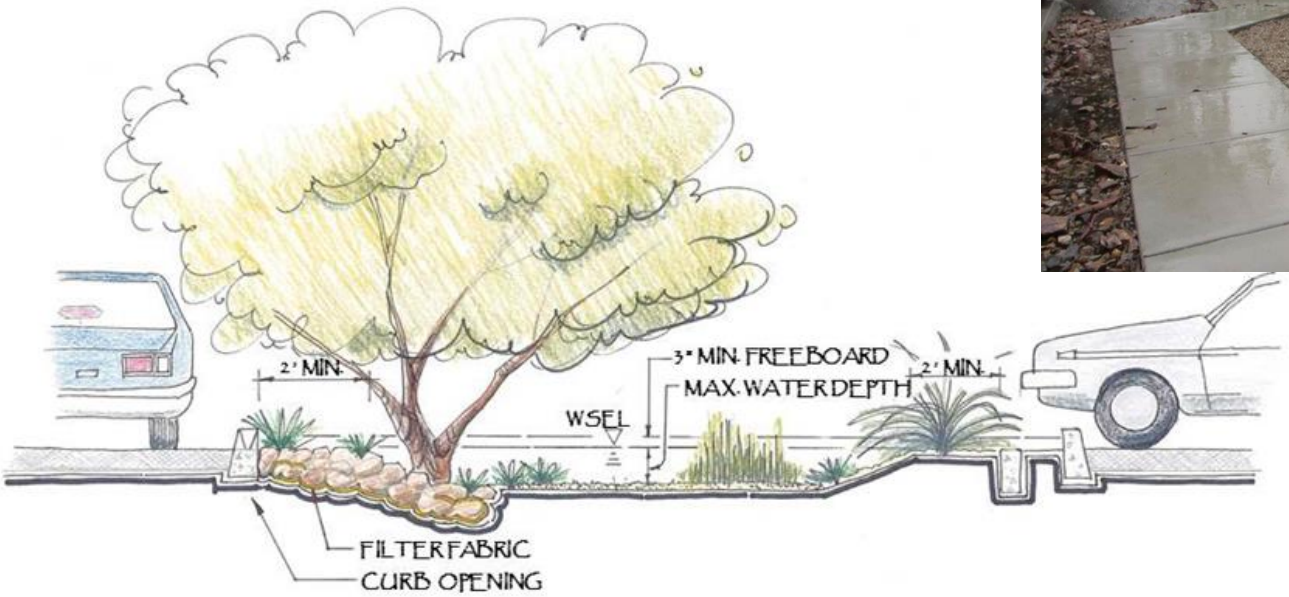
Structural Practices

GI/LID Practices \ Benefits	Reduces Stormwater Runoff		Increases Available Water Supply		Improves Community Livability			
	Reduces Flooding	Improves Stormwater Quality	Reduces Demand for Potable Water	Provides Storage for Use During Dry Periods	Reduces Urban Heat Island and Associated Energy Use	Can Provide Vegetation for Shade and Passive Recreational Use	Improves Aesthetics	Provides Wildlife Habitat
Stormwater Harvesting Basins and Swales	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Bioretention Systems	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Infiltration Trenches	Yes	Yes	In Some Cases	No	In Some Cases	In Some Cases	In Some Cases	In Some Cases
Cisterns	In Some Cases	In Some Cases	Yes	Yes	No	In Some Cases	No	No
Permeable Pavements	Yes	Yes	No	No	In Some Cases	No	No	No
Dry Wells	Yes	Yes	No	No	No	No	No	No

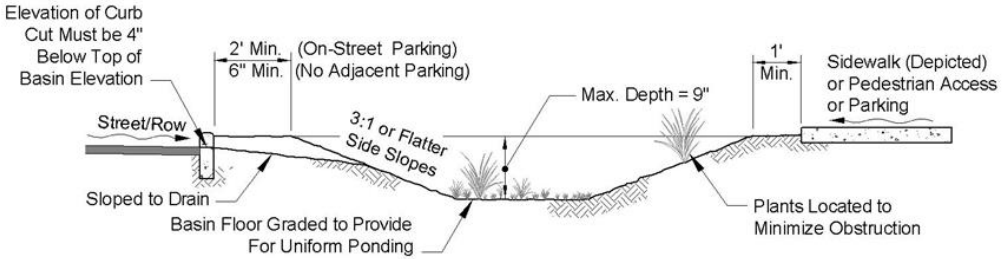
Based on Table from American Rivers, "The Value of Green Infrastructure", 2010.

Yes — In Some Cases — No

Stormwater Harvesting Basins

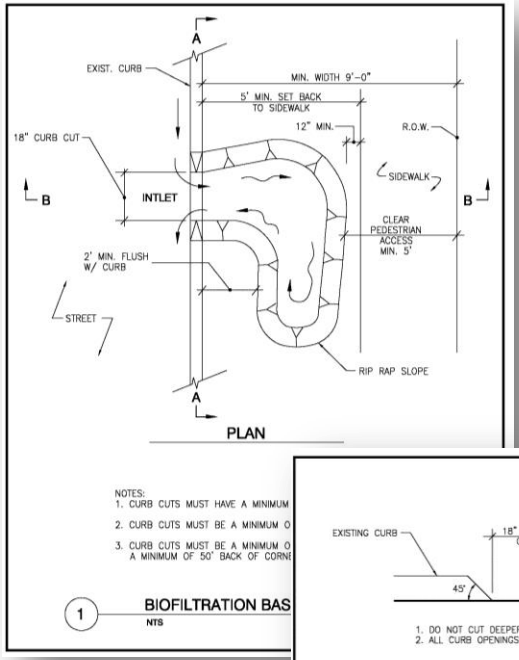


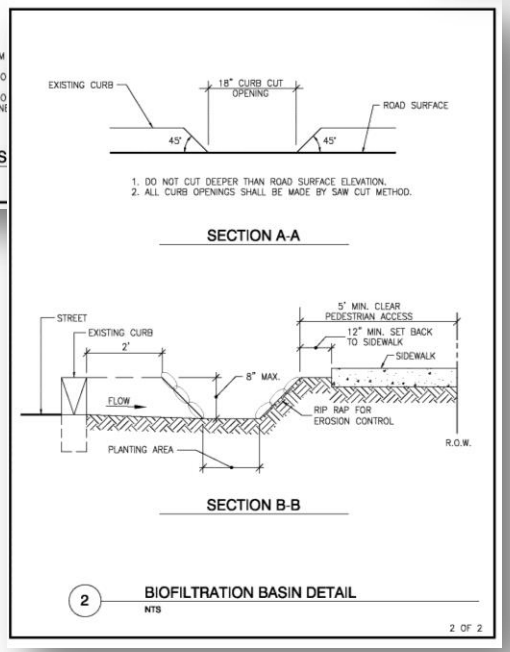
WATER HARVESTING BASIN



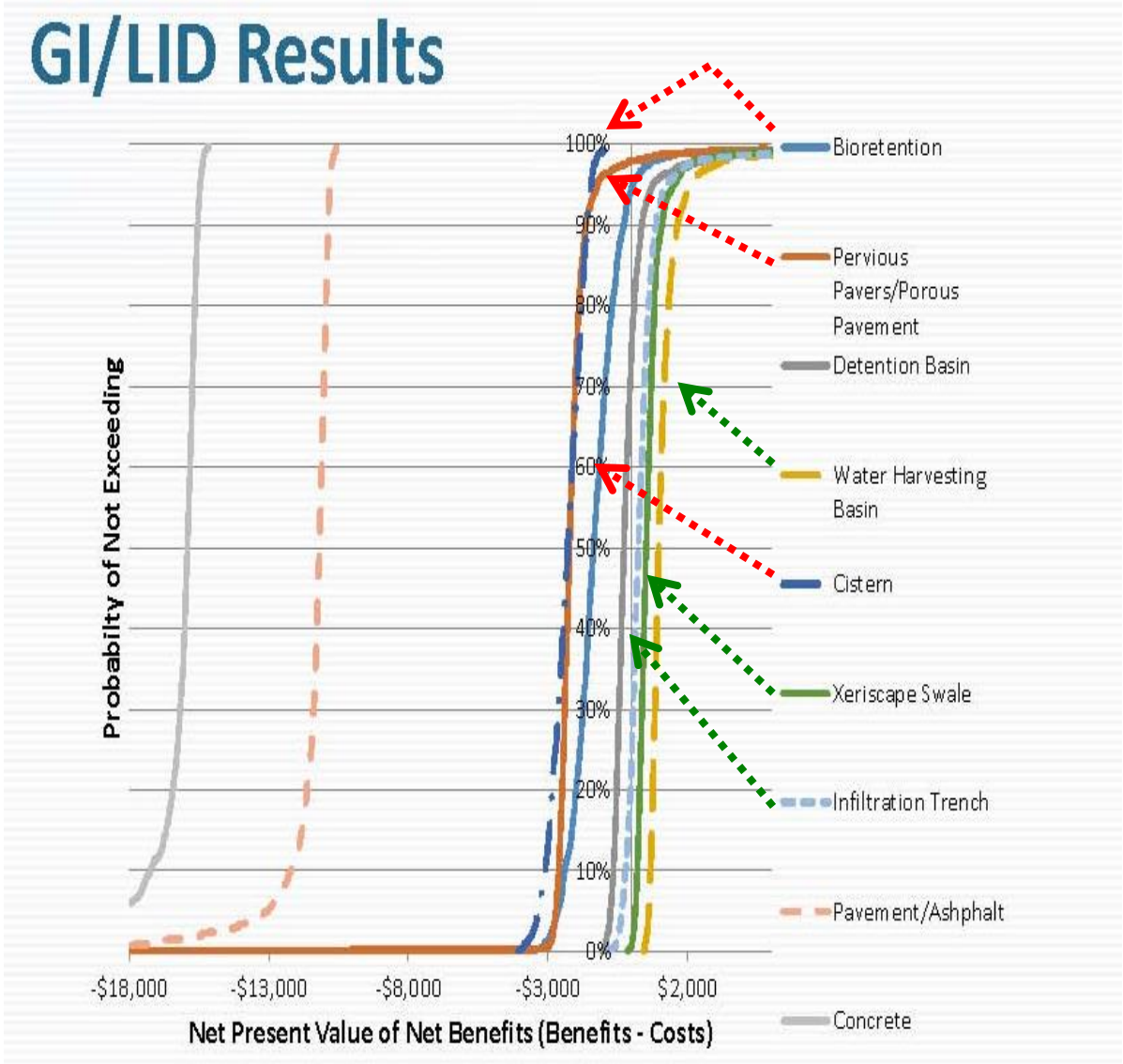
ELEVATION VIEW

Curb Cut Standards





The Business Case: AutoCASE Stormwater Beta Testing



- **Highest Beneficial GI features**
  - Water Harvesting Basin / Infiltration Basin
  - Xeriscape Swale
  - Infiltration trench
- **Not as cost Beneficial GI features**
  - Pervious Pavers/Porous Pavement
  - Cistern
  - Biorention

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PAG Pima Association of Governments

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Impact Infrastructure, LLC
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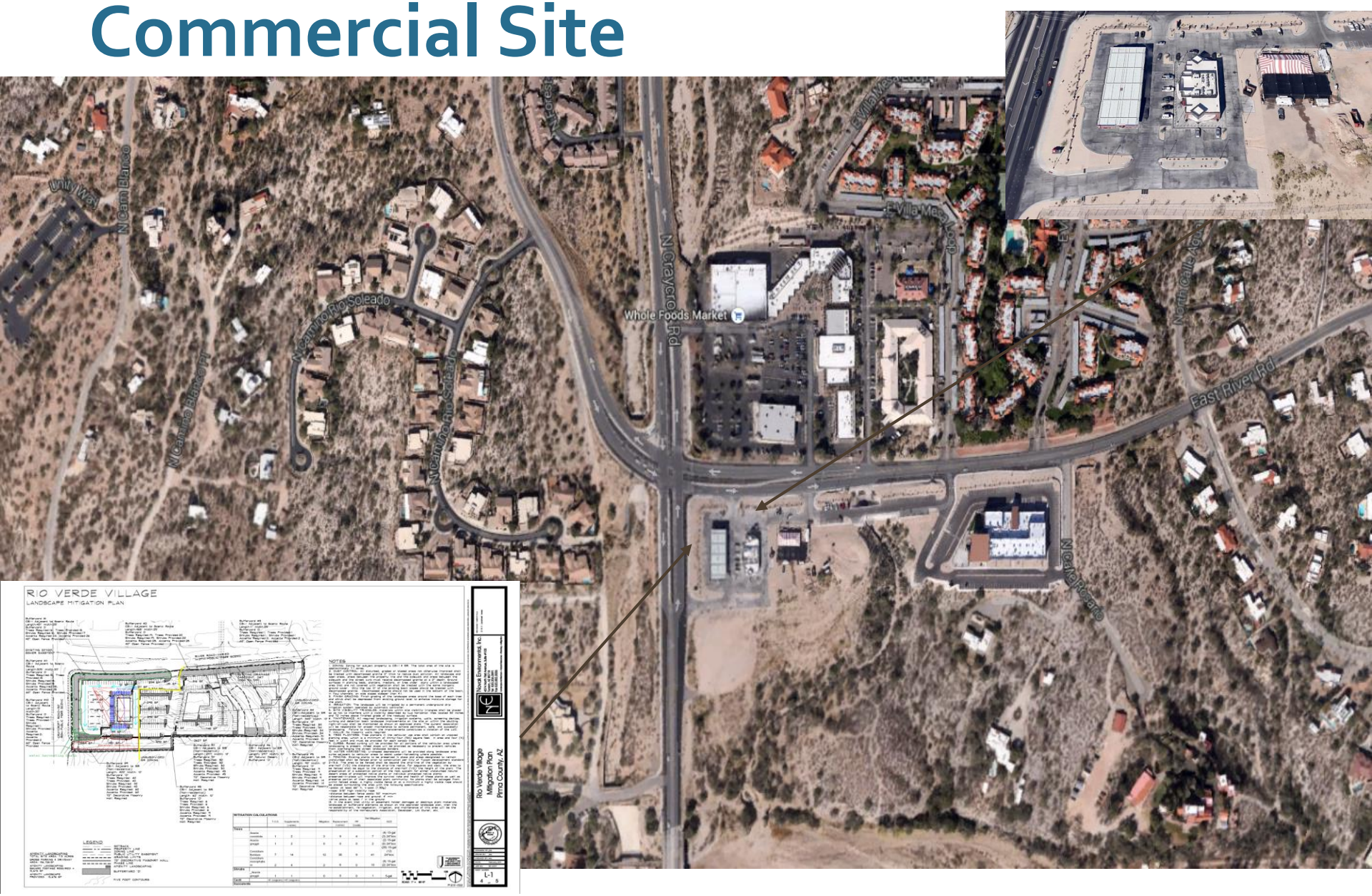
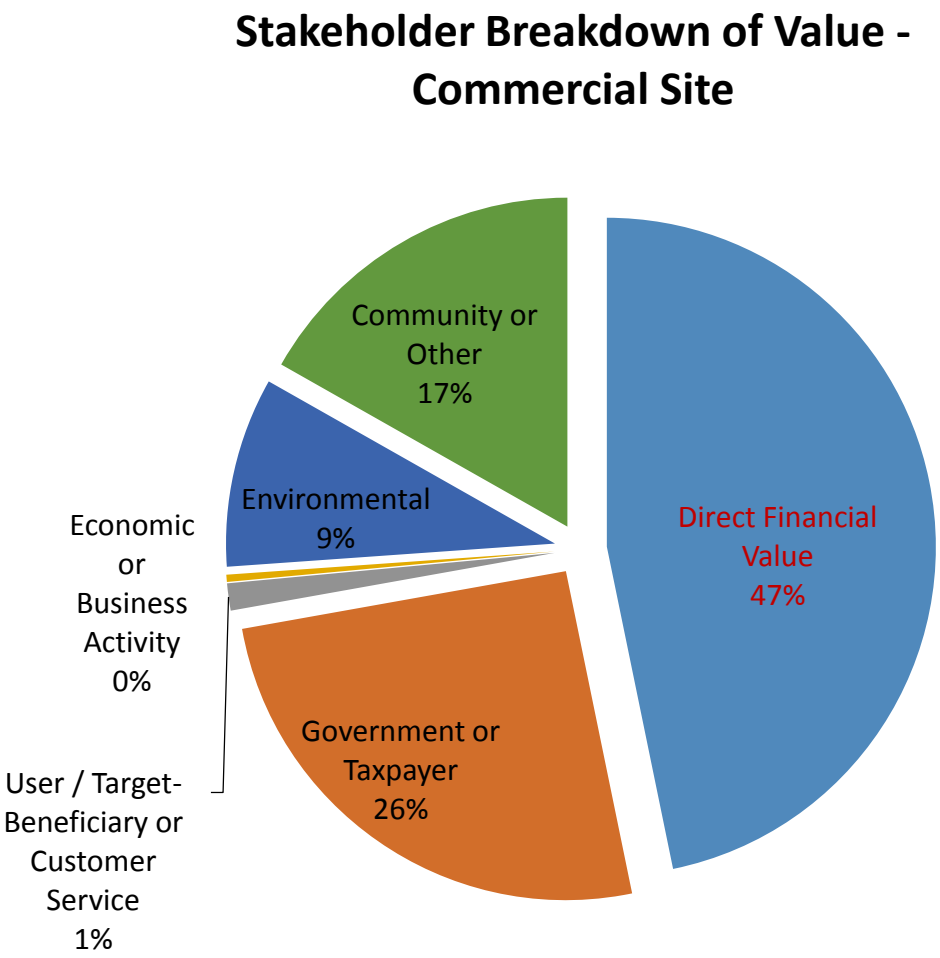
Graph: Impact Infrastructure, LLC AutoCASE final report 7-2014

Commercial Site



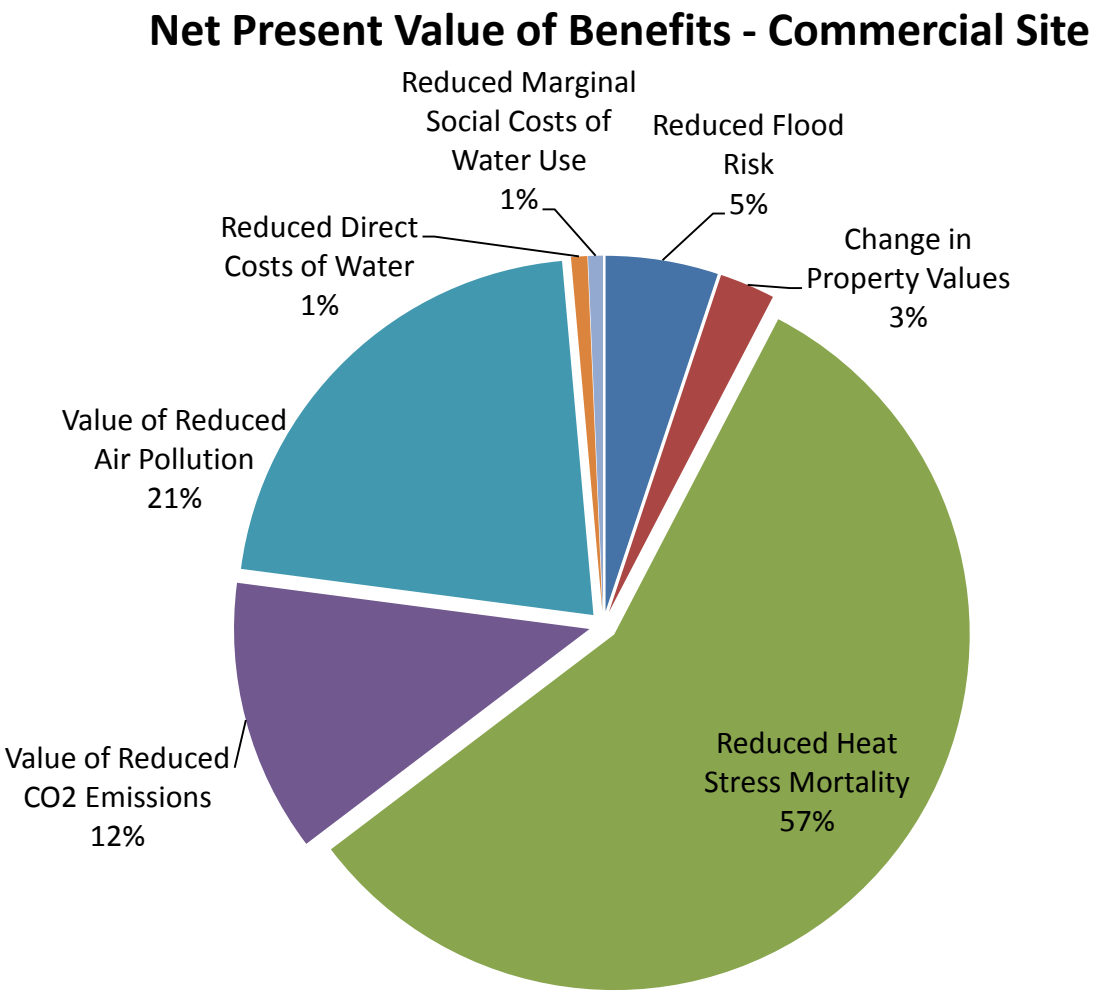
Commercial Site Beneficiaries

- The government, community, and environment all benefit from the use of GI/LID features
- The government has lower need for irrigation, higher economic activity (reduced heat mortality rates) and lower health costs (lower air pollution)
- The community also benefits from lower mortality rates and better health
- The environment benefits from reduced pollution and carbon emissions



Commercial Site Benefits

- Heat related mortality largest benefit
- Air pollution - CO, SO_2, NO_2, PM, O_3
- CO_2
  - Most Likely: $24 (IWGSCC 2010)
  - Low: $14 (Nordhaus 2011)
  - High: $115 (Stern 2006)



Conclusions

- Stormwater is a potentially important resource in our area.
- The greatest potential for stormwater harvesting is at the neighborhood scale and smaller.
- We have prepared guidance on how to implement Green Infrastructure/ Low Impact Development.
- Our Cost-Benefit Analysis indicates GI/LID is cost effective.
- The greatest benefits are not in potable water costs.
- Next Step – LID Workshop April 9, 2015

Acknowledgements

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Stantec

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