TRANSITioning the *WATERSHED*

Balance systems to

CAPTURE surface runoff
HARVEST rainfall
REUSE adjacent greywaters

[Layering sustainable WATER management]
for landscapes within *[rapidly densifying TODs]*

Places which

experience population growth soon
promote sustainable lifestyle

Mary Villarreal
LDE 593 Applied Project
Spring 2015

1 **Context:**

Water in arid urban environment

2 **Context:**

Urban landscapes at risk

3 **Methodology:**

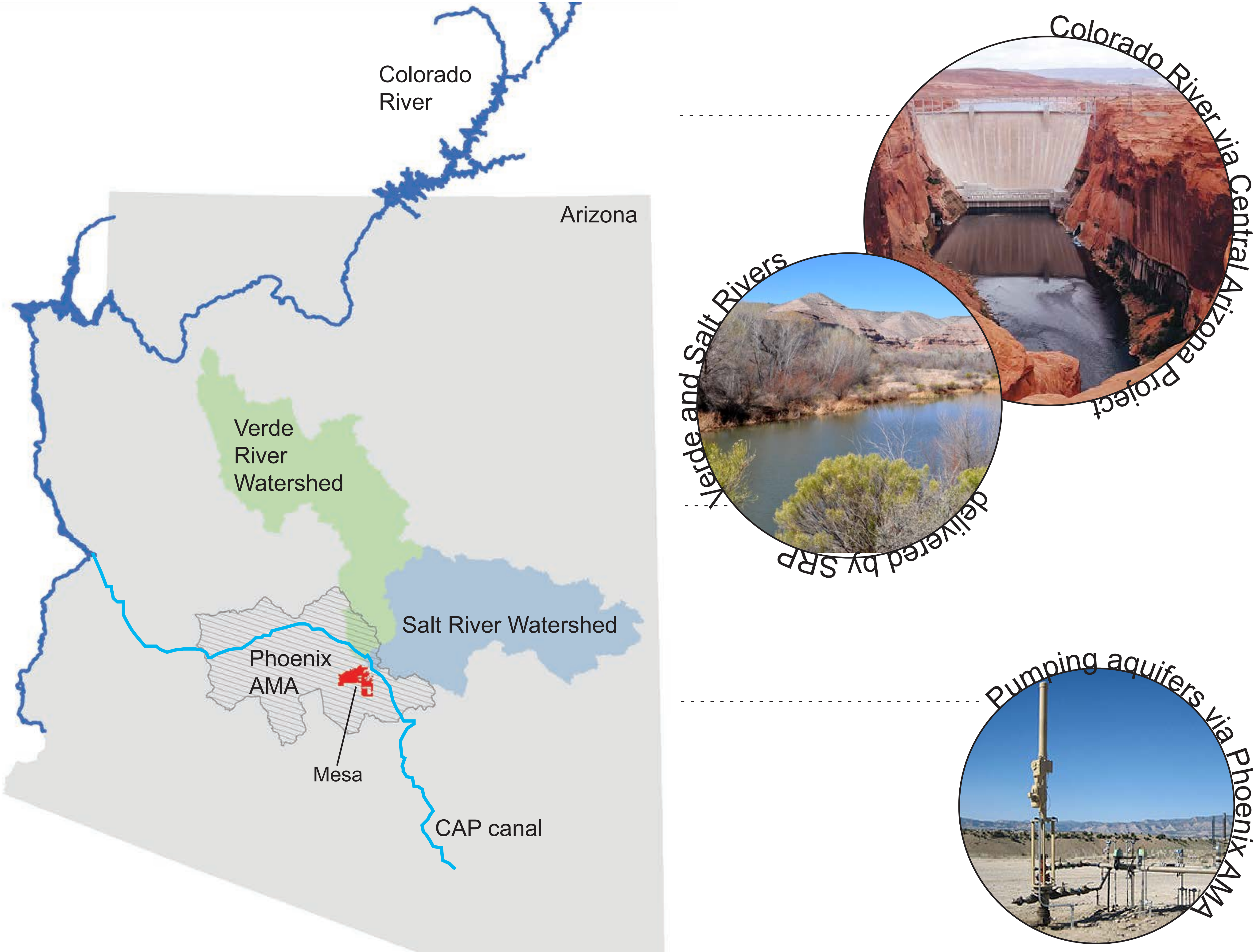
Layering sustainable management

4 **Proposal:**

Watershed transit oriented district

[Layering sustainable WATER management] 3
for landscapes within [rapidly ***densifying*** TODs]

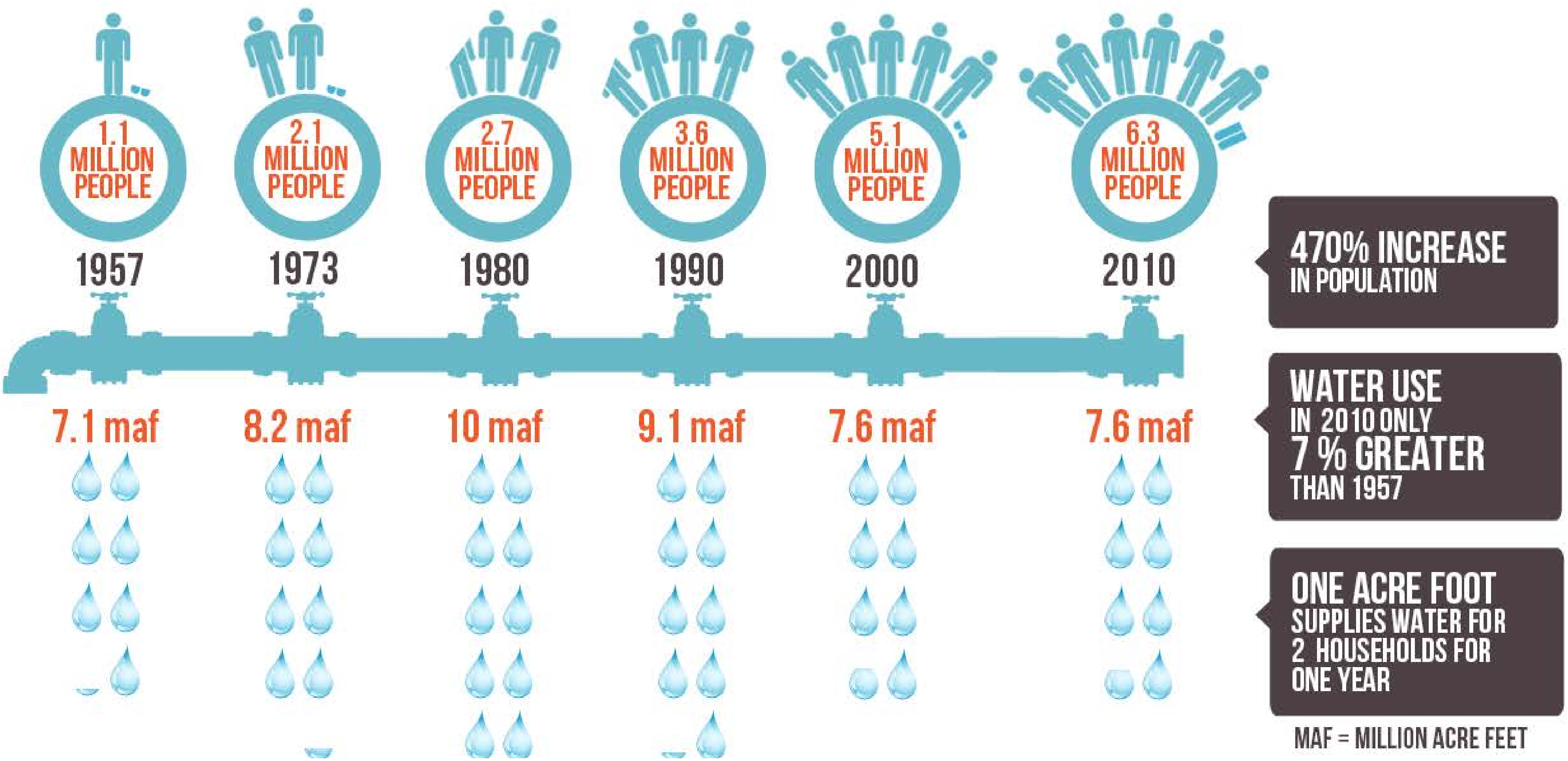
1 2 4



Colorado River
Arizona
Verde River Watershed
Salt River Watershed
Phoenix AMA
Mesa
CAP canal
Colorado River via Central Arizona Project
Verde and Salt Rivers delivered by SRP
Pumping aquifers via Phoenix AMA

ARIZONA'S POPULATION, WATER USE AND GROSS DOMESTIC INCOME FROM 1957-2010

ARIZONA'S WATER USE IS **VIRTUALLY THE SAME TODAY** AS IT WAS MORE THAN A **HALF-CENTURY AGO**, DUE TO STRONG PLANNING, POLICY, CONSERVATION, AND INVESTMENT. **THE 1980 GROUNDWATER MANAGEMENT ACT** WAS A CRITICAL TURNING POINT.



Arizona Municipal Water Users Association (AMWUA)

"*<u>Water is critical</u>, but once it is provided - as it has to be or Phoenix could not exsist - but once it is provided it does not bring and answer to what this city should become.*

<u>It is a precondition</u> to an answer. The politics of water, as all of you know, are essential, but they are not, in themselves, an answer.

It only buys you entry into the next level of questions." -Paul Goldberger

Desert Cities: Water Politics and Design Dinner Lecture, February 19,1999

The Arizona Republic
Sunday April 26, 2015

Section F, page 5....

Opinion article by Terry Goddard, about the challenge to politicians addressing and anticipating crisis before they happen.

Don't flinch from the truth. Wave it like a flag to get solutions

Listening to Phoenix Mayor Greg Stanton's State of the City

ROBERT ROBB
EDITORIAL COLUMNIST

No need to defer key decision on rooftop solar

From the political notebook:

» The state utilities are rushing to the Arizona Corporation Commission with proposals to change what they pay or charge residential rooftop solar customers. The commission is pondering whether it is appropriate to consider these requests as standalone proposals or defer consideration of them until part of a full-blown rate case.

If the commission views the issue properly, there's no need or rationale to defer a decision until a rate case.

Viewed properly, the question isn't cost-shifts or the cost-avoidance benefits of solar — things competing experts would unproductively gum to death in a rate case.

The proper question is very narrow and doesn't need a full-blown rate case to answer: What should utilities pay for surplus rooftop power the commission requires them to purchase?

The current answer is the utility's retail price. Most of the utilities are saying this is too much, that they should

See ROBB, Page 7F

Dark money examined

Robert Robb will moderate a Goldwater Institute debate on anonymous political speech: Is it protected by the First Amendment? Go online to www.youtube.com/user/GoldwaterInstitute from 7-9 p.m. Tuesday to watch four legal experts debate the issue.

LINDA VALDEZ
EDITORIAL WRITER

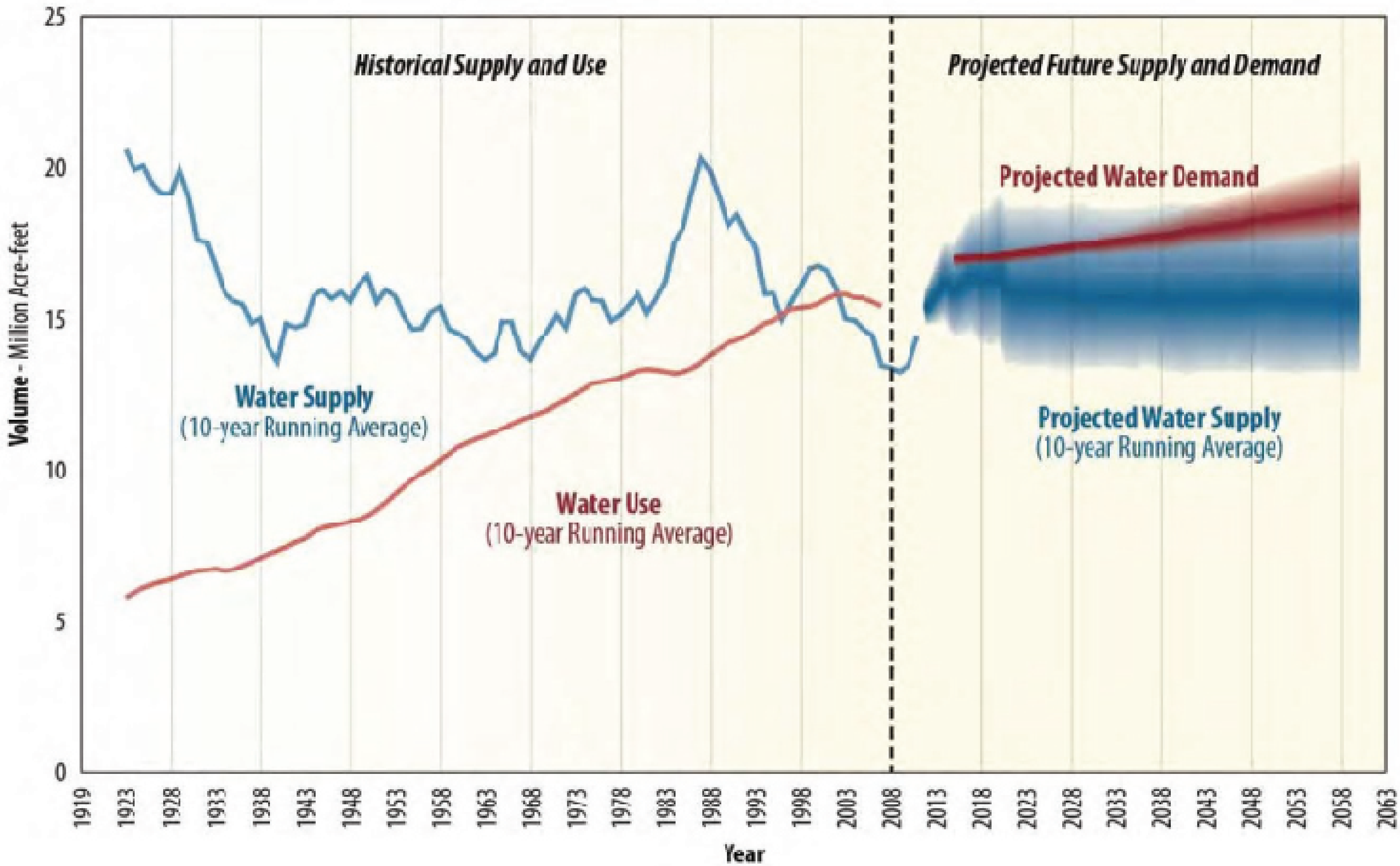
Holding a baby bald eagle is a wow moment

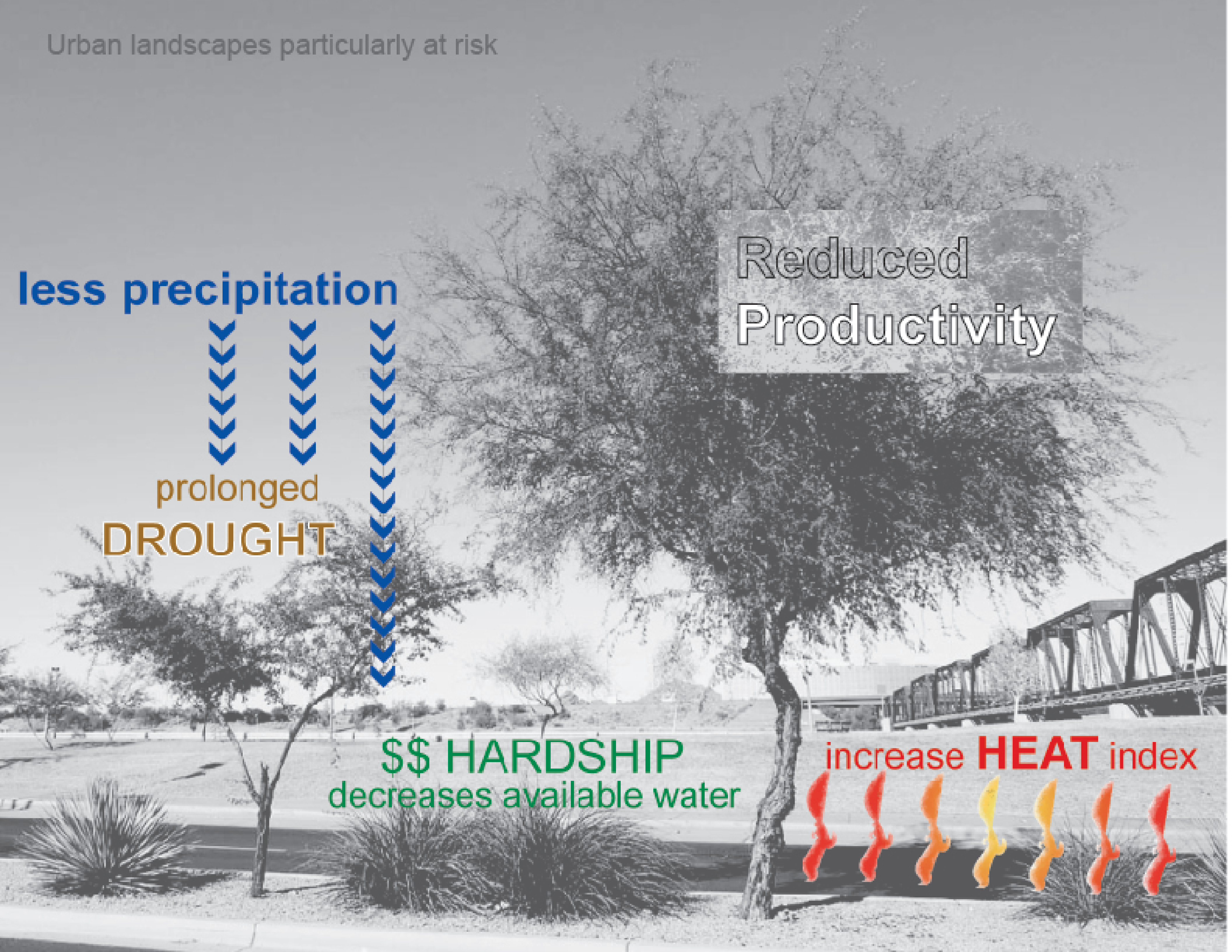
Bald eagle Number 30X has yellow feet and sharp black talons that have never snatched a fish from the cool water of Lake Pleasant. Yet.

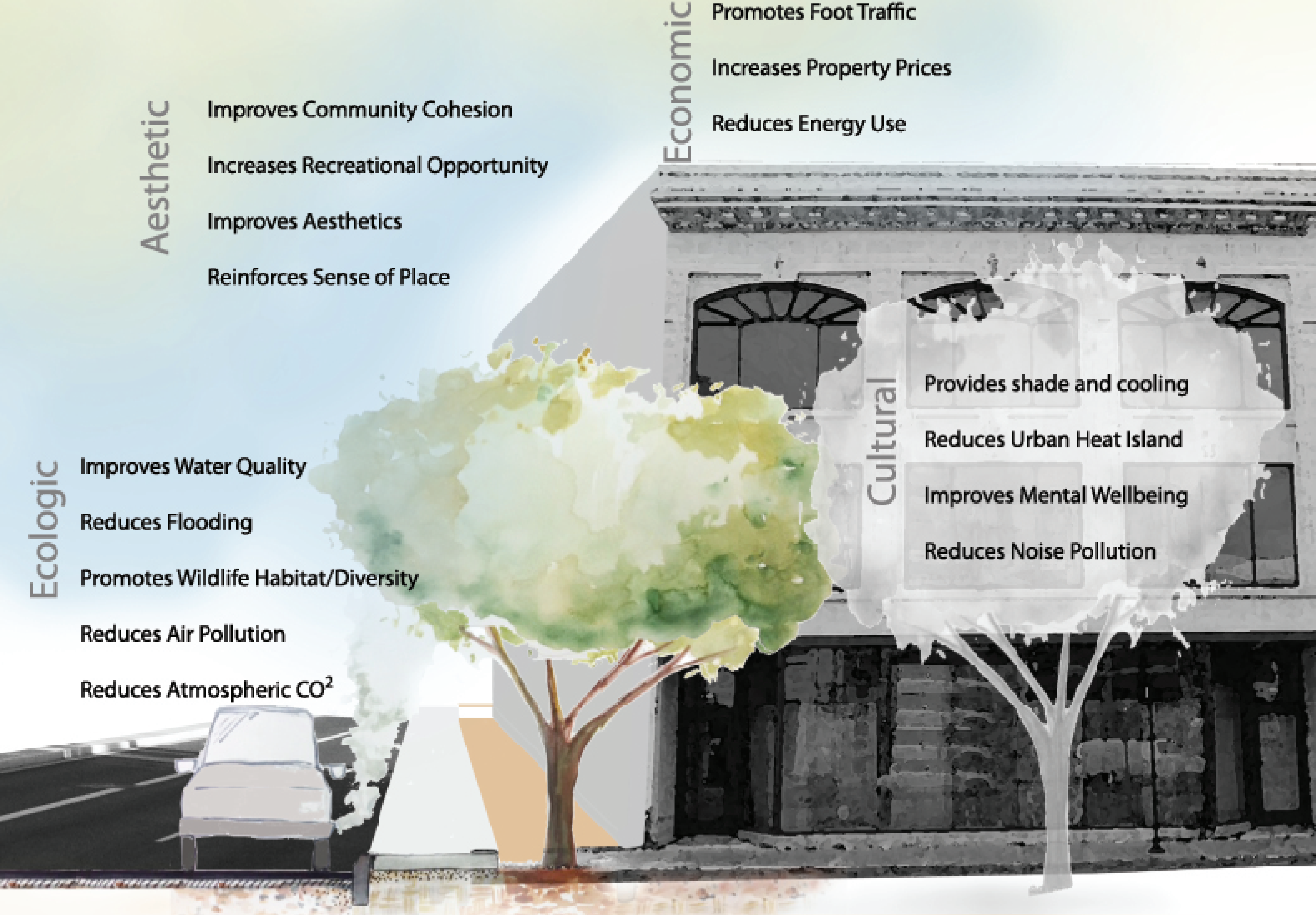
His wings have never carried him over the desert landscape. Yet.

He's only about 6 weeks old.

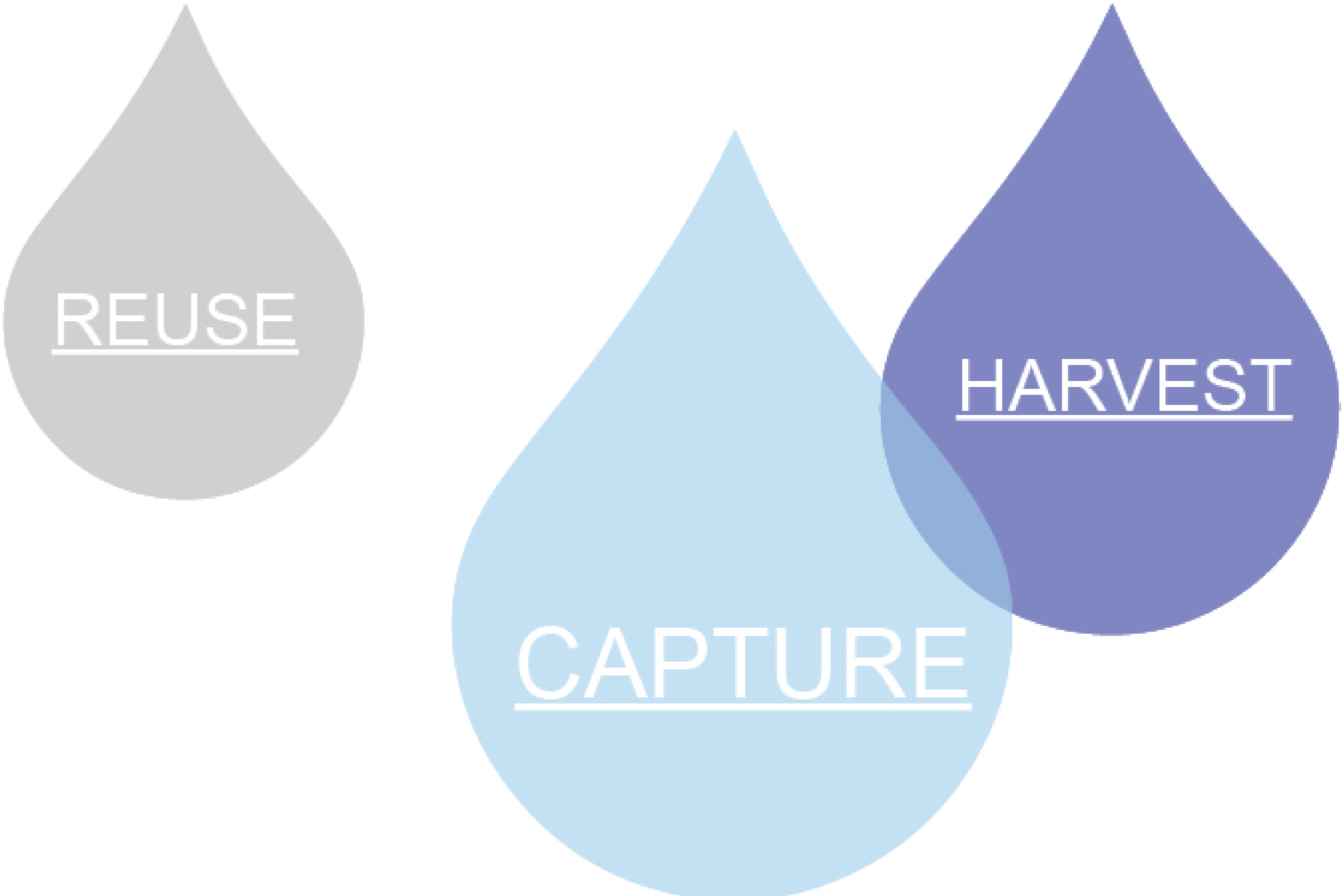
Colorado River Basin Water Spply and Demand Study
U.S. Department of the Interior, Bureau of Reclamation




Urban landscapes particularly at risk
less precipitation
Reduced
Productivity
prolonged
DROUGHT
$$ HARDSHIP
decreases available water
increase HEAT index



Ecosystem services of urban trees compiled from
(The Value of Green Infrastrcture, Center for Neighborhood Technology, 2010)
and (City of Melbourne, Urban Forest Strategy, 2012)



If we manage layered systems of water supply within arid urban environment, can we meet demand?

CAPTURE surface runoff

Capture: The directional collection of rainfall into defined permeable regions for infiltration

Direct or contain surface runoff (often referred to as stormwater) in order to infiltrate rainfall into permeable land cover.

Many techniques capture and infiltrate stormwater.
Green Infrastructure is often used to describe a network of decentralized stormwater management practices.

	Reduces Stormwater Runoff											Improves Community Livability						
Benefit	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding	Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO_2	Reduces Urban Heat Island	Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture	Improves Habitat	Cultivates Public Education Opportunities
Practice										CO_2								
Green Roofs	●	●	●	●	○	○	○	●	●	●	●	●	◒	●	◒	◒	●	●
Tree Planting	●	●	●	●	○	◒	○	●	●	●	●	●	●	●	●	◒	●	●
Bioretention & Infiltration	●	●	●	●	◒	◒	○	○	●	●	●	●	●	◒	◒	○	●	●
Permeable Pavement	●	●	●	●	○	◒	●	◒	●	●	●	○	○	●	○	○	○	●
Water Harvesting	●	●	●	●	●	◒	○	◒	◒	◒	○	○	○	○	○	○	○	●

Center for Neighborhood Technology, Green Infrstructure Values Guide

SW 12th Avenue Green Street Project
Portland, Oregon
Kevin Robert Perry, ASLA

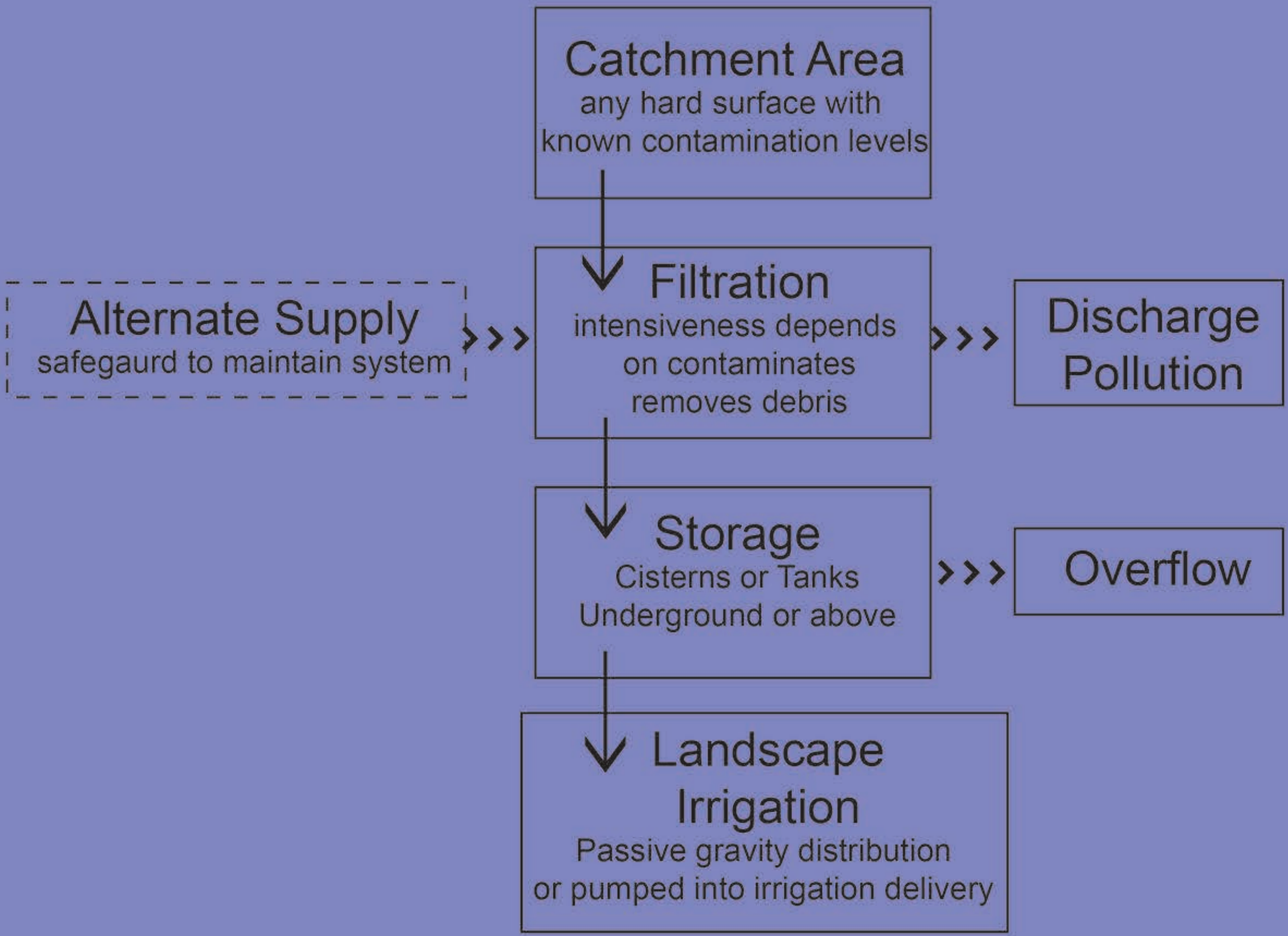
Determinate Variables:

rain event data
area in sq ft of infiltration
permeability
types of runoff surfaces
% coefficient
contaminates
capactity
maintanence of system
landscape capacity

HARVEST rainfall

Harvesting: "the collection of rain without an artifical inducement"

The intent is to "concentrate runoff and collect it in a basin or cistern to be stored for future use" -2012, Kinkade. Designing with Water



Underwood Family Sonoran
Landscape Laboratory
Tucson, Arizona
TenEyck Landscape Architects Inc.

Determinate Variables:

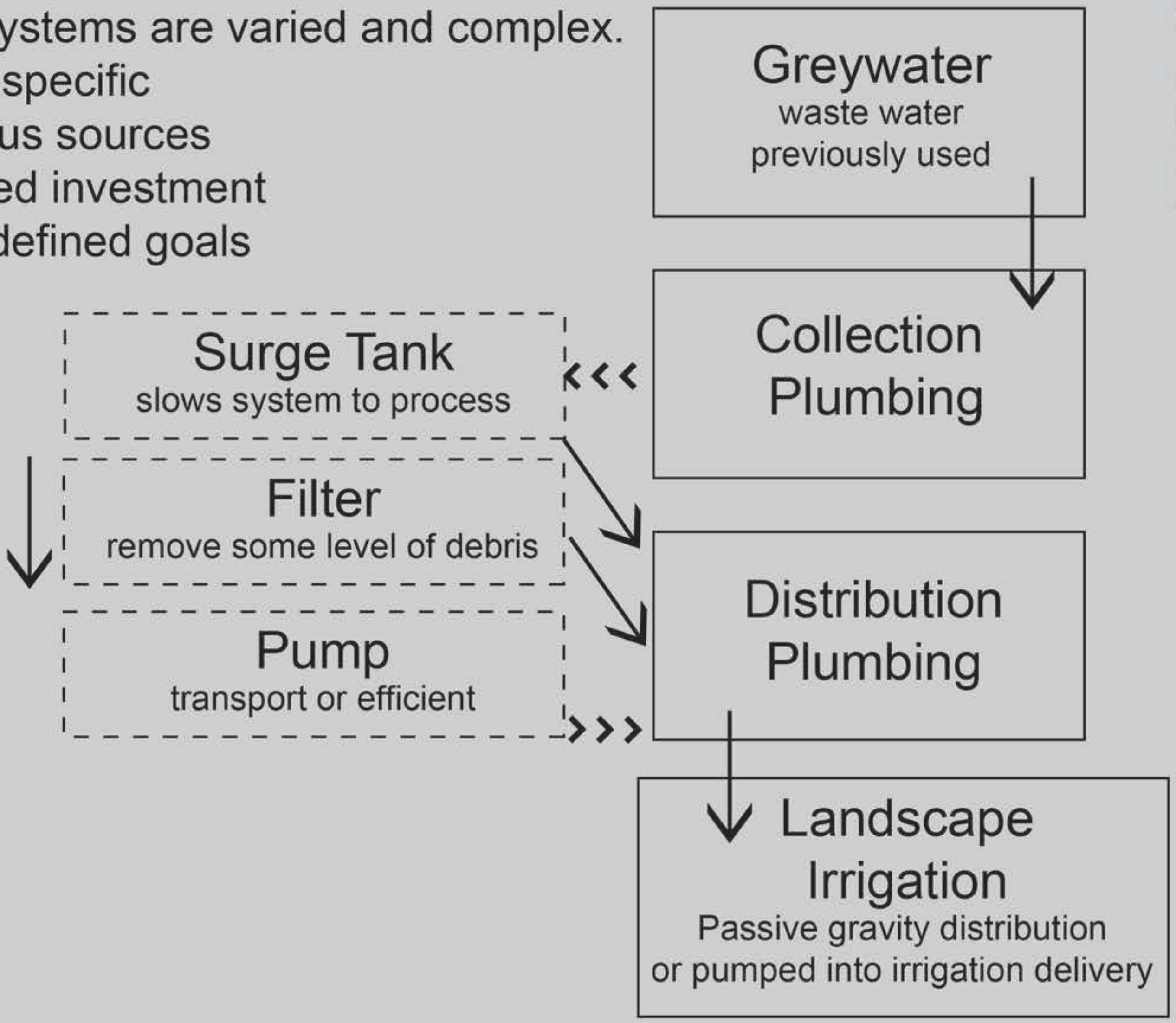
rain event data
area in sq ft of catchment
type of surface
% coefficient
contaminates
storage capactity
maintanence of system
integration with irrigation

REUSE adjacent greywaters

Reuse: recirculating previously used water within the site

Greywaters: waste waters of previous use with varying degrees of contamination excludes waste water contaminated by human waste (blackwater)

Greywater systems are varied and complex.
- context specific
- numerous sources
- increased investment
- clearly defined goals



Underwood Family Sonoran Landscape Laboratory
Tucson, Arizona
TenEyck Landscape Architects Inc.

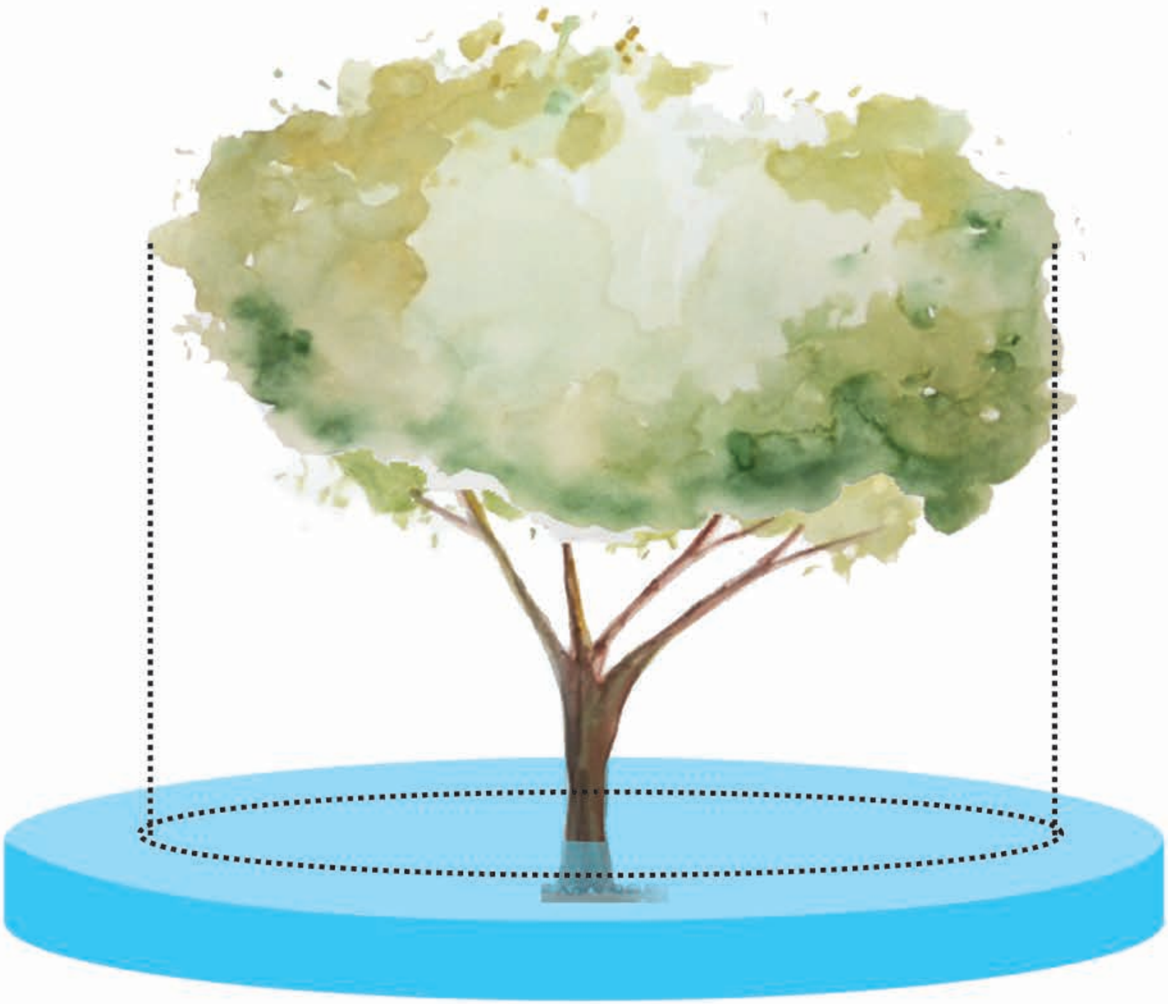
Determinate Variables:

source gallons collected
Source specifics
- contaminants
- plumbing efficiency

filter capability
system
- components
- placement

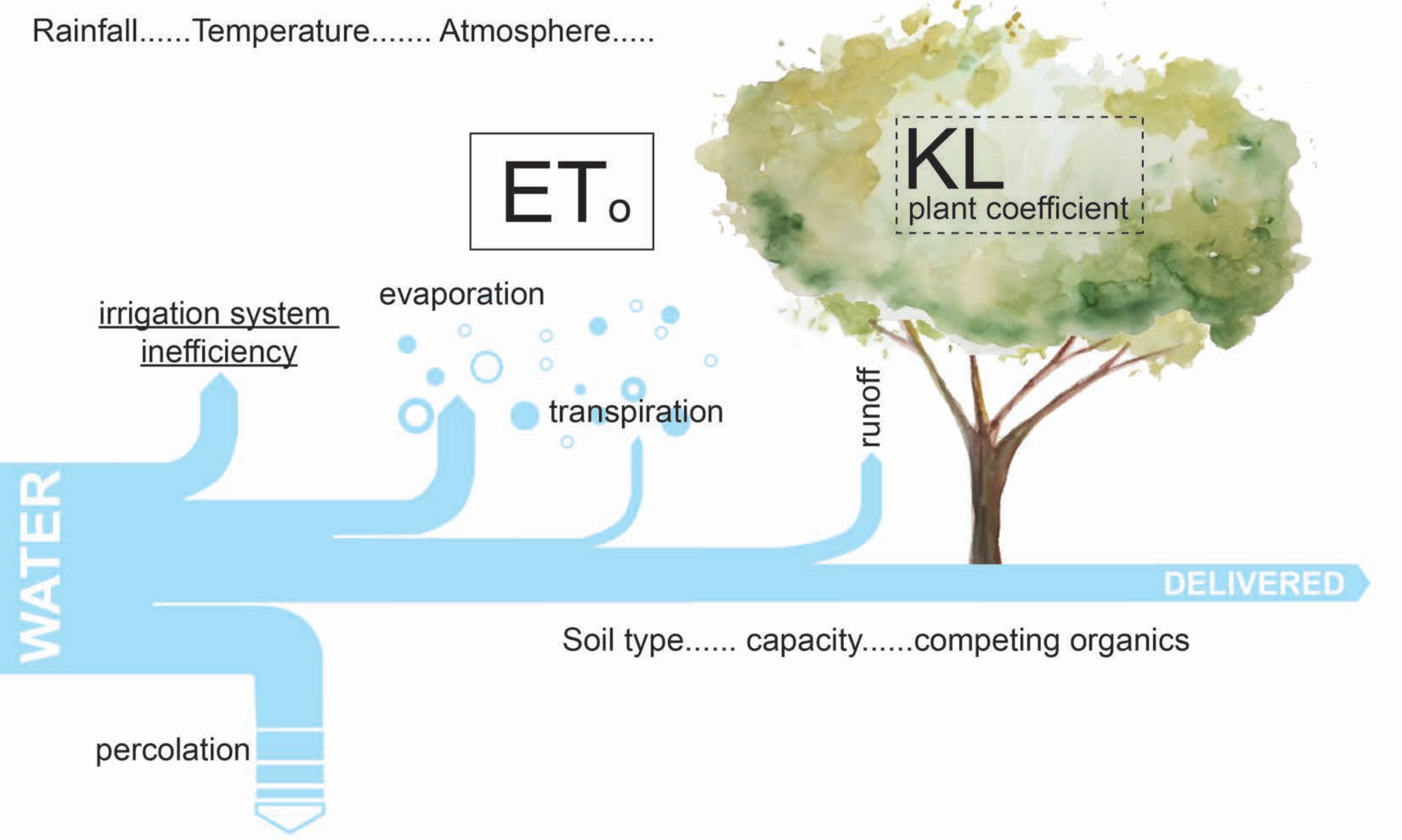
integration with irrigation

How much water does a tree use?



"Wrong Question"

- Chris A. Martin, School of Letters and Sciences, Arizona State University



How much water meets irrigation demand to ensure continued ecoservice benefits of landscapes in arid urban environments?

SUSTAIN ecosystem services

Sustain: Maintain balance of systems to ensure ecoservices of urban landscapes

Utilize water resources from within urban watershed to provide irrigation for landscape. Enhance urban watershed to relate ecosystem services with contributing waters.

TABLE C: GALLONS OF WATER REQUIRED TO WET ROOT ZONE

Plant Type	Plant Canopy Diameter in Feet: 1′	2′	3′	4′	5′	6′	8′	10′	12′	14′	16′	18′	20′
Trees	1.5	5	11	16	22	26	38	59	85	115	150	190	235
Shrubs	1	4	8	12	17	20							
Groundcover/Cacti	.5	2	3.5	5	7	9							

NOTE: The amount of water needed will vary depending on soil type and soil conditions. See illustration on page 13.

WATER USE IT WISELY

LANDSCAPE WATERING GUIDELINES

How Much & How Often Water to the outer edge of the plant's canopy and to the depth indicated. Watering frequency will vary depending on season, plant type, weather and soil.		Seasonal Frequency — Days Between Waterings: Spring Mar - May	Summer May - Oct	Fall Oct - Dec	Winter Dec - Mar	Water This Deeply (Typical Root Depth)
Trees	Desert adapted	14-30 days	7-21 days	14-30 days	30-60 days	24-36 inches
	High water use	7-12 days	7-10 days	7-12 days	14-30 days	24-36 inches
Shrubs	Desert adapted	14-30 days	7-21 days	14-30 days	30-45 days	18-24 inches
	High water use	7-10 days	5-7 days	7-10 days	10-14 days	18-24 inches
Groundcovers & Vines	Desert adapted	14-30 days	7-21 days	14-30 days	21-45 days	8-12 inches
	High water use	7-10 days	2-5 days	7-10 days	10-14 days	8-12 inches
Cacti and Succulents		21-45 days	14-30 days	21-45 days	if needed	8-12 inches
Annuals		3-7 days	2-5 days	3-7 days	5-10 days	8-12 inches
Warm Season Grass		4-14 days	3-6 days	6-21 days	15-30 days	6-10 inches
Cool Season Grass		3-7 days	none	3-10 days	7-14 days	6-10 inches

These guidelines are for established plants (1 year for shrubs, 3 years for trees). Additional water is needed for new plantings or unusually hot or dry weather. Less water is needed during cool or rainy weather. Drip run times are typically 2 hours or more for each watering.

AMWUA water use it wisely
Landscape Irrigation best practices

OR REMAIN THE SAME

A Ewing Education Services class is coming to your area

LANDSCAPE IRRIGATION AUDITOR WORKSHOP [2-DAY]

REGISTER OR LEARN MORE AT

WWW.EWINGEDUCATIONSERVICES.COM

Irrigation
Determinate Variables:

placement / siting
microclimatic conditions
 species plant factor
 planting density
 aspect/exposure
climatic conditions
 local ET values
system/technology ability
water frequency / source

CAPTURE

Determinate Variables:

rain event data
area in sq ft of catchment
type of surface
% coefficient
contaminates
storage capactity
maintanence of system
integration with irrigation

'C' yield %supply

HARVEST

Determinate Variables:

rain event data
area in sq ft of infiltration
permeability
types of runoff surfaces
% coefficient
contaminates
capacity
maintanence of system
landscape capacity

'H' yield %supply

REUSE

Determinate Variables:

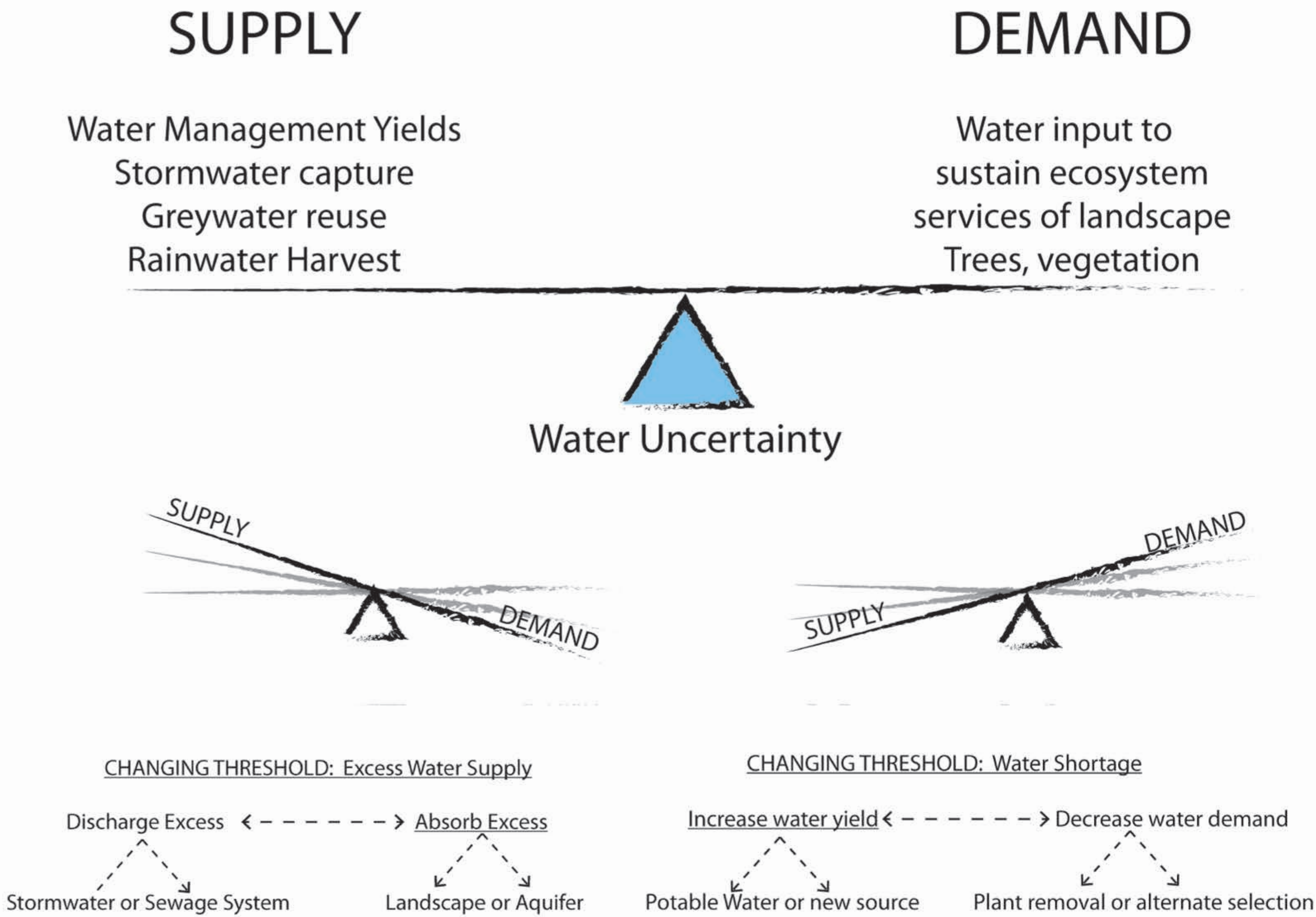
gallons collected from source
Source specifics
contaminants
plumbing efficiency
filter capability
system components, placement
integration with irrigation

'R' yield %supply

SUSTAIN landscapes

Irrigation
Determinate Variables:

placement / siting
microclimatic conditions
species plant factor
planting density
aspect/exposure
climatic conditions
local ET values
system/technology ability
water frequency / source


SUPPLY
DEMAND
Water Management Yields
Stormwater capture
Greywater reuse
Rainwater Harvest
Water input to
sustain ecosystem
services of landscape
Trees, vegetation
Water Uncertainty
SUPPLY
DEMAND
DEMAND
SUPPLY
CHANGING THRESHOLD: Excess Water Supply
Discharge Excess
Absorb Excess
Stormwater or Sewage System
Landscape or Aquifer
CHANGING THRESHOLD: Water Shortage
Increase water yield
Decrease water demand
Potable Water or new source
Plant removal or alternate selection

ValleyMetro.org releases numerous reports and intentions for future light rail extensions.

Previously built light rail extensions have proven to spur redevelopment, increase density, and promote a more sustainable lifestyle

valleymetro.org/gilbertroad

GILBERT ROAD

LIGHT RAIL EXTENSION

VALLEY METRO

REPORT CARD — **NOVEMBER 2014**

PROJECT DESCRIPTION

The 1.9-mile Gilbert Rd. project will extend light rail beyond the Central Mesa extension on Main St. to Gilbert Rd. in Mesa by 2018. It consists of two stations and a park-and-ride on the west side of Gilbert Rd. At Gilbert Rd., there are significant transit connections and the ability to draw more riders from the East Valley.

BENEFITS

The Gilbert Rd. extension will serve the growing transit demand in the East Valley. It will attract new riders and increase development opportunities in central Mesa.

UPDATE

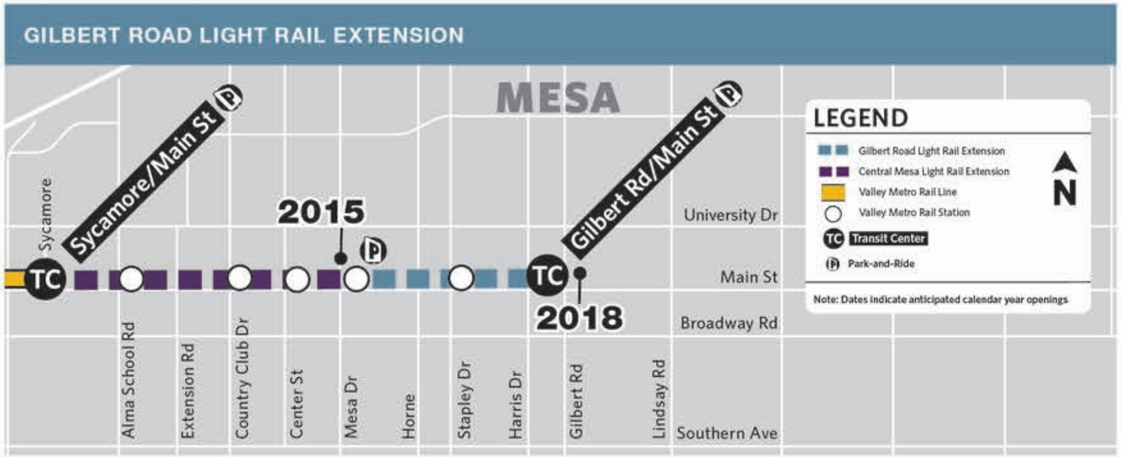
- The design elements of preliminary engineering are complete
- Estimates of project construction costs have been reviewed and comments were resolved
- Currently defining how the funding will be applied
- Project agreements are being refined to include project specific information as it becomes available

BUDGET

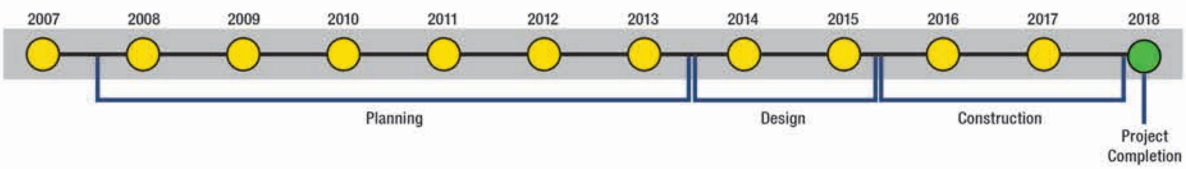
	Programmed*	Expended**
Project Development	$11,100,000	$2,187,194
Final Design	$20,400,000	$0
Construction	$130,200,000	$0
TOTAL	**$161,700,000**	**$2,187,194**

*Does not include financing cost.
**Estimated as of November 30, 2014.

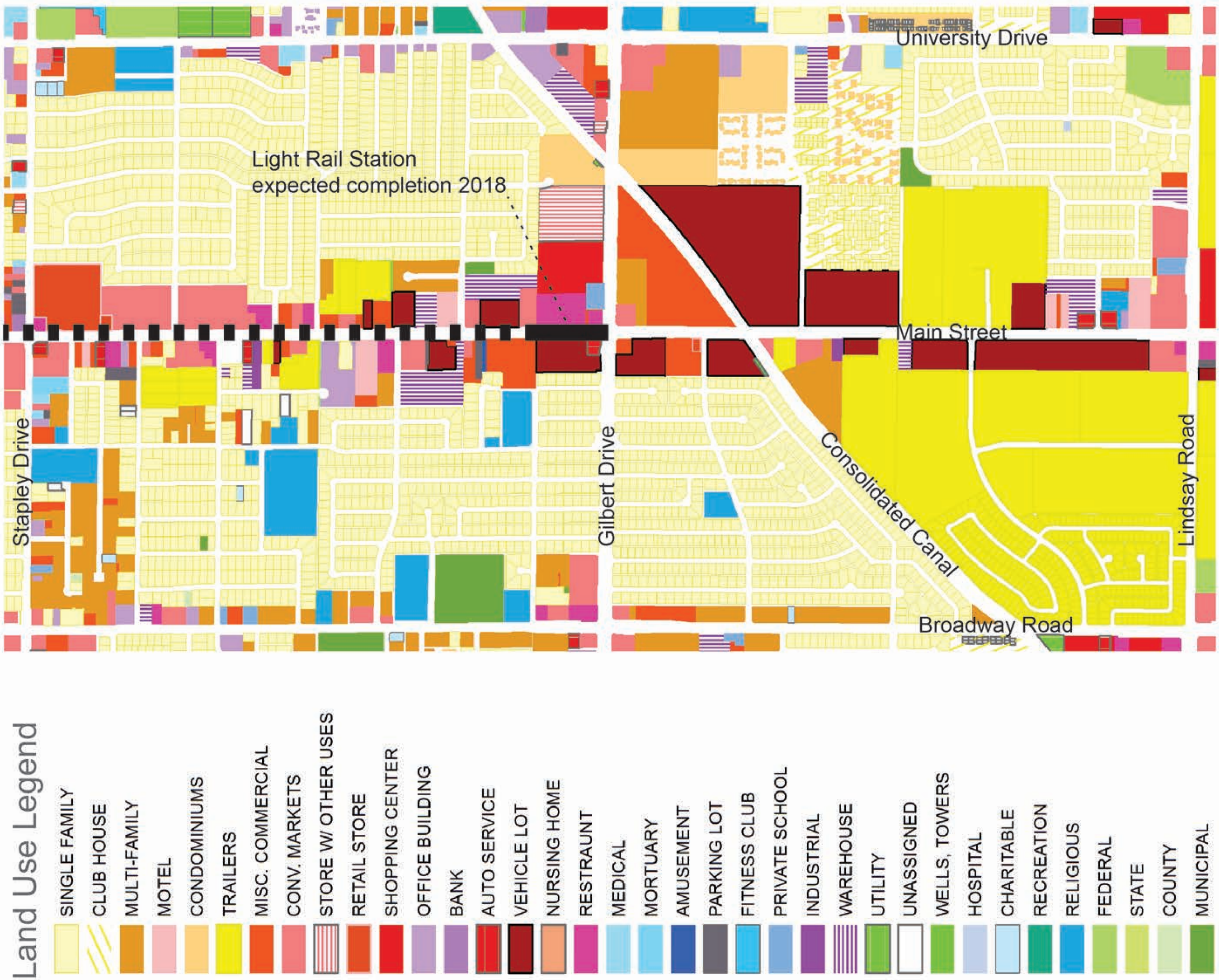
ROUTE MAP



SCHEDULE



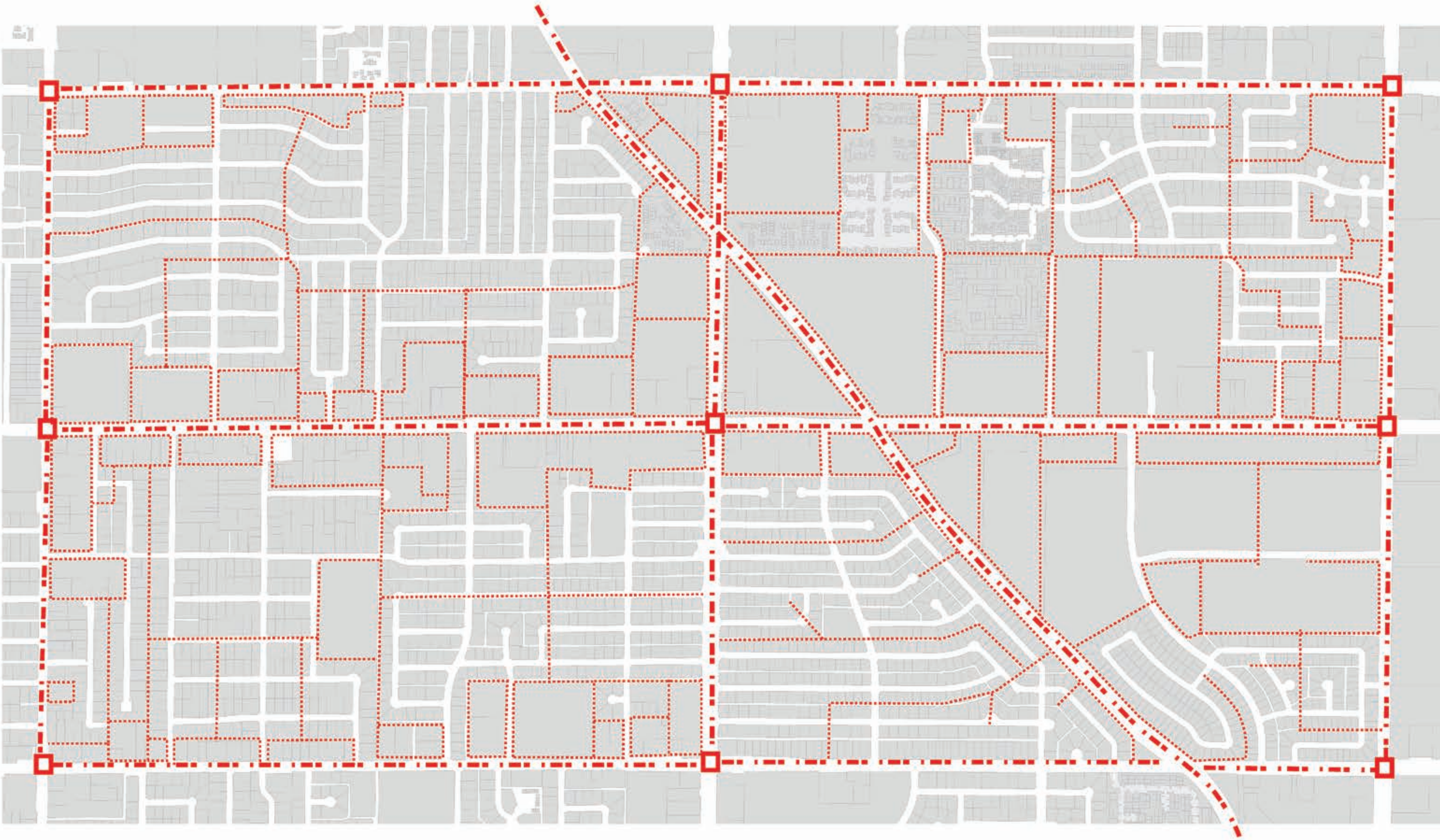
Gilbert rd / Main st Light Rail Transit Oriented District



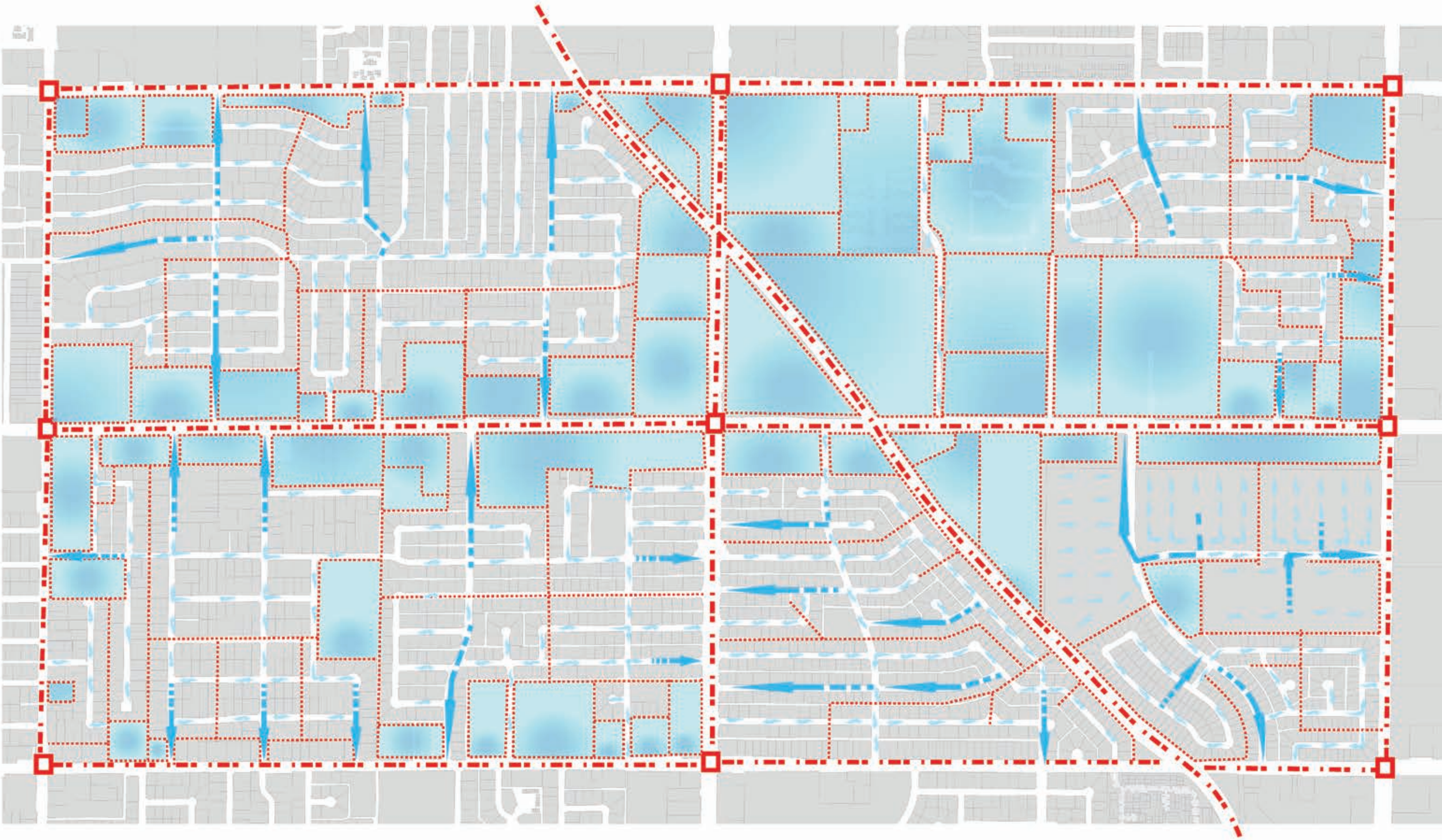
Non residential parcels

Grading and ranking of parcels likely to be redeveloped

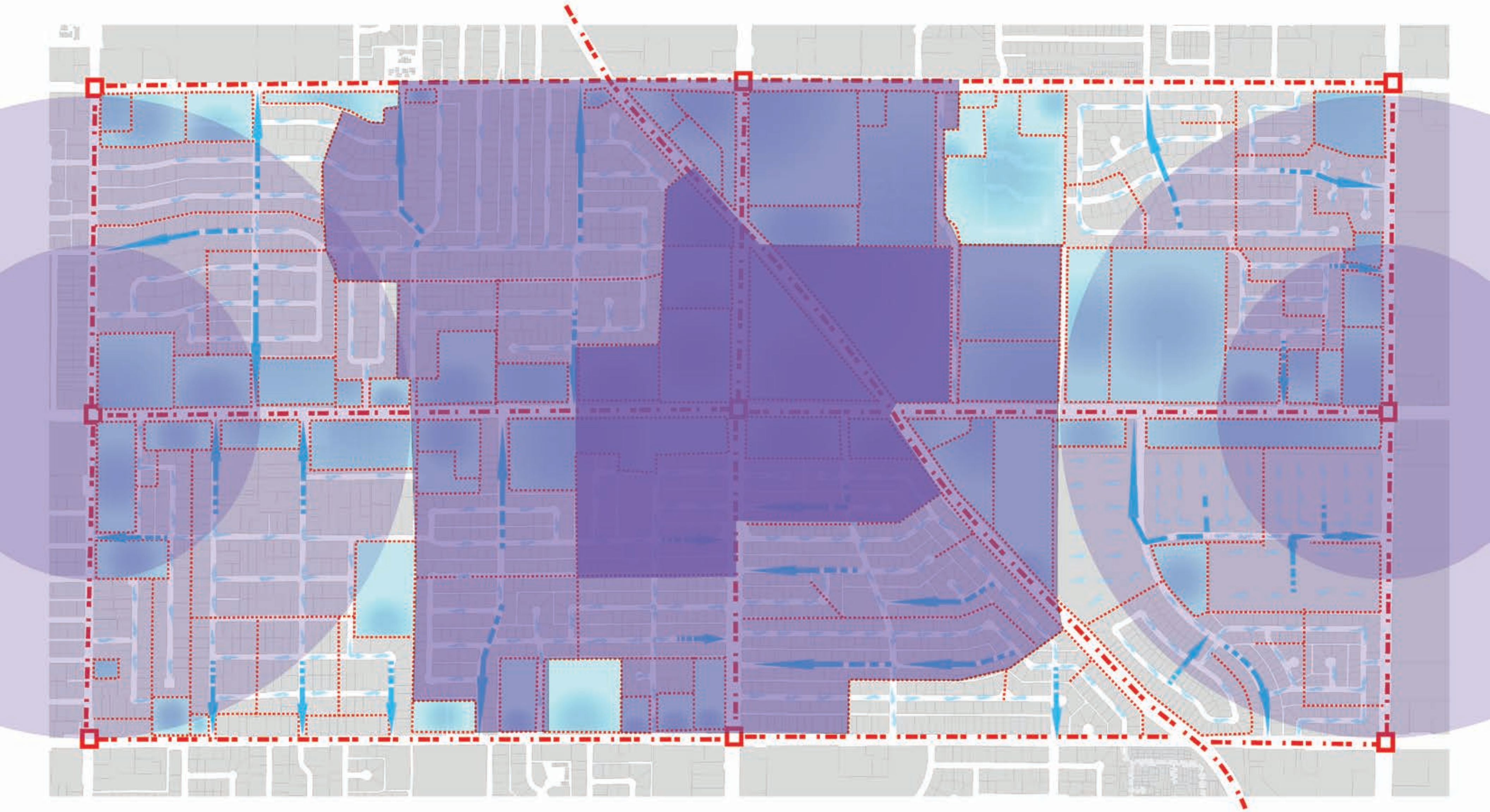
Major and minor ridges contain and direct flows

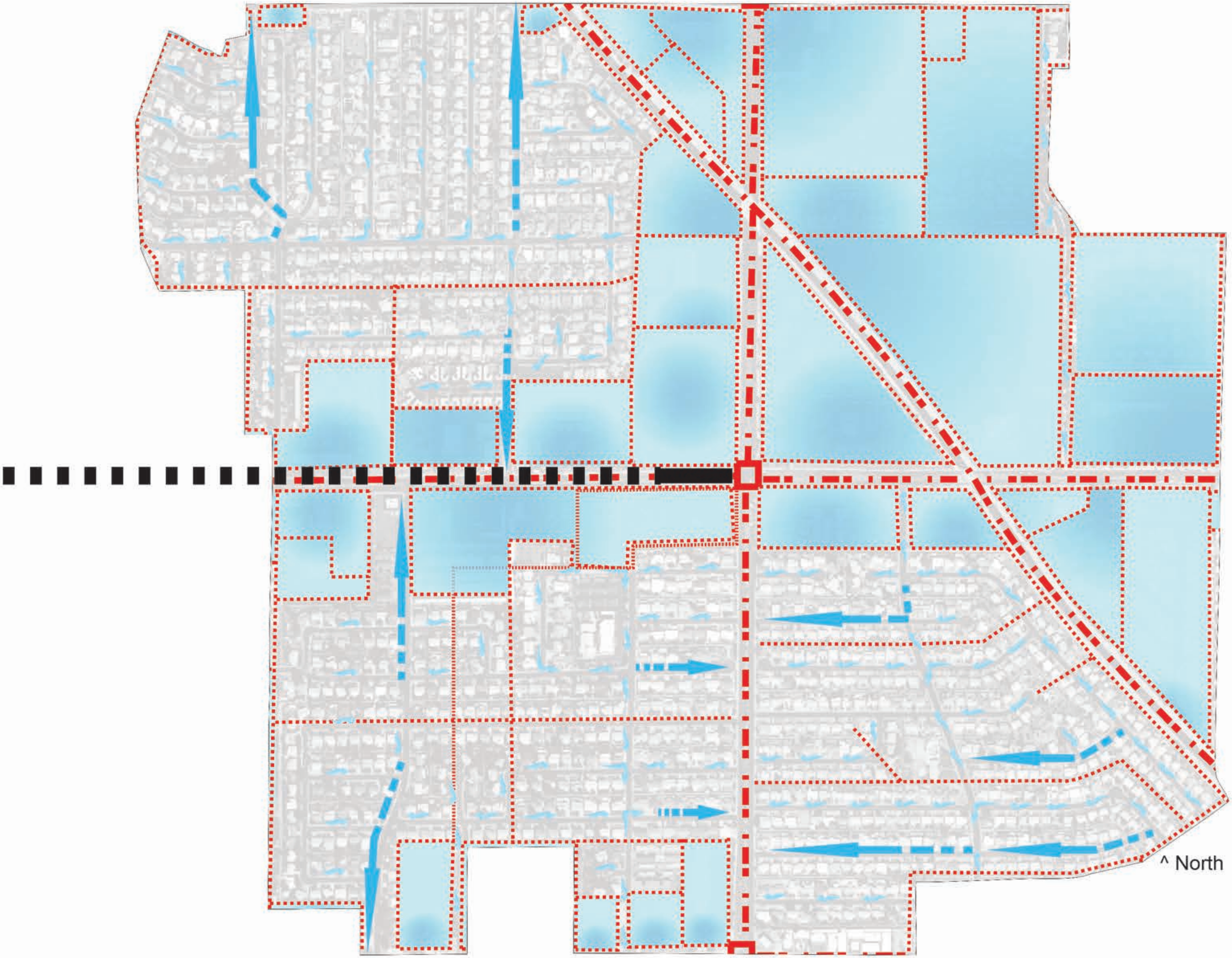


Surface flows within watershed, Commerical properties drain in isolation

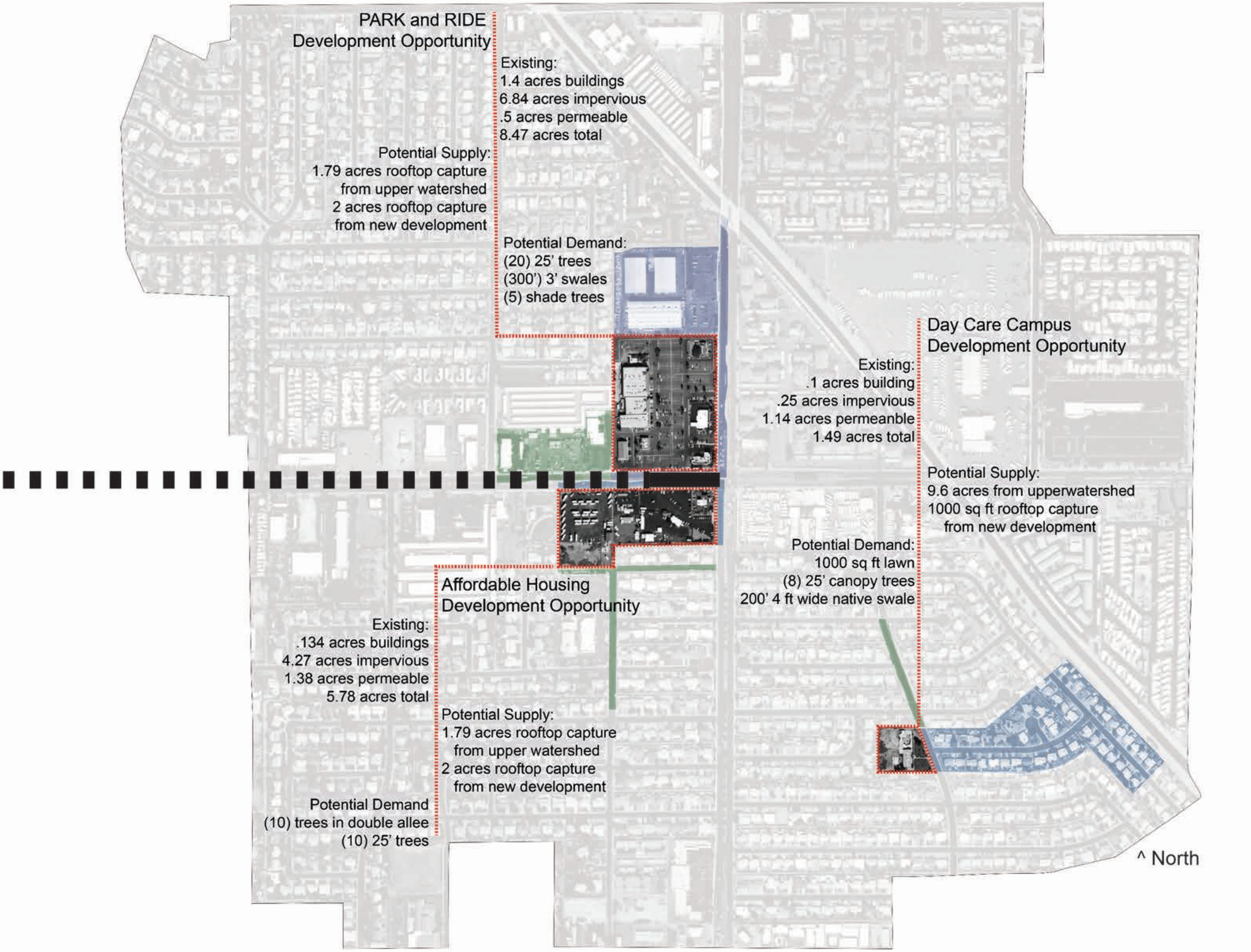


Transit Oriented District defined by walkable shed within urban watershed
Watershed Transit Oriented District (WsTOD)





Watershed Transit Oriented District (WsTOD)



Potential development within WsTOD

Potential Development: Day Care Campus

Existing Condition:
.1 acres building
.25 acres impervious
<u>1.14 acres permeable</u>
1.49 acres total


Typical residential housing


View A. northward towards Main St


View B. into parcel from north

Potential Supply:
capture:
1.3 acres on site
capture and harvest:
9.6 acres from upper watershed
reuse:
bathroom sinks, laundry (40 person)

Potential Demand:
400 ‘ street trees
(14) Swan Hill Olive trees
= 105, 280 gallons per year at peak

500 sq ft lawn
= 11,000 gallons per year- bermuda

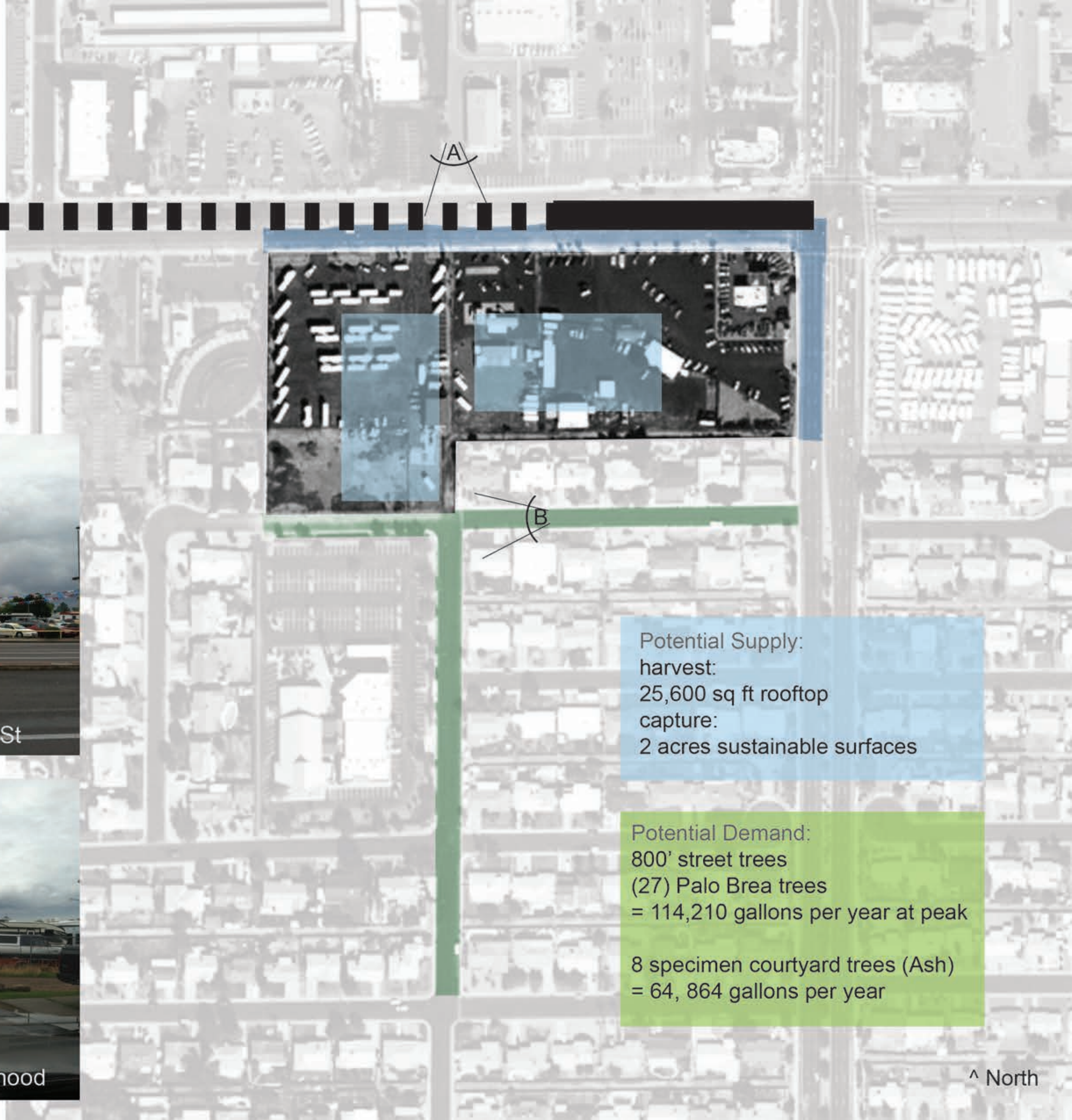
2000 sq ft filtration swales
= 26,000 gallons per year - native

Potential Development: Affordable Housing

Existing Condition:
.134 acres building
4.27 acres impervious
1.38 acres permeable
5.78 acres total

View A. southward across Main St

View B. westward into neighborhood



Potential Supply:
harvest:
25,600 sq ft rooftop
capture:
2 acres sustainable surfaces

Potential Demand:
800' street trees
(27) Palo Brea trees
= 114,210 gallons per year at peak

8 specimen courtyard trees (Ash)
= 64, 864 gallons per year

Potential Supply:
harvest:
16,500 sq ft large retail rooftop (1)
72,000 sq ft garage rooftop (2)
20,000 sq ft retail rooftop (3)
capture:
37,800 sq ft roof runoff (4)
36,000 sq ft parking runoff
30,000 sq ft parking runoff

Potential Demand:
(4) high water use trees (ash)
= 40,892 gallons per year
(20) medium water use (salicinia)
= 102,220 gallons per year
(10) medium water use (swan hill)
= 51,110 gallons per year
(15) large queens wreath vine
= 26,100 gallons per year
(20) low water use (blue palo verde)
= 56,400 gallons per year
3350 sq ft filtration swale
= 23,450 gallons per year

= 300,172 gallons per year
@ $6.43 per 1000 gallons

= $1,930 per year in water cost...

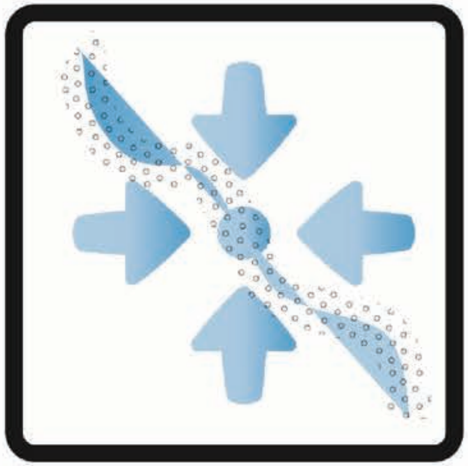

View A. southward on west side


View B. westward on south side


View C. westward on Main street

Potential Development:
Park and Ride Transit Center

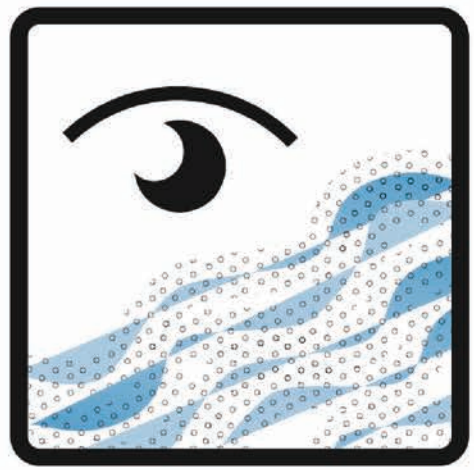
GOAL: Manage and balance numerous water systems: engage dialogue about water ethic in arid urban environments



Efficient Collection/ Delivery of Water

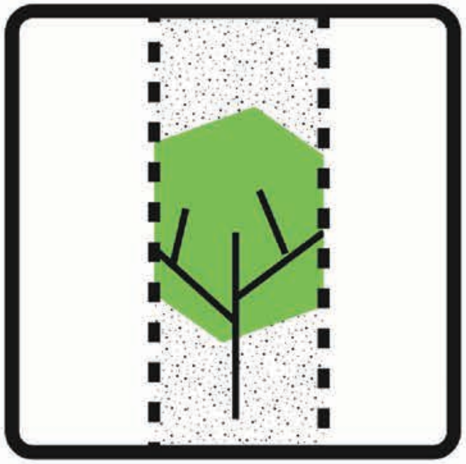
Sustainable Materiality

Showcase Water Components

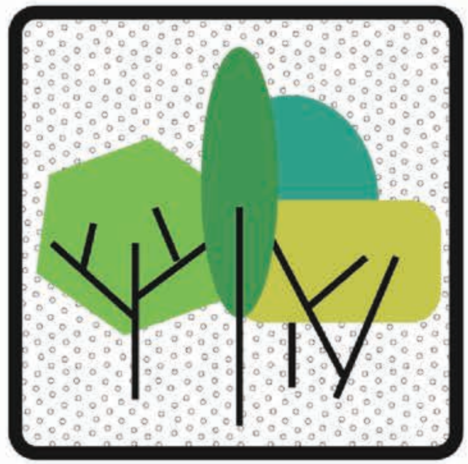


Reveal Conveyance

GOAL: Promote and ensure ecosystem services: anticipating water scarce future with resilient systems

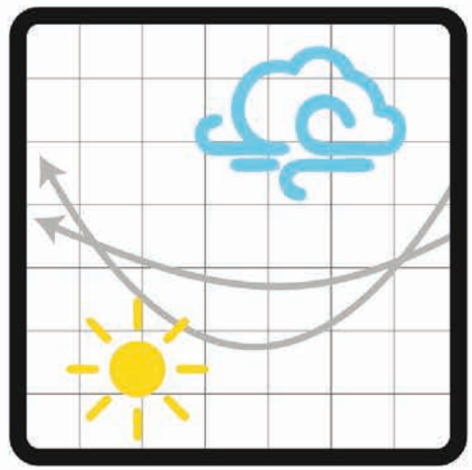


Accommodate Plants

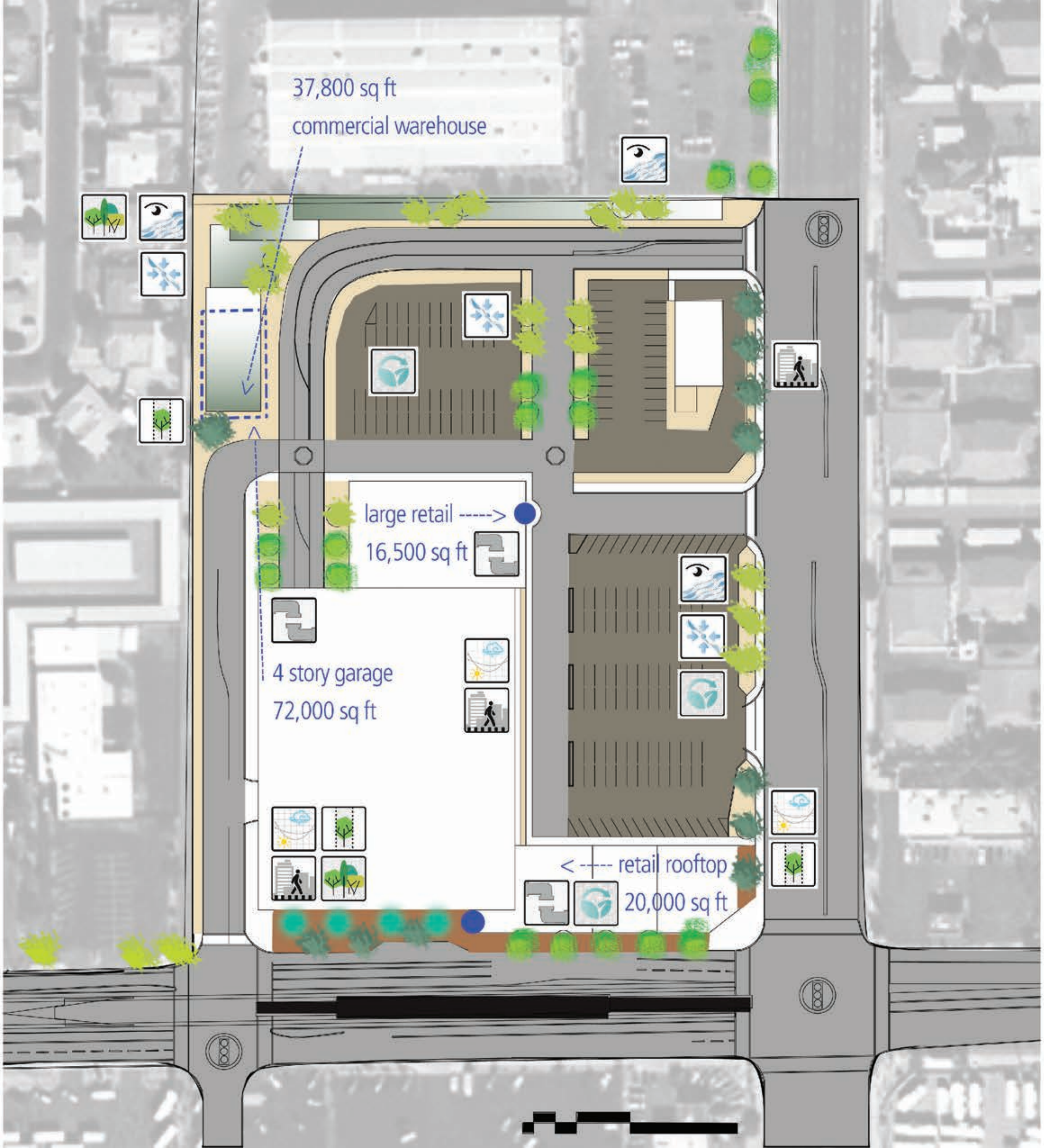


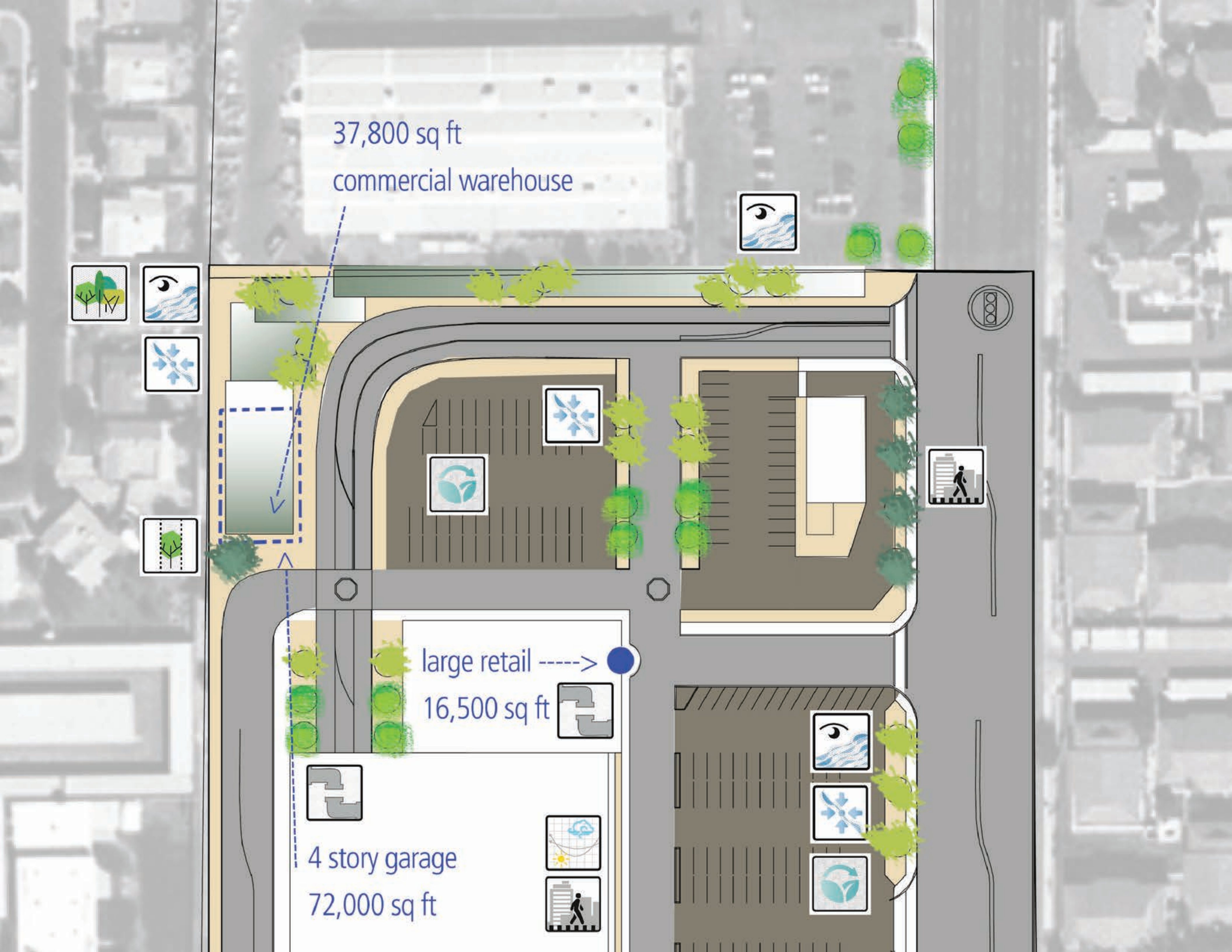
Diverse Plant Palette

Walkable Human Habitat



Relate Site Development to Ecosystem Services


37,800 sq ft
commercial warehouse
large retail ----->
16,500 sq ft
4 story garage
72,000 sq ft
<----- retail rooftop
20,000 sq ft


37,800 sq ft
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Balance systems to

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HARVEST rainfall
REUSE adjacent greywaters

[Layering sustainable WATER management]
for landscapes within [rapidly ***densifying*** TODs]

Places which

experience population growth soon
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