

**Teaching Proposal:**

**Landscape Architecture Foundation Landscape Performance Education Grant (LPEG), 2015**

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The Design School at Arizona State University

***Principal Investigator / Instructor Reflections***

**Background:**

This project was conducted during the spring 2015 semester in The Design School at Arizona State University. The scope of the project was to explore the teaching and learning of landscape performance as a primary learning objective within the framework of the Master of Landscape Architecture (MLA) thesis studio. The project was proposed as a continuation and expansion of the 2014 LPEG sponsored-project of a similar nature.

The principle goal of the project was to engage MLA and Master of Urban Design (MUD) students in their final studio course in a thesis project that required the creation of a design project that used landscape performance strategies, concepts and tools to enhance and evaluate the design. The studio course was supplemented with a weekly seminar on “Design Performance” (in the Design School at Arizona State University, I have been using the term “design performance” instead of “landscape performance” with the explicit understanding that the two terms mean essentially the same thing, but “design performance” is more broadly inclusive, representing all of the design disciplines within The Design School (6 disciplines and 16 different degree programs)).

The Design School has professional studio-based masters programs in the disciplines of architecture (MArch), industrial design (MID), interior architecture (MIA), landscape architecture (MLA), visual communications design (MVCD), and urban design (MUD). Although most of these masters programs were established relatively recently, the MArch program has operated for many years and it has successfully used the applied studio project format for a culminating project for quite some time. It makes it easier to manage our programs – both in terms of communicating degree requirements to students and accountability policies with the ASU Graduate School by using these thesis/applied project options consistently for all of these degree programs across The Design School. This studio course was the final, required core studio in the professional curriculum for MLA and MUD students.

Within the MLA program, a thesis or an applied culminating project is a core requirement in the concluding semester of the degree program. At ASU the difference between a “Thesis” and an “Applied Culminating Project” is that process and product of a “Thesis” must following standard ASU Graduate School format and procedures typical of traditional master’s theses in most disciplines in most research institutions. The “Applied Culminating Project” permits the student to engage in an independent investigation in format and process that has much more flexibility in both the process and the deliverable products. Although students have the option to choose either approach (thesis or applied project), almost all choose, or are encouraged to choose the applied project format. In our School, this generally means that most of our MLA students enroll in a semester-long research project that explores a significant design issue and plies the findings of that research through a prototype design project that illustrates the application of those research findings in a professional design setting. Most of those students will enroll in a studio course that has a single faculty instructor. Some highly-capable and motivated students will be given permission by the faculty to work on their Applied Project independently of the studio with a Landscape Architecture faculty member of their choice. Each of the students will have a principle faculty critic and all of them will present and defend their work before a jury that includes the landscape architecture faculty as well as outside reviewers.

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Our MArch and MLA programs are each accredited by the respective accrediting agencies (NAAB and LAAB). Both the MArch and the MLA degree programs have a two-year track for students that come from a professional undergraduate degree background and a three-year track that accommodates students without professional undergraduate background in the related discipline. The MUD program is structured as a post-professional degree, requiring a student to already have advanced professional education in either architecture or landscape architecture as a prerequisite to entry into the program. The instruction in the MUD program is carried out by architecture and landscape architecture faculty members of The Design School. MArch, MLA and MUD students have several overlapping courses within their curricula. Within the MLA Applied Project Studio this past spring, there were nine MLA and two MUD students enrolled. Two of the nine MLA students were also completing concurrent Master of Architecture (MArch) degrees and their studio project also included an architectural design component related to and integrated with their landscape architecture design.

#### **Project Organization:**

The LAF LPEG project was integrated into the core of the studio course requirements. The assignment to the students was to propose and pursue a complex design project appropriate for the profession with a program and site for the Phoenix, AZ, USA region. Recent project types have included mixed use urban design, transit-oriented development, riparian area restoration, complete streets, urban park systems, neighborhood in-fill development and others. The project must also identify a specific significant issue or challenge to resolve with design. Significant issues might be topics such as water or energy conservation, sustainability, walkability, urban heat island, urban food production and others. As the student explores design alternatives, they apply and test various design performance strategies to determine the most effective ways to address the significant issue. Assessment considers the application of evidence-based research and best practices. When the design concept has been developed, it is then evaluated against a quadruple bottom-line, with the goal to show how the proposal contributes to outcomes in these four areas – ecologic, economic, socio-cultural and aesthetic.

The projects were to be developed as prototype models, rather than as one-off endeavors. The goal was to draw conclusions about lessons learned from this design and its assessment that can be applied to future similar designs. Students are challenged to show “What difference does the design make?” “How do you know?” This approach to design integrates evidence-based science related to landscape performance into design decision making.

Another major component of this LPEG project was the creation of an integrated seminar course dedicated to the topic of “Design Performance” that formally met for an hour each week to explore and discuss issues, philosophies, history and strategies for using “Design Performance” tools and techniques in evaluating, enhancing and promoting better design. When we taught the integrated seminar of Design Performance last spring (2014) we had participation by two students in the seminar who were not enrolled and participating in the studio course. This year (2015) only students in the studio participated in the seminar. An observation from this is that a program would not need a separate course and enrollment for studio and seminar is the instructional objectives were organized and delivered to a single cohort of students.

The activities of the seminar included reading and discussing topics of design performance based on the book *Urban Design and the Bottom Line: Optimizing the Return on Perception*, by Dennis Jerke, Douglas R. Porter and Terry J. Lassar and published by ULI in 2008. The LPEG introductory webinar, hosted by LAF LPEG

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Program Manager, Arianna Koudounas, was the feature of one of the early seminar sessions. Another activity of the seminar was to review and discuss the 2014 LAF-produced Webinar on incorporating landscape performance research into design, presented by Allyson Mendenhall, PLA, Associate, Director of DW Legacy Design; Design Workshop; Deb Mitchell, FASLA, PLA, Senior Vice President, SmithGroupJJR; and Skip Graffam, ASLA, PLA, Partner, Director of Research, OLIN. We contacted Allyson Mendenhall of Design Workshop as a follow-up and she shared the DW Legacy Design check sheets that the firm uses in early design conception to explore the ways in which they will develop their performance expectations. The students were then able to use these check sheets to begin to outline the performance expectations for their projects. The web-based resources for LAF's Landscape Performance and the Sustainable Sites Initiative were also reviewed.

Students discussed the nature of the quadruple bottom line as advocated by Jerke (economic, ecological, social and aesthetic – sometimes referred to by others as Planet, Profit, People and Poetics) and sought way to demonstrate quadruple-bottom-line benefits into their own projects. We also explored a variety of historic and contemporary approaches, strategies and theories related to design performance, illustrated as:

Strategies of design performance:

- Traditional, historic and/or conventional concepts of design performance evaluation:
  - Vitruvius – “firmness, commodity & delight”
  - Sullivan/Wright – “form follows function”; “form and function are one”
  - Precedence-based design
  - AIA: “Standard of Practice”
  - Pro Forma studies
  - Case Study Investigations
  - Health, Safety, & Welfare
  - Bottom Line
- Contemporary advances to design performance evaluation:
  - Life-cycle cost analysis
  - Value engineering
  - Return on Investment (ROI)
  - Post-occupancy evaluation (POE)
  - Value-added design
- Quality assessment applied to project, firm and/or design management:
  - Total Quality Management (TQM)
  - ISO 9000
  - Six Sigma Management (6σ)
- Innovation and Experimental approaches
  - Best Practices
  - Triple Bottom Line
  - Quadruple Bottom Line
  - House of Quality

The seminar also included a guest lecture from Chris Brown, FASLA, of Floor Associates of Phoenix. Brown shared the firm's experience with applying landscape performance strategies in the design and development of the George "Doc" Cavalliere Park in Scottsdale, AZ. The park is featured as one of the LAF landscape performance case studies and also is one of the Sustainable Sites Initiative-rated design projects.

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### **The Studio Project Topics:**

There were 11 projects, each with a different agenda of critical issues and problems to solve, developed by the students during the semester. The projects are described below. The final deliverables for each student included:

- an illustrated image file to be presented with the final oral presentation. The images were created with text and images from the student's research and design concepts work and composited with presentation software. The files were submitted in a .pdf format. The final formal presentations were 30 minutes in length with the student presenting their work in 15 minutes to jury of invited professional experts and faculty and the jury having 15 minutes for question and answer, comments and suggestions.
- a poster, in .pdf format, with a hardcopy printed out for hanging and reference at the final jury presentations and at the open house presentation during The Design School final review week. Each student was required to have at least one 2' x 6' poster, though at the student's option, they were given the option to have multiple boards. The boards were a collage of images, text and other information that provides a summary of the design proposal. Students opting for more than one board must have a first board that can summarize the work by itself if the project is chosen to be included in The Design School summer show in the Design Gallery.
- a professional report in an 8 1/2" x 11" format, submitted as .pdf document. The report will contain a written summary of the research exploration, background, investigations, design concepts, and design evaluation and assessment.

Samples of student products are submitted as representative of the students' efforts and achievements.

### **MLA/MUD Thesis Project Abstracts:**

#### ***Ali Abbaszadegan (MARCH/MLA) "Structural Complexity in Architectural Green Roof Systems"***

The objective of this thesis project at its core is to argue the need for implementing sustainable infrastructure into both the natural and built environments, specifically how we as designers need to use green roof systems in various types of building typologies to enhance structural components as well as to balance our natural systems around their specific context. The methodology of the project includes multiple scales tied to the issue from looking at large master plans to the detail involved in the constructability of efficient living systems. The design solutions and strategies proposed in this project are a small key in a larger scheme on how to implement certain ecological and architectural solutions to the dire challenges of climate change that we as designers will be facing for years to come.

#### ***Nate Bochniak (MLA) "Urban Stream Regeneration"***

The focus of my thesis is to examine how urban streams and riparian areas are affected by new housing developments. The site which I have chosen to study is the Gila River located South of Buckeye, AZ and the man-made lakes created from the mining in the area. While working with the City of Buckeye last spring in Professor Petrucci's and Professors Ewan's studio; we examined this area to see how development would happen. I will develop strategies on how these watersheds and riparian areas can still be developed while also maintaining a natural and sustainable ecosystem.

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***Roman Cervantes (MArch/MLA) "Characterizing Urban Landscapes through Imagability"***

According to the Oxford Dictionary, a monument is defined as "a building, structure, or site that is of historical importance or interest". Louis Kahn defines monumentality as "a spiritual quality inherent in a structure which conveys the feeling of its eternity that it cannot be added to or changed. Monumentality is enigmatic. It cannot be intentionally created. Neither the finest material nor the most advanced technology need enter a work of monumental character for the same reason that the finest ink was not required to draw up the Magna Carta". The scope of this project does not set out to create a sense of "spiritual monumentality" in urban landscapes. Instead it aims at understanding and identifying characteristics and or conditions of existing monumental urban landscapes, in order to develop a framework for their application to the design of future spaces. The research will look at spaces like Central Park, Millennium Park, Emerald Necklace, Indian Bend Wash, etc. and study their monumentality related to history, culture, activity, district, physicality, etc. The application of these characteristics/conditions would enable the interaction between the physical environment and society, user and site, cultivating an experience of monumentality.

***Gurnoor Kaur (MUD) "Streetscape for Pedestrians in a Light Rail TOD"***

The ELEMENTS or ARTIFACTS - IDENTIFIED, to be STUDIED, ANALYZED and REDEFINED in THEIR EXPERIENCE OF are: The STREET and the VOLUME surrounding the street. The project will build upon existing research, site conditions and contexts to propose a TOOL KIT of STRATEGIES and TACTICS that will be specific to the site of the 3.1 mile Light Rail extension into Mesa but also, contain the FLEXIBILITY of installation into similar sites and situations. The strategies and tactics are tangible but they aim, -to recreate the intangible memory of a humanized street experience and -regenerate, revitalize the economic, social and aesthetic standards of the area.

***Sijia Liu (MLA) "Edible Housing: Home food production meets the family nutrition needs"***

Project statement: Humans need nutrients to support life and health. People without healthy food and essential nutrients are like fish without clean water. So this project aims to propose a home food production system that can meet family nutrition needs.

***Meiling Cai (MUD) "Vacant to Vibrant: Infill and Urban Renewal of Gateway District"***

Defined as uncontrolled expansion of urban areas, urban sprawl brings negative impacts like environmental, social and economic impacts to the society. This thesis project is focused on how to redeveloping vacant land in urban area (due to urban sprawl) into vibrant and vital spaces. Vacant land creates several negative impacts including social, economic and safety issues, as well as environmental issue. There is urgent call for redevelopment of vacant lands. The project located in Gateway District in Phoenix. And this thesis project is trying to find solutions and strategies to transfer vacant land to vibrant and vital.

***Cris Portugal (MLA) "Plaza (A)Dorada: An Urban Design for Culture & Community"***

The outcome is for the diverse, but dominantly Latino population of Phoenix Residents living in the neighborhood of "Plaza (A)Dorada" to come together in a single place that they can be proud to collectively call their home. To express the rich and dynamic history of South Phoenix, as well as encourage dialogue and solidarity among its people and the residents of the greater Phoenix area. To celebrate this place, its history and its future, as it is, while providing a setting for conversation and expression of individual identity. Project Location: The Intersection of Southern and Central Avenues in Phoenix, Arizona.

***Lisa Santy (MLA) "Growing Connections: Mentors in the Garden"***

A toolkit for customized mentoring programs using the garden as a medium for positive, mutually beneficial interaction and personal growth. Depending on context, this model can be tailored to school, community or church gardens and applied to youth-to youth, as well as more traditional mentor/mentee relationships. Garden mentorship programs abound for those wanting to learn about gardening and school and community gardens are becoming commonplace. The idea of using the garden as a mechanism for building meaningful relationships and fostering positive life skills is not only an idea with merit, but a unique angle that deserves greater exploration.

***Junyu Su (MLA) "Greening The Light Rail Station"***

The light rail system plays an important role in public transportation in PHX. Anyway, the railway system showed some potential parts to be developed. Light rail station and the rail system show an impact in decentralizing the central areas, and a mixed road conditions with light rail had the potential danger to the residents and drivers. The project is aimed to develop an open space based on the location of the light rail station (the light rail station will be part of the green open space), a green space extended through the residential areas to the commercial areas across the street. The project will be able to solve the problems and provide a new kind of green infrastructure with public open spaces for the residents, reform the road conditions, adding it more connection to the commercial area with residents' areas. More values will brought to surrounding areas: lands values will increase, more population will attracted to the area, public transportation will be supported and improved. Also, more green lands will be added to the city, noise, UHI and carbon dioxide emission can be reduced also the storm water can be absorb by the green areas. Site: Light rail station on Montebello and the 19th street, the station on W Camelback Road with 19th Ave. Context (issues): 1. Light rail and light rail stations had a decentralization impact on the mixed use area in PHX. Separate the two areas from the streets. 2. Light rail causes noise to the surrounding areas. 3. The mixed use with light rail and roads made it and unsafe potential situation for the user and people in PHX. 4. Storm water in the urban areas can cause a water flooding. 5. No enough open spaces in the mixed use areas in PHX. 6. The station of the light rail is not a friendly place in the summer time in PHX, that's another reason why the public transportation is not well organized and used here.

***Mary Villarreal (MLA) "Layering sustainable water management for landscapes within rapidly densifying TODs"***. Water is a vital resource in arid urban environments. As the Phoenix metropolitan region implements TOD along new legs of the Metro Light Rail system, there is an opportunity to use this resource responsibly. With the expected urbanization that accompanies Light Rail development, numerous sustainable water management practices can be utilized. Greywater systems can develop alongside new mid-rise buildings, increased impermeable surfaces can harvest rainwater for landscape use and stormwater capture can be incorporated within public spaces of the TOD. By layering sustainable water management practices, we can test the economic, ecologic, social and cultural saliency of this approach. Importantly, this can be a vital tool in forming policy for the greater region.

***Yudan Wang (MLA) "Creating Sustainability in Low-Income Communities"***

This project discusses the current living issues of low-income communities in South Phoenix. Aims to give some design solutions to transfer low-income community to a sustainable community. The sustainable community provides an economic model for local food supply, green network deal with urban island effect and air pollution, water harvesting system and some new technologies making community more energy efficient. To create a health, walkable, safe, green and energy efficient community.

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### **Student Work Evaluation and Critique:**

During the semester, students has regular desk critiques during studio production time. At regular intervals, all students make semi-formal progress presentations to a review panel made up of faculty. These faculty members included the regular landscape architecture faculty, some adjunct faculty members, several of the architecture/urban design faculty and occasionally critics from outside the university. These may have been public officials serving a “client role” for a specific project or they may have been technical or professional experts providing additional mentoring in a particular student’s project. These monthly progress reviews were scheduled and announced from the beginning of the course and were designated as open, public reviews.

At the end of the semester, there was a final, formal, public presentation of the projects by the students. A jury for these presentations was composed of:

- Mr. Hunter Beckham, FASLA, PLA, SWT, St. Louis and ASLA VP of Practice
- Mr. Chris Brown, FASLA, PLA, Floor Associates, Phoenix
- Ms. Michele Shelor, ASLA, PLA, Colwel-Shelor, Phoenix
- Ms. Cynthia Beckham, architect, Exec. Director - Facility Design, Sisters of Mercy Health System
- ASU Landscape Architecture & Urban Design Faculty

### **Project Assessment – Studio Component:**

The spring 2015 semester was the second year in a row for the particular instructional format and goals that governed the course. I believe that it was easier for students to conceptualize a challenging but manageable project that had interesting design opportunities and significant performance benefit potentials. We made a thematic push to apply one of the concepts presented in the LAF LPEG Orientation Webinar – the concept that design development can be explored as “Features leading to Functions leading to Benefits”. For example, a landscape design feature might be the development of a streetscape using best practices of “complete streets”. The functions of the design might be to articulate separate spaces for activities and operations by motorized vehicles, bicycles, and pedestrians with components that also provide spatial separation and definition, shade, and human scale. The resulting benefits of these features and their functions might be measured in outcomes of reduction of urban heat island, improved wayfinding by users, increased safety and satisfaction by pedestrians.

The assessment of the jury was that the project work demonstrated a high level of competence and creativity and the students were commended for their professionalism and vision. Several of the students and their work has already been recognized within The Design Schools awards and “Design Excellence” program and I expect others to receive regional and national visibility. The course and the products will serve as good models for the application of landscape design performance concepts in advanced studio design courses.

### **Potential for Improving the Instructional Components:**

There are a couple of considerations for the future improvement of the course. The first is related to offering both the studio and the seminar courses as concurrent interdependent courses. It is extremely challenging to manage the institutional and structural aspects of offering multiple courses for multiple enrollment by students and it would be easier to just combine the learning activities of both into the single studio course with the seminar content just offered as a lecture/discussion component of the studio.

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The second recommendation resolves around the open-ended nature of design. Design exploration (at any educational level) tends to expand any available time. The course could be improved with a more assertive effort on the part of the instructor to move the students from activities of design conceptualization and visualization into processes of design evaluation and performance assessment at a faster and more deliberate rate. No matter how advanced, experienced and sophisticated the students are, we're still challenging them to operate at a critical level beyond their previous experience and that means that we need to be especially assertive in coaching the students to constantly explore the justification and the evidence to support their design speculation. We (faculty mentors, jurors, critics and finally the students themselves) need to constantly be asking, "What are you doing (related to design decisions)? Why did you do it? What is the benefit/consequence? How do you know?"

#### **LPEG Component on Assessment of Landscape Performance Knowledge**

There was an additional component to this LPEG project. It centered on the development of assessment tools for evaluating the learning that students have related to understanding and applying aspects of landscape design performance. This exploration was conducted by the LPEG Fellow parallel but independent from the activities and responsibilities of the students. The goals of learning assessment are to determine "What do students know" (or what should they know) and "How well do they know it?"

The "What should students know about landscape design performance?" topics are taken from LAF's Landscape Performance Series Benefit Toolkit website (<http://landscapeperformance.org/benefits-toolkit>). These topics include:

- Land
  - Soil creation, preservation & restoration
- Water
  - Stormwater management
  - Water conservation
  - Water quality
  - Flood protection
  - Water body/groundwater recharge
- Habitat
  - Populations & species richness
- Carbon, Energy & Air Quality
  - Energy use
  - Air quality
  - Temperature & urban heat island
  - Carbon sequestration & avoidance
- Materials & Waste
  - Reused/recycled materials
  - Waste reduction
- Social
  - Recreational & social value
  - Educational value
  - Food production

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#### Economic

- Property values
- Operations & maintenance savings
- Construction cost savings
- Other economic

The question about how well someone knows about something is best described by theory developed by Benjamin Bloom and now referred to as Bloom's Taxonomy of Learning. According to Anderson and Krathwohl (2001), Bloom's Taxonomy says that how well someone knows about a topic is demonstrated by how that person can use that information. At the lowest level of the knowledge is basic awareness and remembering – the ability to retrieve, recognize or recall related knowledge from long-term memory. The second level is comprehension or understanding – having the ability to explain information or concepts. The third level is application – the capacity to use the information. The fourth level is analysis – the capacity to break up complex information into constituent parts, determining how the parts operate and their relationship to the whole of the system. The fifth level is evaluation – the exercise of judgement based on criteria and standards. The sixth and highest level is creating – the ability to develop new ways of seeing and understanding information related to the topic.

In creating testing and assessment tools for determining how well someone knows about a topic considers how a question asks a student to recognize, use or apply the information. The table below illustrates these

Level of Knowledge Understanding	Use / verbs	Products
6 Creating (creating new understanding)	change, combine, compose, create, design, formulate, hypothesize, improve, invent, predict	booklet, cartoon, multimedia, new game, poem, skit.
5 Evaluating (defend concept or ideas)	appraise, defend, dispute, editorialize, judge, justify, prioritize, rate, select, support, verify	critique, judgement, opinion, recommendation, report, self-evaluation
4 Analyzing (distinguish different parts)	appraise, compare, contrast, differentiate, distinguish, examine, infer, outline, sequence, test	chart, plan, questionnaire, spreadsheet, summary, survey
3 Applying (use information in new ways)	classify, demonstrate, dramatize, illustrate, practice, solve, use	collection, interview, model-building, presentation, role playing, scrap book, simulation
2 Understanding (explain information or concepts)	calculate, describe, discuss, expand, explain, identify, locate, outline, report, restate	drawing, paraphrasing, peer teaching, show & tell, story problems, summary
1 Remembering (remembering information)	define, duplication, list name, recall, reproduce, tell underline	definitions, fact charts, lists, recitations, worksheets

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Another table, provided by Lord & Bavisar (2007), provides an additional perspective towards the creation of questions or evaluative activities for an assessment of level of understanding:

Bloom's Level	Potential action(s) of student	Question cues / verbs
6 evaluation / creation	Evaluate, argue in support/against, panel discussion	Assess, decide, grade, recommend, justify, judge, debate, verify, argue, recommend
5 synthesis / evaluation /	Create something new from different concepts	Create, design, invent, plan, propose, devise, compose, construct
4 analysis	Break concepts into parts and analyze how different parts are related to one another	Review, design, analyze, construct, investigate, categorize, separate, compare and contrast
3 application	Apply rules or concepts to a problem	Apply, calculate, solve, show, illustrate, construct, classify
2 comprehension / understanding	Summarize in own words, paint a picture, make a flow chart	Describe, categorize, summarize, explain, interpret, outline, compare, distinguish, predict, translate
1 knowledge / awareness / remembering	Recall the memorized information	List, define, label, identify, name, find, write, state, describe, tell

There is already precedents for knowledge assessment related to design performance in the testing that is done related to LEED credentialing by the USGBC. The test preparation materials for the LEED Green Associate include these sample questions:

1. When applying for innovation credits, a project team

(A) Cannot submit any previously awarded innovation credit.

**(B) May receive credit for performance that doubles a credit requirement threshold.**

(C) May submit a product or strategy that is being used in an existing LEED® credit.

(D) May receive a credit for each LEED Accredited Professional that is on the project team.

*This question represents Knowledge Domain A. LEED Process, credit categories and Task Domain A. LEED Green Associate Tasks*

2. A developer wants to make a profit by building a new office that maximizes daylighting and views. What actions might the developer take to fulfill all parts of the triple bottom line?

(A) Restore habitat onsite

(B) Purchase ergonomic furniture

(C) Pursue local grants and incentives

**(D) Provide lighting controllability for occupants**

*This question represents Knowledge Domain I. Project Surroundings and Outreach, environmental impacts of the built environment and Task Domain A. LEED Green Associate Tasks, assist others with sustainability goals.*



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Based on the above presented listing of knowledge topics (what one knows) and the framework for Bloom's Taxonomy (how well one knows it), the following table organizes an outline for developing assessment questions or assessment activities.

	Awareness	Understanding	Application	Analysis	Evaluation	Creation
<b>Land</b> Soil creation, preservation & restoration						
<b>Water</b> Stormwater management, water conservation, water quality, flood protection, water body/groundwater recharge						
<b>Habitat</b> Populations & species richness						
<b>Carbon, Energy &amp; Air Quality</b> Energy use, air quality, temperature & urban heat island, carbon sequestration & avoidance						
<b>Materials &amp; Waste</b> Reused/recycled materials, waste reduction						
<b>Social</b> Recreational & social value, educational value, food production						
<b>Economic</b> Property values, operations & maintenance savings, construction cost savings, other economic						

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Work to develop assessment tools that educators can use to evaluate students' performance knowledge continues at this point and remains an on-going project. I expect to continue to work on developing these concepts and tools and to report on them through contributions to conference presentations and papers.

**Published References to cited work in this report:**

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational objectives: Complete edition, New York: Longman.

Jerke, Dennis; Porter, Douglas R. and Lassar, Terry J. 2009. *Urban Design and the Bottom Line: Optimizing the Return on Perception*, Washington, DC: Urban Land Institute

Lord, T., & Baviskar, S. (2007). Moving students from information recitation to information understanding: Exploiting Bloom's Taxonomy in creating science questions. *Journal of College Science Teaching*, 36(5), 40-44.

USGBC 2015. Credentialing Materials for LEED-accredited Professionals. [www.usgbc.org/redentials#ga](http://www.usgbc.org/redentials#ga).

**Organizations Referenced in this Report:**

Landscape Architecture Foundation (LAF). [www.lafoundation.org](http://www.lafoundation.org)

Sustainable Sites Initiative (SSI). [www.sustainablesites.org](http://www.sustainablesites.org)

US Green Building Council (USGBC). [www.usgbc.org](http://www.usgbc.org)



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Spring 2015 Semester

LDE 593 / MUD 690 Advanced LA/UD Studio IV  
Applied Project / Thesis in Design Performance

## Syllabus: Advanced Applied Project/Thesis Studio

Course(s): This syllabus serves several courses. This advanced design studio course is intended as a culminating studio for master of landscape architecture and master of urban design students. The course sections for enrollment in the course include: **LDE 593 Topic: Advanced Landscape Architecture Studio IV**, and **MUD 690 Topic: Advanced Urban Design Studio IV**. The spring 2015 class schedule line numbers for the courses are:  
LDE 593 Class #23807  
MUD 690 Class #24235

Description: This is the regular thesis studio that most MLA students will take. The ASU Graduate College recognizes this course as a “*non-thesis, culminating experience*” or project. By being a “project,” the Graduate College’s rules for format, process, and content are somewhat relaxed. The final product doesn’t have to follow the format of a traditional scholarly thesis – it can be formatted in a manner appropriate to the professional discipline, including the use of drawings, reports, models or other similar professional documentation. The expectations of the landscape architecture faculty is that exploration and presentation protocols may be more flexible but a researchable issue is systematically and rigorously examined, evaluated and specific conclusions and recommendations are made. Design, as a process for exploring or comparing ideas may be an acceptable part of the project, but it is probably not the object of the project intent (“doing a design project” is not the goal of the thesis studio).

The themed topic and focus of the course will be **Design Performance**. Students will develop a complex design project that addresses a significant professional issue. The project will explore and demonstrate how advanced design resolves that issue in a performative manner using evidence-based practices and performance-based metrics.

This course is intended to give professional design students (especially MLA and MUD students) an opportunity to engage in complex design that applies a research-based approach. The

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course serves as a culminating experience for the MLA or MUD degree. The focus will be on both process and outcome related to a research topic of significance to the discipline, of professional interest to the student and supportable by the resources of The Design School (including available faculty expertise).

- Instructor:** Prof. Kenneth R. Brooks (serving as studio supervising instructor in consultation and collaboration with other landscape architecture and urban design faculty)  
Office location: DN 72 (lower level, NW corner)  
Phone (with voice mail): 480-965-2533  
Email: *Kenneth.Brooks@asu.edu*  
Office Hours: Wednesdays 10:00-11:00, Thursdays 2:00-4:00 and by appointment; drop-ins are invited on a time-available basis (if you come by and I'm not available, please leave a message so that I can get back to you). The best way to consult with me is to request an appointment during class or by email.
- Grading:** Traditional grades will be assigned with LA faculty consultation.
- Requirements:** Each student will propose a researchable topic or issue. The proposal will include a description of the issue, the methodology to be used in investigating it, the lead landscape architecture faculty, the anticipated outcomes and deliverables. Each student will propose at least two faculty members as lead reviewers (including the designated thesis studio supervisor). Students may invite other faculty and other professionals serve as critics, advisors, and/or reviewers. The proposals, periodic reviews and final project presentations/defense will be conducted and adjudicated by a committee of the landscape architecture and/or urban design faculty and invited guests. Students taking the formal thesis track (LDE 599) will follow a similar process, with the addition of review and acceptance by the officially-approved supervisory committee.
- Course Meetings:** The thesis studio is scheduled to meet regularly on Wednesday and Friday afternoons from 1:30 - 5:55pm. Because of the independent nature of the projects, students will have flexibility in the use and management of much of this time for project work. Students will schedule weekly critique review sessions with the studio supervisor (Brooks) and with other faculty.

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Monthly progress presentations and reviews will be made by each student to a committee of faculty reviewers during the term.

**Final Products:** All students will prepare both a formal oral final presentation and documents that can be digitally archived. The final documents will include:

- an illustrated image file to be presented with your final oral presentation. The images can be created with text and images from your work and composited with any presentation software. The file will be submitted in a .pdf format. The final formal presentation will be 30 minutes in length with the student presenting their work in 15 minutes to jury of invited professional experts and faculty and the jury having 15 minutes for question and answer, comments and suggestions.
- a poster, in .pdf format, with a hardcopy printed out for hanging and reference at the final jury presentations and at the open house presentation during The Design School final review week. Each student is required to have at least one 2' x 6' poster, though at the student's option, they may have multiple boards. The boards will be a collage of images, text and other information that provides a summary of the design proposal. Students opting for more than one board must have a first board that can summarize the work by itself if the project is chosen to be included in The Design School summer show in the Design Gallery.
- a professional report in an 8 1/2" x 11" format, submitted as .pdf document. The report will contain a written summary of your research exploration, background, investigations, design concepts, and design evaluation and assessment. An appendix with further information for the Professional Report is attached to this syllabus.

All students are also encouraged to present their work in a venue for professional peer-review (such as an article, a conference presentation or a competition submission) in a format appropriate to the venue.

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Review Dates: (review location will be announced.)  
1st Mid-Review Fri, Jan 30 – 15 minutes/student  
Project Issues, Goals, Scope, Program, Expectations  
2nd Mid-Review Fri, Feb 27 – 30 minutes/student  
Research, Ideation, Concepts, Implementation Strategies  
3rd Mid-Review Fri, Fri Mar 20 – 30 minutes/student  
Design Implementation and Development  
4th Mid-Review Thu, Apr 30 Final Rev. – 30 minutes/student  
Design Completion, Design Performance Assessment  
The Design School Public Design Reviews Open House  
Friday, May 8 Showcase Poster Show

Related Course: The thesis studio, focusing on Design Performance, will be complimented by seminar on Design Performance. The seminar will explore the nature of design performance and examine strategies, systems and tools for applying and communicating issues of performance. The Seminar will be scheduled as a “course within a course”, meeting Fridays for one hour of discussion and presentation in the studio conference room.



## **Recommendations and Guidelines for Developing the Thesis Project Professional Report**

### **Professional Report Presentation**

A professional report is a document that makes a comprehensive presentation of the inputs and outputs of your thesis / culminating project. It defines the scope of the work, shares the background and framework for the project, demonstrates the investigations and processes and research findings and presents results, conclusions and recommendations. Like an academic thesis or dissertation, it is intended to be a document of advanced scholarship with rigorous and systematic presentation of the contents, but as a professional report the presentation format is much more flexible. The guidelines and suggestions within this document are intended to help you organize and present a document that comprehensively summarizes your thesis / culminating project.

The report should be prepared as a stand-alone document – that is, you could give a copy of it to someone and they could read it and fully understand what you did, what you learned, and what you consider the outcomes and recommendations to be. It should be formatted as a document in an 8½" x 11" format containing text, images, tables, charts, and illustrations in an organized and logical order. The document may be submitted in a digital .pdf format. Printing and submitting a hardcopy is optional.

The rest of these comments describe the suggested form, format, order and content of the report:

### **Cover**

According to an old saying, "First impressions are lasting impressions." The cover of the report will be a direct and indirect statement about the nature, scope and content of the report. It will also make a statement about the professionalism, capabilities and interests of the author of the report. There is a great deal of freedom and flexibility in the design of the cover. It should quickly and directly communicate the scope and content of the thesis project. On an implicit level, it should justify itself as a contribution to the body of knowledge of landscape architecture and/or urban design. In descending priority, it should minimally show the title of the project, the author, The Design School at Arizona State University and the date. Some people prefer to make the title page and the cover essentially the same (with the only difference being that the cover is made out of a coverstock paper). A cover that looks like the top sheet of a term-paper does more damage than good to the credibility of a designer/researcher. The cover may also incorporate imagery in the form of an iconic illustration or photograph that helps to brand the project.

### **Title**

The title of the project should clearly and succinctly represent the intent and scope of the research. Titles may change several times during the research, development and rewriting of the thesis/dissertation project, therefore it isn't necessary to be overly concerned about "final" title selection during the proposal development stage. Don't use jargon. The thesis/dissertation project may later be indexed alphabetically by title in a card catalog or database so it is important to have the first non-article word substantially related to the subject rather than start out as "A Study of...", or "An Evaluation of...". The title should appear on the cover page, at the top of the title page, the abstract and on the first page of the text of the report.

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### **Title Page**

The purpose of the title page is to identify the project and the individual author, the degree program, the School and University associated with the project. It is to be similar in appearance to the title page of a completed thesis/dissertation. The title page minimally should contain the project title, the author's name and degree, the name of the School (The Design School at Arizona State University), the faculty members who served as instructor, (Prof. Kenneth R. Brooks, FASLA, FCELA, PLA), the course number and title and the date. The inside title page often looks very similar to the cover page, but it usually has additional information, like the reference to the course, that is important to the document, but not important for the cover. The inside title page usually doesn't have bold graphics on it the way a cover might.

### **Keywords**

Key words are a useful way to help people find your work by critical topical words or concepts. You should select a group of words (usually between 3 to 6 words) that are central to the topical focus of the project.

### **Abstract**

An abstract is a synopsis describing, in brief, the essence of the thesis/dissertation work. The reader should be able to have a clear idea of the goals and intent of the proposed research from the abstract. A summary of the background, hypothesis, anticipated results and some discussion of their significance should be the major content of the abstract. An abstract is typically written after the other sections are written. It should not exceed one page in length. For these projects, I recommend limiting the abstract to no more than five sentences and no more than 100 words. Place the title at the top of the page, followed by the name of the researcher/author, author's degree title (Master of Landscape Architecture Candidate or Master of Urban Design Candidate), The Design School at Arizona State University and the date before beginning the text.

### **Outline of Report Sections**

Use a brief outline of the contents of the report to help you organize the content. This outline is not a part of the final report, but a writing tool to help you organize and construct the document. The outline might include anticipated section titles, major headings and possibly minor headings. Additional contents of the report (such as title page, acknowledgments, table of contents, and appendices) should also be listed. A simple, generic chapters and/or section organization might be similar to the outline shown in the table below. Feel free to add some annotation under the sections to show the contents of those sections (for instance, the contents of appendices might be letters, survey form, data, glossary or index).

- Cover
- Title page
- Abstract
- Acknowledgments
- Table of Contents
- Table of Figures
- Section 1: Executive Summary (introduction, justification, summary of process & outcomes)
- Section 2: Background (background, context and history – includes literature review)
- Section 3: Methodology, Processes, Explorations
- Section 4: Findings, Observations and/or Design Proposals
- Section 5: Interpretations, Conclusions and Recommendations for Future Application
- Literature Cited
- Appendices (such as oversized drawings, field work, datasets)

### **Generic thesis/dissertation outline:**

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### Editorial Format/Style

Editorial style includes such considerations as margin width, organization and layout of headings and subheadings, footnoting, handling of illustrations, pagination, insertion of quoted passages and citation of literature. The editorial style for the thesis/dissertation should be decided and described so that its rules of format can be used when the thesis/dissertation is begun rather than making style changes after the manuscript is completed. You should also consider the type faces and spacing of characters to use in the thesis/dissertation. If you will be using original artwork or photographs, describe how they will be produced, reproduced and formatted within the framework of layout rules. The Graduate School currently requires these to be in a style approved by the department. They give the student's department or committee relative freedom on almost all format rules (except margins, which must be followed for the sake of binding). The Master of Landscape Architecture Program leaves the decision of style format to the thesis/dissertation committee. The author should identify a recognized refereed journal appropriate to the research being done and adopt it as the guide for editorial style. A brief summary of style rules should be compiled for reference during later writing. It would be desirable to use this style during the development of the proposal so that the author becomes comfortable with it. The *Publication Manual of the American Psychological Association* or *The Chicago Manual of Style* may be referred to for detailed style questions. Mock-up sheets showing style and layout will help accelerate layout and paste-up later. You should prepare a listing of the various style decision that you have made with examples of such things as citation format, heading style, margination, pagination, and use of graphics.

### APA Style Standards for Planning and Design Students

The *Publication Manual of the American Psychological Association* is one of the leading standard references for style issues for thesis, dissertations and professional reports in disciplines of Architecture, Landscape Architecture, Planning and Urban Design. Most Graduate Schools allow departments and programs to select style guidelines for the theses produced by their students. Although some of the natural science disciplines and humanities disciplines use different style guides, the *APA Manual* has become a leading standard for environmental design and is therefore recommended as the preferred style manual for this course. It is appropriate to use the *APA Manual* because many of the thesis/dissertation research projects reflect social science and/or behavioral topics for which APA practices are the standard anyway and because the manual is comprehensive, convenient and inexpensive for use as a reference for students wrestling with issues of editorial style.

By default, it has become the standard practice environmental planning and design departments to tell the students that they should follow the *APA Manual* unless they had a good reason for using an alternative approach.

The principal intent of the *APA Manual* is to assist scholars with the preparation of manuscripts that will later be typeset by an editor into a scholarly journal article. Although we currently use an updated edition, which has significant accommodations for computing technology, including word processors and Internet-based literature, many of the conventions were established when the primary media was conventional typewriters. For instance, words or phrases that would be set in an *italic* typeface by the typesetter are supposed to be underlined instead, just as they would have been if typed on a typewriter that didn't have multiple type fonts. By contrast, *The Chicago Manual of Style* (CMS) describes style conventions more typically intended for typeset books, monographs and similar publications. Some of the style alternatives suggested here follow (CMS) recommendations.

Most of Master of Landscape Architecture, Master of Architecture, and Master of Urban Design students will be doing much more professional report writing and desk-top publishing than they will preparing manuscripts for publication for scholarly journals. For this reason, we'll encourage several style changes

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that are more in keeping with desk-top self-publishing as might be done in professional offices and agencies. Here are several recommended modifications:

- APA Practice: When book titles are listed in text, they should be listed in roman typeface and underlined (APA 3.13). The same practice is used for book and journal titles in a references cited section (APA 3.110).

Preferred Alternative: If book titles had been typeset, they probably would have been placed in italic type (CMS 7.129) and therefore the desktop publishing convention should be to place those titles in an italic font.

- APA Practice: When listing references in a bibliography or references cited section, the authors should be in the form of surname name followed by initials. The first and middle names are always abbreviated to initials (APA 3.110 and 3.111).

Preferred Alternative: One of the traditional practices of science is to take care not to “through away data.” In the spirit of “keeping data,” include any first or middle names that the author or publisher uses in the publication (CMS 15.77, 16.5 & 16.6). As scholars and professionals develop publications with current information from current authors, it is valuable to cultivate the continued sense of a community of peers. Using the given names of authors helps to promote that sense of community.

- APA Practice: The *APA Manual* requires that book or article titles only capitalize the first letter of the first word in the title and subtitle and any proper nouns (APA 3.113-3.116).

Possible Alternative: The *Chicago Manual of Style* suggests that titles may either capitalize the first letters of all significant words in the title or may capitalize only the first letter of the first word in the title and subtitle (CMS 16.5 & 16.6). For your work, you may select either approach, as long as it approved by your major professor. Just be sure to use the selected style consistently throughout.

- APA Practice: The *APA Manual* requires the reference citations in the bibliography be typed in paragraph form -- indented at the beginning of the citation and then continuing in continuous, word-wrap paragraph form through the whole citation. The citation paragraph is presented in double-spaced format. (APA Appendix 3-A). The expectation is that the manuscript is typed in double space throughout, and the editor would typeset the reference paragraph as single spaced in hanging indent format.

Preferred Alternative: Since the ultimate typeset format would be a single spaced paragraph in hanging indent format, the author should use that common desktop publishing format. Although citation paragraphs would be single-spaced, use double spacing between the citations.

- APA Practice: The *APA Manual* requires that page numbers be placed in the top right-hand corner, one inch from the right edge of the page in the space between the top edge of the paper and the first line of text (APA 4.06)

Preferred Alternative: According to the *Chicago Manual of Style*, most type-set publications place the page number at the bottom of the page against the outside of the page -- next to the right margin for right-side pages and next to the left margin on left-hand pages (CMS 1.84). Since proposal abstracts don't have left-hand pages, all pages numbers should be placed on the right-hand side next to the margin. Since it may be difficult to know which pages will be left or right, it may be more convenient to number pages at the bottom center.

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**Editorial Style Check sheet.** The following editorial style features represent the many decisions that the author may have. Make a decision and give a description and an example of each of the following:

Style manual or guide:

Margins:

Left

Right

Top

Bottom

Heading format and position:

(left/right/top/bottom positions and margins; examples)

Chapter or Section Titles:

format (font size and expression – such as bold, caps, underline)

position

spacing

example

Text

Font typeface & size

Paragraph (indentation or not)

Justification (left, right, center)

Text line spacing

Spacing between paragraphs

Spacing before new headings or sections

1st order heading:

format

position

spacing

example

2nd order heading:

format

position

spacing

example

3rd order heading:

format

position

spacing

example

citation format (example – author, date; footnote, endnote):

page numbering:

table and figure format:

### **Table: Editorial Style Check Sheet**

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### **Literature Cited**

At the end of the proposal, the author should have a section of literature cited within the proposal. This need not be a comprehensive bibliography but only a listing of those publications that were referred to in the proposal. Your literature cited section can be even more valuable if you make it annotated – that is, provide a sentence or two of comment about the content of the publication following the citation.

### **Illustrations, Maps, Charts, Photographs, and Graphs**

Describe the graphic materials to be included in the thesis/dissertation. What will they show? What will their format be? How will they be produced and reproduced? What will the media be? Many people think of a thesis/dissertation as the expression of ideas in a written narrative form. Remember that as a member of a visual discipline that graphic images are (or should be) one of your most powerful communication tools. Don't overlook the opportunity to use a mixture of graphics and text to present your findings and ideas. Professional reports often have liberal use of images and illustrations to make their point. Remember that all illustrations, graphics, photographs and any other similar materials need to have a reference citation if they come originally from a source other than the author.



# Symbiotic Urban Water Systems:

## The Architectural Impact of Integrating Living Technologies to Manage Watershed Flows and Ecosystem Services



**Ali Abbaszadegan**



# Symbiotic Urban Water Systems:

## The Architectural Impact of Integrating Living Technologies to Manage Watershed Flows and Ecosystem Services

### Living Roofs

Living roofs and roof gardens are vegetated roof surfaces that can help to improve the performance of the building by forming better acoustic quality in the interior and increasing the life of the roof membrane. Also, the system creates a greater aesthetic appeal and biodiversity. Green roofs fall into two categories: extensive and intensive. The extensive system is lightweight, has a shallow soil depth and small plants to serve ecological functions. Intensive green roofs can be as big as you want them to be and have roof top gardens with shrubs, trees and walkways to maximize accessibility and use. Planting methods can take on different shapes in different places due to local responses to plant use. It is also beneficial that innovative architecture compliment the green roof system to help maximize all sustainable infrastructure components.



### Wetlands

Wetland hydrology is associated with the spatial and temporal dispersion, flow, and physiochemical attributes of surface and ground water in its reservoirs. Based on hydrology, wetlands can be categorized as riverine (associated with streams), lacustrine (associated with lakes and reservoirs), and palustrine (isolated). Sources of hydrological flows into wetlands are predominately precipitation, surface water, and ground water. Water flows out of wetlands by evapotranspiration, surface runoff, and sub-surface water outflow. Hydrodynamics (the movement of water through and from a wetland) affects hydroperiods (temporal fluctuations in water levels) by controlling the water balance and water storage within a wetland.

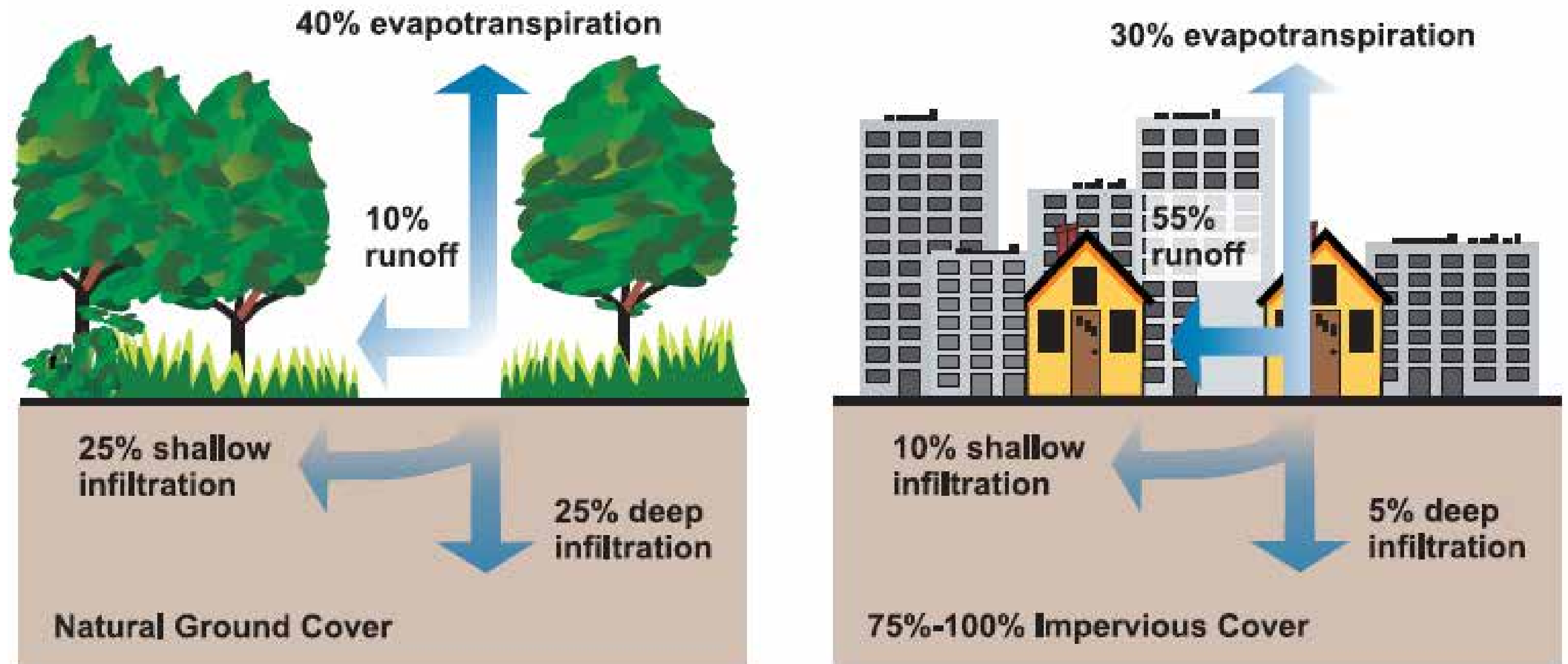


Source: Richardson, JL, Arndt, JL & Montgomery, JA 2001, 'Hydrology of wetland and related soils' in JL Richardson & MJ Vepraskas (eds), Wetland Soils, Lewis Publishers, Boca Raton



# Symbiotic Urban Water Systems:

## The Architectural Impact of Integrating Living Technologies to Manage Watershed Flows and Ecosystem Services



Source: U.S. Environmental Protection Agency, Washington, D.C. "Protecting Water Quality from Urban Runoff." Document No. EPA 841-F-03-003

# Living Roofs / Integration

There are two types of green roofs. The **Extensive** system is lightweight, shallow soil depth and small plants to serve ecological functions. **Intensive** green roofs can be as big as you want them to be, real roof top gardens with shrubs, trees and walkways to maximize accessibility and use.

## Core Plants:

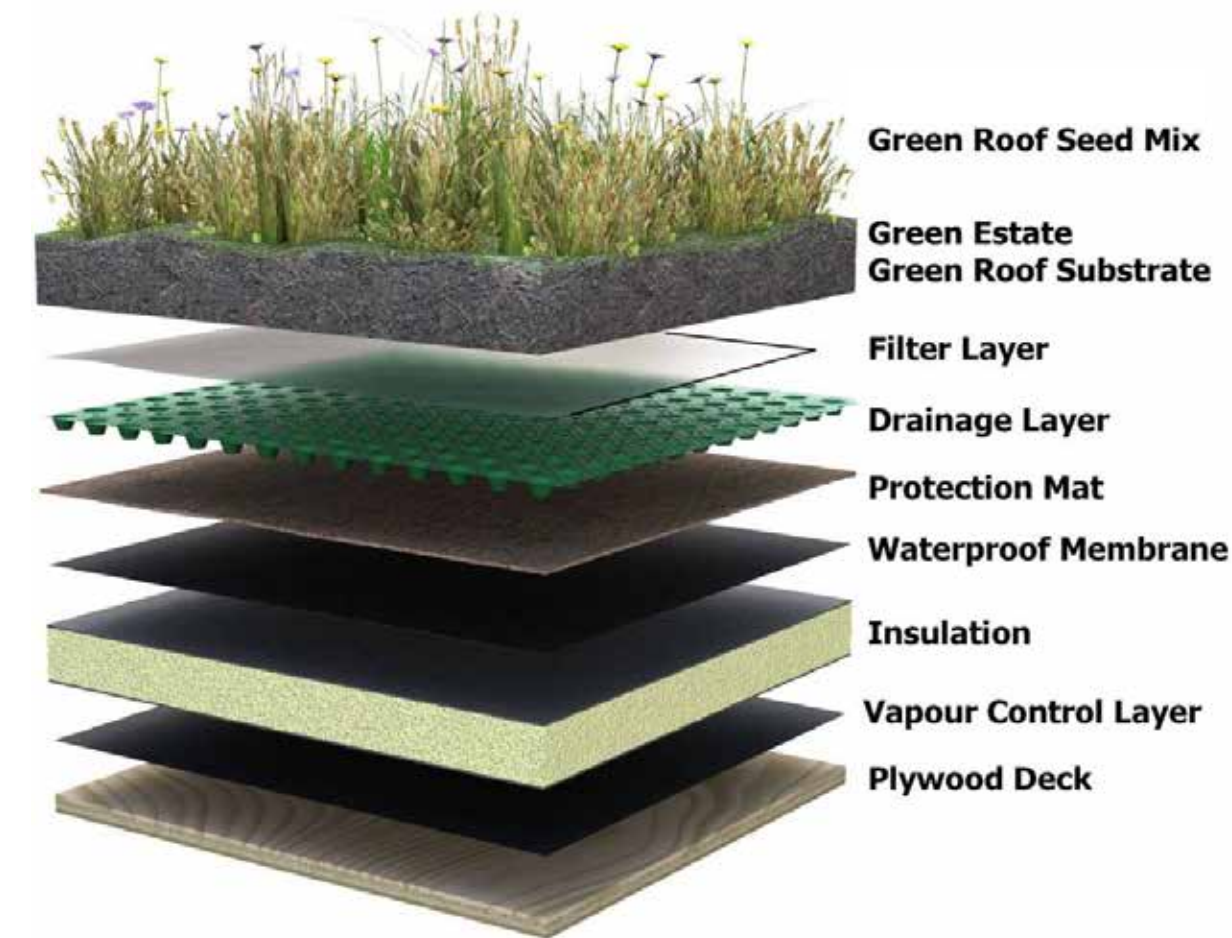
- Low Maintenance
- Long Lived
- Exist is Shallow Substrate
- Do Not Need Irrigation
- Groundcover Habitat
- Open to All Installation Methods

## Succulent Mix:

- Low Weight
- Low Inputs
- Low Nutrient Outfall
- Low Maintenance
- Limited Design Options

## Layers of a Green Roof:

From top to bottom



Planting methods can take on different shapes in a multitude of places to help **transform** the Architecture into an **adaptable tool** to sequester carbon, **reduce** the heat island effect and **manage** storm water runoff.

# Living Roofs / Integration

**A green roof test plot at the University of Georgia retained 88% of precipitation for small storms (<1 inch), 48% for larger storms (>3 inches), and delayed the peak flow by an average of 18 minutes for 31 rain events between Nov 2003 and Nov 2004.**

Carter, Timothy L., and Todd C. Rasmussen. (2006). Evaluation of the hydrologic behavior of green roofs. *Journal of the American Water Resources Association* 42(5), 1261-1274.

**A Michigan State University study used test platforms to test the influence of roof slope (2 and 6.5%) and green roof media depth (2.5, 4.0, and 6.0 cm) on stormwater retention. For all combined rain events, platforms at 2% slope with a 4-cm media depth had the greatest mean retention, 87%, although the difference from the other treatments was minimal. The combination of reduced slope and deeper media clearly reduced the total quantity of runoff.**

VanWoert, Nicholas D., D. Bradley Rowe, Jeffrey A. Andresen, Clayton L. Rugh, R. Thomas Fernandez, and Lan Xiao. (2005). Green Roof Stormwater Retention: Effects of Roof Surface, Slope, and Media Depth. *Journal of Environmental Quality*, 34(3), 1036-1044.



# Artificial Wetlands / Integration

A treatment wetland is an engineered sequence of water bodies designed to filter and treat waterborne pollutants found in storm water runoff or effluent.

In **treatment** wetlands aerobic and anaerobic biological processes can neutralize and capture most of the dissolved nutrients and toxic pollutants from the water, resulting in the discharge of clean water.

Many regulatory agencies list treatment wetlands as one of their recommended “best management practices” for

**controlling** urban runoff. Treatment wetlands can also be used for sewage treatment.

Source: Wastewater Treatment Wetlands: Contaminant Removal Processes by William DeBusk, University of Florida, Institute of Food and Agricultural Sciences





# Artificial Wetlands / Integration

**Results from a multi-year study demonstrate that a constructed stormwater wetland is effective in removing phosphorus, nitrogen, total suspended solids, copper, and E. coli in stormwater runoff. The 0.4-ha wetland has 20 plant species and treats an 18.2-ha suburban watershed. Phosphorus, nitrogen, and suspended solids were removed nearly year-round, with removal of total suspended solids highest during the summer. Performance of the wetland was consistent over two-year-long periods four years apart, though no maintenance was performed on the wetland.**

Wadzuk, Bridget M., Matthew Rea, Gregg Woodruff, Kelly Flynn, and Robert G. Traver. (2010). Water-quality performance of a constructed stormwater wetland for all flow conditions. *Journal of the American Water Resources Association*, 46(2), 385-394.

# Water at the MACRO scale





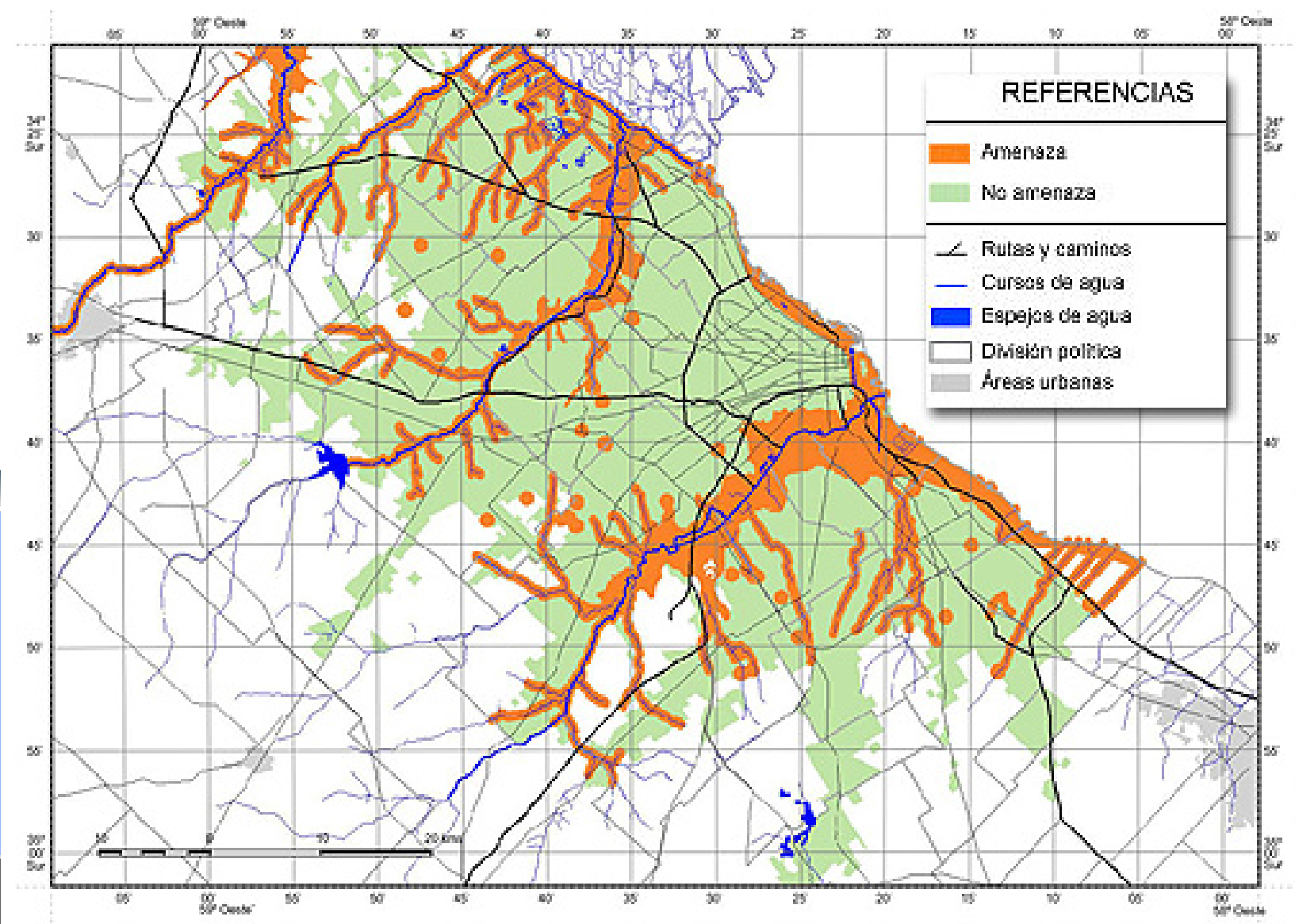
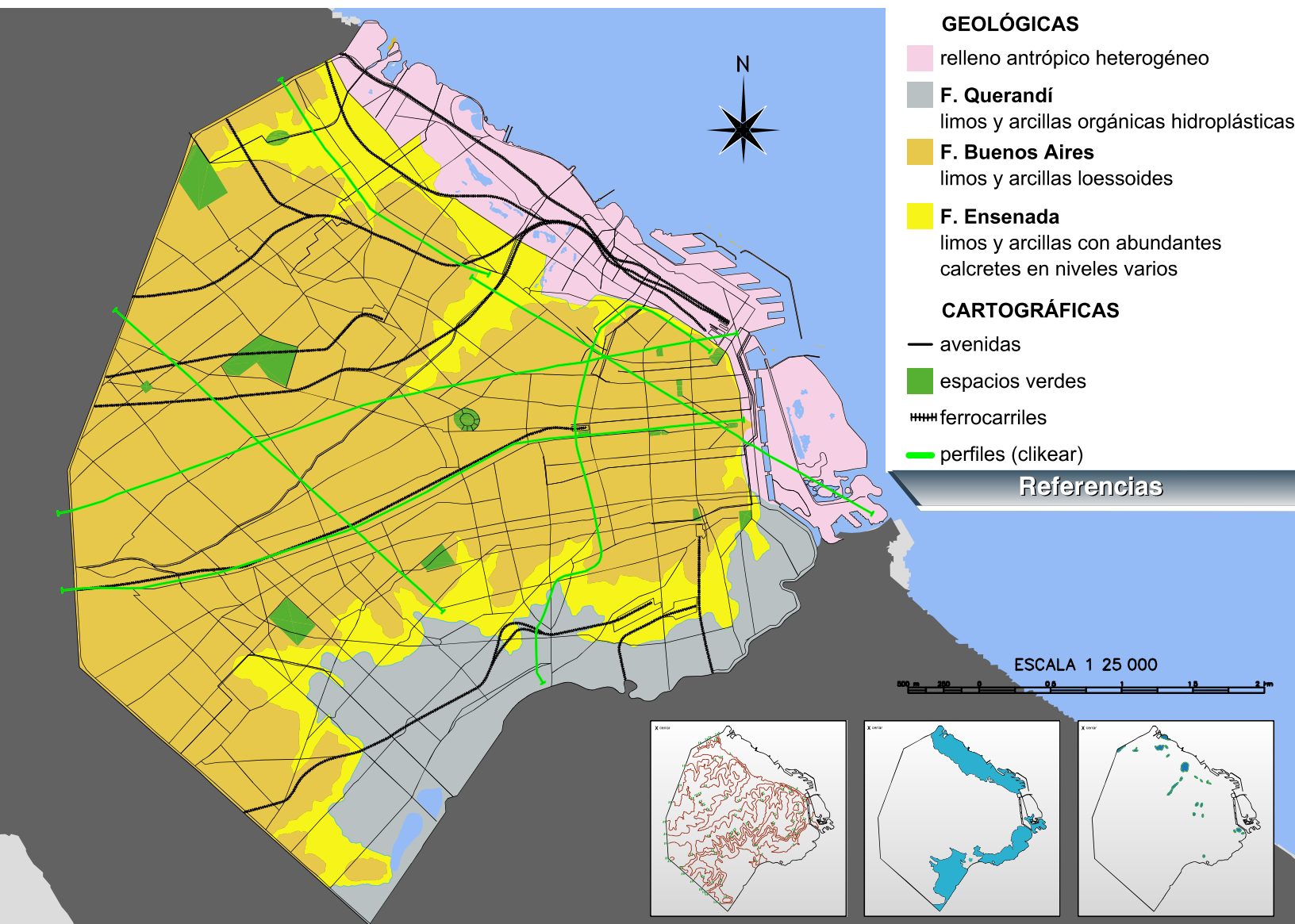
Rio de la Plata

Pilot Area

Airport (EZE)



# Geology and Pollution







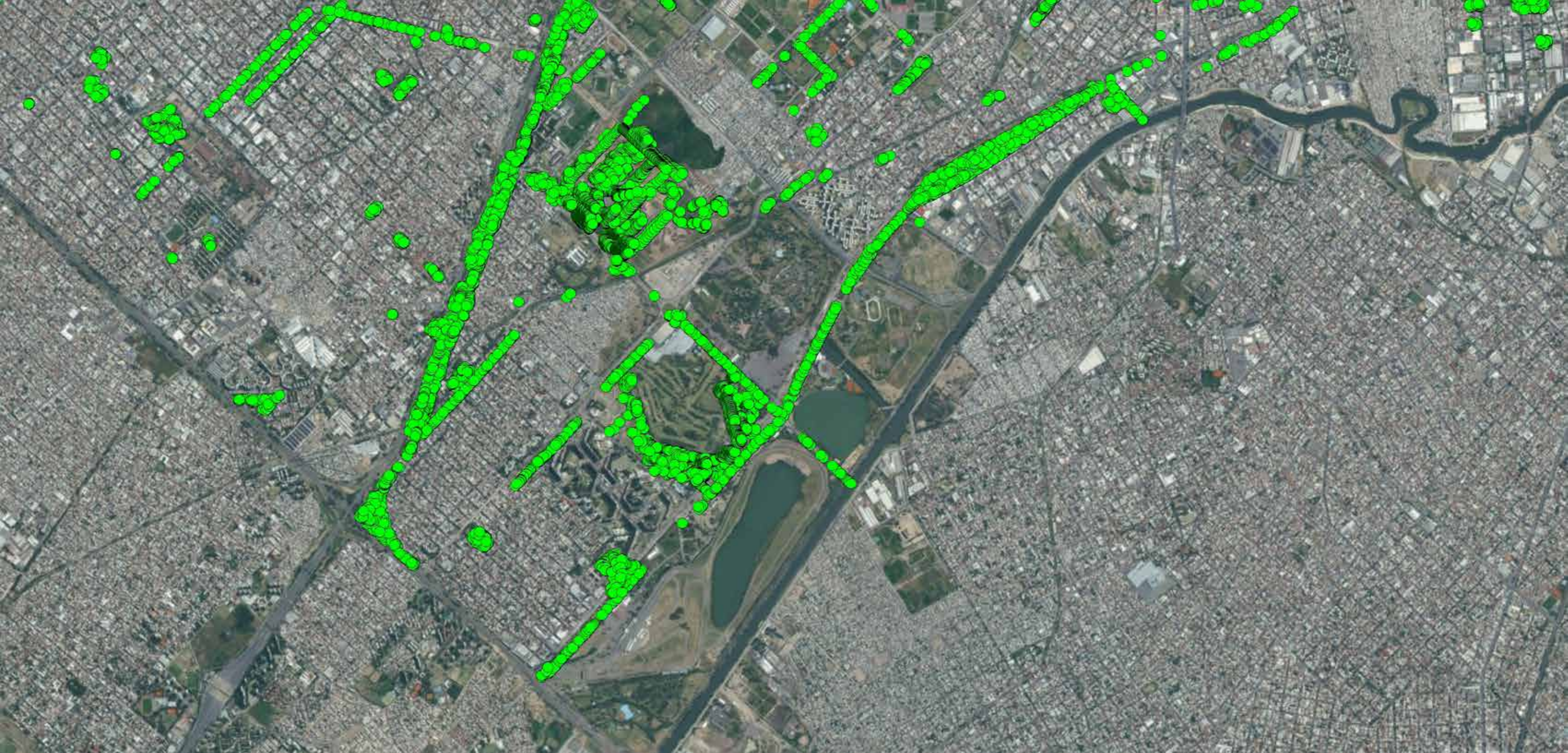
**Aerial Comuna 8**





**Green Space**





**Tree Coverage in Public Areas**



# **Tree Coverage in Public Areas**

**The monetary benefits of urban trees outweigh their maintenance and other associated costs. In a study of five U.S. cities, each dollar invested in urban trees returned between \$1.37 and \$3.09 in benefits. Benefits measured include energy savings, atmospheric CO2 absorption, air quality benefits, stormwater runoff reduction, and aesthetic and other benefits gauged by measuring increases in real estate values.**

**McPherson, Greg, James R. Simpson, Paula J. Peper, Scott E. Maco, and Qingfu Xiao. (2005). Municipal forest benefits and costs in five U.S. cities. Journal of Forestry 103(8), 411-416.**





**Stormwater Drains**



# **Symbiotic Urban Water Systems:**

**The Architectural Impact of Integrating Living Technologies to Manage Watershed Flows and Ecosystem Services**





# A Delta of Program and Activity

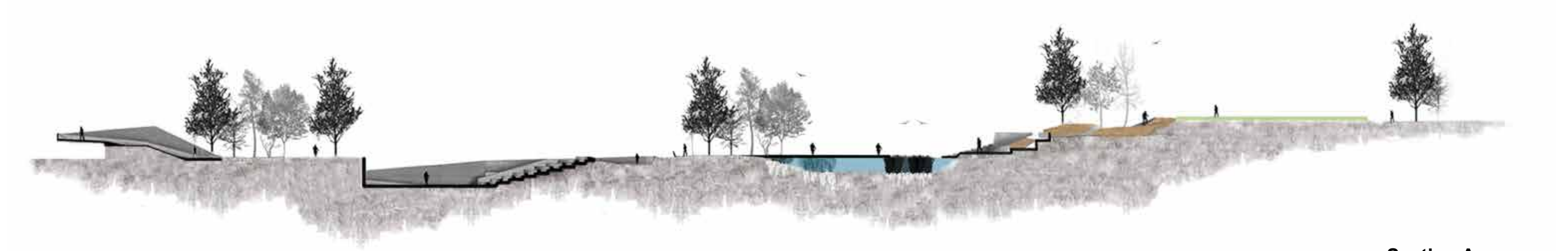
- High School
- Circulation
- Wetland
- Villa Olimpica



## Creating a Living System

The Master Plan creates a wetland typology that intern is both active and passive at different points. The linear tidal flow wetland system works its way from Lago Soldati through a multitude of program spread across the site. The surrounding community is given new amenities and spaces to interact with. The circulation through the site acts as an interpretive trail to help educate the public about the diversity and beauty of the natural wetland system that used to be vibrant in this area.

# A Delta of Program and Activity



Section A

**Water at the SITE scale**



**Site**

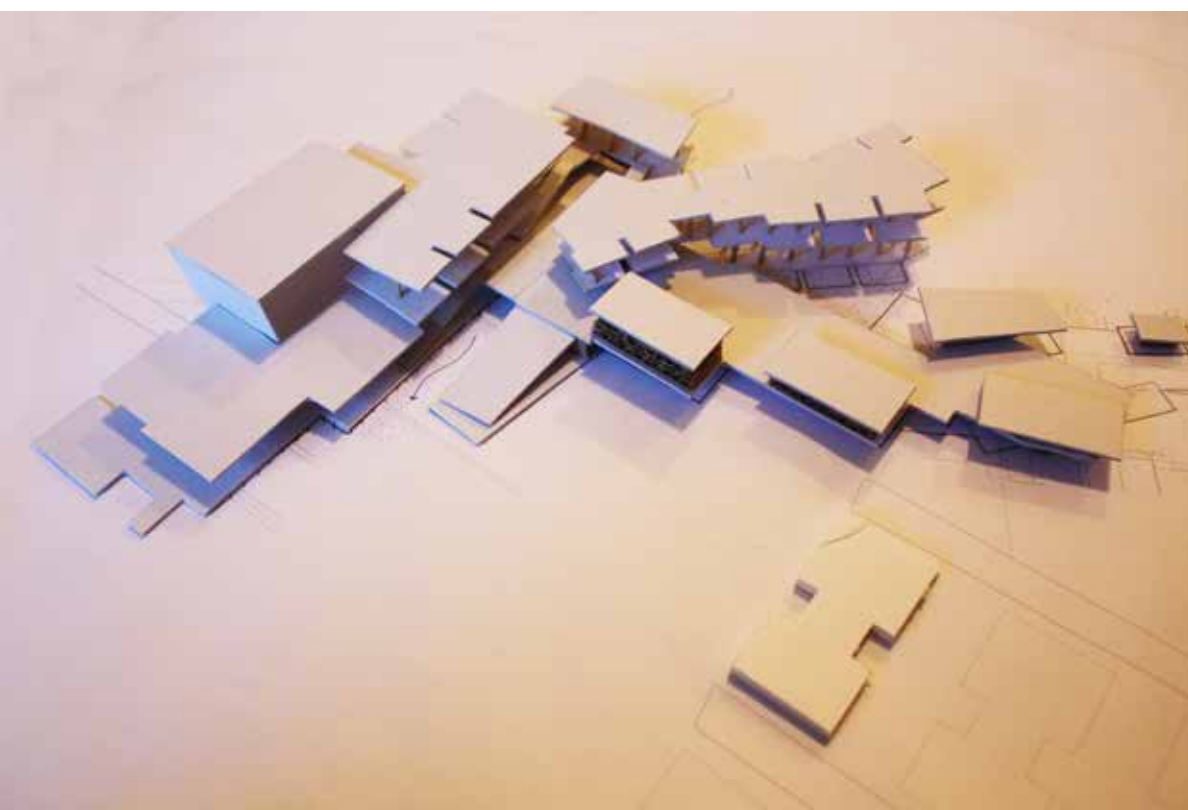




# Living Architecture and Ecological Urbanism = Colegio De Los Piletones

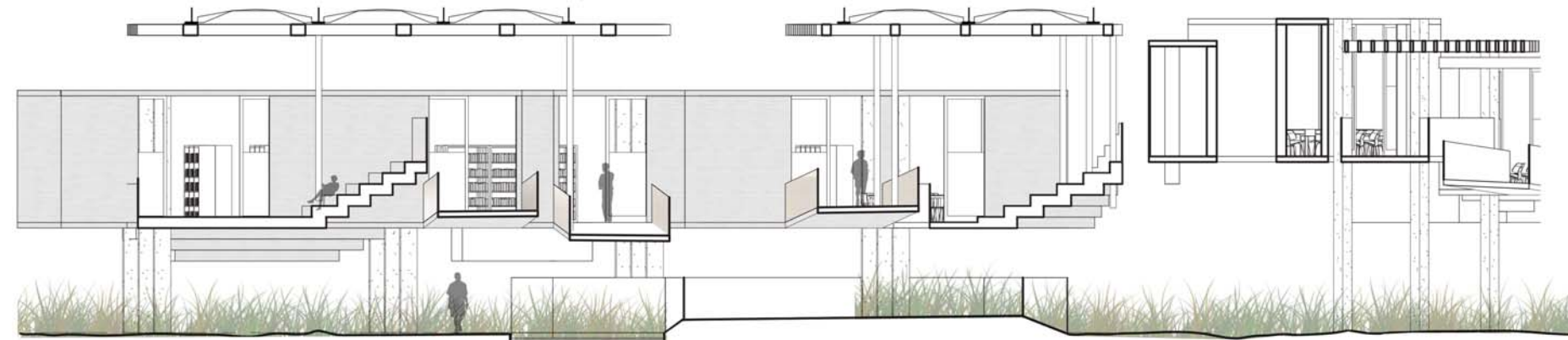
## Tectonic Morphology

The building uses **traces** of the informal settlements that are around the area to create a **sense of place** to the overall concept. The main idea is to push the building into the **wetland** that is created to form a strong relationship with nature as well as be able to act as an interpretive trail from one end of the **neighborhood** to the other. The building will act as a community **social** gathering space that will help tie the two divided sides together. This will happen at the location of Lago Soldati, which is currently an environmental hazard due to its lack of maintenance and negligence. By placing the building inside Lago Soldati there is an **opportunity** to reverse the current cycle of deterioration and turn the ephemeral lake into a working wetland **system** that can have the ability to heal itself. The building allows this to happen by the amount of site work and program necessary for the school. By placing it here the design of the site is forced to accommodate the **sustainable** systems placed within and around the **structure**.

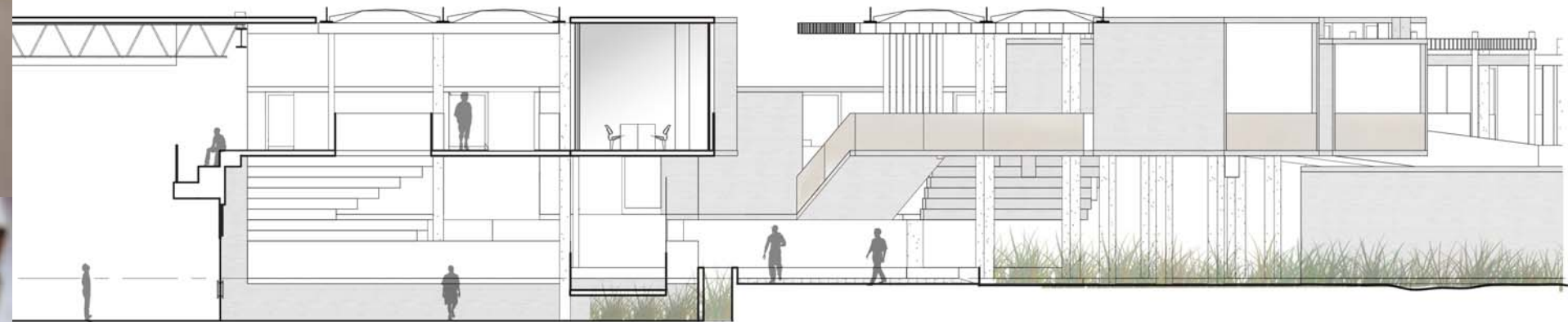




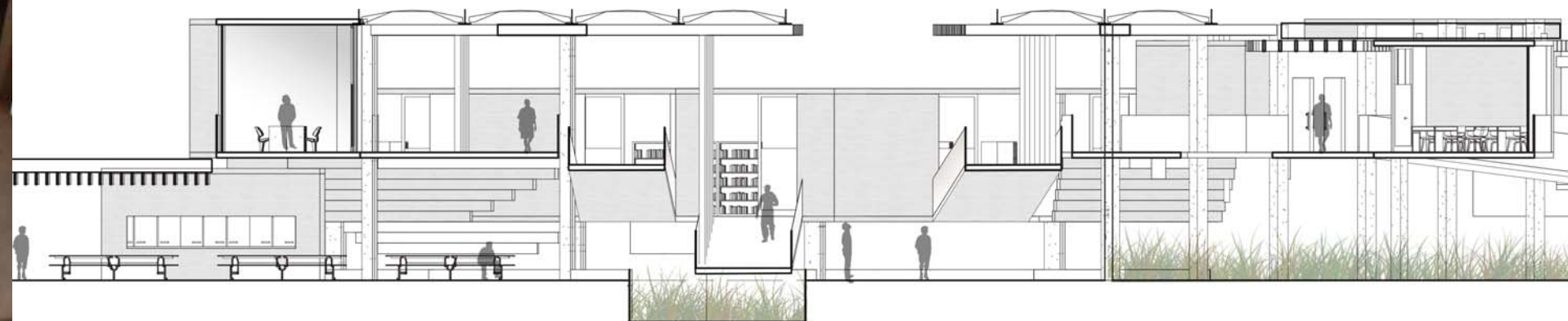
# Architectural Impact to Living Systems



Short Section Through Circulation Canyon

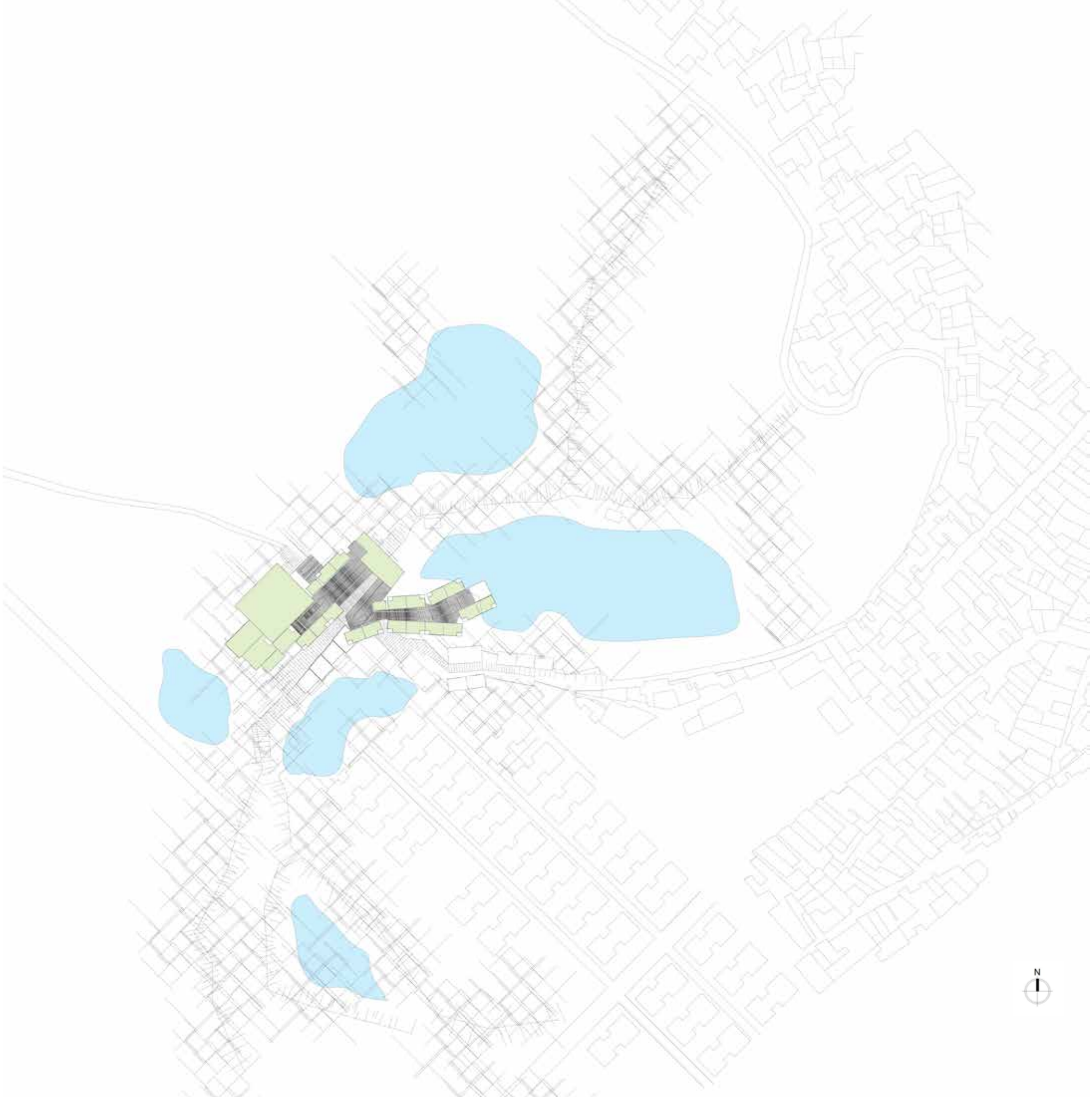


Short Section Through Gymnasium



Short Section Through Cafeteria

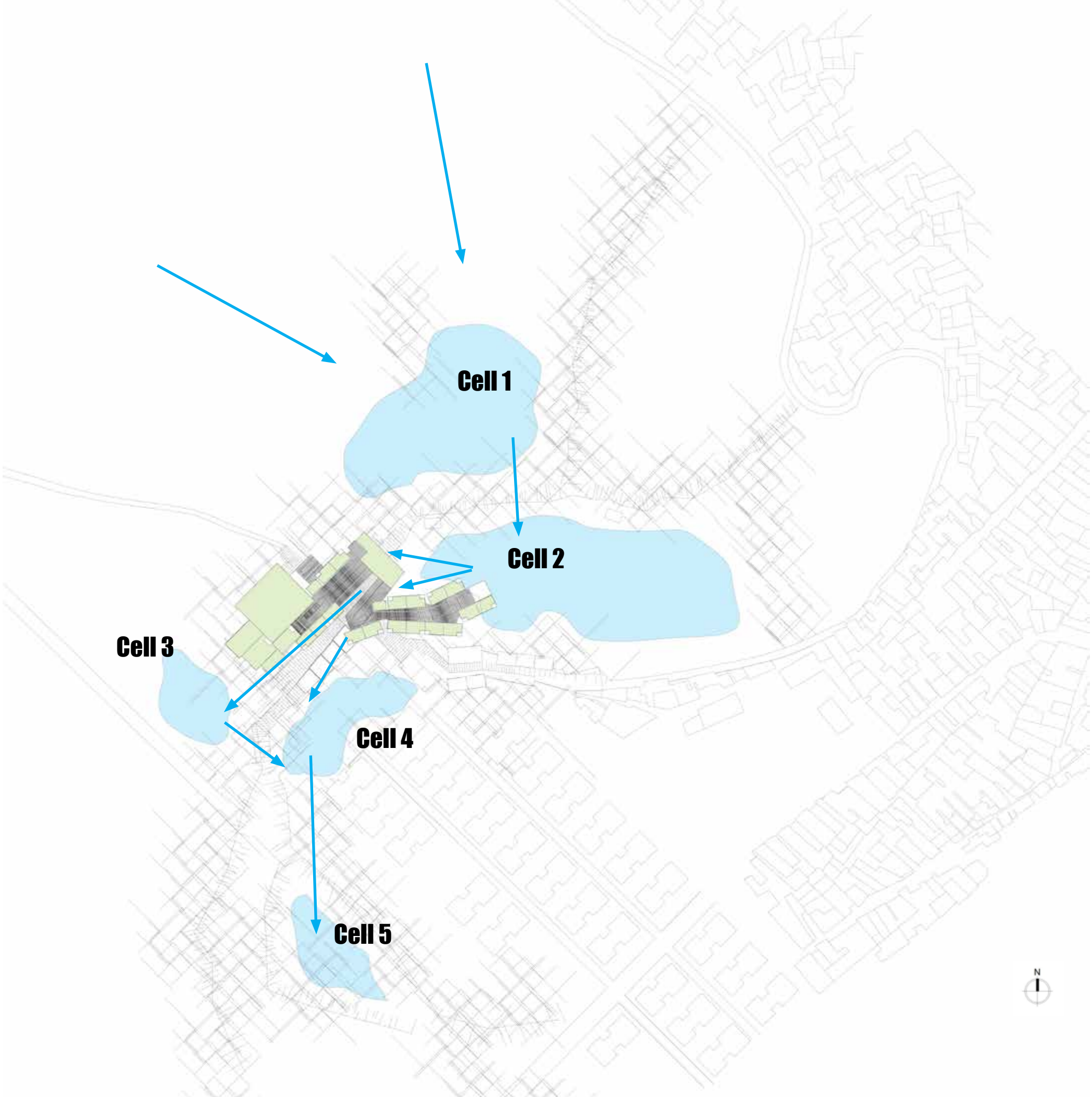
# Site Plan

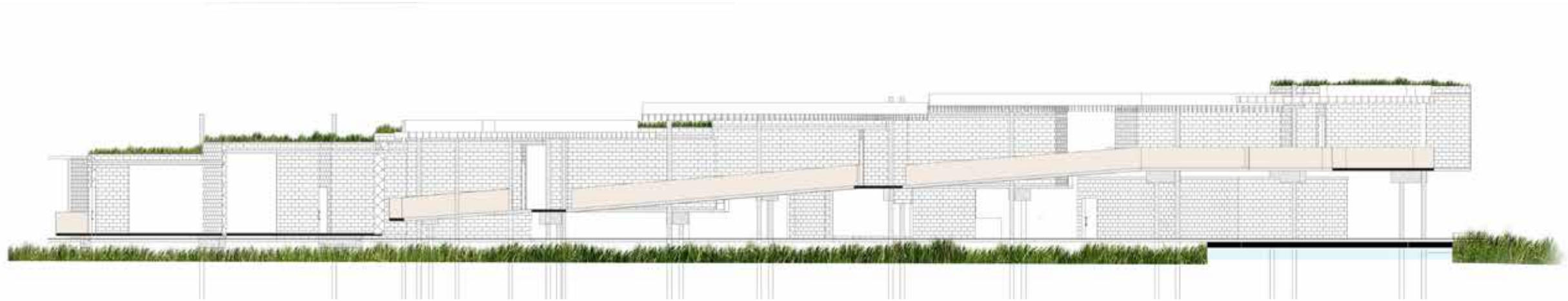




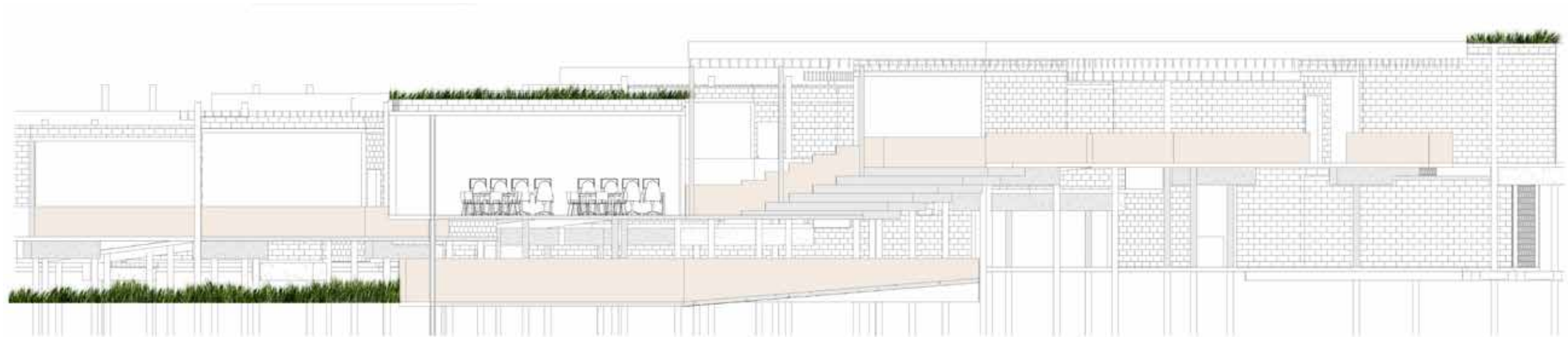
# Site Plan

Waterflow

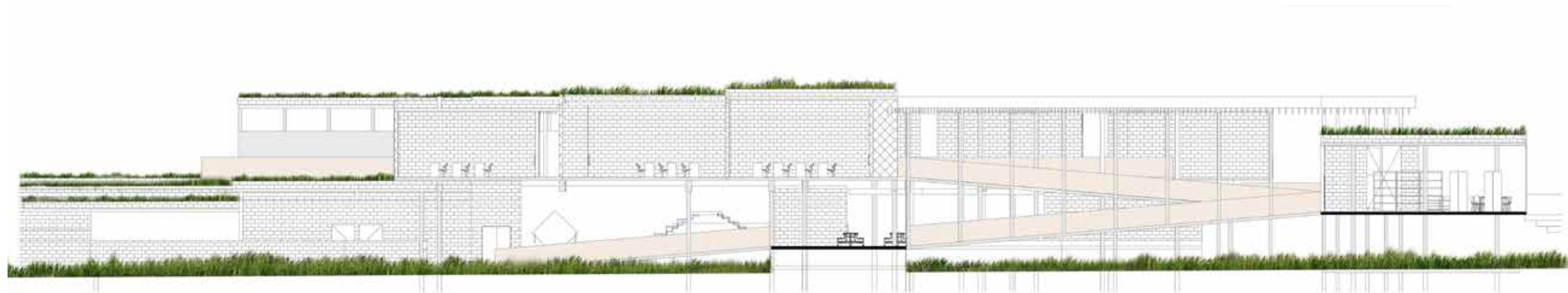




**Section Cut Trough Classroom Hallway to Wetland**



**Section Cut Trough Library to Amphitheater**



**Section Cut Trough Canyon Wetland**









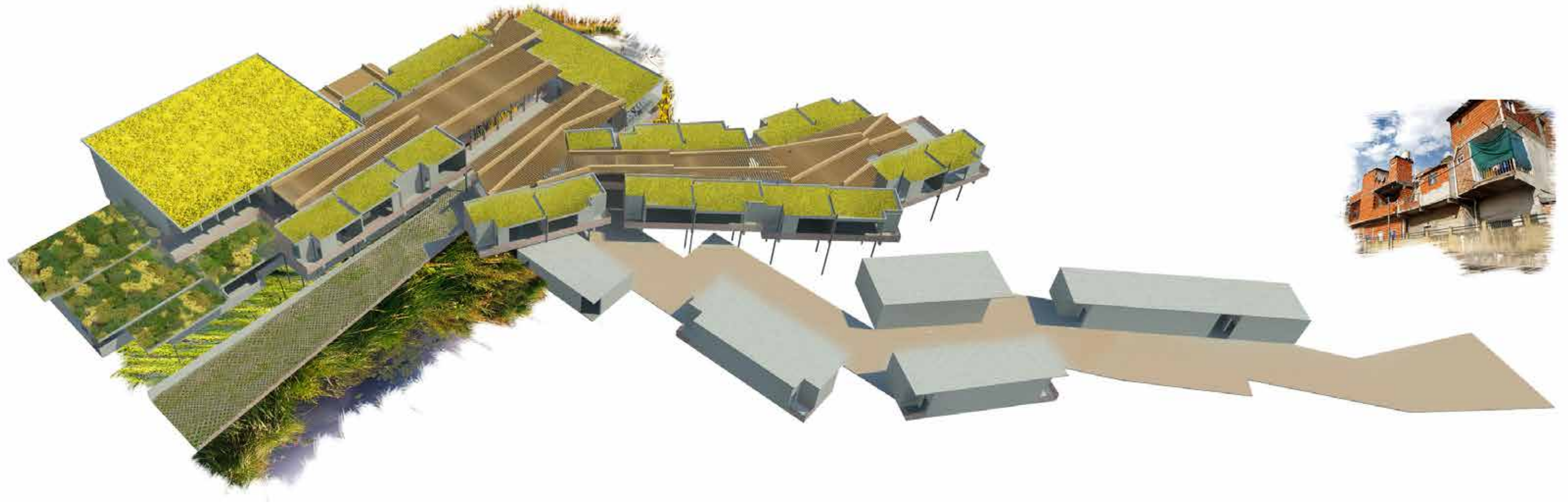






# **Symbiotic Urban Water Systems:**

**The Architectural Impact of Integrating Living Technologies to Manage Watershed Flows and Ecosystem Services**



# Living Architecture and Ecological Urbanism

True resource use independence is not just about ecological restoration, or more energy efficient buildings, but a cohesive renewable living system for humans that is sustainable, comfortable, economic and beautiful

```
graph TD; A[sustainable] --> B[+ecosystem]; C[beautiful] --> D[+value]; E[economic] --> F[-climate change]
```

+ecosystem      +value      -climate change



# Living Architecture / Necessity + Outcomes + Benefits

The post industrial revolution society pushed nature out of its path as much as it could to achieve success in advancing science and technology.

Now that the consequences of **global warming** and pollution are clear, it is time for designers to rethink the value of nature in

urban and rural areas and how to incorporate advances in **technology** to benefit nature rather than dismissing it. There are many technical and beneficial applications for green roofs that can mitigate the negative environmental impacts of our built environment. We have lost nature within high density areas and causing extensive damage to ecosystems. All indigenous societies across the globe incorporated

**natural systems** into their civilizations to create maximum efficiency and sustainability that met their needs and have allowed us to be where we are today. Unsustainable and low efficiency systems combined with population growth are jeopardizing the future of the next

generation. It is time to **rethink** the standard and to build up the natural environment around us rather than take it down. Green roofs are a

tool that can help to put our ecosystems back into balance. With proper **planning**, design, installation and maintenance a green roof has the ability to provide many benefits toward a building as well as its surrounding landscape context.





**Understand living system technologies in a way that allows full design creativity and control to better enhance not only the architecture of the site, but the overall health and welfare of the surrounding community**







# References

Cantor, Steven L. Green Roofs in Sustainable Landscape Design. New York: W.W. Norton &, 2008.

Clemens, Steve. "Alternative Energy EMagazine - | AltEnergyMag." Alternative Energy Resources, News, EMagazine& Library | AltEnergyMag.Altenergymag.Web. 14 Feb. 2014. <[http://www.altenergymag.com/emagazine.php?issue\\_number=07.08.01](http://www.altenergymag.com/emagazine.php?issue_number=07.08.01)>.

Dunnett, Nigel. Small Green Roofs: Low-tech Options for Greener Living. Portland, Or.: Timber, 2011.

Kirk, Patricia L. "Synergistic Landscapes." Urban Land. 67.11-12 (2008): 146-150.

Newberg, Sam. "Greening a City from the Top Down [Chicago]." Urban Land. 66.3 (2007): 76-79.

Nyren, Ron. "Sustaining the Landscape."Urban Land. 67.6 (2008): 48-52.

Oberndorfer, Erica, Jeremy Lundholm, Brad Bass, Reid R. Coffman, Hitesh Doshi, Nigel Dunnett, Stuart Gaffin, Manfred Köhler, Karen K. Y. Liu, and Bradley Rowe. "Green Roofs as Urban Ecosystems: Ecological Structures, Functions, and Services." BioScience 57.10 (2007): 823-33.

Reed, Lawrence. "Merging Buildings with the Land."Urban Land. 67.11-12 (2008): 33-34.

Snodgrass, Edmund C., and Linda McIntyre.The Green Roof Manual: a Professional Guide to Design, Installation, and Maintenance. Portland: Timber, 2010.

Snodgrass, Edmund C., and Lucie L. Snodgrass.Green Roof Plants: a Resource and Planting Guide. Portland, Or.: Timber, 2006.

Weiler, Susan K., and KatrinScholz-Barth.Green Roof Systems: a Guide to the Planning, Design, and Construction of Landscapes over Structure. Hoboken, NJ: John Wiley & Sons, 2009.



**Thank You!**





# Neighborhoods Food Production Partnership:

*Homeowner-based Commercial Urban Agriculture*

MLA

Sijia Liu

# Introduction



+



=



Sell to



SINGLE FAMILY HOUSE

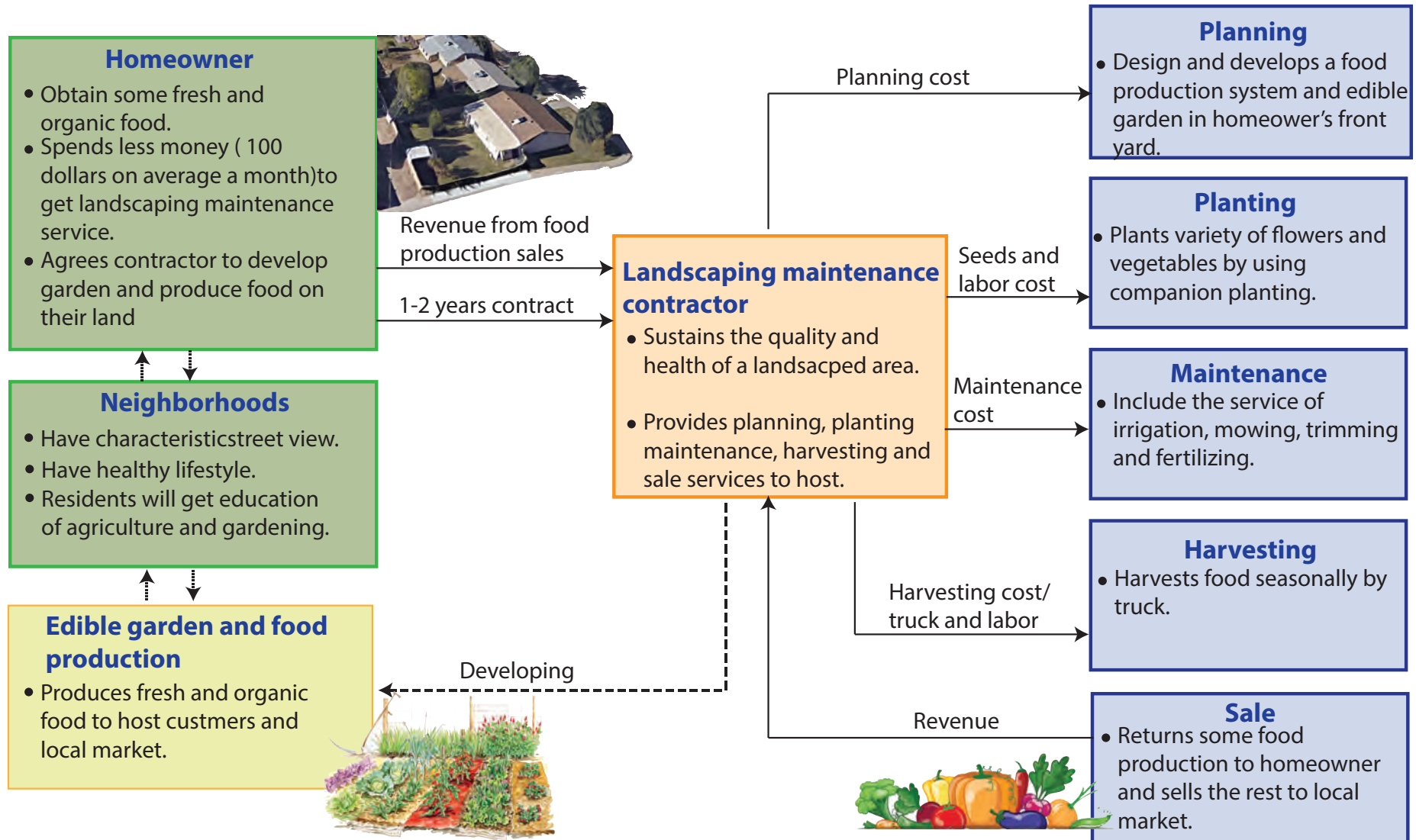
EDIBLE GARDEN

HOME FOOD PRODUCTION

LOCAL FOOD MARKET



# Roles of Neighborhoods Food Production Partnership



# Local Food Production on residential lots is saleable

Summary of Economic Costs and Benefits of Home Vegetable Gardens

Source	Cost			*Value of Yield	Net Value			
	*Materials and Supplies	Hours of Labor	*Fair Market Cost of Labor		*Net Value (including Labor Costs)	*Net Value (excluding Labor Costs)	Net Value / square foot (including Labor Costs)	Net Value / square foot (excluding Labor Costs)
Uttinger & Connolly, 1978	\$115	39	\$149	\$322	\$58	\$208	\$0.39	\$1.39
Stall, 1979	\$306	NR	NR	\$1585	NA	\$1279	NA	\$2.13
Stephens et al., 1980	\$162	23	\$201	\$1082	\$720	\$921	\$0.51	\$0.66
Stephens et al., 1980	\$200	68	\$594	\$1172	\$379	\$973	\$0.59	\$1.53
Cleveland et al., 1985	\$187	153	\$1104	\$333	-\$959	\$145	-\$1.16	\$0.17
Cleveland et al., 1985	\$217	111	\$800	\$385	-\$633	\$167	-\$1.01	\$0.27
Doiron, 2009	\$305	NR	NR	\$2072	NA	\$1767	NA	\$1.18
Roth, 2011	\$343	54	\$463	\$651	-\$155	\$308	-\$0.18	\$0.35
Roth, 2011	\$380	72	\$650	\$876	-\$154	\$496	-\$0.18	\$0.56
Roth, 2011	\$158	48	\$421	\$678	\$99	\$520	\$0.11	\$0.59
Mean	\$237	71	\$548	\$916	-\$81	\$678	-\$0.11	\$0.88
Standard Deviation	\$85	40	\$293	\$546	\$499	\$515	\$0.67	\$0.64
Median	\$209	61	\$528	\$777	-\$48	\$508	-\$0.11	\$0.66

\*All costs and values reflect dollar values in 2013.



# Local Food Production on residential lots is saleable

## Calculation of economic cost and value of Neighborhoods Food Production Partnership (One year per 1000sq.ft)

Cost		Net Value	
Material		Value of Field(Production)	
Seeds	200	Beets	1311
Soil amendm	100	Lettuce	630
plant starts	200	Basil	1848
mulch	50	Marigold	200
		Beans	735
Supply		Leeks	306
fertilizers	100		
water	300		
Total	950		5030
		Net Value	4080

Cost of labor 38000/year    Value of labor maintenance 2000sq.ft/hour  
one labor one day can maintain 16000sq.ft

### Coclusion

So the minimum amount of homeowners needed to start a commercial enterprise is 20 or it is needed about 20000 square feet land to produce food. If we don't have 20000 square feet land, we cannot balance the front cost.

[http://www.plangarden.com/app/vegetable\\_value/](http://www.plangarden.com/app/vegetable_value/)

# Site Analysis: Existing Condition

Location: Mission Valley , North Chandler

Year Built: 1982

Lot Size on Average: 8000-9000Sq. ft

Front Yard Size on Average: 1000Sq.ft

Household Income: \$50,000/year

Homeowner Association Community





# Water Issue



Water will be a big issue to produce food in neighborhoods.

Saving water is a good way to lower the cost.

On average homeowner will spend \$100 every month to pay the irrigation in 1000 square feet.



# Water Issue: How to save water



## Mulch and woodchips

Mulches of manure or compost will be incorporated naturally into the soil by the activity of worms and other organisms.

Mixing the mulch with soil and putting woodchips on top of the soil will help the soil hold water for longer time to prevent evaporation




It will save half amount of water that usually use to irrigate the plants.



# Water Issue: How to save water

## Swimming Pool Backflow to Irrigate

Save 300 gallons portable water per month

<b>Salt-tolerant plants: Can use pool/spa water</b>	<b>Moderately sensitive plants: Limited use of pool/spa water</b>	<b>Plants sensitive to salt: Do not use pool/spa water</b>
<p>Oleander Evergreen Euonymas Rosemary Bougainvillea Natal Plum Texas Ranger Olive Native Mesquite Desert Broom Saltbush Aloe Deer Grass Bear Grass Ice Plant  Japanese Honeysuckle Others...</p>	<p>Glossy Privet Pyracantha Lantana Xylosma Juniper Bottlebrush Most Acacia Species Palo Verde Yucca Others...</p>	<p>Fruit Trees Star Jasmine Roses Algerian Ivy Fraser's Photinia Chinese Hibiscus Willow Hopbush Jojoba Others...</p> 

# Birds Control

## Visual Bird Deterrents

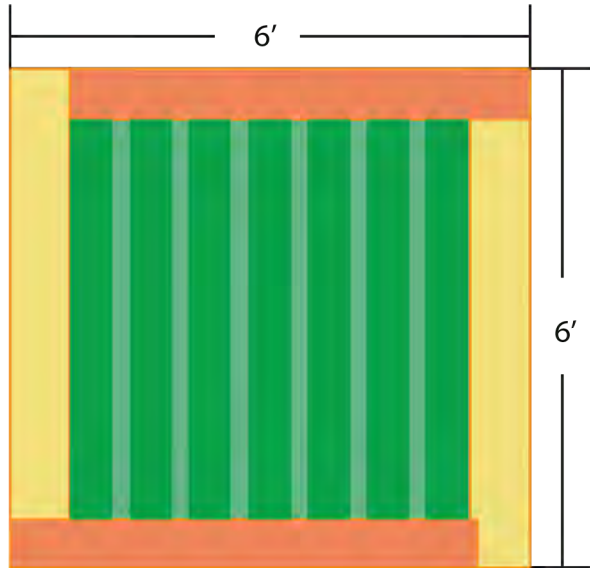
Visual scare devices are things like plastic owls and coyotes, Terror Eyes balloons, and shiny tape. Anything that is supposed to irritate or make the birds feel unsafe by appealing to their visual sense is classified as a visual scare. (Tom Starling , 2011)





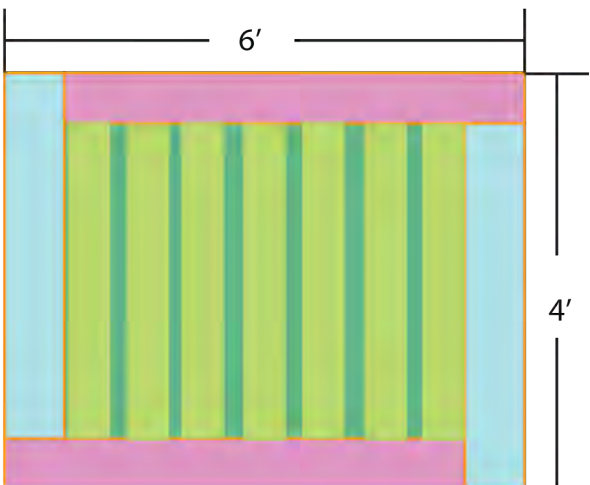
# Design Concept

## Companion planting



Using companion planting through out the landscape is an important part of integrated pest management.

So one of my design concept is that as 6 feet by 6 feet and 6 feet by 4 feet to be an unit to plant vegetables inside and plant flowers around them to group them together.

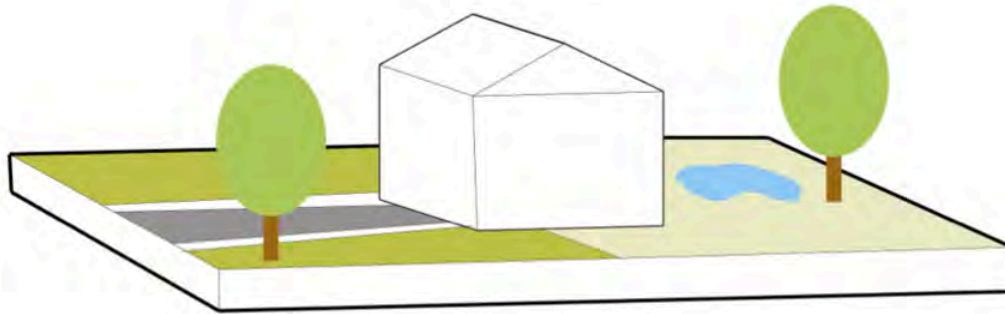


# Design Proposal

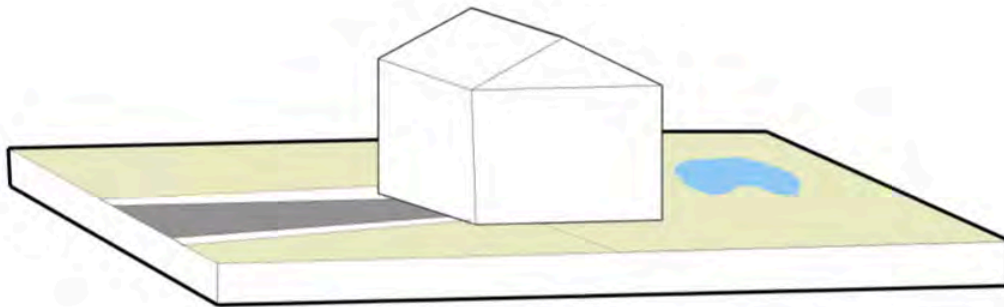




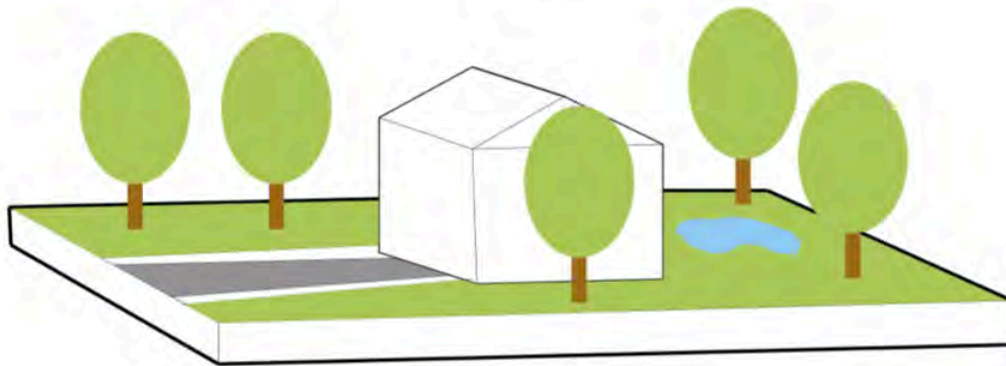
# Design Proposal: Front Yard Existing Types



Front yard type 1: grass and tree



Front yard type 2: sand and gravel



Front yard type 1: trees and designed landscape



# Design Proposal: Plan





# Design Proposal: Plants

## Seasonal Vegetables

January--April	May--June	June--July	July--Sept	Sept--October	Oct--Dec
Carrots	Blackberries	Leeks	Chiles	Green beans	Carrots
Bok choy	Garlic	Garlic	black eye peas		Bok choy
Lettuce	Leeks	Green beans	Green beans		Lettuce



Carrots



Bok choy



Lettuce



Blackberries



Green beans



Chiles

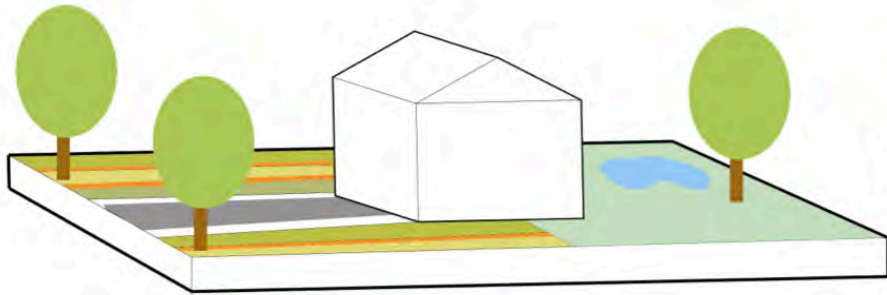


black eye peas

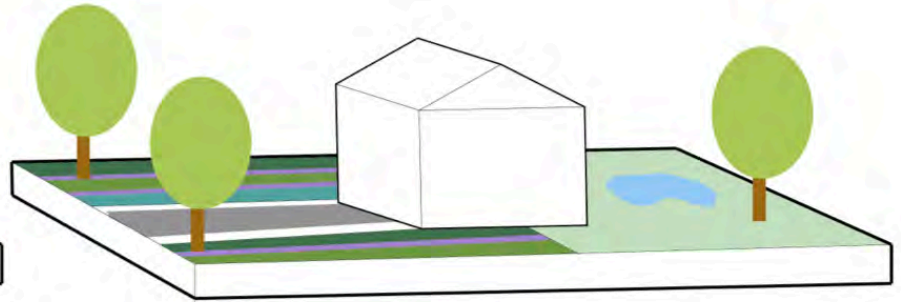


Garlic

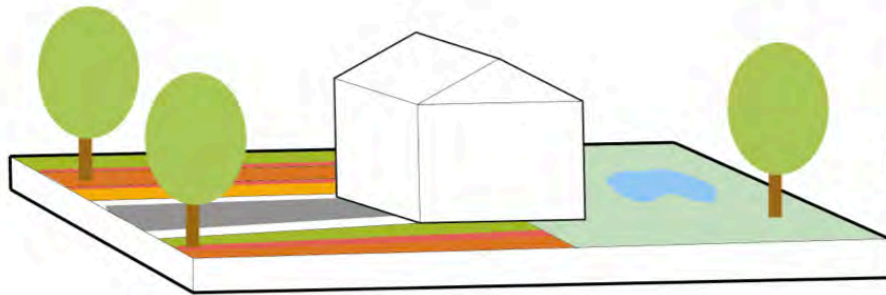
# Design Proposal: Analysis and Section



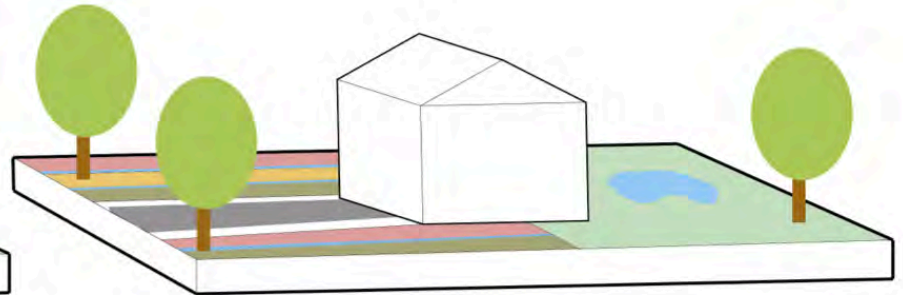
Front yard Design type 1: Face South



Front yard Design type 2: Face North



Front yard Design type 3: Face West



Front yard Design type 4: Face East





# Design Proposal: Perspective



# Design Performance

## Quadruple Bottom Lin

### Economic

Creates 146,880 dollars value of field per year

### Ecological

Reduces 4800 gallons portable water use per year.

### Social

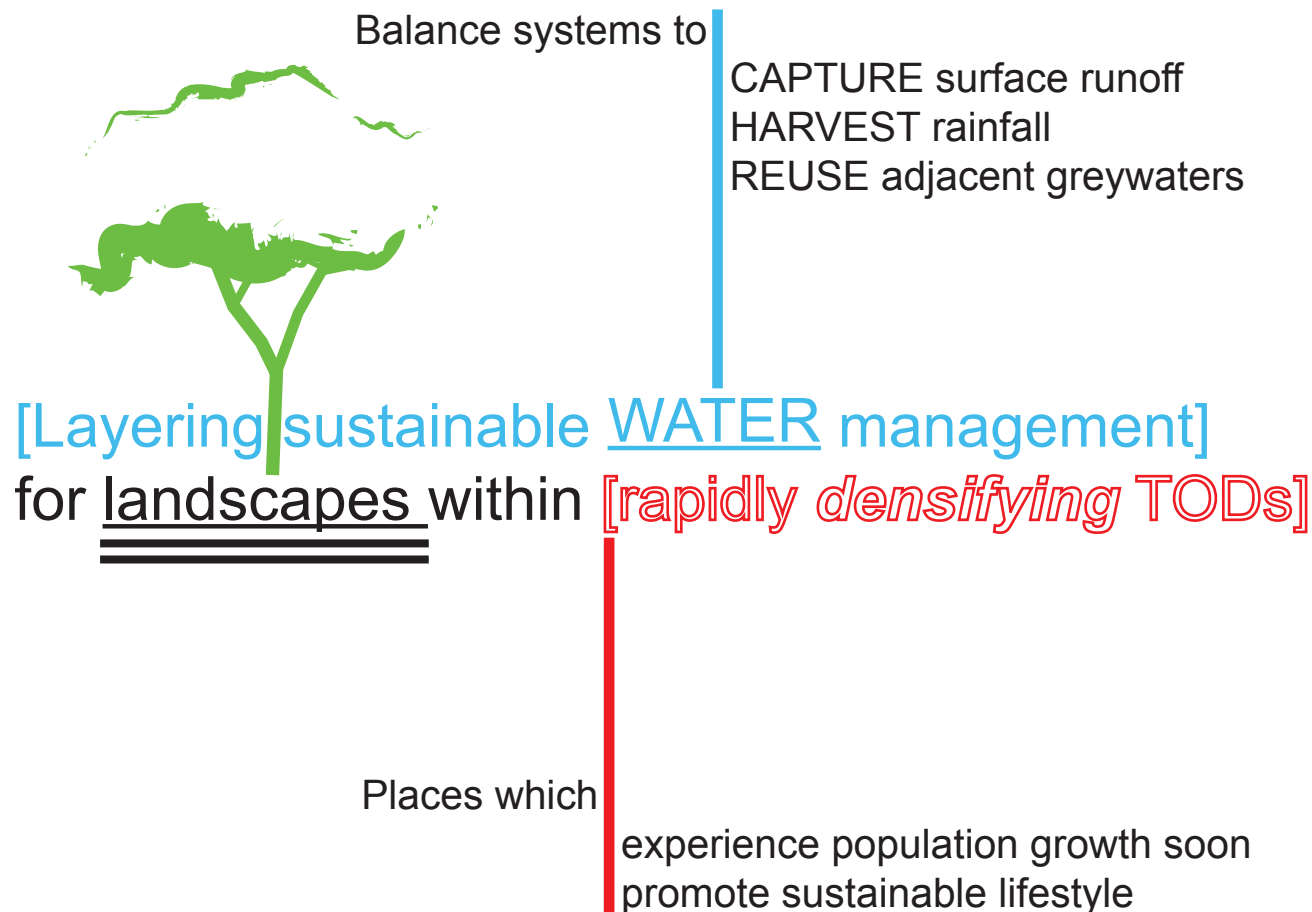
Produces 28 tons organic food production

### Aesthetic

Builds 36000sq.ft Street landscape in neighborhoods



# TRANSITIONing the *WATERSHED*



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

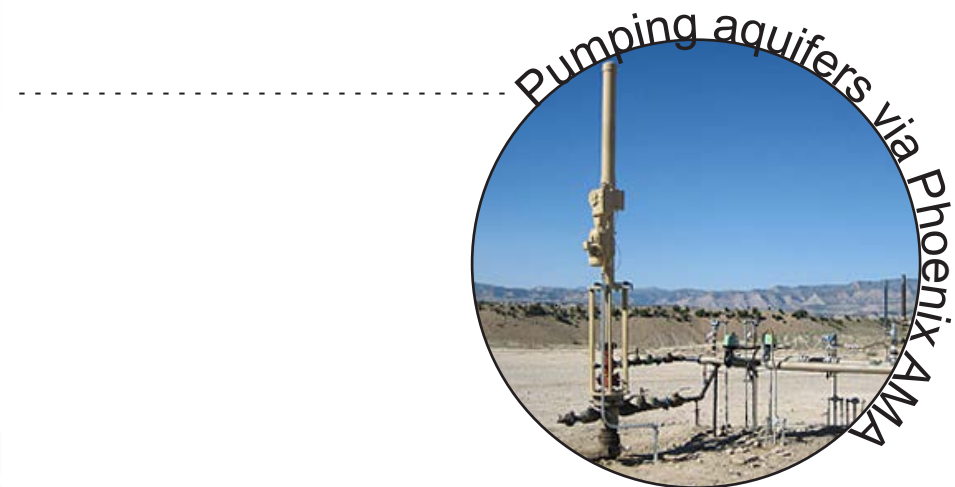
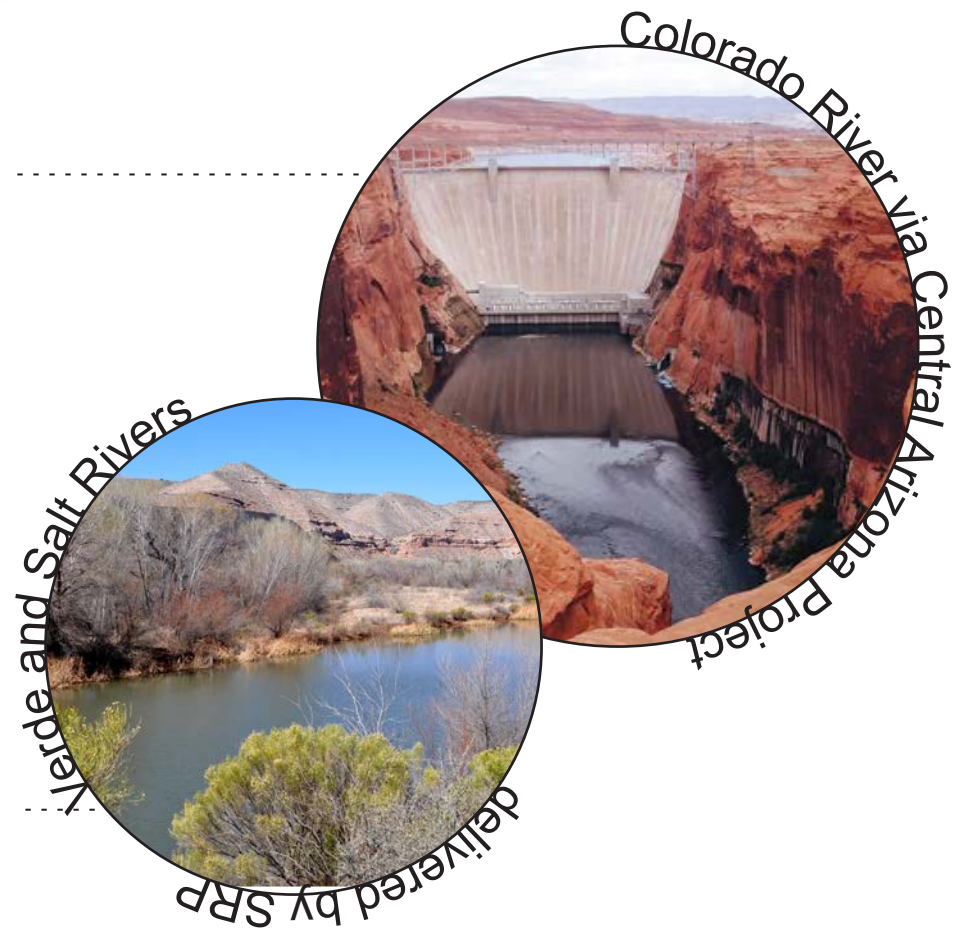
1

[Layering sustainable WATER management] <sup>3</sup>  
for landscapes within [rapidly *densifying* TODs]

2

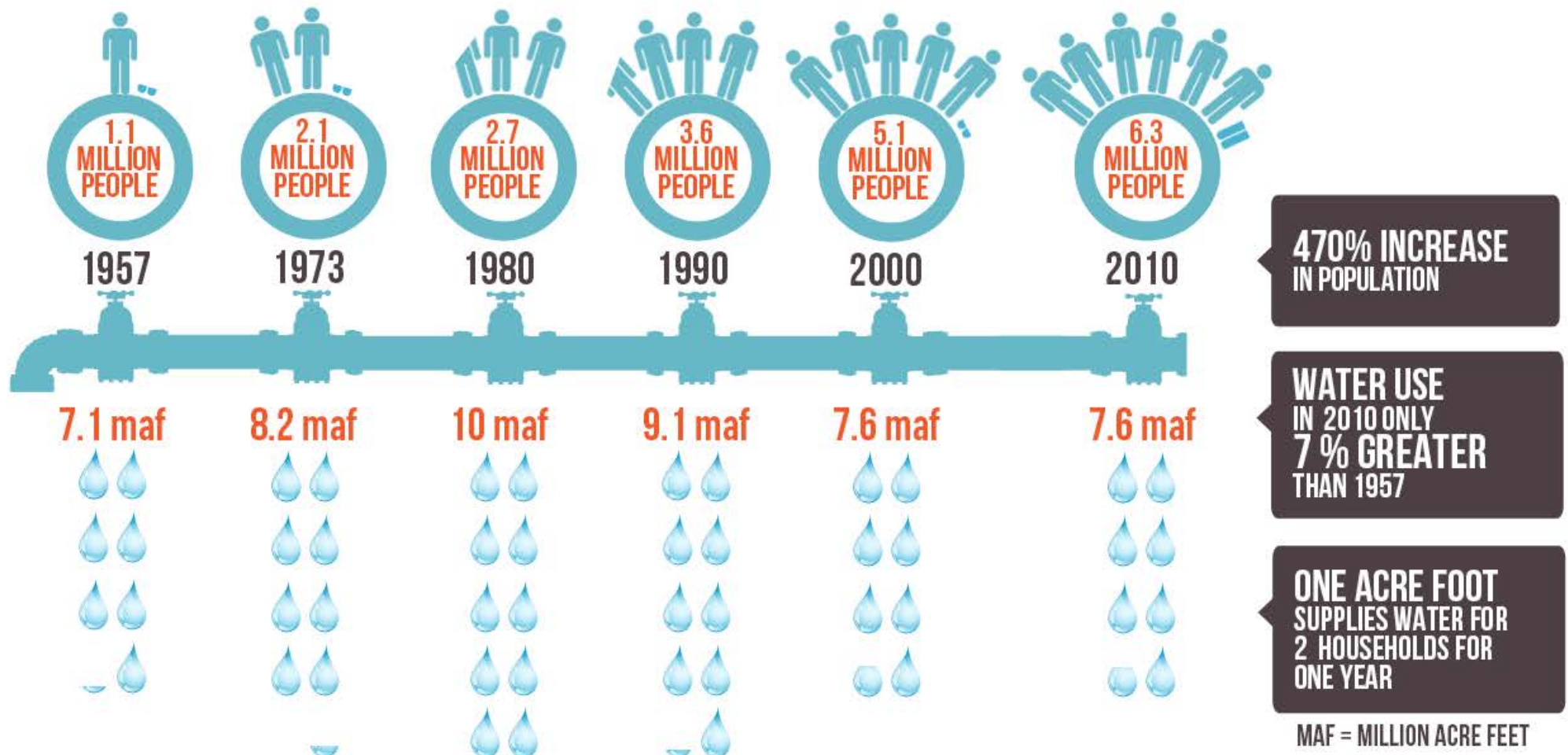
4





# 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.







*"Water is critical, but once it is provided - as it has to be or Phoenix could not exist - but once it is provided it does not bring and answer to what this city should become. It is a precondition 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





## No need to defer key decision on rooftop solar

**F**rom 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](http://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

**B**ald 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.



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

The Arizona Republic  
Sunday April 26, 2015

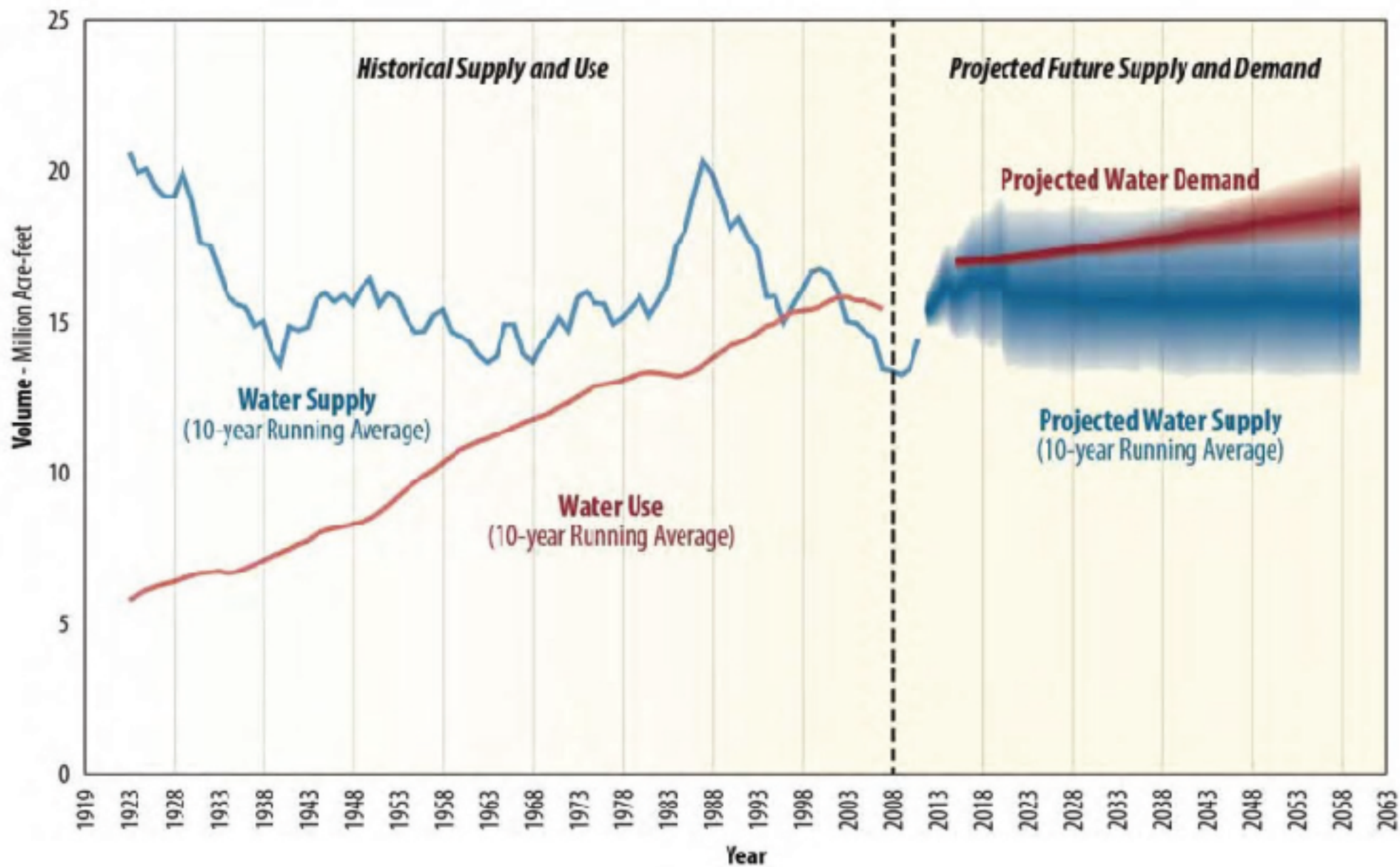
Section F, page 5....

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



# Colorado River Basin Water Supply and Demand Study

U.S. Department of the Interior, Bureau of Reclamation



Urban landscapes particularly at risk

Reduced  
Productivity

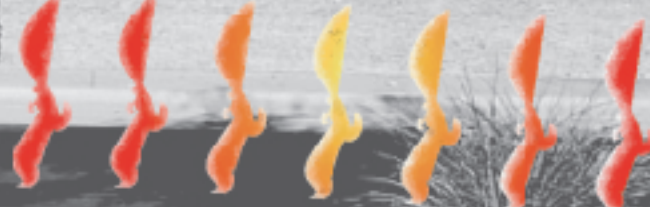
less precipitation



prolonged  
**DROUGHT**

**\$\$ HARDSHIP**  
decreases available water

increase **HEAT** index





## Aesthetic

- Improves Community Cohesion
- Increases Recreational Opportunity
- Improves Aesthetics
- Reinforces Sense of Place

## Ecologic

- Improves Water Quality
- Reduces Flooding
- Promotes Wildlife Habitat/Diversity
- Reduces Air Pollution
- Reduces Atmospheric CO<sup>2</sup>

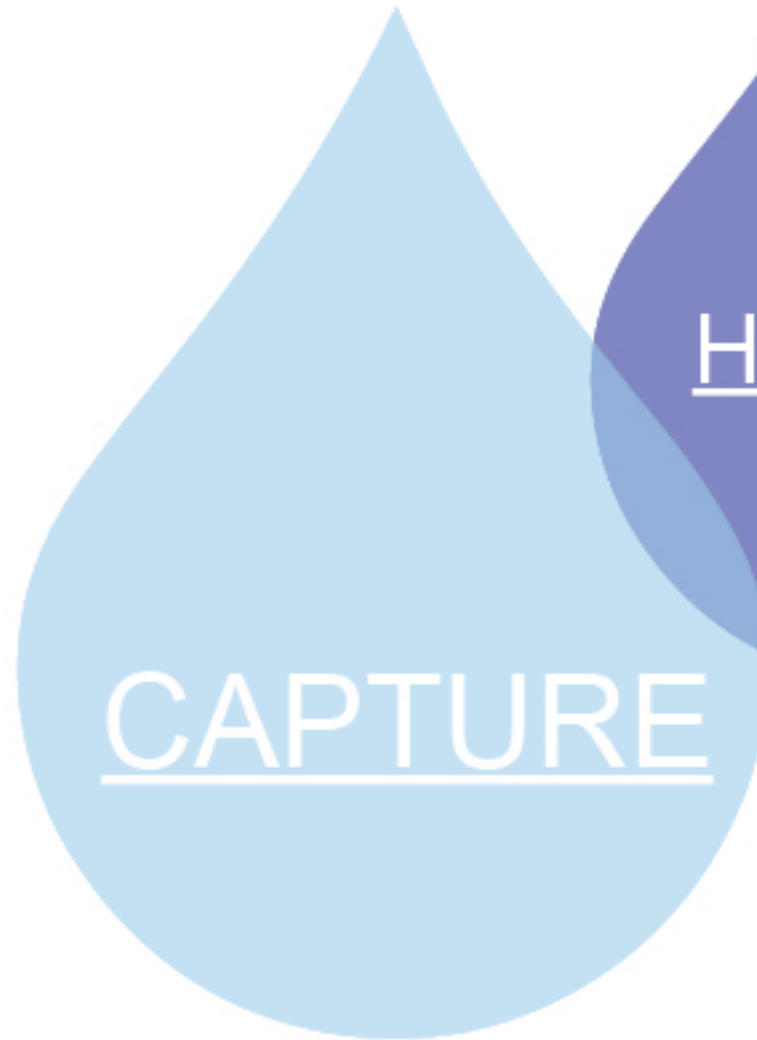
## Economic

- Promotes Foot Traffic
- Increases Property Prices
- Reduces Energy Use

## Cultural

- Provides shade and cooling
- Reduces Urban Heat Island
- Improves Mental Wellbeing
- Reduces Noise Pollution

Ecosystem services of urban trees compiled from  
(The Value of Green Infrastructure, 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.



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

Benefit	Reduces Stormwater Runoff											Improves Community Livability						
	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding								Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture		
Practice																		
Green Roofs	●	●	●	●	○	○	○	●	●	●	●	●	●	●	●	●	●	●
Tree Planting	●	●	●	●	○	●	○	●	●	●	●	●	●	●	●	●	●	●
Bioretention & Infiltration	●	●	●	●	●	●	○	○	●	●	●	●	●	●	●	○	●	●
Permeable Pavement	●	●	●	●	○	●	●	●	●	●	●	○	○	●	○	○	○	●
Water Harvesting	●	●	●	●	●	●	○	●	●	●	○	○	○	○	○	○	○	●

Determinate Variables:

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



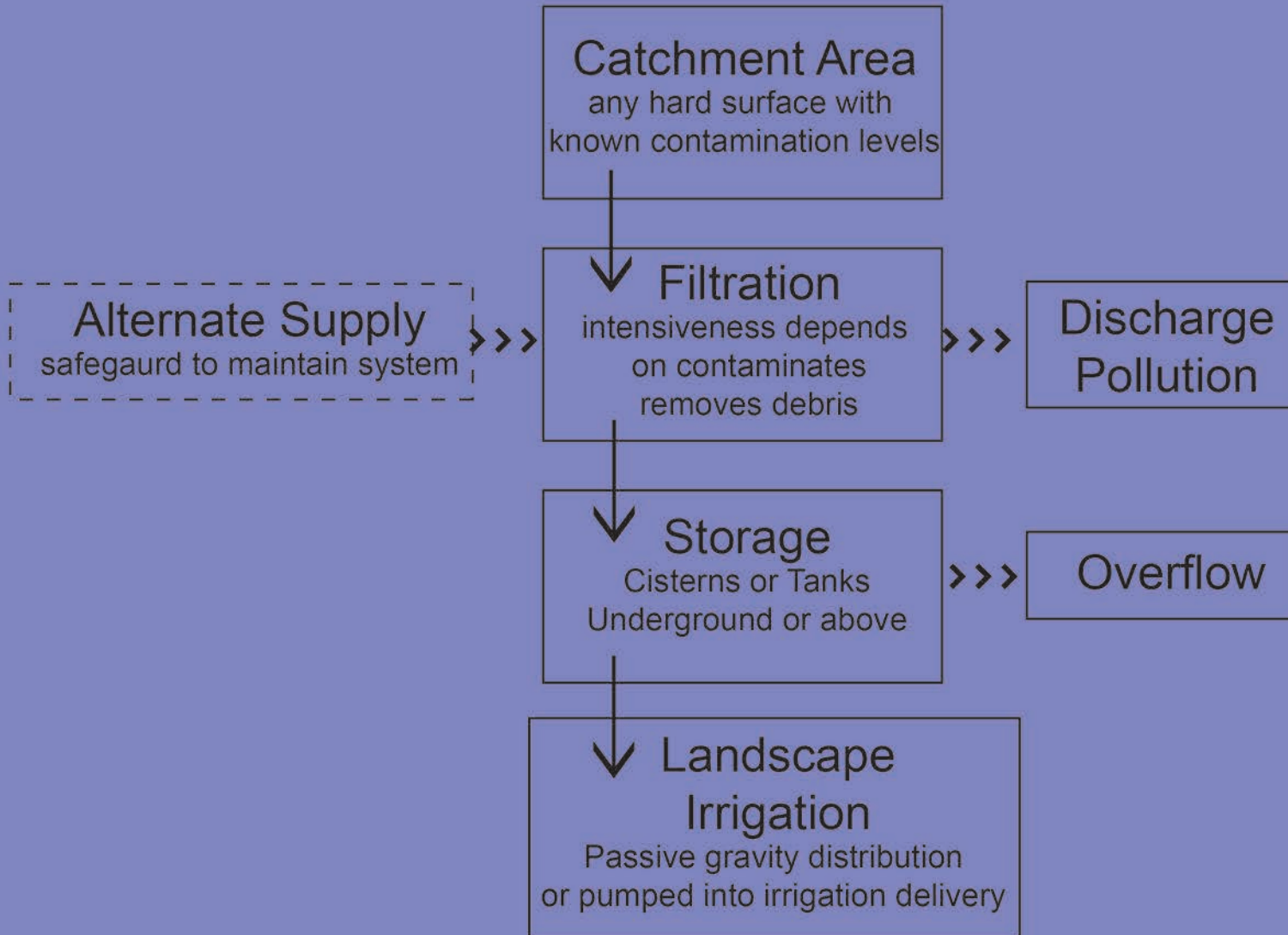
# HARVEST rainfall

Harvesting: “the collection of rain without an artificial 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 capacity  
maintenance of system  
integration with irrigation

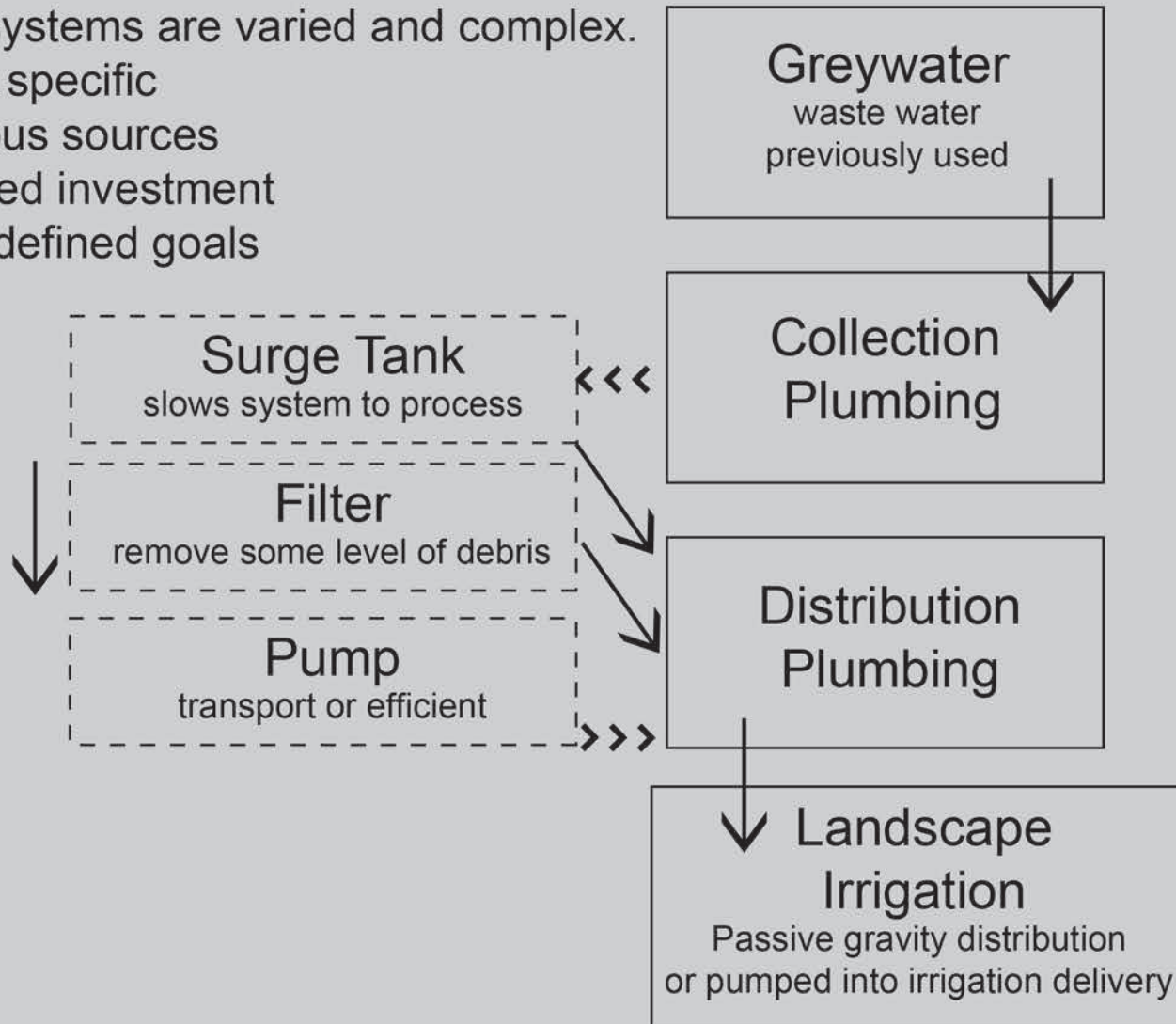


# REUSE adjacent greywaters

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

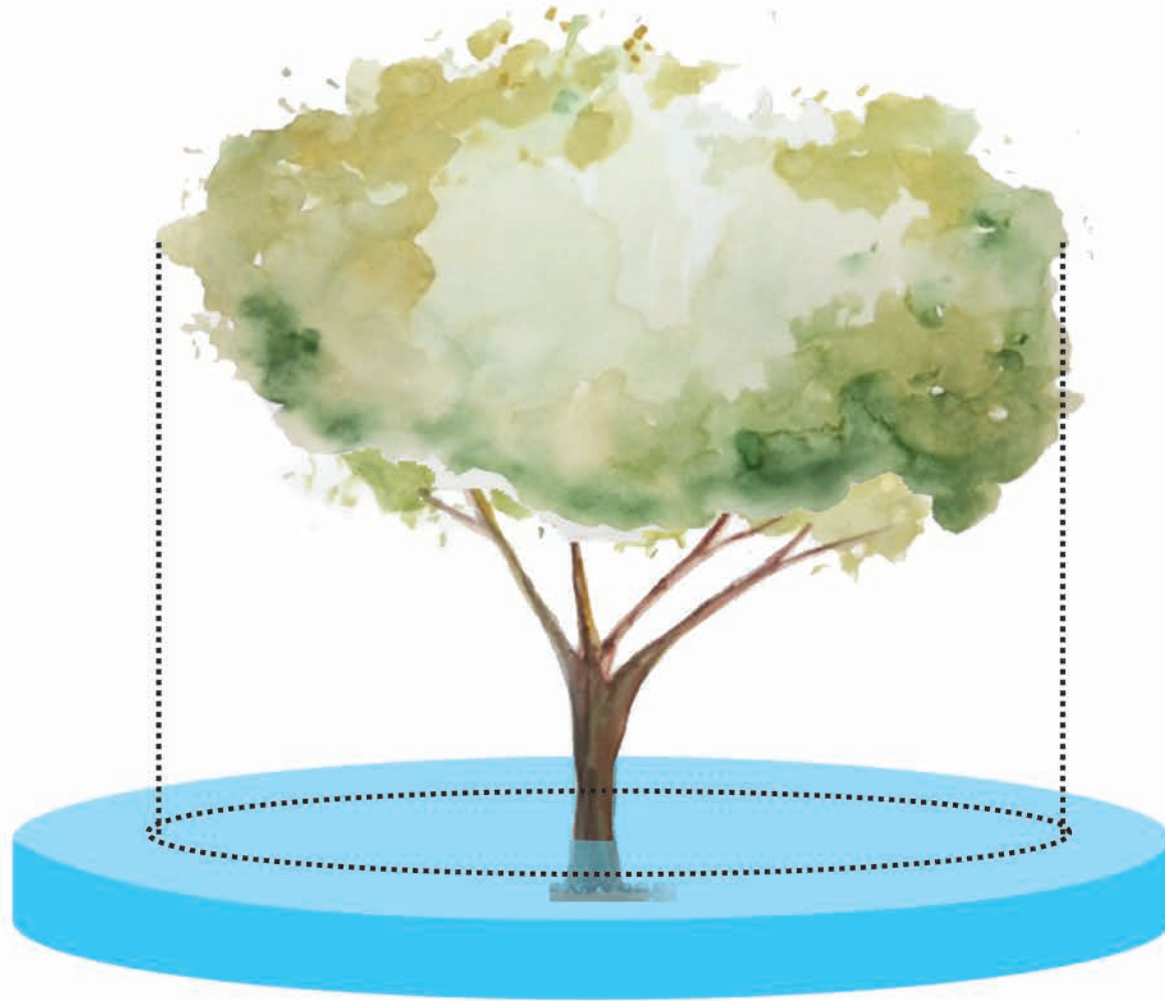


Underwood Family Sonoran  
Landscape Laboratory  
Tucson, Arizona  
TenEyck Landscape Architects Inc.

## 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?

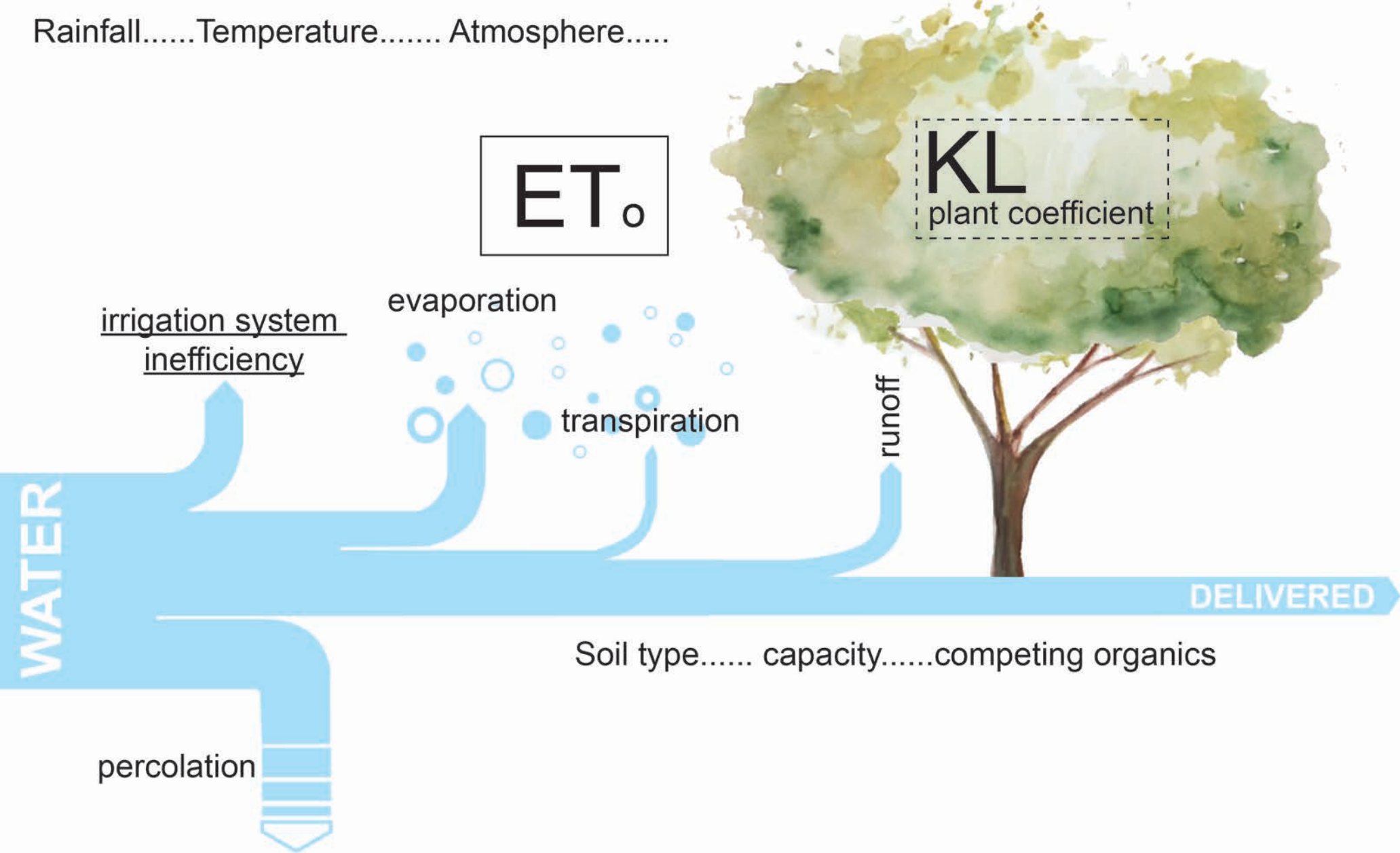


## “Wrong Question”

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



Rainfall.....Temperature..... Atmosphere.....



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.

# LANDSCAPE WATERING GUIDELINES

How Much & How Often <small>Water to the outer edge of the plant's canopy and to the height indicated. Watering frequency will vary depending on seasons, plant type, weather and soil.</small>		Seasonal Frequency — Days Between Waterings					Water This Deeply (Typical Root Depth)
		Spring Mar - May	Summer May - Oct	Fall Oct - Dec	Winter Dec - Mar		
Trees	Desert adapted	14-30 days	7-21 days	14-30 days	30-40 days	24-34 inches	
	High water use	7-12 days	7-10 days	7-12 days	30-40 days	24-34 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	3-5 days	3-7 days	5-10 days	8-12 inches	
Warm Season Grass		4-14 days	3-6 days	3-10 days	15-20 days	6-30 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. Deep root trees are typically 2 hours or more for each watering.

AMWUA water use it wisely  
Landscape Irrigation best practices



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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



Determinate Variables:

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

# CAPTURE

‘C’ yield    %supply

Determinate Variables:

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

# HARVEST

‘H’ yield    %supply

Determinate Variables:

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

# REUSE

‘R’ yield    %supply

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

SUSTAIN  
landscapes

# SUPPLY

Water Management Yields  
Stormwater capture  
Greywater reuse  
Rainwater Harvest

# DEMAND

Water input to  
sustain ecosystem  
services of landscape  
Trees, vegetation

Water Uncertainty



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



# GILBERT ROAD

## LIGHT RAIL EXTENSION



valleymetro.org/gilbertroad

### 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

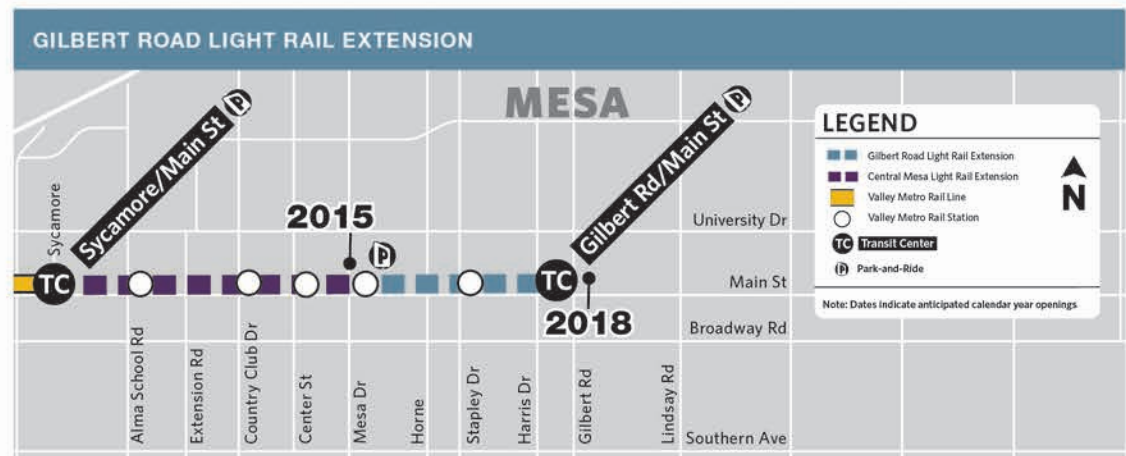
- The design elements of preliminary engineering are complete
- Estimates of project construction costs have been reviewed and comments were resolved
- Currently defining how the funding will be applied
- Project agreements are being refined to include project specific information as it becomes available

#### BUDGET

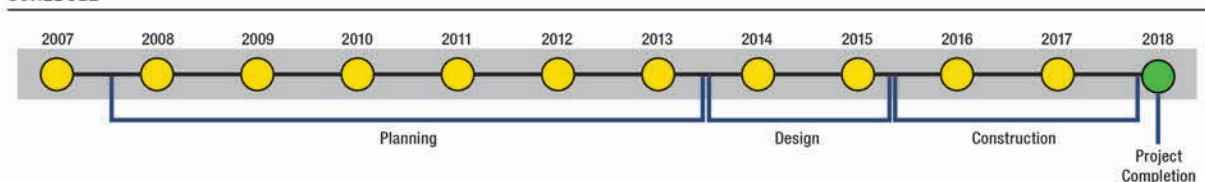
	Programmed*	Expended**
Project Development	\$11,100,000	\$2,187,194
Final Design	\$20,400,000	\$0
Construction	\$130,200,000	\$0
<b>TOTAL</b>	<b>\$161,700,000</b>	<b>\$2,187,194</b>

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

### ROUTE MAP



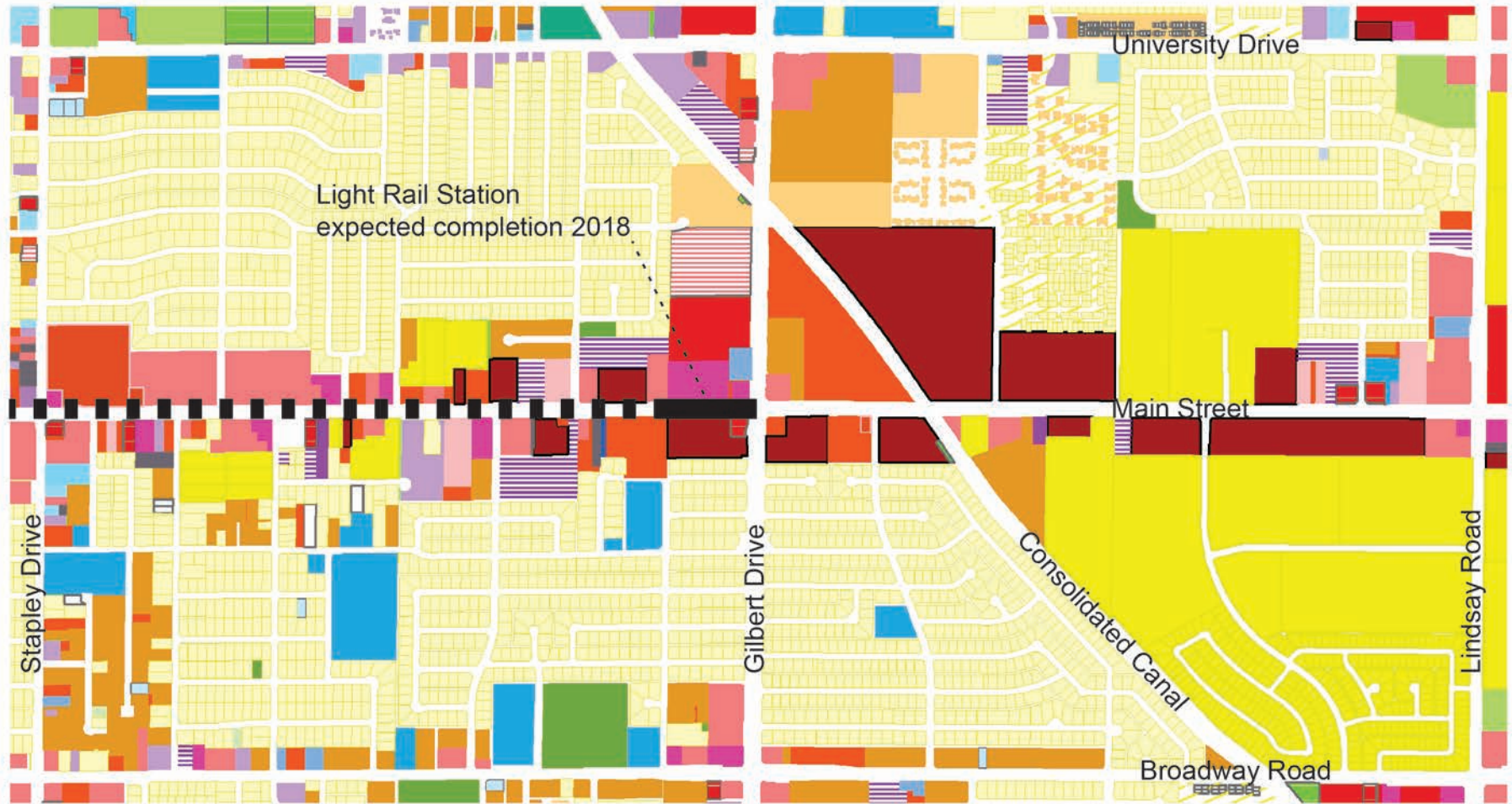
### SCHEDULE



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

# Gilbert rd / Main st Light Rail Transit Oriented District

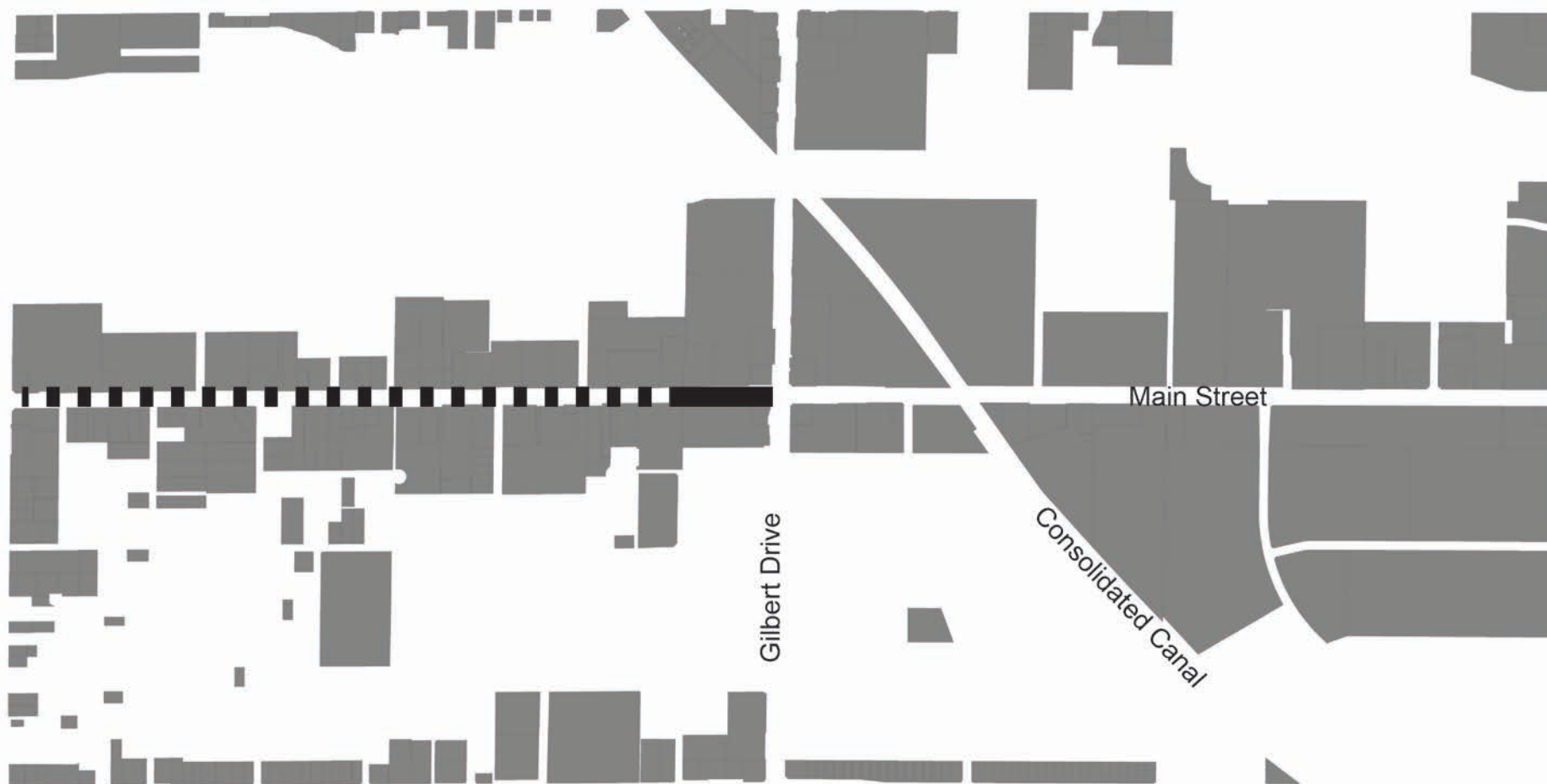


## Land Use Legend

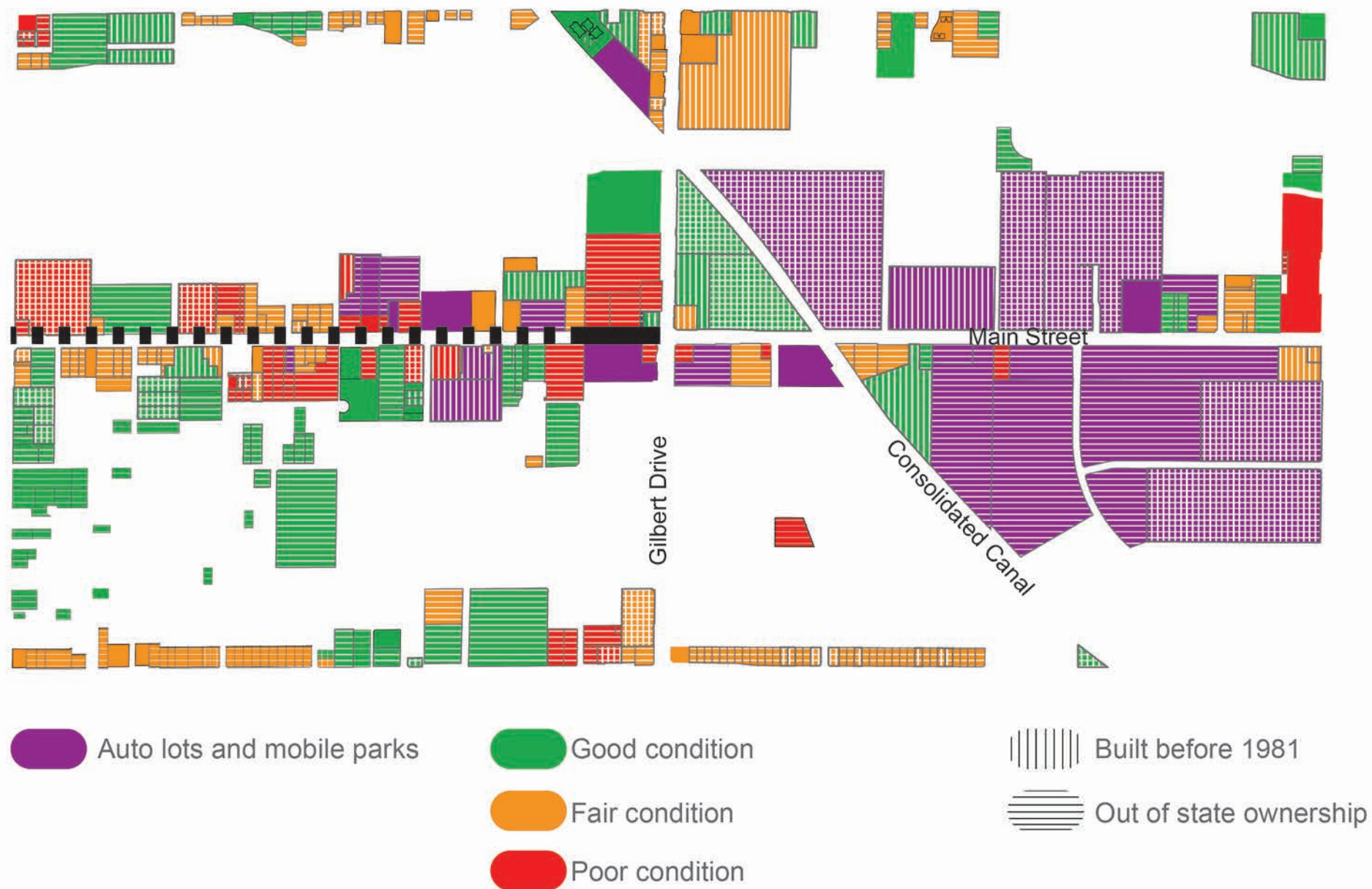
SINGLE FAMILY	CLUB HOUSE	MULTI-FAMILY	MOTEL	CONDOMINIUMS	TRAILERS	MISC. COMMERCIAL	CONV. MARKETS	STORE W/ OTHER USES	RETAIL STORE	SHOPPING CENTER	OFFICE BUILDING	BANK	AUTO SERVICE	VEHICLE LOT	NURSING HOME	RESTAURANT	MEDICAL	MORTUARY	AMUSEMENT	PARKING LOT	FITNESS CLUB	PRIVATE SCHOOL	INDUSTRIAL	WAREHOUSE	UTILITY	UNASSIGNED	WELLS, TOWERS	HOSPITAL	CHARITABLE	RECREATION	RELIGIOUS	FEDERAL	STATE	COUNTY	MUNICIPAL
[Yellow]	[Yellow with diagonal lines]	[Orange]	[Pink]	[Light Orange]	[Yellow]	[Red]	[Red]	[Red with horizontal lines]	[Red]	[Red]	[Purple]	[Purple]	[Red]	[Dark Red]	[Orange]	[Pink]	[Light Blue]	[Light Blue]	[Dark Blue]	[Grey]	[Blue]	[Blue]	[Purple]	[Purple]	[Green]	[White]	[Green]	[Light Blue]	[Light Blue]	[Green]	[Green]	[Light Green]	[Light Green]	[Light Green]	[Green]



Non residential parcels

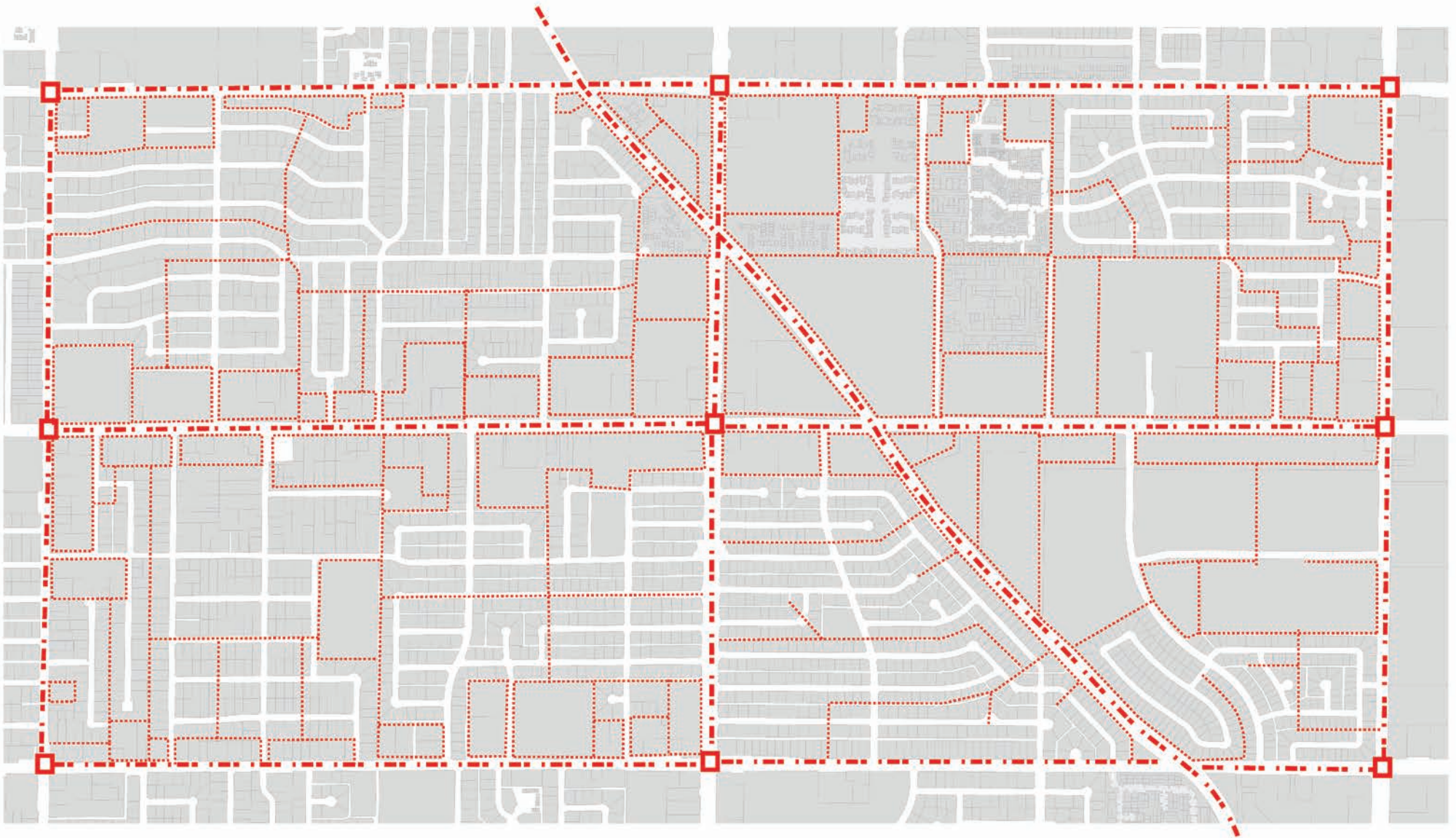


## Grading and ranking of parcels likely to be redeveloped



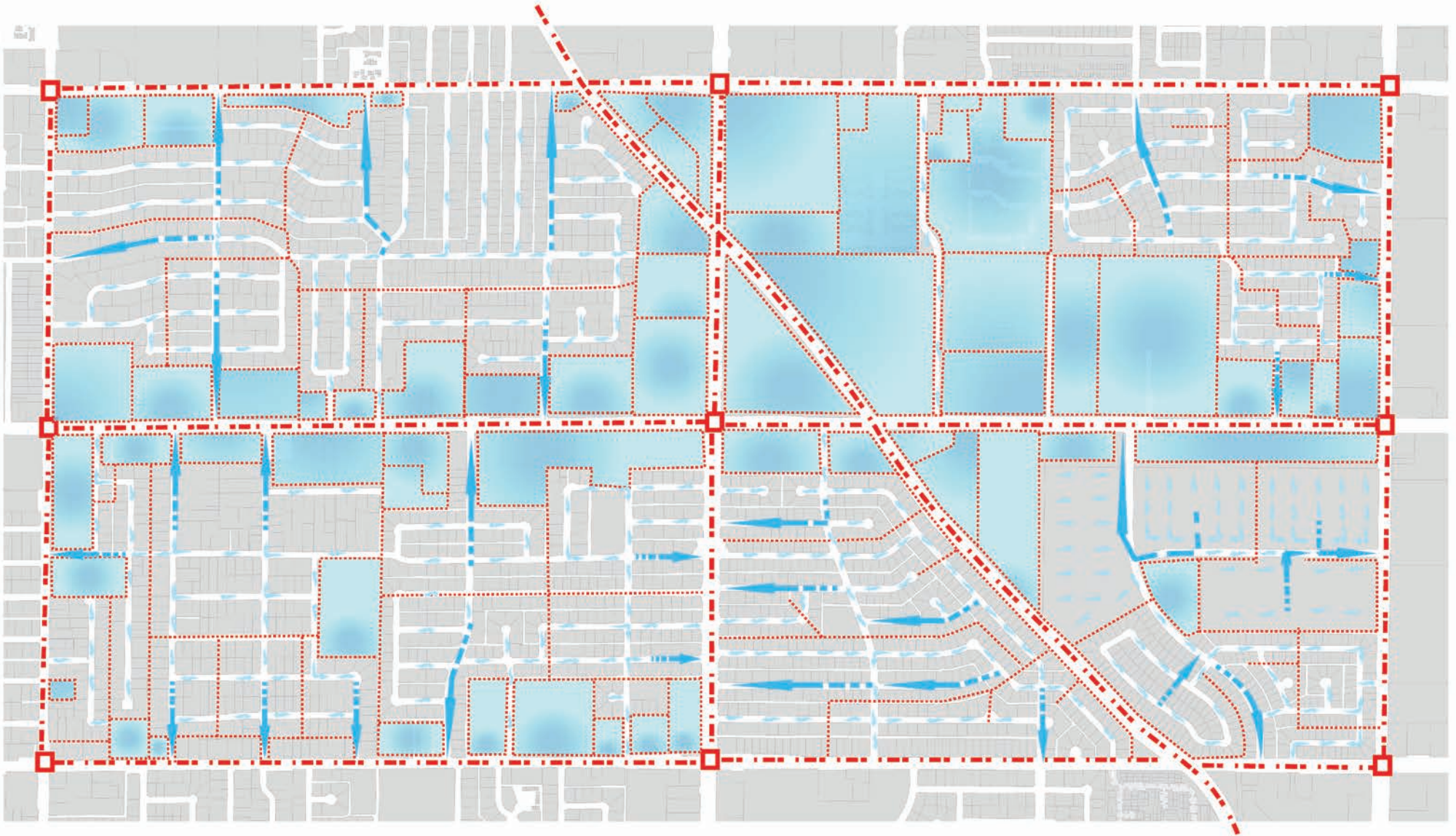


Major and minor ridges contain and direct flows



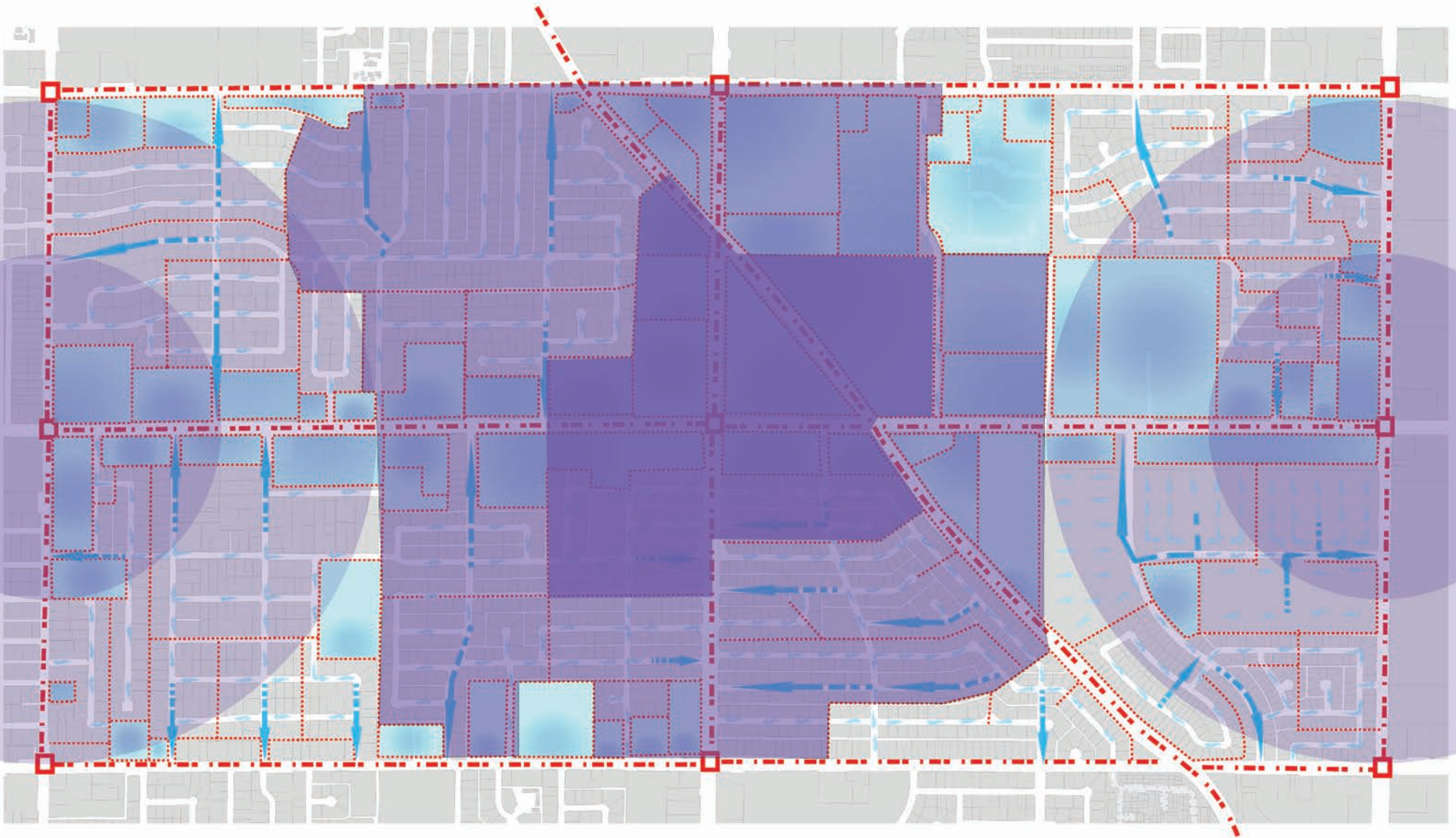


Surface flows within watershed, Commerical properties drain in isolation

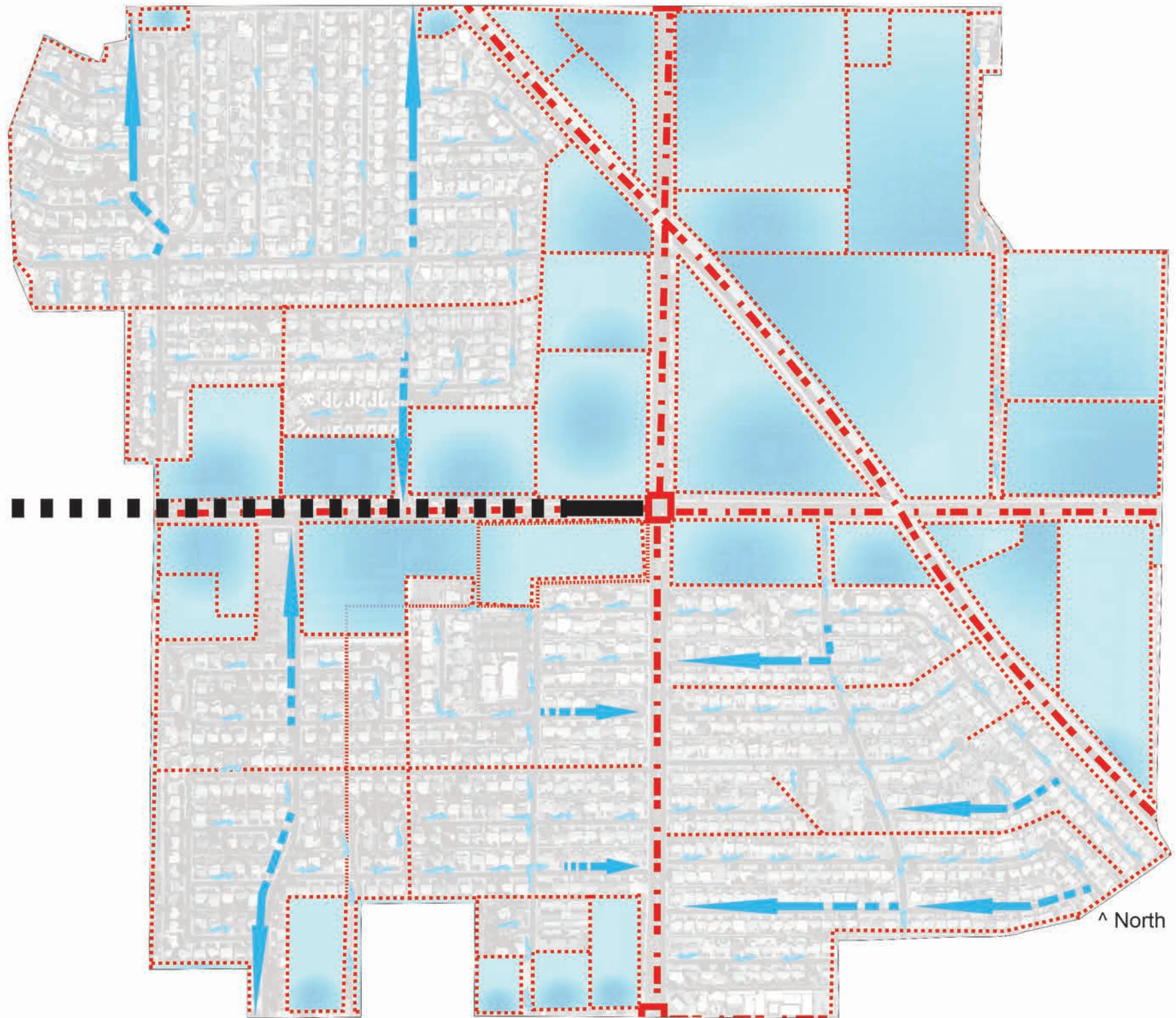




Transit Oriented District defined by walkable shed within urban watershed  
Watershed Transit Oriented District (WsTOD)







Watershed Transit Oriented District (WsTOD)



### PARK and RIDE Development Opportunity

Existing:  
1.4 acres buildings  
6.84 acres impervious  
.5 acres permeable  
8.47 acres total

Potential Supply:  
1.79 acres rooftop capture  
from upper watershed  
2 acres rooftop capture  
from new development

Potential Demand:  
(20) 25' trees  
(300') 3' swales  
(5) shade trees

### Day Care Campus Development Opportunity

Existing:  
.1 acres building  
.25 acres impervious  
1.14 acres permeable  
1.49 acres total

Potential Supply:  
9.6 acres from upperwatershed  
1000 sq ft rooftop capture  
from new development

Potential Demand:  
1000 sq ft lawn  
(8) 25' canopy trees  
200' 4 ft wide native swale

### Affordable Housing Development Opportunity

Existing:  
.134 acres buildings  
4.27 acres impervious  
1.38 acres permeable  
5.78 acres total

Potential Supply:  
1.79 acres rooftop capture  
from upper watershed  
2 acres rooftop capture  
from new development

Potential Demand  
(10) trees in double allee  
(10) 25' trees

^ North



## Potential Development:

### Day Care Campus

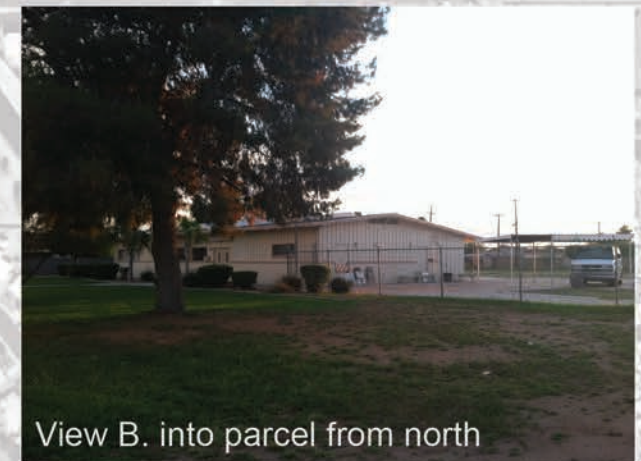
#### Existing Condition:

.1 acres building

.25 acres impervious

1.14 acres permeable

1.49 acres total



#### 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

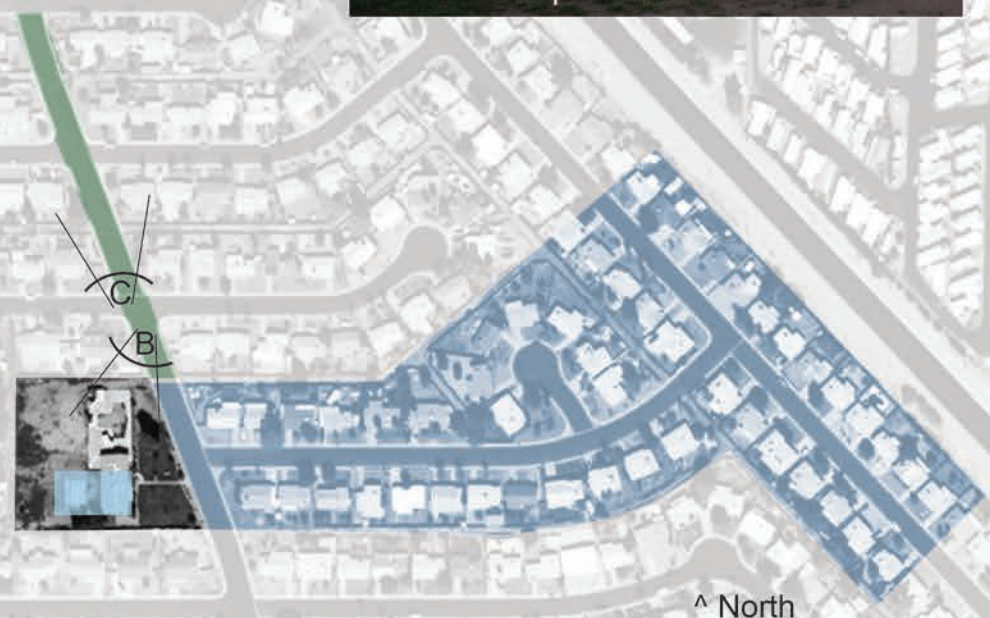
= 105, 280 gallons per year at peak

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

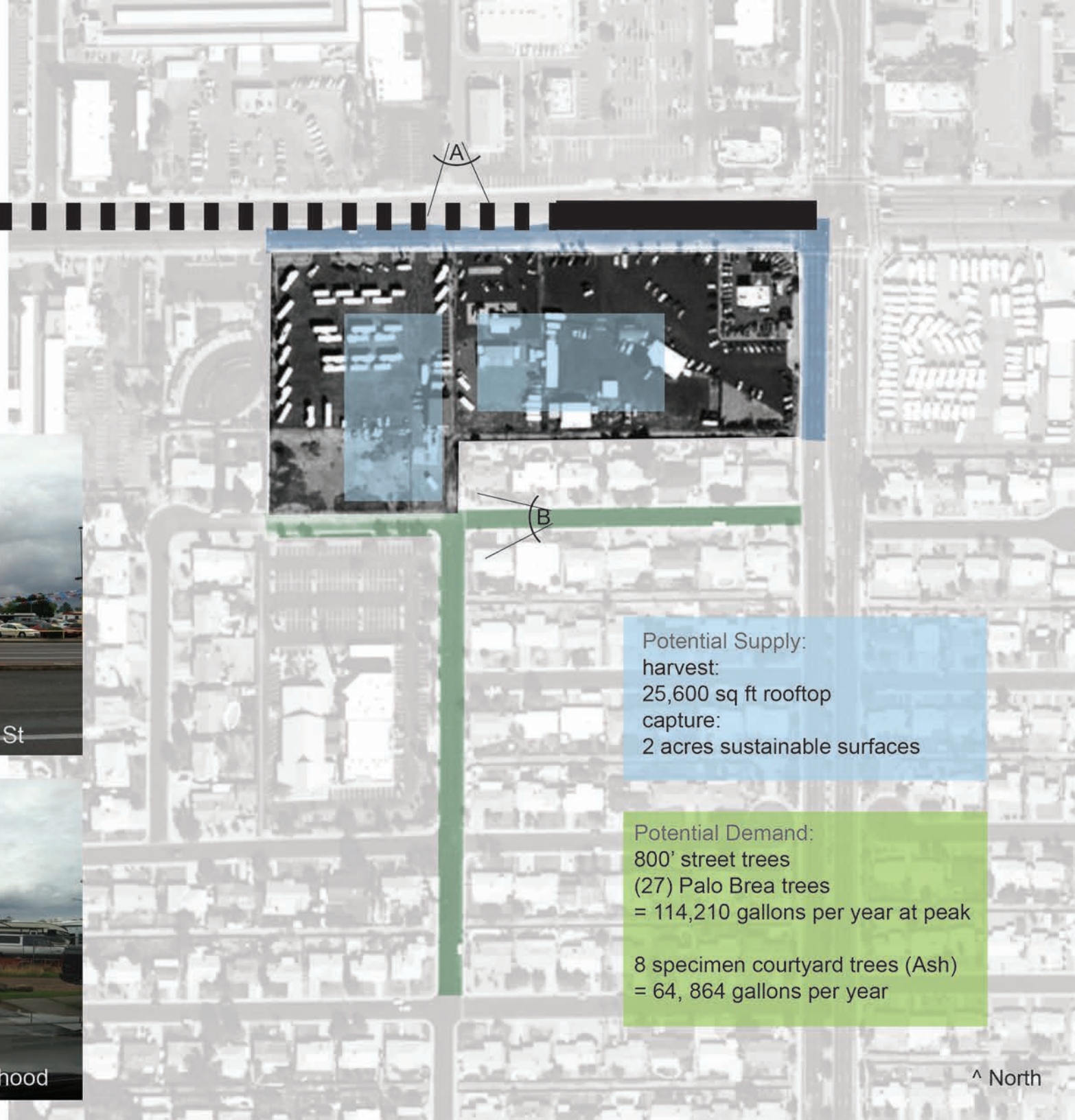
Existing Condition:  
.134 acres building  
4.27 acres impervious  
1.38 acres permeable  
5.78 acres total



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

^ North



#### 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

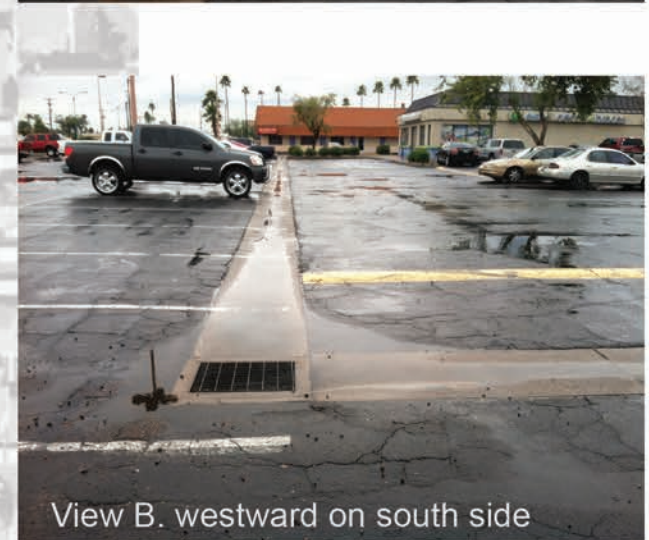
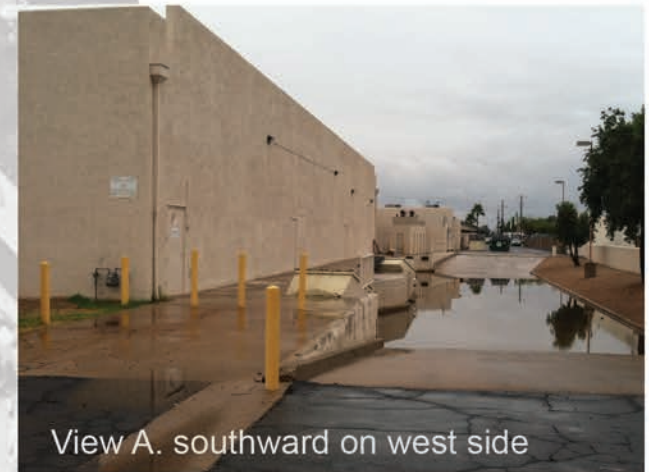
3350 sq ft filtration swale

= 23,450 gallons per year

= 300,172 gallons per year

@ \$6.43 per 1000 gallons

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

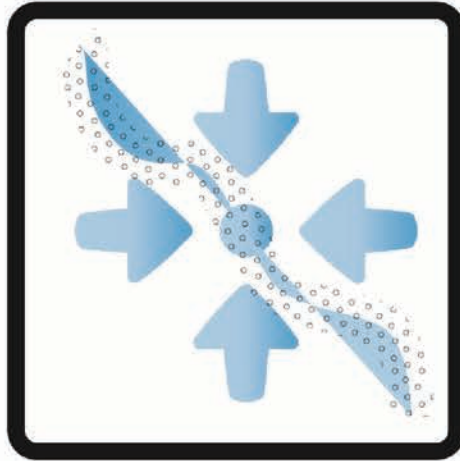


Potential Development:  
Park and Ride Transit Center

^ North



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



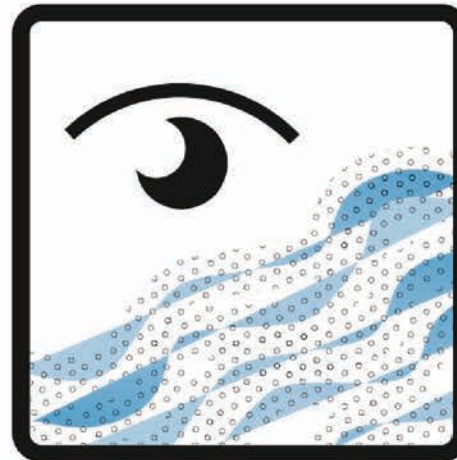
Efficient Collection/  
Delivery of Water



Sustainable Materiality

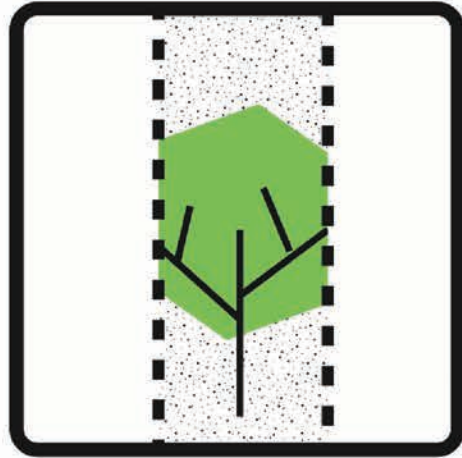


Showcase Water  
Components

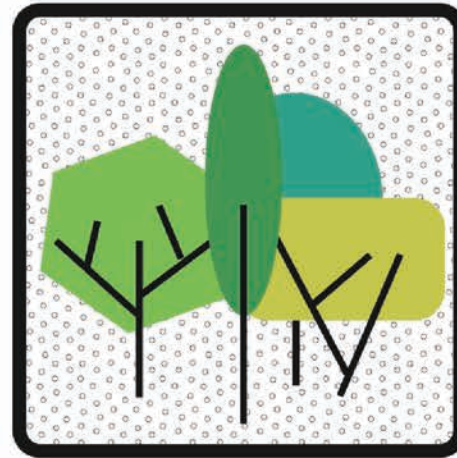


Reveal Conveyance

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



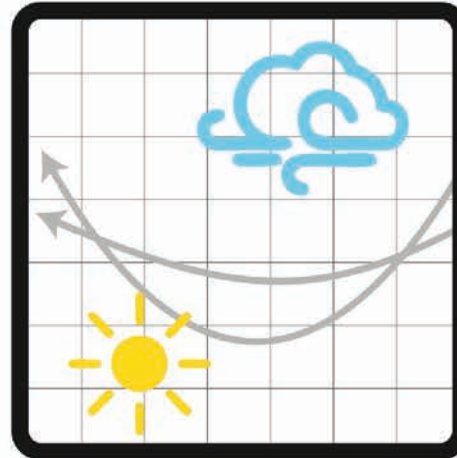
Accommodate Plants



Diverse Plant Palette



Walkable Human  
Habitat



Relate Site Development  
to Ecosystem Services

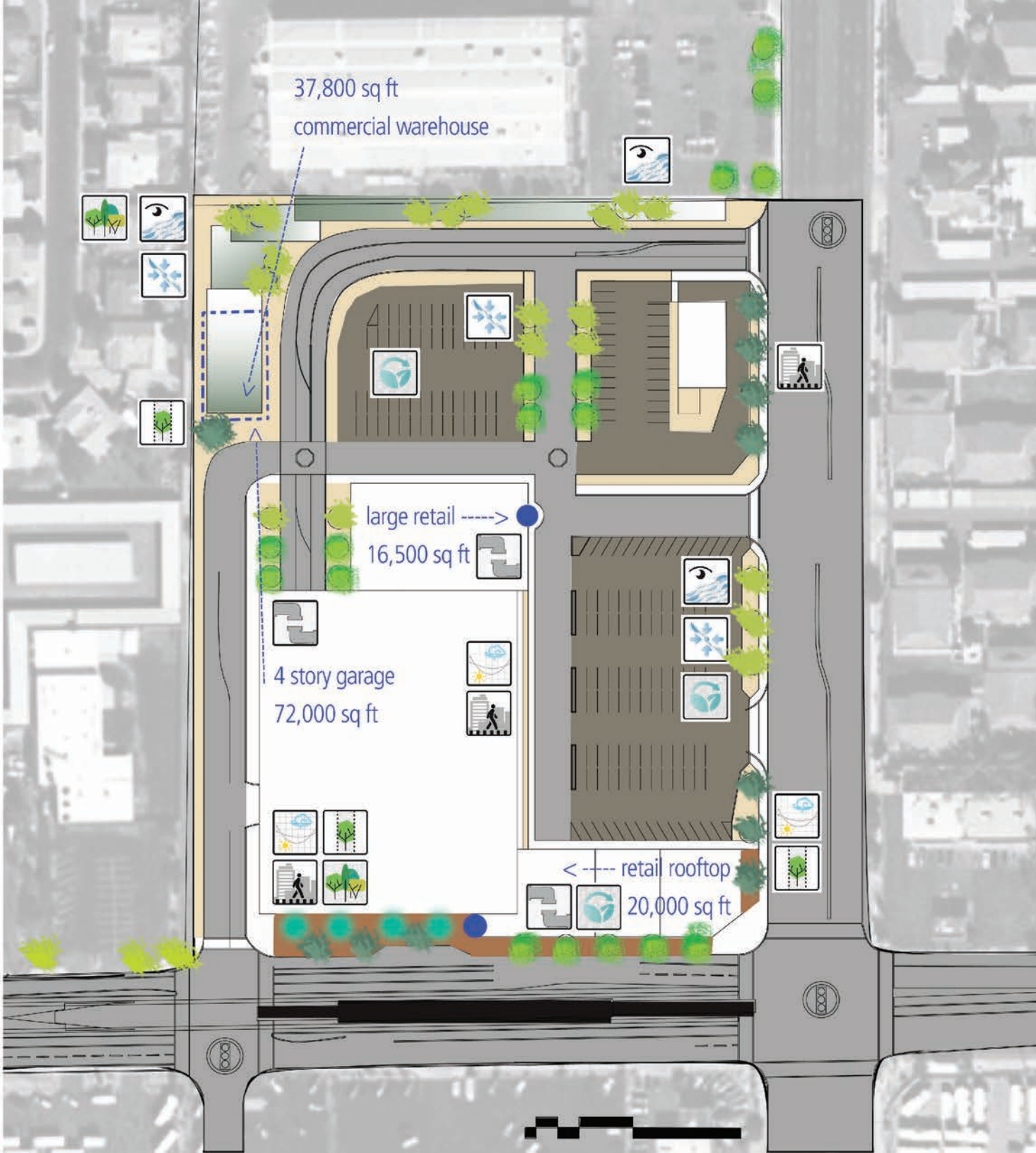


37,800 sq ft  
commercial warehouse

large retail ----->  
16,500 sq ft

4 story garage  
72,000 sq ft

<----- retail rooftop  
20,000 sq ft



37,800 sq ft  
commercial warehouse



large retail -----> ●  
16,500 sq ft



4 story garage  
72,000 sq ft





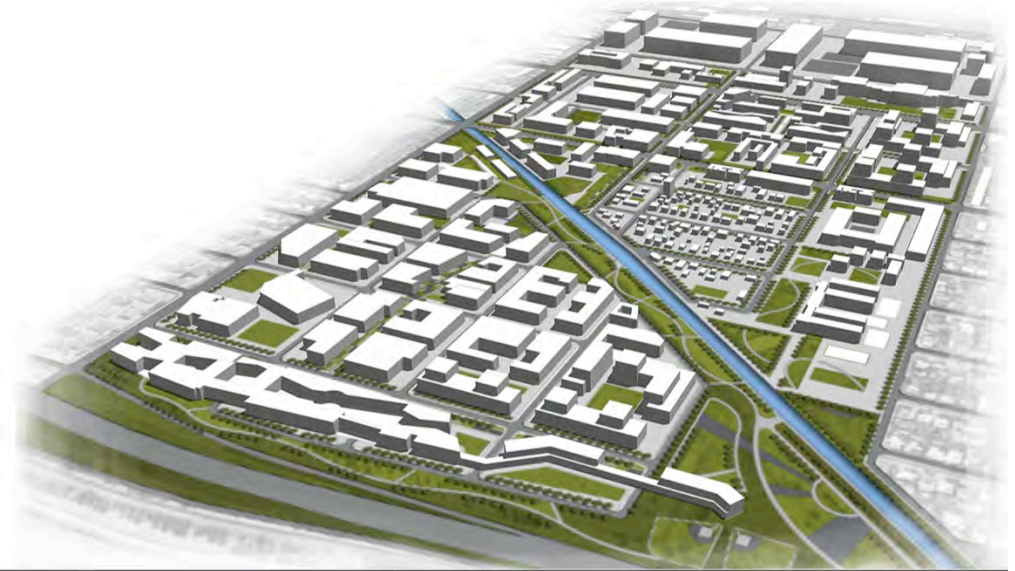
Balance systems to

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



---

# **Vacant to Vibrant: Infill and Urban Renewal of Gateway District**

Meiling Cai  
Arizona State University

Thesis Project Report  
Prof. Kenneth Brooks  
May 11th, 2015



# **Vacant to Vibrant: Infill and Urban Renewal of Gateway District**

Herberger Institute for Design and Art

Master of Urban Design

Meiling Cai

Prof. Kenneth R. Brooks, FASLA, FCELA, PLA

May 10<sup>th</sup>, 2015

## **Acknowledgements**

First and foremost, I would like to show my deepest gratitude to my supervisor, Professor Kenneth Brooks, a respectable, responsible and resourceful scholar, who has provided me with valuable guidance in every stage of research and design. Without his enlightening instruction, impressive kindness and patience, I could not have completed my thesis. His keen and vigorous academic observation enlightens me not only in this thesis but also in my future study.

I shall extend my thanks to all the professors in my study in Arizona State University for their direct and indirect help to me. My sincere appreciation also goes to my dear friends and classmates in the design school for their company.

Last, my thanks would go to my beloved parents and Mr. Yang Liu, for their unconditional love, support and companionship.



## **Abstract**

Influenced by the Interstate 10 freeway, Gateway district began to decline in the 1960's, and became further isolated from the rest of the city due to additional freeway development. With 300 acres of vacant land, the Gateway neighborhood has become a place lacking of service and livability, with low economic investment and poor living conditions. This project explores strategies for infill, and urban renewal and vibrancy, turning the Gateway district into an attractive place for investment and living. The vacant is infilled with new development, providing more open space, housing and services, and improving the environment and living conditions in this area. The goal is to transform Gateway district from vacant and decline into a new vibrant community.

**Key Word:** Vacant, infill, renewal, Gateway District, vibrant, lively community, investment

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## 1 Introduction

“In the urban planning and development industries, infill has been defined as the use of land within a built-up area for further construction, especially as part of a community redevelopment or growth management program or as part of smart growth.”—Dunphy Robert (2005)

Urban infill is a design strategy that focused on the redevelopment of vacant land and brown field to make a compact city, thus to reduced human carbon footprint and automobile use. Urban renewal usually refers to land redevelopment in areas of moderate to high-density urban land use.



Urban sprawl started in United States from 1950s, is the main factor that caused problems like global climate change, environmental problems like water pollution and air pollution. As the progress of urban sprawl in the past, many vacant lands have been left in urban areas, which have many negative impacts to the neighbor and city. Vacant lands caused low investment and low tax; also create many social problems, for example, safety issues and lacking of sense of community. There is urgent need for redevelopment of vacant lands, as it is a way to confront urban sprawl, and also, redevelop vacant lands could bring social, environmental, and economic benefits. The following article will pick Gateway District in Phoenix as an example, to discuss the opportunities and barriers of infill and urban renewal, and the strategies to use infill and urban renewal to transfer Gateway District- a declined neighborhood- into a vibrant and lively community.

**Fig. 2**



## 2 History and background



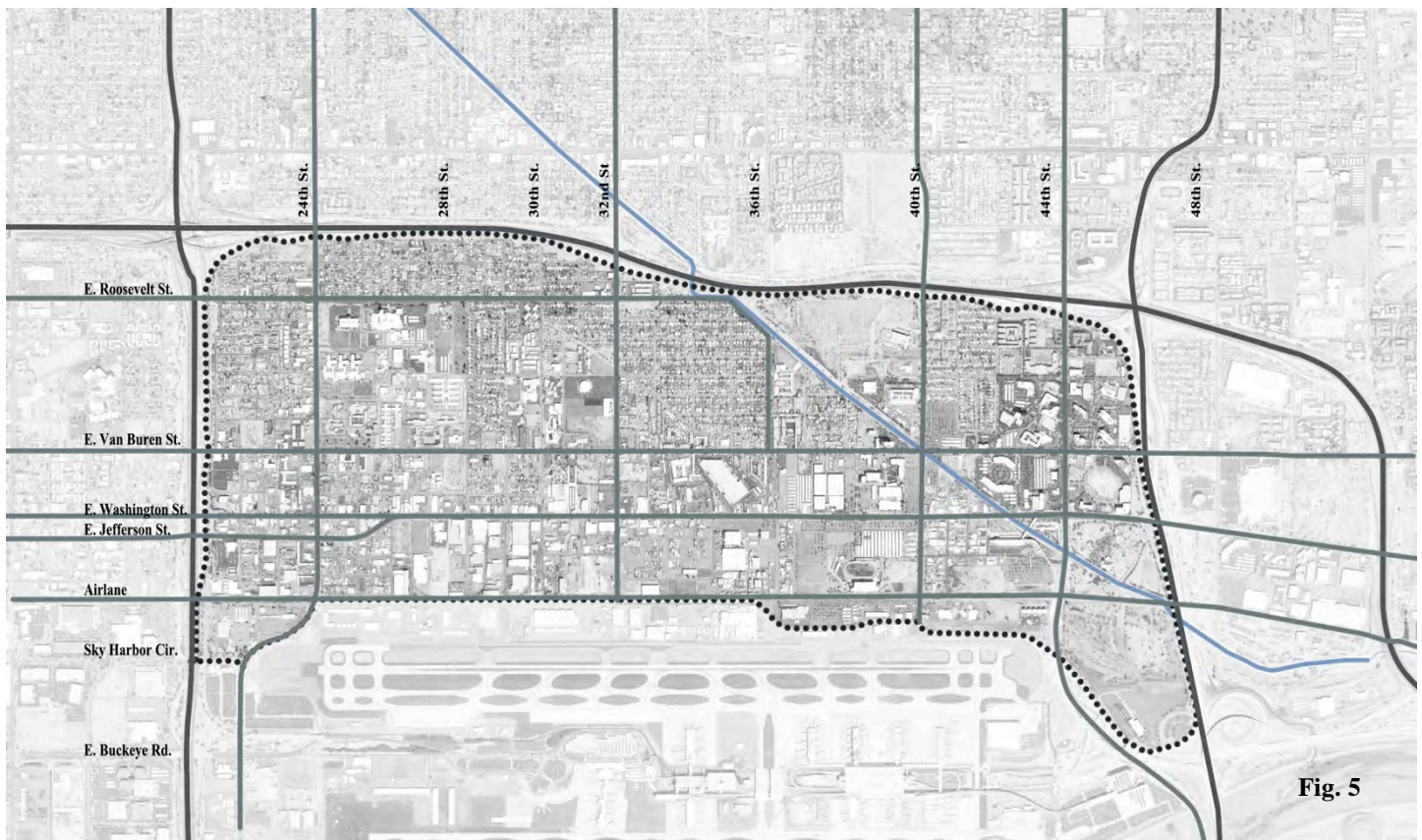
Fig. 3

### 2.1 Overview

Gateway District located in the southeast corner of Phoenix (see figure 4), is the birthplace of Phoenix. For more than 1000 years ago, the ancient Hohokan people lived in what is now Phoenix, the culture center of their city, known as Pueblo Grande, was located in what we now call the Gateway District. This district has been gateway to Phoenix for many years, with Van Buren serving as the major connection to Phoenix and Sky Harbor Airport; Van Buren emerged as a tourist corridor accommodating newlyweds and auto-tourists.



Fig. 4



Influenced by the Interstate 10 freeway, the expansion of the airport and the industrial development, Gateway district began to decline in the 1960's, Van Buren Street lost its importance, tourists were attracted to newer shopping malls and hotels; the commercials along Van Buren corridor declined, the used to be stylish and modern motor courts became cheap, temporary housing and hourly motels. Gradually, due to the additional freeway development, Gateway District became further isolated from the rest of the city; and eventually, commercials died and removed, results in 300 acres vacant land remain in Gateway districts. As the result, the Gateway neighborhood has become a place lacking of service and livability, with low economic investment and poor living conditions.



## **2.2 Opportunities and Barriers**

### **2.2.1 Opportunities**

The first one is social opportunity. There is an urgent need for urban infill. As the negative outcome of urban sprawl, there are a lot of vacant lands in downtown Phoenix and Many districts and communities are declined. There are many social negative impact of vacant land, such as social isolation, as vacant land divided communities apart. And creates a lot of safety issues, residents has low sense of secure to walking in the night. Also, as the declination of community with large amount of vacant land, the sense of community is low. Therefore there is a call for urban infill and redevelopment of vacant land in social aspect.

Secondly, there is economic value of urban infill. Infill and redevelopment make good economic sense, both for developers and the public. Vacant land and brown fields means low investment, and low tax income. Infill development of vacant land and brownfield will benefit the public no matter what they had been developed into. Open space or green space been developed into vacant land, they benefit public with more open space and better community environment. Both commercial and residential can create more job opportunity and more service for public, and also could increase the property value of the community and tax income. As for the developer, compare to green field in suburban are, there are already infrastructure and amenities constructed around the urban vacant land, they can save money on them. And also, mature community could provide stable customer and attract new customers. Closer to downtown is also a huge location advantage that will increase the property value. Being close to town is an amenity, ensuring shorter travel times o services and allowing for multiple modes of travel including walking and cycling. Reduces infrastructure costs and improves the town's economy and vibrancy. Reduces costs for providing services such as fire, police and infrastructure maintenance. Meaningful rural

open space is protected

Finally is the environmental value. As Sierras said in the book “In communities across America ‘sprawl’—scattered development that increases traffic, saps local resources and destroys open space—is taking a serious toll.” The global climate change affects everyone, as the temperature in summer is getting higher than past, made the desert city, which is already too hot for human even worse. People are suffering from air pollution due to the over use of automobile, There are an urgent need for all citizens to have a better environment to live, with more open space and clear air. Moreover, in the perspective of protecting ecological balance, there is a call for stop taking over green space and preserve wildlife habitat. “A key challenge in achieving the dual goals of climate change planning is that the land-use policy options to address adaptation and mitigation many conflict... The key land-use pattern implication of climate change mitigation is concentrating development so that car travel and building energy use is reduced; it brings a strong new impetus to the existing anti-sprawl/smart growth campaign.” (Hamin & Gurran, 2009) According to the U.S. Environmental Protection Agency in “The Transportation and Environmental Impacts of Infill Versus Greenfield Development: A Comparative Case Study Analysis” cases studied suggest that “in the right conditions, infill development can make travel more convenient by reducing travel time, lowering travel costs, and lessening congestion. Infill development can also cost significantly less, in total public dollars, in private transportation dollars, and in externalities. Finally, the results suggest that infill development can improve community environmental quality and inputs to quality of life such as accessibility. This study concludes that infill can produce non-trivial transportation, environmental, and public infrastructure cost benefits.” Communities can create incentives and design standards for compatible infill development in existing urban centers adjoining commercial areas, strip centers, or neighborhoods.



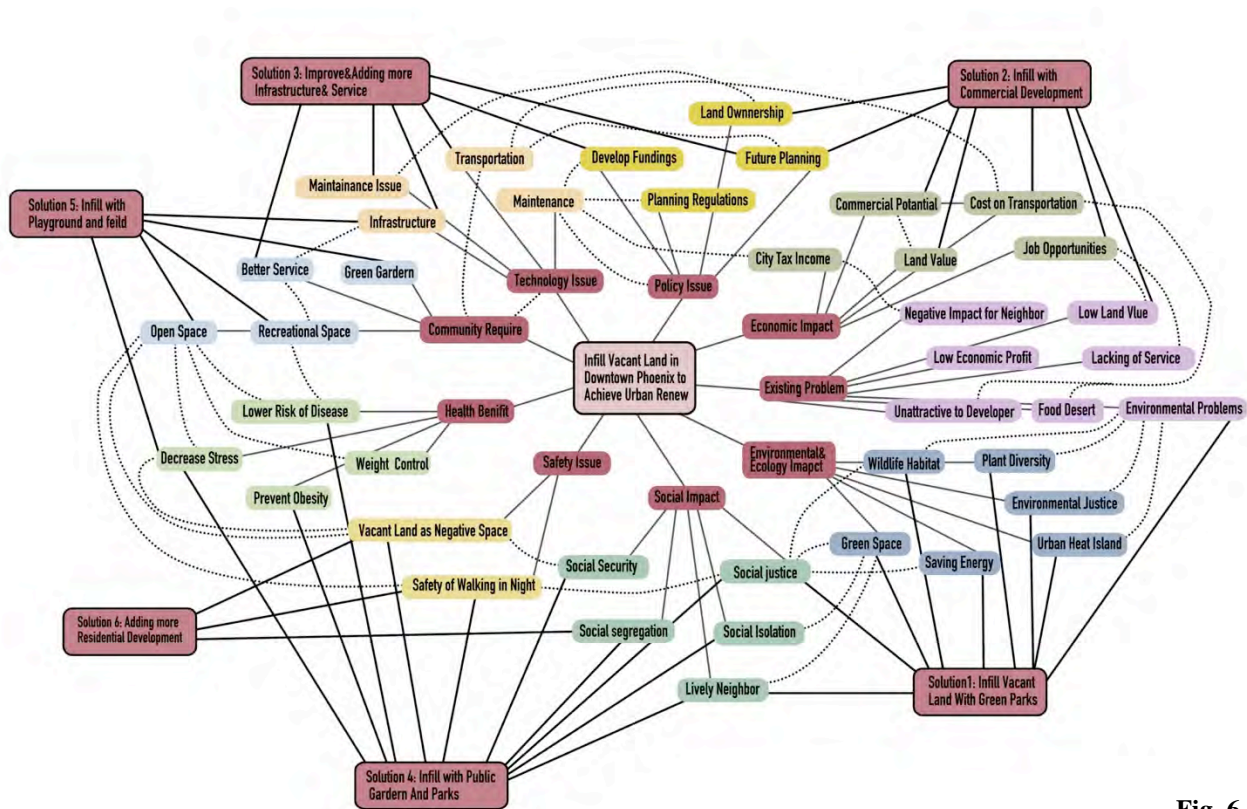


Fig. 6

## 2.2.2 Barriers

Although there are many opportunities as discussed above, there also some barriers existing and impeding the urban infill.

Firstly is the economic issue from developers' point of view. Infill and redevelopment projects often cost more to build than raw land projects. "Hard costs, such as land, site preparation, construction, and parking vary widely but generally run more for infill and redevelopment. Typically soft costs, such as survey, architecture, engineering, legal, permitting, and marketing, also run more due to design challenges and public process requirements inherent to infill and redevelopment projects. The marginal cost of infill may be greater than for development on the

edge of the urban area.”(Otak, 1999) Thus the profit is relatively small for developer. Another economic issue is the reduced marketability, as in most declined communities, the situation is low quality of education and crime, and those factors could possibly lead to the poor quality of infill development, and reduced the marketability of redevelopment.

<b>DEVELOPMENT COSTS (per s.f. of floor area)</b>	<b>INFILL</b>	<b>SPRAWL</b>
Land	\$15-20+	\$8-12
Site and Off-Site Preparation	\$5-10+ (toxics)	\$5-10+ (infrastructure)
Hard Costs: Construction (wood frame only)	\$60-65	\$45-55
Parking (infill-structured parking; sprawl- included above)	\$15-18	\$0
Soft Costs (40% of hard costs)	\$32-37	\$20-26
Contingency (5%)	\$6-7	\$4-5
<b>SUBTOTAL</b>	<b>\$133-157</b>	<b>\$82-108</b>
Profit (15%)	\$20-23	\$12-16
Marketing	\$10-11	\$6-8
<b>TOTAL COST</b>	<b>\$163-191 / s.f.</b>	<b>\$100-132 / s.f.</b>

Source: *Building Livable Communities: A Policymaker's Guide to Infill Development*, Local Government Commission (1995).

Fig. 7

Secondly, there are problems about land ownership and scale limitation. As the vacant lands in urban area often has different ownership, this situation creates a lot of coordination works and difficulties for developer to buy the lands from several owners. Moreover, compare to green field in the edge of city, the scale of vacant land is relatively small, and limits the projects that can be developed inside, which eliminate large scale development out, and push them to the green fields.

Finally, there maybe some negative impacts of the infill development in urban area. Although a



more impact city could reduce the global climate change, however the consequence of urban infill development could have the possibility to influence the microclimate. “It is equally possible to conceptualize scenarios in which mitigation and adaptation goals are in conflict with each other. For instance, urban containment through higher density often results in a loss of permeable surfaces and tree cover, intensifying storm water and flood risks associated with changed climatic scenarios, and in some climatic conditions exacerbating the discomfort and health impacts of hotter summers. Strategic planning processes are intended to provide a way of resolving competing goals.” (Hamin & Gurran, 2009) Which means, in the same time of positive impact to the global climate change, urban infill will possibly increase the negative impact of urban heat island and other problems in smaller scale.

“Factors that influence the choice to use motorized or no motorized transport are based primarily on two fundamental aspects of the way land is used: (a) proximity (distance) and (b) connectivity (directness of travel) (16). Other factors, such as travel cost, environmental quality, and aspects of convenience and access (e.g., parking availability) are also likely influential. Proximity relates to the distance between trip origins (i.e., where one is) and destinations (i.e., where one is going). Proximity is determined by two land use variables. The first is density...the second is land use mix. “(Saelens& Sallis& Frank, 2003) Coordination between settlement and transportation is necessary, and it is important to built city in smart growth strategy, and there is urgent need of urban infill development in cities like Phoenix. Rather than grow horizontal, Phoenix should grown more vertical, and become a compact city to seek further development.

To sum up, the barriers are most about the input and revenue—whether the interests are good enough to worth all the trouble developers go through? And the answer is positive, Gateway District has a lot of opportunities and advantages to earn the investments.

### 3 Methodologies

#### 3.1 Site Analysis

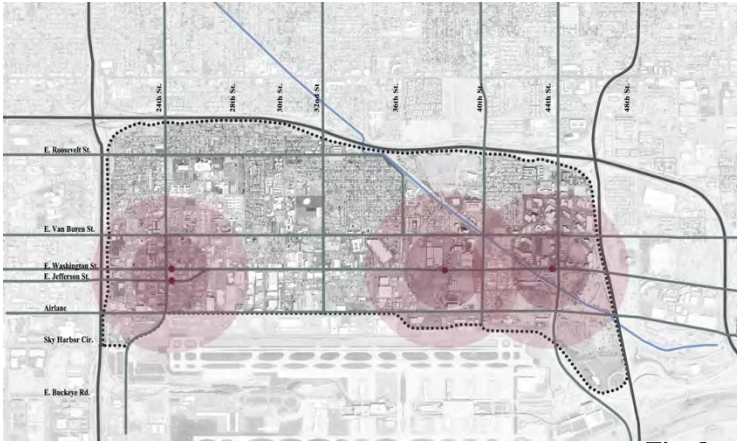


Fig. 8

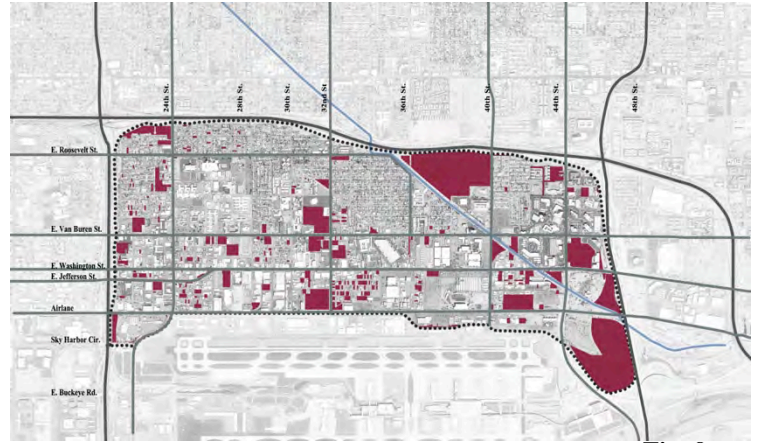


Fig. 9

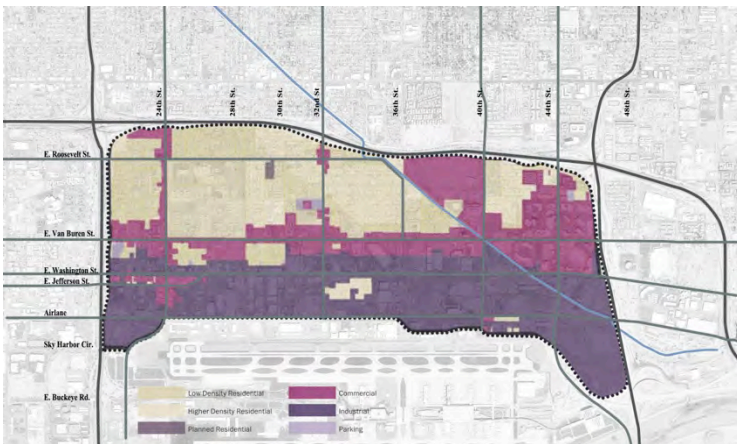


Fig. 10

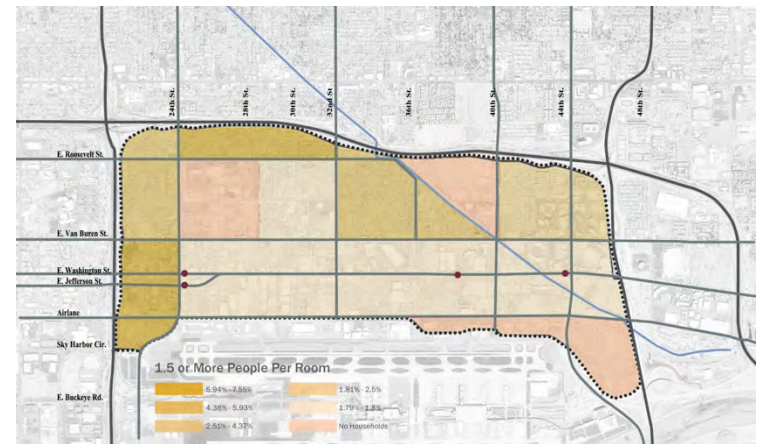


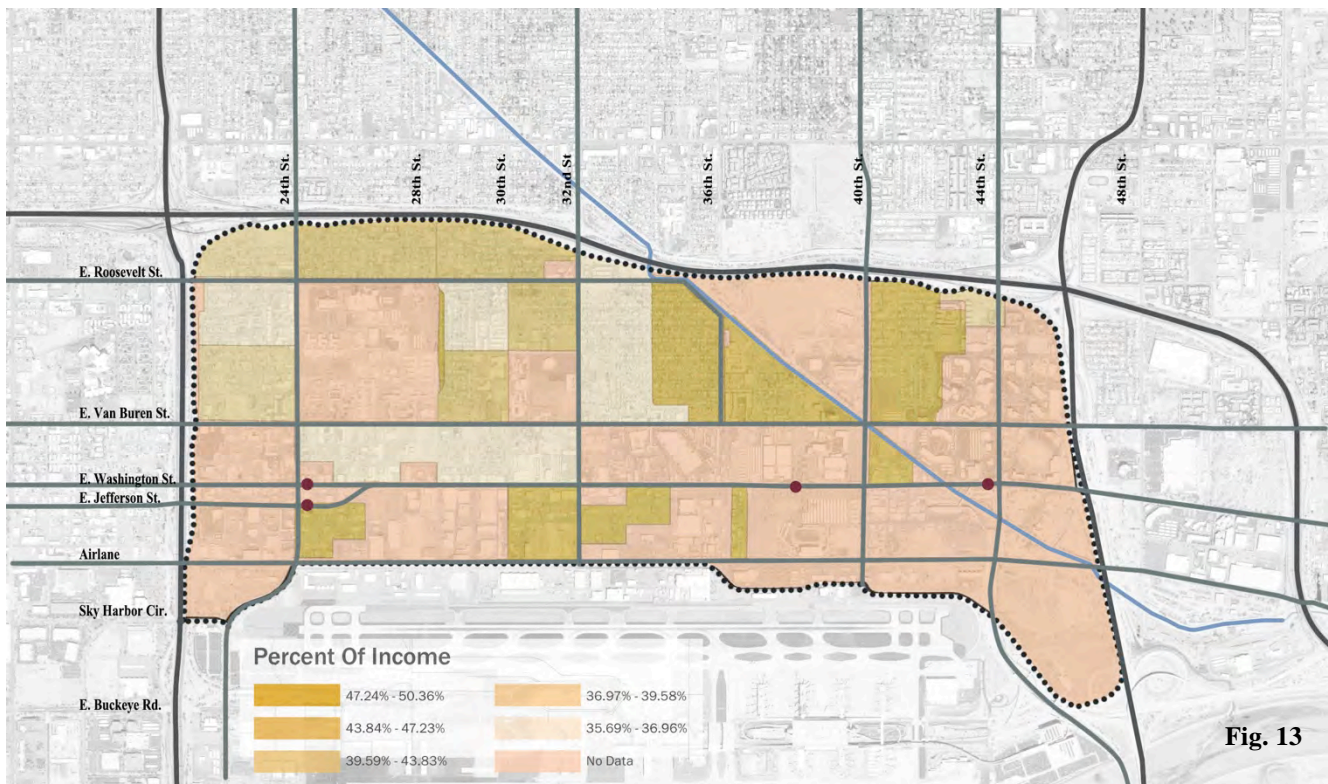
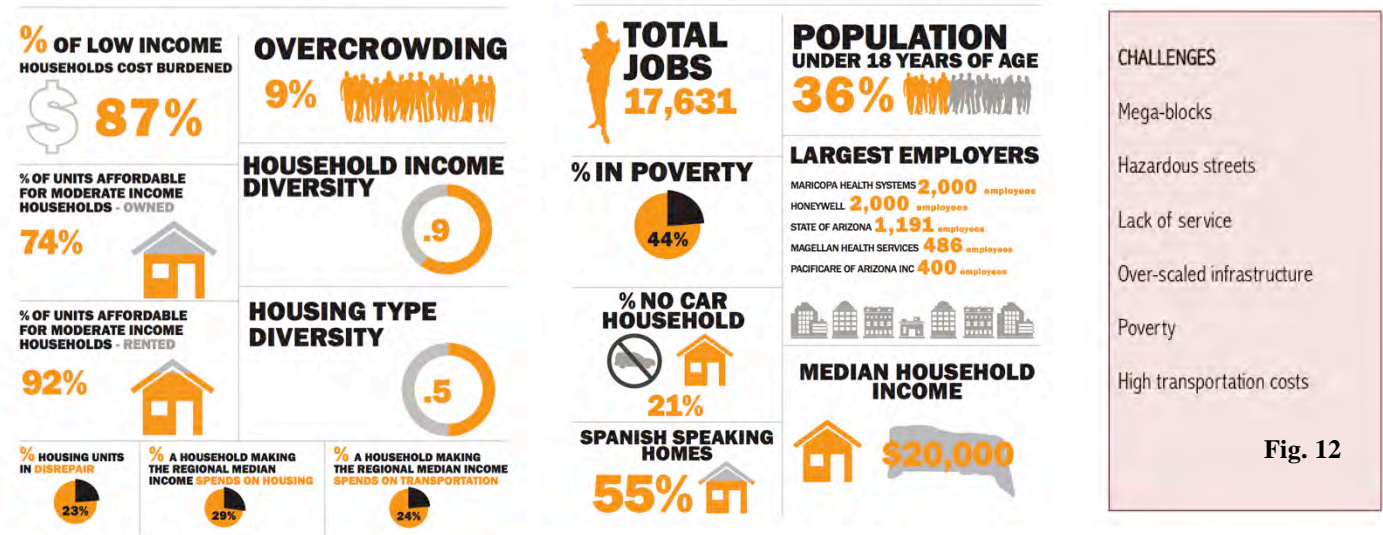
Fig. 11

There are 300-acre vacant lands in total in this site (see Fig 9), and a light rail corridor passing through, results with 3 light rail stations along Washington Street (see Fig 8). There mainly three kinds of land use inside this site. Along the East Washington Street and to the south of it is industry use; there are commercial and retail along East Van Buren Street and 24<sup>th</sup> Street; and rests of lands are mostly residential neighborhood (see Fig 10, 11).



### 3.1.1 Challenges

There are three main challenges existing in Gateway District: poverty, lacking services, and infrastructure; and they formed into a vicious cycle.





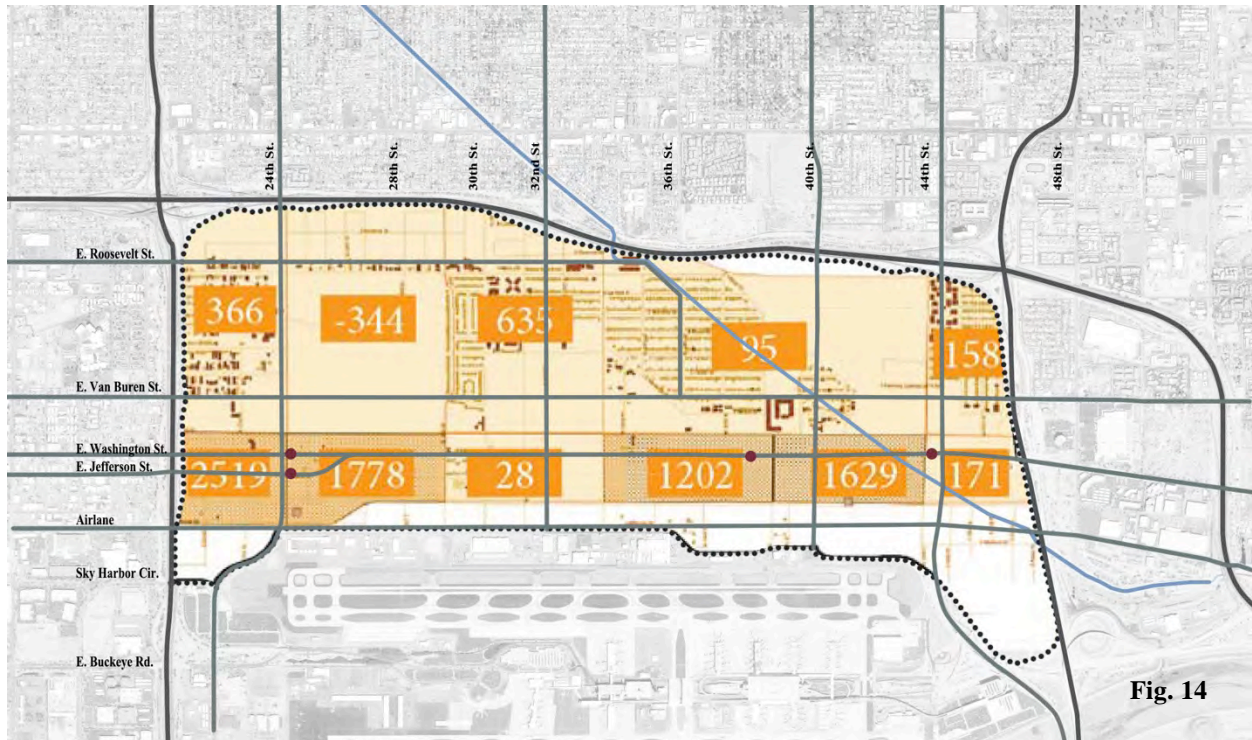


Fig. 14

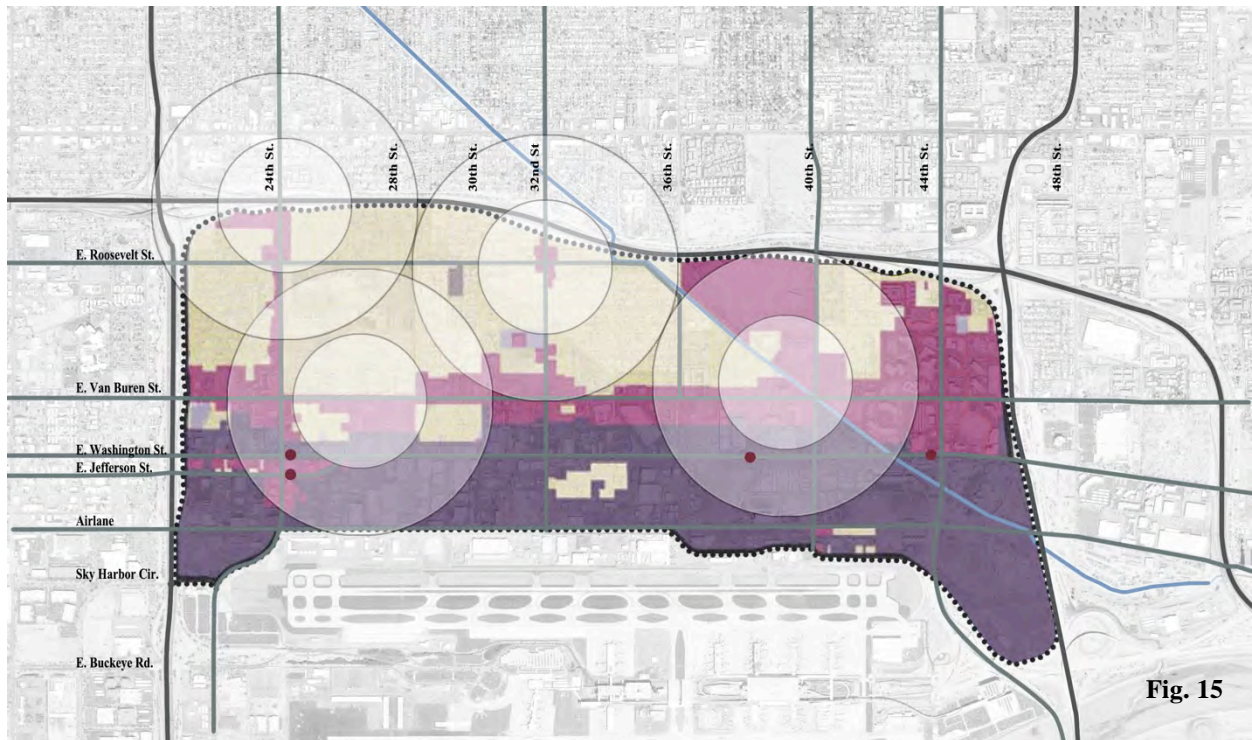


Fig. 15



To start with poverty, as the declined condition of the whole district together with the 300 acres vacant lands, which results in low investment and low tax income in this area; (according to Reinvent PHX GATEWAY TOD policy plan) 44% population in this district are under poverty, leading to the situation of crowded households and poor housing conditions, 21% of household without cars, and the residents lacking of purchasing power, it is hard to bring in new services. The lacking of purchasing power and low tax income led to the result of lacking service and infrastructure. Gateway District is a food desert, a recreation desert. The public transportation is not enough for residents, and the mega-blocks and hazardous streets are not suitable for people to walk or biking, spatially in summer. All those bad living conditions together made the district even less attractive for investment, and the vicious cycle went on and on.

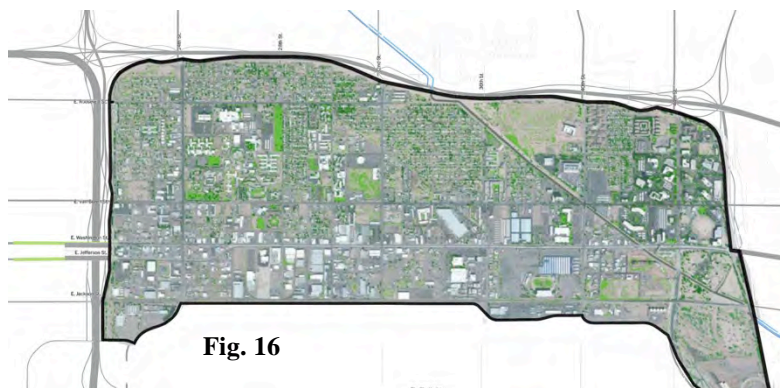


Fig. 16

As has discussed above, what is needed in this district are: better living conditions, more services, better infrastructure, more amenities, better traffic conditions, more open space and green space, and a better traffic system to help

with the poverty and also help with the environment, better public transportation for people who don't own cars, and TOD could be a solution.



Fig. 17



Fig. 18

How to make those needs become true? As we know space and land is not a problem, because we have 300 acres of vacant land, which dispersed all over this district. However, the most important factor needed to make the infill and renew happen is, we need money or in other words investment, to build what are needed. This could be a problem.



Fig. 19





Fig. 20

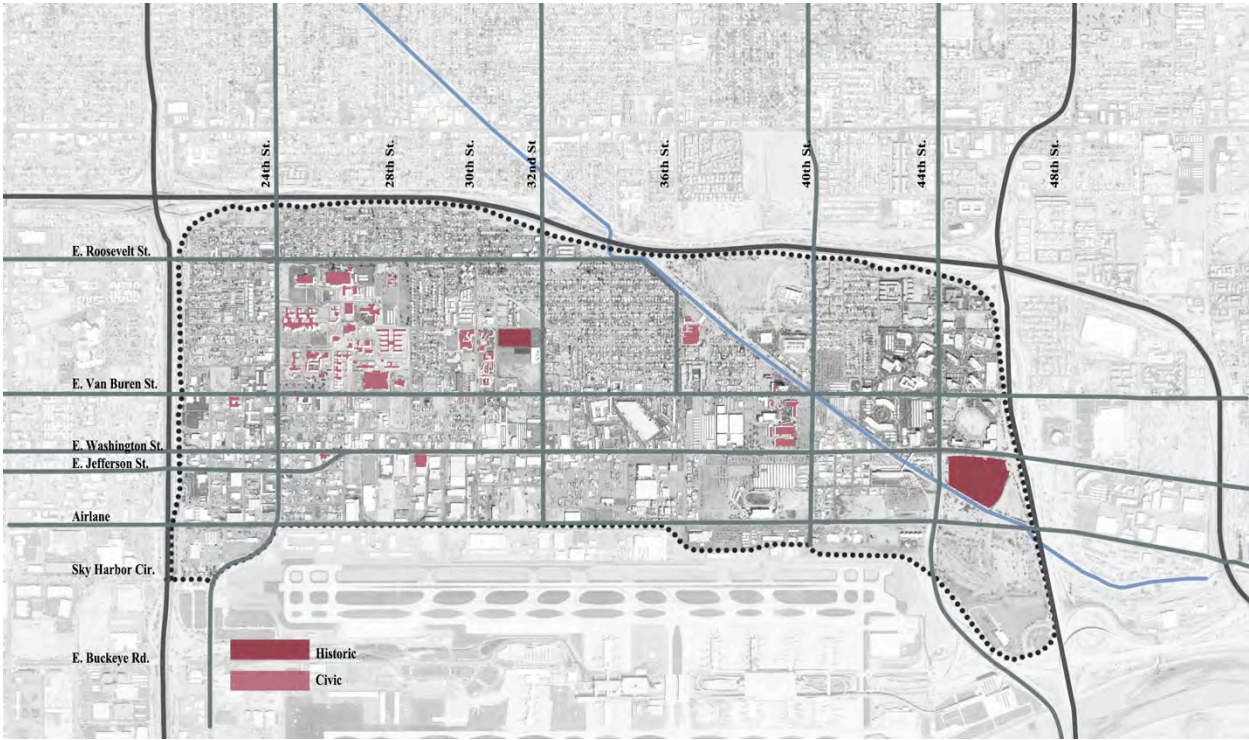
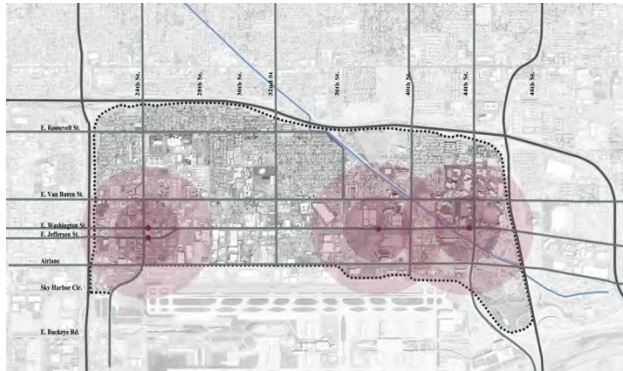


Fig. 21

### 3.1.2 Advantages

Gateway District has many opportunities and advantages that had been ignored and need to be excavation. First of all, the location of Gateway (see Fig. 20) and the existing institutions provide this district a huge housing potential (see Fig. 21). Gateway located in the southeast corner of Phoenix, and near the edge of Tempe (see Fig. 20), which made Gateway approximately in the center of downtown Phoenix and downtown Tempe, this could attracts many new residents into Gateway. For example, a young faculty of ASU working in Tempe campus, and living in a rented apartment in Downtown Phoenix, if there are new housing development built in Gateway, with nice amenities and relatively low price, it could be a possible option for this faculty to move to Gateway to save money and also save half travel time everyday. Moreover, the institutions and hospital inside this district have also provided many potential residents to housing development.

Secondly, the approaching to Sky Harbor International Airport provides great possibilities to have a business-commercial employment center in that area (see Fig. 20). For example, more hotels and office complexes could be built in that area for businessmen, and also headquarters of International Corporation (for example Amazon).



Thirdly, the light rail corridor passing through, with 3 light rail stations inside Gateway District, bring potential passengers into this district, as the three existing light rails station could serve as transportation nodes, thus leading to the possibility of commercial development around each nodes. Moreover,

the light rail and light rail station provide a fine foundation for TOD development inside this district, which could provide a better mobility network to this area.



### **3.2 Research on Infill and Vibrant community**

What is a vibrant community? There are many different answers from different people focusing on different levels, the main factors to shape a vibrant community are as follows:

According to Jane Jacob's four tenets of vibrant neighborhoods are, in short form:

1. Mixed primary uses that creates traffic/vibrancy throughout the day.
2. Short blocks to make neighborhoods more walk able.
3. Mixed age and overhead buildings to enable a diversity of businesses.
4. Population density. (Jacob, 1961)

In a report titled Reclaiming Our Humanity, Sherri Torjman, vice-president of the Caledon Institute of Social Policy, says a vibrant community is one that:

1. Provides support that meets the basic needs of all members.
  2. Promotes inclusion to enable all members to participate actively in social, economic, cultural and political life.
  3. Promotes opportunities for the lifelong acquisition of knowledge and skills by all members.
- (Torjman, 2001)

According to a record of an event held in Santa Barbara Foundation, to the residents there, a vibrant community should have following qualities:

1. ARTS AND CULTURAL EXPRESSION are encouraged and celebrated.
2. LIVING & DYING WITH DIGNITY are community values.
3. LIFELONG LEARNING is encouraged and available.
4. SAFETY is both a community and a personal responsibility.
5. CIVIC ENGAGEMENT is considered a duty

6. SUSTAINABLE ECONOMIC GROWTH is cultivated

7. PROTECTION OF OUR ENVIRONMENT and HISTORICAL PLACES is a shared value that benefits human health and our local economies.

Learn from those representative points mentioned above, together with other points, there are similarities between each point of view, to sum up, a vibrant community should have qualities as follows:

1. A sense of safety and security.
2. Walk able neighborhoods and sustainable environment.
3. Easy accessibility and mobility
4. Certain population density.
5. Sustainable economic growth.
6. Mixed primary uses that creates traffic/vibrancy throughout the day.

To make the Gateway District a vibrant community, we should make sure the infill and urban renewal development fulfill those qualities to ensure the community became a vibrant space.

Fig. 22





### 3.3 Solutions

Combine the site analysis and vibrant community qualities together, here we came the solutions of the direction of how to infill and renew this district to make a vibrant community. Firstly, to infill the vacant land inside this district, we should seize the opportunities of the location advantages, infill mixed-use and mixed income housing and retail first along the light rail corridor. Add more public transportations to form TOD development mode (see figure 4) inside the site. Then step by step (see figure 3), have more development along main road.

Assuming all the development discussed above could be successfully introduced into Gateway District, as new residents and users and consumers being brought in, the income composition of this district will be totally different, and the purchasing power of whole residents has been improved, which will ends in more services like retail and commercial investment into this district. Thus more tax income could be created for the district to put into infrastructure and amenities, which could leading to a better environment and living condition, and increase the land value. And finally could turn the vicious circulation into a virtuous one.



Fig. 22



Finally, infill some of the vacant lands with parks and pocket parks; adding green spine and green path to provide residents better walking and biking environment; build green street along main streets, for example, Van Buren Street, to act like the linkage of each retail store and commercial complex, and also provide better walking street.

“Factors that influence the choice to use motorized or no motorized transport are based primarily on two fundamental aspects of the way land is used: (a) proximity (distance) and (b) connectivity (directness of travel) (16). Other factors, such as travel cost, environmental quality, and aspects of convenience and access (e.g., parking availability) are also likely influential. Proximity relates to the distance between trip origins (i.e., where one is) and destinations (i.e., where one is going). Proximity is determined by two land use variables. The first is density...the second is land use mix. “(Saelens& Sallis& Frank, 2003) Coordination between settlement and transportation is necessary, and it is important to built city in smart growth strategy, and there is urgent need of urban infill development in cities like Phoenix. Rather than grow horizontal, Phoenix should grown more vertical, and become a compact city to seek further development.



### 3.4 Case studies

#### a. Infill with mixed- income & mixed-use housing



Gracie's Thrift Store, Mixed use- low-income apartment



Fig. 23

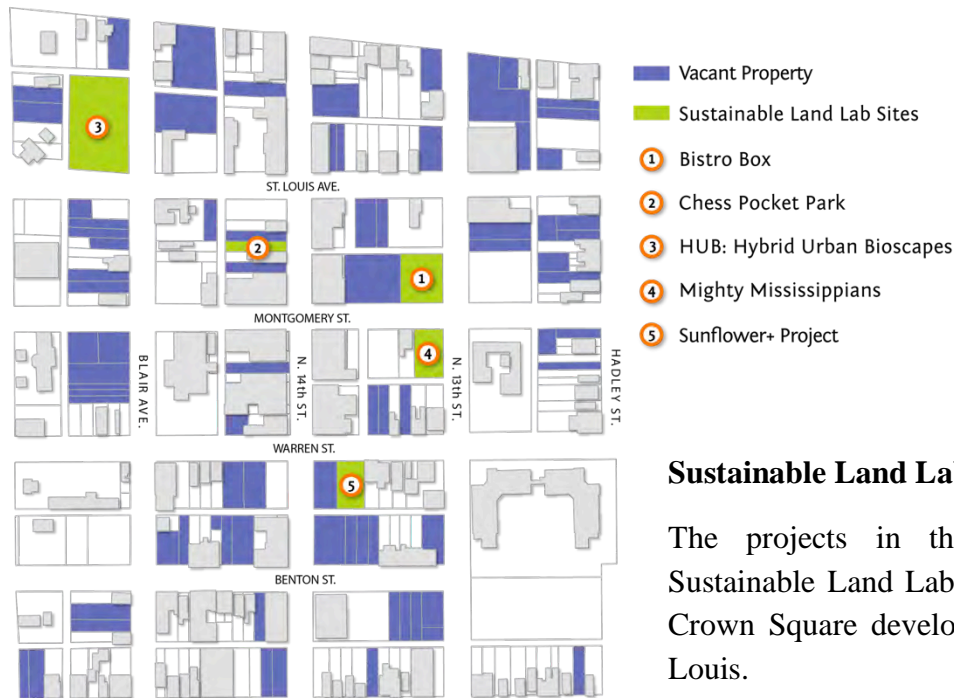


Grigio Metro Apartments, Mixed use- mixed income apartment



Fig. 24

## b. Infill with green space and commercial



### Sustainable Land Lab

The projects in the first phase of the Sustainable Land Lab are all located near the Crown Square development in Old North St. Louis.



**Sunflower+ Project:** Turning into a community asset through the planting of sunflowers. With a goal of eventually spurring redevelopment of these vacant parcels, the sunflowers will improve soil quality, remove soil contaminants and eventually produce a marketable set of products from flowers to seeds to biodiesel.



**Chess Pocket Park:** An outdoor community chess venue for residents with a permanent location that supports our primary community asset – people.





**Mighty Mississippians:** A modern agricultural and sustainable living model, Using concepts of permaculture, the site will demonstrate the interdependent relationships that work efficiently and sustainably in nature and that worked for previous civilizations, from the soil to the birds, to humans.



**Bistro Box:** The Bistro Box concept is a small business incubator that transforms surplus cargo containers into a compact restaurant and culinary destination.



**The HUB:** Hybrid Urban Bioscopes project is testing a palette of landscape and leisure/recreation strategies that can be used to improve the community.

Fig. 26

## 4 Design Proposal

### 4.1 Concept Phasing

There are three light rail stations inside this site, according to the rules of urban development and constructions, developments for example commercial and residential and retails happen most usually start from the traffic nodes, which in this case, are the three light rail stations. By analyzing the opportunity of each road surface, and following certain opportunities, this site could infill and renewed as the following (see Fig. 27)

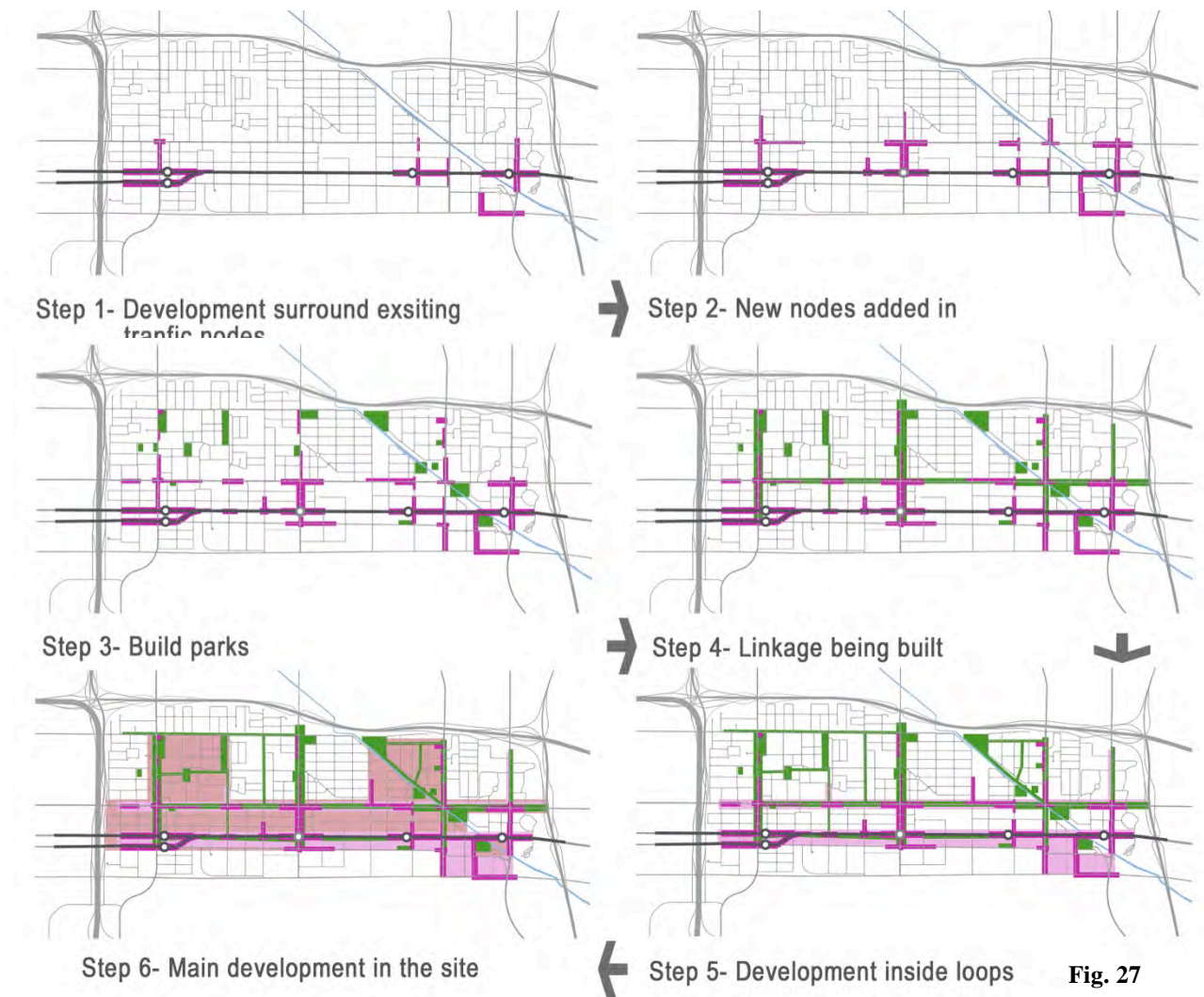


Fig. 27



## 4.2 Design Proposal

### 4.2.1 Overview

This design proposal takes full advantages of existing site condition:

1. Location advantages: Passing through by light rail corridor
  - Easy access to well maintained freeway
  - Close to Sky Harbor Airport
  - Located in-between Downtown Phoenix and Downtown Tempe
2. Existing building advantages: Existing institutions
  - Existing industry
  - Existing communities

Which will end in excellent housing opportunity and potential attractions for commercial and retail development in Gateway District. This proposal designs Gateway District into community

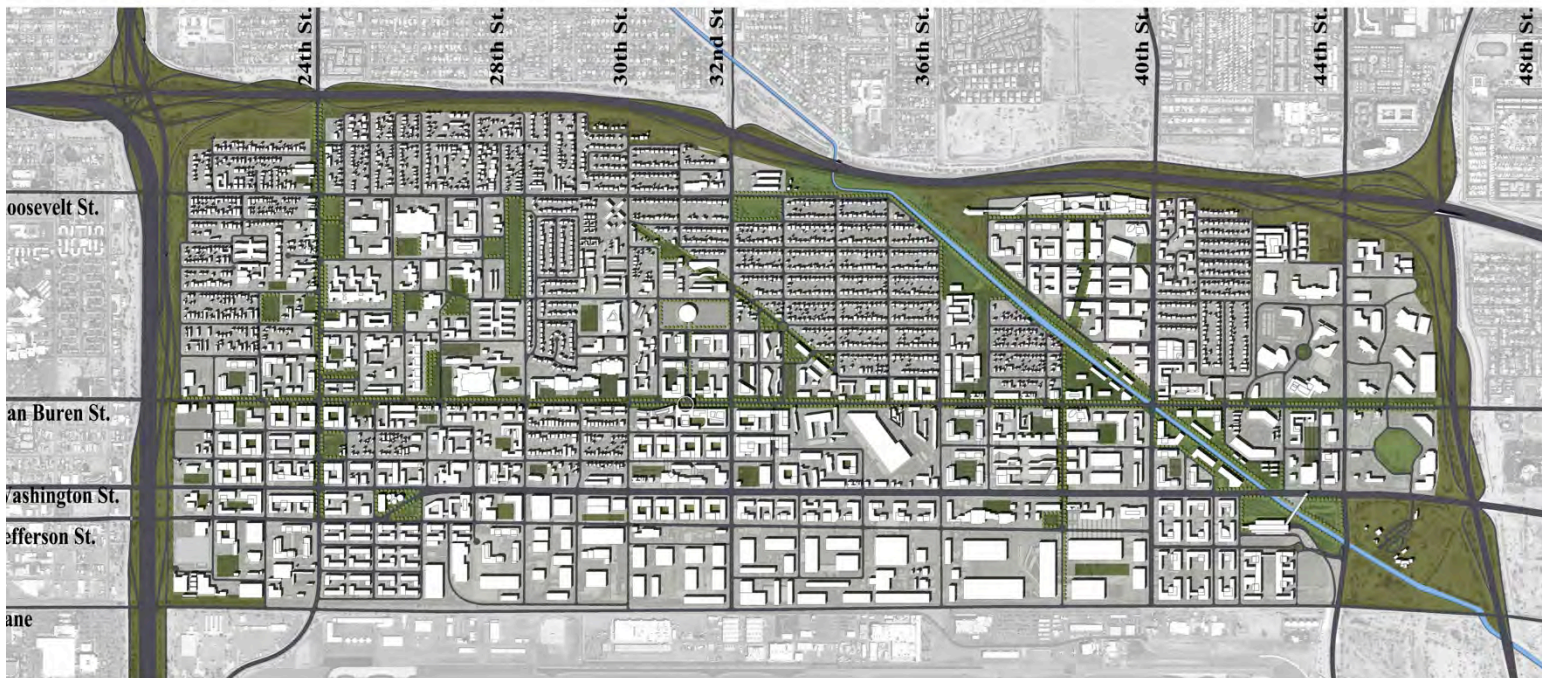


Fig. 28

with commercial& retail& housing development along Washington Street and influence Van Buran Street with the vitality, to bring Van Buren from declined street back to life into the new main street of Gateway district.

#### 4.2.2 Land Use Proposal

This proposal infill some vacant land into housing and commercial, and renew some of the poor condition existing buildings including residential and industry into new development, mainly housing complexes and commercial. By doing so, this proposal trying to provide enough housing and commercial for the future demands, and by increasing the development density and creating more destinations and services to this district to revitalize the whole district, thus to reach the goal of making Gateway District a vibrant community.





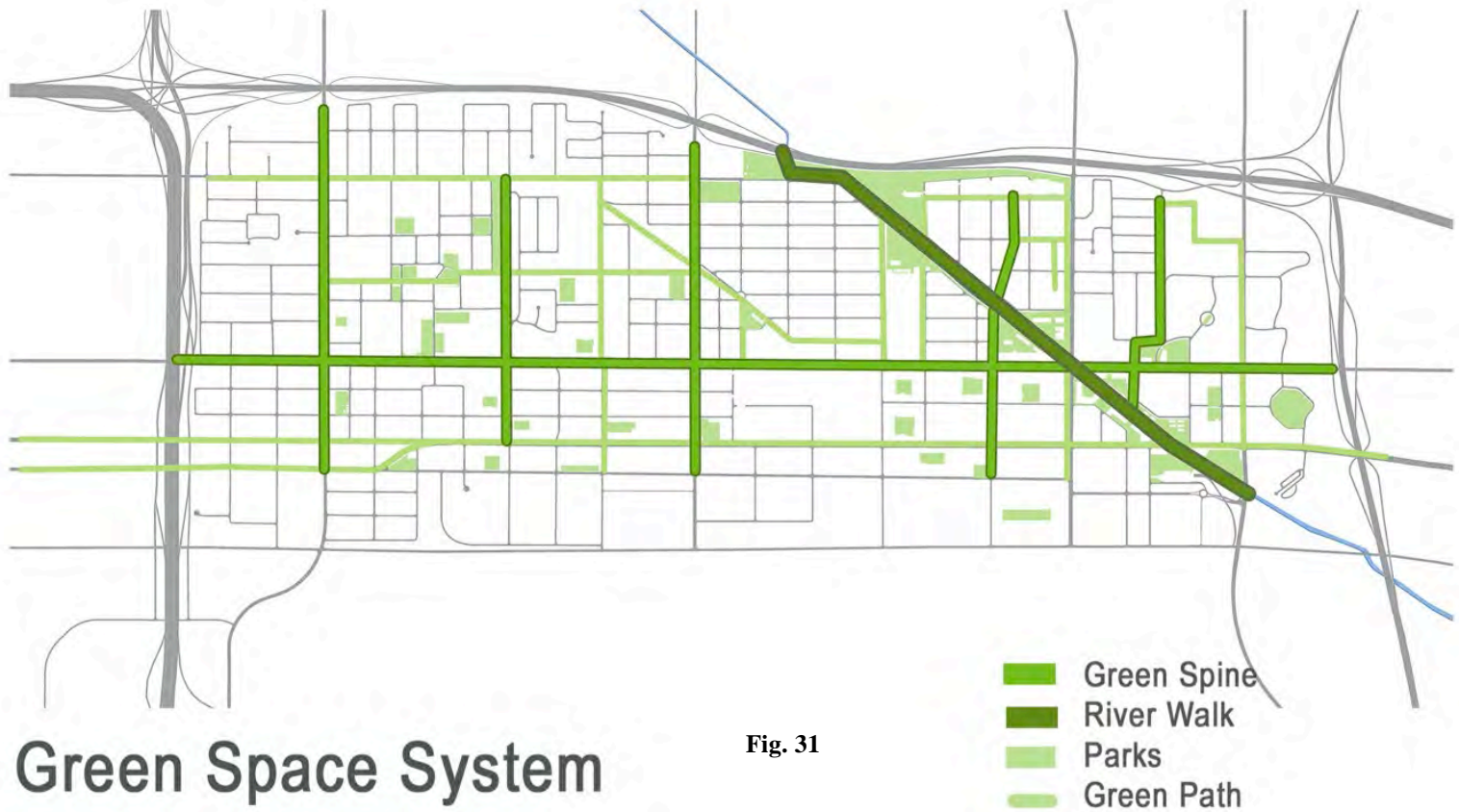
As shown in the land use map, this proposal designed new commercial& housing development along East Van Buran Street and East Washington Street, made the area in-between those two street a new development band for the whole district. According to the population and income analysis mentioned above, the new housing development will mainly be mixed-income housing complex, with retails in the 1<sup>st</sup> floor, to provide service for neighborhood.

There are several types of different types of housing, including mixed-income apartment, and mixed-use housing complex, and also new middle income residential neighborhoods. Commercial and retails are mostly designed in the 1<sup>st</sup> floor of housing complex, along street surface and corner. Because firstly, the street surface and corner always bring more customers in. And secondly, retail stores and restaurant always play important role in making a lively street atmosphere, thus make a friendly and vitalized environment for the community



Fig. 30

### 4.2.3 Green Network Proposal



The key point to design a vibrant community is to provide walkable neighborhoods and sustainable environment. Which means, the community needs to provide more amenities to residents to maintain a walkable neighborhood. Moreover, as large amount of residents inside this community is in poverty, it is important for them to have a better walking friendly environment.

This design proposed 3 green systems (see Fig. 31 )

- a. Green Spine-** will be built along main street, connecting retail stores and pocket parks and small urban plazas together, the street will be covered with trees and green path on the sidewalk, and also provide bike lane in the same time.
- b. River Walk-** To take full advantages of the existing channel, river walk could be building along the both side of it. Provides shading for joggers and bikers, and also for walk.



- c. **Parks-** Infill some of the vacant land into pocket park or public parks, to provide more amenities to the residents and also, parks along street could add more attraction and attract potential customers. And parks are also an effective way to increase the sense of community and safety.

Fig. 32

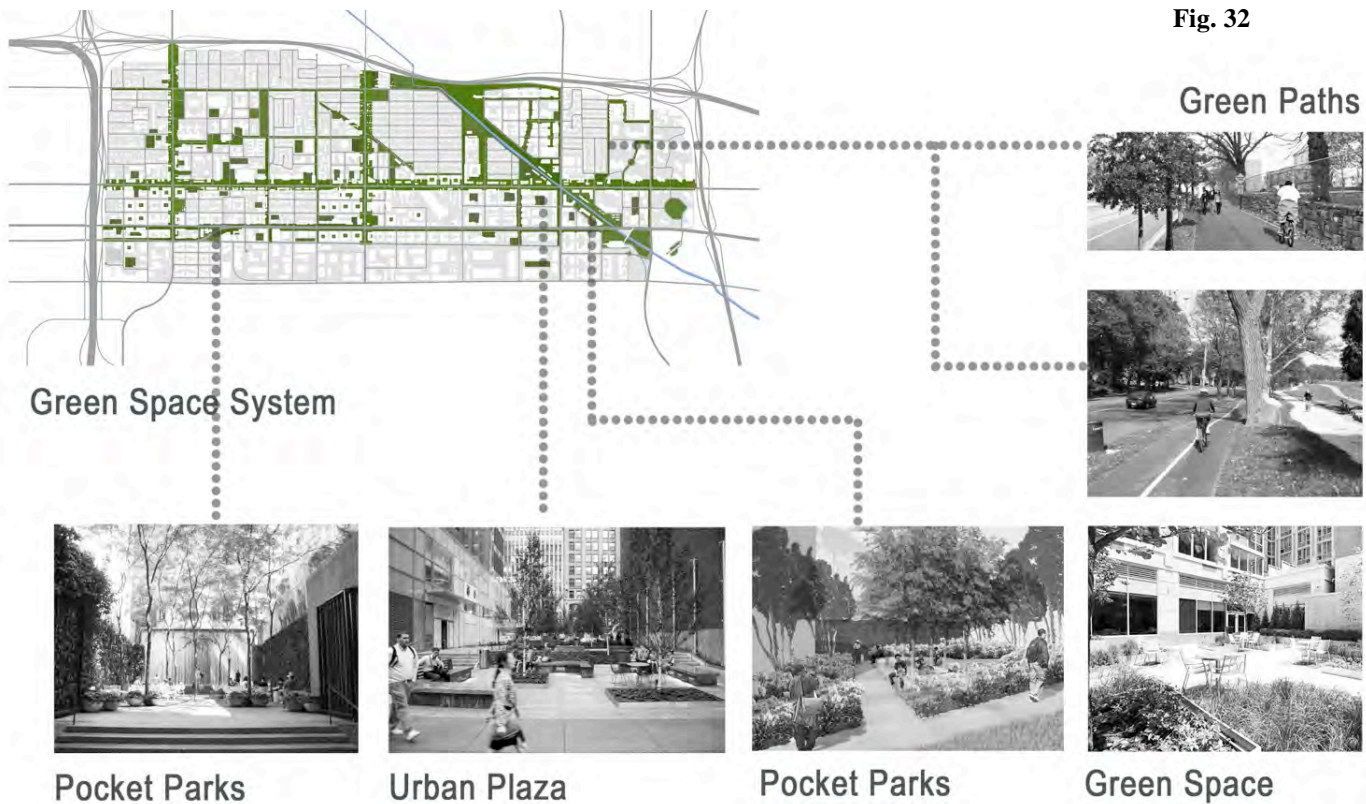
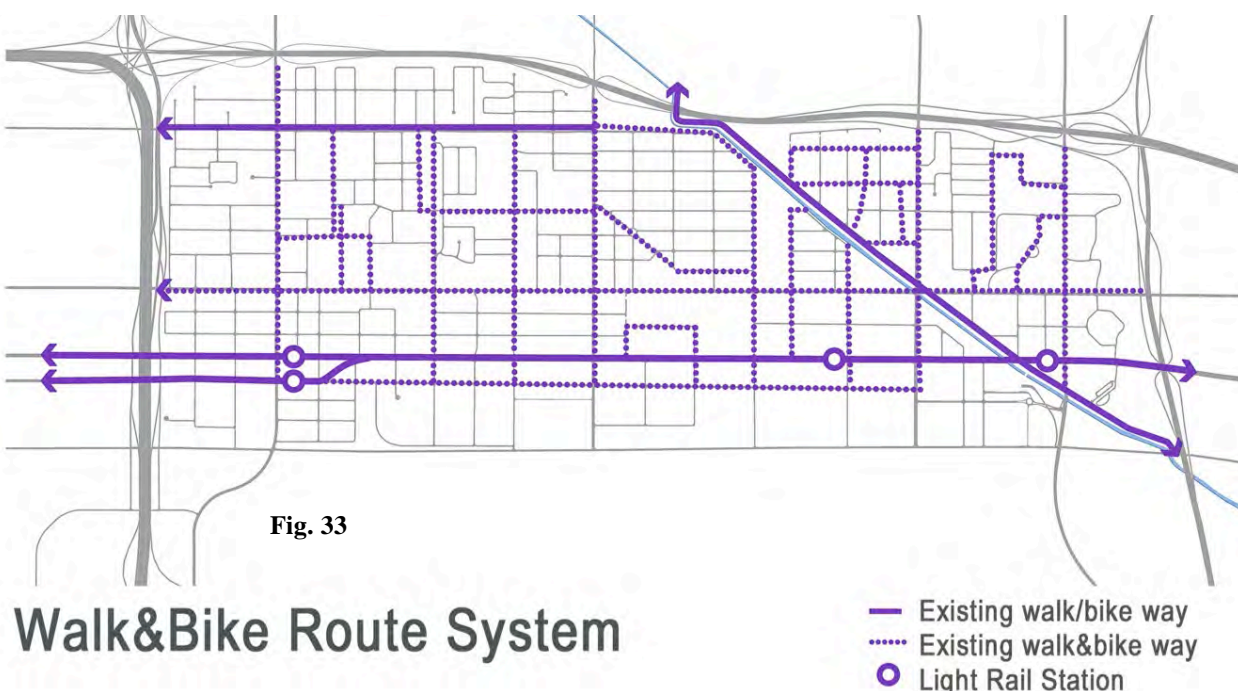


Fig. 33

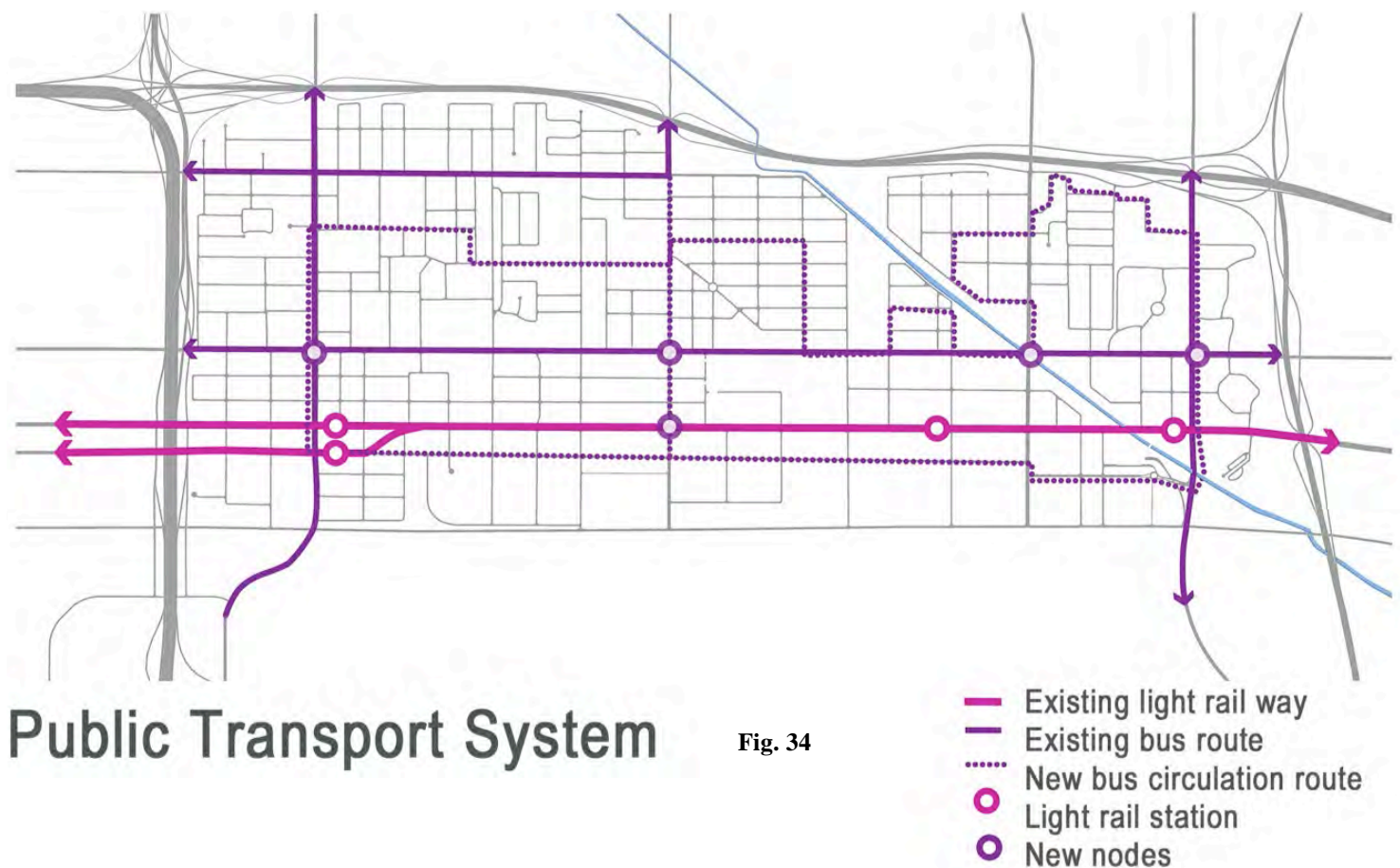


#### 4.2.4 Public Transportation

Another key point to design a community into vibrant neighborhood is easy accessibility and mobility. There are many problems inside this site that decreased the mobility; low percentage of car ownership, mega-blocks make the distance not suitable for walking, large amount of residents in poverty, and unfriendly walking streets.

As the design will add shading and Green Street and pathways, the walking condition will be better than ever. Moreover, this proposal is using TOD development modes to help this district becoming a community with easy accessibility and mobility.

New circulation bus and new transportation nodes has designed. And to combine the bus line with the green streets and green pathways, to create friendly and easier way for people to walk and to take bus and light rail.





### 4.3 Detail Demonstration

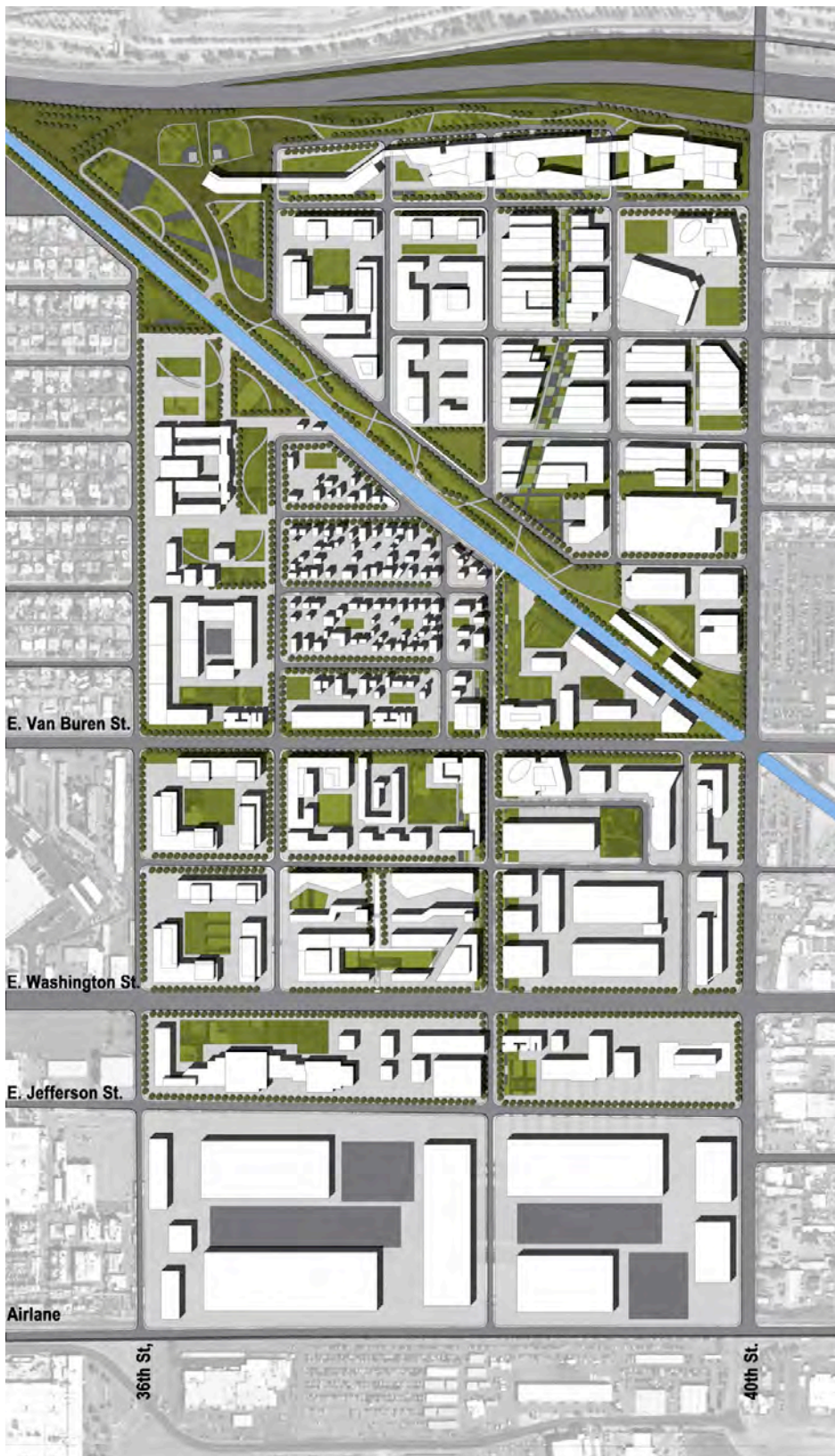
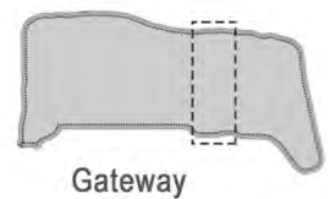


Fig. 35

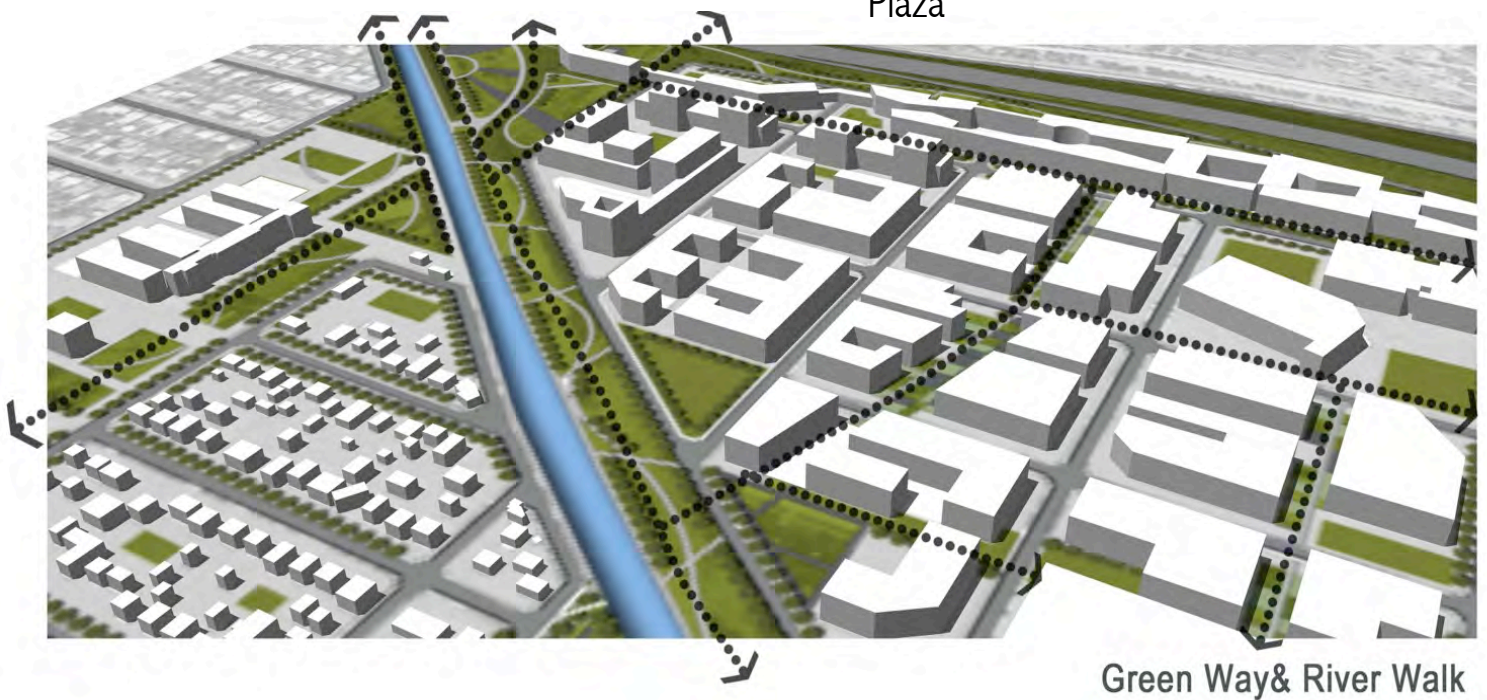




### 4.3.1 Detail and Examples of parks



Fig. 36





### 4.3.2 Van Buren Street- New Green Street

Van Buren Street Plan



Van Buren Street Perspective



Van Buren Street Section



Fig. 37

The current Van Buren Street is composed with five traffic lanes and two sidewalks. No shading or vegetation exists on the street, which made the walking condition on this street terrible. According to this proposal, Van Buren will act as a new main street in Gateway District, and the connection between each south-north street, the walking condition is extremely important. This design proposed Van Buren Street into a Green Street, traffic lanes will be reduced into four lanes, and spare a lane for green lanes for biker. Moreover, trees and vegetation will add on the sidewalk and bike lane.

### 4.3.3 River Walk



**Canal River Walk Before**



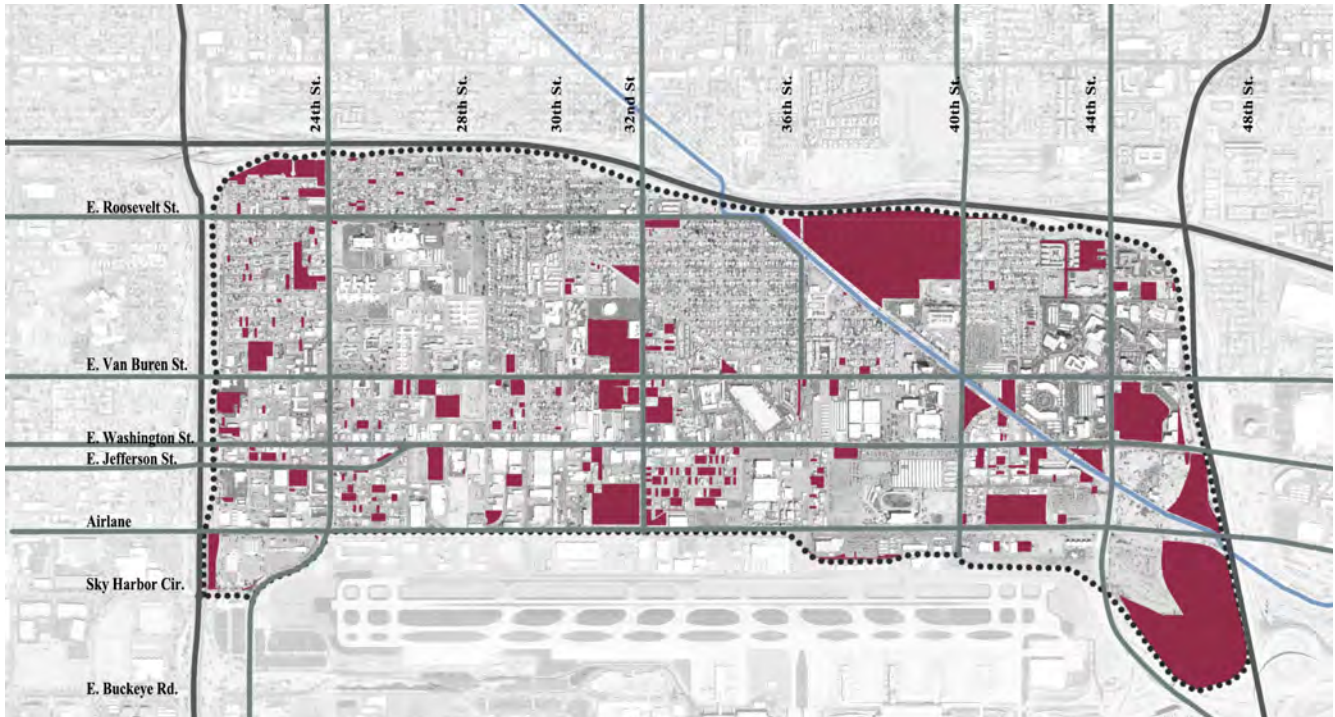
**Canal River Walk After**

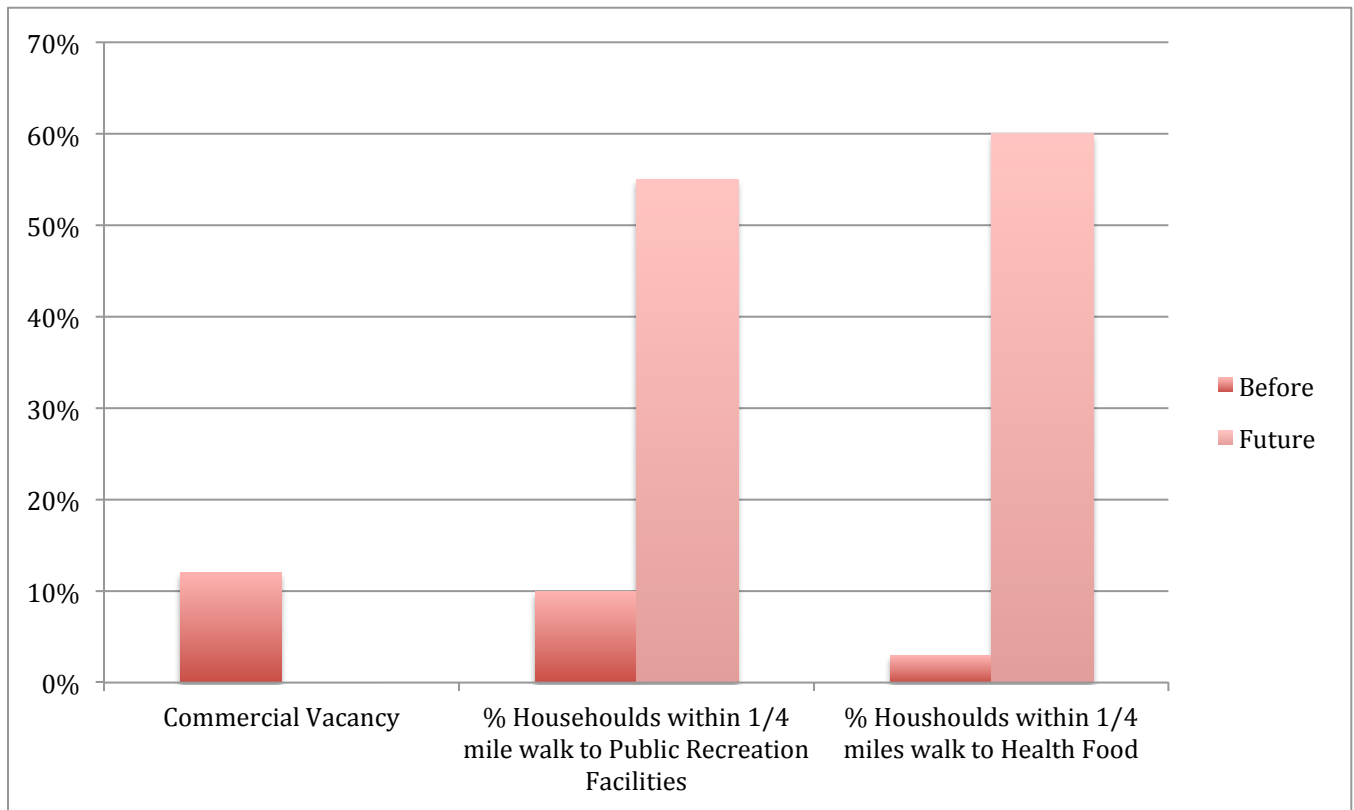
**Fig. 38**



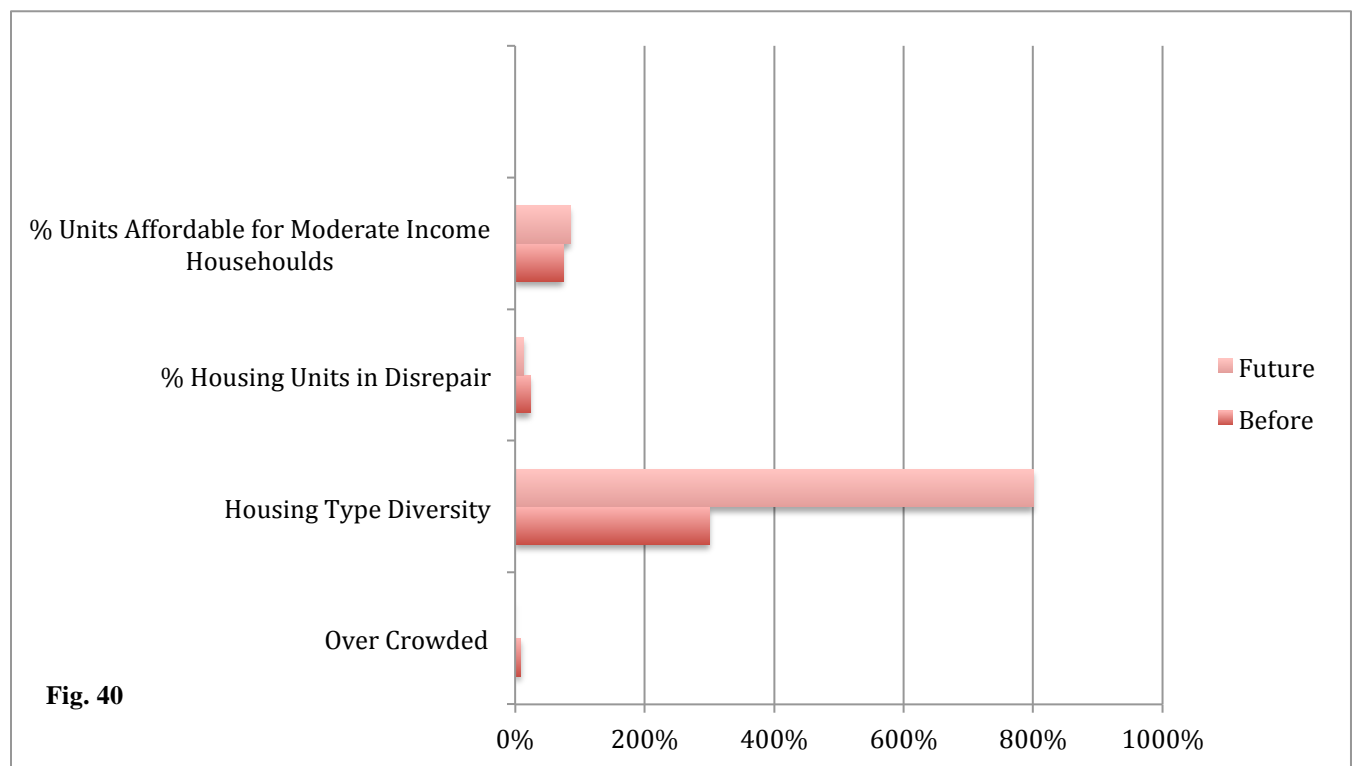
## 5 Design Evaluations

### 5.1 Vacant Land Infill Evaluation





**Fig. 39** Service Comparison Before& After

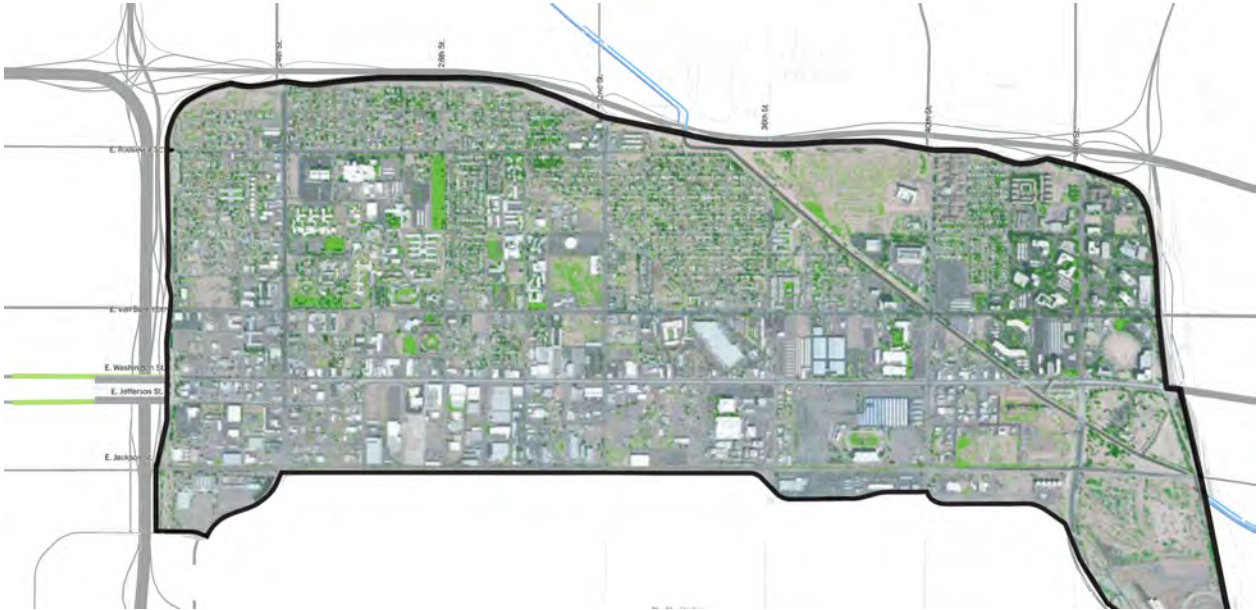


**Fig. 40**

**Housing Condition Comparison Before& After**



## 5.2 Green Space Evaluation



### Green Space Before

Fig. 41



Fig. 42

### Green Space After

## Green Space Comparison Before& After

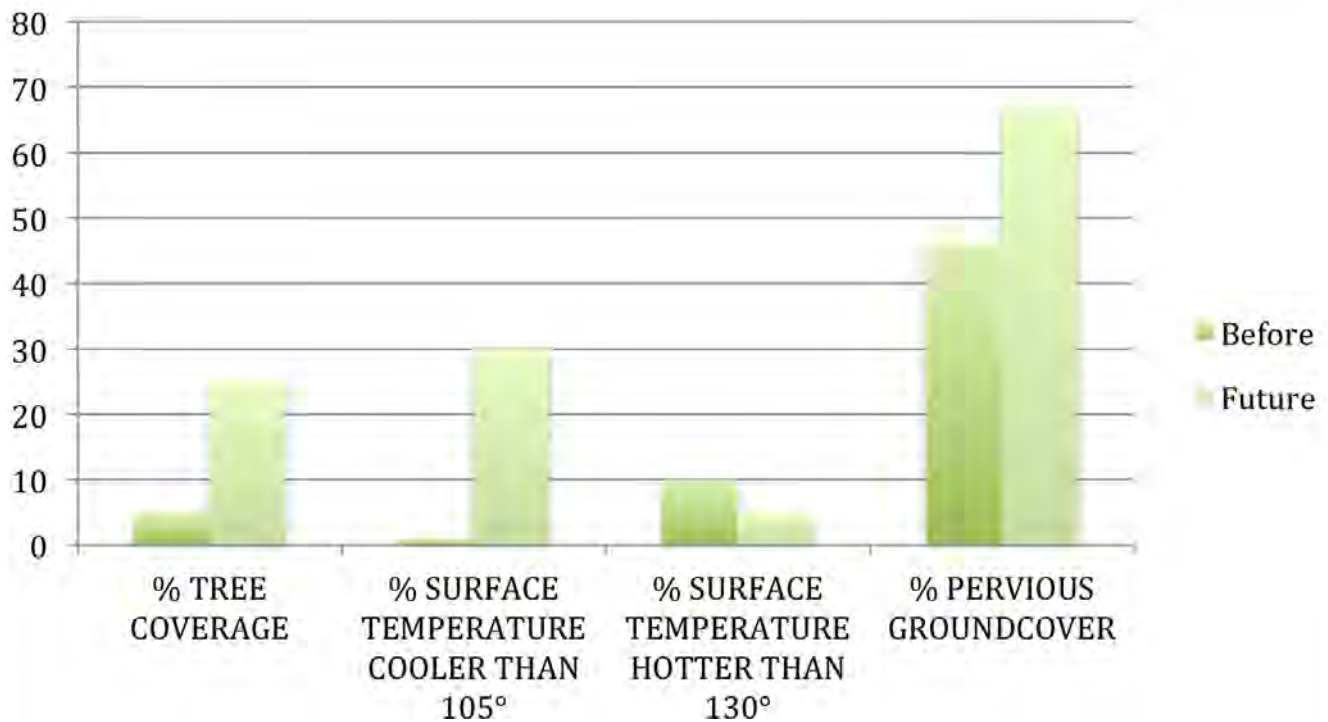
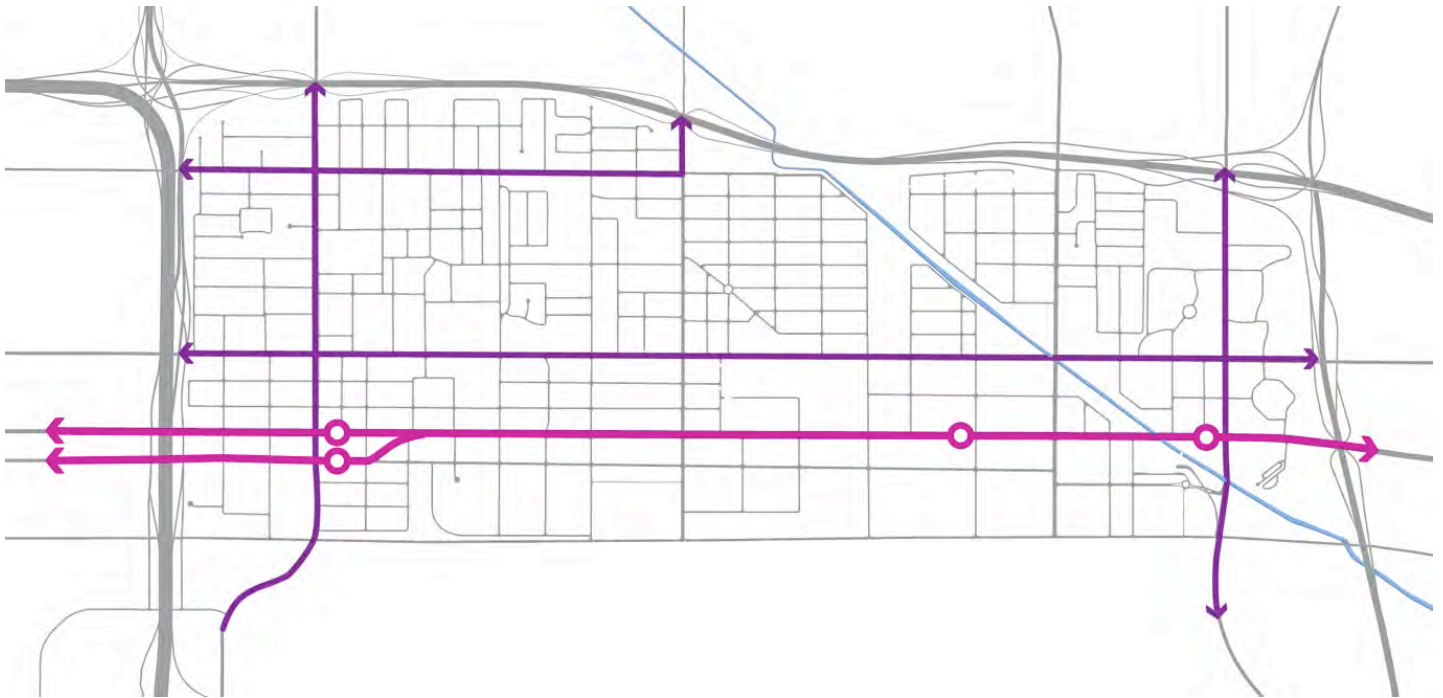


Fig. 43

Compared to existing condition, more trees and vegetation had added to street and sidewalk. Moreover, by infill some vacant land with pocket parks and public parks and urban plazas, the tree coverage increased, which could lead to cooler surface temperature thus provide people better living condition and environment, and also, is more environmental friendly.



### 5.3 Public Transportation Evaluation



#### Public Transportation Comparison Before& After

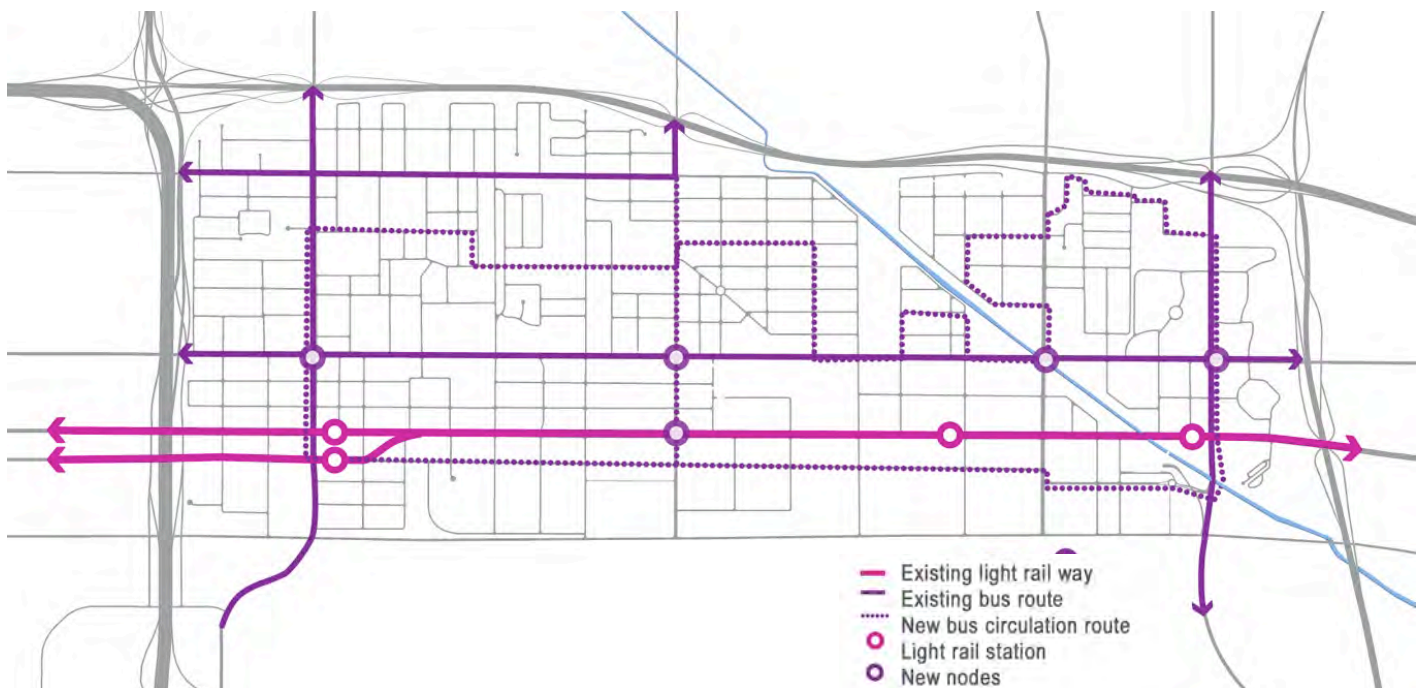


Fig. 44

列 1	%OF RESIDENTS WALK, BICYCLE TO WORK	AVERAGE HOURS WAITING FOR TRANSIT SERVICES (BUS + LIGHT RAIL)	AVERAGE TRANSIT FREQUENCIES Transit (BUS + LIGHT RAIL)	ANNUAL LIGHT RAIL USE (BOARDINGS/DEB OARDINGS)	PUBLIC TRANSIT ROUTE
Before	18	30min	25min	1,433,764	5
Future	54	15min	15min	2,240,000	7

Fig. 45

### Public Transportation Comparison Before& After

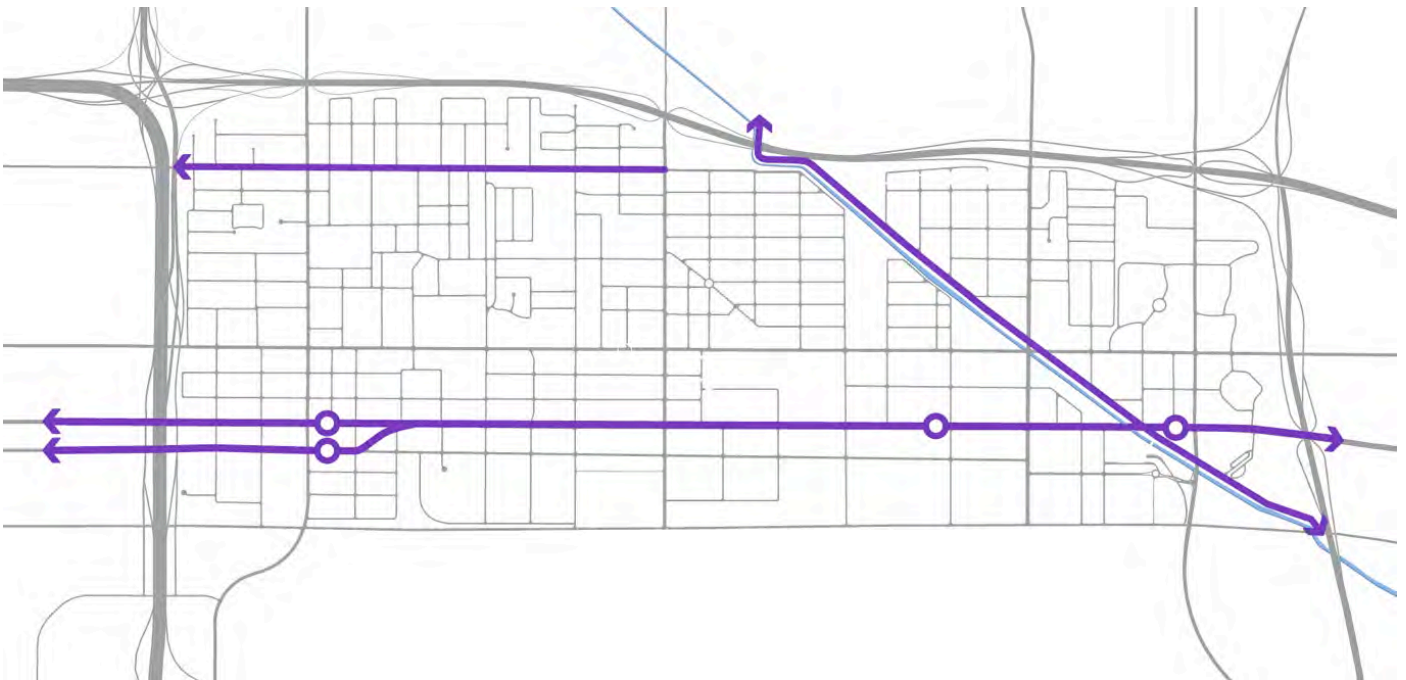
## 5.4 Walkability Evaluation

By adding Green Street, Green Path and River Walk, this proposal increased walkable street from 3 into 21. And by the good connectivity from each destinations including commercial, retail, residential and public transportation, this proposal designed the whole neighborhood into a walkable community.

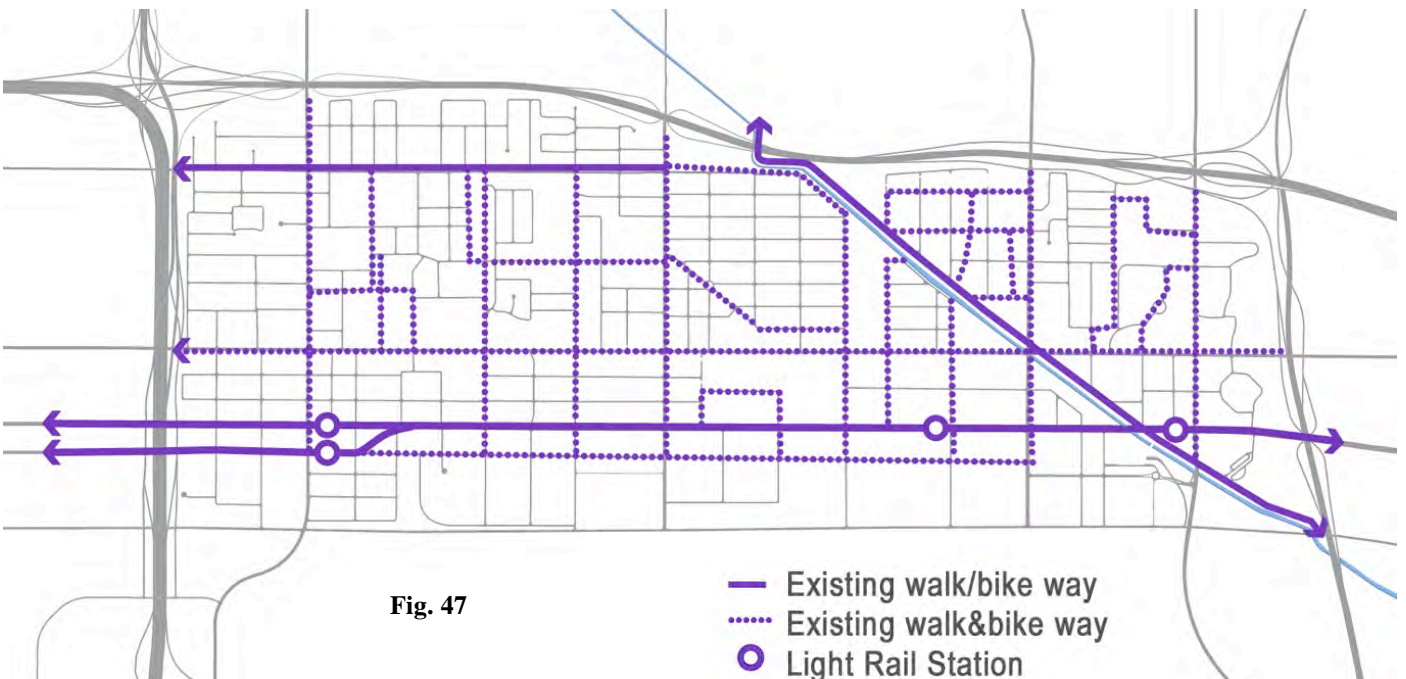
Walkability	Walkable Route	% Households within 1/4 mile walk to Public Recreation Facilities	% Households within 1/4 miles walk to Health Food	%Walk with Shading
BEFORE	3	10	3	0.5
FUTURE	21	55	60	89

Fig. 46





**Walk & Bike Route Before**



**Fig. 47**

**Walk & Bike Route After**

## **5.5 Quadruple Bottom Line Benefits**

### **5.5.1 Economical**

Firstly, by infill 300-acre vacant land with new development, which could attract potential residents to Gateway Community, as well as attract developer and new investment, which will increase the tax income. Secondly, by building a mixed-use commercial and business near sky train station, more company will be drawn to this district, which means more jobs will be created, and also create potential customer for local commercial and business, in this way, this design will benefit Gateway District with more jobs. Thirdly, designing this district into Green & Walkable community plus with new development, could increase the land value, and lead to better economic benefits for developer and for real estate.

### **5.5.2 Social**

Being a declined community as Gateway District, there are many social problems including social isolation, lacking of sense of community and safety issue. By infill the vacant land into public civic parks and commercial and retails, adding more vitality into this district, convert the declining neighborhood into a lively and vibrant community, with strong sense of community and safety.



### **5.5.3 Environmental**

Both infill and renewal of Gateway District have increased the coverage of green space to this area, which efficiently decrease the surface temperature, and could provide a more sustainable environment to residents. Moreover, by adding TOD development mode into this area, could reduces the usage of automobiles, thus reduce urban heat island for the whole city.

### **5.5.4 Aesthetical**

This design has provided many newly amenities for the community, change Gateway District from a declining community into a well-maintained, beautiful new district.



## **Literature Cited**

Dunphy, Robert. (2005). "Smart Transportation and Land Use: the New American Dream". Smart Growth and Transportation: Issues and Lessons Learned. Conference proceedings, Transportation Research Board, volume 32). Washington, D.C.: Transportation Research Board of the National Academies. p. 126

“The Infill and Redevelopment Code Handbook” September, 1999

City of Phoenix, “Reinvent PHX GATEWAY TOD policy plan”, 2015

Saelens, B. E., Sallis, J. F., & Frank, L. D. (2003). Environmental correlates of walking and cycling: findings from the transportation, urban design, and planning literatures. *Annals of behavioral medicine*, 25(2), 80-91

Sierra Club. (2003). Stop sprawl: Sierra Club Challenge to Sprawl Campaign. <http://www.sierraclub.org/sprawl/> (accessed September 23, 2003).

Hamin, E. M., & Gurran, N. (2009). Urban form and climate change: Balancing adaptation and mitigation in the US and Australia. *Habitat international*, 33(3), 238-245

Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House.

Torjman, S. (2001). *Reclaiming Our Humanity*.