TETRA TECH

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Site Design Procedures

Jason Wright, PE

Site Assessment, Planning, and Site Design

- Site Design Principles of LID
  - Phase I: Site Assessment
  - Phase II: Preliminary LID Design
  - Phase III: Final Design

Site Assessment, Planning, and Site Design

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Phase I: Site Assessment

Step 1: Identify Regulatory Needs
- Identify applicable zoning, land use, subdivision and other regulations
- Identify targeted pollutants and pollutants of concern
- Identify setbacks, easements, utilities, and possible conflicts (e.g., traffic, flood control)

Step 2: Conduct Hydrologic and Geotechnical Survey
- Identify natural areas to be conserved or restored
- Conduct geotechnical survey including drainage characteristics, hydrologic flow paths, and soil infiltration rates

Step 3: Protect Key Hydrologic Areas
- Protect areas of natural hydrologic function
- Protect possible areas for infiltration

Phase II: Preliminary LID Design

Step 4: Use Drainage and Hydrology as Design Elements
- Identify the spatial layout of the site using hydrologic flow paths as a feature
- Determine approximate conveyance and BMP locations

Step 5: Establish Clearing and Grading Limits
- Define the limits of clearing and grading
- Minimize disturbance to areas outside the limits of clearing and grading

Step 6: Reduce/Minimize Total and Effective Impervious Area
- Evaluate conceptual design to reduce impervious surfaces
- Investigate potential for impervious area disconnection

Step 7: Determine LID BMPs
- Determine potential BMPs according to hydrologic and pollutant removal process needs and cost estimates (see Chapter 3)
- Repeat Steps 4 through 7 as necessary to ensure that all stormwater management requirements and project goals are met

Iterative design process may require reevaluation of Steps 4–7

Phase III: Final Design

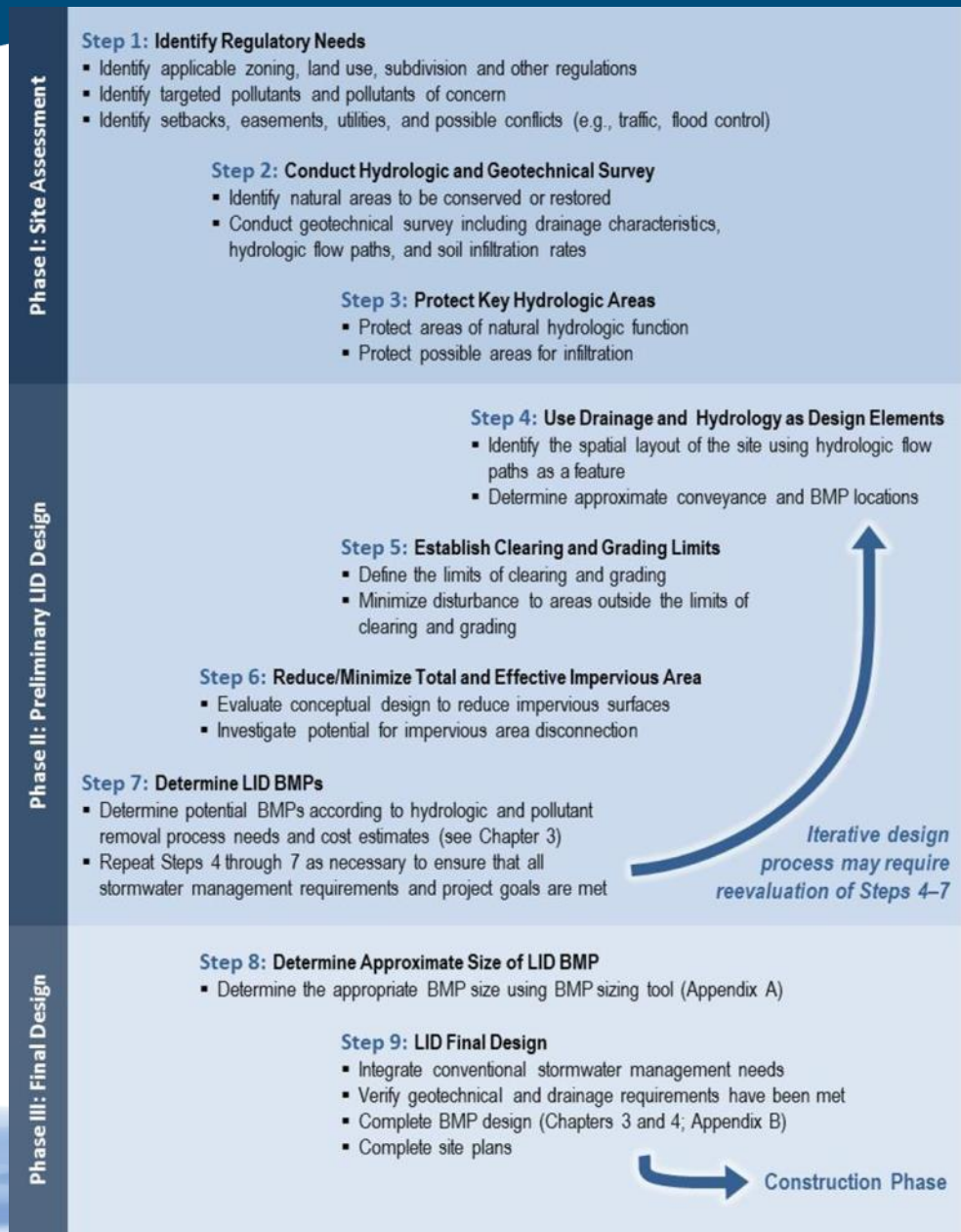
Step 8: Determine Approximate Size of LID BMP
- Determine the appropriate BMP size using BMP sizing tool (Appendix A)

Step 9: LID Final Design
- Integrate conventional stormwater management needs
- Verify geotechnical and drainage requirements have been met
- Complete BMP design (Chapters 3 and 4; Appendix B)
- Complete site plans

Construction Phase

Site Assessment, Planning, and Site Design

- Site Design Principles of LID
  - Phase I: Site Assessment
    - Step I: Identify Regulatory Needs
    - Step 2: Conduct Hydrologic and Geotechnical Survey
    - Step 3: Protect Key Hydrologic Features
  - Phase II: Preliminary LID Design
  - Phase III: Final Design



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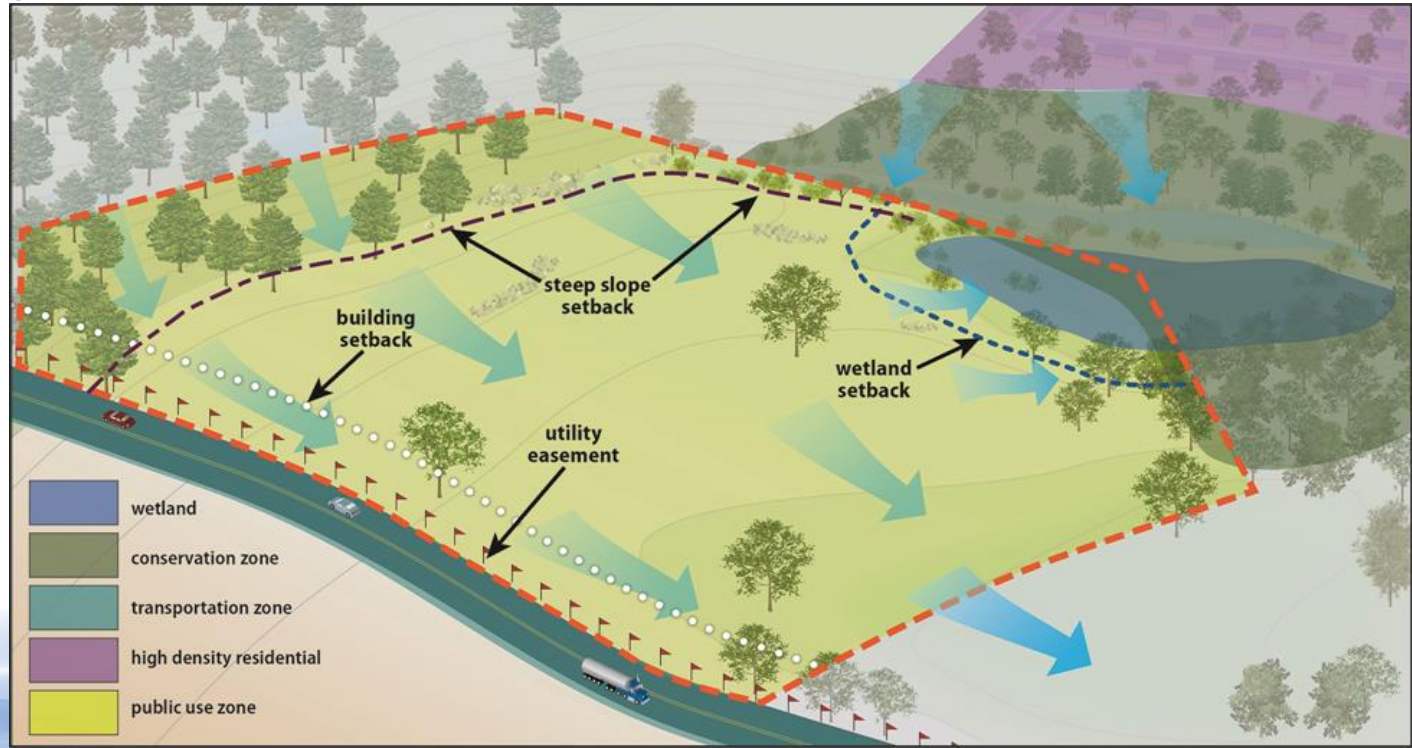
Site Assessment, Planning, and Site Design

- Site Design Principles of LID
  - Phase I: Site Assessment
    - Step I: Identify Regulatory Needs
      - Identify applicable zoning, land use, subdivision, and other regulations
      - Identify setbacks, easements, and utilities (Call 811 for utility location)
      - Identify targeted pollutants and pollutants of concern



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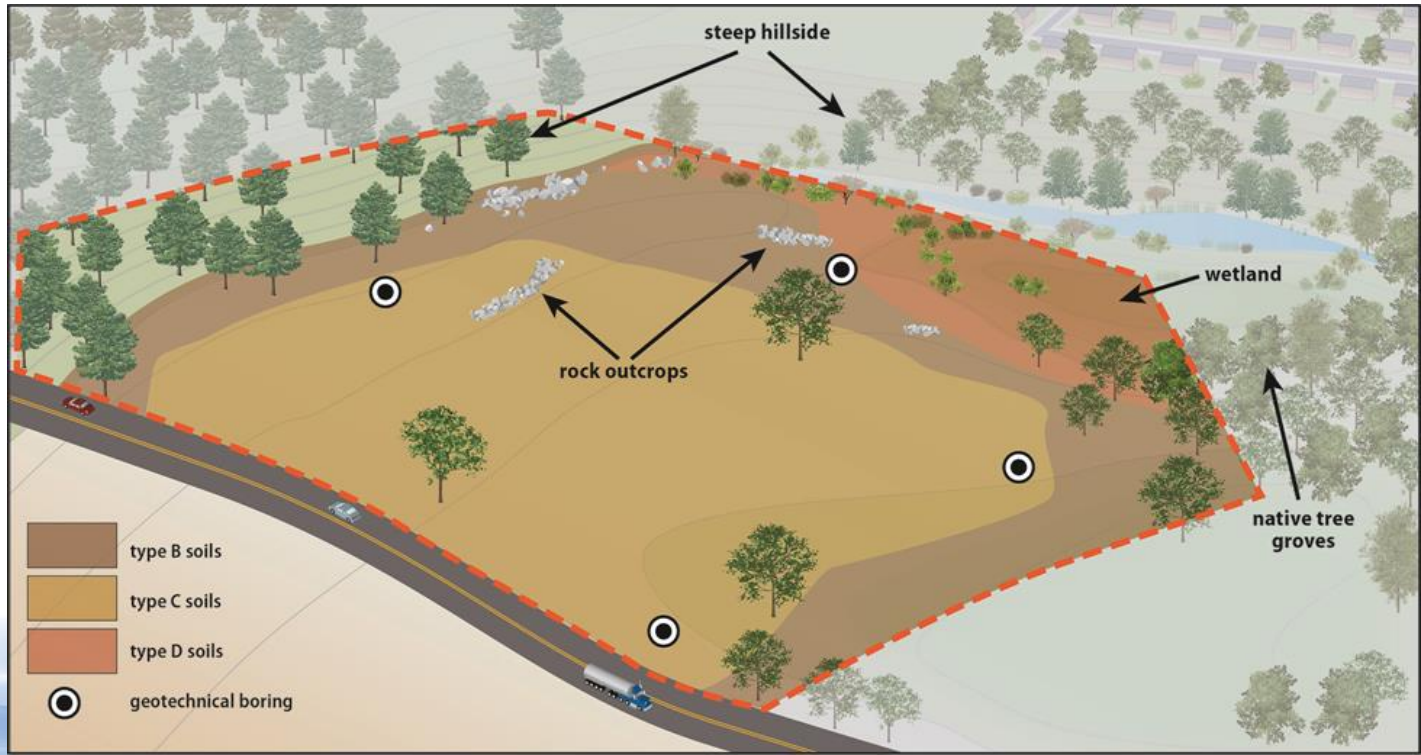
Site Assessment, Planning, and Site Design

- Site Design Principles of LID
  - Phase I: Site Assessment
    - Step 2: Conduct Hydrologic and Geotechnical Survey
      - Identify natural site features to be conserved or restored
      - Conduct a geotechnical survey including drainage characteristics, hydrologic flow paths, and soil infiltration tests



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- Site Design Principles of LID
  - Phase I: Site Assessment
    - Step 2: Conduct Hydrologic and Geotechnical Survey
      - Identify natural site features to be conserved or restored
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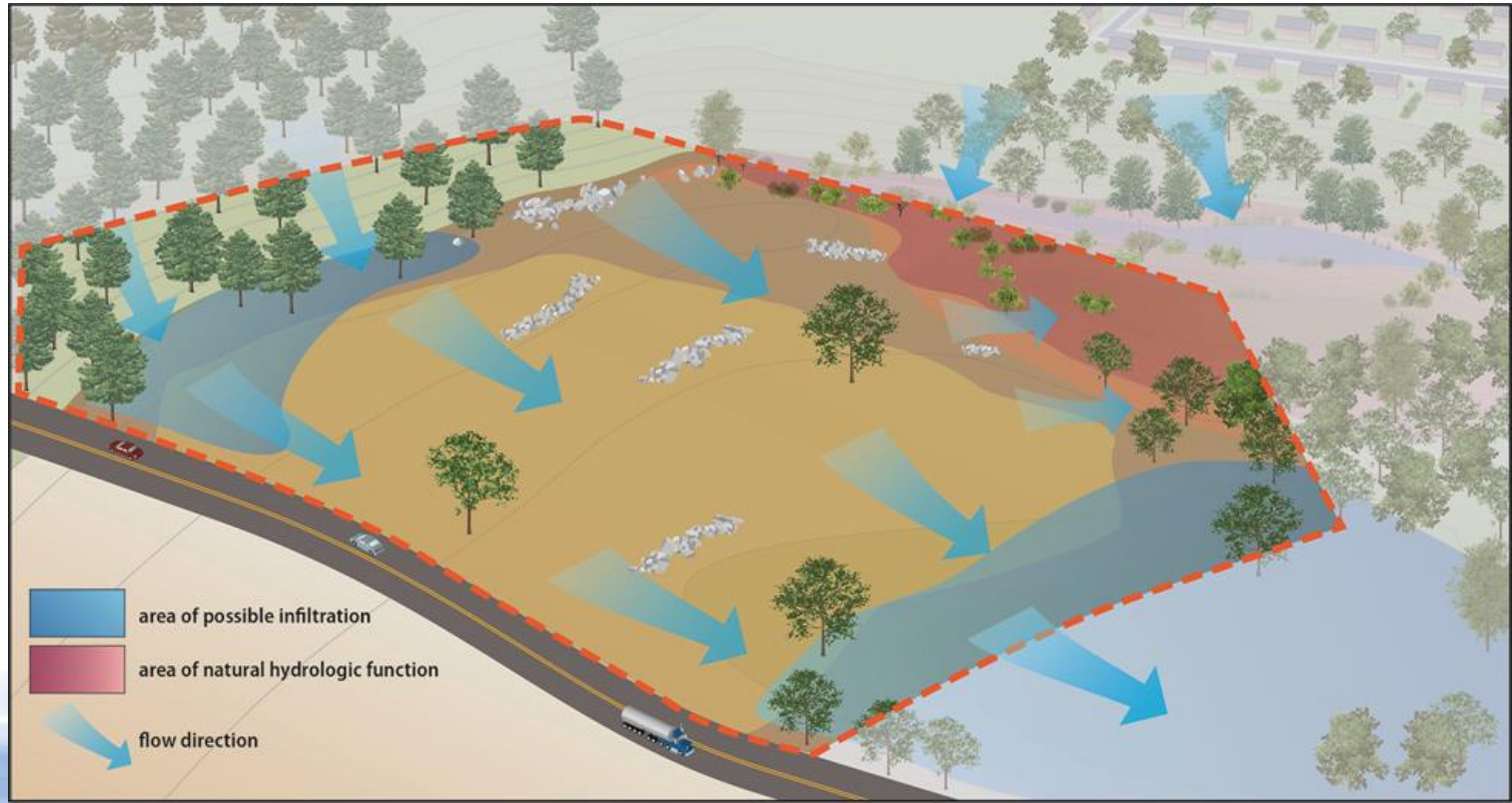
- Site Design Principles of LID
  - Phase I: Site Assessment
    - Step 3: Protect Key Hydrologic Features
      - Protect areas of natural hydrologic function
      - Protect possible areas for infiltration



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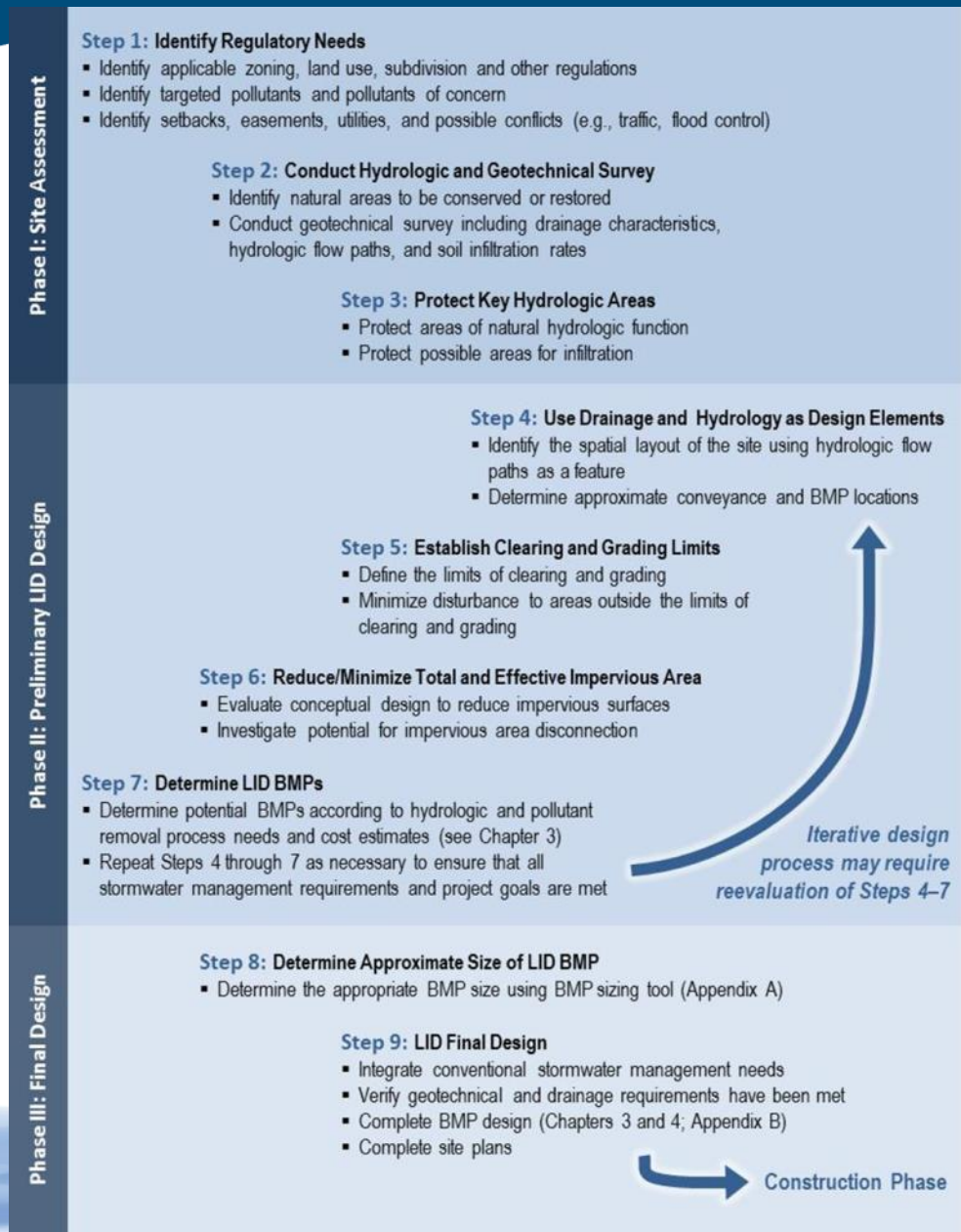
Site Assessment, Planning, and Site Design

- Site Design Principles of LID
  - Phase I: Site Assessment
  - Phase II: Preliminary LID Design
    - Step 4: Use Drainage and Hydrology as Design Elements
    - Step 5: Establish Clearing and Grading Limits
    - Step 6: Reduce/Minimize Total and Effective Impervious Area
    - Step 7: Determine LID Practices
  - Phase III: Final Design



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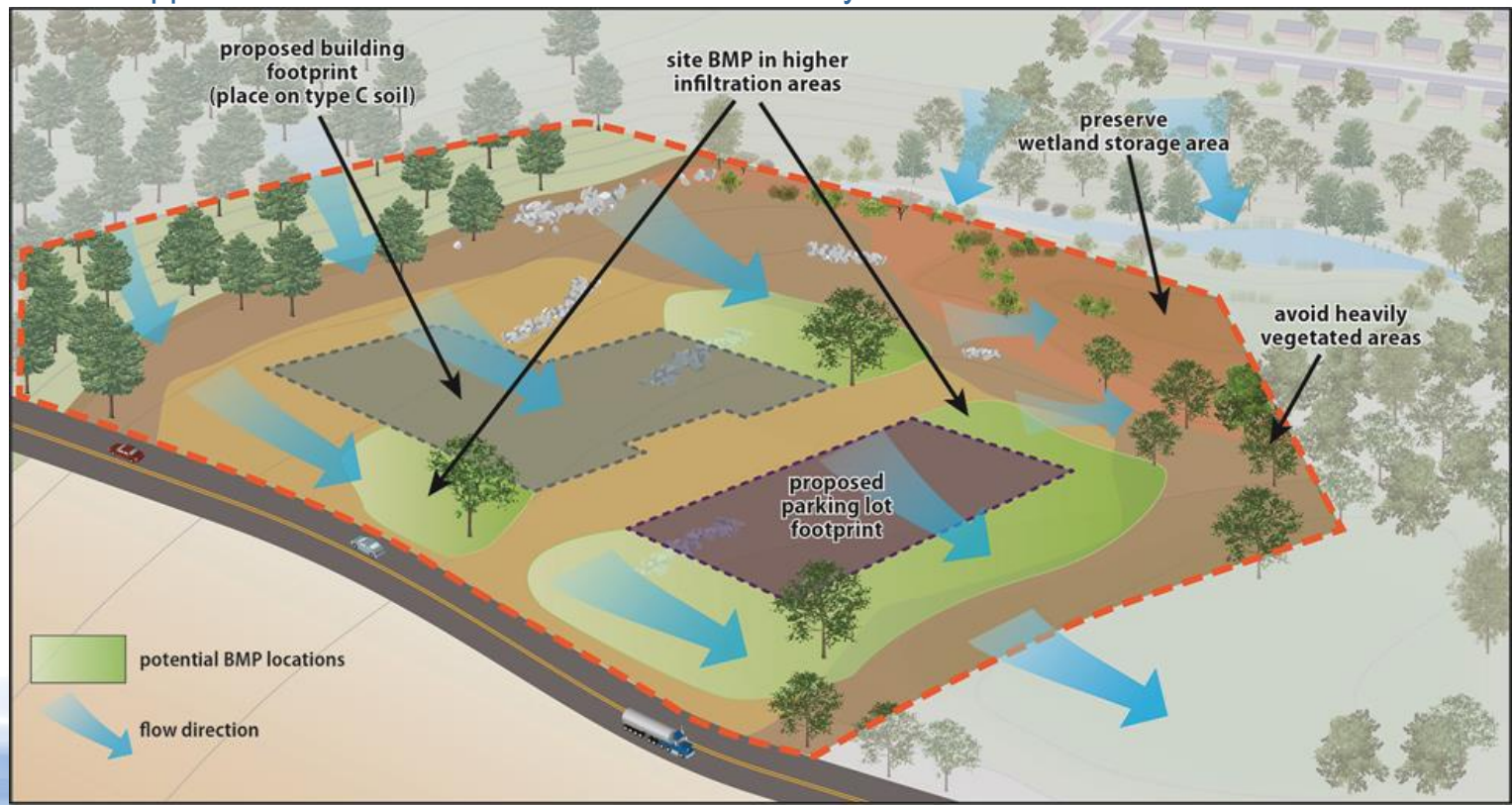
Site Assessment, Planning, and Site Design

- Site Design Principles of LID
  - Phase II: Preliminary LID Design
    - Step 4: Use Drainage and Hydrology as Design Elements
      - Identify the spatial layout of the site using hydrologic flow paths and natural drainage as a feature
      - Determine approximate locations for infiltration and conveyance BMPs



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Site Assessment, Planning, and Site Design

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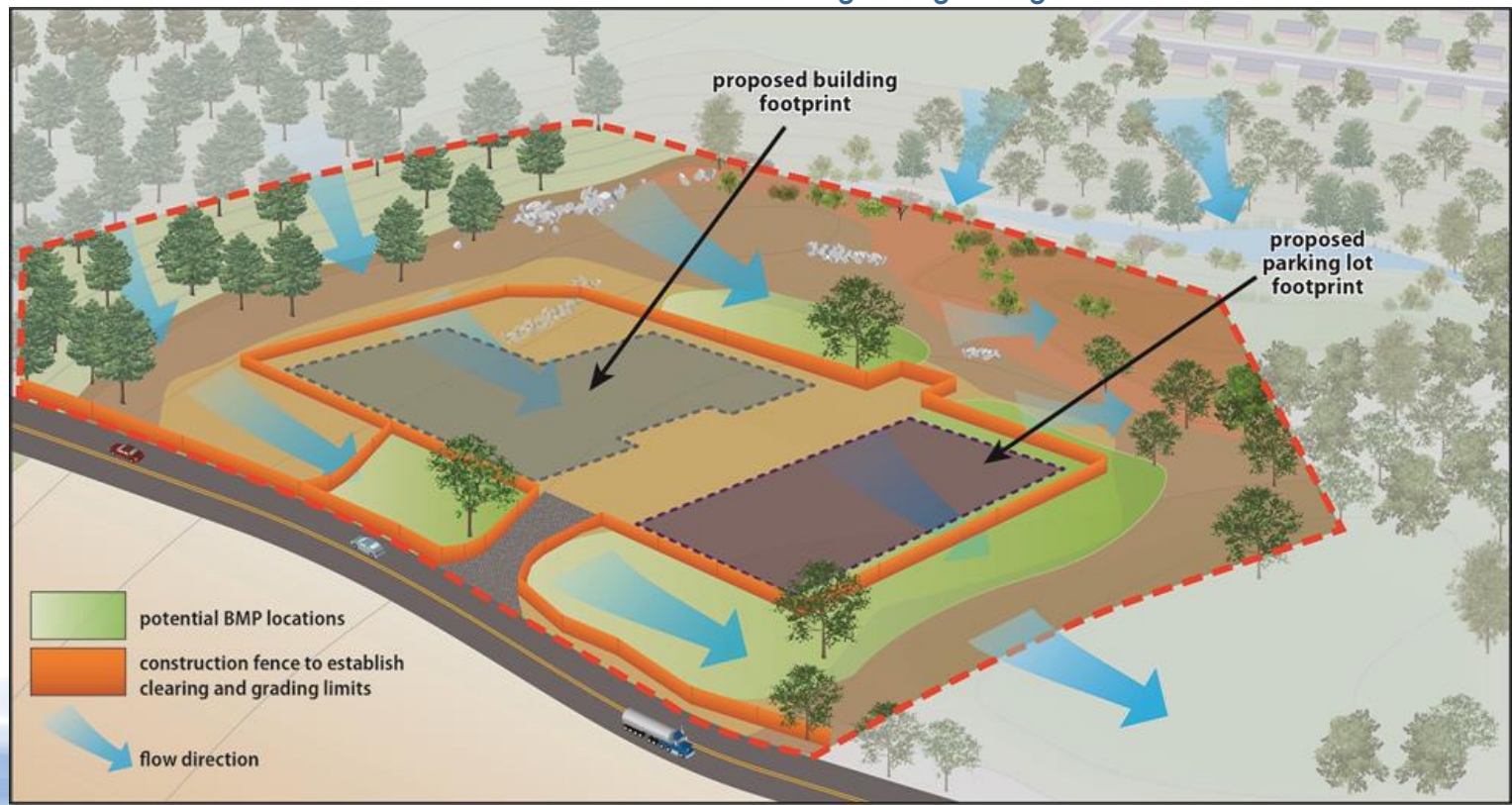
  - Phase II: Preliminary LID Design
    - Step 5: Establish Clearing and Grading Limits
      - Define the limits of clearing and grading
      - Minimize disturbance to areas outside the limits of clearing and grading



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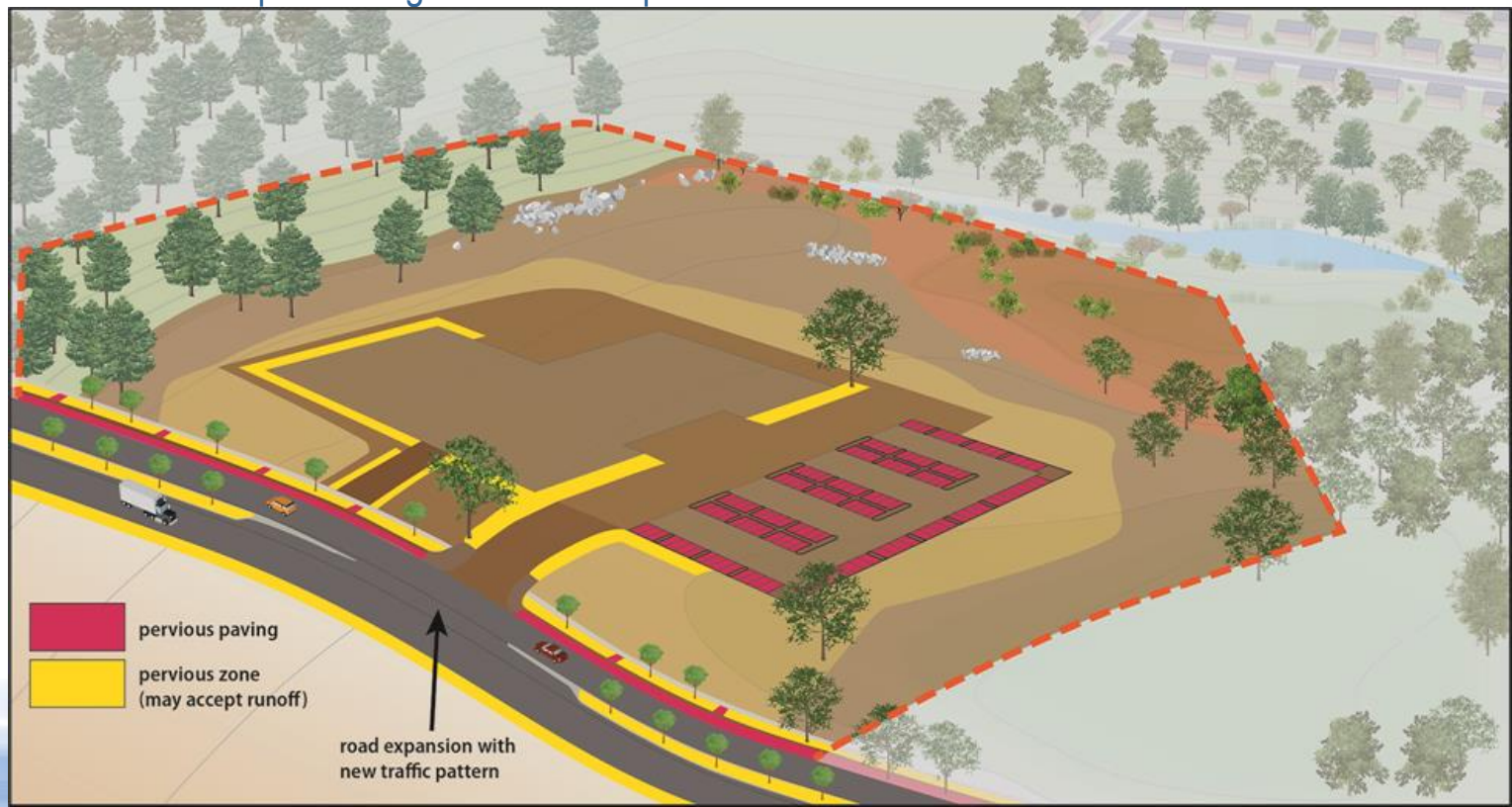
Site Assessment, Planning, and Site Design

- Site Design Principles of LID
  - Phase II: Preliminary LID Design
    - Step 6: Reduce/Minimize Total and Effective Impervious Area
      - Investigate the potential for impervious area disconnection
      - Evaluate the conceptual design to reduce impervious surfaces



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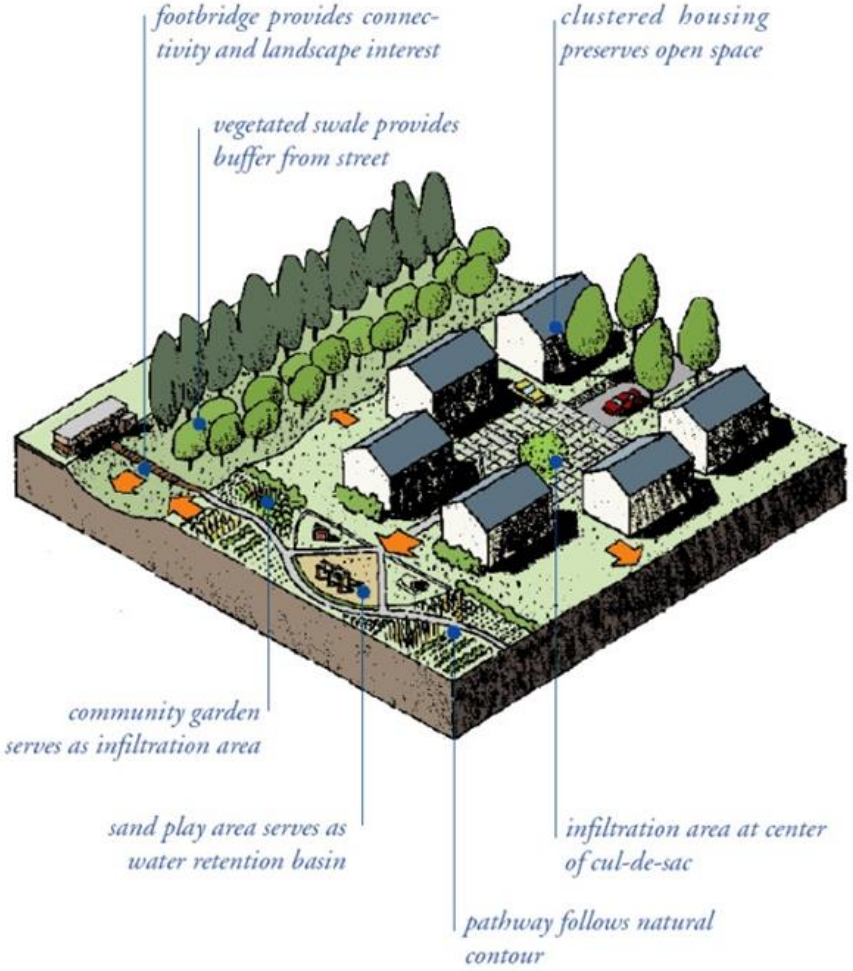
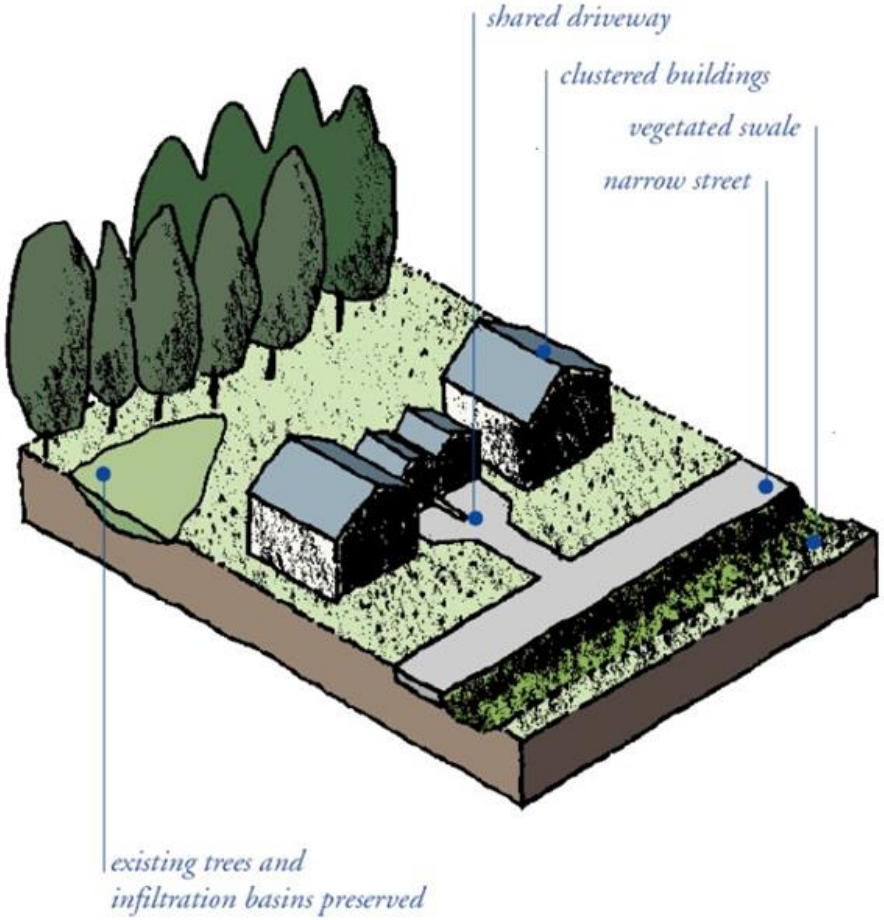
Site Assessment, Planning, and Site Design

Impervious Area Disconnection



Source: County of San Diego LID Handbook

Reduce Impervious Surfaces



Site Assessment, Planning, and Site Design

Conventional “Fat” Street

Source: NCSU-BAE

Green Infrastructure “Skinny” Street

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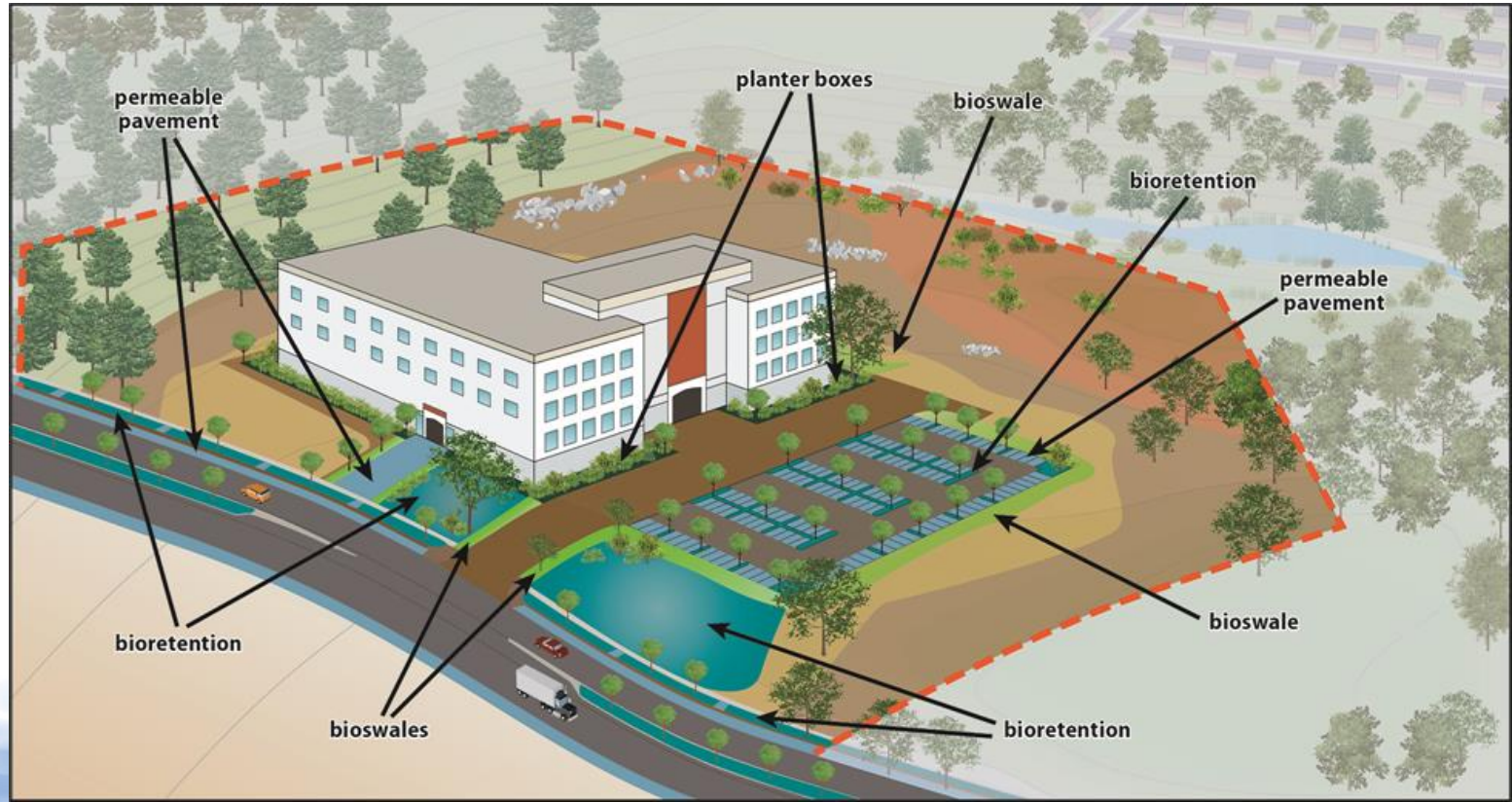
  - Phase II: Preliminary LID Design
    - Step 7: Determine LID Practices
      - Determine potential BMPs according to hydrologic and pollutant removal process needs and cost estimates



Site Assessment, Planning, and Site Design

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Site Assessment, Planning, and Site Design

Site Assessment, Planning, and Site Design

- Results of Phase II
  - The analyses in Phase II should produce a preliminary site plan that includes:
    - Hydrologic flow paths and natural drainage features (Step 4)
    - Locations where infiltration and conveyance features could be located (Step 4)
    - Limits of clearing and grading (Step 5)
    - Results of an impervious area reduction analysis (e.g., parking area reduction, permeable pavement options) (Step 6)
    - Candidate BMPs and their approximate locations (Step 7)

Site Assessment, Planning, and Site Design

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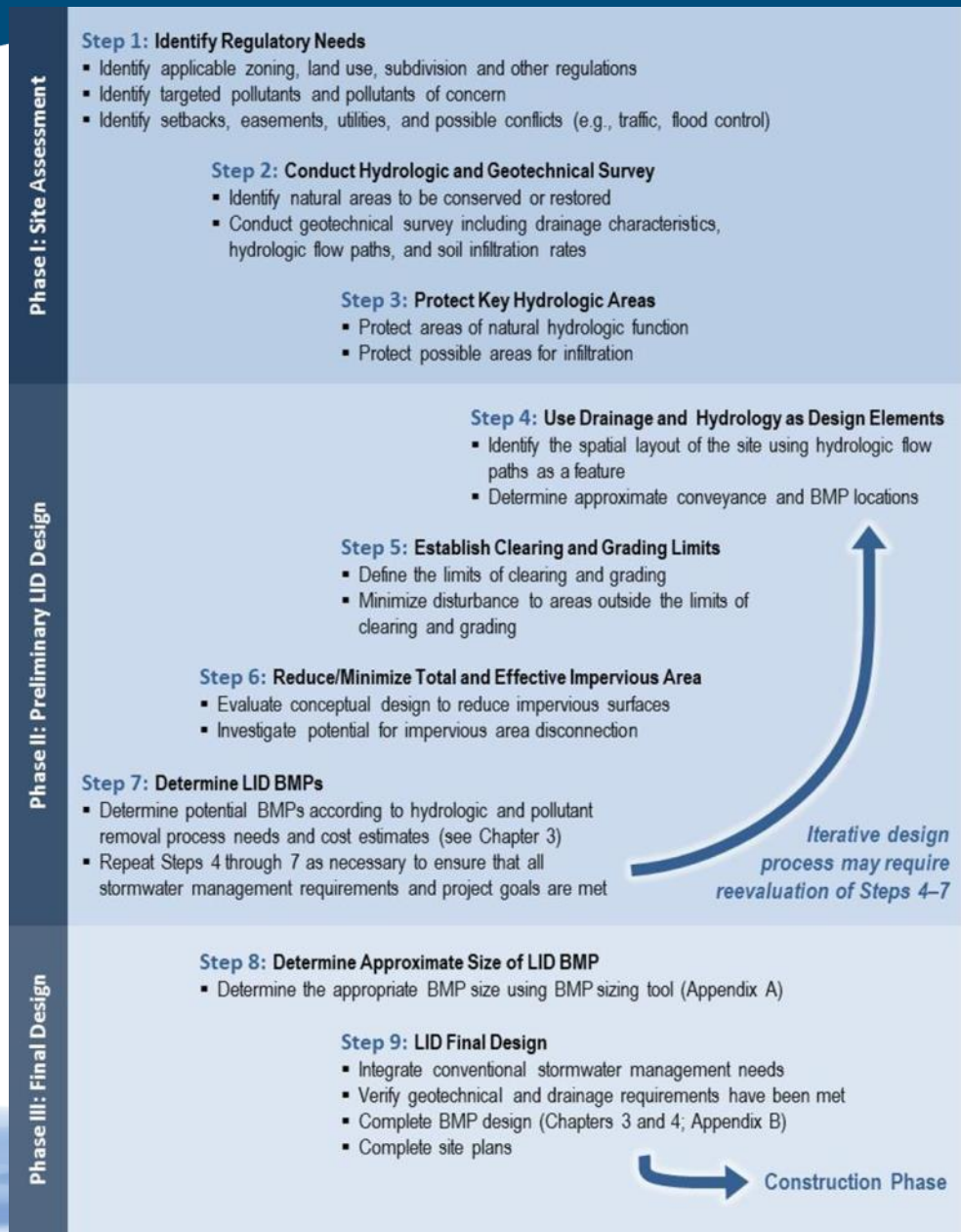
  - Phase I: Site Assessment
  - Phase II: Preliminary LID Design
  - Phase III: Final Design
    - Step 8: Determine Appropriate Size of LID Practices
    - Step 9: Final Site Design



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Site Assessment, Planning, and Site Design

- Site Design Principles of LID
  - Phase III: Final Design
    - Step 8: Determine Appropriate Size of LID Practices
      - Determine the approximate BMP size using the BMP sizing tool
    - Step 9: Final Site Design
      - Verify that geotechnical and drainage requirements have been met
      - Complete BMP designs such as finish details and notes
      - Complete the site plans

How can we reduce impacts from existing development?

Neighborhood Streets Retrofits

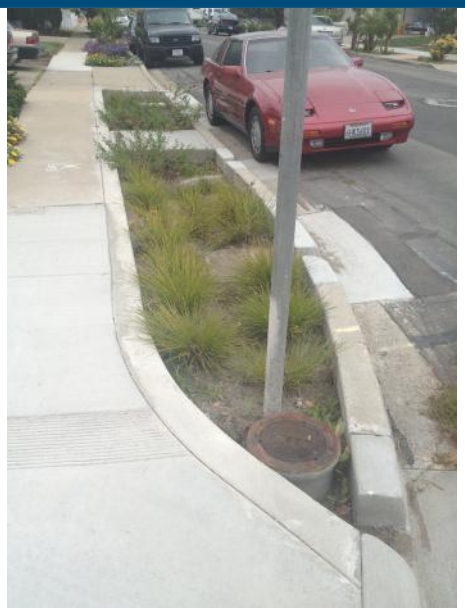

Photo courtesy Watershed Management Group

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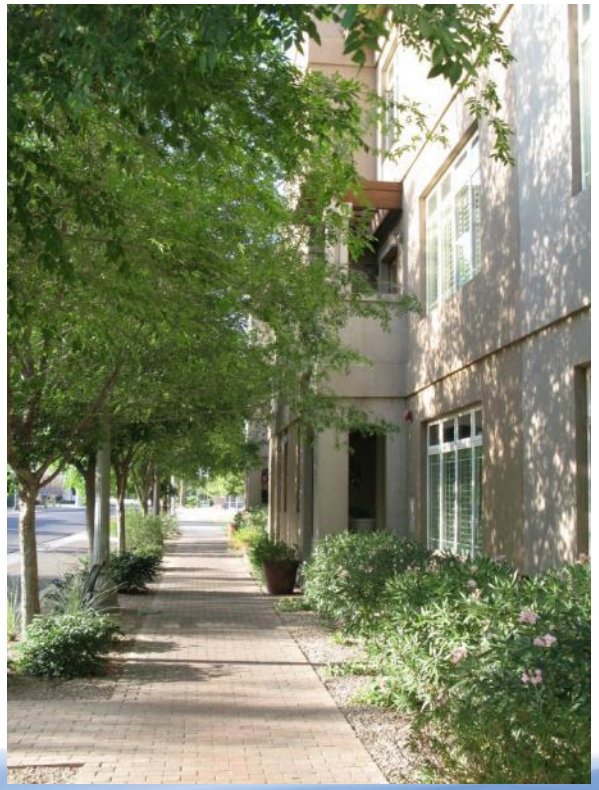
Downtown Streetscape and Public Space Retrofits



Photos courtesy City of Phoenix

DOT Highway Retrofits

I-19 and Canoa Ranch Road, Pima County, AZ

Arizona State Highway179, Sedona, AZ

Public Property Retrofits

School micromanaging stormwater.

Park stormwater detention basin also serving as playing field.

Municipal facility onsite capture.

Private Property Retrofits

Photos courtesy Watershed Management Group

Look around. You'll see lots of retrofit opportunities…

Photos courtesy City of Phoenix

Photo courtesy Watershed Management Group

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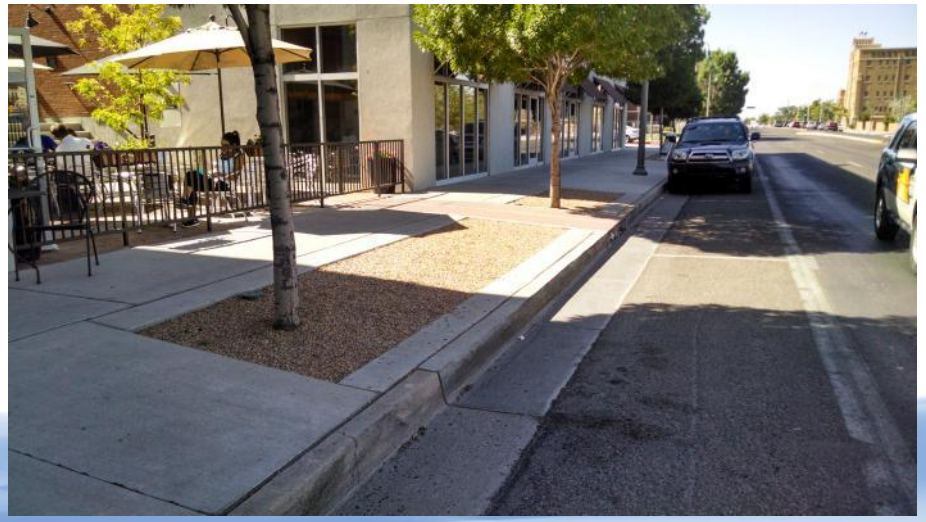

Questions and Discussion