RESILIENT
Home Building Conference
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RESILIENT SITE PLANNING AND FOUNDATIONS

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GCCDS Gulf Coast Community Design Studio

Community & Regional Resilience Institute CARRI

Strengthening Homes and Safeguarding Families
FLASH
FEDERAL ALLIANCE FOR SAFE HOMES
www.flash.org

FEMA

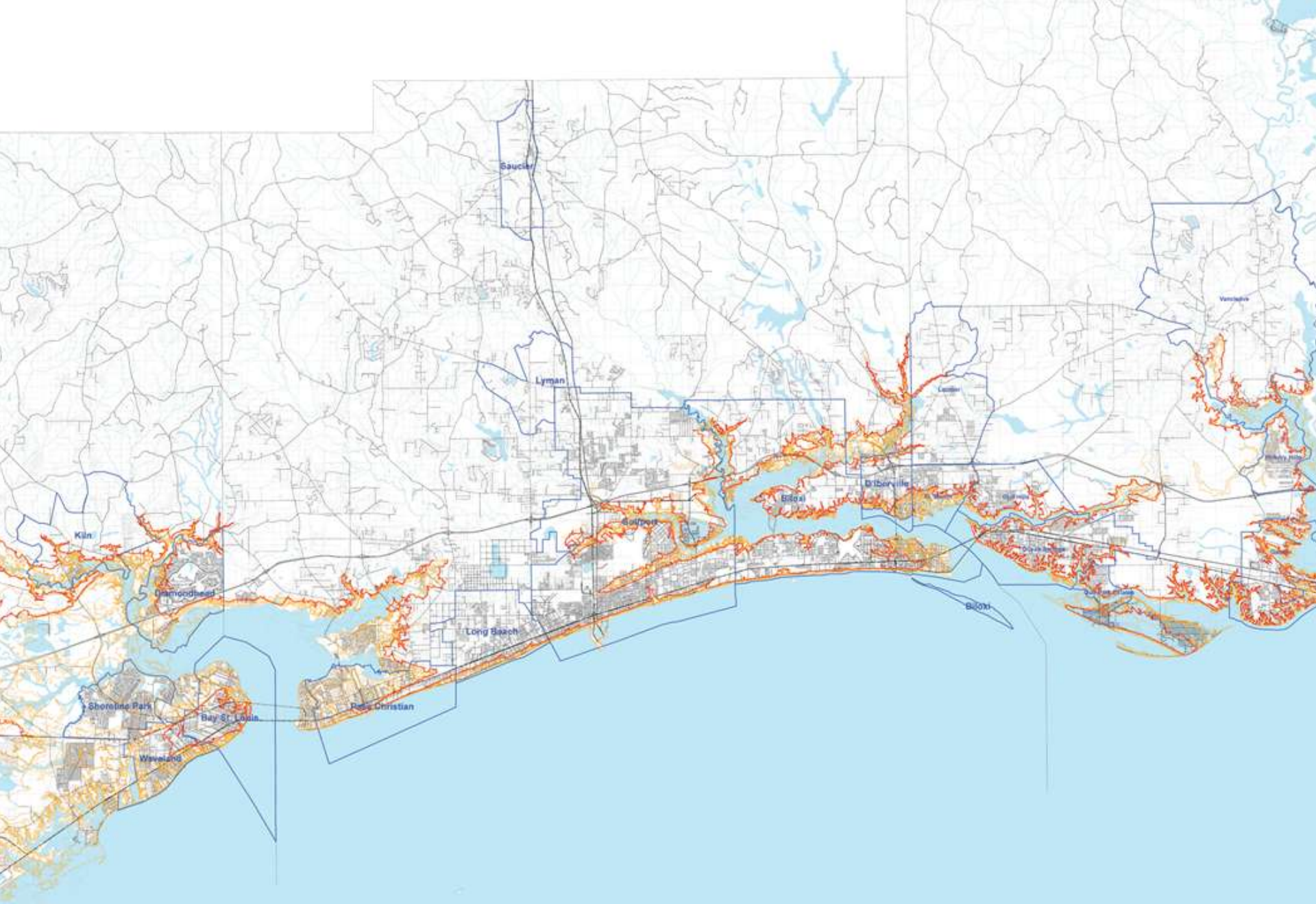
JAMES WHEELER
GULF COAST COMMUNITY DESIGN STUDIO

View of GCCDS work space

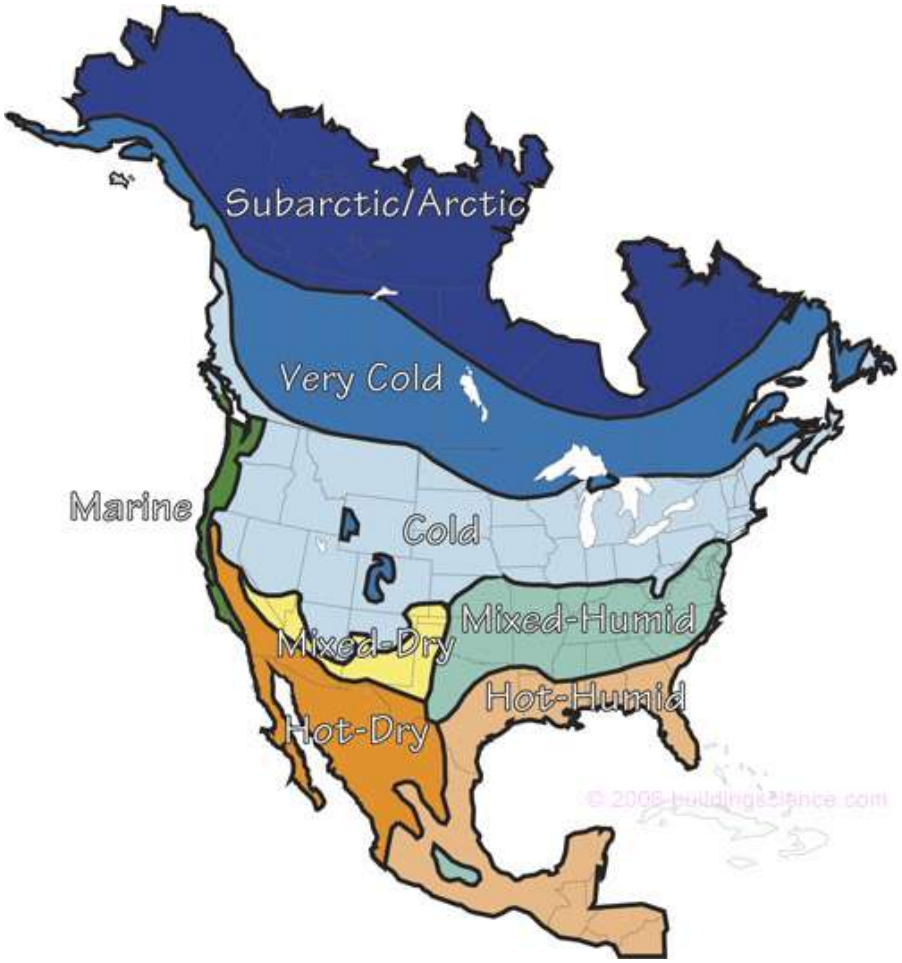
RESILIENT SITE PLANNING AND FOUNDATIONS

OUTLINE

I. GENERAL SITE DESIGN FACTORS
II. RESILIENT SITE DESIGN
III. SOIL STRENGTH
IV. FOUNDATION TYPES
V. RESILIENT FOUNDATION DESIGN



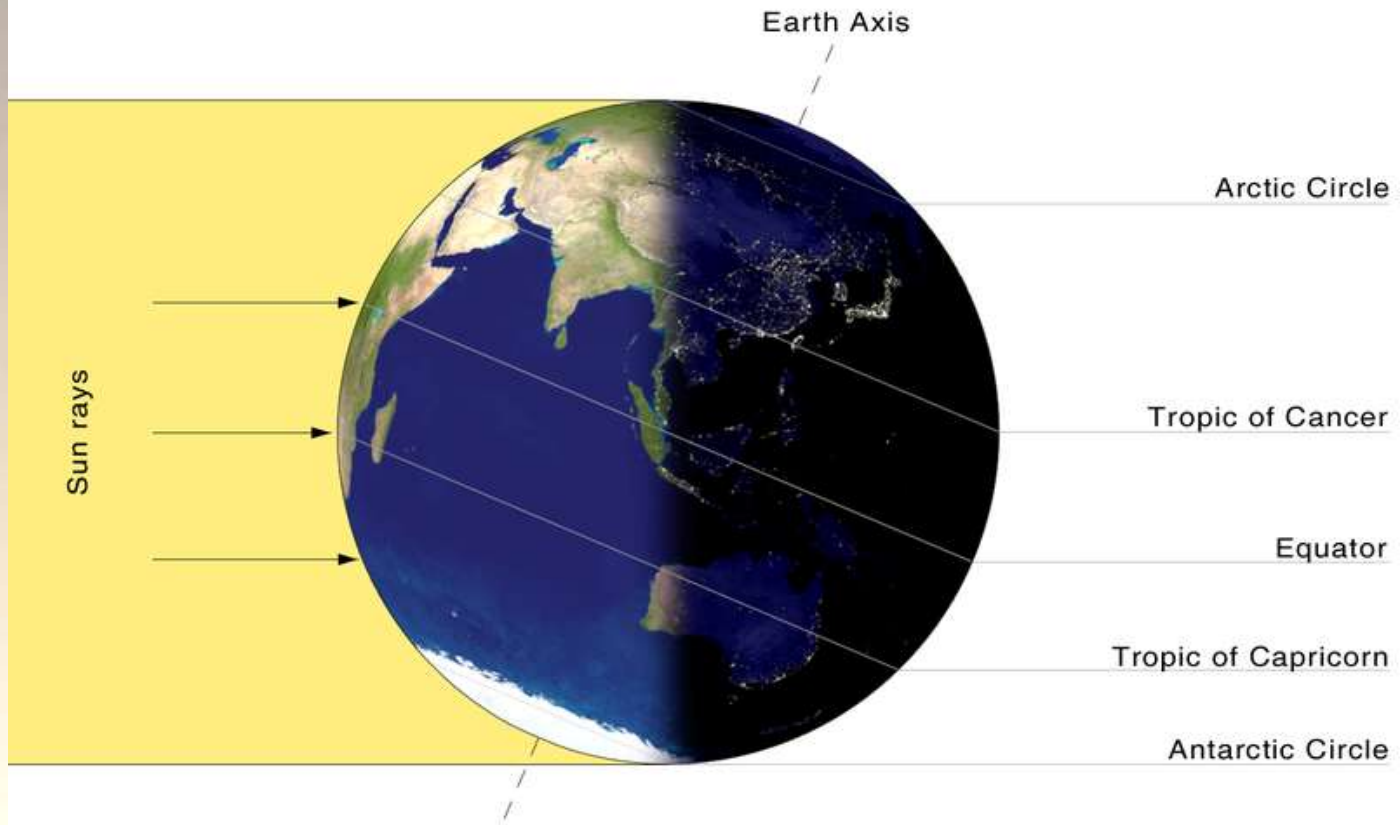
I. GENERAL SITE DESIGN FACTORS



Hot-Humid

A hot-humid climate is defined as a region that receives more than 20 inches of annual precipitation and where one or both of the following occur:

- a 67 F or higher wet bulb temperature for 3,000 or more hours during the warmest six consecutive months of the year; or
- a 73 F or higher wet bulb temperature for 1,500 or more hours during the warmest six consecutive months of the year[1]

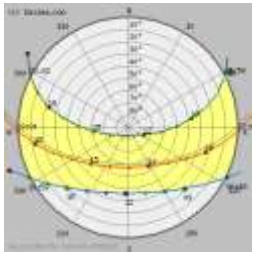


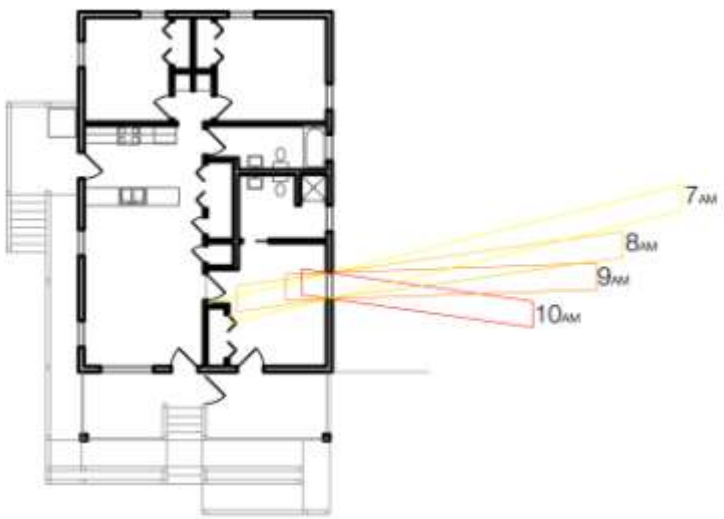
*THE BENEFITS OF DAYLIGHTING: KITCHENS, LIVING ROOMS, DINING ROOMS, FAMILY ROOMS

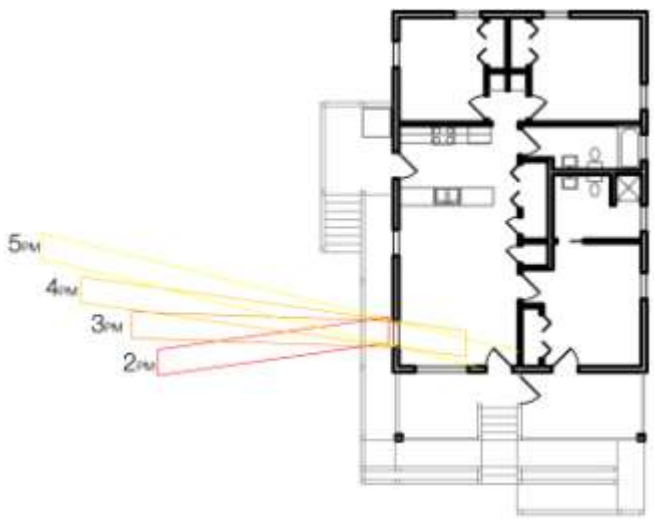
*USING OUTDOOR SPACES

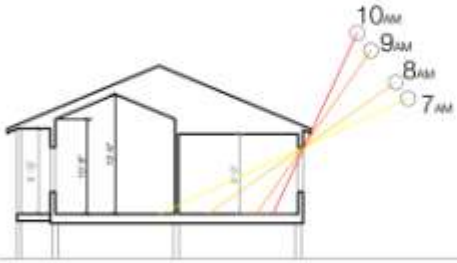
*ORIENTATION FOR SHADE: EAST/WEST

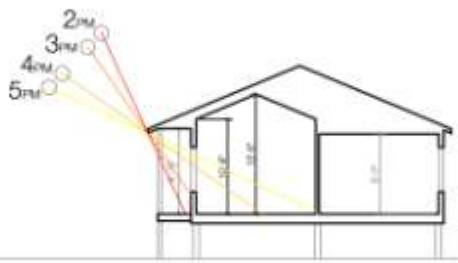
*ORIENTATION FOR AIR FLOW: NORTH/SOUTH











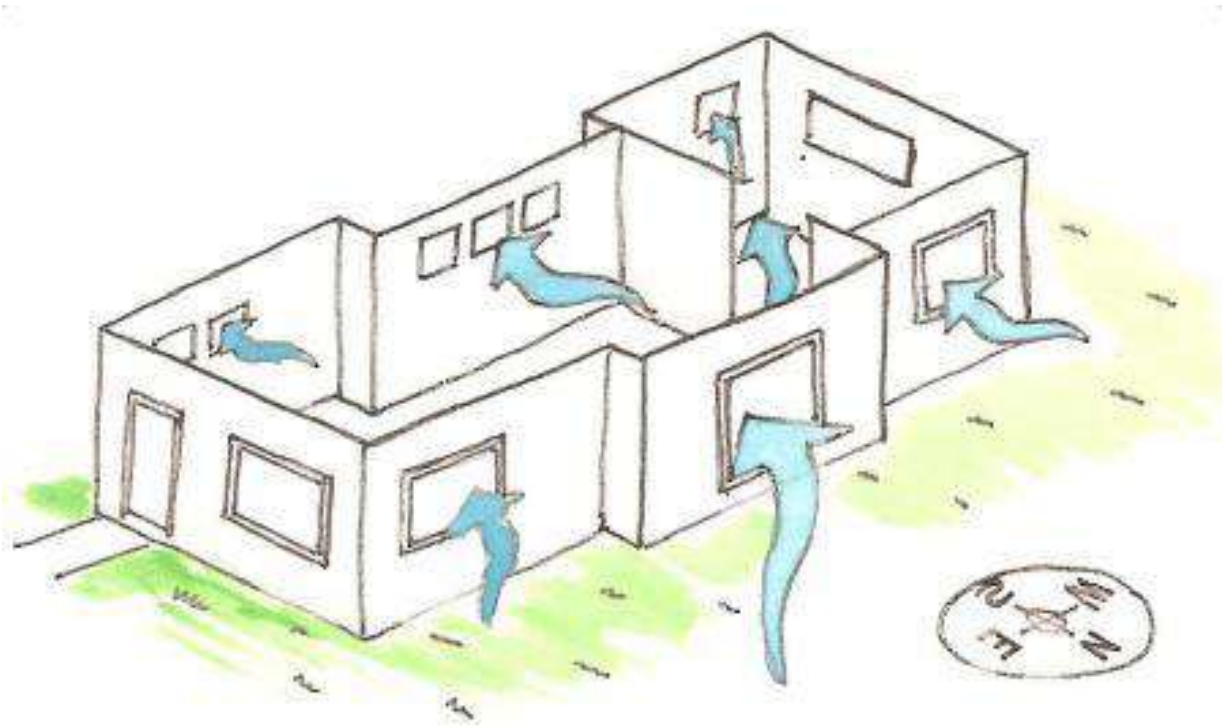
MORNING

SUMMER SOLSTICE

EVENING

SCOUR/ELEVATION

SHADE/SUPPORT



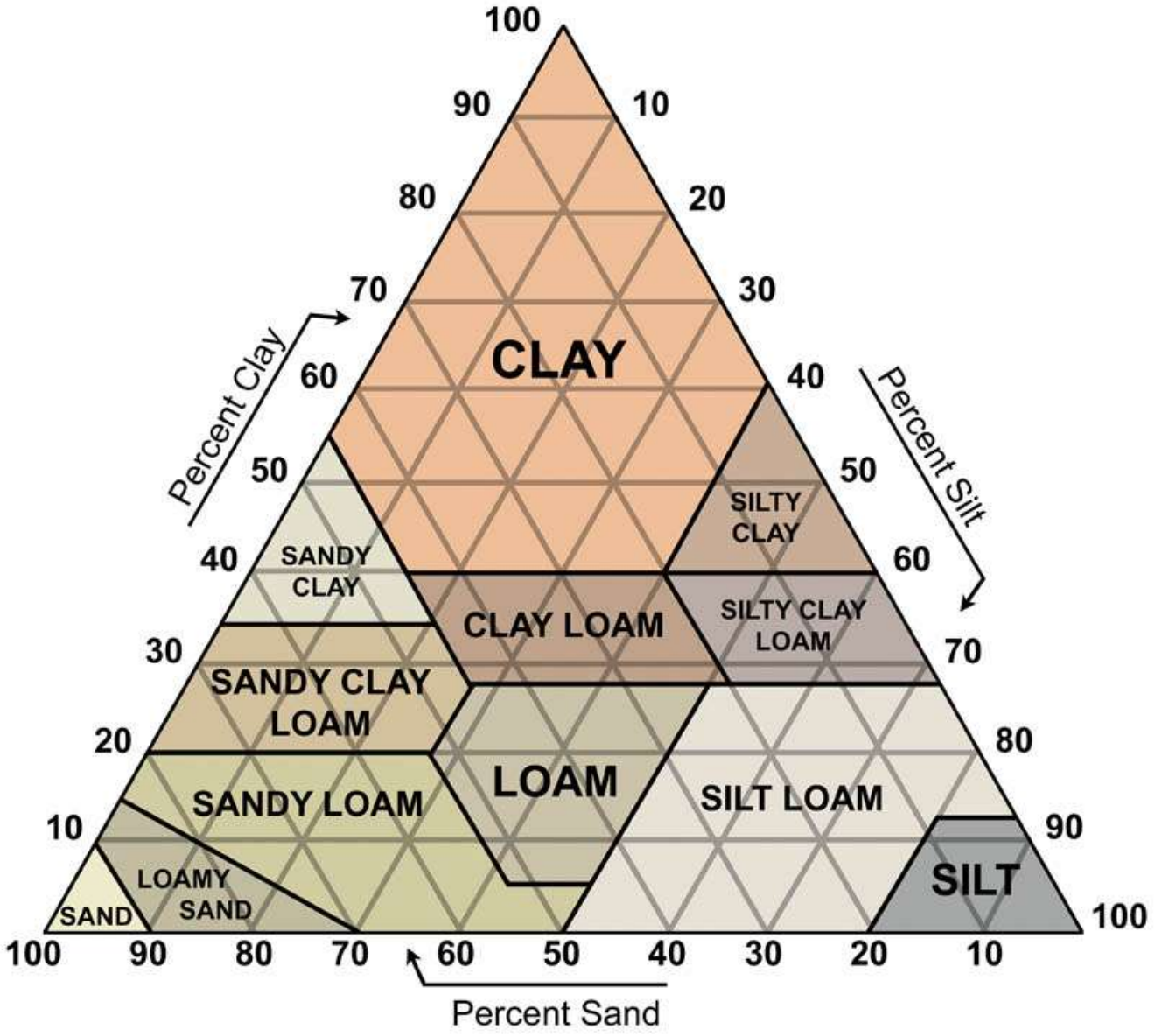
USING/TRANFERING WIND LOADS

RESILIENT SITES: WATER & LANDSCAPE

1. DECREASE IMPERVIOUS SURFACES
2. HAVE A PROPER GRADING PLAN
3. HAVE A PROPER PLANTING STRATEGY
4. PART 2 AND 3 WORKING TOGETHER

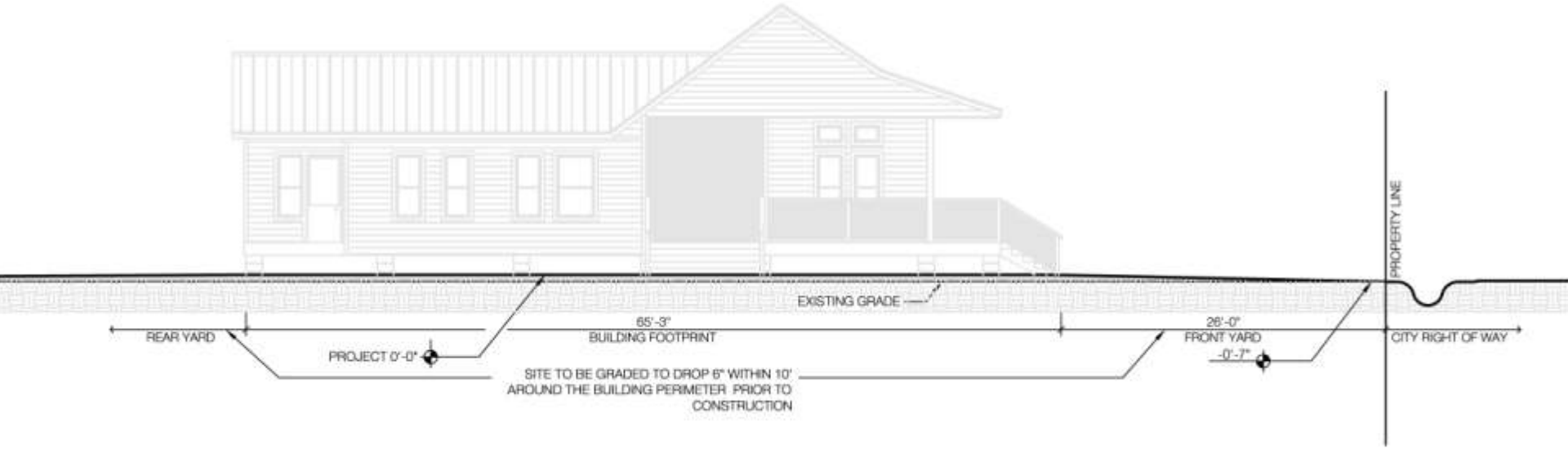
1. DECREASE IMPERVIOUS SURFACES ON SITE

PERVIOUS PAVERS REDUCE HARD SURFACE %'s

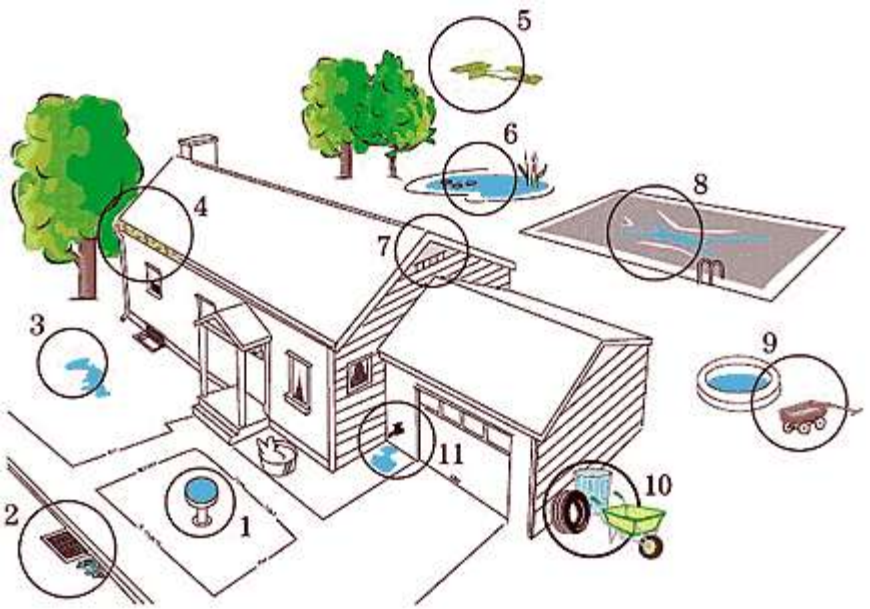


SOIL TYPES PRESENT ON THE MS GULF COAST

SECTION B

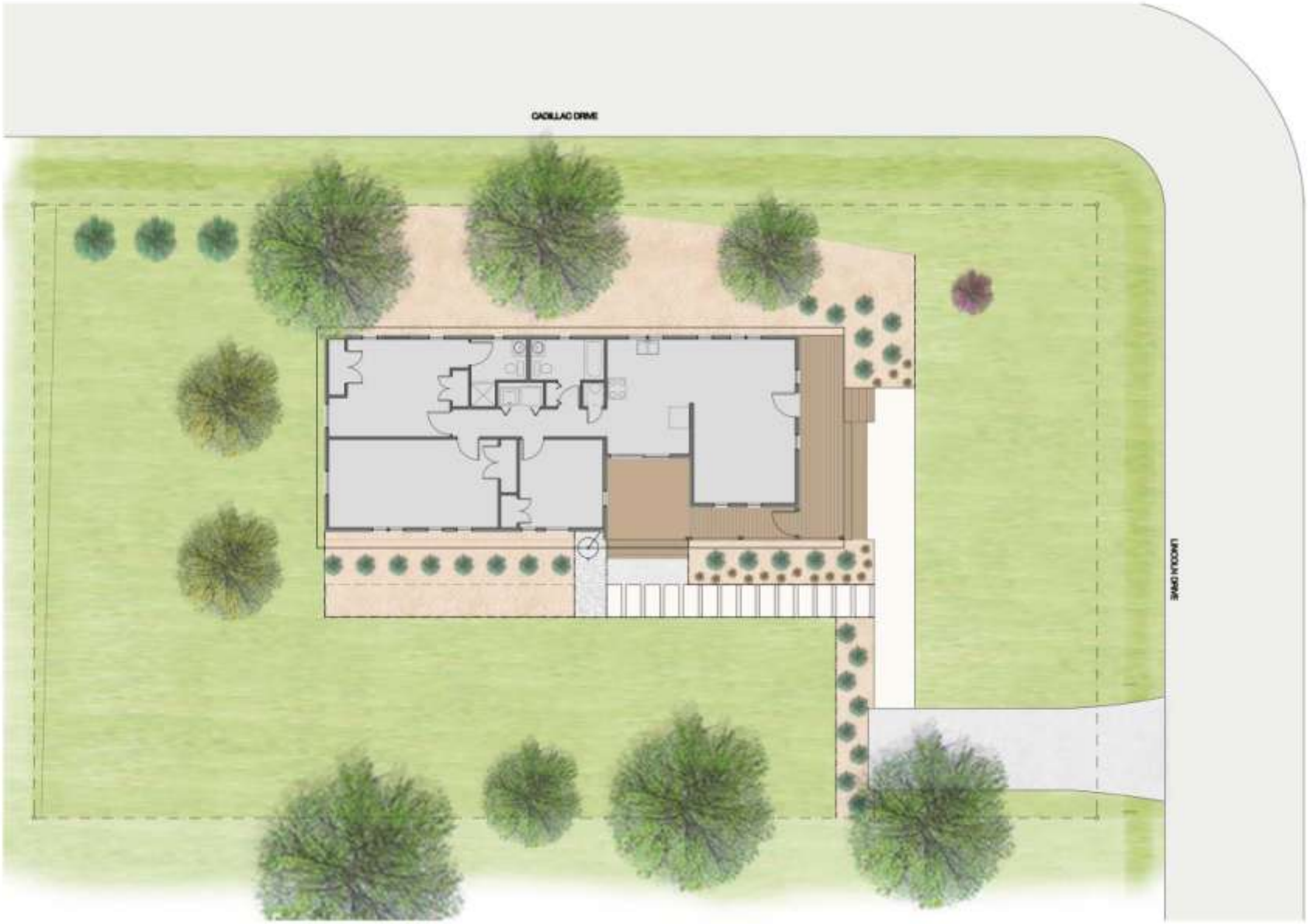


2. PROPER GRADING PLAN



KEEP WATER FROM UNDER THE HOUSE

MOVE WATER TO WHERE IT SHOULD BE



3. PROPER PLANTING STRATEGY


Phoenix Dactylifera Medjool


Itea virginica


Leucothoe axillaris


Hypericum


Callicarpa americana


Yucca


Schizachyrium scoprium


Rosmarinus officinalis


Muhlenbergia lindheimeri


Berberis vulgaris


Plumbago auriculata


Perovskia atriplicifolia


Spiraea x vanhouttei


Rudbeckia hirta


Hemerocallis

EACH SITE IS DIFFERENT, PLAN ACCORDINGLY

EACH SITE IS DIFFERENT, PLAN ACCORDINGLY

4. GRADING AND PLANTING WORKING TOGETHER

FILTER BEFORE ENTERING GROUNDWATER

PLANTS CREATE HABITAT FOR LOCAL WILDLIFE

ENERGY EFFICIENCY INCREASE FOR HOUSING

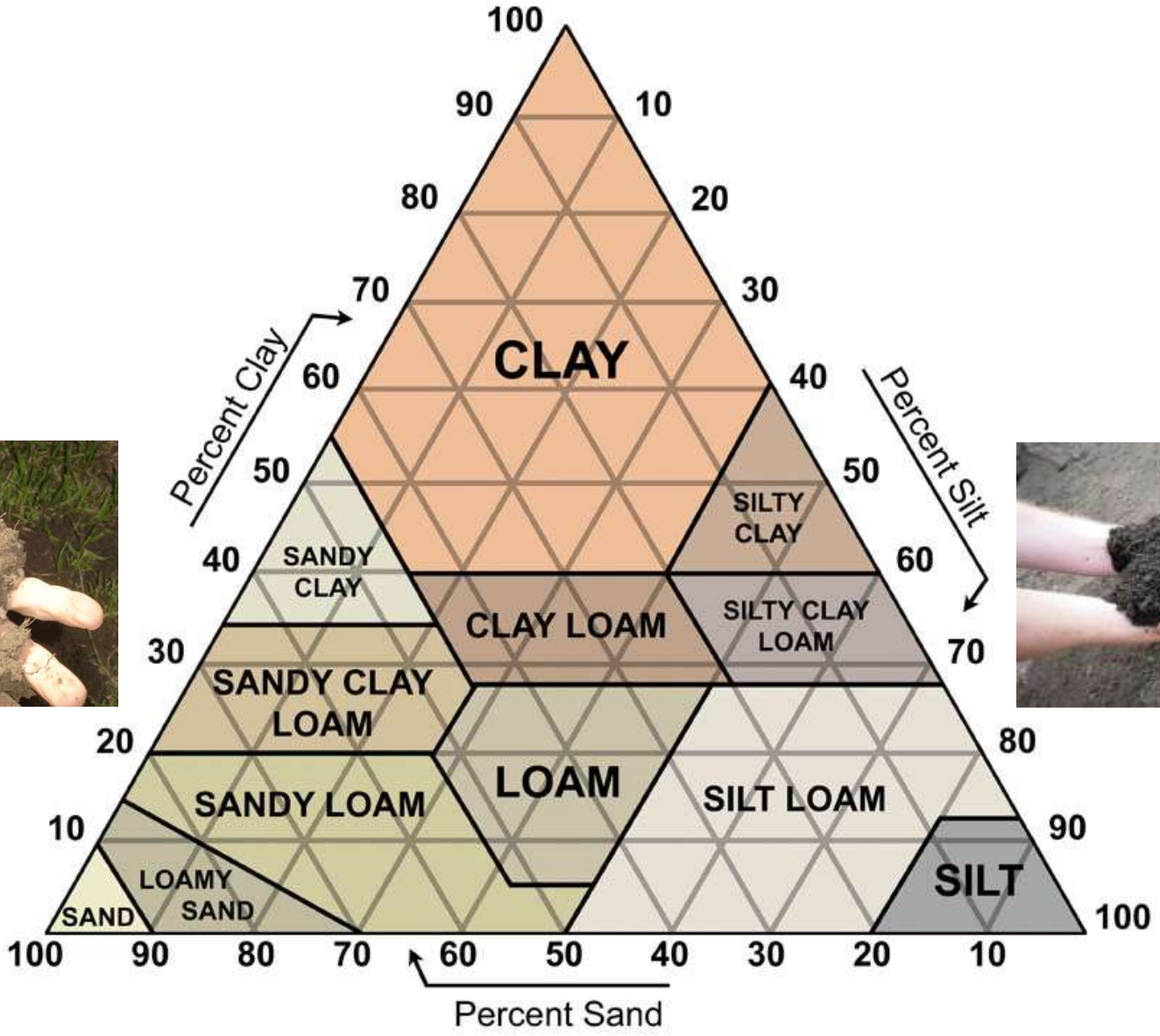
PROPER SHADING CAN REDUCE ENERGY CONSUMPTION BY 25%- NATIONAL RENEWABLE ENERGY LABORATORY

THREE PROPERLY PLACED SHADE TREES CAN SAVE $200 - $300 ANNUALLY- U.S. DEPT. OF ENERGY

SHADED NEIGHBORHOODS ARE 3 TO 6 DEGREES COOLER THAN UNSHADED NEIGHBORHOODS.

BECAUSE COOL AIR SETTLES AT THE GROUND IT CAN BE UP TO 25 DEGREES COOLER IN THE SHADE THAN NEXT TO UNSHADED IMPERVIOUS BLACKTOP AND GROUND LEVEL.

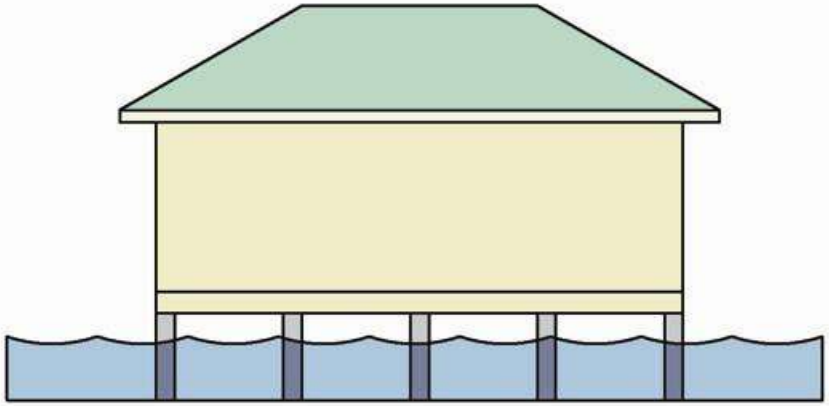
ENERGY EFFICIENCY INCREASE FOR HOUSING



III. SOIL STRENGTH AND FOUNDATIONS

TEST SOILS TO DETERMINE BEARING CAPACITY

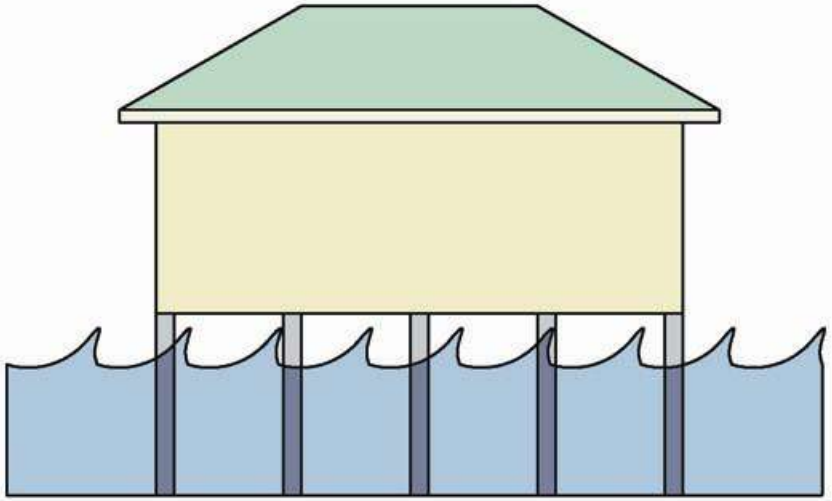
FOUNDATIONS AND RESILIENT CONSIDERATIONS



A ZONE

BASE FLOOD ELEVATION BELOW FLOOR LEVEL

FOUNDATION OPENINGS REDUCE HYDROSTATIC PRESSURE

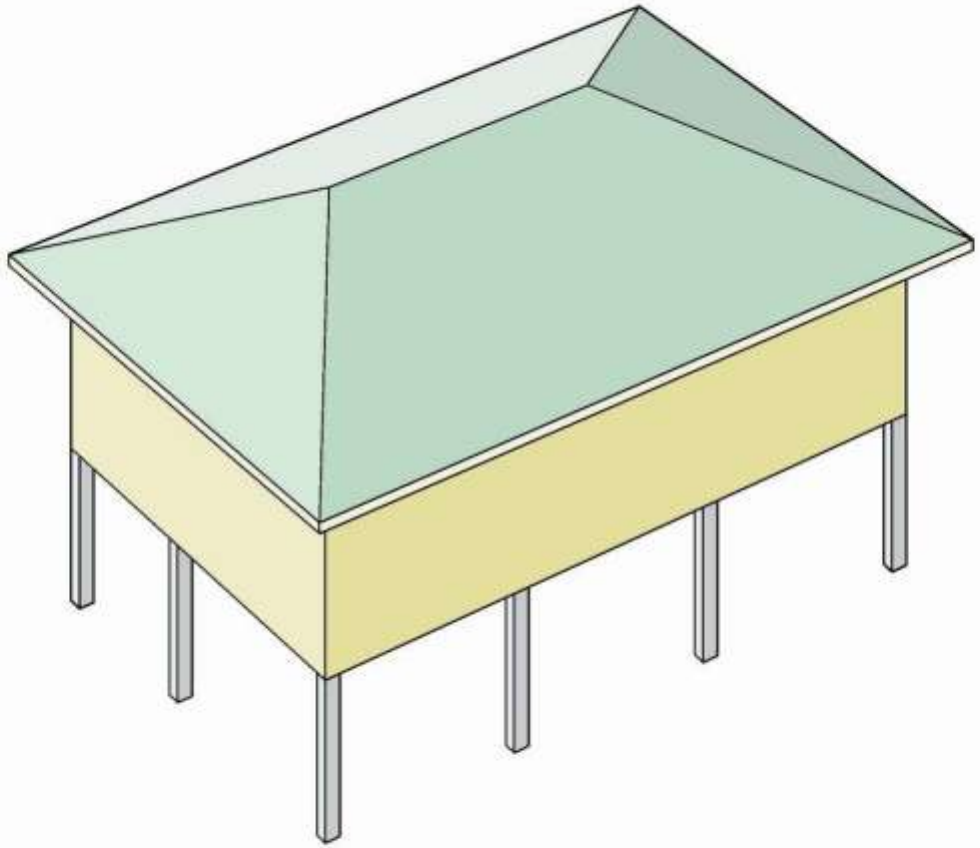


V ZONE

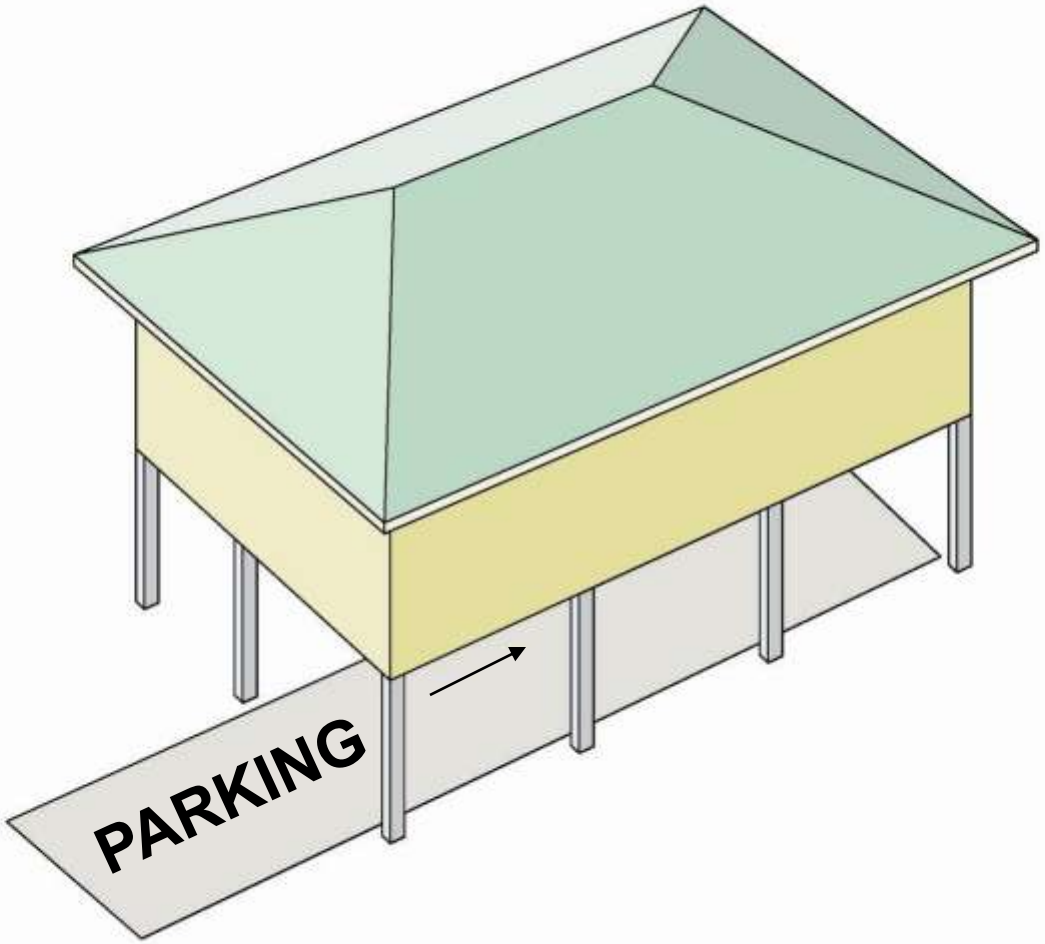
BASE FLOOD ELEVATION BELOW LOWEST HORIZONTAL STRUCTURE

FOUNDATION ALLOWS FREE FLOW OF MOVING WATER

ELEVATED FOUNDATION REQUIREMENTS



USES ALLOWED BELOW BASE FLOOD ELEVATION



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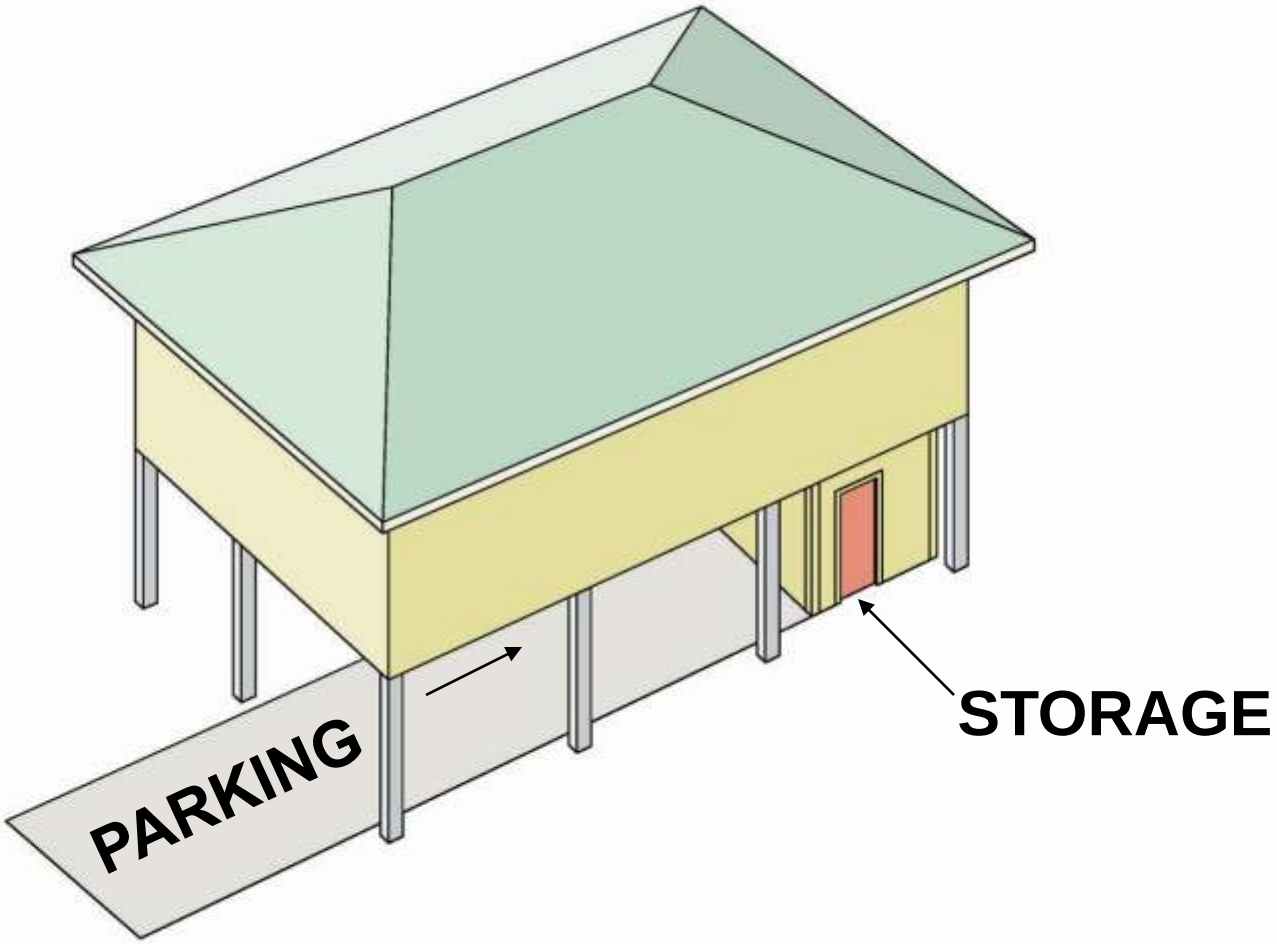

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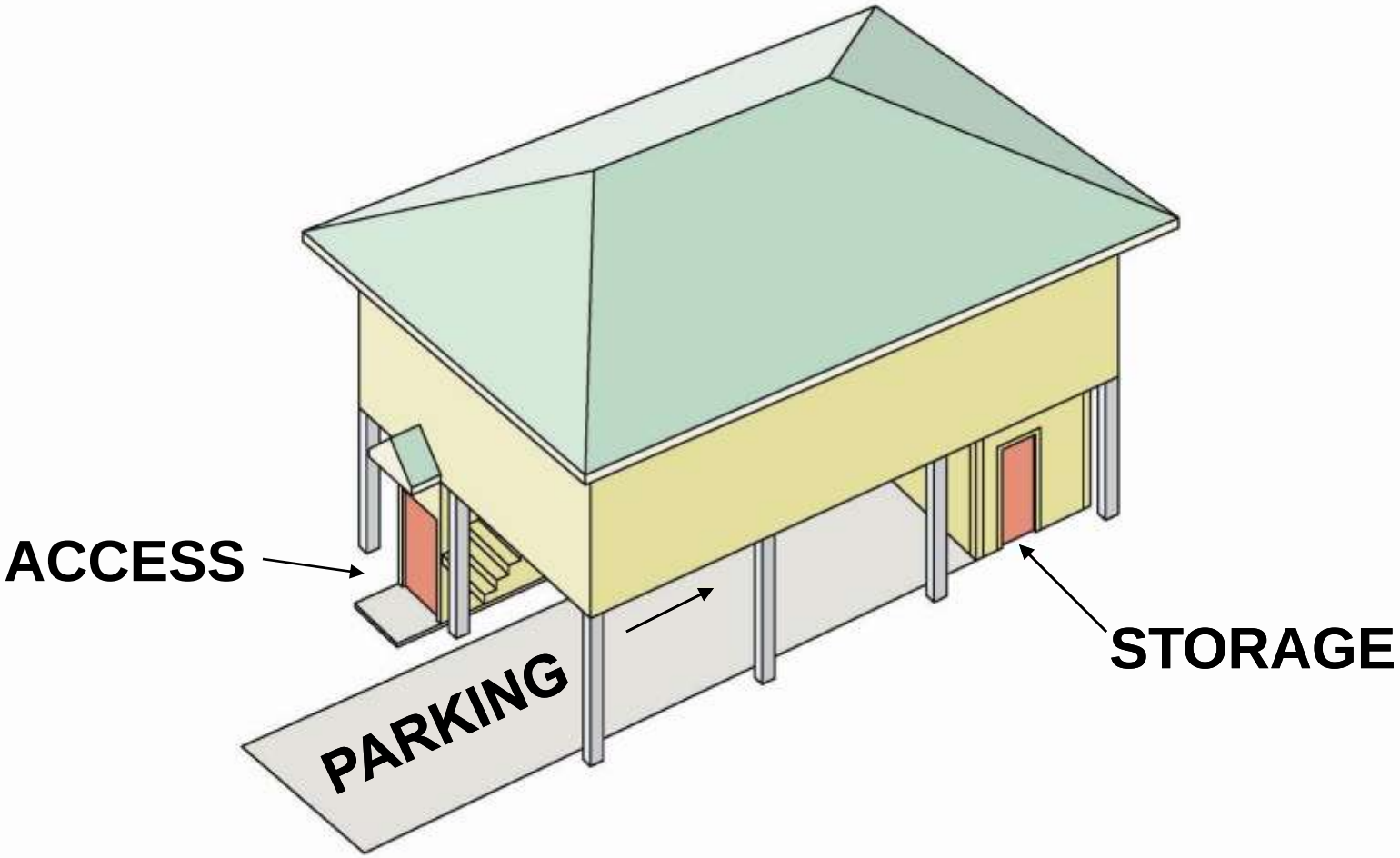
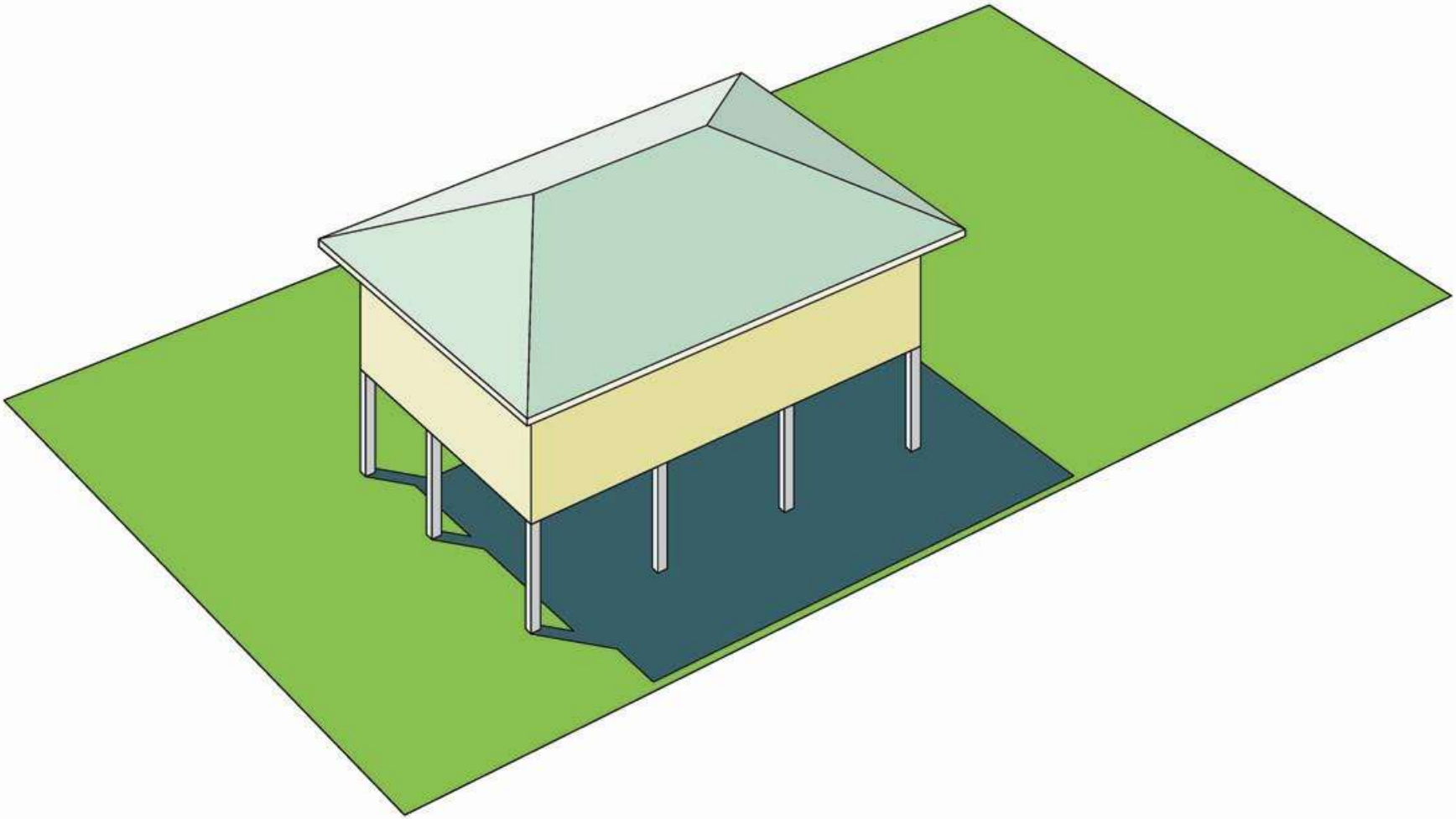
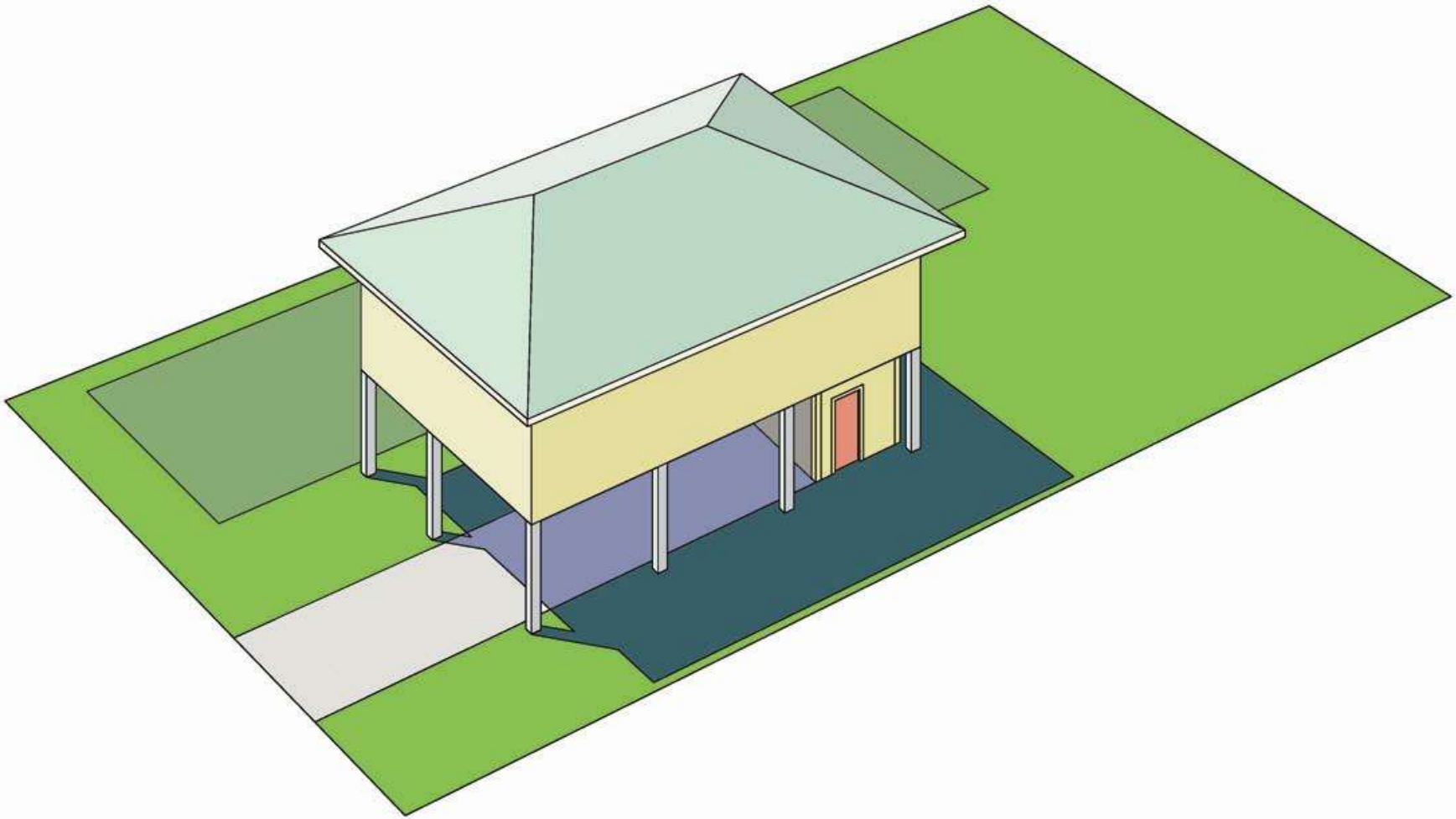


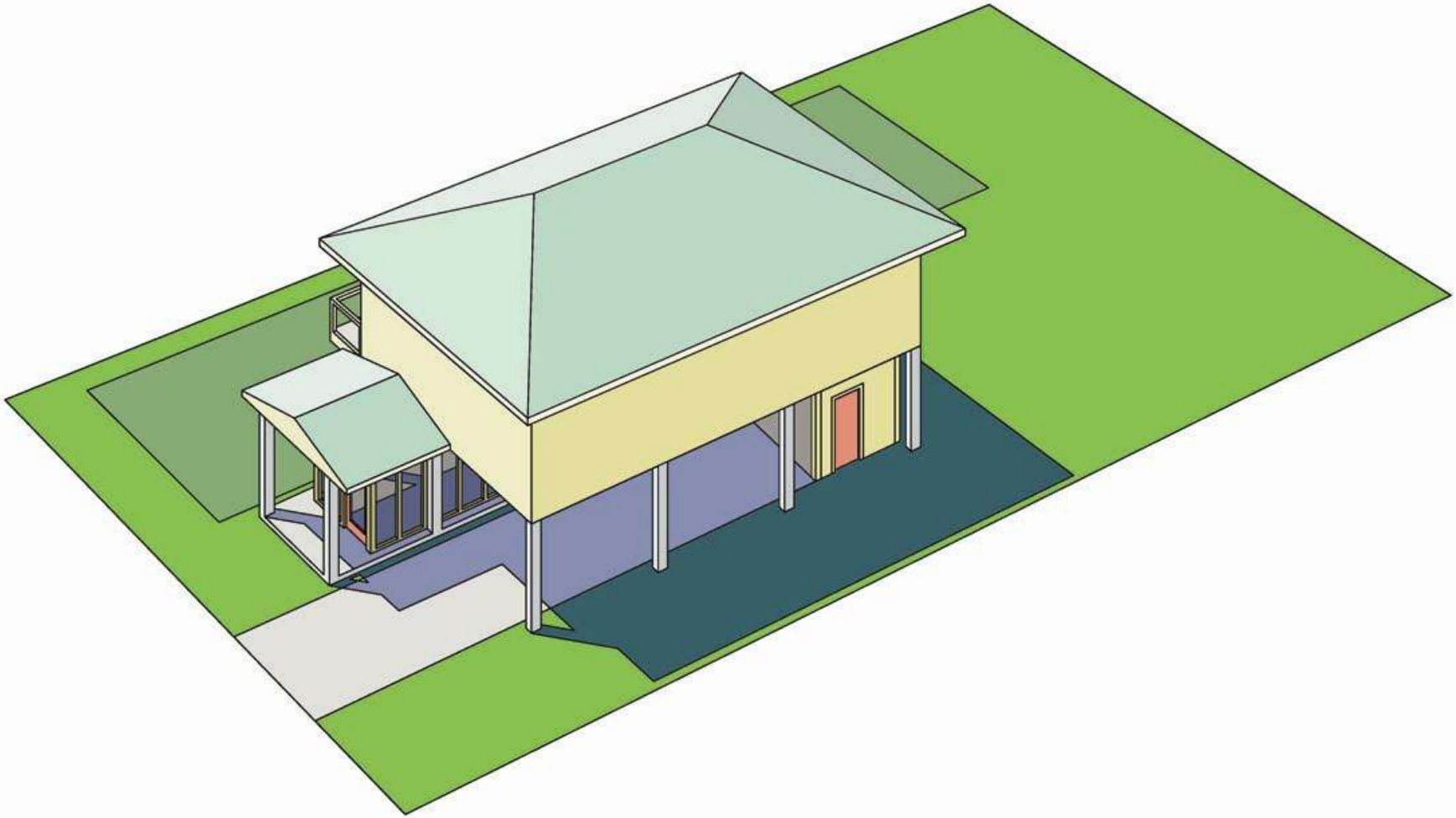
USES ALLOWED BELOW BASE FLOOD ELEVATION

ACCEPTABLE	NOT ACCEPTABLE
CONCRETE	GYPSUM BOARD
CONCRETE BLOCK	MINERAL FIBER BOARD
CEMENT BOARD	WOOD FIBER BOARD
GLASS	HARD BOARD
TREATED LUMBER	NON-TREATED LUMBER
MARINE PLYWOOD	EXTERIOR GRADE PLYWOOD
FOAM INSULATION	FIBER INSULATION
METAL DOORS AND FRAMES	WOOD DOORS AND FRAMES

FLOOD RESISTANT CONSTRUCTION







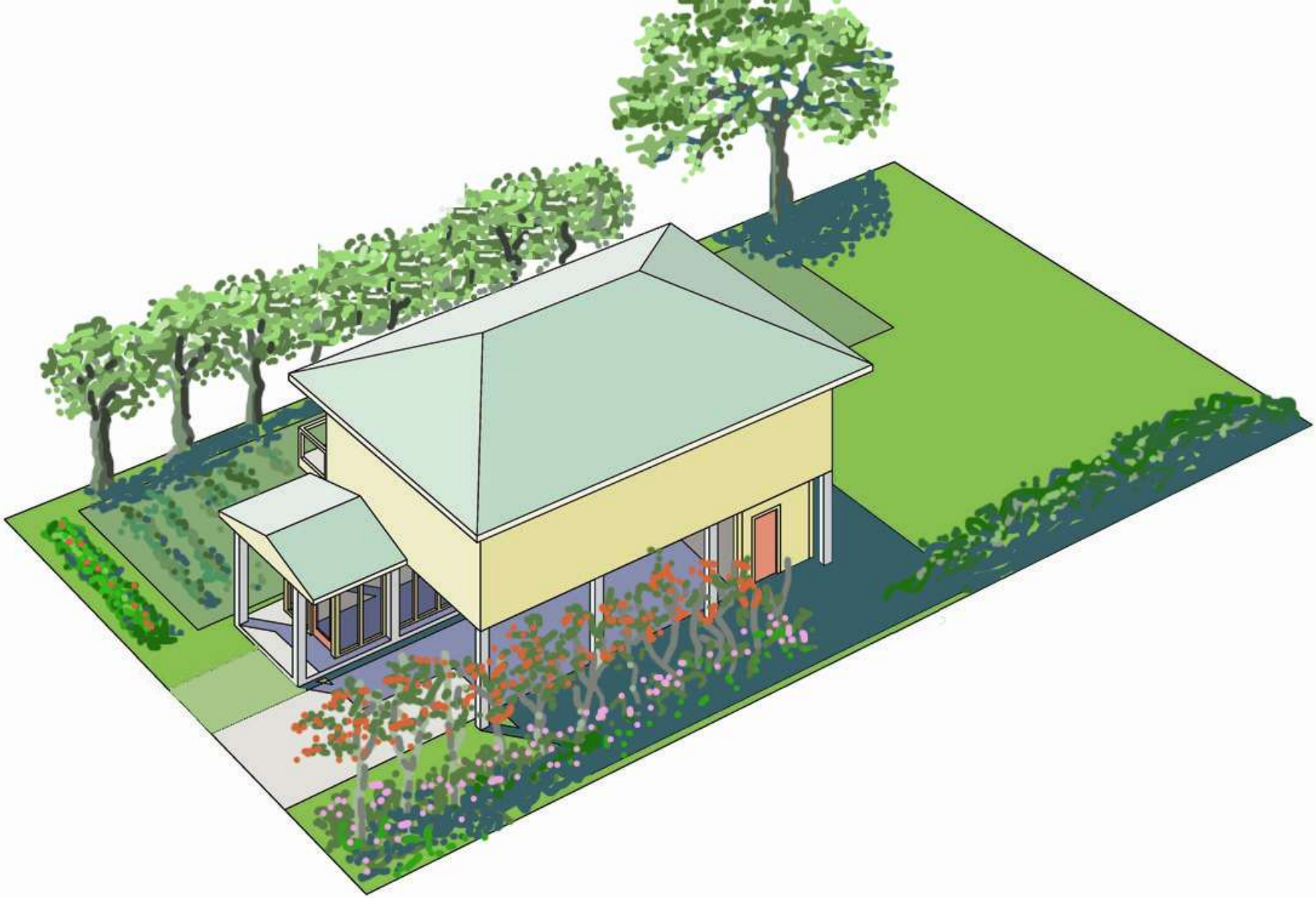


Figure-Ground Of
East Biloxi
Before Hurricane Katrina

October 2007

Sources: City of Biloxi, 2005

0 0.05 0.1 0.2 0.3 0.4 Miles

GCCDS

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BUILDINGS BEFORE HURRICANE KATRINA

Figure-Ground Of East Biloxi After Hurricane Katrina

October 2007

Sources: GCCDS Housing Assessment, Summer 2007. City of Biloxi.

0 0.05 0.1 0.2 0.3 0.4 Miles

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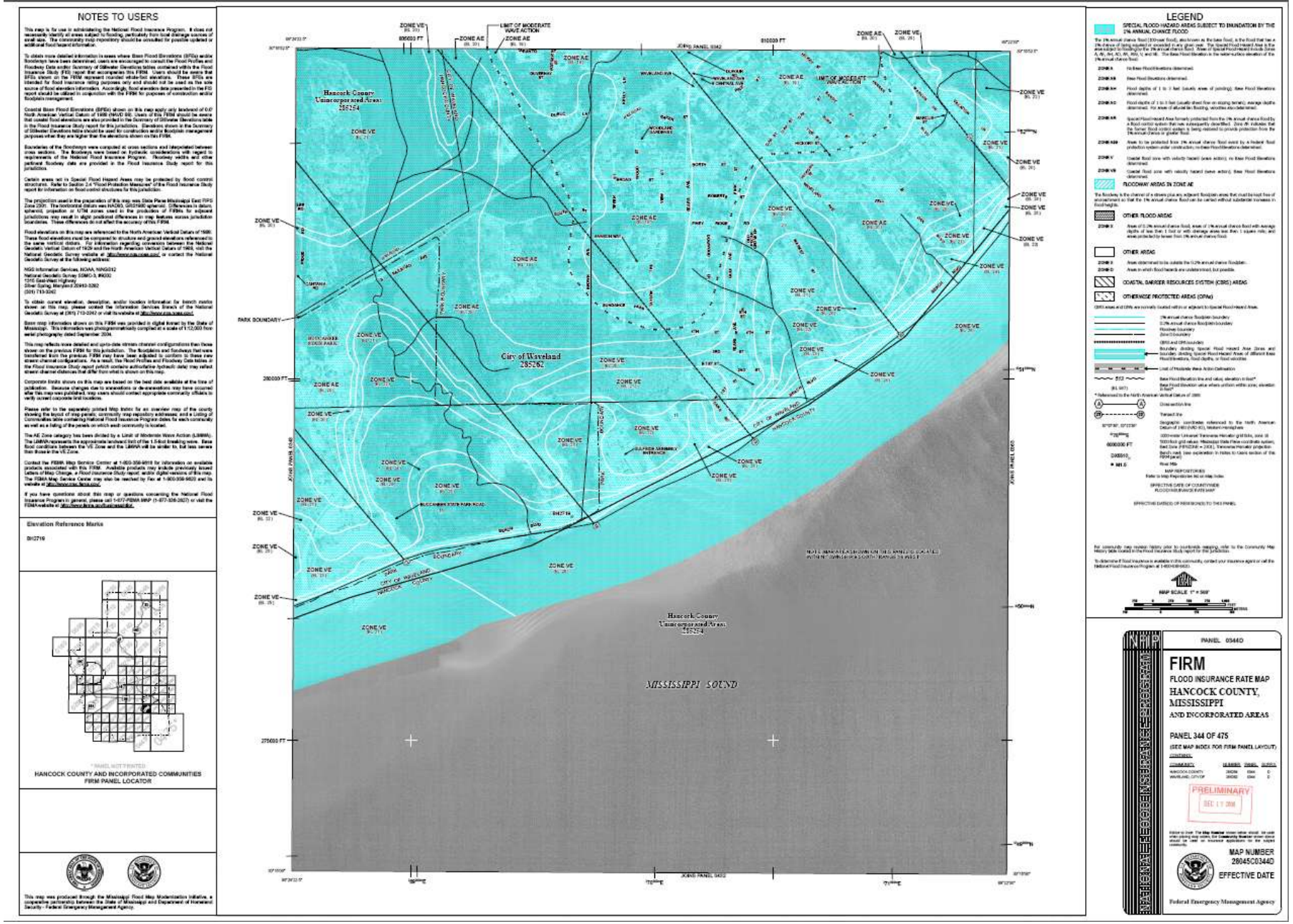
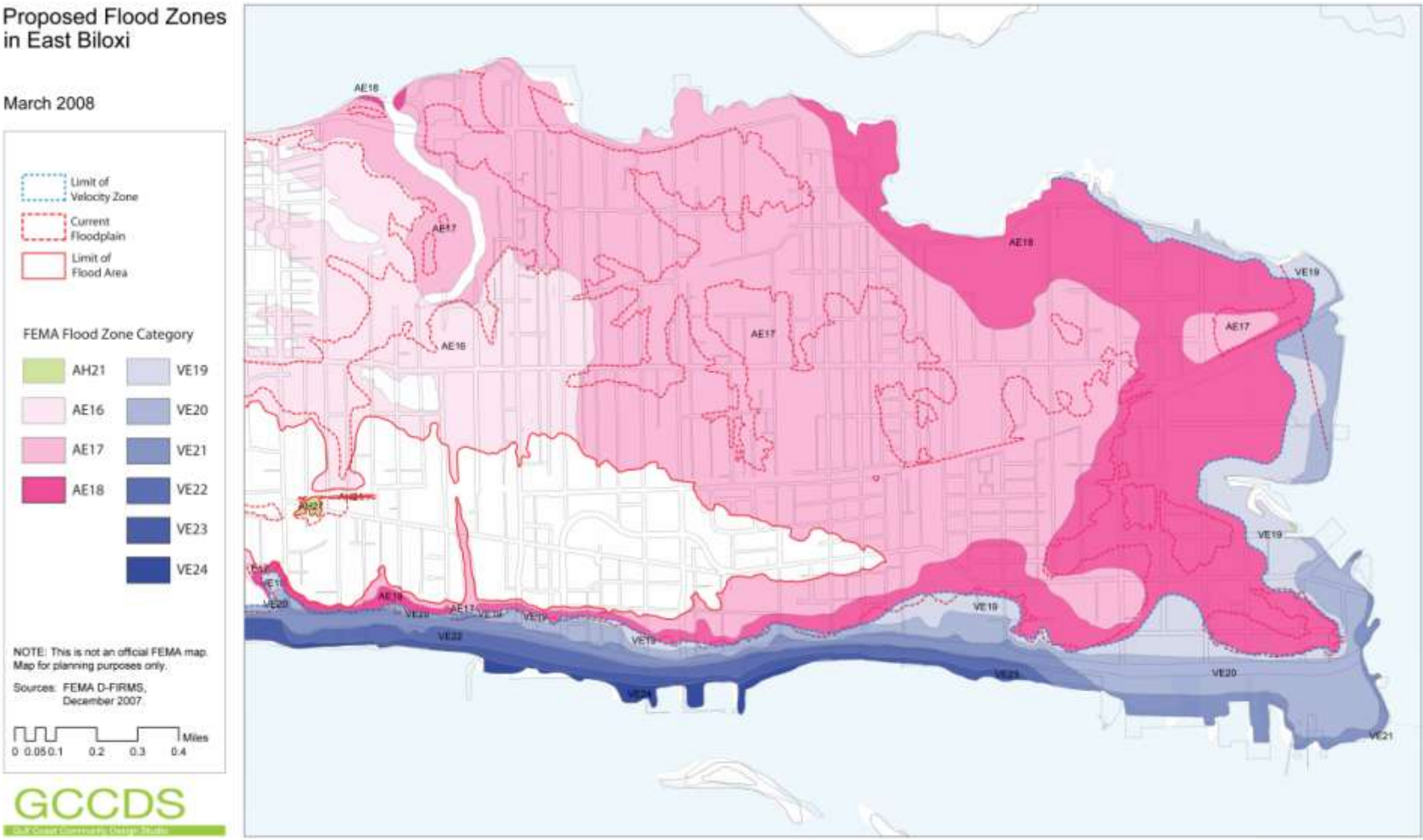
Impact of Hurricane Katrina on Buildings in East Biloxi


10/03/2007



DIGITAL FLOOD INSURANCE RATE MAPS (DFIRM)



IMPLICATIONS IN COASTAL FLOOD ZONES

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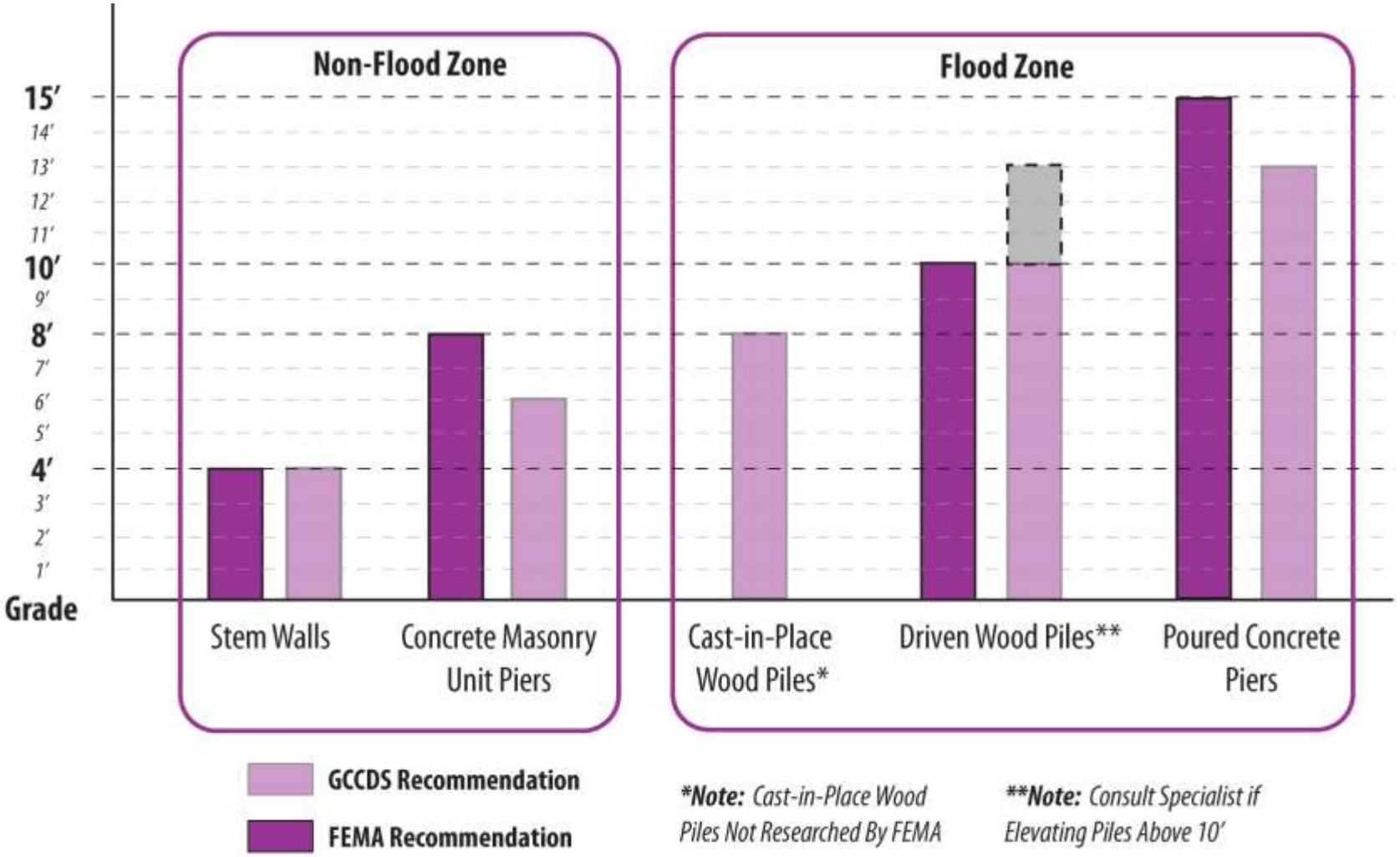
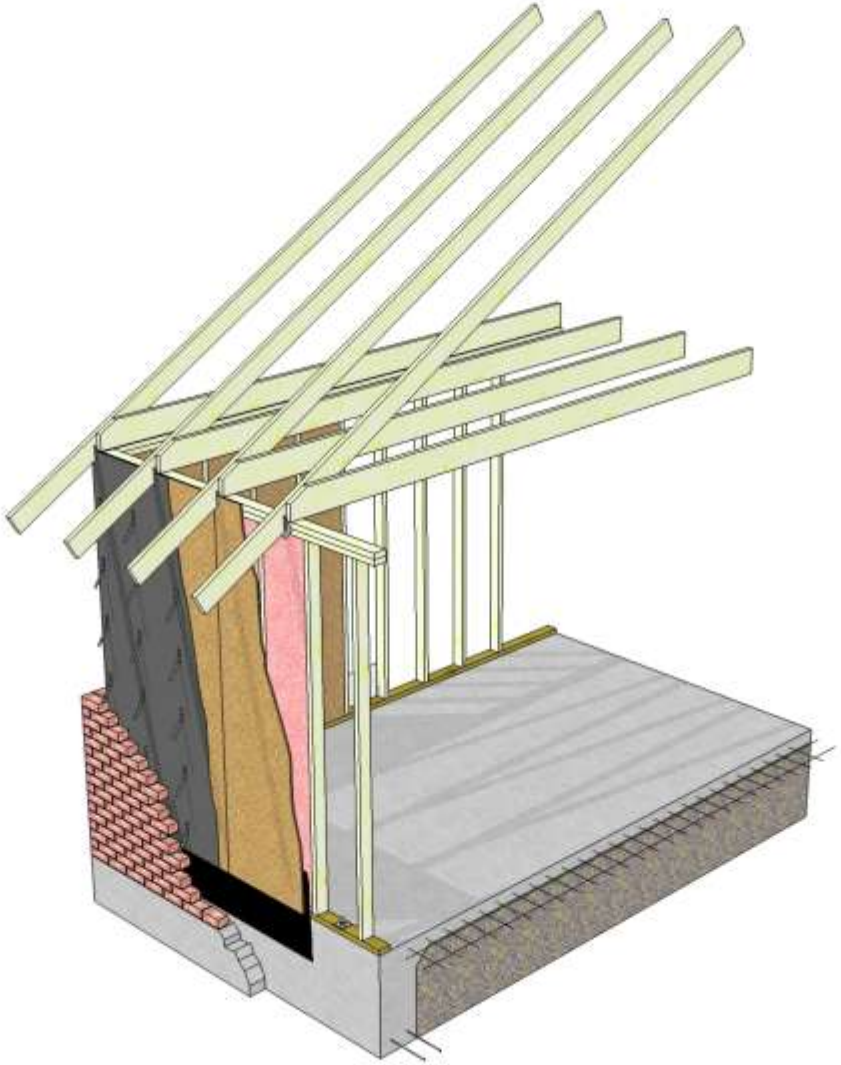
REBUILDING THE MISSISSIPPI GULF COAST. East Biloxi After Katrina.


Non-Flood Zone
Flood Zone
15′
14′
13′
12′
11′
10′
9′
8′
7′
6′
5′
4′
3′
2′
1′
Grade
Stem Walls
Concrete Masonry Unit Piers
Cast-in-Place Wood Piles*
Driven Wood Piles**
Poured Concrete Piers
GCCDS Recommendation
FEMA Recommendation
*Note: Cast-in-Place Wood Piles Not Researched By FEMA
**Note: Consult Specialist if Elevating Piles Above 10′



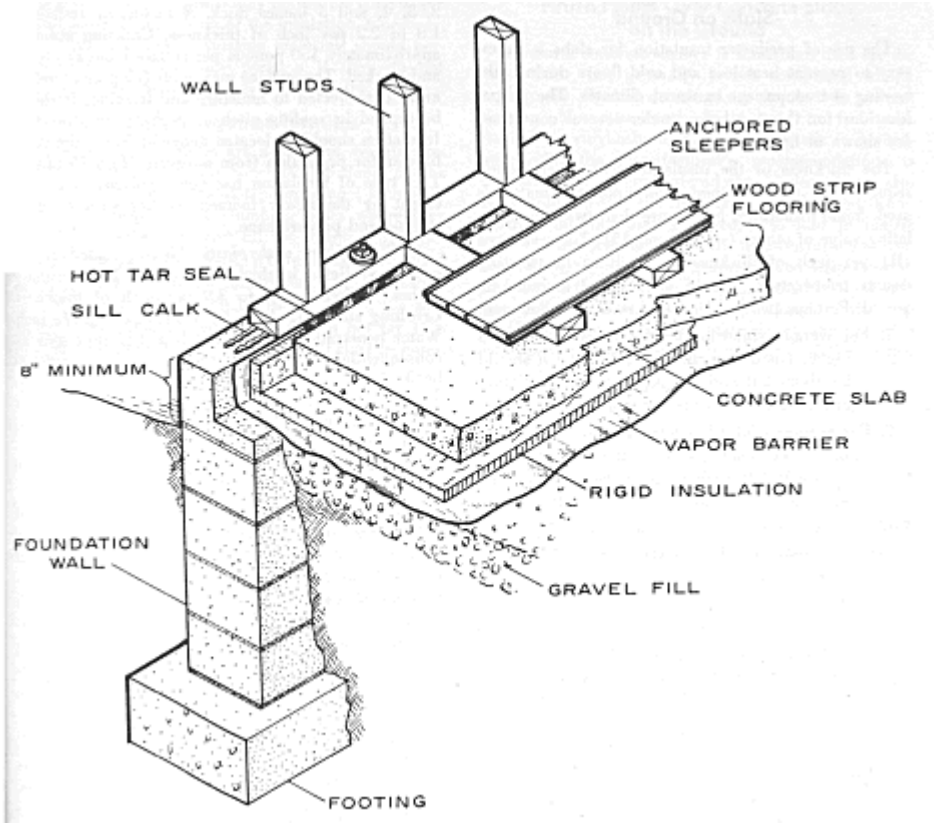
FOUNDATIONS: SLAB ON GRADE

RESILIENT FOUNDATIONS: STEM/CHAIN WALLS

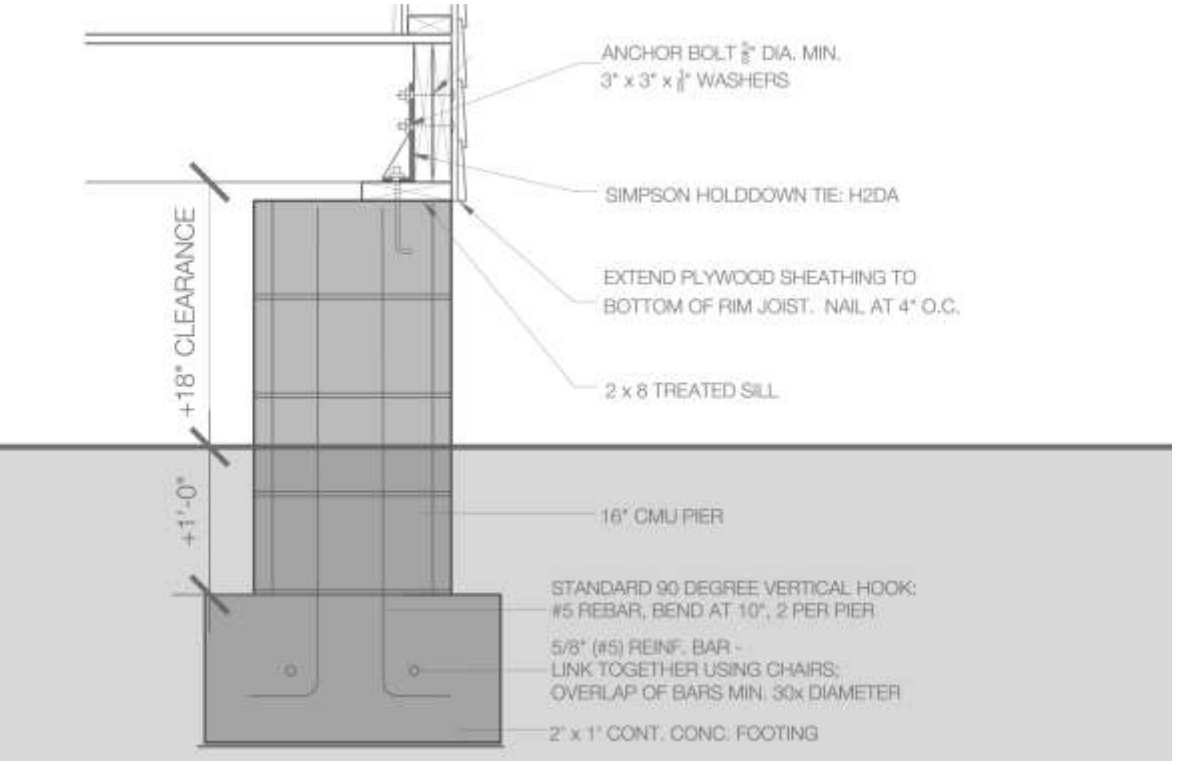
*APPROPRIATE FOR A ZONES AND ELEVATIONS BELOW 4’

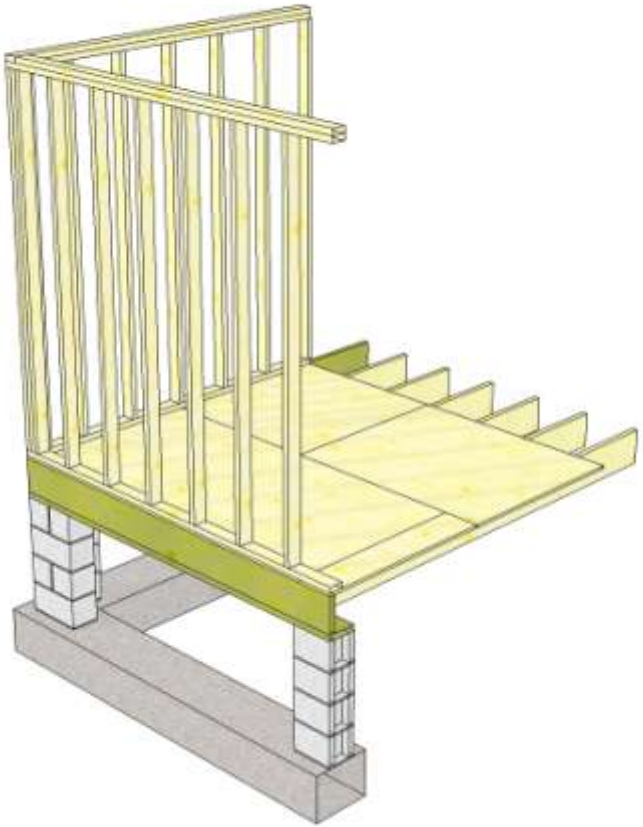
*INTERIOR MAY BE BACKFILLED AND A SLAB POURED ACROSS THE SURFACE

*IF LEFT UNFILLED, BUILDER SHOULD CONSULT LOCAL MUNICIPALITY ON THE SPACING AND SIZING OF VENTS REQUIRED BY LOCAL CODE.



RESILIENT FOUNDATIONS: STEM/CHAIN WALLS





RESILIENT FOUNDATIONS: CMU FOOTINGS

RESILIENT FOUNDATIONS: CMU FOOTINGS

*CMU PIERS REQUIRE LARGE AMOUNTS OF REINFORCEMENT TO RESIST LATERAL WIND AND FLOOD LOADS

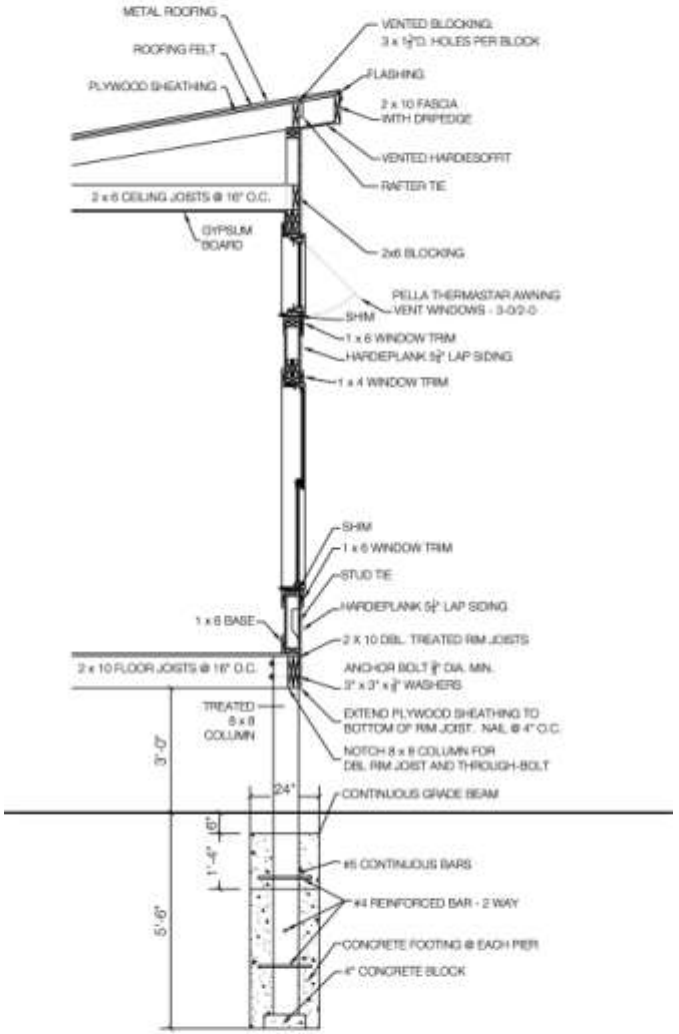
*EACH PIER BEARS ON A CONTINUOUS CONCRETE FOOTING BELOW THE SOIL.

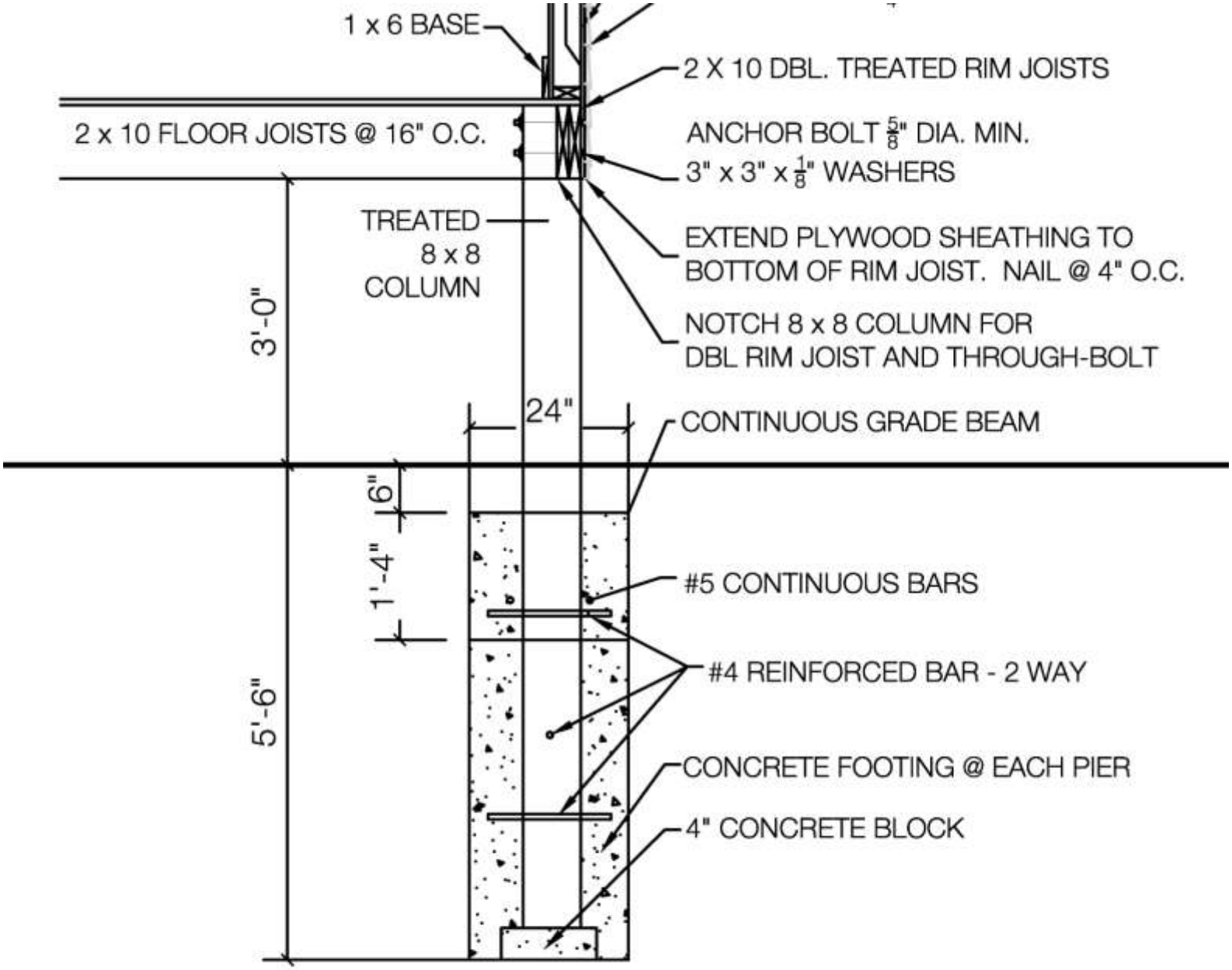
*HEIGHT SHOULD BE LIMITED TO AVOID FAILURE AND IS NOT RECOMMENDED FOR HIGH ELEVATIONS

RESILIENT FOUNDATIONS: CMU FOOTINGS


Bedroom
Bathroom
Closet
Master Bedroom
Porch
Living Room
Dining
Kitchen

FLOOR PLAN


METAL ROOFING
ROOFING FELT
PLYWOOD SHEATHING
VENTED BLOCKING
3 x ½" D. HOLES PER BLOCK
FLASHING
2 x 10 FASCIA WITH DRIPEDGE
VENTED HARDIESOFFIT
RAFTER TIE
2 x 6 CEILING JOISTS @ 16" O.C.
GYPSUM BOARD
2x6 BLOCKING
PELLA THERMASTAR AWNING VENT WINDOWS - 3-0/2-0
SHIM
1 x 6 WINDOW TRIM
HARDIEPLANK 5½" LAP SIDING
1 x 4 WINDOW TRIM
SHIM
1 x 6 WINDOW TRIM
STUD TIE
HARDIEPLANK 5½" LAP SIDING
1 x 6 BASE
2 X 10 DBL. TREATED RIM JOISTS
2 x 10 FLOOR JOISTS @ 16" O.C.
ANCHOR BOLT ½" DIA. MIN.
3" x 3" x ¼" WASHERS
TREATED 8 x 8 COLUMN
EXTEND PLYWOOD SHEATHING TO BOTTOM OF RIM JOIST. NAIL @ 4" O.C.
NOTCH 8 x 8 COLUMN FOR DBL RIM JOIST AND THROUGH-BOLT
3'-0"
24"
CONTINUOUS GRADE BEAM
1'-4"
16"
#5 CONTINUOUS BARS
#4 REINFORCED BAR - 2 WAY
5'-6"
CONCRETE FOOTING @ EACH PIER
4" CONCRETE BLOCK


1 x 6 BASE
2 X 10 DBL. TREATED RIM JOISTS
2 x 10 FLOOR JOISTS @ 16" O.C.
ANCHOR BOLT 5/8" DIA. MIN.
3" x 3" x 1/8" WASHERS
TREATED
8 x 8
COLUMN
EXTEND PLYWOOD SHEATHING TO
BOTTOM OF RIM JOIST. NAIL @ 4" O.C.
NOTCH 8 x 8 COLUMN FOR
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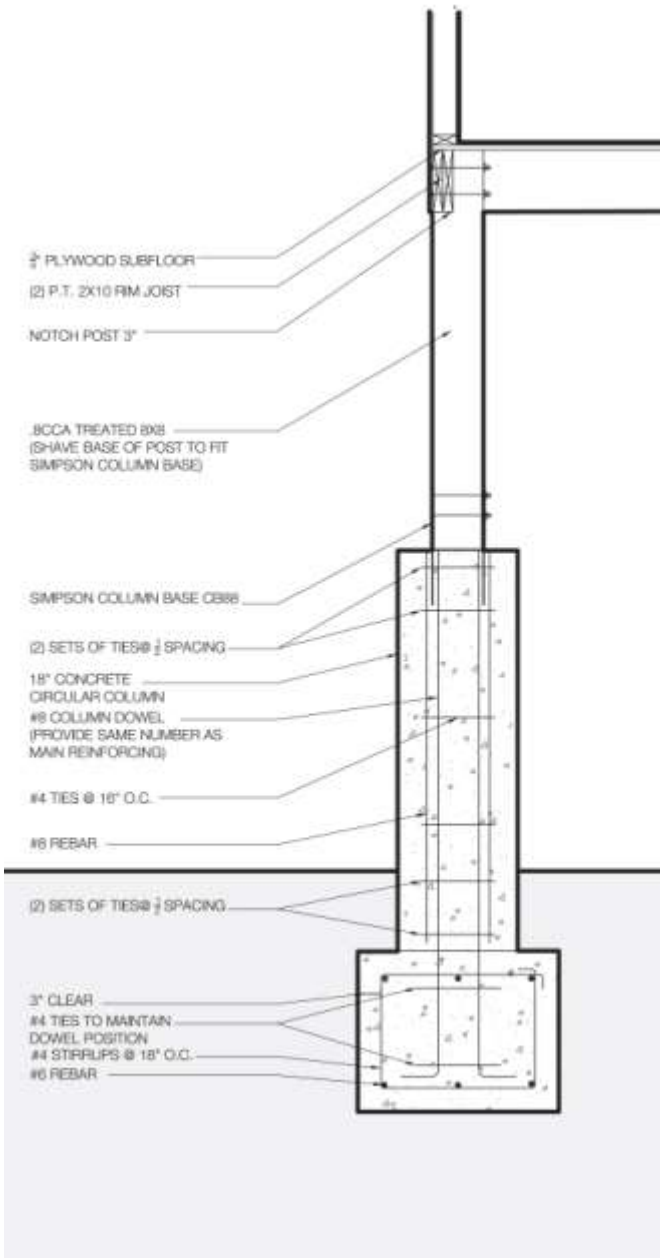
CONCRETE FOOTING @ EACH PIER
4" CONCRETE BLOCK



DEEP FOUNDATIONS- CONCRETE PIERS

*CAN BE ENGINEERED TO REACH HIGHEST ELEVATIONS

*CONCRETE GIVES THE GREATEST STRENGTH FOR ELEVATING IN FLOODPLANE

*PIERS FORM AN OPEN PLAN THAT IS LESS SUCCEPTABLE TO THE EFFECTS OF SCOUR.

*DRAWBACKS CAN BE AVAILABILITY OF CONTRACTORS ABLE TO EXECUTE ENGINEERING AND COST DIFFERENTIAL

DEEP FOUNDATIONS- CONCRETE PIERS

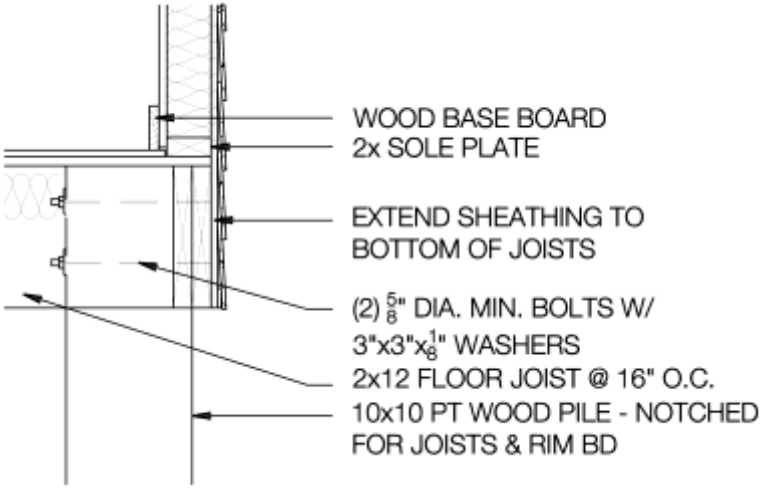
DEEP FOUNDATIONS- DRIVEN WOODEN PILES

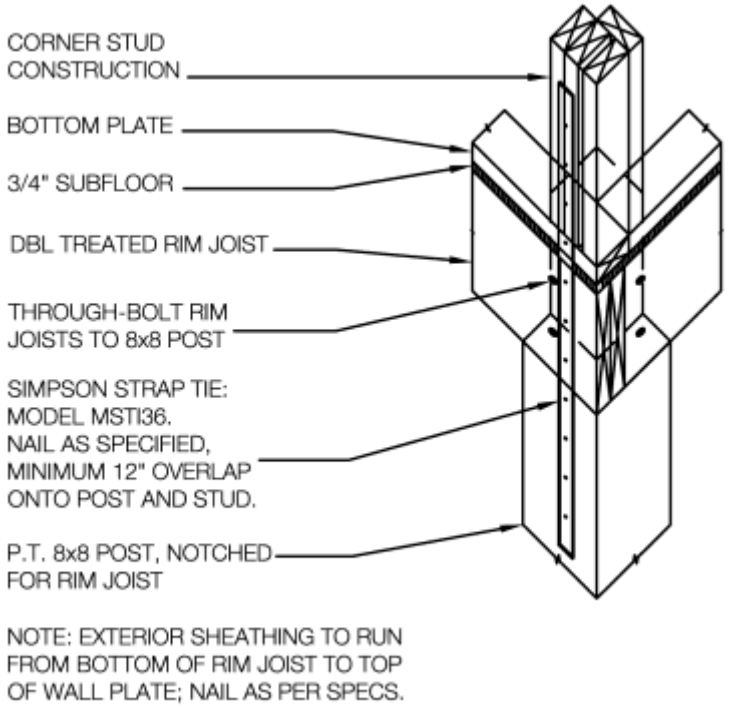
*WOODEN PILES ARE EASILY NOTCHED TO RECEIVE JOISTS, NO CONCRETE IS NEEDED.

*RELY ON FRICTION WITH TO RESIST GRAVITY AND UPLIFT

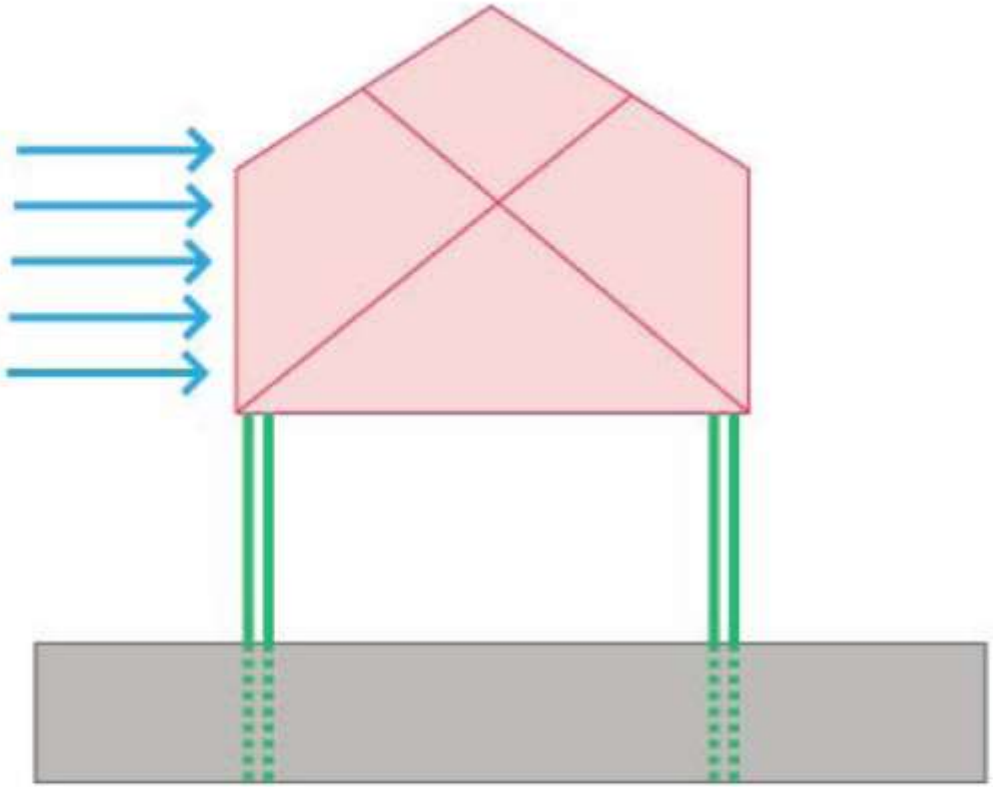
*PILES FORM AN OPEN PLAN THAT IS LESS SUCCEPTABLE TO THE EFFECTS OF SCOUR.

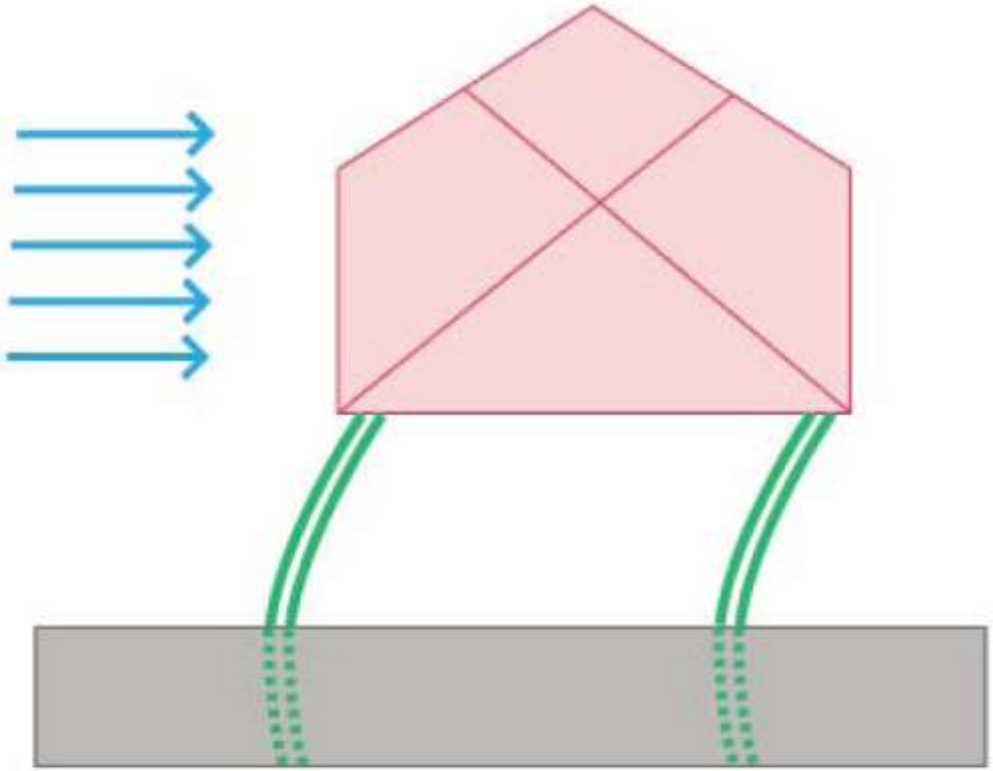
*DRIVEN BY A PNEUMATIC OR HYDRAULIC HAMMER UNTIL DETECTED RESISTANCE INDICATES THEY HAVE REACHED AN ACCEPTABLE BEARING CAPACITY.

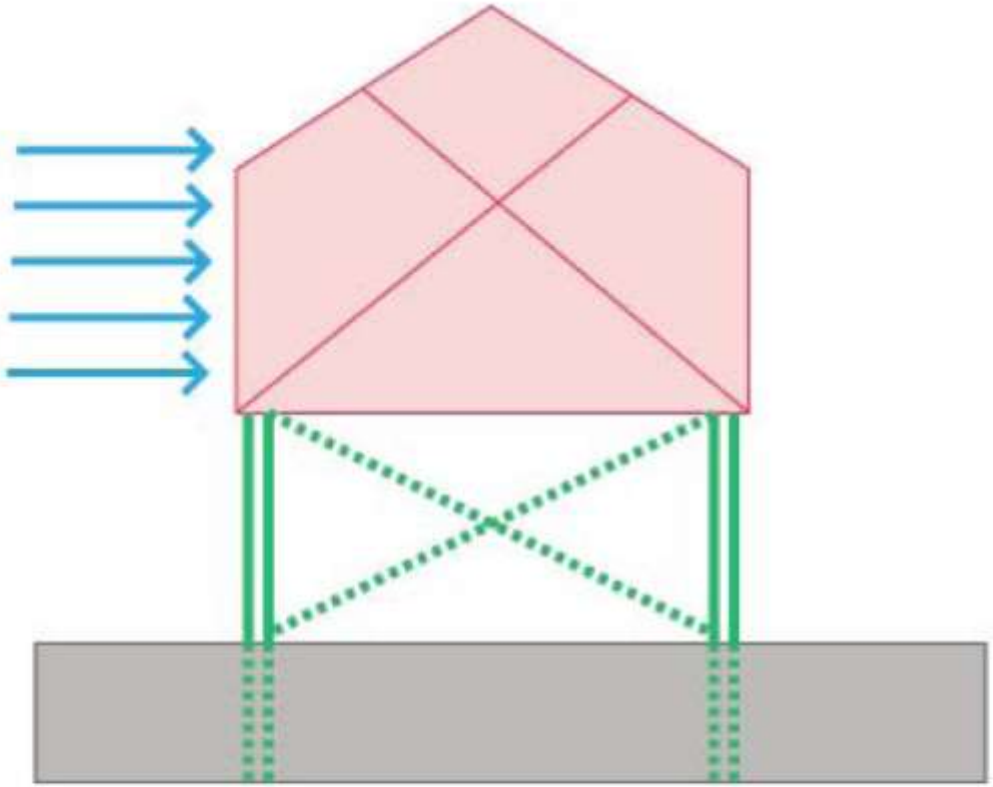


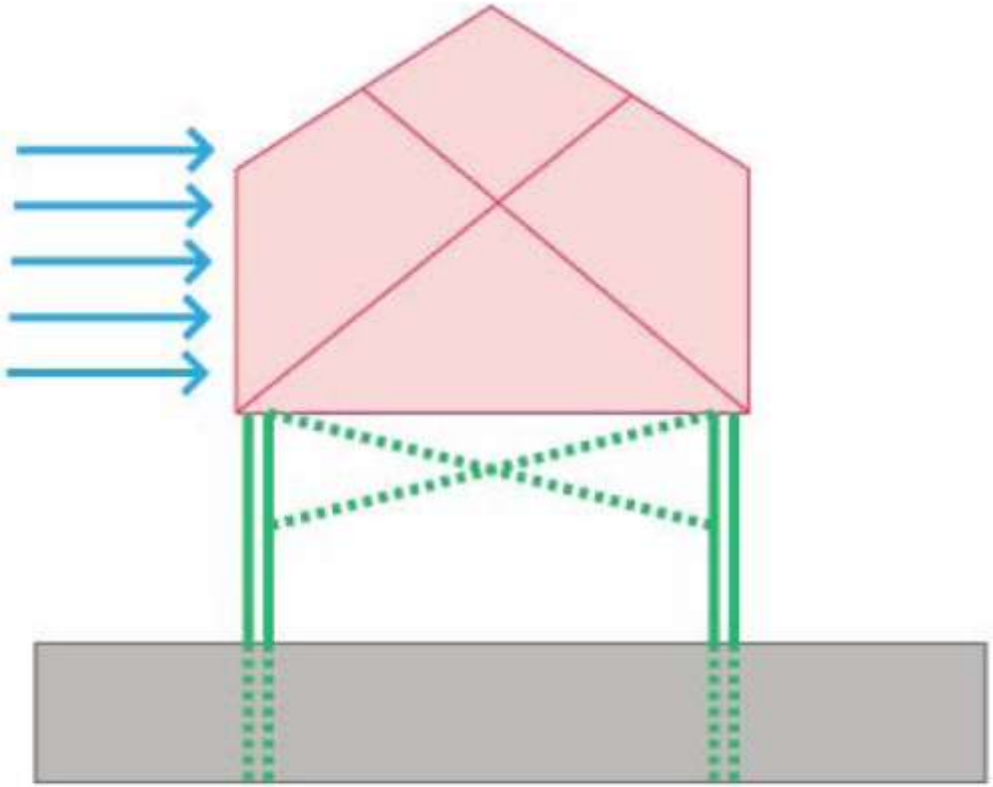


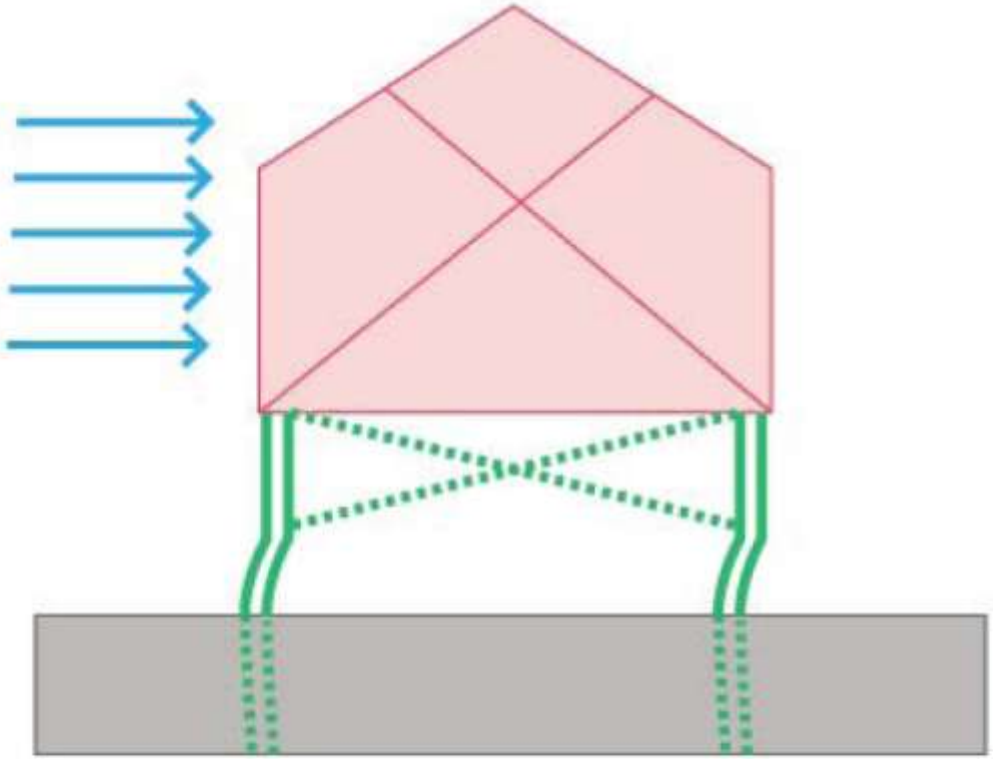
DEEP FOUNDATIONS- DRIVEN WOOD PILES

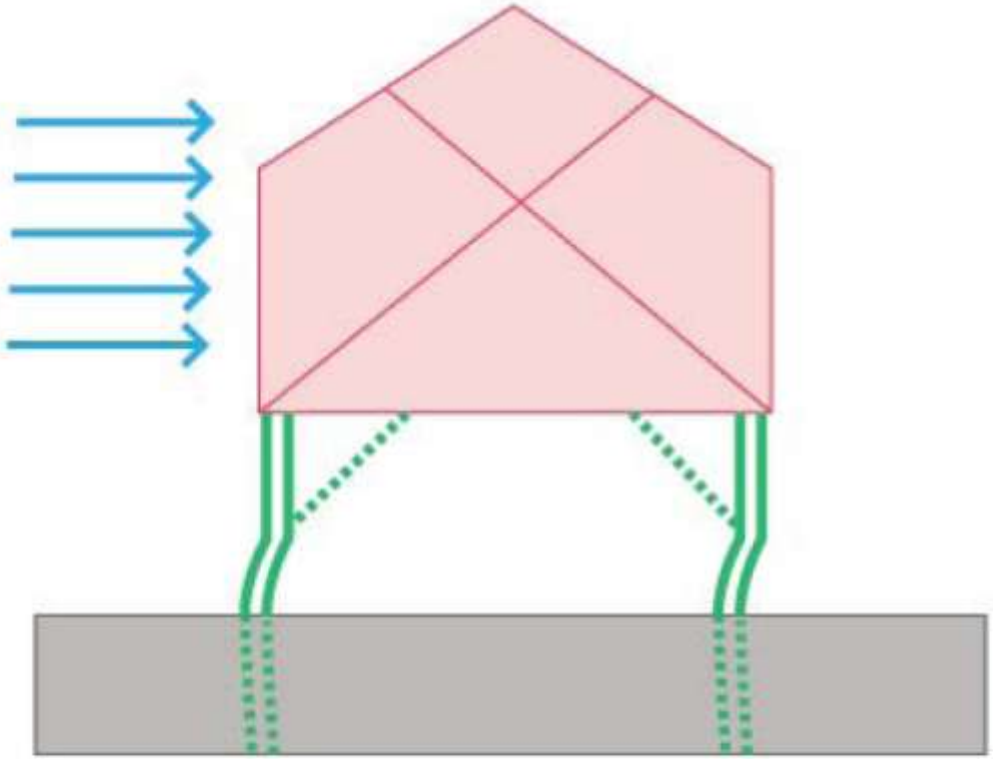


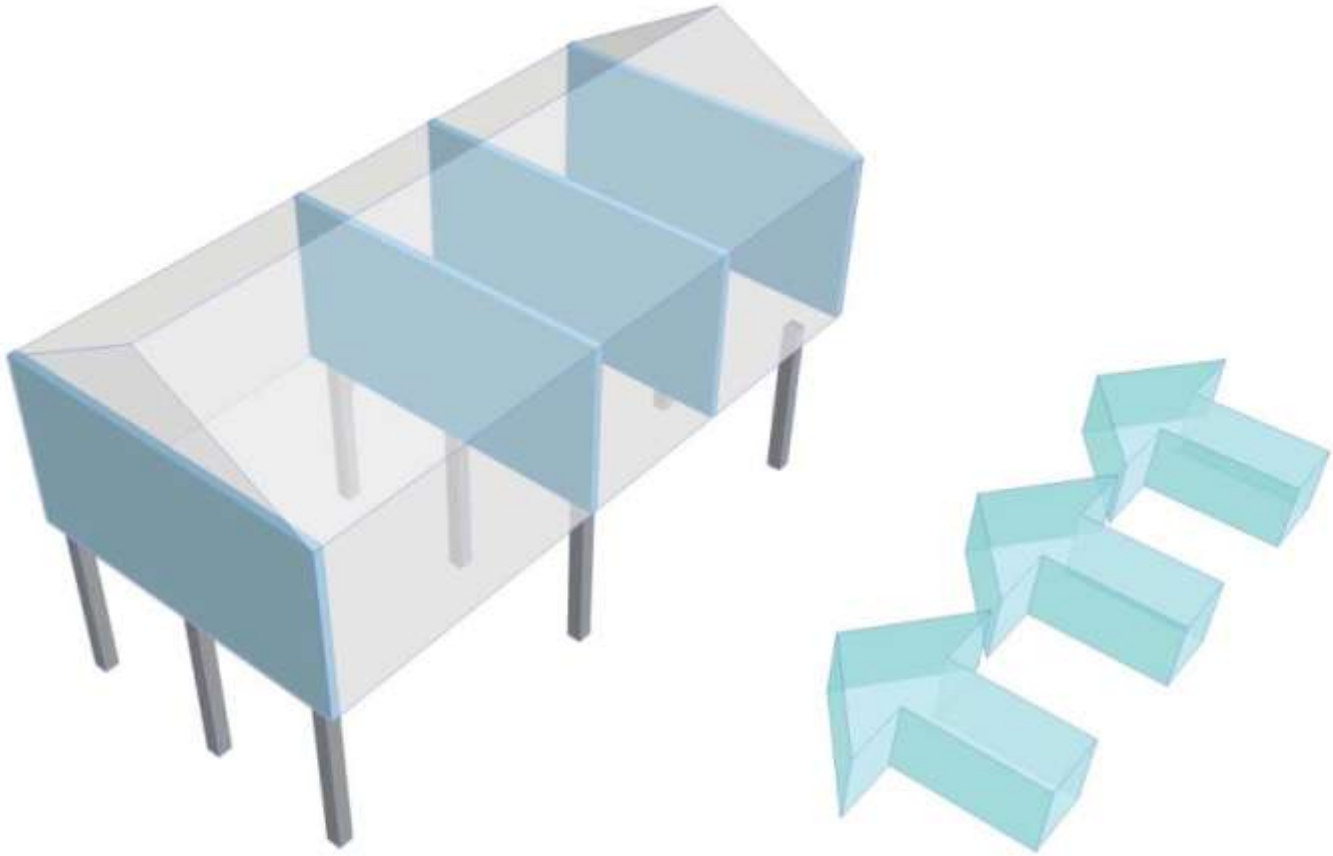


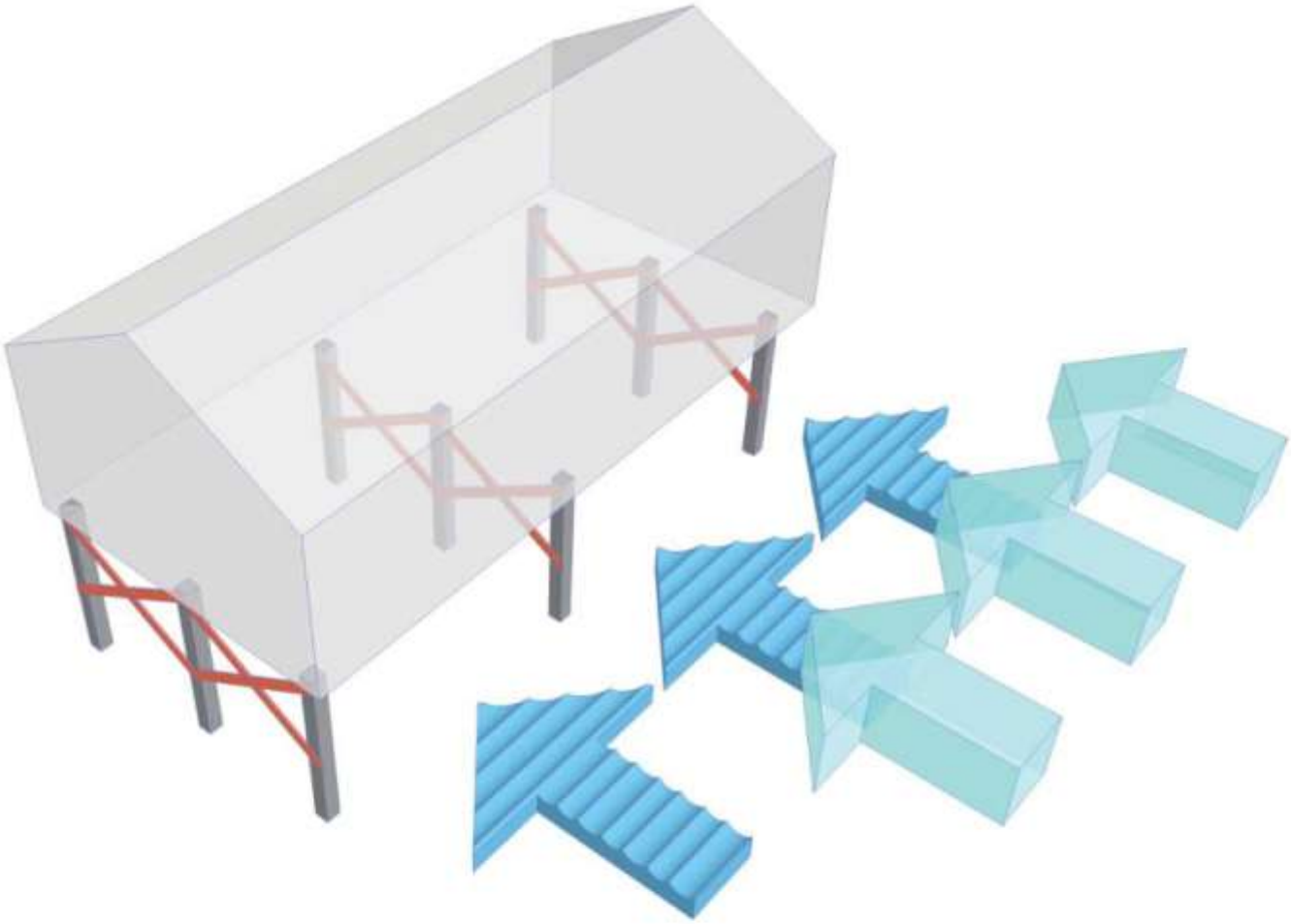




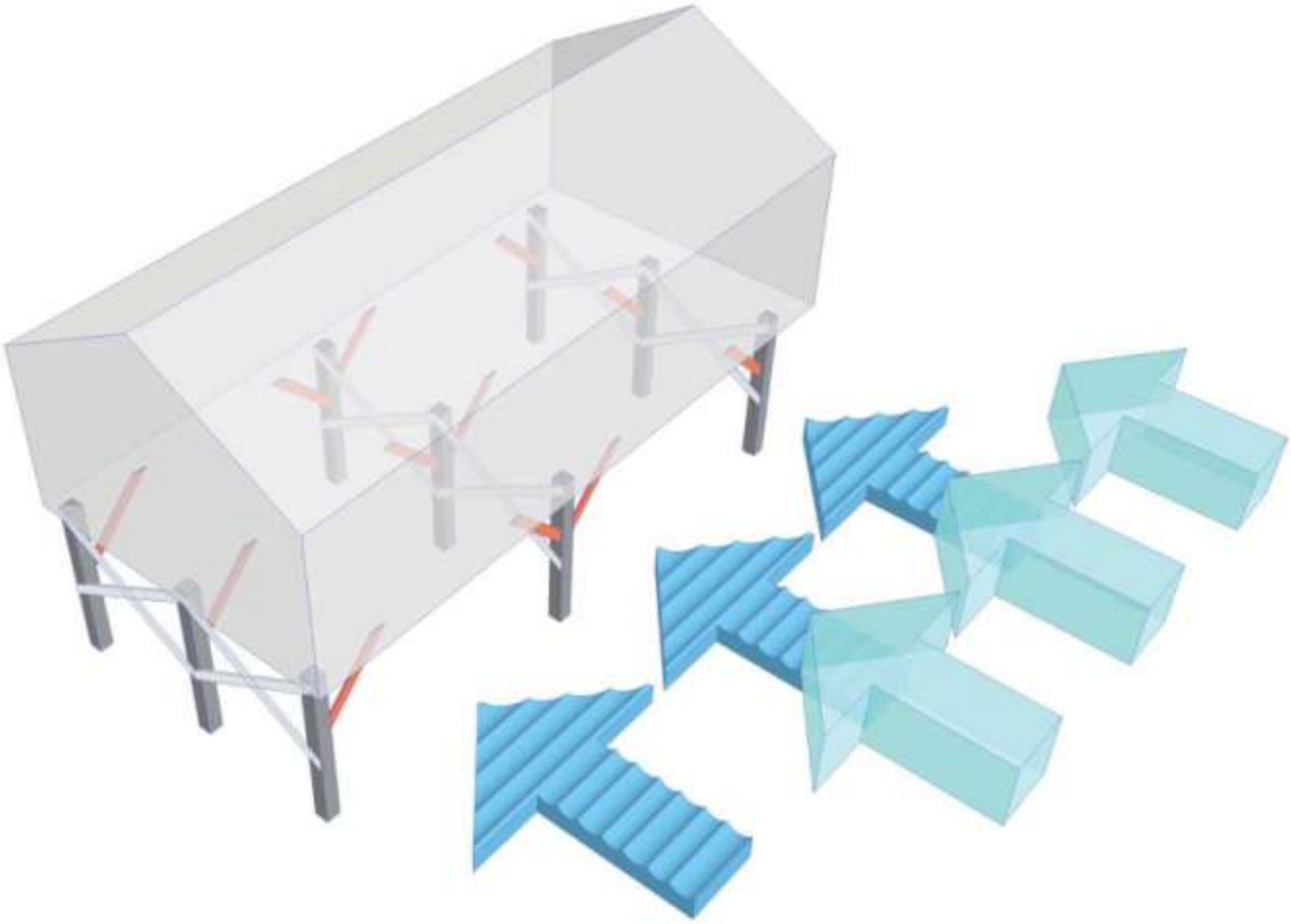








BRACING



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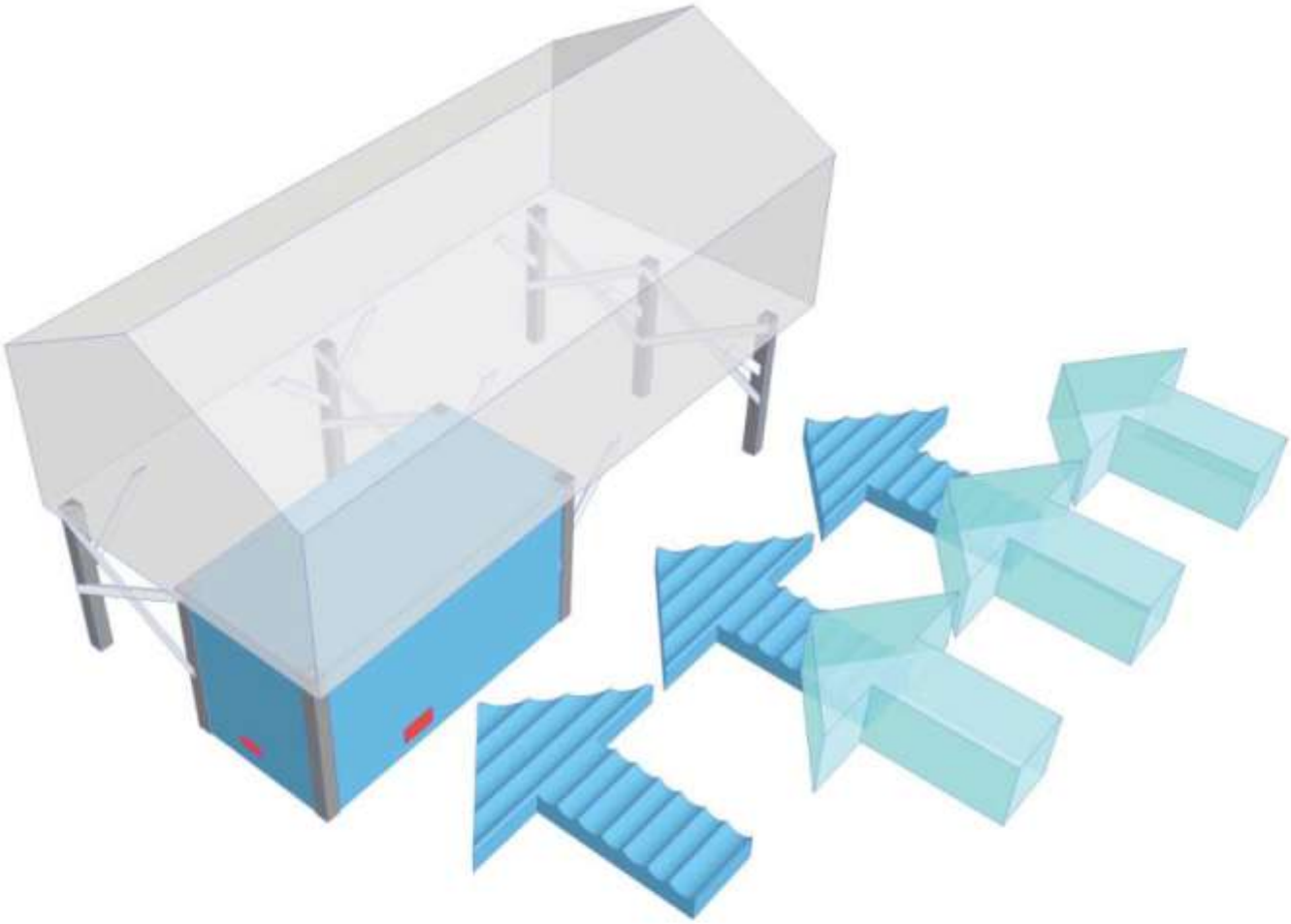

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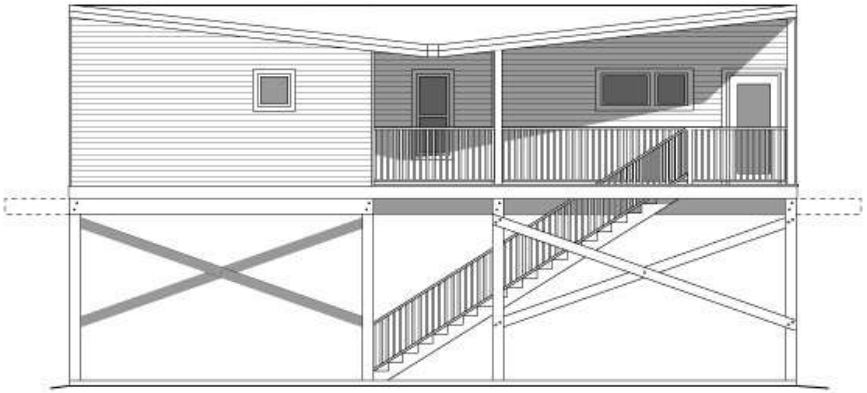

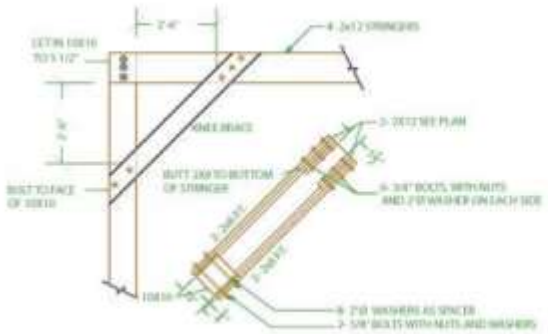

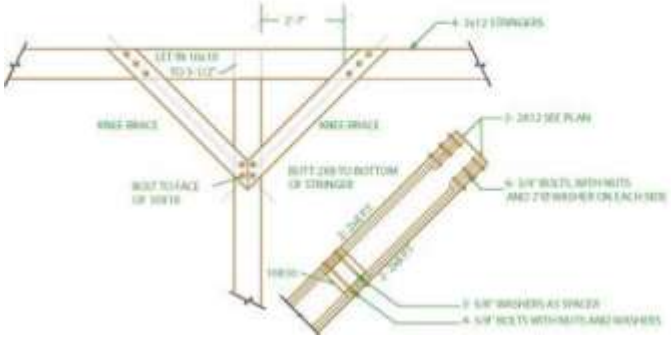

RESOURCES

SSTD 10-99: STANDARD FOR HURRICANE RESISTANT RESIDENTIAL CONSTRUCTION

SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL

ACSE 7-98: MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES

AMERICAN SOCIETY OF CIVIL ENGINEERS

FEMA COASTAL CONSTRUCTION MANUAL

INTERNATIONAL BUILIDNG CODE - IBC 2003/2006