MANTELLA HOMES:
AMPHIBIOUS HOUSING FOR THE NEW NORMAL

THE QUESTION OF WHETHER OR NOT TO REBUILD IN SUCH A HIGHLY VULNERABLE AREA IS OFTEN PREDICATED ON THE DESIRE TO RE-ESTABLISH THE SENSE OF COMMUNAL LIVING BORNE OF THE RELATIONSHIPS FORGED AMONGST THE RESIDENTS AND EVIDENT IN THE ARCHITECTURE OF PROXIMAL LIVING OF THIS ONCE FISHING COMMUNITY. THE RELATIONSHIP BETWEEN THE PEOPLE IS HEAVILY RELIANT ON THE INTERRELATIONSHIP BETWEEN THEIR HOMES AND AS SUCH, THE RELEVANCE OF OF THE AFFINITY BETWEEN A HOUSE AND THE GROUND BECOMES VITAL. A VIABLE ALTERNATIVE TO PERMANENT STATIC ELEVATION IS AMPHIBIOUS HOUSING. UNLIKE FLOATING HOMES, AN AMPHIBIOUSHOUSE IS SECURED ON THICK, TELESCOPING STEEL POSTS INSERTED INTO CONCRETE PILES COMMON IN BEACHFRONT CONSTRUCTION. THIS OPTION AFFORDS THE SAFETY SOUGHT BY THE NEW FEMA REGULATIONS WHILE PRESERVING THE “COTTAGE CULTURE” OF COASTAL COMMUNITIES BY PROVIDING A BUOYANT FOUNDATION WHICH ALLOWS THE HOME TO SIT AT GRADE DURING NORMAL CONDITIONS AND TO ELEVATE WITH RISING WATER LEVELS AND LOWER AGAIN AS THE LEVELS RECEDE. A SIMILAR LOGIC CAN BE APPLIED TO WALKWAYS THAT COULD RISE FROM THE GROUND TO RETAIN THE CONNECTIVE INFRASTRUCTURE LOST DURING NATURAL DISASTERS. PLANTERS THAT FLOAT COULD ACT AS ARMOR FROM FLOATING DEBRIS AND PROVIDE THE VISUAL COMFORT OF THE FAMILIAR IN A TIME OF CRISIS. ADAPTABILITY BECOMES THE NEW NORMAL.

GROUND FLOOR MASTER PLAN

WATERFRONT PATH

- CONTINUOUS PATH FOR WALKING, BIKING, RUNNING AND EXCERCISE ROUTE
- PROVIDES WATERFRONT CONTINUITY + RIVERFRONT ACCESSIBILITY
- PROVIDES REST AREAS WITH BENCHES + OPPRTUNITIES FOR VISTAS

NEIGHBORHOOD PARK

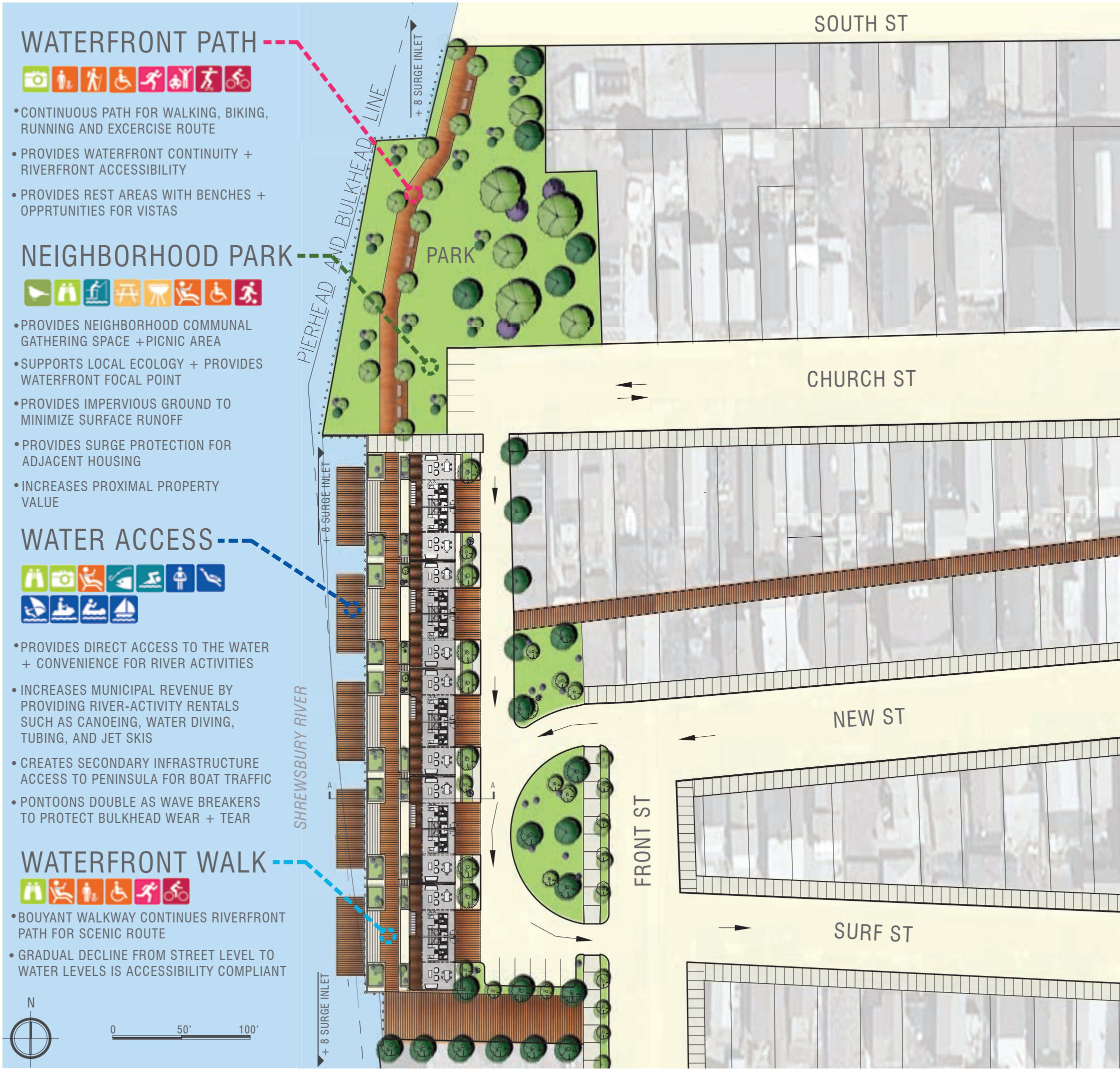
- PROVIDES NEIGHBORHOOD COMMUNAL GATHERING SPACE +PICNIC AREA
- SUPPORTS LOCAL ECOLOGY + PROVIDES WATERFRONT FOCAL POINT
- PROVIDES IMPERVIOUS GROUND TO MINIMIZE SURFACE RUNOFF
- PROVIDES SURGE PROTECTION FOR ADJACENT HOUSING
- INCREASES PROXIMAL PROPERTY VALUE

WATER ACCESS

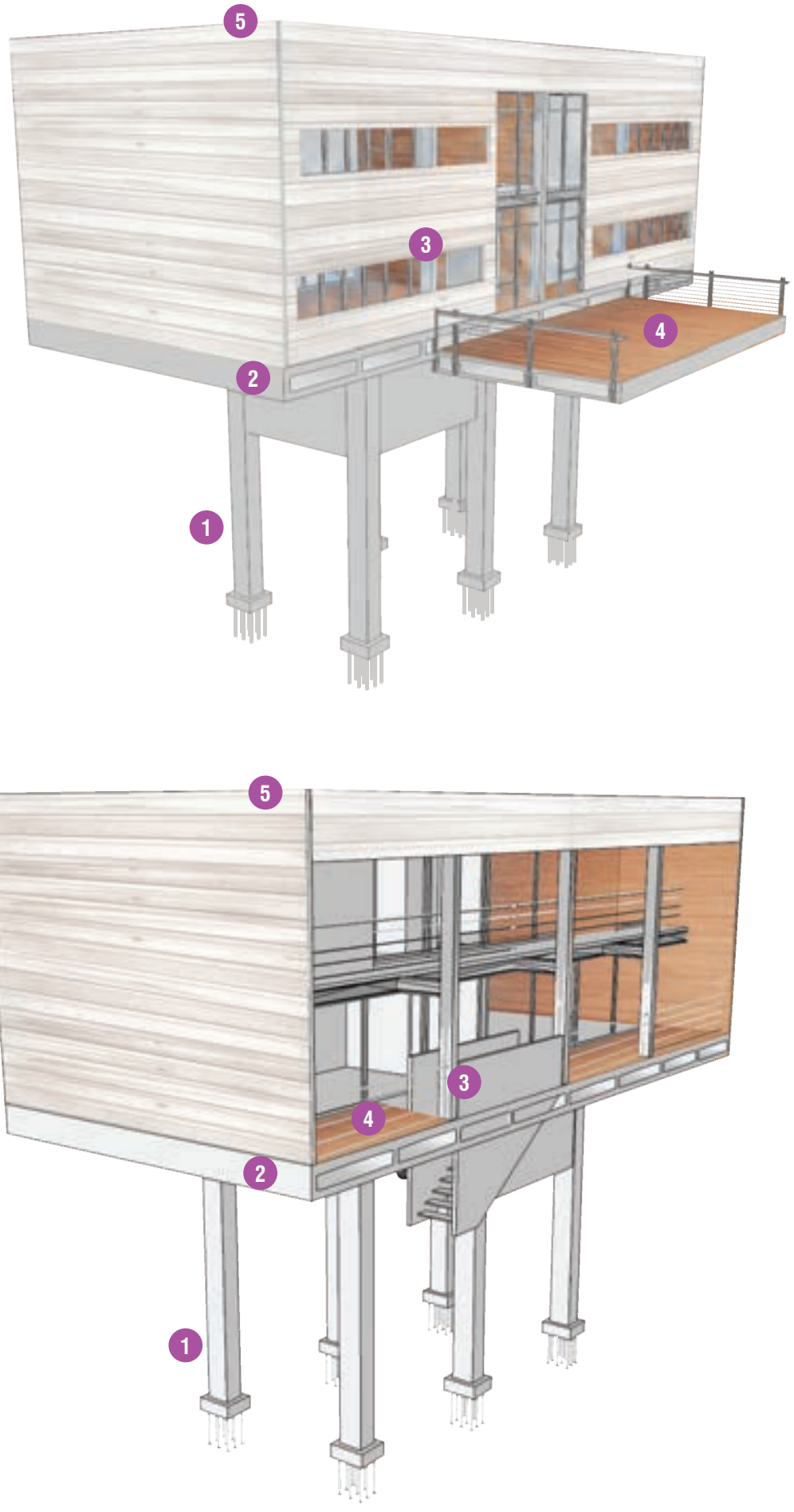
- PROVIDES DIRECT ACCESS TO THE WATER + CONVENIENCE FOR RIVER ACTIVITIES
- INCREASES MUNICIPAL REVENUE BY PROVIDING RIVER-ACTIVITY RENTALS SUCH AS CANOEING, WATER DIVING, TUBING, AND JET SKIS
- CREATES SECONDARY INFRASTRUCTURE ACCESS TO PENINSULA FOR BOAT TRAFFIC
- PONTOONS DOUBLE AS WAVE BREAKERS TO PROTECT BULKHEAD WEAR + TEAR

WATERFRONT WALK

- BOUYANT WALKWAY CONTINUES RIVERFRONT PATH FOR SCENIC ROUTE
- GRADUAL DECLINE FROM STREET LEVEL TO WATER LEVELS IS ACCESSIBILITY COMPLIANT



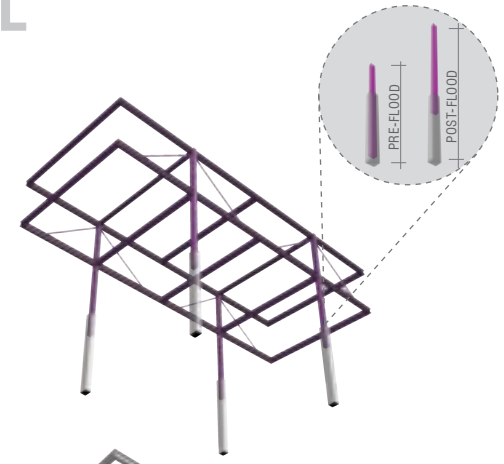
BUILDING ENVENLOPE



5 POINTS TOWARD A NEW NORMAL

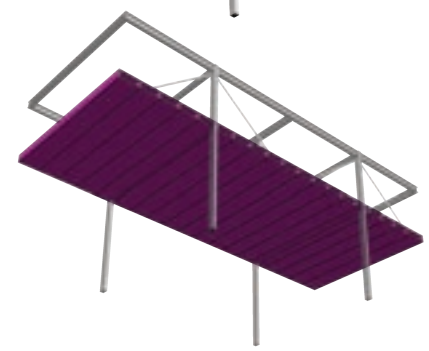
1 TELESCOPING SUPPORTS

ALLOWS THE HOME TO RETAIN A RELATIONSHIP WITH THE GROUND PLANE WHILE PROVIDING THE RANGE OF VERTICAL MOTION TO ALLOW THE FOUNDATION TO RISE WITH THE WATER LEVEL WHILE PROTECTING THE COLUMNS FROM PROLONGED WIND VULNERABILITY.



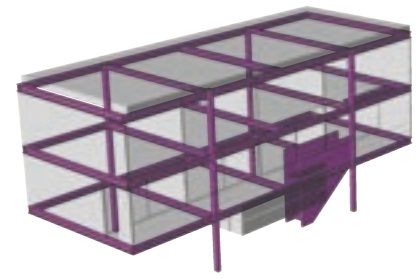
2 BOUYANT FOUNDATION

EPS FOAM ORGANIZED IN A CLOSED CELL STRUCTURE CONTAINING 98% AIR MAKING IT BOUYANT. THE FOAM IS COVERED IN CONCRETE TO PROTECT IT FROM INSECTS AND ENVIRONMENTAL DEGREDATION AS WELL AS TO REINFORCE THE STRUCTURE OF THE HOME.



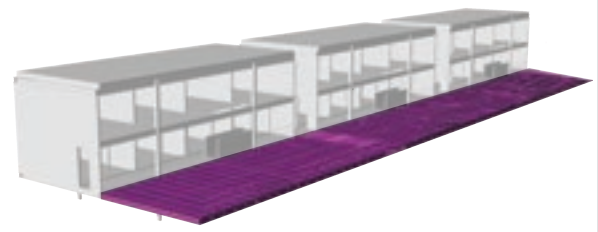
3 THE BUMPER

REINFORCED FRAMING PROTECTS THE HOME FROM PROJECTILE HAZARDS INCLUDING FLOATING AND AIRBORNE DEBRIS THAT CAN COLLIDE WITH THE EXTERIOR OF THE HOME DURING A DISASTER EVENT. IN ADDITION, IT HELPS TO STABALIZE THE STRUCTURE DURING HIGH WINDS.



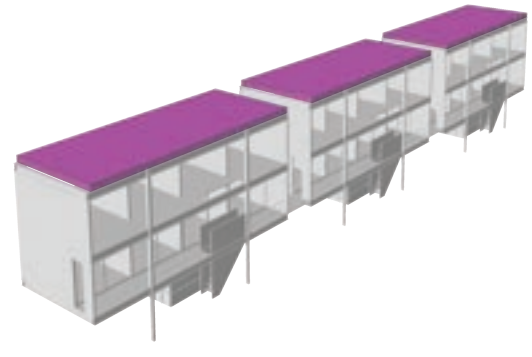
4 THE SUPER PORCH

A FLOATING WALKWAY THAT PERFORMS AS A SIDEWALK DURING NORMAL CONDITIONS AND DOUBLES AS A FLOATING DOCK DURING FLOODING EVENTS. PERMITTING THE INFRASTRUCTURE TO FLOAT WITH THE HOMES PROVIDES NORMALCY & ACCESSABILITY DURING STROMS.

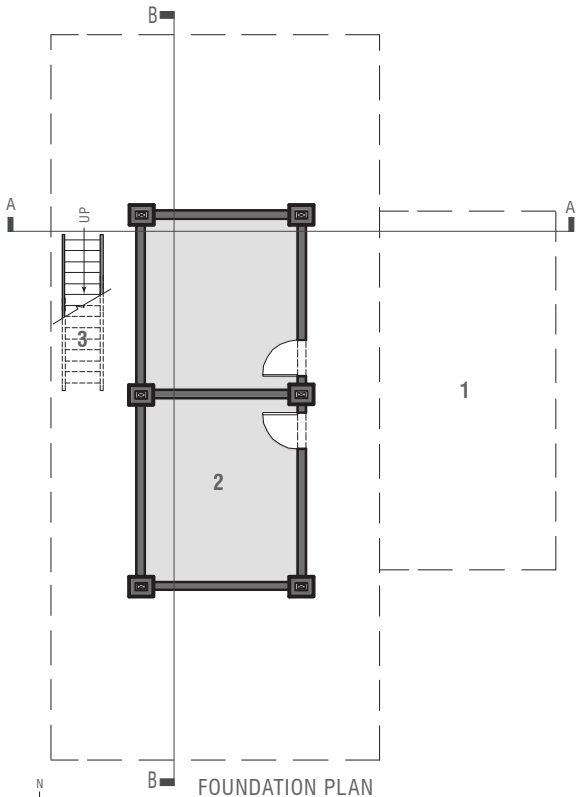


5 THE GREEN ROOF

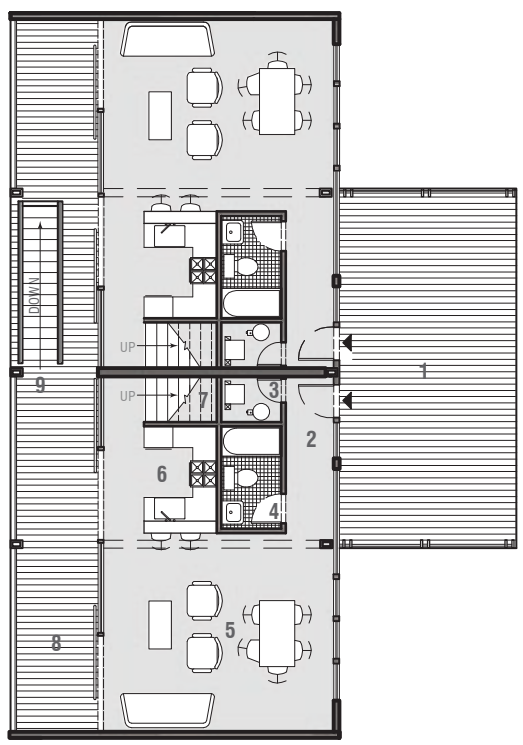
DIMINISHES STORM RUNOFF WHICH CONTRIBUTES TO FLOODING EVENTS + PROVIDES RECREATIONAL SPACE DURING EXTENDED FLOODING PERIODS. IT ALSO PROVIDES A SECONDARY CONNECTIVE LAYER ABOVE THAT OF THE WALKWAY.



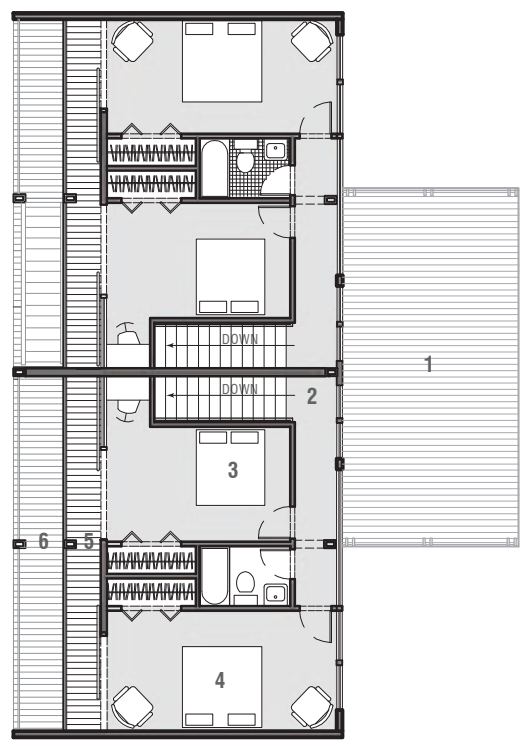
UNIT PLANS - TYPICAL



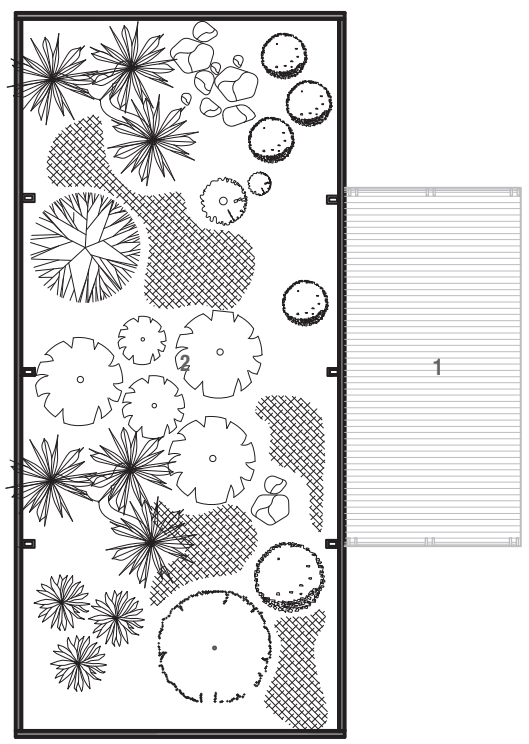
FOUNDATION PLAN
SCALE: 1/16" = 1'-0"



GROUND FLOOR PLAN
SCALE: 1/16" = 1'-0"



SECOND FLOOR PLAN
SCALE: 1/16" = 1'-0"



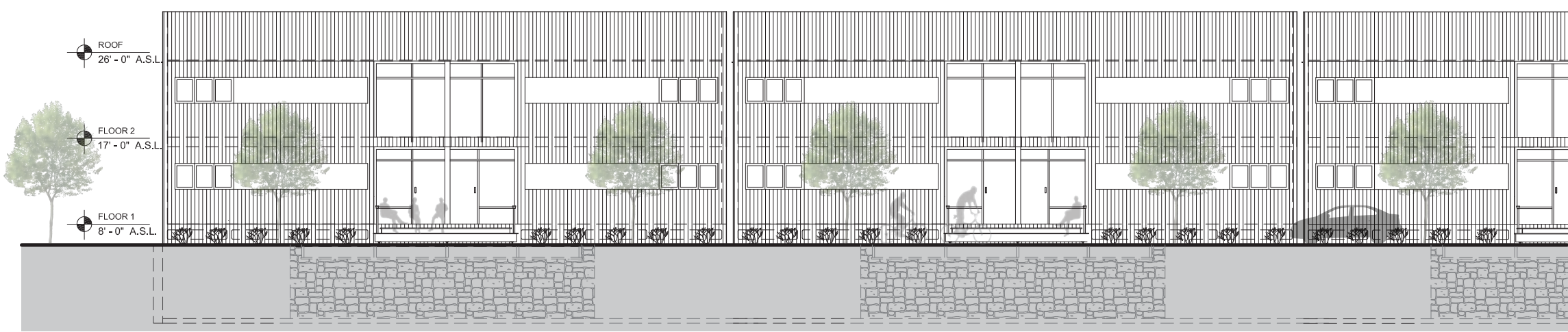
ROOF PLAN
SCALE: 1/16" = 1'-0"

1 ENTRY PORCH ABOVE
2 STORAGE W/ BLOWOUT WALLS
3 STAIRS TO MAIN LEVEL

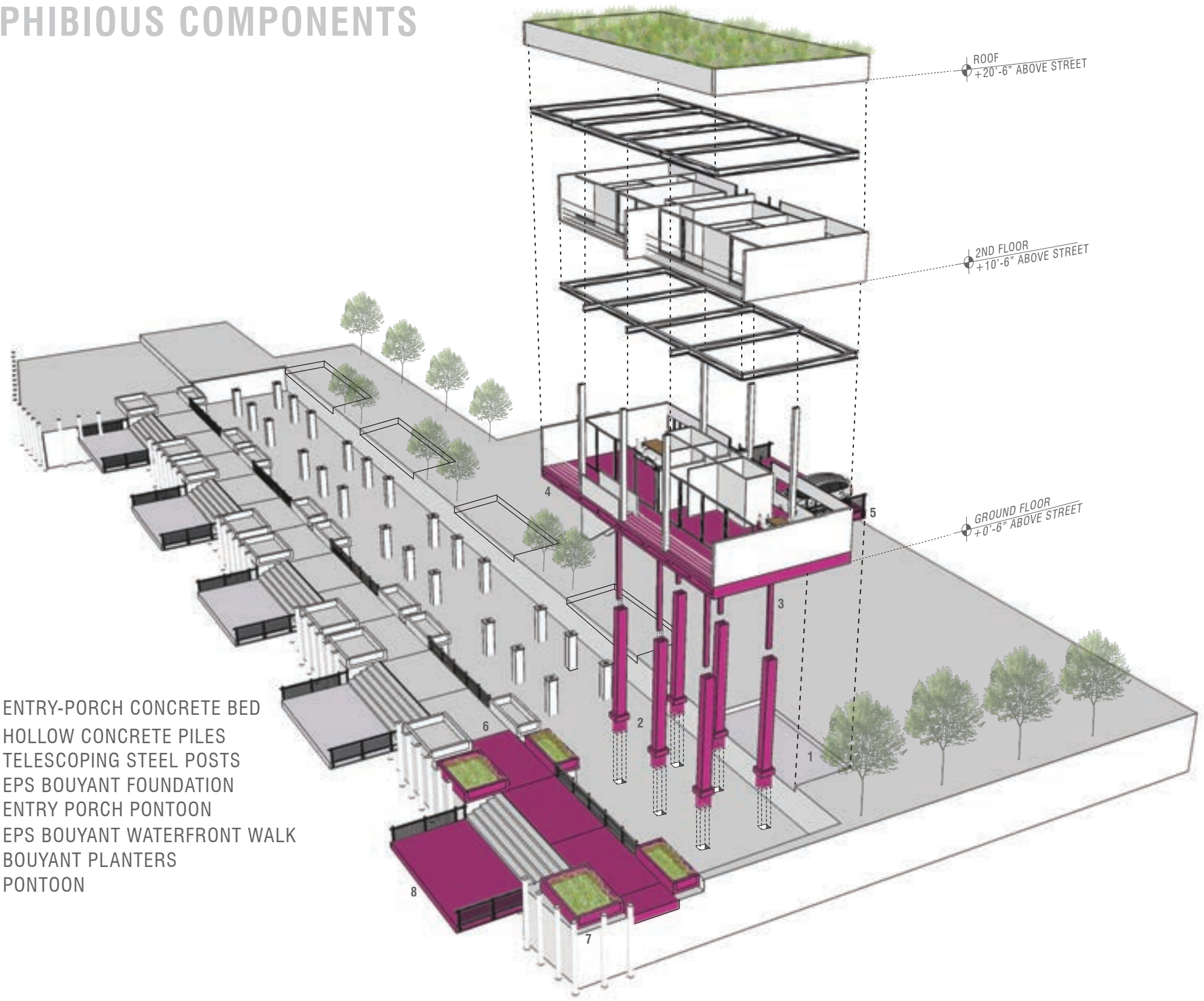
1 ENTRY PORCH/CAR PONTOON
2 ENTRY FOYER
3 MECHANICAL ROOM
4 BATHROOM
5 LIVING ROOM/DINING ROOM
6 KITCHEN
7 STAIRS TO SECOND LEVEL
8 SHARED REAR PORCH
9 STAIRS TO SUB-GRADE LEVEL

1 ENTRY PORCH BELOW
2 STAIRS TO DOWNSTAIRS
3 BEDROOM
4 MASTER BEDROOM
5 PRIVTE BEDROOM BALCONY
6 SHARED PORCH BELOW

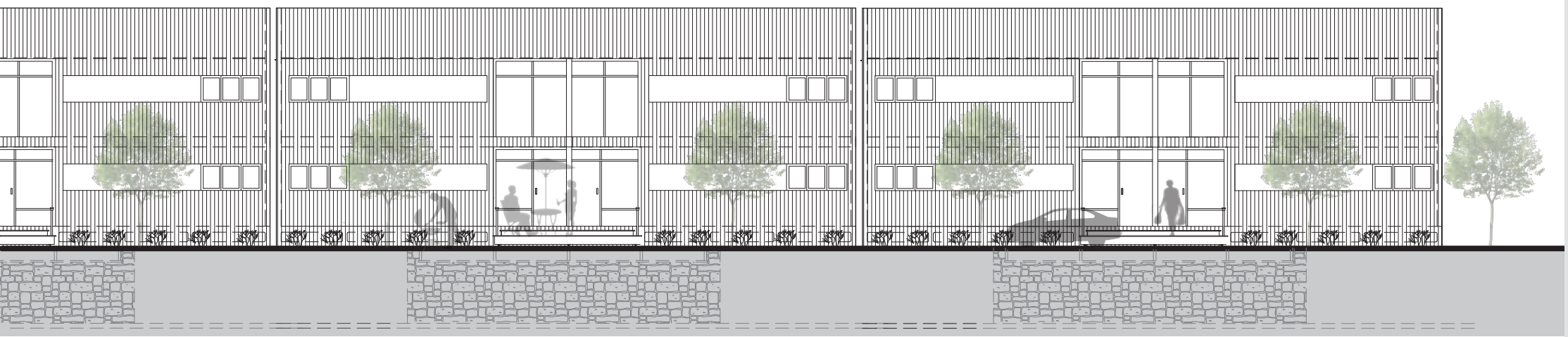
1 ENTRY PORCH BELOW
2 ROOF GARDEN



AMPHIBIOUS COMPONENTS

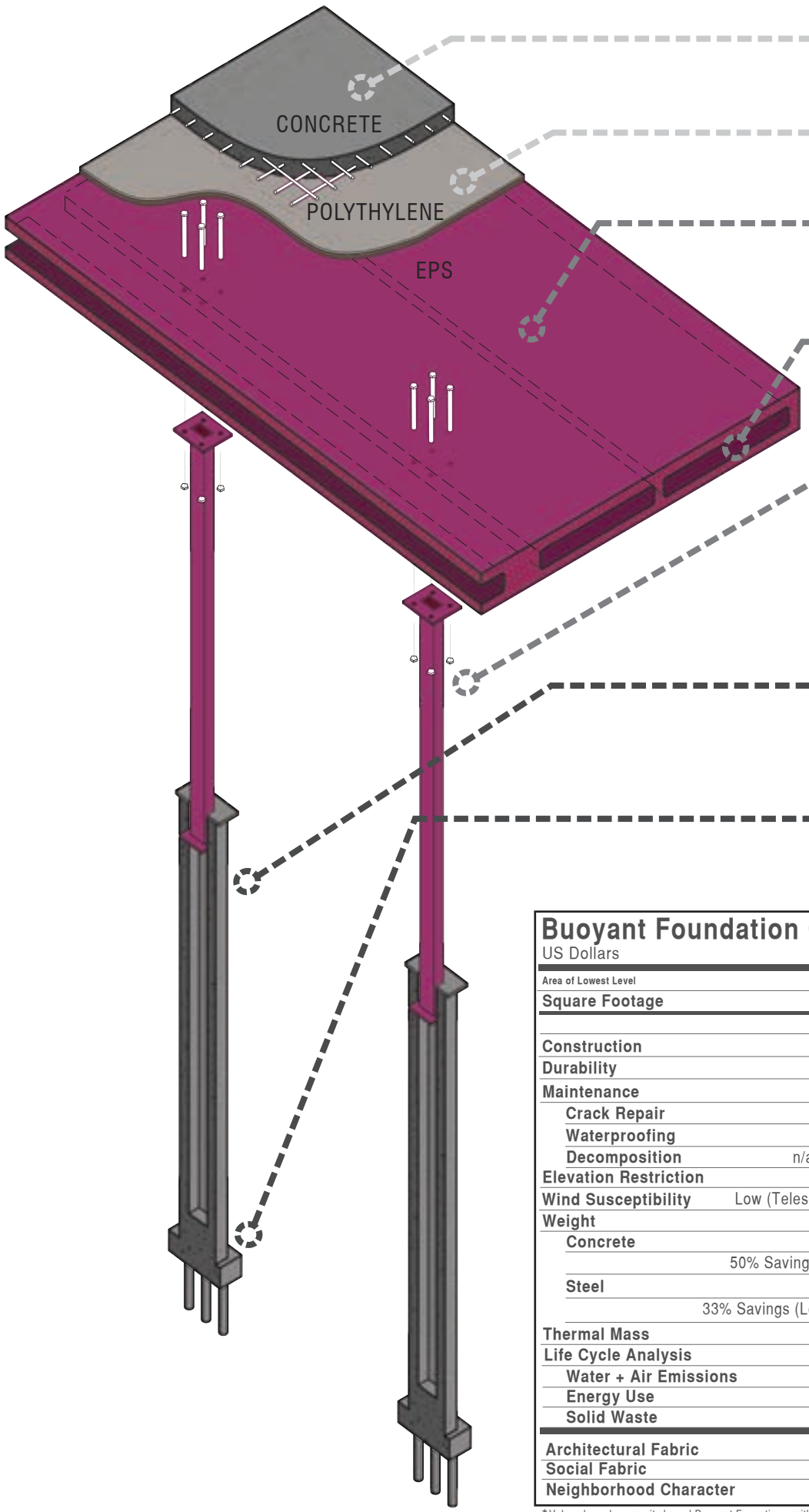


1 ENTRY-PORCH CONCRETE BED
2 HOLLOW CONCRETE PILES
3 TELESCOPING STEEL POSTS
4 EPS BOUYANT FOUNDATION
5 ENTRY PORCH PONTOON
6 EPS BOUYANT WATERFRONT WALK
7 BOUYANT PLANTERS
8 PONTOON



EAST ELEVATION

BUOYANT FOUNDATION EXPLAINED



COATING

2" THICK CONCRETE COATING OF 2000# MIX TO PROTECT EPS FROM POTENTIAL DEGRADATION DUE TO CHEMICALS AND INSECTS

1.25" THICK POLYTHYLENE COATING TO QUADRUPLE THE LIFESPAN OF THE EPS

BUOYANT STRUCTURE

EXPANDED POLYSTYRENE GEOFOAM FOUNDATION(EPS)-SUBMEREGED EPS ONLY ABSORBS ABOUT 7% WATER; CONTAINS NO CFCs

EPS CONSISTS OF "PEARLS" OR A CLOSED CELL STRUCTURE, WHICH CONSISTS OF APPROXIMATELY 98% AIR WHICH ACCOUNTS FOR ITS BUOYANCY

GRAVITY BASED TELESCOPING SUPPORTS MADE OF SURGE RESISTENT STEEL ARE ATTACHED TO THE UNDERSIDE OF THE BUOYANT FOUDATION + INSTERTED INTO HOLLOW CONCRETE PYLONS; END STOPPERS PREVENT SEPARATION OF THE TWO

FOUNDATION

HOLLOWED OUT CONCRETE PYLONS ANCHOR THE TELESCOPING SUPPORTS IN PLACE AND THE INNER CAVITY ALLOWS VERTICAL TRANSALTION TO OCCUR

FOOTINGS ANCHORED TO ROCKBED

Buoyant Foundation Cost*

US Dollars — 2012 Relative Value

Area of Lowest Level	
Square Footage	1500sf
	For EPS GeoFoam
Construction	$20-25k
Durability	80-100+yrs
Maintenance	Low
Crack Repair	n/a (no freeze/thaw cycle)
Waterproofing	100% Impermeable
Decomposition	n/a (not affected by saltwater)
Elevation Restriction	n/a**
Wind Susceptibility	Low (Telescoping Columns Protected)
Weight	Low***
Concrete	18.4yd^3 [14m^3]
	50% Savings (Due to Air Cell Structure)
Steel	4070 lb [1850kg]
	33% Savings (Less Concrete = Less Rebar)
Thermal Mass	High Insulative Properties
Life Cycle Analysis	Resilient****
Water + Air Emissions	2-9% Reduction
Energy Use	3-14% Reduction
Solid Waste	5-21% Net Reduction
Architectural Fabric	Preserved
Social Fabric	Preserved
Neighborhood Character	Preserved

*Values based on gravity based Buoyant Founations, without any mechanically driven components required.
**Non-applicable because foundation rises with water level; elevation restricted on average to 20-ft steel columns, the depth requied by most piles to reach the rockbed.
***Reduction in steel + concrete requirements reduces overall mass by 50% and shoring by 50%.
****Data obtained from http://www.epsindustry.org/eps-sustainability/life-cycle-analysis

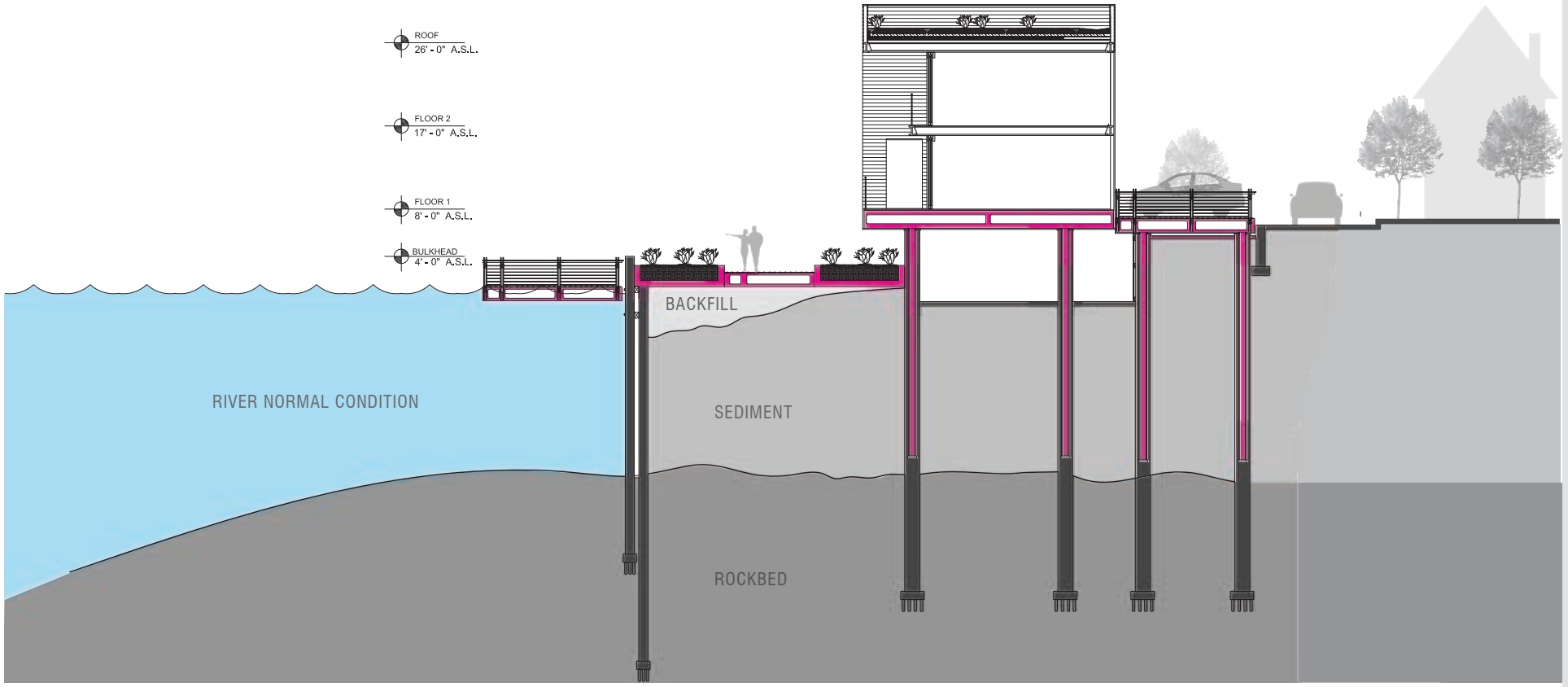
Permanent Static Elevation Cost

US Dollars — 2012 Relative Value

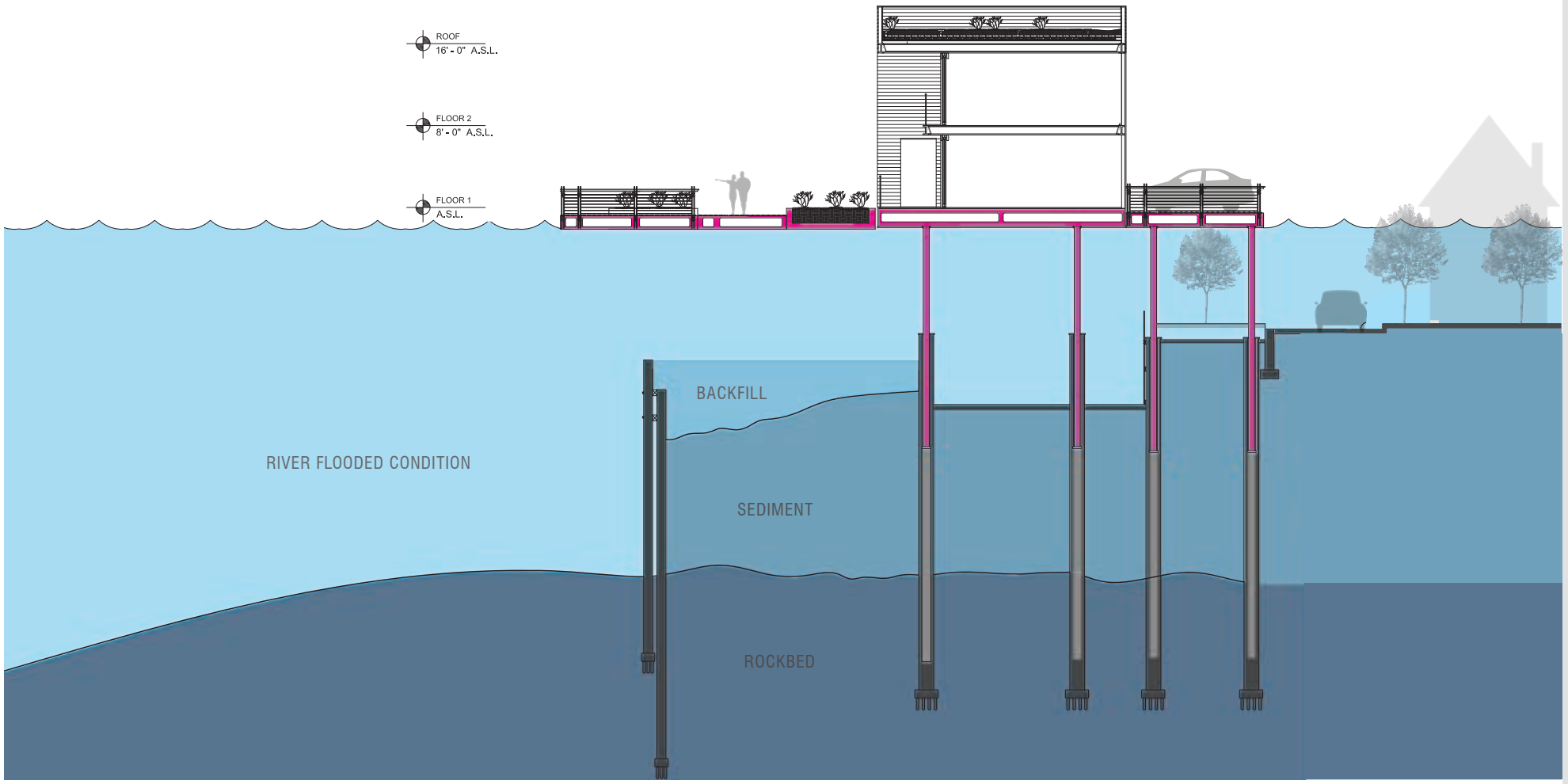
Area of Lowest Level	
Square Footage	1500sf
	For Reinforced Concrete Block
Construction	$40-60k
Durability	80-100+yrs*
Maintenance	High
Crack Repair	12-15mo (affected by freeze/thaw + erosion)
Waterproofing	every 12-15mo to prevent erosion
Decomposition	Vunerable to rebar +saltwater corrosion
Elevation Restriction	BFE**
Wind Susceptibility	High (Exposed to hurricane/wind damage)
Weight	High***
Concrete	37yd^3 [28m^3]
	50% Increase(Due to additional area covered)
Steel	6070 lb [2750kg]
	33% Increase(More Concrete = More Rebar)
Thermal Mass	High Insulative Properties
Life Cycle Analysis	Non-Resilient****
Water + Air Emissions	28% Increase
Energy Use	15% Increase
Solid Waste	10% Increase
Architectural Fabric	Severely Disrupted
Social Fabric	Severely Disrupted
Neighborhood Character	Altered

*Estimation assumes yealy maintenace for cracks and erosion. Exposure to salwater lessens lifespan of concrete to 50 years.
**In most cases, structure will not be raised above BFE requirements due to expense and convenience of accessibility. (Note: BFE is only an estimation of water rise)
***Increase in steel + concrete requirements increases overall mass by 50% and shoring by 50%.
****Data obtained from http://www.nrmca.org/taskforce/Item_2_TalkingPoints/Sustainability/Sustainability/SN2137a.pdf

BUOYANT FOUNDATION CROSS-SECTIONS

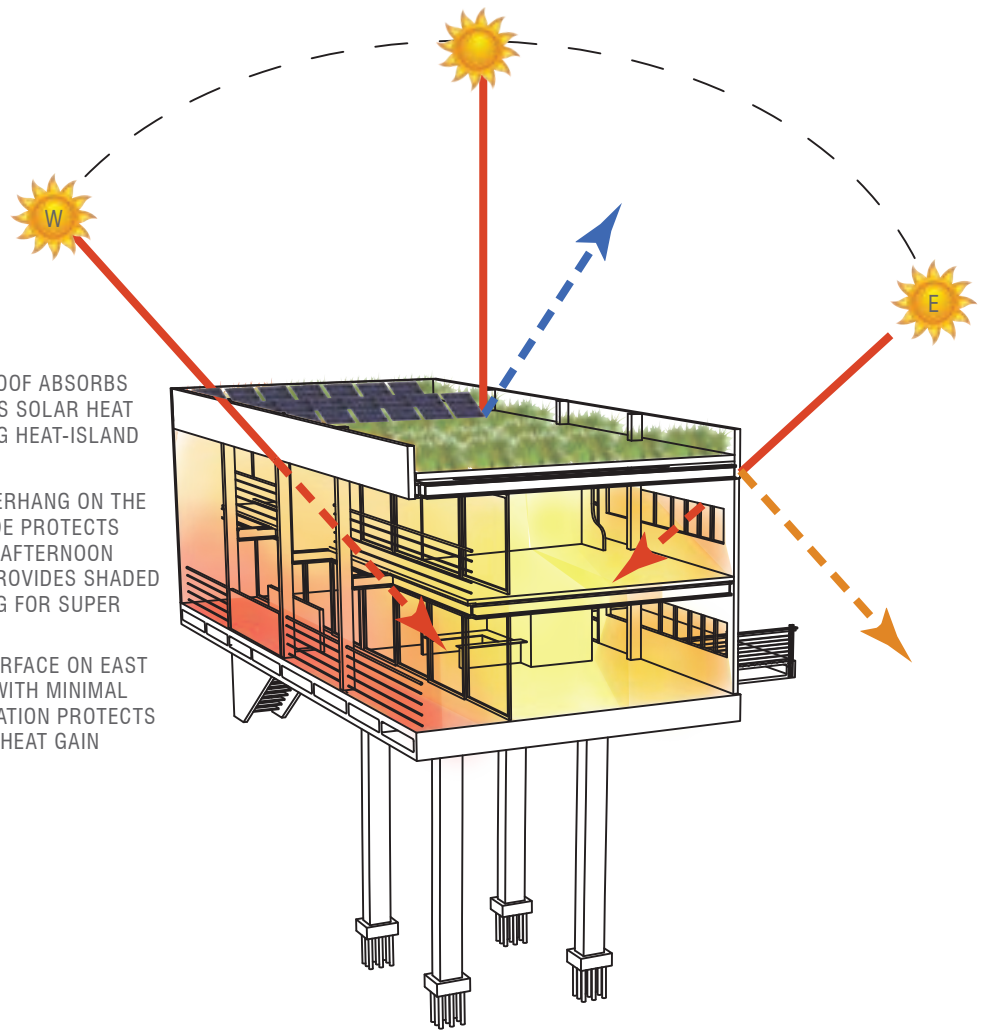


CROSS SECTION - DRY CONDITION



CROSS SECTION - FLOODED CONDITION

ENVIRONMENTAL CONSIDERATIONS

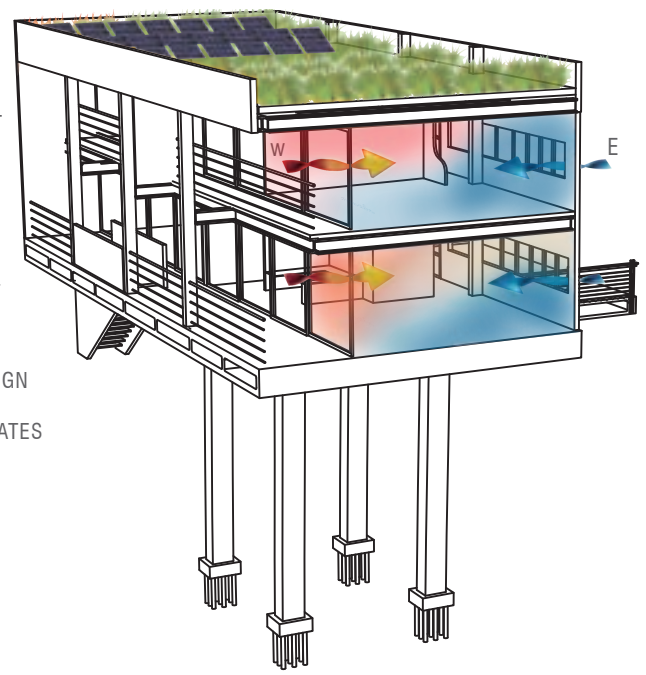


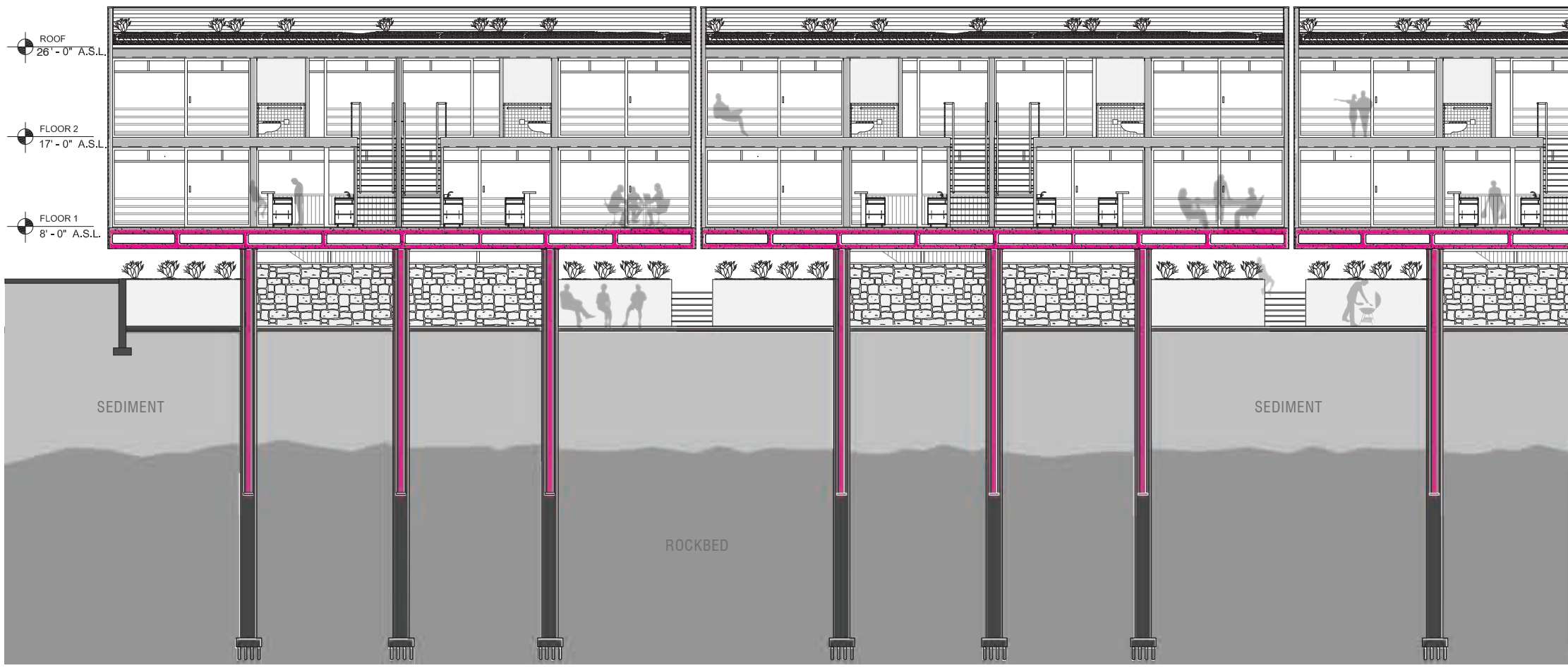
SOLAR

- GREEN ROOF ABSORBS +RETAINS SOLAR HEAT REDUCING HEAT-ISLAND EFFECT
- DEEP OVERHANG ON THE WEST SIDE PROTECTS AGAINST AFTERNOON SUN + PROVIDES SHADED COVERING FOR SUPER PORCH
- SOLID SURFACE ON EAST FACADE WITH MINIMAL FENESTRATION PROTECTS AGAINST HEAT GAIN

VENTILATION

- GREEN ROOF BEHAVES AS INSULATION BARRIOR-IN SUMMER IT KEEPS OUT HEAT + KEEPS IN COOLER AIR-IN WINTER IT KEEPS OUT COLD AIR AND MAINTAINS WARMER AIR INSIDE
- WARMER AIR ENTERS THE HOME FROM THE WEST AND IS MIXED IN WITH COOLER AIR FROM THE EAST PROVIDING MODERATE TEMPERATURE
- THE NARROW BUILDING DESIGN PROVIDES ADEQUATE CROSS VENTILATION WHICH CIRCULATES AIR

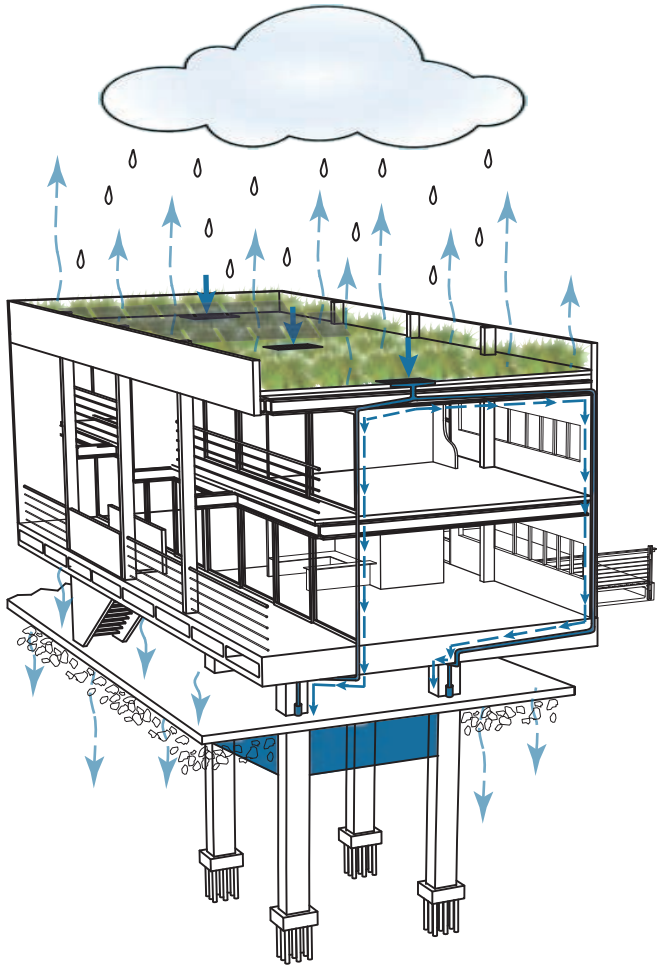




LONGITUDINAL SECTION

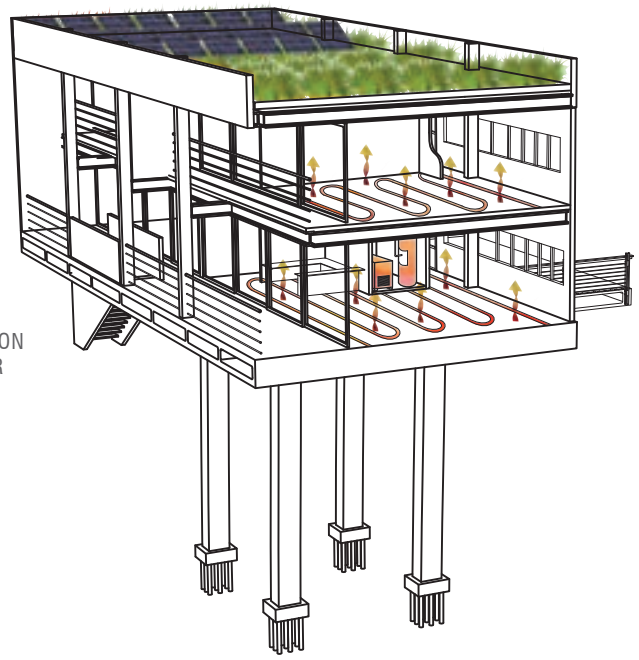
DRAINAGE DIAGRAM

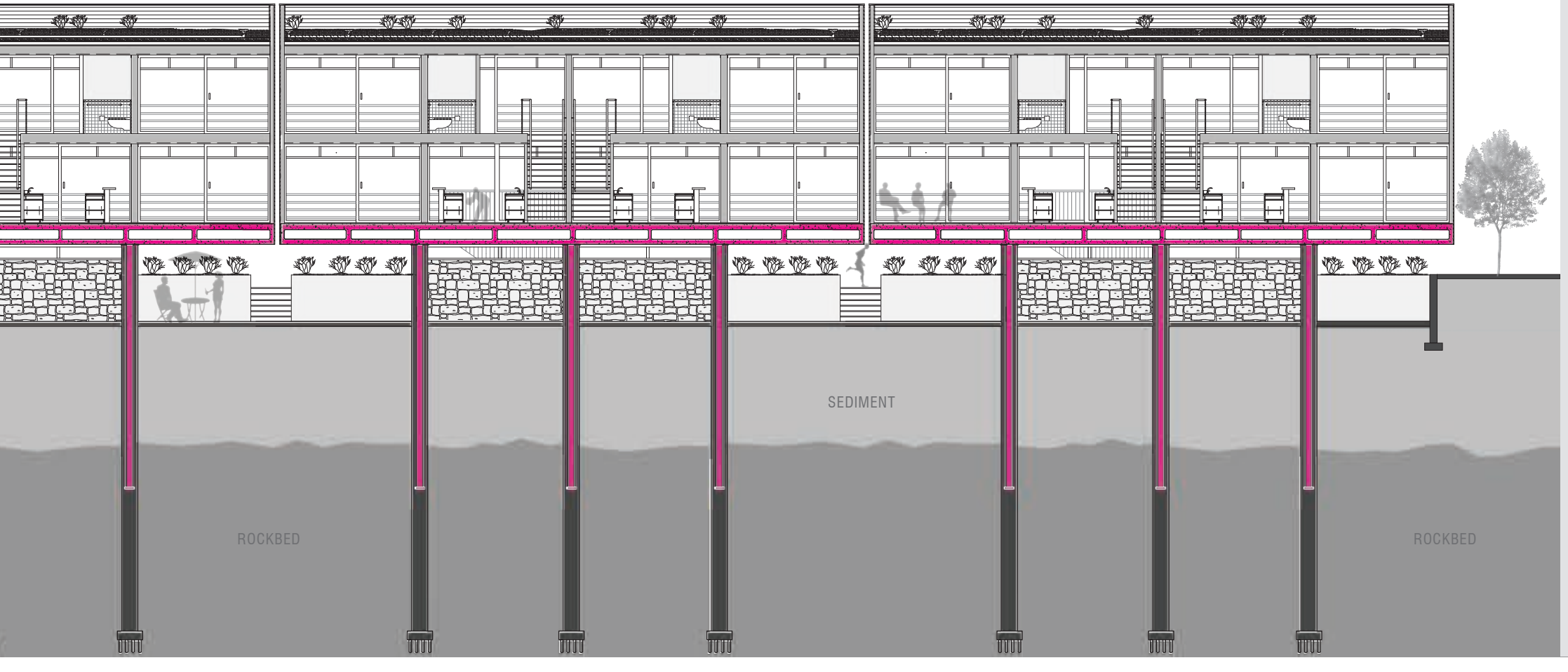
- GREEN ROOF RELEASES MOISTURE SLOWLY BACK INTO THE ATMOSPHERE
- ROOF DRAINS DIRECT EXCESS RUNOFF TO UNDERGROUND CISTERN FOR WATER COLLECTION AND LATER RECYCLED FOR GREY WATER USE
- ALL CONCRETE ON SITE IS PERVIOUS CONCRETE WHICH ALLOWS WATER TO PENETRATE TO EARTH UNDERNEATH IN ORDER TO DIMINISH SURFACE RUNOFF



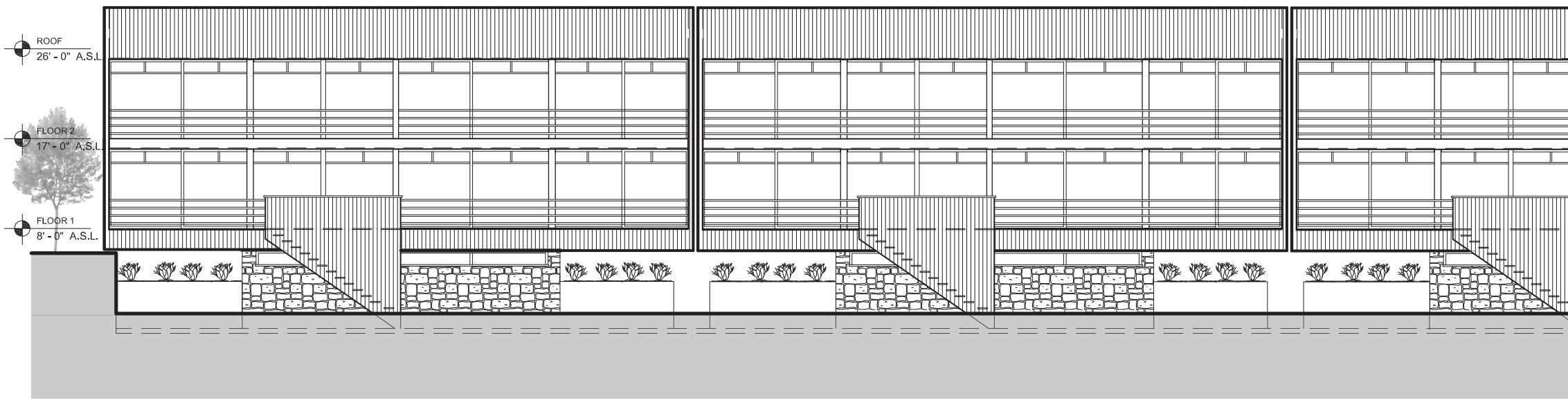
ENERGY DIAGRAM

- SOLAR PANELS ON THE ROOF ALLOW THE HOME TO BE SELF-SUSTAINED IN THE EVENT OF AN EMERGENCY
- RADIANT HEATED FLOORS REDUCES ENERGY REQUIRED TO HEAT THE HOME ALLOWING THE HEAT SOURCE TO BE LOW IN THE OCCUPIED SPACE AND COOL AS IT RISES
- UTILITY ROOM + EQUIPMENT IS PLACED ON FIRST FLOOR AND REMAINS ABOVE INUNDATION LEVELS AT ALL TIMES IN ORDER TO PREVENT DAMAGE + INTERRUPTION OF SERVICE

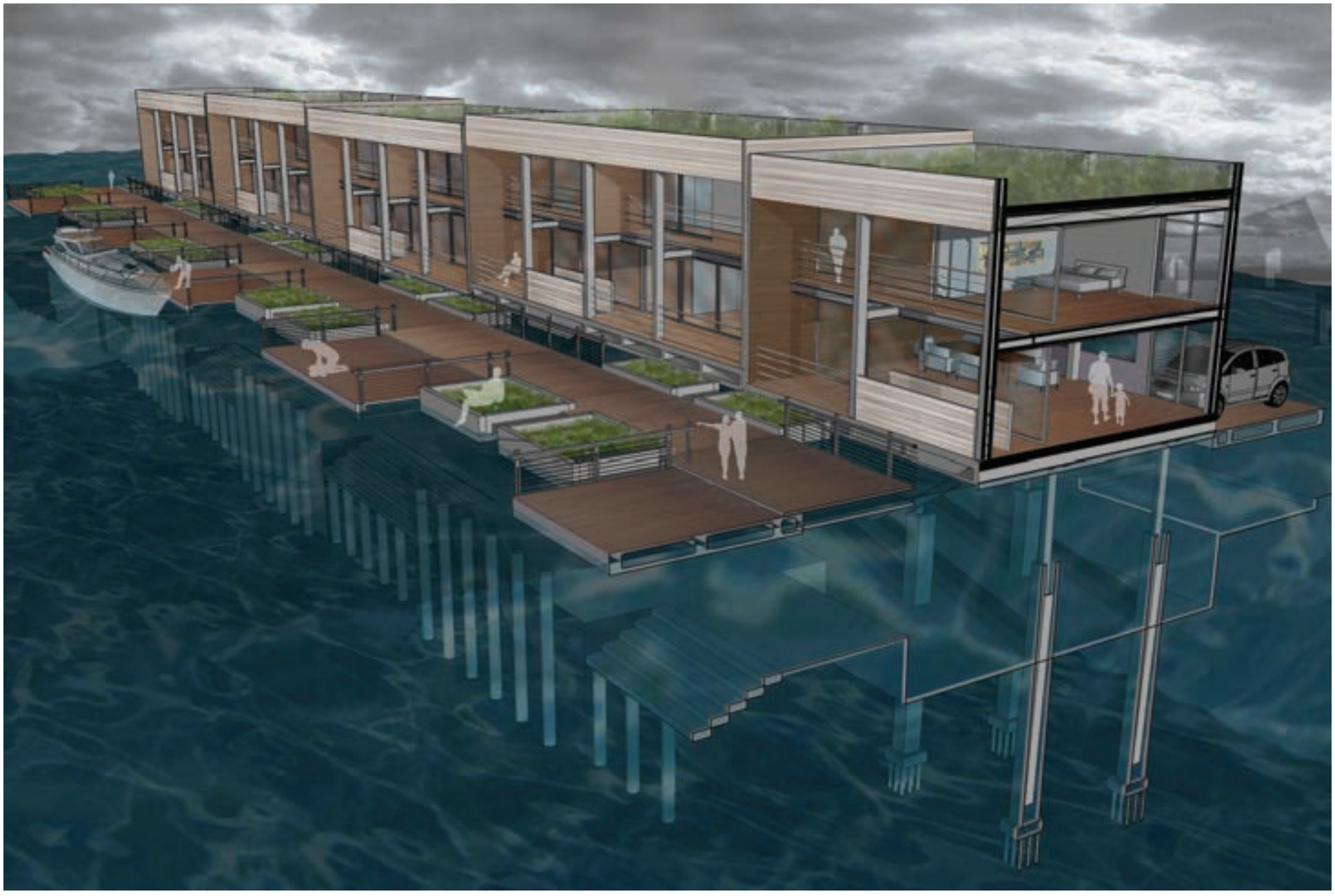


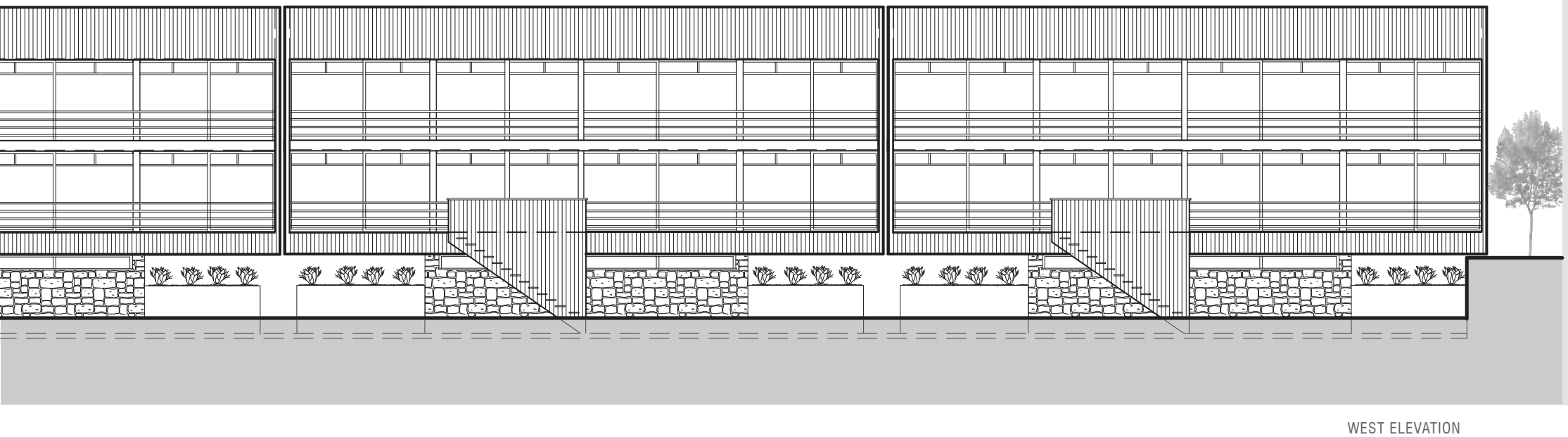


NORMAL CONDITION



FLOODING EVENT





WEST ELEVATION