RESNET
Residential Energy Services Network

Setting the STANDARD for QUALITY

Green Energy Rater Training

Donney Dorton – Guaranteed Watt Saver Systems Inc.
Jay Hall – Building Knowledge Inc.
Pepper Smith – Davis Energy Group
Laura Uhde – Southface Energy Institute

Introduction

- Welcome
- Introductions
- Review of Agenda

Agenda

- Module 1: Why Green Energy Raters Are Needed
- Module 2: Typical Steps in the Verification and Certification Processes
- Module 3: Green Energy Rater's Role in Durability
- Module 4: Green Energy Rater's Role with Accountability Forms
- Module 5: Performance Tests

Agenda (cont.)

- Module 6: Review of Non-Energy Calculations Req'd by Green Home Rater
- Module 7: Detailed Overview of Green Inspections
- Module 8: Documentation Requirements
- Module 9: Professionalism

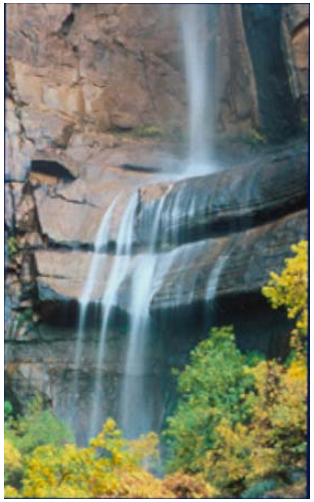
What is a Green Energy Rater?

A HERS rater that has been trained to conduct inspections, testing and verification for a green home building program.

Sample Programs:

- LEED for Homes
- EarthCraft House
- GreenPoint Rated
- Austin Energy
- Earth Advantage
- Build Green

Why Green Building?



Buildings Use:

- 30-40% of total US energy
- 60-70% of electricity
- 35-40% of municipal solid waste
- 25-30% of wood & raw materials
- 25% of water

Why Green Energy Raters?

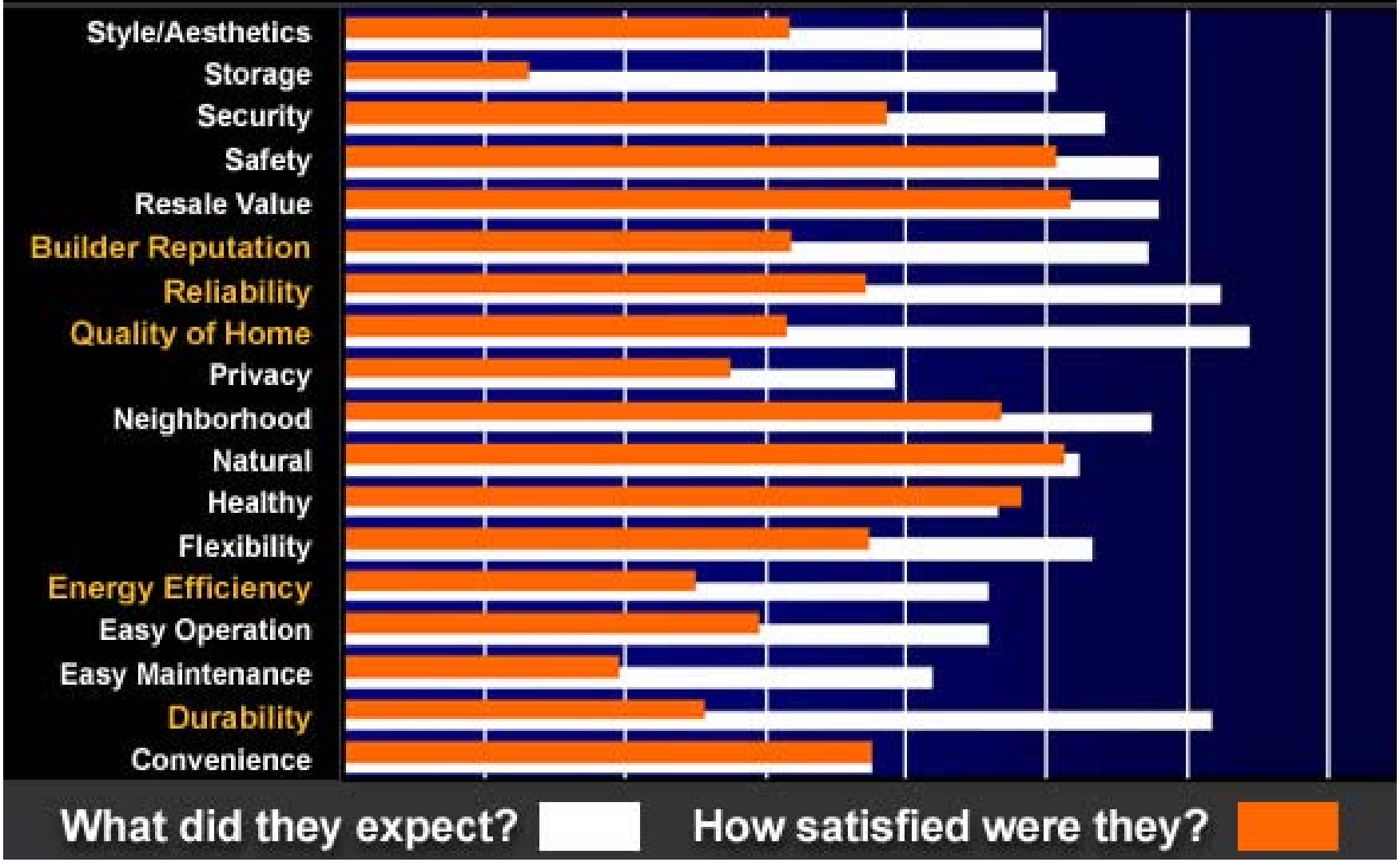
- Preliminary Rating
  - What is a green home?
  - What is the marketplace looking for?
  - Setting homebuyer expectations: features, benefits and costs

What do Consumers Want?

- 91% want energy efficiency
- 61% want ENERGY STAR ratings
- 80% say that current construction practices do not meet their interest in sustaining the environment
- 96% are willing to pay more for “green” features
  - 32% are willing to pay $2,500 more
  - 36% are willing to pay $5,000 more
- When asked to pick 3 out of 8 upgrades:
  - 94% picked energy efficient features
  - 59% picked improved indoor air quality features
  - 40% picked kitchen cabinet upgrades

Survey published in November 2001 issue of *Professional Builder*
www.housingzone.com

Home Owner's Priorities



Why Green Energy Raters?

- Program Performance Tier Selection
  - Alignment of builder's current level of green building with a green home program
  - Identify additional cost effective measures

Why Green Energy Raters?

- Quality Assurance
  - Reduce/minimize call-backs
  - Enhance builder's credibility and reputation
  - Discourage "green washing"

Why Green Energy Raters?

- Consistent Message showing Value of Green Homes
  - Homebuyer benefits
  - Builder benefits

Builder Benefits

- Improved Customer Satisfaction
- Market Differentiation
- Reduced Callbacks
- Increased Value

Home Buyer Benefits

- Higher quality/durability
- 30-70% energy savings
- Environmentally Responsible
- Healthier Living
- Increased Value

"Because He Matters Most"

I chose an EarthCraft home because indoor air quality is important to the health of my son, Drew. He has allergy related asthma and since we've lived in our new Hedgewood home, he's really improved. If I can buy a new home and get both great design and a healthier environment for my family, then it's the right choice for us.

Pam Carrington
Kingsboro Home Owner

It Has To Be
HEDGEWOOD

Committed To Our Buyers And To Our Environment

Our EarthCraft homes are healthier for your family, save energy, require less maintenance, AND are environmentally responsible.

Typical Steps in the Verification and Certification Processes

Verification & Certification Process

- Preliminary Ratings
  - Design Charettes
- Participation in Project Team Meetings
  - Communications
  - Consulting
- Site Visits for 3rd Party Visual Inspections
- Performance Tests for 3rd Party Inspections
- Documentation & Submittals

Green Energy Rater's Role in Durability

Defining Durability

- Building a house for the lifetime it was intended to be used for
- Planning needs to be done at the front end
- Design in durability
- Selection of materials
- Installation of materials

Basics to Know for Durability Planning

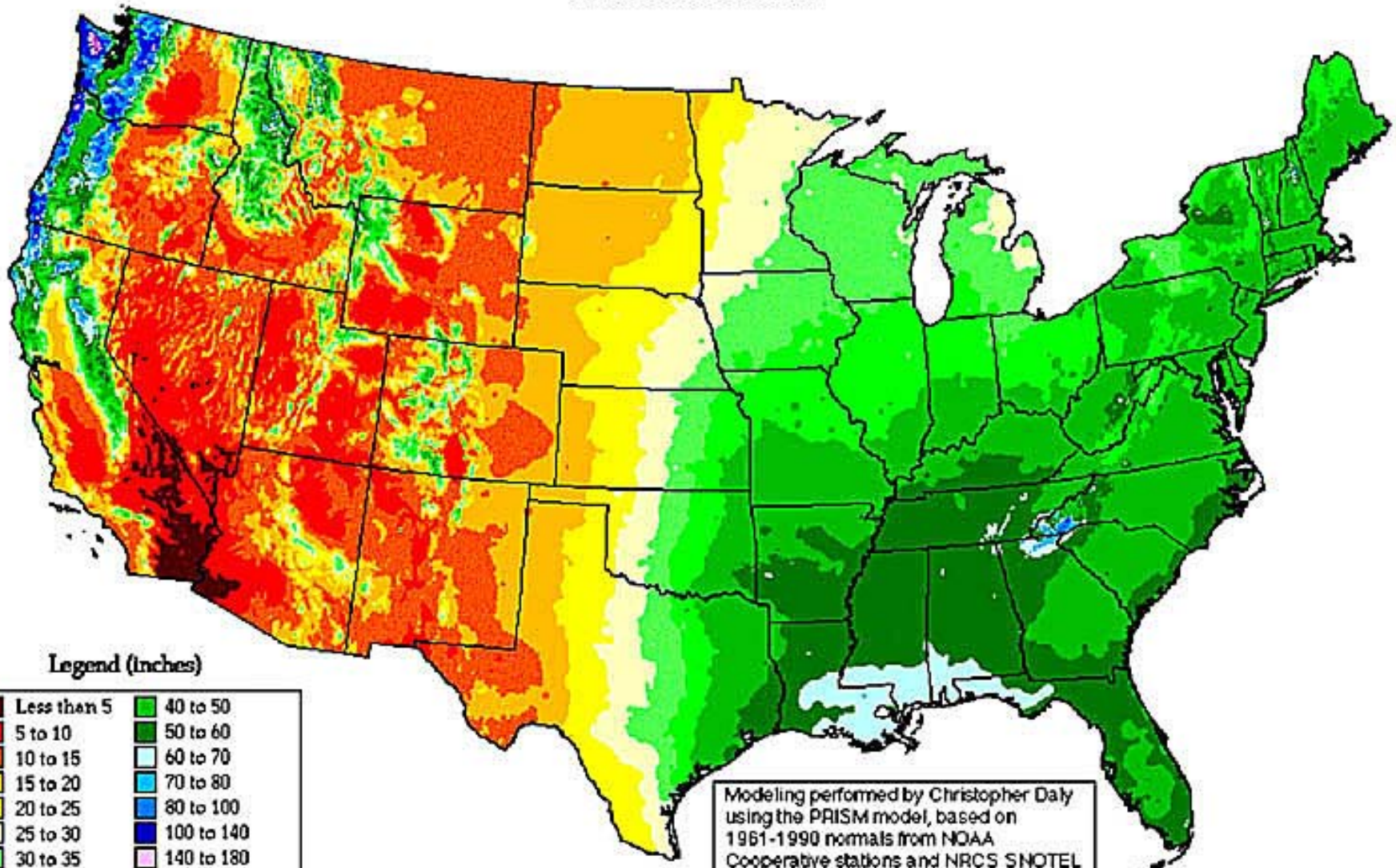
- In addition to airsealing and insulation from HERS:
  - Climate
  - Moisture Flow in Buildings
    - Liquid
    - Vapor
  - Site
  - Materials

Synergies

- Durability relates to:
  - Energy efficiency
  - Water management
  - IPM
  - IAQ
  - Safety

Annual Average Precipitation

United States of America



Legend (inches)

Less than 5	40 to 50
5 to 10	50 to 60
10 to 15	60 to 70
15 to 20	70 to 80
20 to 25	80 to 100
25 to 30	100 to 140
30 to 35	140 to 180
35 to 40	More than 180

Period: 1961-1990

Modeling performed by Christopher Daly using the PRISM model, based on 1961-1990 normals from NOAA Cooperative stations and NRCS SNOTEL sites. Sponsored by USDA-NRCS Water and Climate Center, Portland, Oregon.

Oregon Climate Service
George Taylor, State Climatologist
(541) 737-5705

Moisture Flow in Buildings

Moisture flows in two forms: liquid and vapor

- **Bulk**

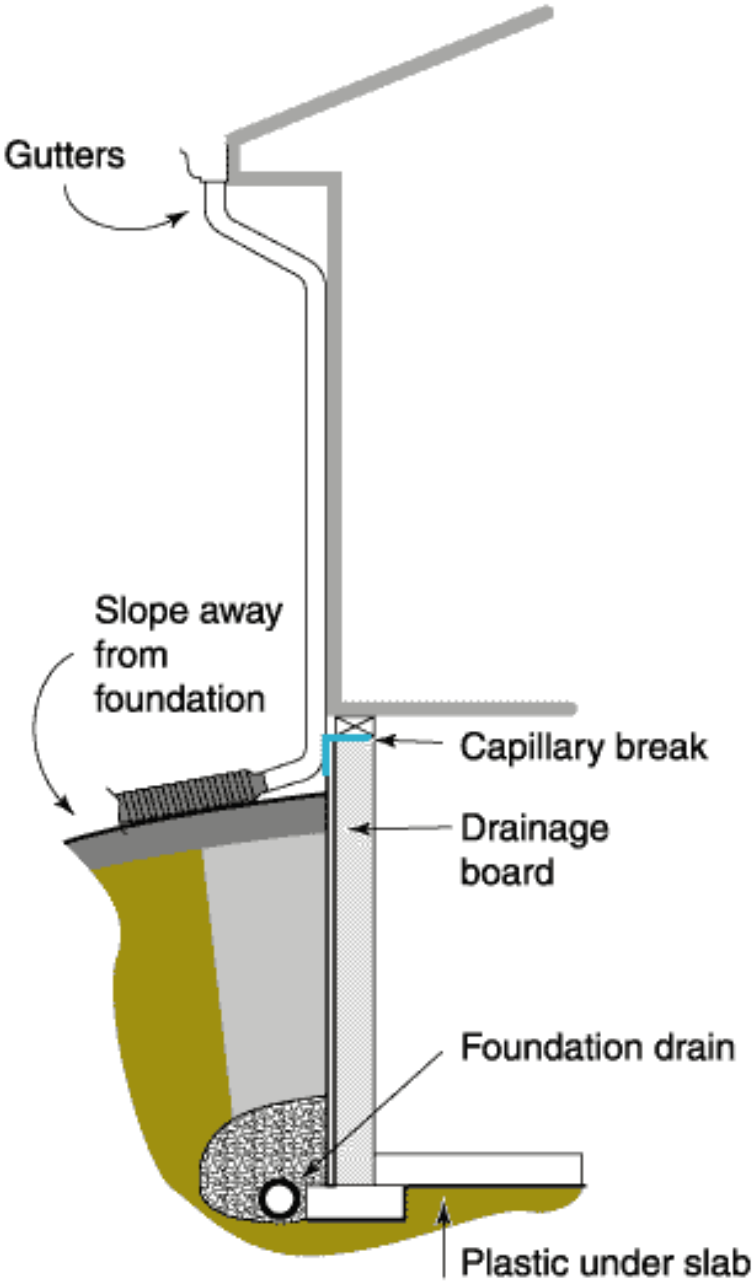
  Liquid water (rain, drainage, plumbing leaks)
- **Capillarity**

  Wicking through porous materials (concrete, fiberglass and cellulose insulation, wood)
- **Diffusion**

  Molecules of water moving through porous materials
- **Infiltration**

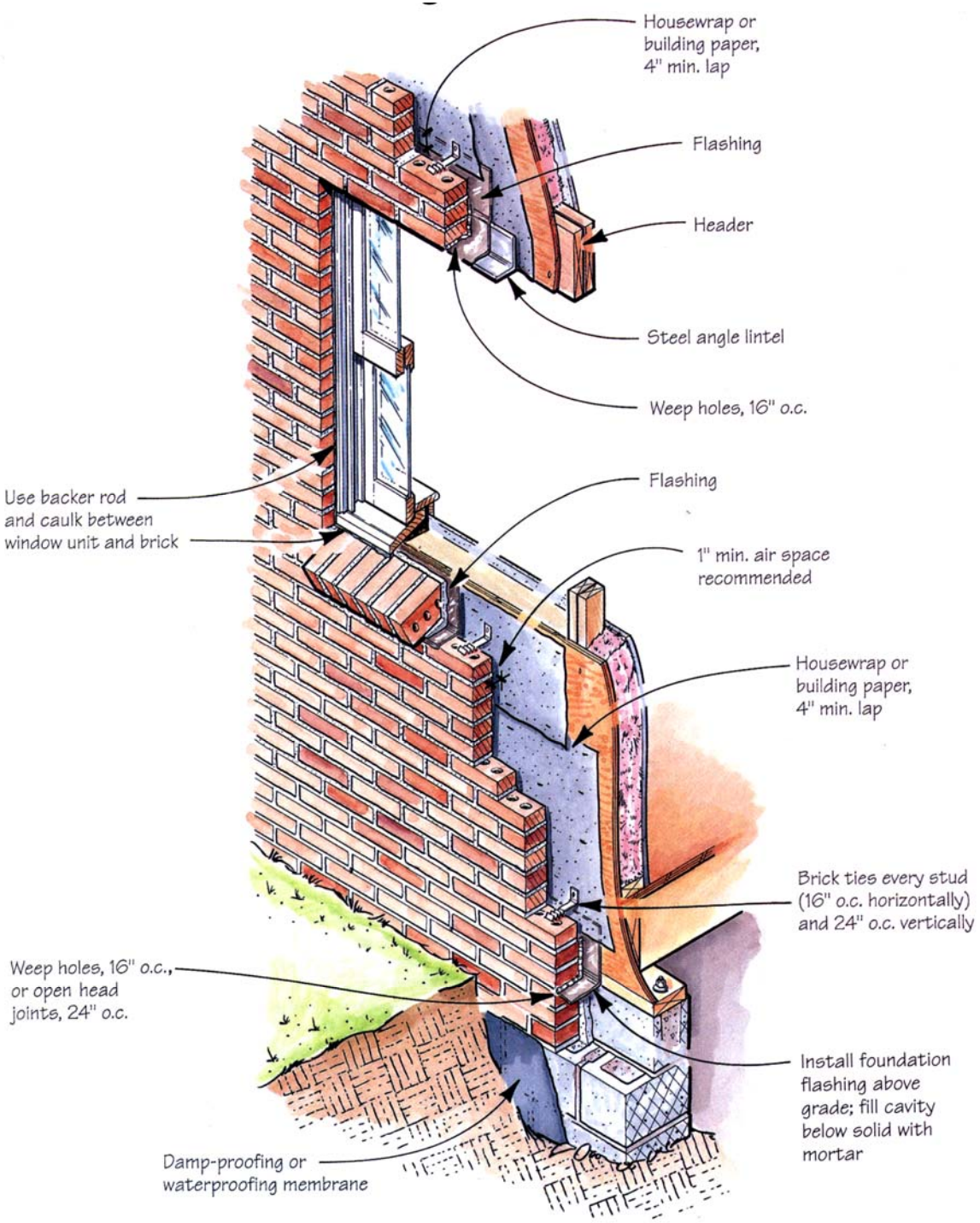
  Moisture laden air brought into or out of the house

Liquid Water Management



Liquid Water Management

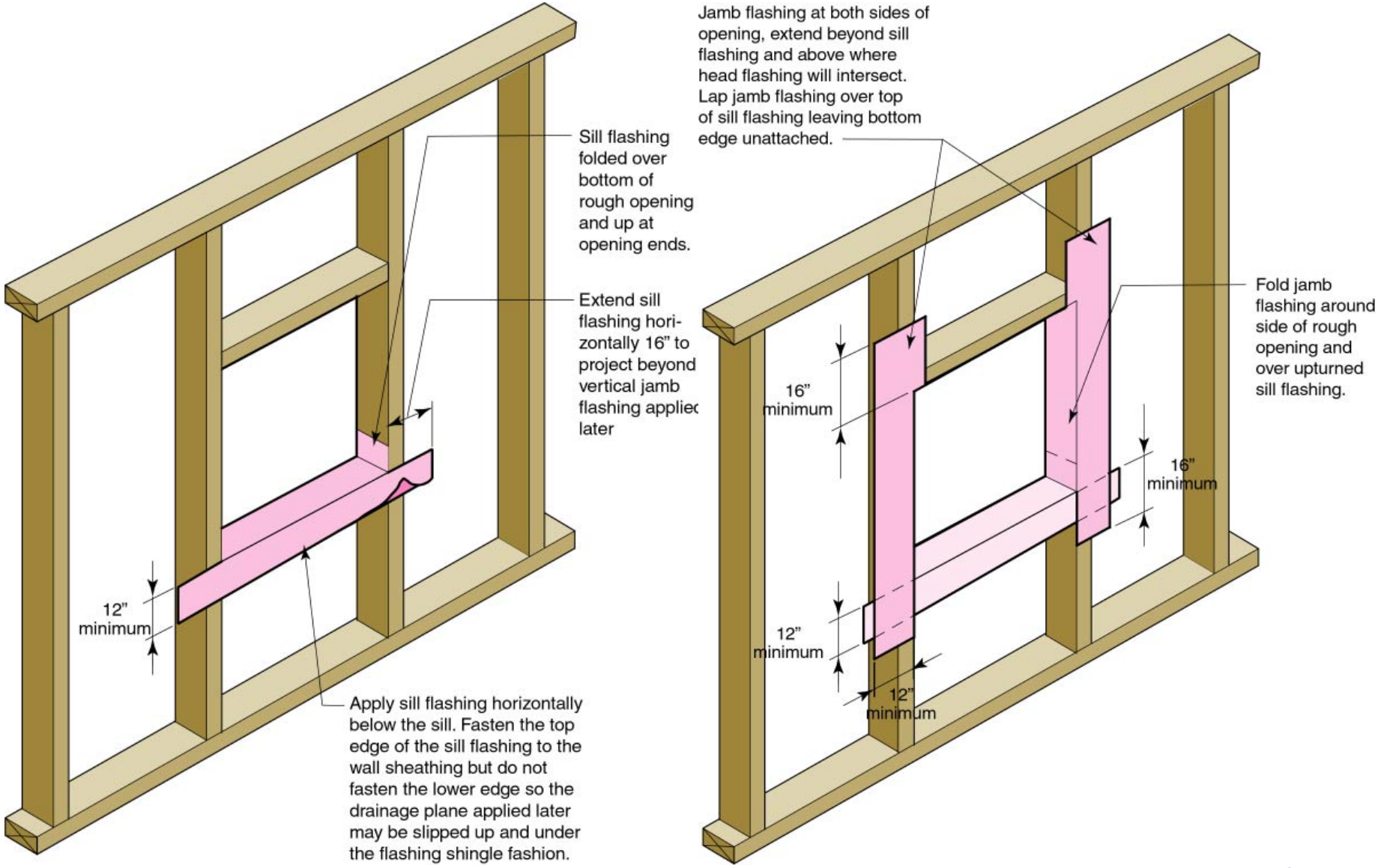
- Don’t let any water in
- When water gets in, let it get out



Drainage Planes

Window Flashing – Steps 1 & 2

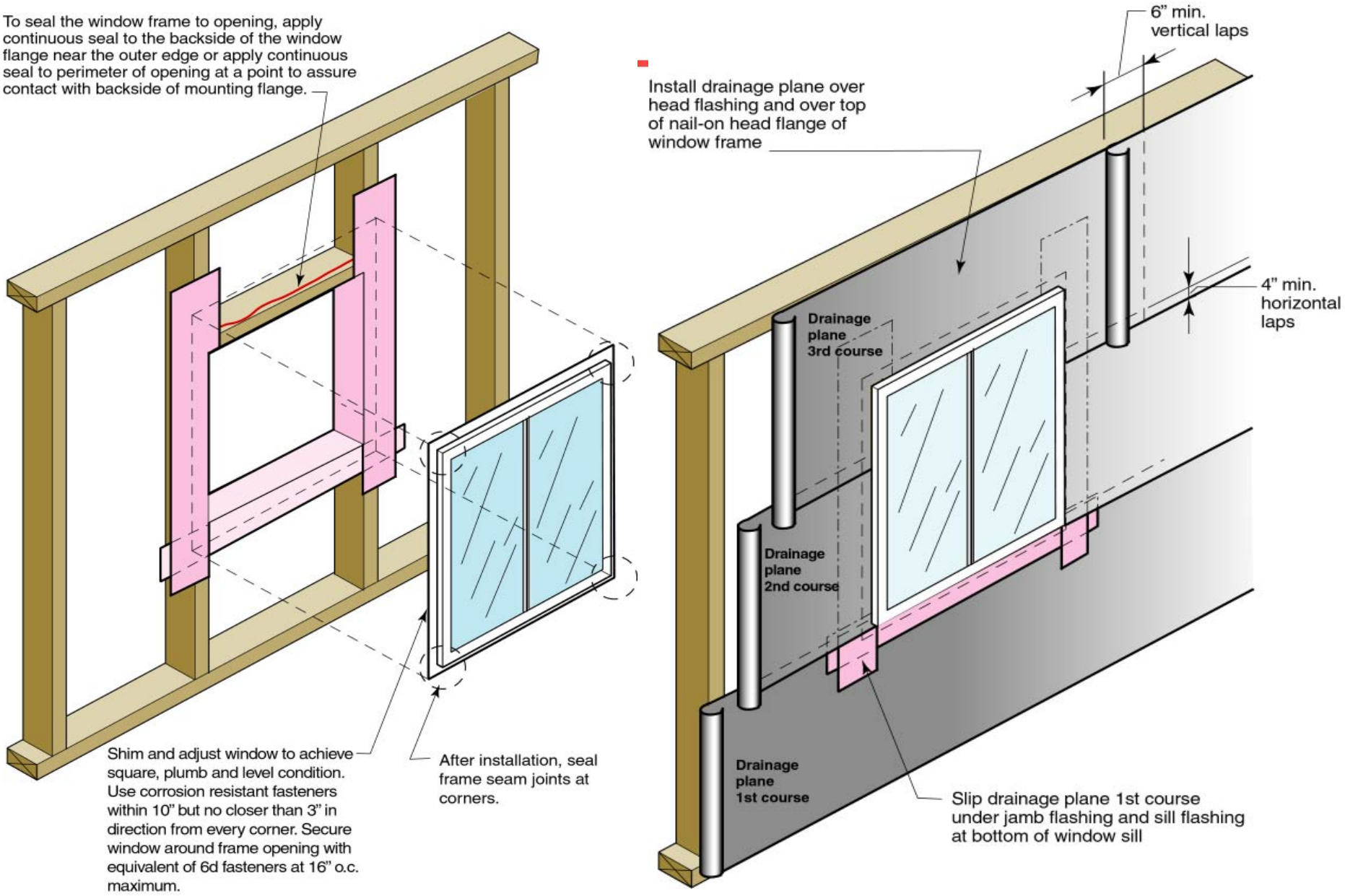
LU4



Slide 27

LU4 If you have better details on flashing, please put them in.
Laura Uhde, 1/1/2008

Window Flashing - Steps 3 & 4



Humidity Problems

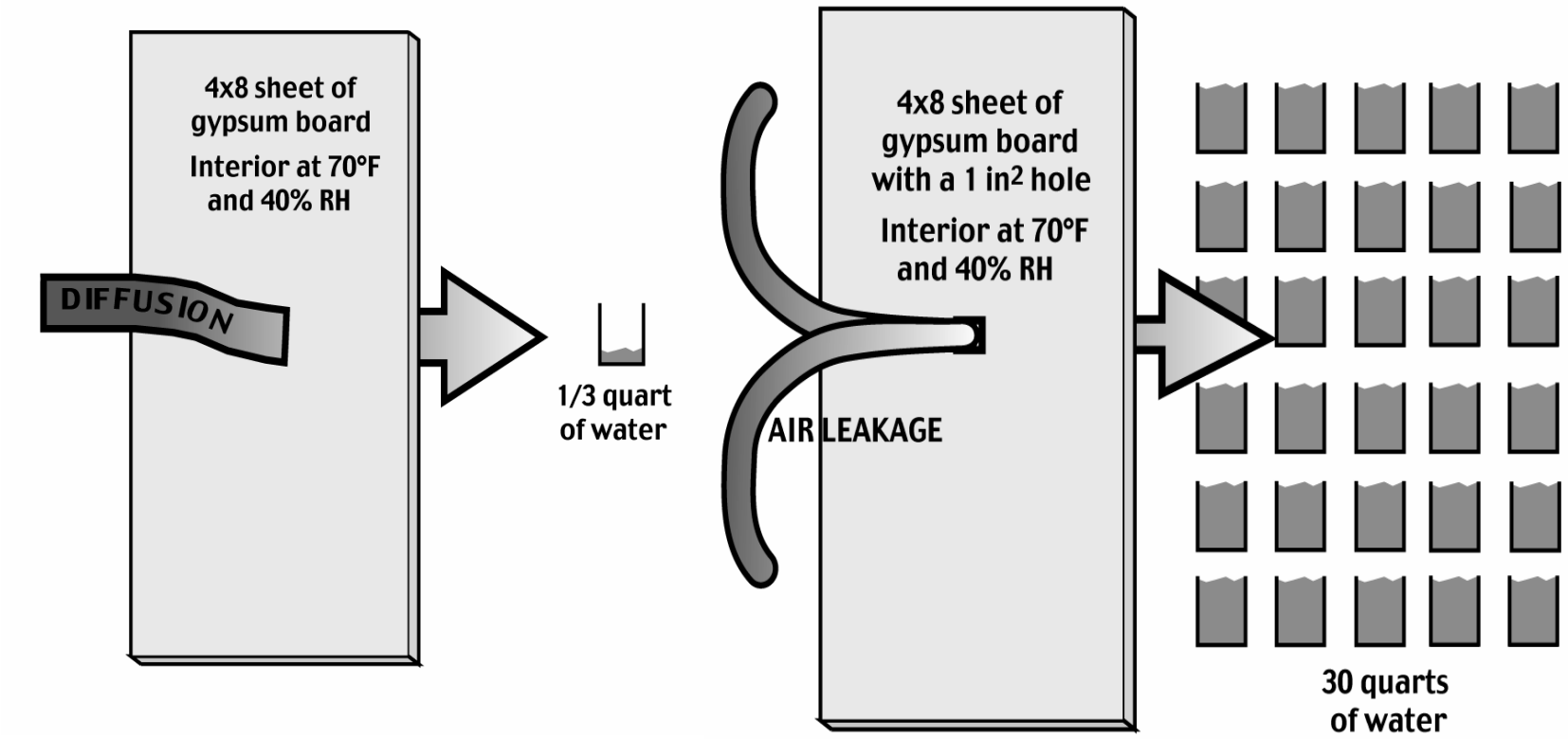
- Building decay …….. 100% RH
- Interior mold……RH > 70%
- Dust mites……RH > 50%
- Static electricity, dry sinus…….. ……. RH < 25%

Ideal health & comfort is 30%-50% RH at room temperature (~72° F)

Conditions for Mold Growth

- Food: Organic materials
  - Wood, paper, sheetrock
- Temperature: 40º F to 100º F
- Excess moisture is the primary cause
  - Water: flooding, roof and plumbing leaks
  - Water vapor: Mold grows above 70% RH

Vapor Diffusion vs. Air Leakage



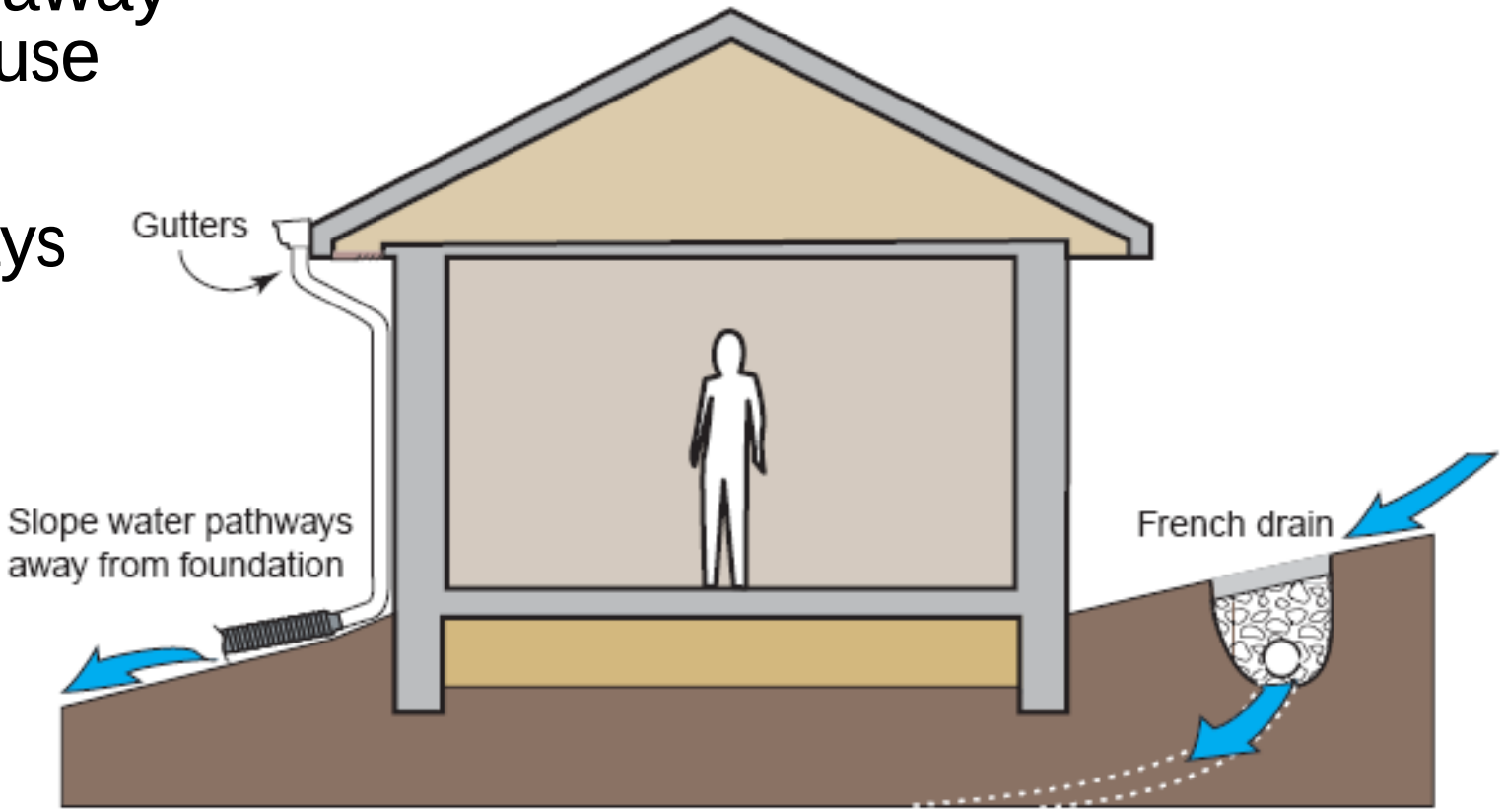
Perm Ratings of Materials

- Drywall……30-50
- Housewrap……..5-50
- Semi-gloss latex enamel……..…6.6
- Primed & Painted Drywall……2-3
- Interior plywood……1.9
- 15 pound asphalt felt……1-4
- Insulated foam sheathing…….0.4-1.2
- Exterior plywood/OSB……..0.7
- Vapor retarder paint…….0.6-0.9
- Asphalt coated kraft paper……0.4
- Polyethylene……0.06

Durability

Grade and Gutters away from house

Covered entryways



Durability

Integrate flashing

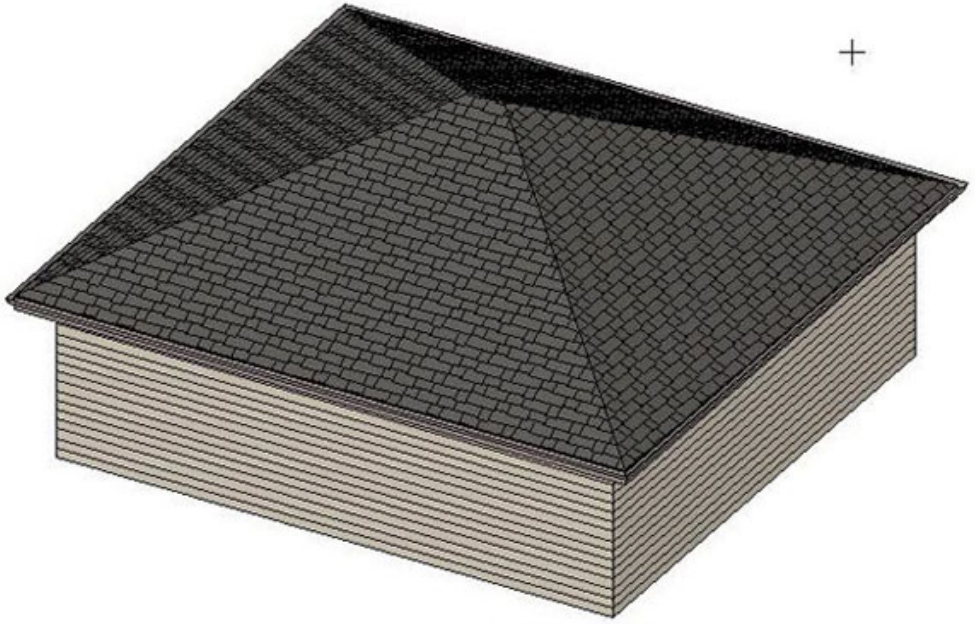
Durability

- Gravel bed beneath slabs
- Humidity controls
- Drain tile location; capillary breaks
- Wet rooms
- Spot ventilation

Durability

- Continuous termite shield

Durability



Durability Planning

- Team creates a durability plan
  - Prescriptive Approach
    - Provides detailed guidance on durability strategies
    - Project teams can pick and choose appropriate measures
    - Some measures are often required
  - Planning Approach
    - The team develops a durability plan based on best practices
    - Team will need prior knowledge of best practices

Prescriptive Sample

DURABILITY
REQUIRED: flashing at wall/roof intersection integrated with wall and roof drainage planes
REQUIRED: flashing at deck/wall or porch/wall intersection integrated with drainage planes
REQUIRED: maintain 2" clearance between wall siding and roof surface (or per product manufacturer installation specification)
REQUIRED: for roofs that slope along an adjoining wall surface, kick-out flashing is installed
REQUIRED: all roof valleys direct water away from walls, dormers, chimneys, etc.
REQUIRED: double layer of builder paper or housewrap behind cementitious stucco or stone veneer or synthetic stone veneer (no drainage cavity necessary) on framed walls
REQUIRED: framed walls covered with drainage plane (drainage membrane, builder paper, housewrap or XPS foam)
sealed crawlspace (unless house is in 100-year flood plain)
roofing (min 30-year warranty)
roofing (min 40-year warranty)
roofing (min 50-year warranty)
roof drip edge
exterior cladding (min 3 sides) with 40-year warranty or durable natural material
drainage plane installed with all seams and edges sealed per manufacturer's recommendation
siding with vented rain screen
back-primed siding and trim (or vented rain screen behind siding)
windows with minimum 25-year warranty

Planning Sample

Durability Strategies by Issue Type		
For each of the high and moderate risk areas indicated in the Risk Evaluation Form, list the durability strategies used in the home. If none are used for a particular durability issue, provide a brief statement explaining why not. Remove example strategies and add lines as needed.		

Exterior Water	Location in Drawings, Specs, and/or Scopes	Pre-work Verified (Builder/trade)	Completion Verified (Builder/trade)	Construction Verified (Rater)
Example: Site graded to drain rainwater away from building		☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

Interior Moisture	Location in Drawings, Specs, and/or Scopes	Pre-work Verified (Builder/trade)	Completion Verified (Builder/trade)	Construction Verified (Rater)
Example: Clothes washer uses stainless steel hoses & position washer on drainage basin		☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

Air Infiltration	Location in Drawings,	Pre-work Verified	Completion Verified	Construction Verified

Durability Planning

- Team integrates plan in to drawings (if required)
- Team assigns responsibility to team members to ensure plan is implemented in the field
- Builder oversees that plan is implemented correctly
  - Some programs may require rater to check final work to make sure it is installed properly and provide recommendations for improvement if needed. May also require a follow-up site visit to confirm changes were made correctly.

Additional Information

ENERGY STAR Indoor Air Package

Verification Checklist

Address or Div/Lot#:			City:	State:			
Section		#	Requirements (see IAP for details)	N/A	Builder Verified	Rater Verified	Flex Spec
ENERGY STAR Qualified Home			verification complete, including Thermal Bypass Checklist			☐	
Moisture Control Features	Water Managed Foundations	1.1	Surface water management system		☐	☐	
		1.2	Drain tile system at all footings		☐	☐	
		1.3	Capillary break below concrete slabs (Ex. see Spec)	☐	☐	☐	
		1.4	Below grade walls damp-proofed (Ex. slab-on-grade)	☐	☐	☐	
		1.5	Sump pump covers air sealed (Ex. no sump)	☐	☐	☐	
		1.6	Crawl spaces unvented, insulated, conditioned (Ex. see Spec)	☐	☐	☐	
		1.7	No vapor barrier on inside of basement/crawlspace walls	☐	☐	☐	
	Water Managed Wall Assemblies	1.8	Flashing system (or equivalent) at bottom of wall		☐	☐	
		1.9	Continuous drainage plane behind cladding		☐	☐	
		1.10	Air seal & align thermal/air barriers (E* TBC)		☐	☐	
		1.11	Fully flash windows and doors		☐	☐	
		1.12	Deck ledger board drainage system	☐	☐	☐	☐
	Water Managed Roof Assemblies	1.13	Air seal & align thermal/air barriers (E* TBC)			☐	
		1.14	Step & "kickout" flashing		☐	☐	
		1.15	Gutter system or equivalent (Ex. Dry)	☐	☐	☐	
		1.16	No. 30 roof felt underlayment		☐	☐	☐
		1.17	Drip edge at roof decking edges (Ex. Dry)	☐	☐	☐	☐
		1.18	Bituminous membrane at valleys & penetrations (Ex. Dry)	☐	☐	☐	
		1.19	Ice flashing at eaves (Ex. Zones 1-4)	☐	☐	☐	

Additional Information

RESNET - www.natresnet.org

US Green Building Council – LEED for Homes - www.usgbc.org/leed/homes

Building Performance Institute - www.bpi.org

Energy and Environmental Building Association - www.eeba.org

ENERGY STAR – www.energystar.gov

Building Science Press – www.buildingsciencepress.com

Detailed Overview of Green Inspections

Definitions

Verify: To establish the truth, accuracy, or reality of *"claim"*

Inspect: To view closely in critical appraisal, to look over, to survey, or to test the condition of

The truth of the”claim”

What is the “claim”?

A. **Design is good**
B. **Materials are good**
C. **All design features are installed**
D. **Workmanship is good**
E. **All of the above**

What is “good”?

To view “closely”

How Close?

“View” measures via:

Remotely:

A. Observe paper documentation of specs.

B. Observe design documentation

C. Verbal communication

On-Site:

D. Visual eye contact

E. Photo-documentation

Other:

All of above

Other rater activities

More detailed forms of review:

- Calculations
- Testing
- Other Certifications
  - HERS
  - ENERGY STAR for Homes
  - IAP
  - ALP
  - etc.

Purpose of inspections

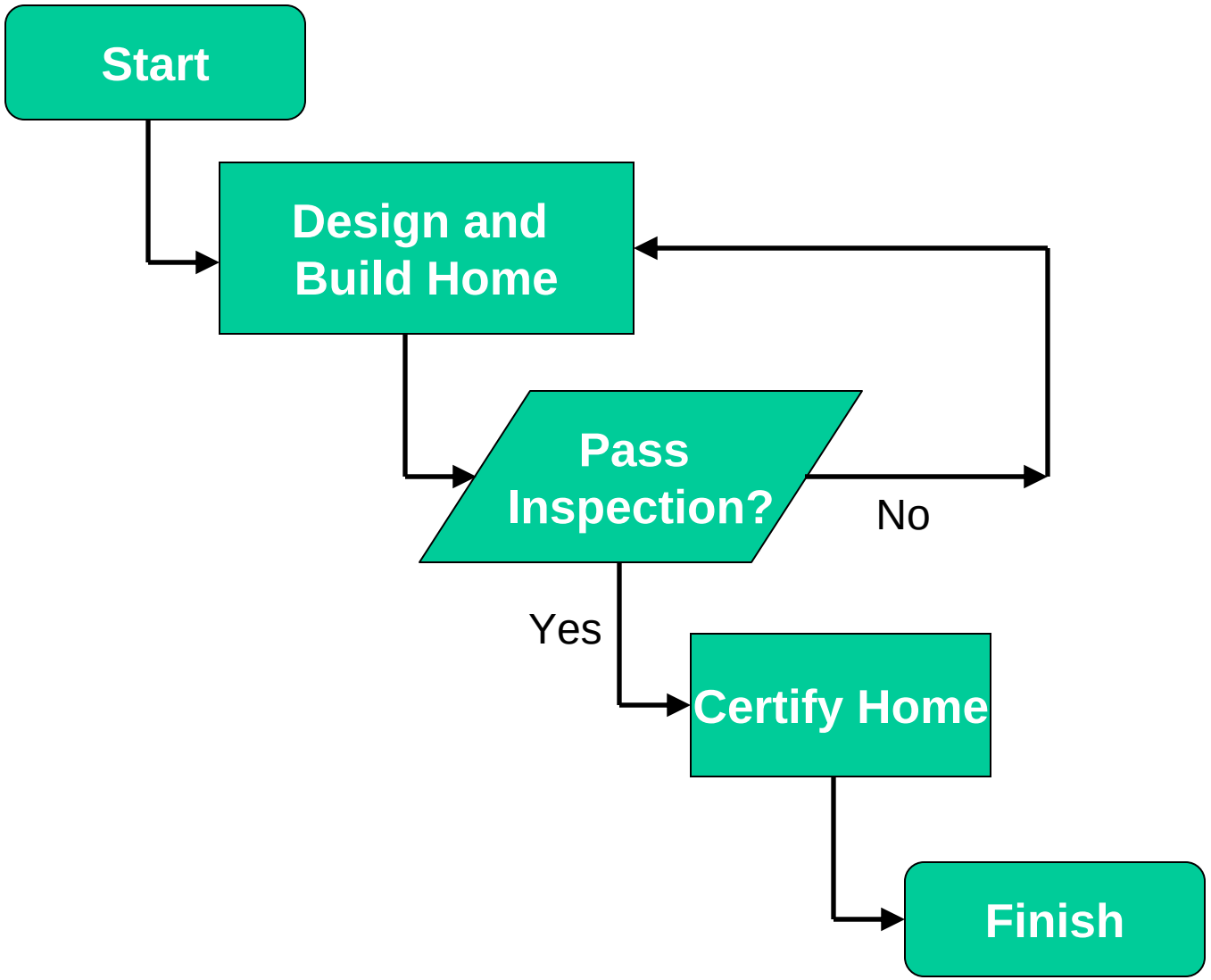
The basic approach:

- Identify problems

Benefits:

1. Compliance with program requirements
2. Potential risks assessed

Basic Inspection Process



Types of risks

Common Problems

- Unclear instructions (docs. and drawings)
- Unfamiliar / untrained trades

Unplanned outcomes

- Wrong measures installed
- Poor performance
- Un-met expectations
- Multiple callbacks
- Unsatisfied homebuyers

Purpose of inspections (cont'd)

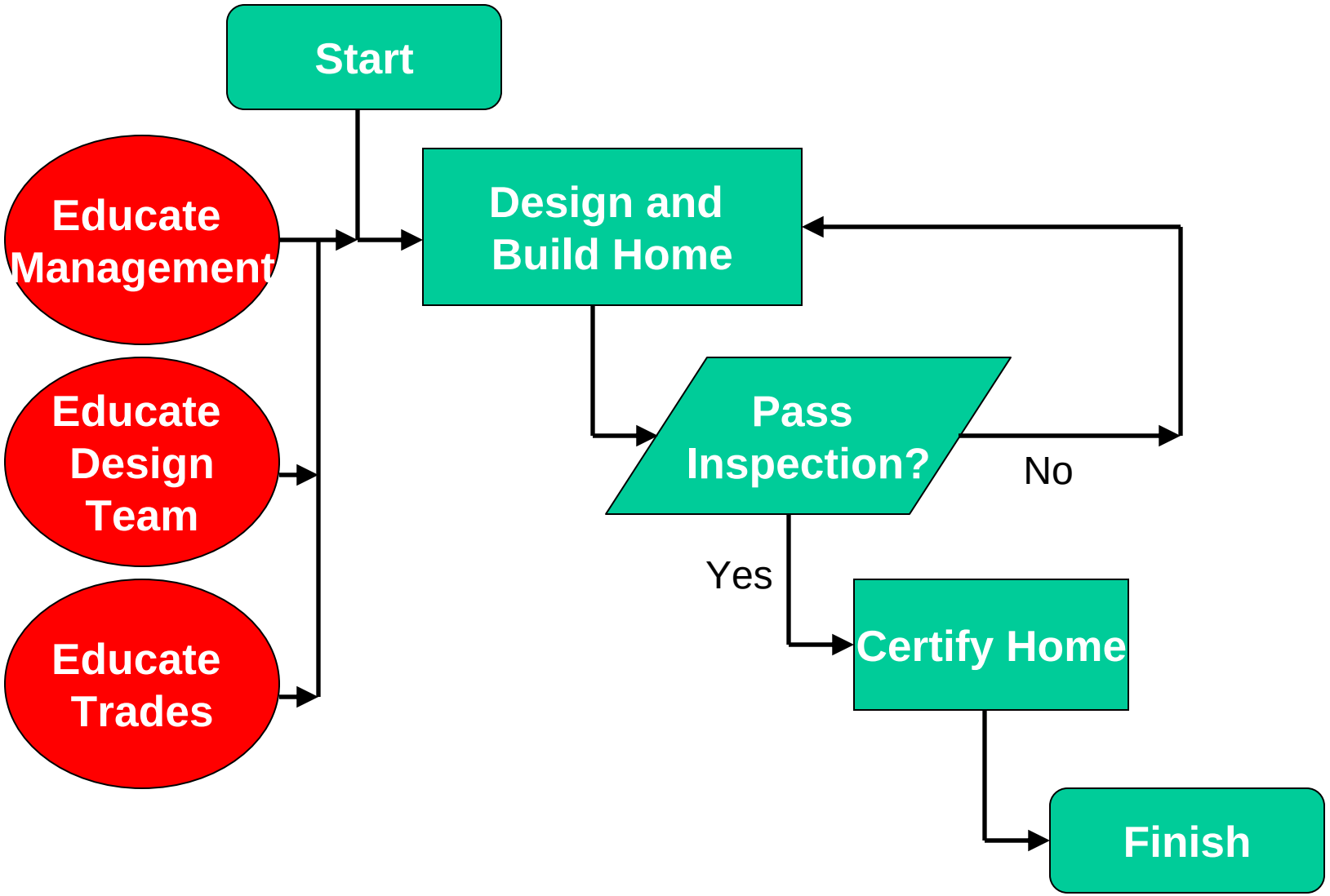
A more successful model:

- Suggest solutions (independent expert advice)

Benefits:

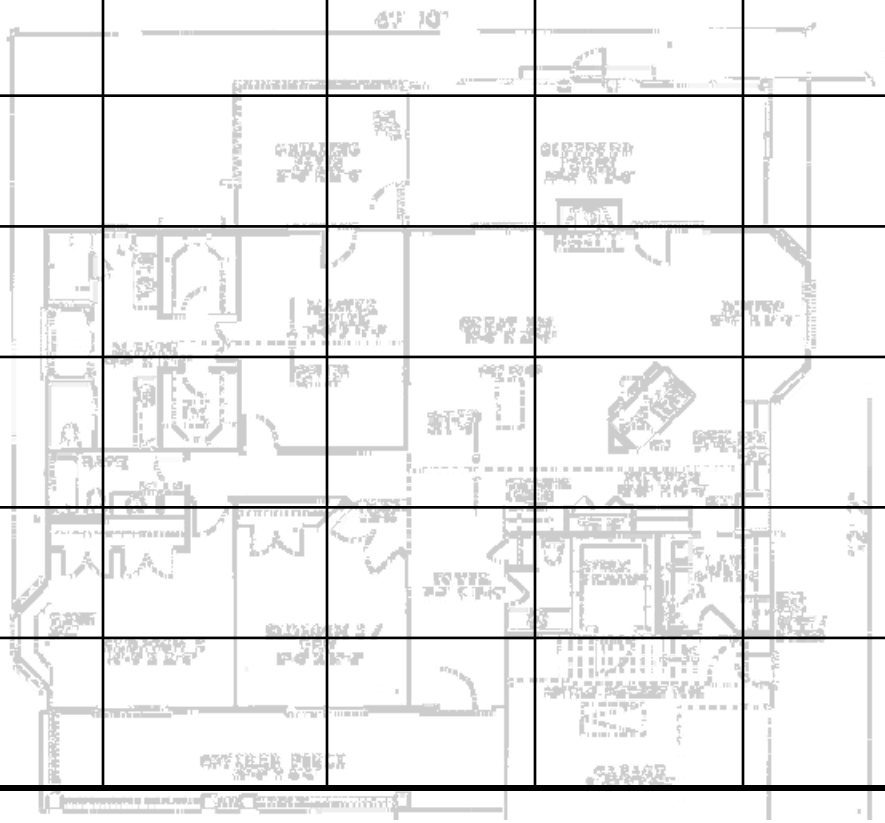
1. Reduce call-backs
2. Save builder money

Enhanced Inspection Process



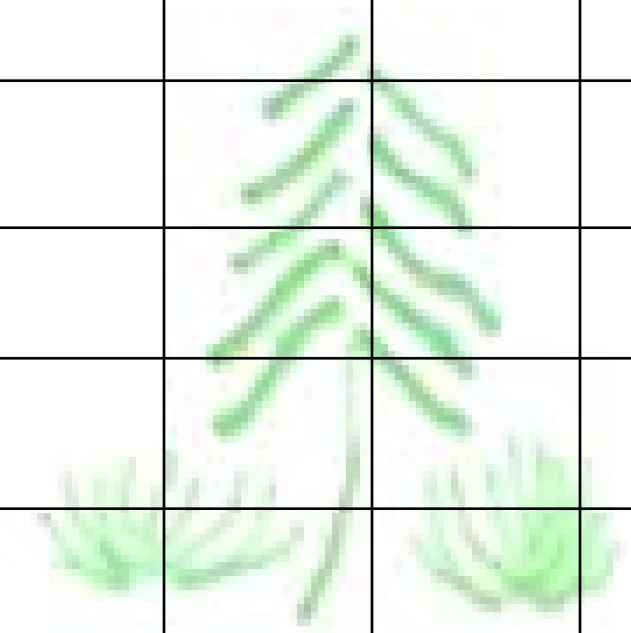
Design Process

Type of Measure	Type of Inspection					
	Paper Review	Design Doc.	Verbal	Visual	Other	All
Quals of project team						



Site / Location

Type of Measure	Type of Inspection					
	Paper Review	Design Doc.	Verbal	Visual	Other	All
Envir. preferable sites						



Water Efficiency

Type of Measure	Type of Inspection					
	Paper Review	Design Doc.	Verbal	Visual	Other	All
Rainwater harvesting						

Materials

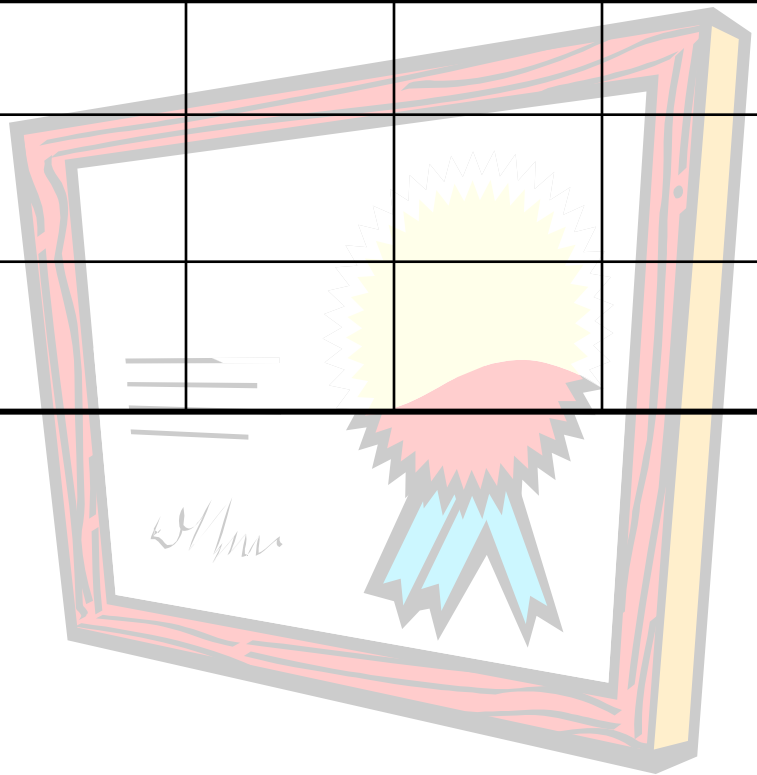
Type of Measure	Type of Inspection					
	Paper Review	Design Doc.	Verbal	Visual	Other	All
Advanced framing						

IEQ

Type of Measure	Type of Inspection					
	Paper Review	Design Doc.	Verbal	Visual	Other	All
Combustion safety						

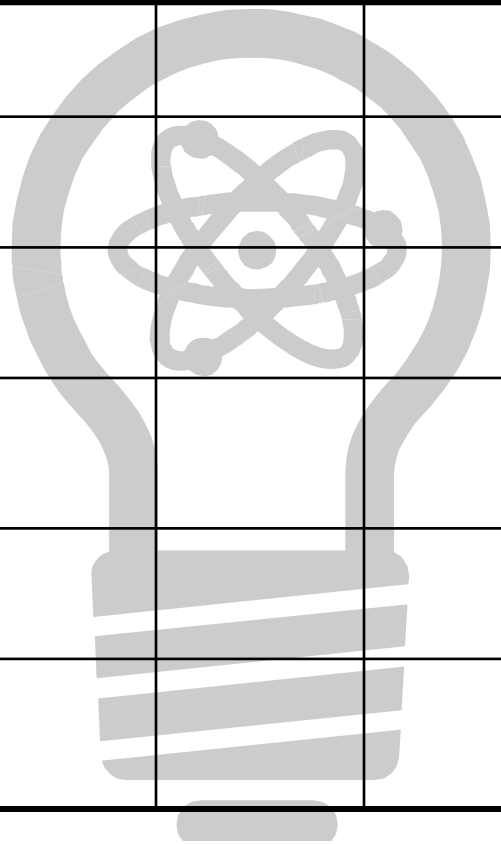
Public Awareness

Type of Measure	Type of Inspection					
	Paper Review	Design Doc.	Verbal	Visual	Other	All
Home owners manual						



Energy

Type of Measure	Type of Inspection					
	Paper Review	Design Doc.	Verbal	Visual	Other	All
Envelope						



Summary

- Clearly understand program's goal (i.e., claims)
- Ask builder about "needs"
- Sell benefits of "inspections"
- Offer to save builder money
- Inspection approach may vary by Program

Performance Tests

Environmental Quality Room Flow Testing

Manual-J 8th Edition

Load Calculation are required by

- LEED for Homes (EQ-6.1)
- ENERGY STAR
- American Lung Association HEALTH HOUSE

Environmental Quality Room Flow Testing

ROOM to ROOM Flow Measurements and Manual-J 8th Edition

Load Calculation are required by or given points by

- LEED for Homes (EQ-6.1)
- American Lung Association Health House

Environmental Quality Room Flow Testing

System 1 Room Load Summary

No	Room Name	Area SF	Htg Sens Btuh	Htg Nom CFM	Run Duct Size	Run Duct Vel	Clg Sens Btuh	Clg Lat Btuh	Clg Nom CFM	Air Sys CFM
---Zone 1---										
1	Entry	97	894	12	1-5	444	865	0	52	60
2	Bed 3	142	2,184	30	1-8	436	2,176	200	130	152
3	WIC 3	35	447	6	1-4	151	188	0	11	13
4	Hall Bath	53	688	9	1-4	271	338	0	20	24
5	Bed 2	146	971	13	1-5	430	838	200	50	59
6	WIC 2	38	73	1	1-4	49	61	0	4	4
7	Master WIC	78	362	5	1-4	190	237	0	14	17
8	Master Bath	131	919	12	1-4	456	569	0	34	40
9	Master Bedroom	263	3,533	48	2-7	484	3,696	400	220	258
10	Living	337	2,900	39	2-6	519	2,916	0	174	204
11	Breakfast/Kitchen	266	4,278	58	3-7	429	4,913	0	293	344
12	Pantry	22	204	3	1-4	76	95	0	6	7
13	Utility	47	980	13	1-5	523	1,020	0	61	71
14	Dining	199	2,623	36	2-6	421	2,366	0	141	165
15	Hall	70	123	2	1-4	91	113	0	7	8
	Ventilation		3,109				1,423	1,002		
	AED Excursion						1,656			
	Duct Loads		4,847				3,541	307		
	System 1 total	1,924	29,135	287			27,011	2,108	1,214	1,426

System 1 Main Trunk Size: 18x18 in.
Velocity: 675 ft/min

Environmental Quality Room Flow Testing

Manual-J 8th Edition
Room-by-Room
Load calculations
provides
HVAC tonnage.

ENERGY STAR allows
15% oversize
or the next available size.

Rhvac - Residential & Light Commercial HVAC Loads
Guaranteed Watt Saver Systems
Oklahoma City, OK 73132

Elite Software Development, Inc.
1925 Ashford Infinity
Page 3

System 1 Room Load Summary

No	Room Name	Area SF	Htg Sens Btuh	Htg Nom CFM	Run Duct Size	Run Duct Vel	Clg Sens Btuh	Clg Lat Btuh	Clg Nom CFM	Air Sys CFM
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6	WIC 2	38	73	1	1-4	49	61	0	4	4
7	Master WIC	78	362	5	1-4	190	237	0	14	17
8	Master Bath	131	919	12	1-4	456	569	0	34	40
9	Master Bedroom	263	3,533	48	2-7	484	3,696	400	220	258
10	Living	337	2,900	39	2-6	519	2,916	0	174	204
11	Breakfast/Kitchen	266	4,278	58	3-7	429	4,913	0	293	344
12	Pantry	22	204	3	1-4	76	95	0	6	7
13	Utility	47	980	13	1-5	523	1,020	0	61	71
14	Dining	199	2,623	36	2-6	421	2,366	0	141	165
15	Hall	70	123	2	1-4	91	113	0	7	8
	Ventilation		3,109				1,423	1,002		
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	System 1 total	1,924	29,135	287			27,011	2,108	1,214	1,426

System 1 Main Trunk Size: 18x18 in.
Velocity: 675 ft./min
Loss per 100 ft.: 0.042 in.wg

Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	2.43	93% / 7%	27,011	2,108	29,120
Recommended:	2.92	77% / 23%	27,011	8,068	35,080

Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	2.43	93% / 7%	27,011	2,108	29,120
Recommended:	2.92	77% / 23%	27,011	8,068	35,080

Environmental Quality Room Flow Testing

ENERGY STAR allows 15% oversize or the next available size.

EPA is developing clarification language

Cooling System Summary					
	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	2.43	93% / 7%	27,011	2,108	29,120
Recommended:	2.92	77% / 23%	27,011	8,068	35,080

Recommended 2.92 tons, that is a 3 ton, next available size is 3.5 ton.

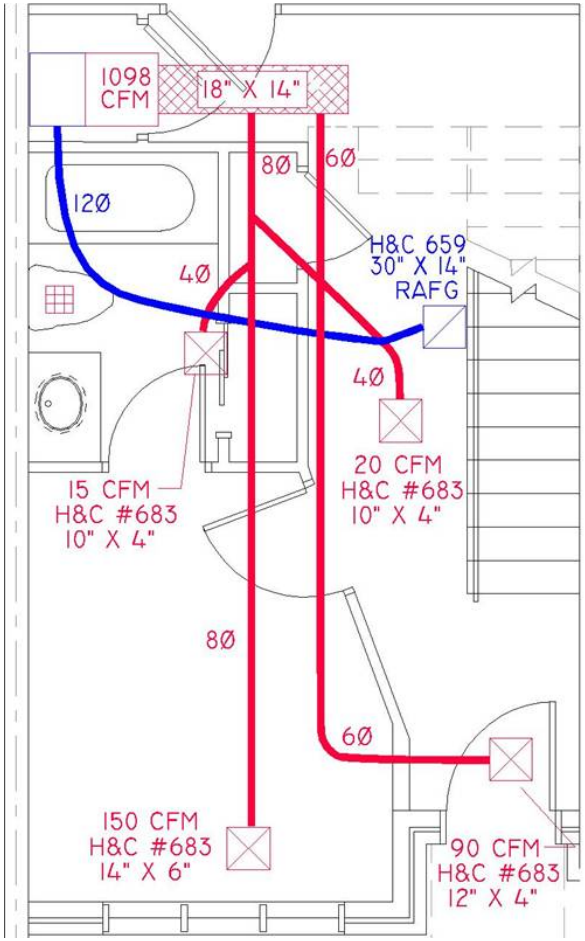
15% oversize means

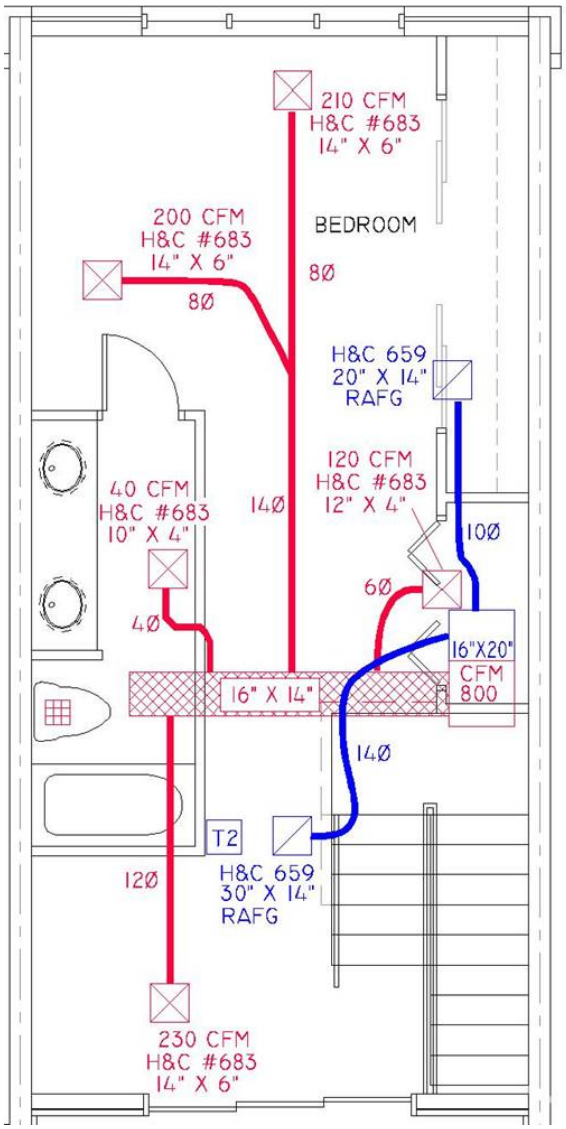
2.92 x 1.15% = 3.4 tons

That is a 3.5 ton

Environmental Quality Room Flow Testing

Manual-D HVAC Layout Design





Environmental Quality Room Flow Testing

• Insert the white foam flow conditioner into the round transition piece between the fan and the flex duct

• Choose a flow ring to match the proposed supply cfm and insert it between the fan and the flex duct

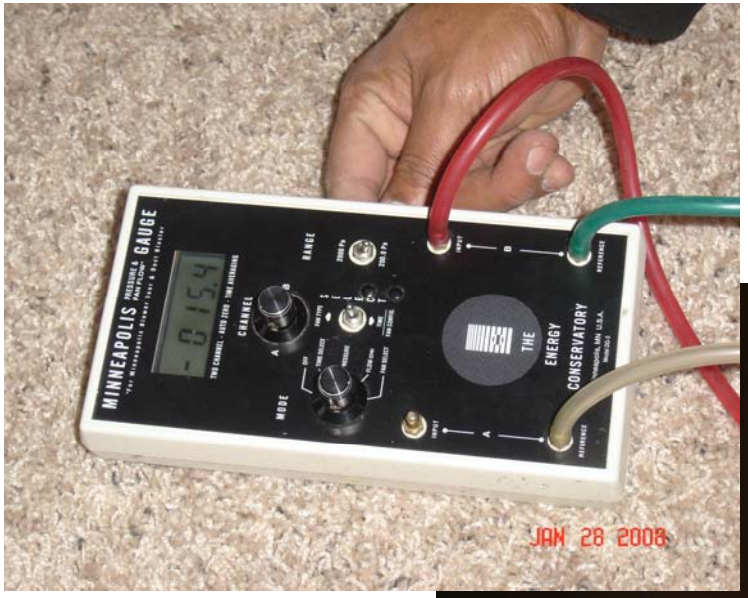
Environmental Quality Room Flow Testing

- Attach the duct blaster to the transition piece mounted on the flex duct

- The fan should be set to depressurize (The metal fan cover should be away from the flex duct when mounted)

Environmental Quality Room Flow Testing

Environmental Quality Room Flow Testing



- **Add a pressure probe in the corner of the flow box and attach it to channel A Input**

- **Leave Channel A reference open**

Environmental Quality Room Flow Testing

- **Connect a hose to the brass pressure tap on the duct blaster and to the Channel B Input (red)**

Environmental Quality Room Flow Testing

- Connect a third hose to the Channel B Reference and to the plastic pressure tap on the duct blaster (green)

Environmental Quality Room Flow Testing

- **Make sure the Flex duct is stretched**

- **Turn on the HVAC fan**

- **Adjust the duct blaster fan speed until the pressure on Channel A equals zero**

Environmental Quality Room Flow Testing

- **Determine the flow through the Duct Blaster fan on Channel B**

Environmental Quality Room Flow Testing

Exhaust Fan Flow Meter

The Energy Conservatory

Environmental Quality Room Flow Testing

Meter Pressure (Pa)	Flow (CFM)		
	E1	E2	E3
1.0	44	21	10
1.2	48	23	11
1.4	52	25	12
1.6	55	26	13
1.8	59	28	14
2.0	62	29	14
2.2	65	31	15
2.4	68	32	16

Meter Pressure (Pa)	Flow (CFM)		
	E1	E2	E3
4.4	92	43	21
4.6	94	44	22
4.8	96	45	22
5.0	98	46	23
5.2	100	47	23
5.4	102	48	23
5.6	103	49	24
5.8	105	50	24
6.0	107	51	25
6.2	109	52	25

Environmental Quality Room Flow Testing

Balometer

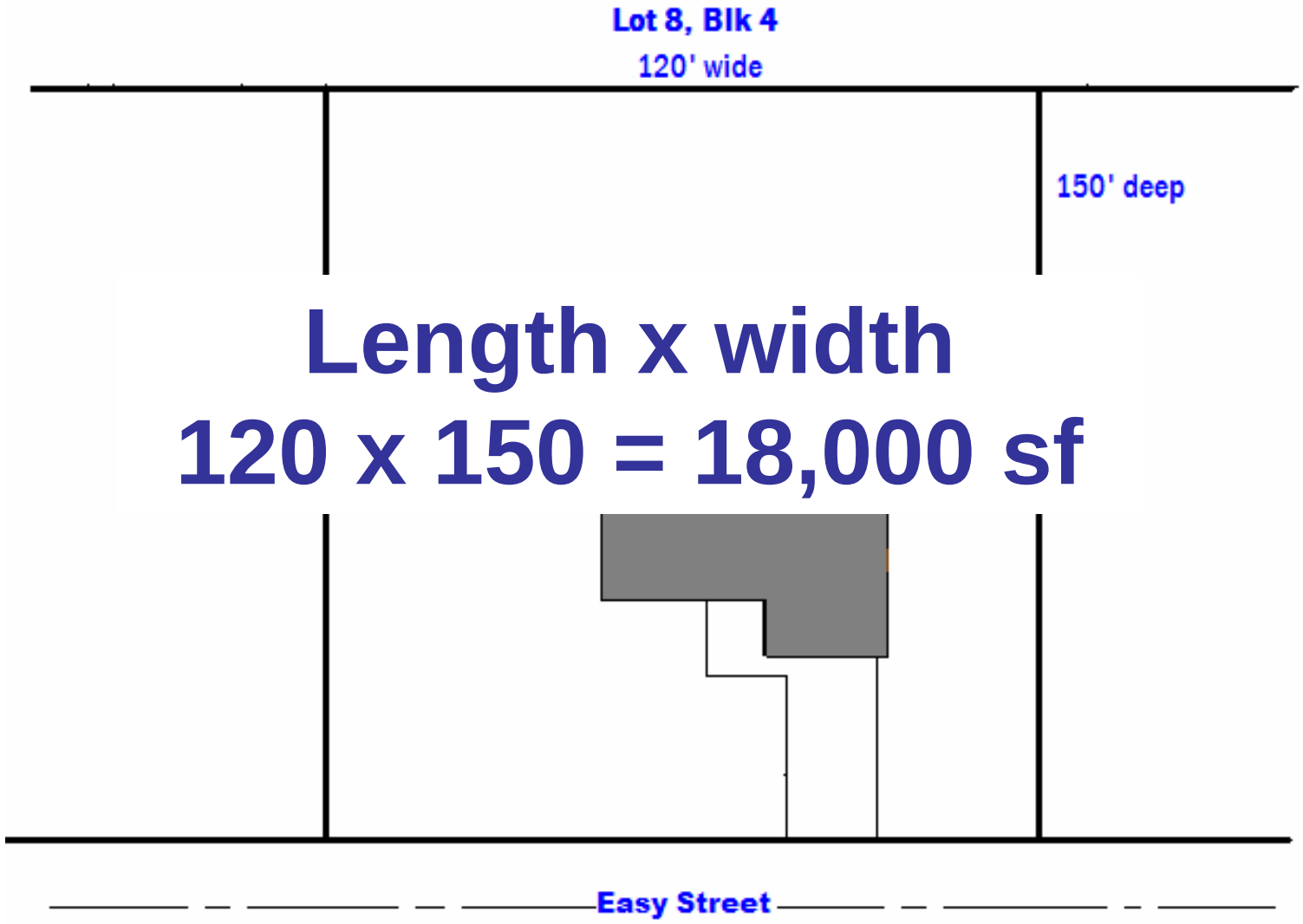
Hand held Flow meter

$1,500 range

Review of Non-Energy Calculations Required by Green Home Rater

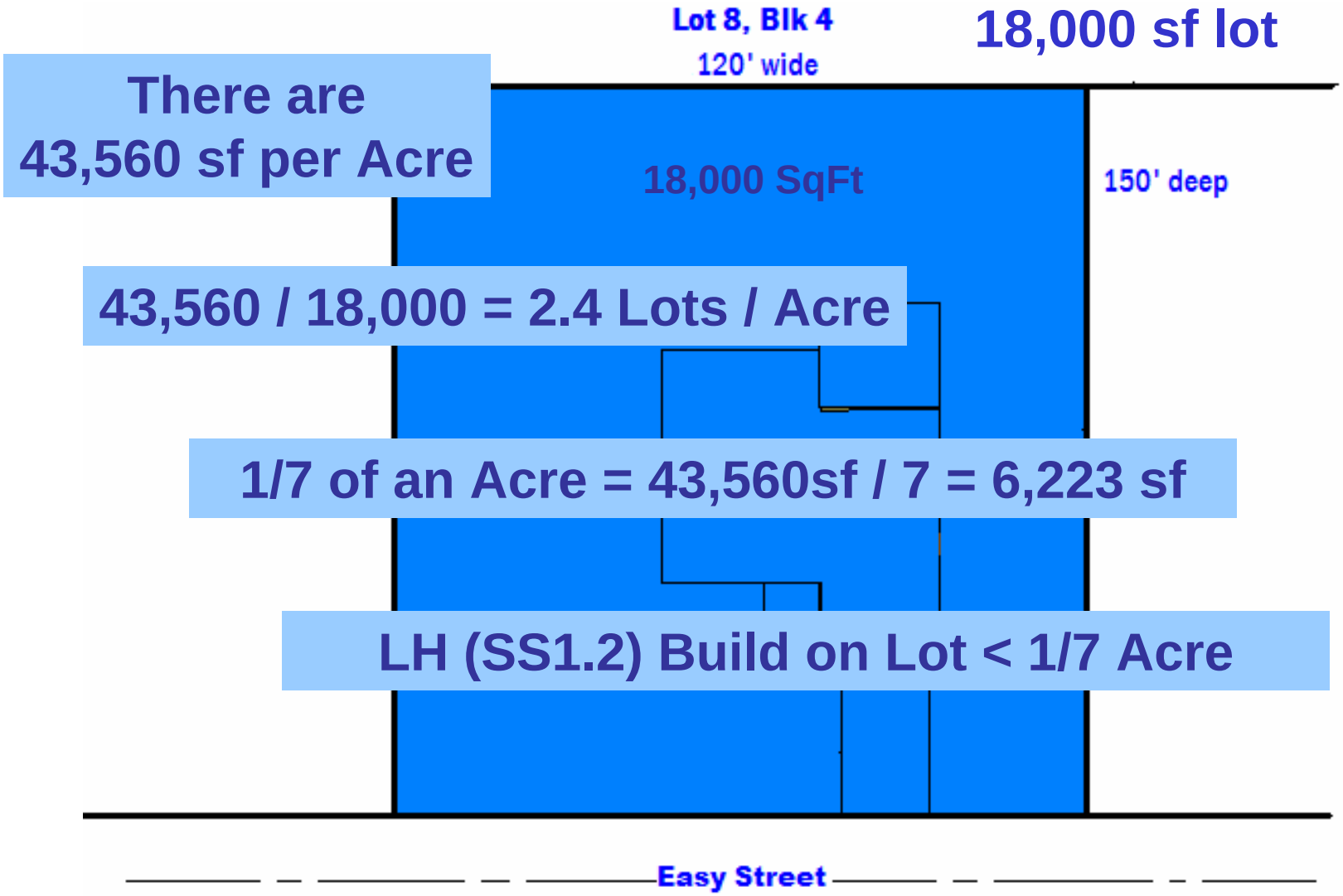
Sustainable Site Calculations

Green Subdivision to the City of Clean Living



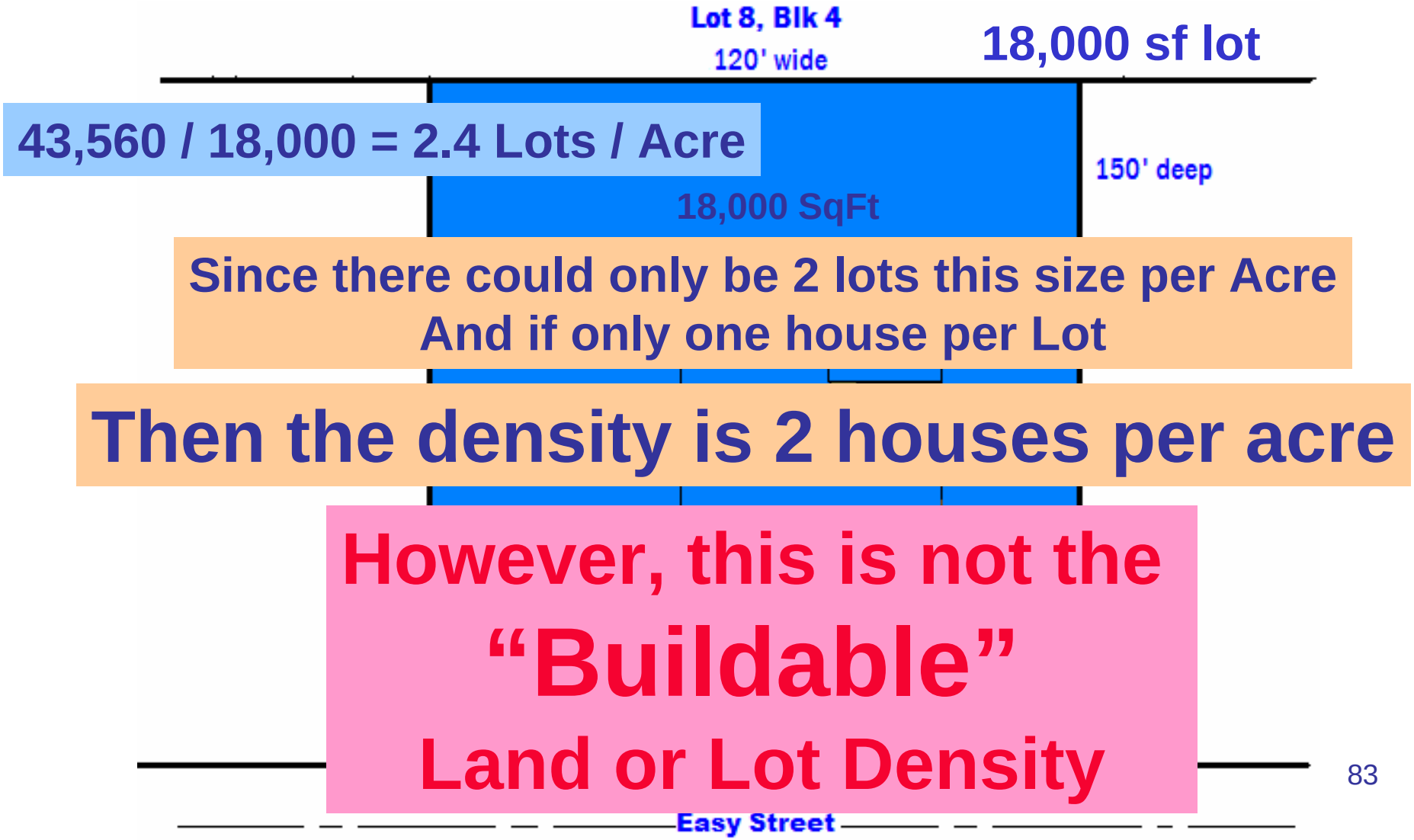
Sustainable Site Calculations

Green Subdivision to the City of Clean Living



Sustainable Site Calculations

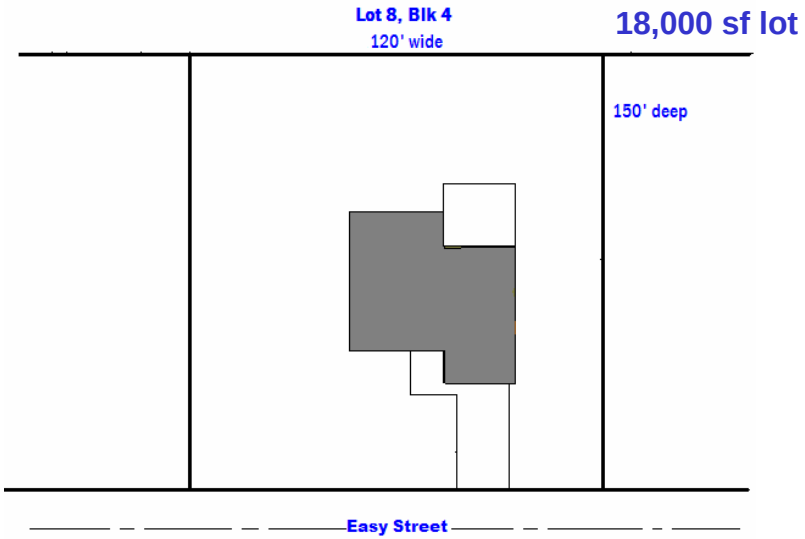
Green Subdivision to the City of Clean Living



Sustainable Site Calculations

What is the "Buildable" SqFt of this Lot?

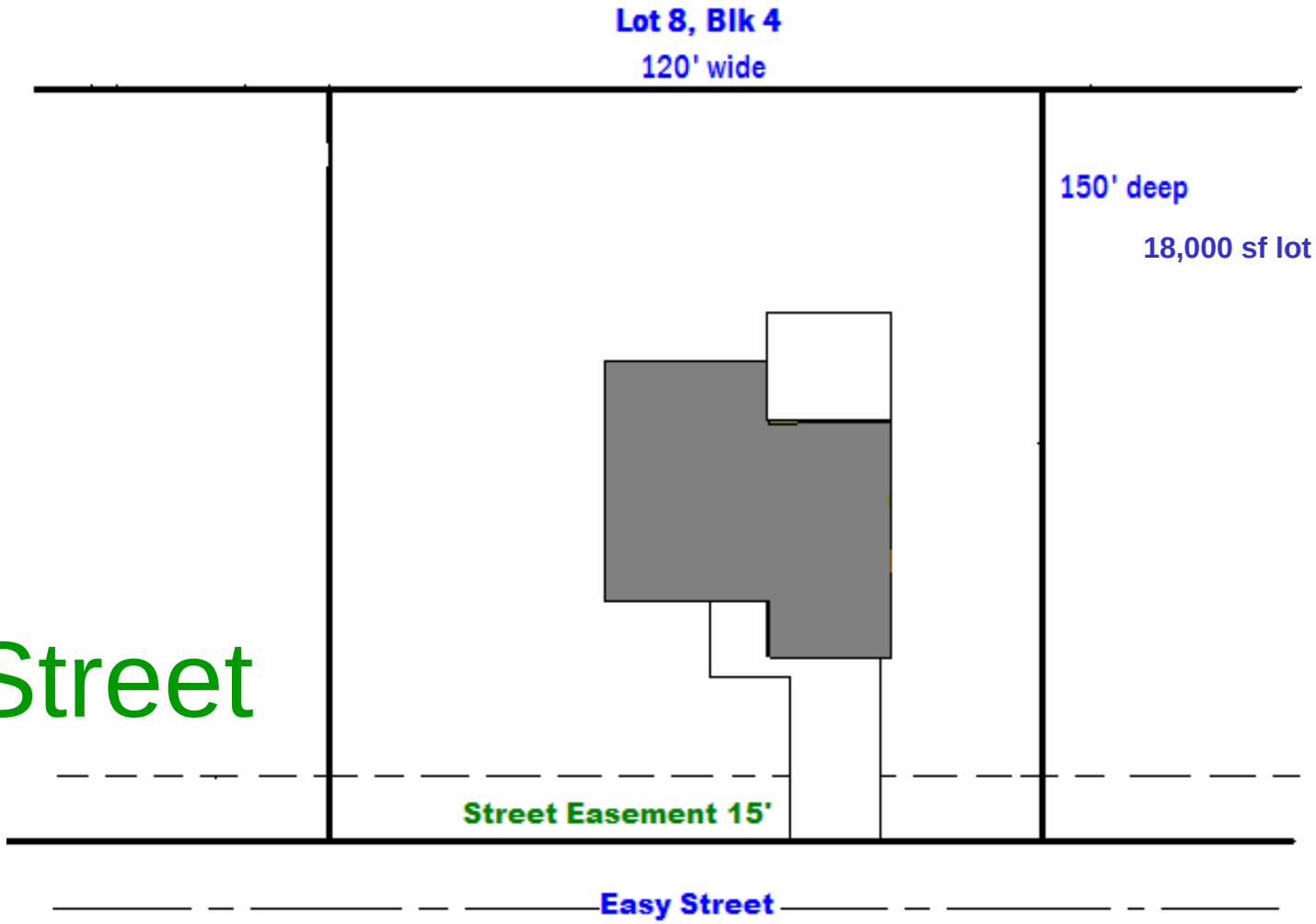
LH (SS-6.3) defines Buildable land as Excluding:



- Public Parks
- Public Streets
- Public Rights of Way
- Land excluded by law
- Land occupied by nonresidential structures
- Only the lots being built for LEED for Homes

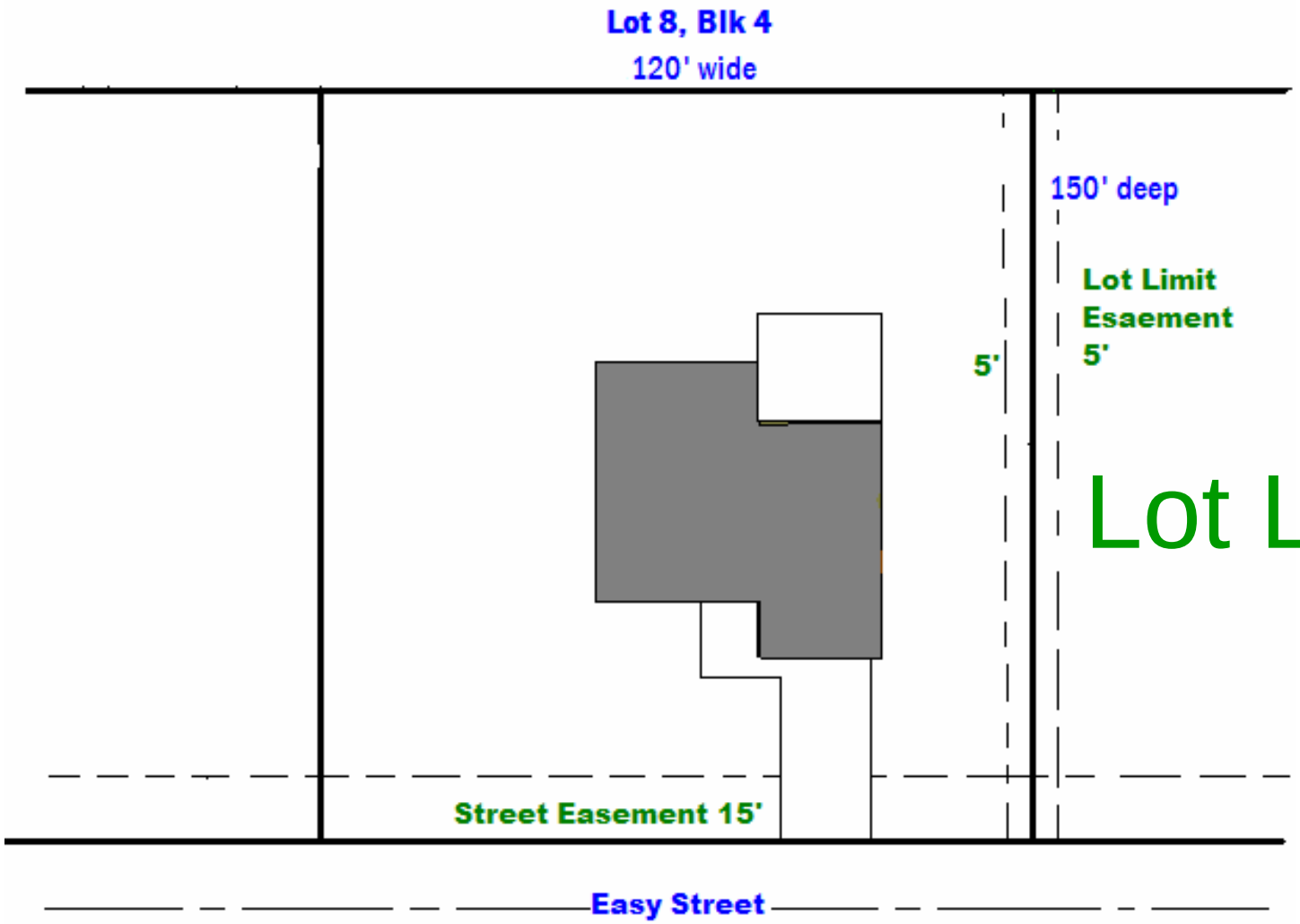
Sustainable Site Calculations

Public rights-of-way or Easements



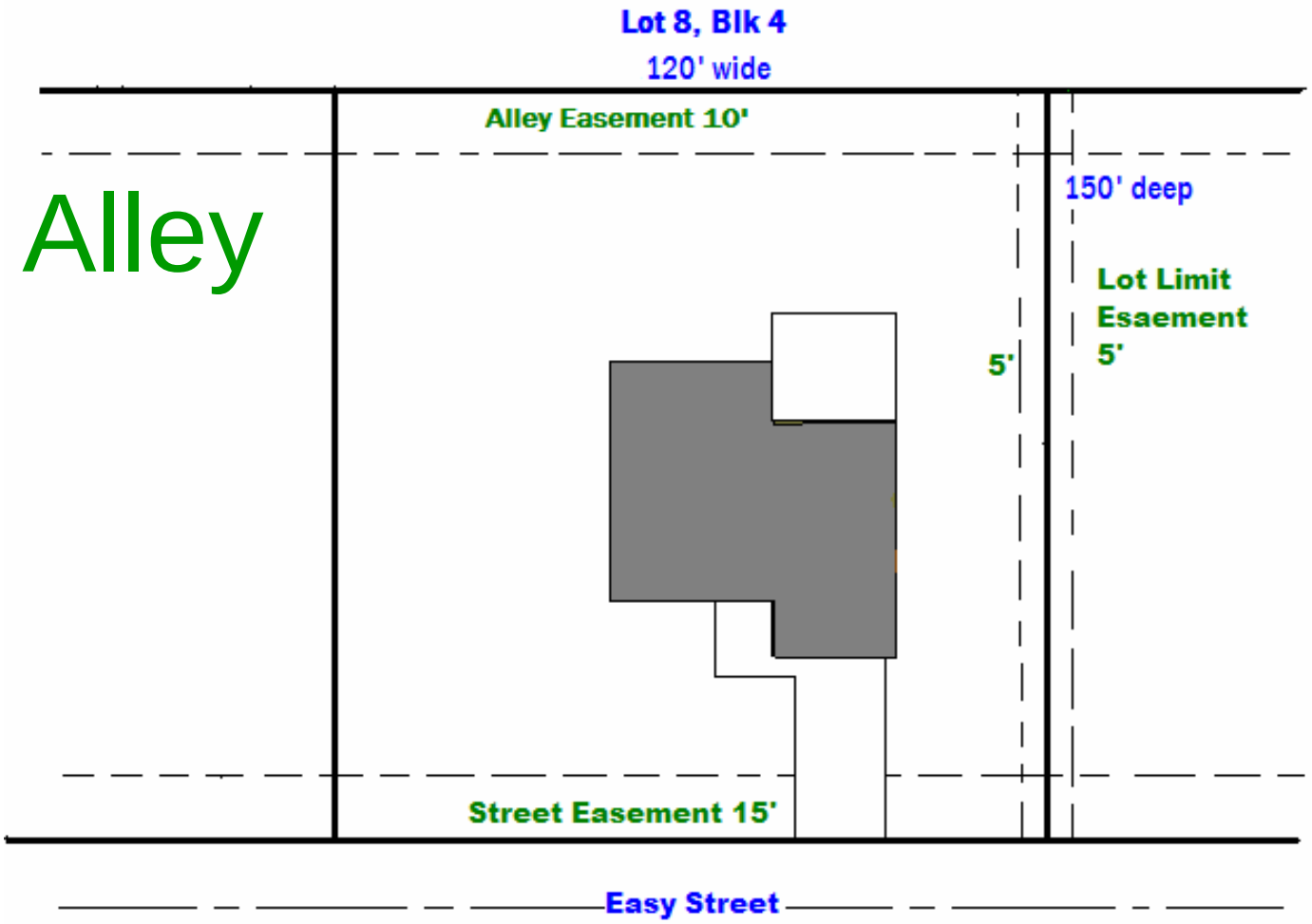
Sustainable Site Calculations

Public rights of way or Easements



Sustainable Site Calculations

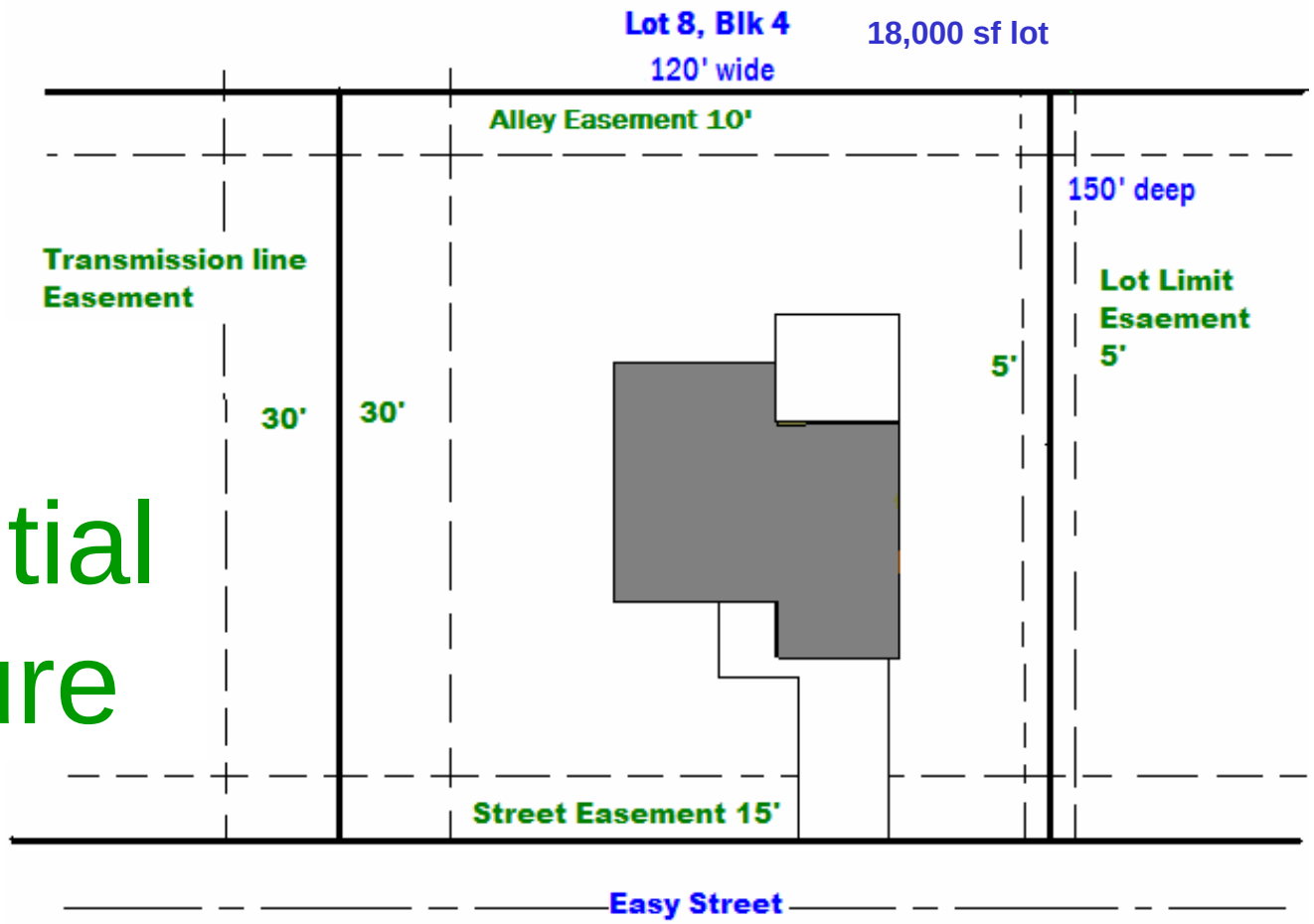
Public rights of way or Easements



Sustainable Site Calculations

Public rights of way or Easements

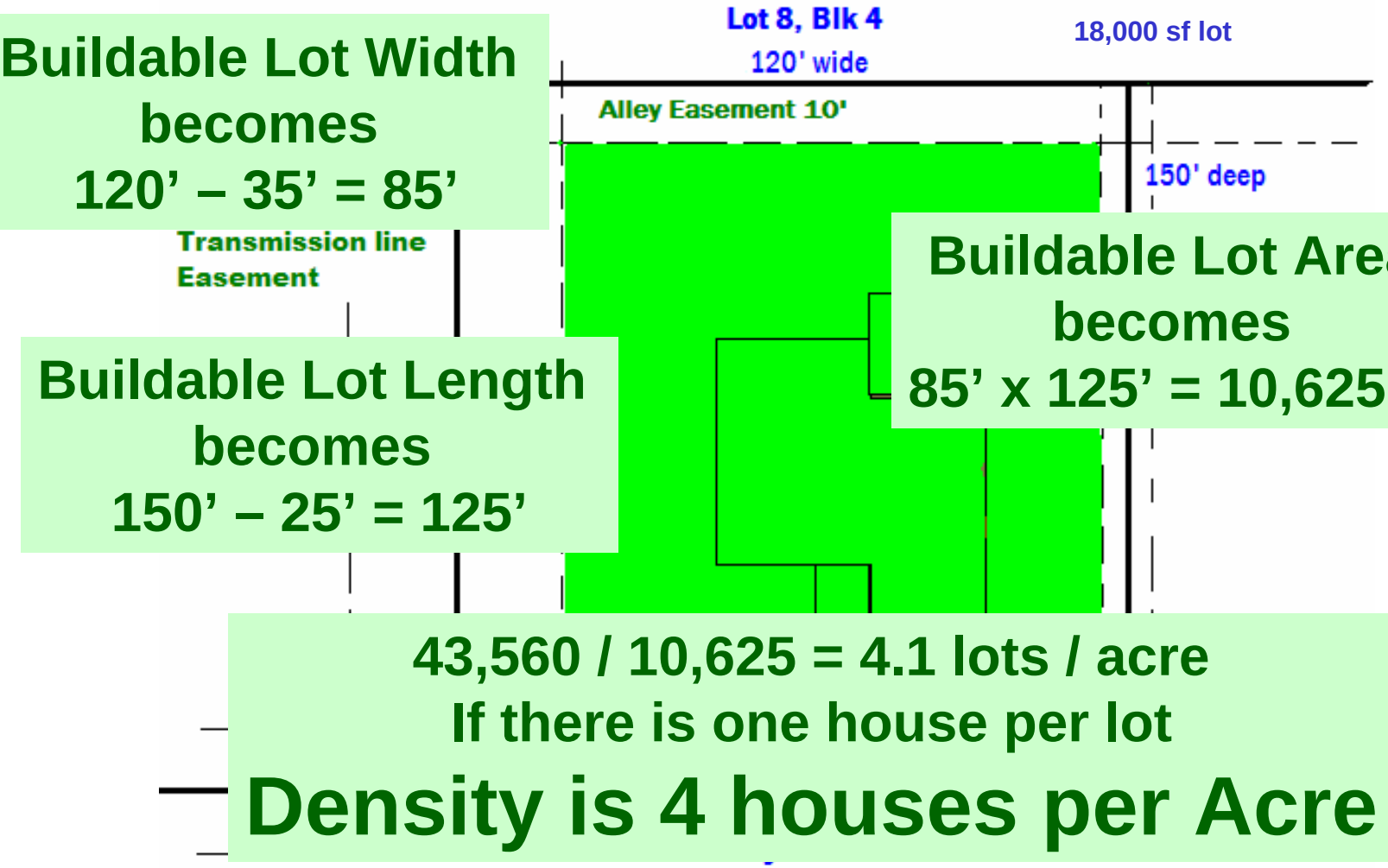
Non Residential Structure



Sustainable Site Calculations

What is the Buildable Land or Buildable Lot?

Buildable Lot Width becomes 120’ – 35’ = 85’



Buildable Lot Area becomes 85’ x 125’ = 10,625 sf

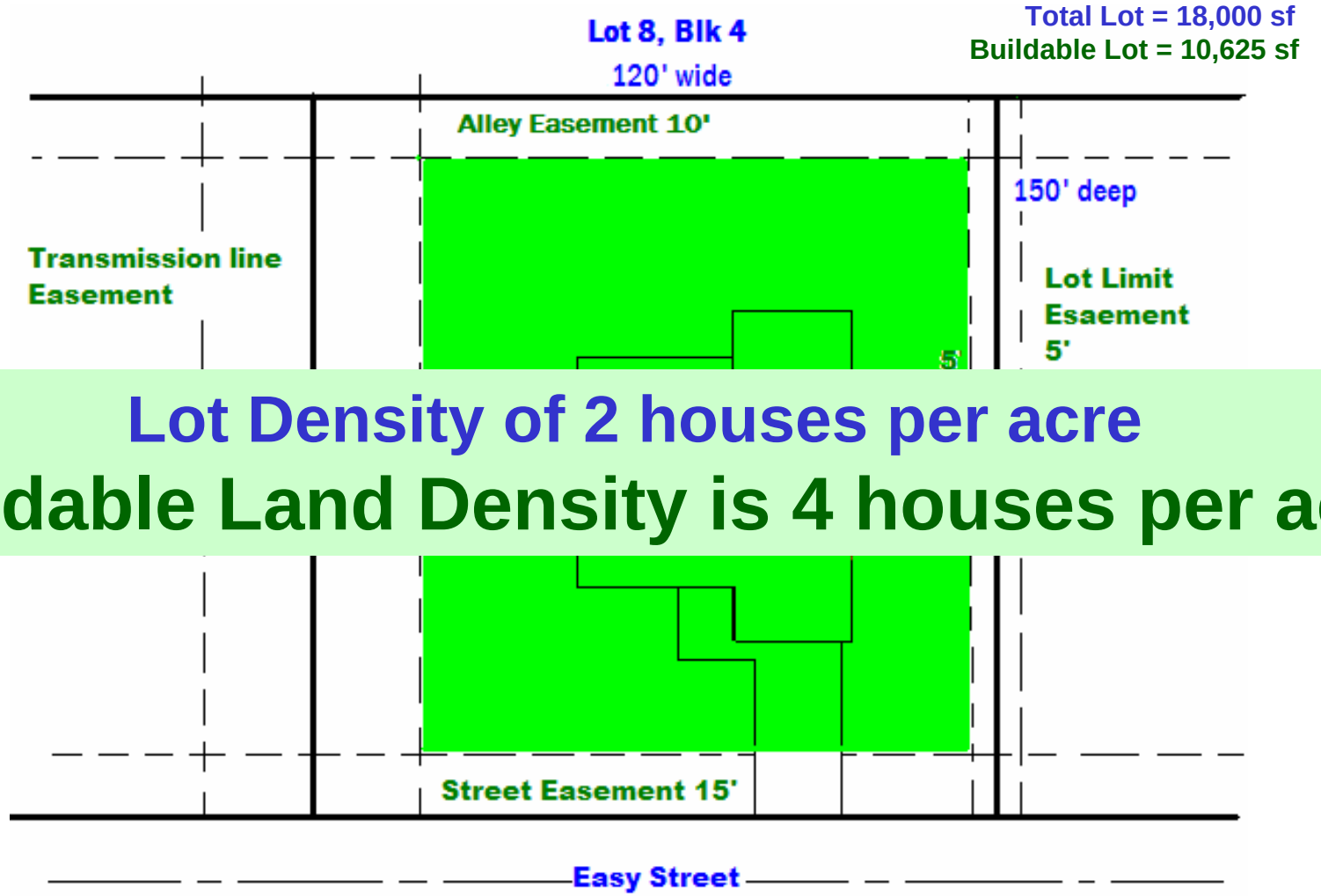
Buildable Lot Length becomes 150’ – 25’ = 125’

43,560 / 10,625 = 4.1 lots / acre
If there is one house per lot

Density is 4 houses per Acre

Sustainable Site Calculations

Housing Density



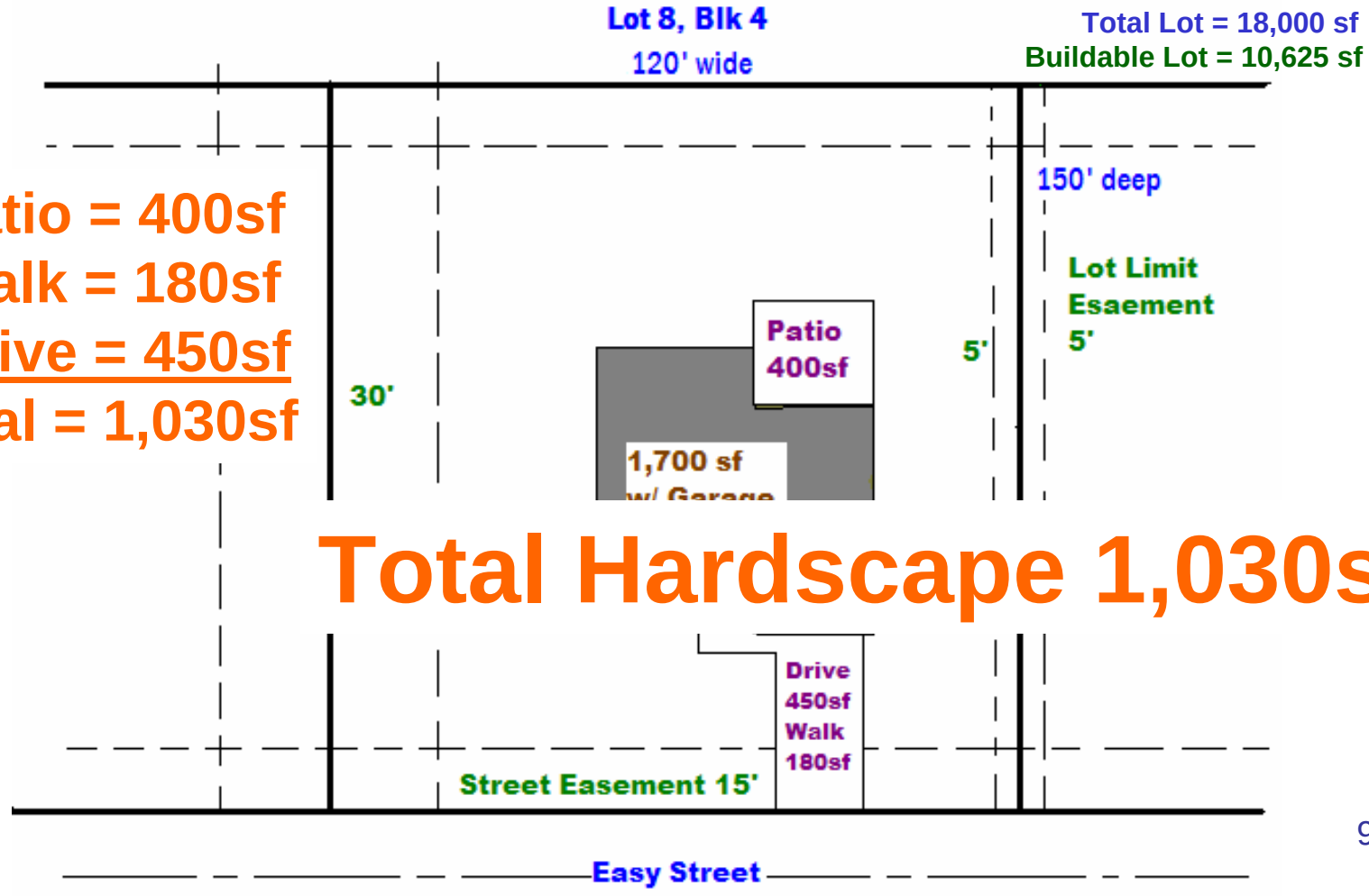
Lot Density of 2 houses per acre

Buildable Land Density is 4 houses per acre

Sustainable Site Calculations

Permeable Sites

What is not Permeable?



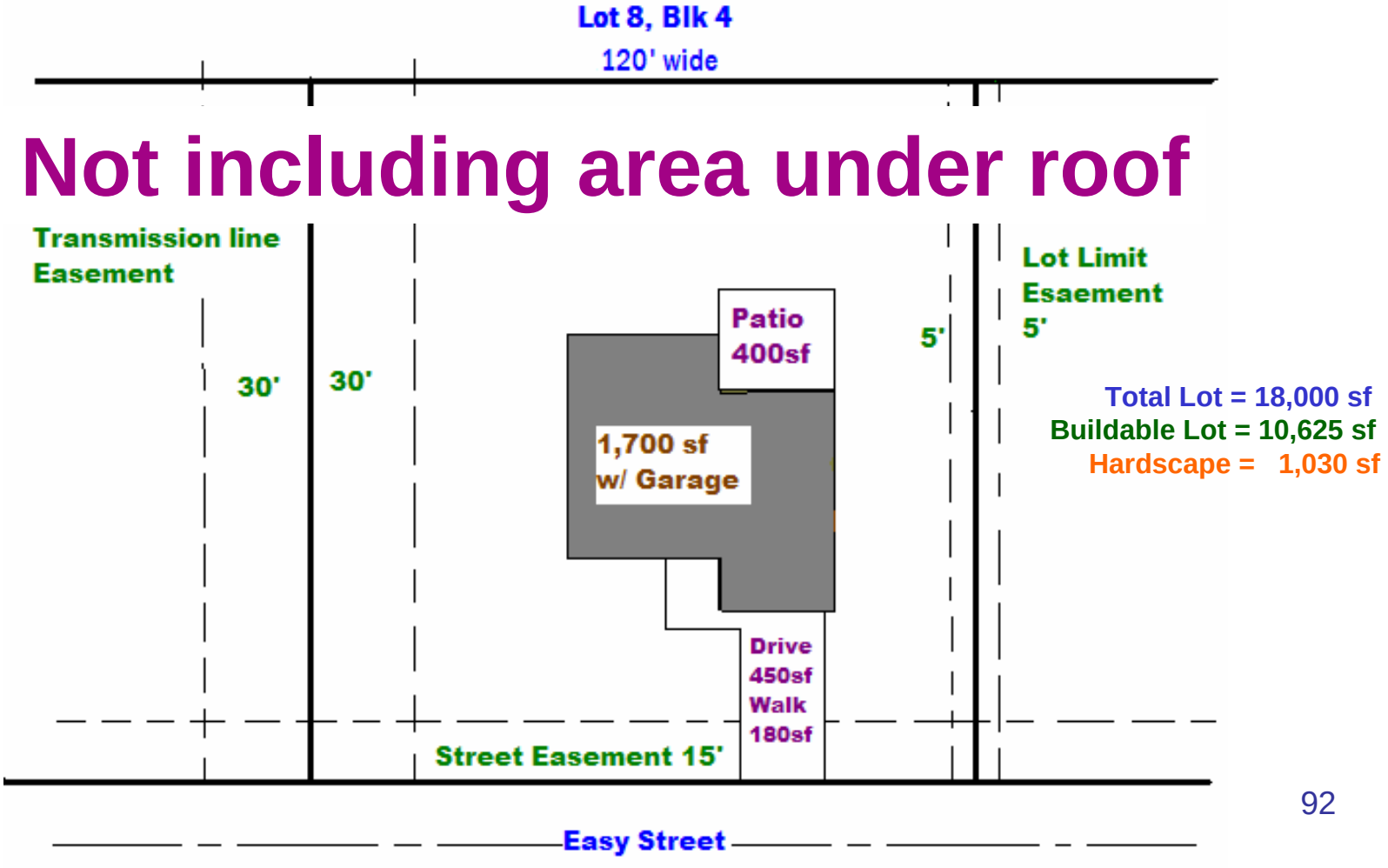
Patio = 400sf
+Walk = 180sf
+Drive = 450sf
Total = 1,030sf

Total Hardscape 1,030sf

Sustainable Site Calculations

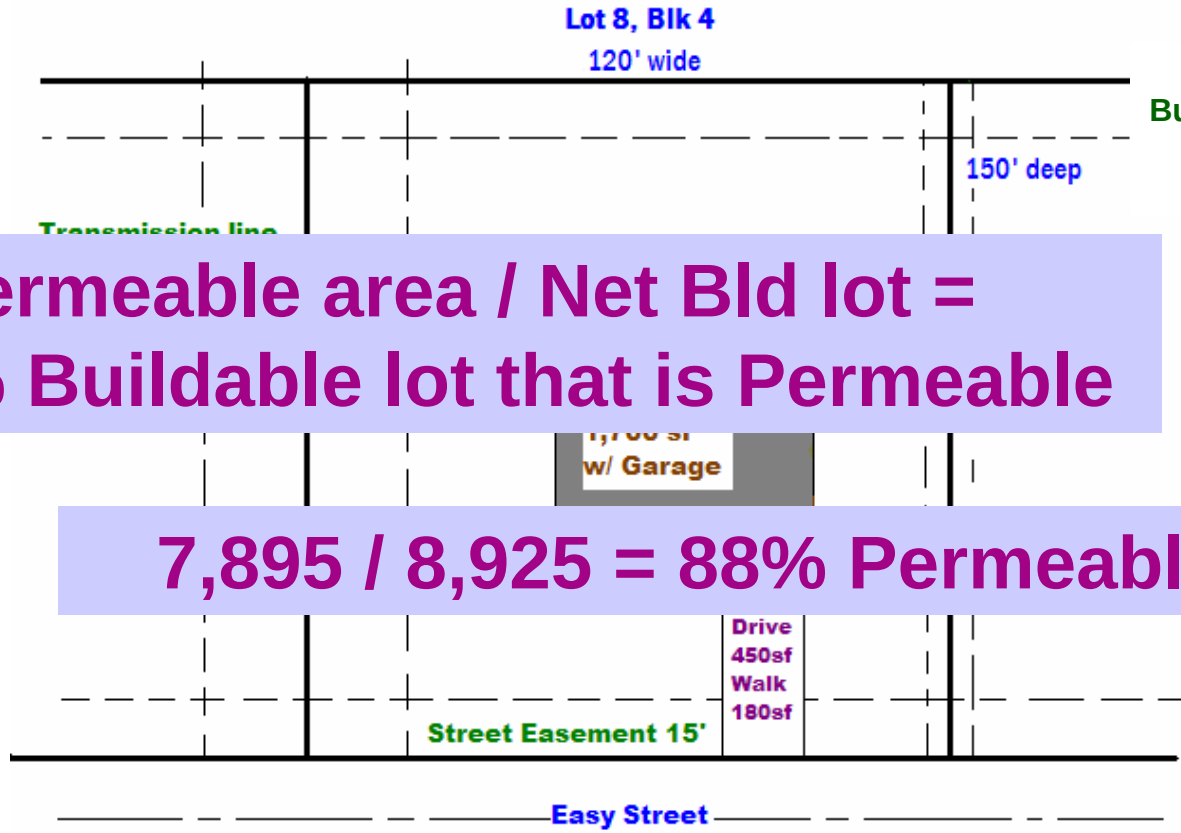
Permeable Sites

LH SS-4.1 Design a lot so 70% is permeable



Sustainable Site Calculations

Buildable lot	**10,625 sf**	**Net Bld Lot**	**8,925 sf**
- Roof area	**- 1,700 sf**	**- Hardscape**	**- 1,030 sf**
= Net Bld lot	**8,925 sf**	**= Permeable area**	**7,895 sf**



Total Lot = 18,000 sf
Buildable Lot = 10,625 sf
Hardscape = 1,030 sf
Roof Area = 1,700 sf

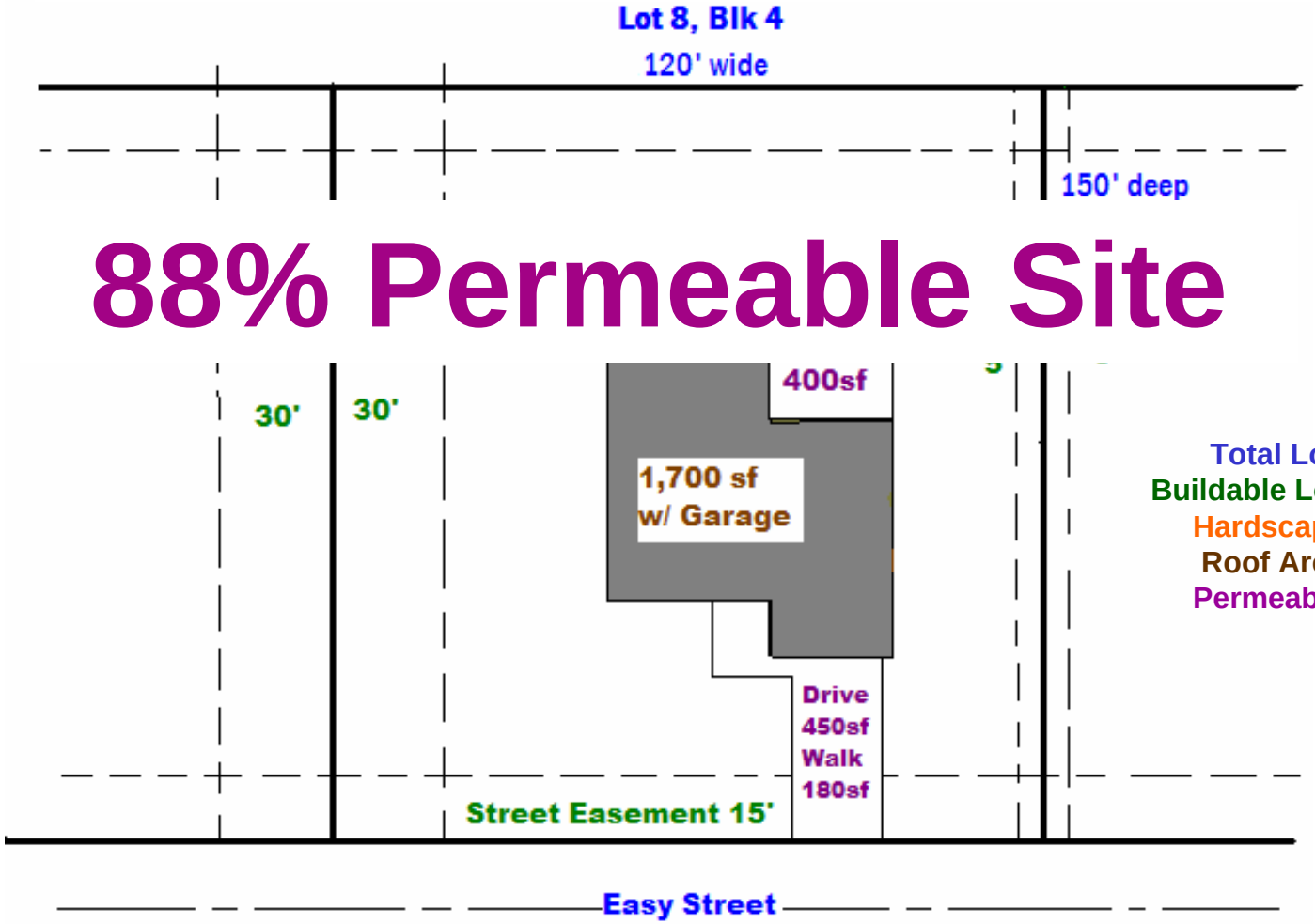
Permeable area / Net Bld lot =
The % Buildable lot that is Permeable

7,895 / 8,925 = 88% Permeable Site

Sustainable Site Calculations

Permeable Sites

LH SS-4.1 Design a lot so 70% is permeable

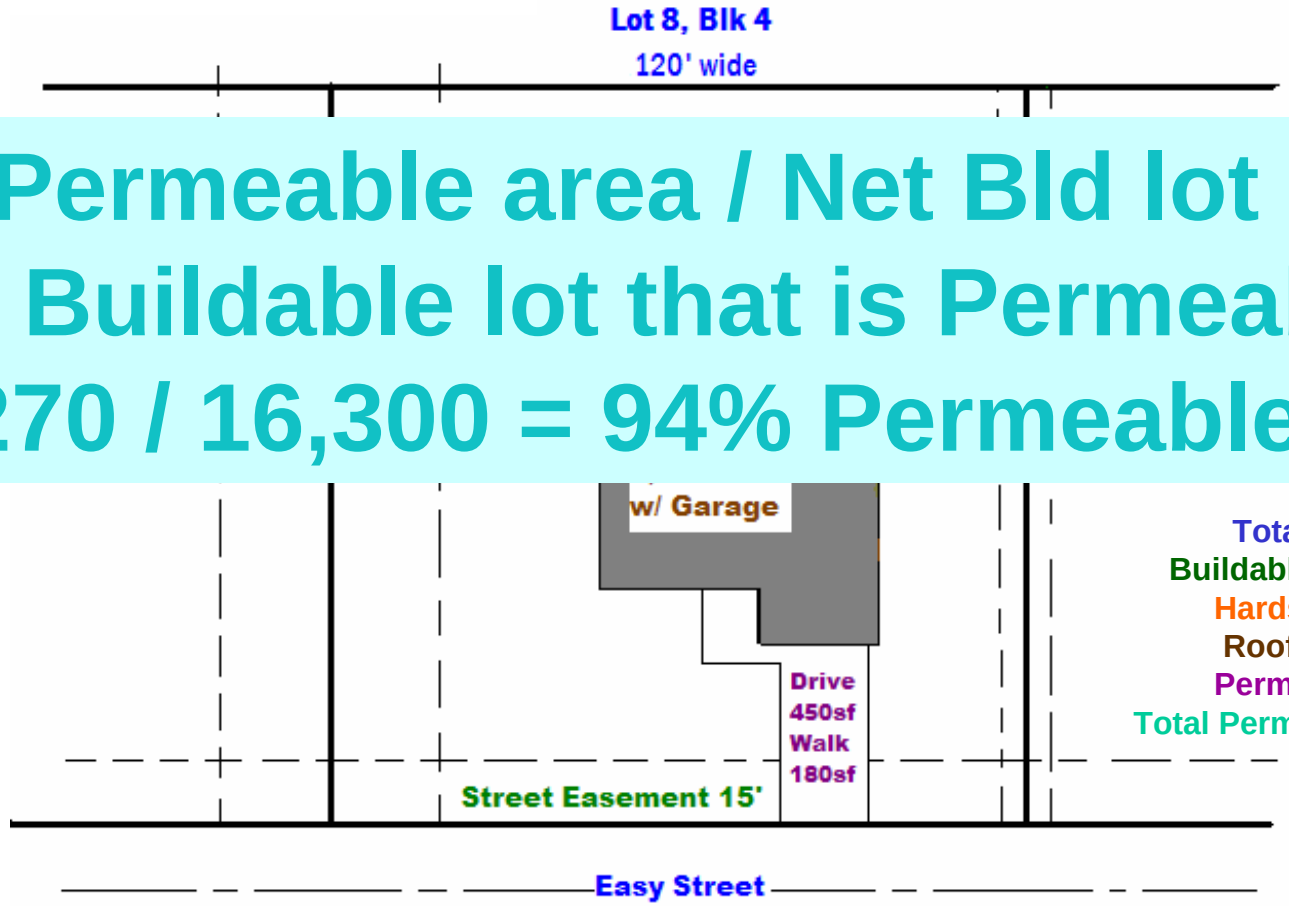


Total Lot = 18,000 sf
Buildable Lot = 10,625 sf
Hardscape = 1,030 sf
Roof Area = 1,700 sf
Permeable = 7,895 sf

Sustainable Site Calculations

Total lot	**18,000**	Net Bld Lot	16,300
- Roof area	**- 1,700**	**- Hardscape**	**- 1,030**
= Net Bld lot	16,300	Total Permeable area =	15,270

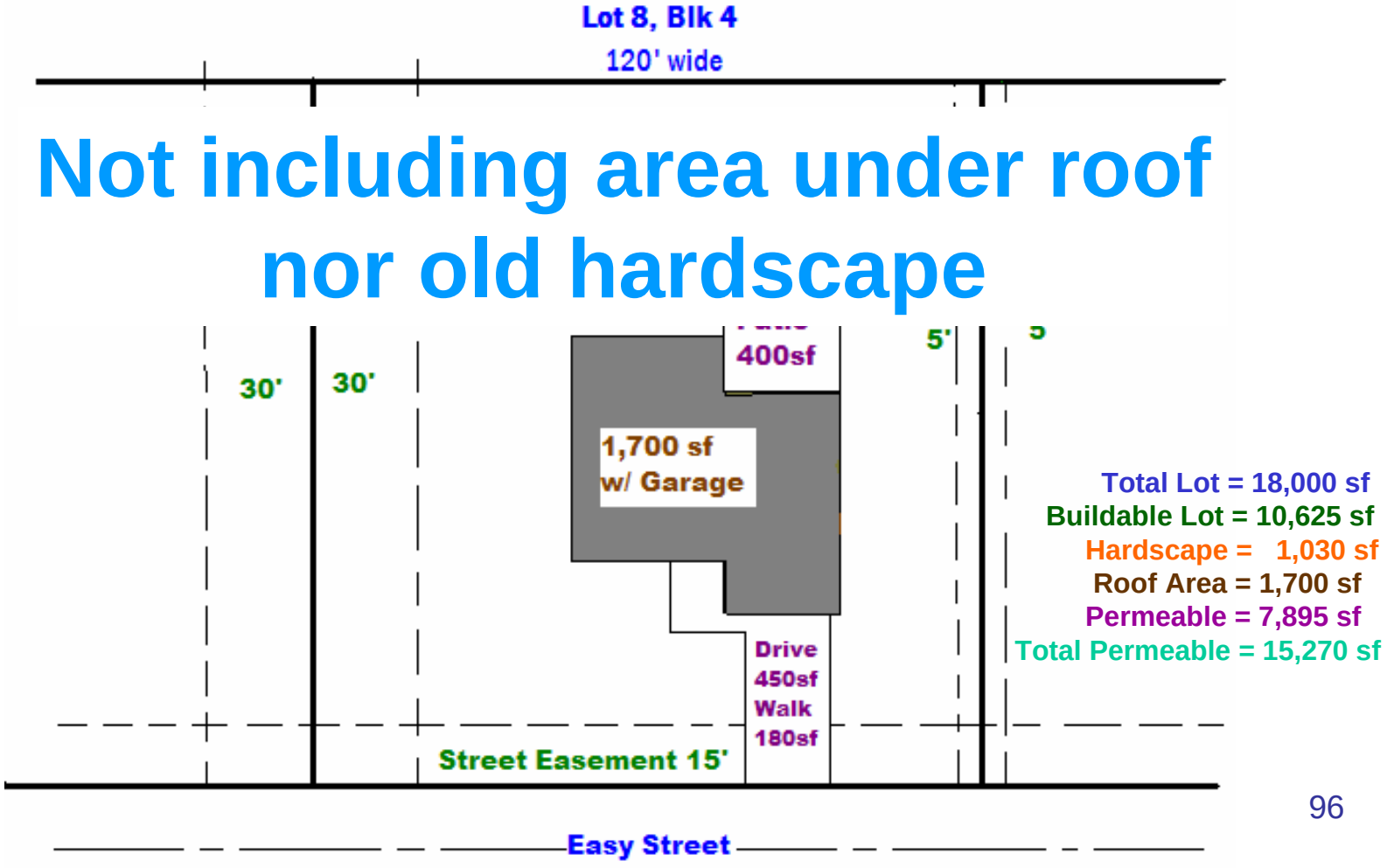
Permeable area / Net Bld lot =
% Buildable lot that is Permeable
15,270 / 16,300 = 94% Permeable Site



Total Lot = 18,000 sf
Buildable Lot = 10,625 sf
Hardscape = 1,030 sf
Roof Area = 1,700 sf
Permeable = 7,895 sf
Total Permeable = 15,270 sf

Sustainable Site Calculations

Minimize disturbed Area of Site
LH SS-1.2b 40% of Buildable Lot Undisturbed



Not including area under roof nor old hardscape

Total Lot = 18,000 sf
Buildable Lot = 10,625 sf
Hardscape = 1,030 sf
Roof Area = 1,700 sf
Permeable = 7,895 sf
Total Permeable = 15,270 sf

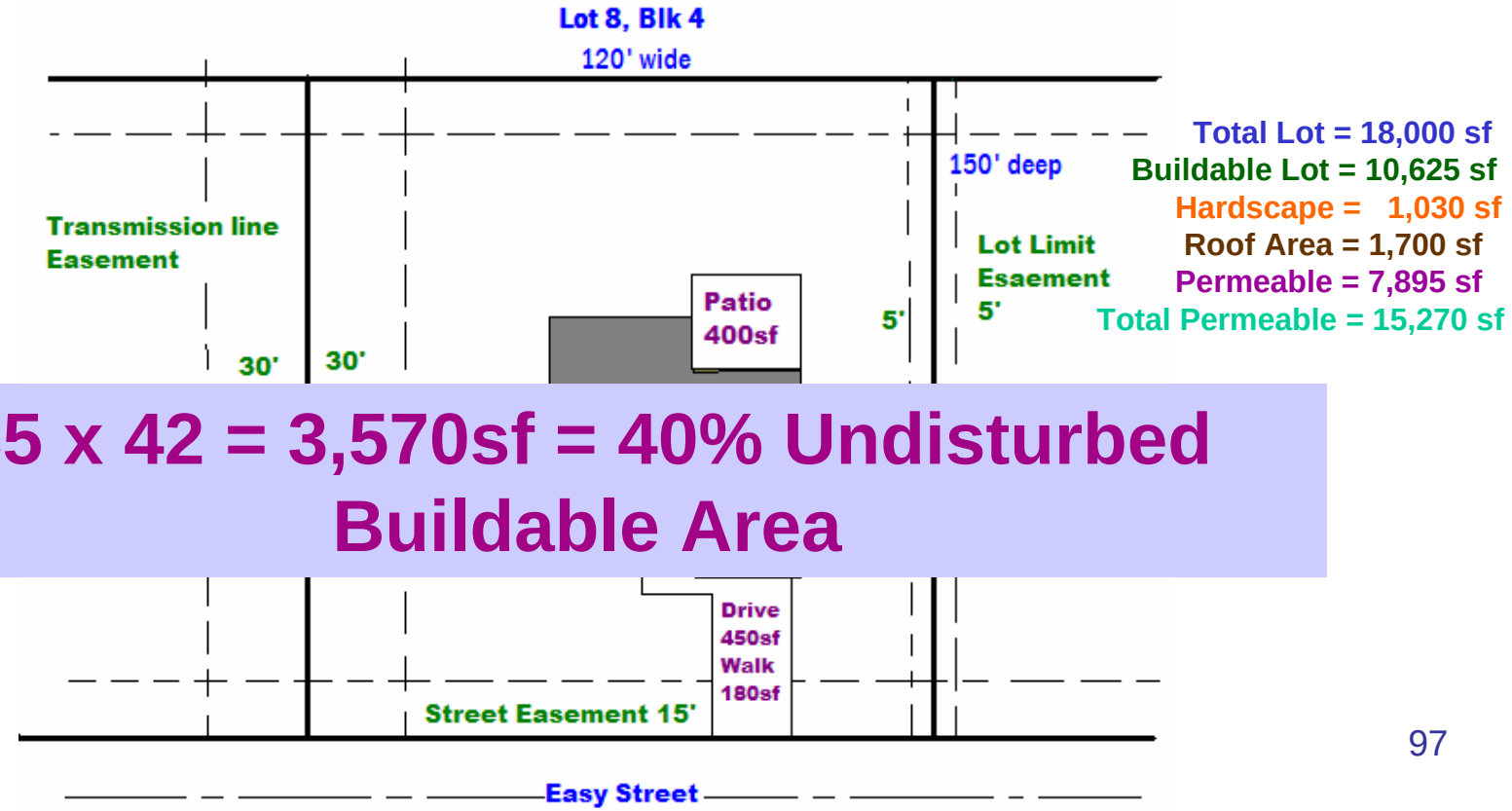
Sustainable Site Calculations

Buildable lot	**10,625 sf**
- Roof area	**- 1,700 sf**
= Net Bld lot	**8,925 sf**

Net Bld Lot **8,925 sf**

X40%

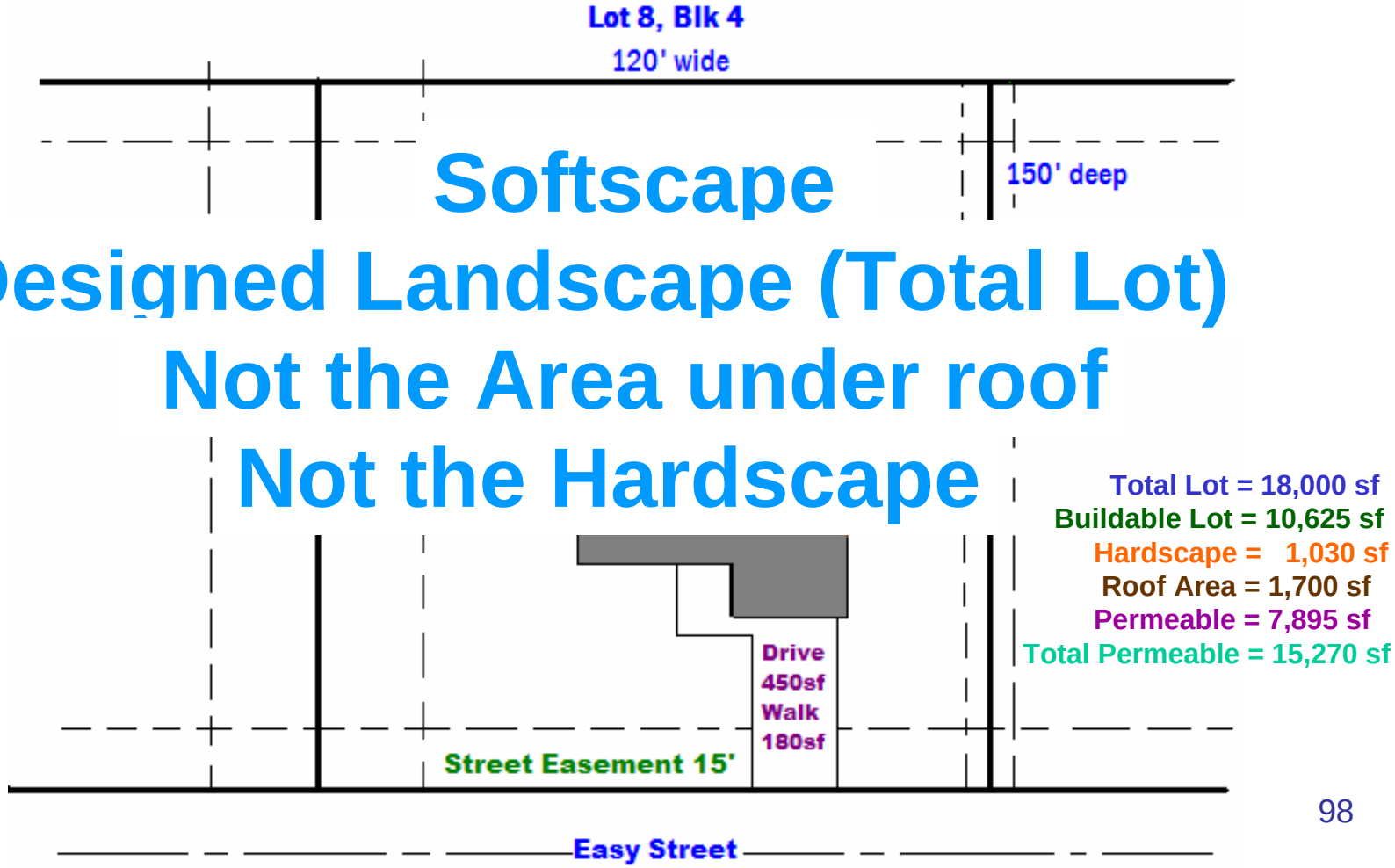
Undisturbed area = 3,570 sf



85 x 42 = 3,570sf = 40% Undisturbed Buildable Area

Sustainable Site Calculations

LH SS-2.3 Limit Conventional Turf in the designed Lanscape Softscapes



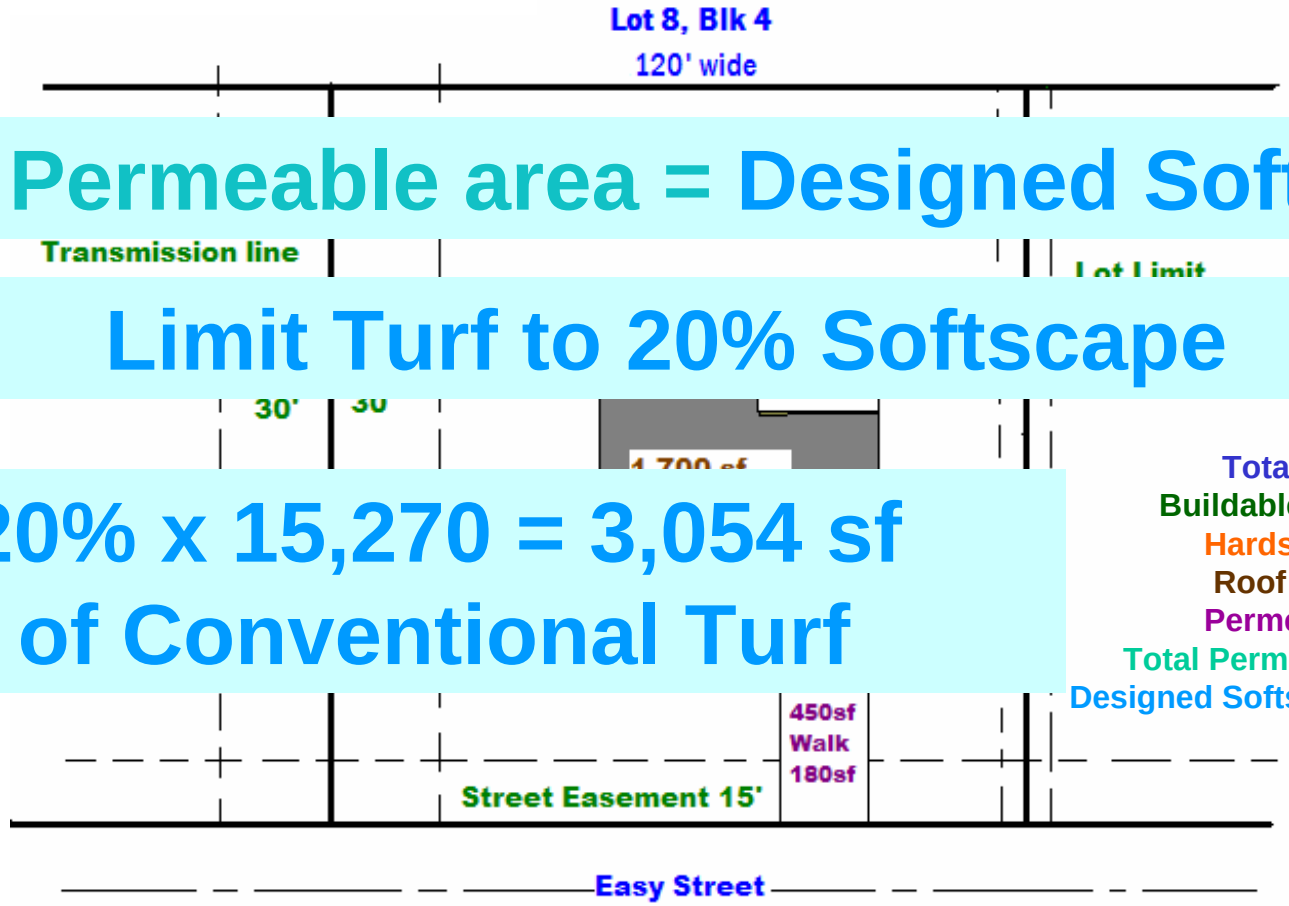
Sustainable Site Calculations

Total lot	**18,000**	Net Bld Lot	16,300
- Roof area	**- 1,700**	**- Hardscape**	**- 1,030**
= Net Bld lot	16,300	Total Permeable area =	15,270

Total Permeable area = Designed Softscape

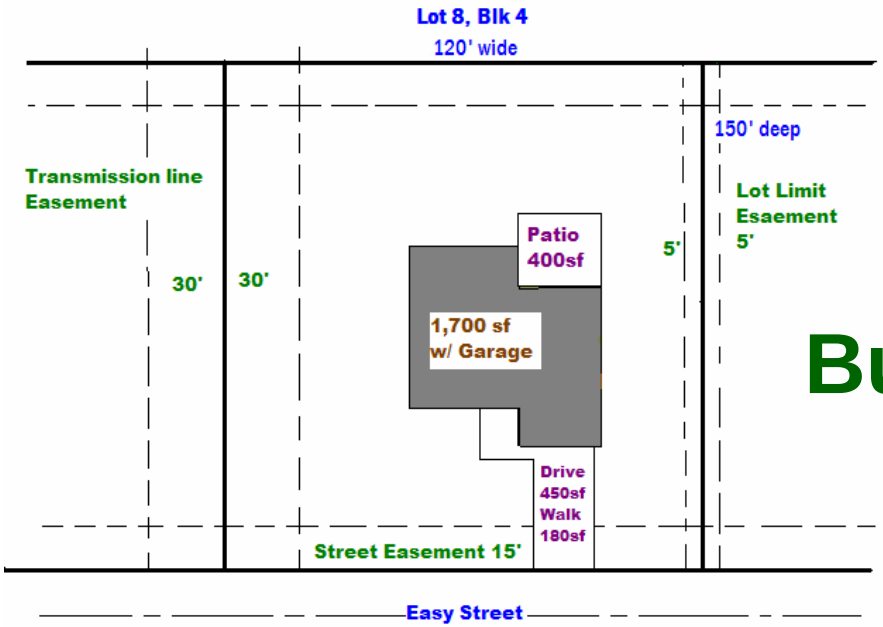
Limit Turf to 20% Softscape

20% x 15,270 = 3,054 sf of Conventional Turf



Total Lot = 18,000 sf
Buildable Lot = 10,625 sf
Hardscape = 1,030 sf
Roof Area = 1,700 sf
Permeable = 7,895 sf
Total Permeable = 15,270 sf
Designed Softscape = 15,270 sf

Sustainable Site Calculations



Total Lot = 18,000 sf

Buildable Lot = 10,625 sf

Hardscape = 1,030 sf

Roof Area = 1,700 sf

Permeable = 7,895 sf

Total Permeable = 15,270 sf

Designed Softscape = 15,270 sf

Documentation Requirements

Documentation

- What is the information used for?
  - Verification & Certification
  - Homeowner education
  - Data collection
- Levels of documentation
  - Light
  - Medium
  - Heavy

Documentation

Each program varies

- Visual verification
- Photo documentation
- Product literature
  - Cut sheet
  - Spec sheet
  - MSDS
- Test results
- Inspection reports

Photo Documentation

- When should you use pictures?
- When are they valuable?
- Connection to accountability

Documentation

- Sample Form

SENSIBLY BUILT FOR THE ENVIRONMENT

EARTH CRAFT HOUSE

SENSIBLY BUILT FOR THE ENVIRONMENT™

Pre-Drywall :___/___/_____ **Final :___/___/_____**

House:			
Inspector:		Builder Name:	
Phone/Radio:		Phone/Radio:	
Asst. Tech:		Builder Signature:	Not Present

Plan name:_____ Total Cond. Sq. Ft._____ HVAC ARI Certified? Y / N Plans: Y / N Load Calc: Y / N

Address:_____ **Min. thermal bridging technique (e.g.OVE, ICF, SIP):**_____

AIR SEALING and INSULATION

Y	N	N/A	VF		
				1	Attic kneewalls sheathed, encapsulated and insulated to R-19
				2	Joist cavities under kneewalls blocked
				3	Stud cavities blocked from attic
				4	Attic subfloor limited or raised
				5	Recessed can lights air-tight and sealed
				6	Skylight shaft walls insulated plus air barrier on attic side
				7	Roof vented properly with solid baffles
				8	Floors over garage sealed
				9	Porch roof sealed at exterior wall
				10	Exhaust fan penetration sealed

HEATING AND COOLING SYSTEMS

Y	N	N/A	VF		
				38	Air handler properly sized per load calc
				39	Joints and seams sealed with mastic
				40	>6 in. btwn ducts & A/H & end caps
				41	Ducts supported every 5 ft.
				42	Flex ducts free of pinches
				43	Sharp turns use metal elbows
				44	No ducts in panned joists/studs/cabinets
				45	No ducts in insulated cavities

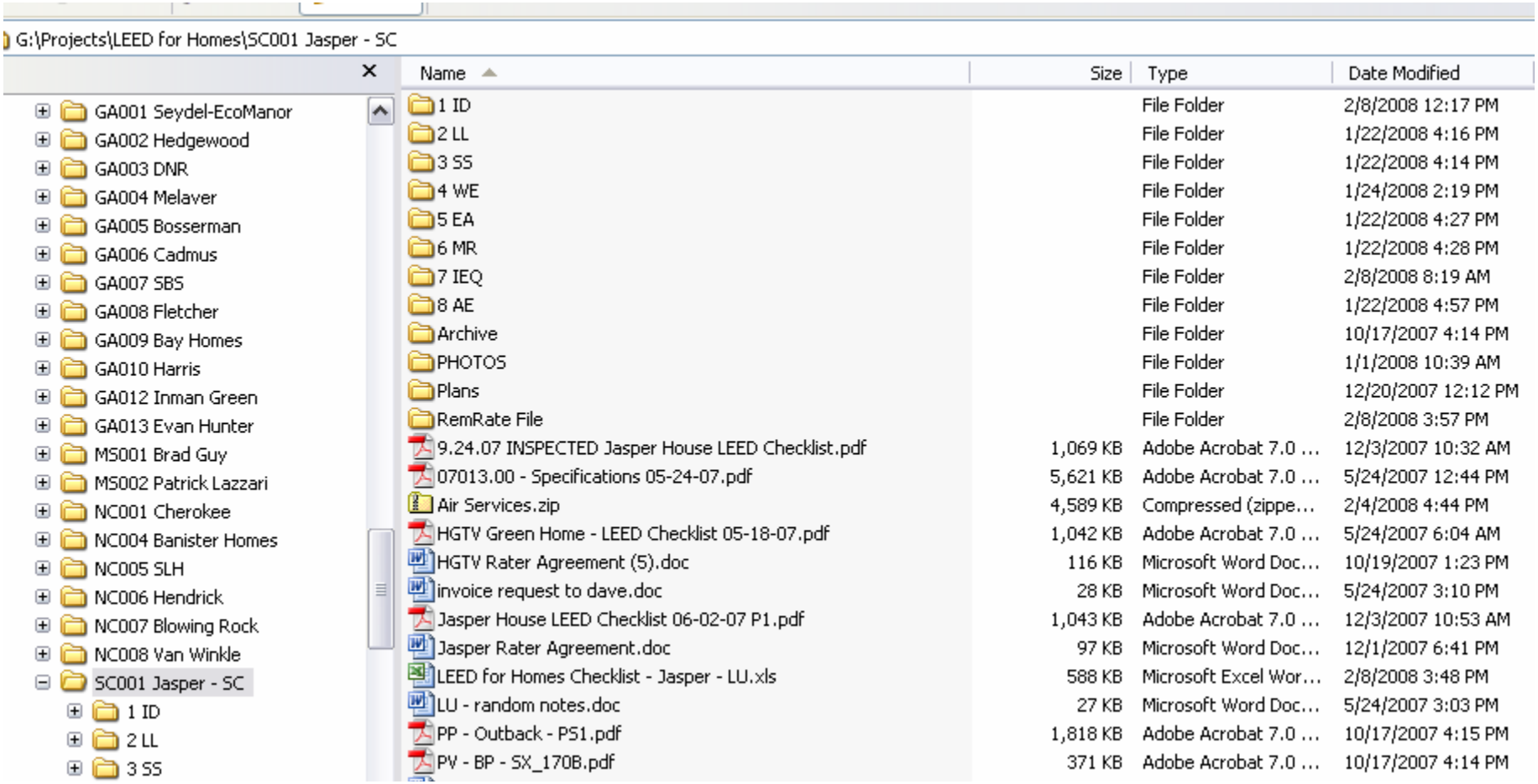
WINDOWS	Windows	Doors	Skylights
SHGC			

Documentation

- Sample items:
  - Man J & Man D
  - ARI Certificate
  - Erosion control measures
  - Advanced framing techniques
  - Realistic calculations (e.g. undisturbed lot area)
  - Material specifications
  - Durability measures
  - Homeowner manual

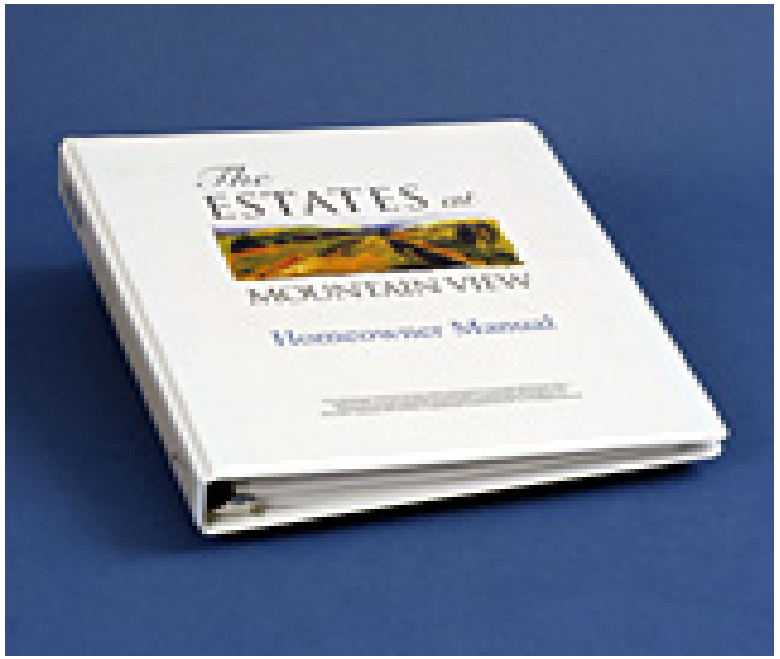
Documentation Binders/Files

- Keeping papers/photos organized is key
- Auditing of files



Sample Homeowner Manual Items

- Contact info
  - Builder
  - HVAC
  - Landscape
  - Recycling
  - Waste
- Calculations
- Durability measures
- Construction photos
- Material & equipment specifications
- Warranty information
- Maintenance Guidelines / Schedule
- How to live in a green home



Green Energy Rater's Role with Accountability Forms

Accountability

- We cannot be everywhere and know all things
- Each program has a balance
- Accountability Forms, Affidavits, Disclaimers and Sign-offs

Accountability

- Sample Form

	Include in AF below?	Party Responsible for Each Prerequisite / Credit	Internal Notes
Sustainable Sites			
SS 2.1 No Invasive Plants			
Materials & Resources			
MR 2.1 FSC Certified Tropical Wood			
Indoor Environmental Quality			
EQ 4.1 Outdoor Air Ventilation EQ 5.1 Basic Local Exhaust EQ 6.1 Room by Room Load Calculations			
Awareness & Education			
AE 1.1 Basic Operations Training			

Step 4. Return a signed copy to the Provider and/or project team leader.

Project Information	
Home Address:	**Return to:**
Builder:	

Accountability Sign-off (to be completed by party responsible for the credits above)

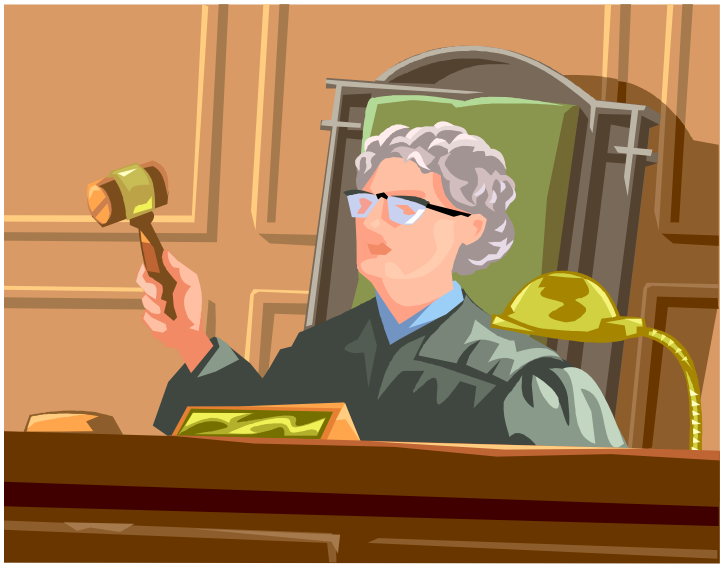
By affixing my signature below, the undersigned does hereby declare and affirm to the USGBC that the LEED for Homes requirements, as specified in the LEED for Homes Rating System, have been met for the indicated credits and will, if audited, provide the necessary supporting documents (drawings, calculations, etc.).

Printed Name		**Company**	
Project Role / Title			
Signature		**Date**	

Professionalism

Professionalism

- Conflict of interest
- Liability / Insurance
- Antitrust



Additional Information

- RESNET
- US Green Building Council
- ENERGY STAR
- Local Green Building Program
- EEBA
- BPI

Questions?

Thank you!

Remember to Sign Out!!