Individual Lot Preparation

Considerations for Residential Construction

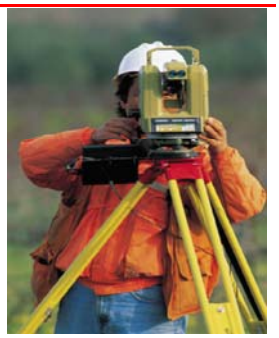
A Webinar Provided by The Pennsylvania Housing Research Center
www.engr.psu.edu/phrc
January 2012

Presented by Bryan Heitzmann

4

Objective

This program will provide an overview of some of the multiple factors that affect the decision of how to best place a house on a lot, while balancing lot conditions, environmental impact, costs, and the final finished appearance.



6

Site Selection

Selecting the site is the very first step in building a house

- Will affect building techniques and design
- Will affect construction costs and finished appearance

- Design considerations include:

-Zoning
-Erosion and sediment control
-Construction access
-Topography/grading/drainage
-Driveway slope
-Soil conditions
-Septic
-Utility hookup locations
-Exposure to sunlight

Site Selection

- Elements of site selection
  - Availability of water, sewer and other utilities
  - Environmental issues (wetlands, soil infiltration capacity, habitat for rare or endangered species)
  - Location regulations (zoning & SALDO)

8

Legal Considerations

It is important to **check with agencies** prior to the start of construction

- zoning offices
- planning commissions
- development boards
- architectural review boards

- Federal, state, and local environmental restrictions may also apply

- Deed restrictions

9

Zoning

10

Zoning Regulations

- Zoning Defines:
  - **Building height**
  - **Setbacks for front, side and rear yards**
  - **Lot coverage, building footprint**
  - **Floor-area ratio**
    - the amount of square footage in the building compared to the square footage of the lot

11

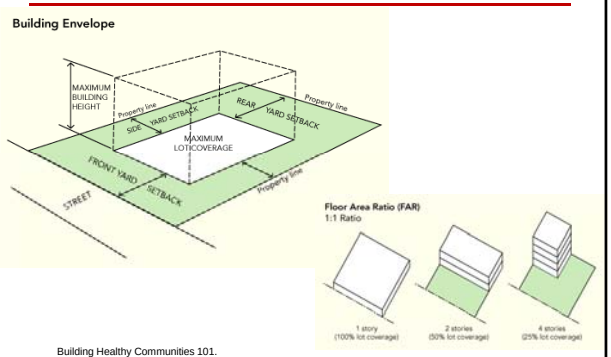
Setback Requirements

Setbacks - The required separation between a lot line and a building or structure

- Make sure that streets and yards are provided with open space and adequate light
- Measurements are taken from the rough exterior building walls to the nearest lot line
- Determined by residential zoning districts
- A property that is part of a planned development or subdivision will usually have setbacks unique to the community

12

Set backs



Building Healthy Communities 101.
http://www.ci.la.ca.us/LAHD/curriculum/gettingfacts/planning/planconcepts.html

13

Typical Building Set Back Standards

A. Criteria and Standards for the Single Family Residential District (R-1)

PERMITTED USES Land and structures may be used for only the following	LOT REQUIREMENTS The following lot requirements shall be met for each primary use			YARD SETBACK REQUIREMENTS The following yard requirements shall be met			MAXIMUM HEIGHT
	MINIMUM SIZE	MINIMUM WIDTH	MAXIMUM COVERAGE	MAXIMUM IMPERVIOUS COVERAGE	FRONT YARD	SIDE YARD	REAR YARD	
PRIMARY USES								
1. Single family detached dwellings, with off-site sewer service	10,000 sq.ft.	80' at the building setback line; 50' at the street line			20 feet on local and collector streets; 50 feet on arterial streets	10 feet	30 feet	40 ft.
2. Single family detached dwellings, with on-site sewer service	1 acre	100' at the building setback line; 75' at the street line	30%	50%				
3. Churches and other places of worship, parish houses and convents 4. Public and private nursery, kindergarten, elementary and secondary schools	1 acre	150' at the building setback line; 100' at the street line			50 feet	50 feet	75 feet	
5. Public park and recreational areas	-	-						
6. Personal Care Boarding Homes	8,500 sq.ft.	80' at the building setback line; 50' at the street line			30 feet on local and collector streets; 50 feet on arterial streets	10 feet	30 feet	
ACCESSORY USES 7. Home occupations 8. Customary uses accessory to the above; essential services	see Primary Use above to which it is accessory							

14

Examples of Special or Supplemental Regulations

- Floodplain
- Slope Controls
- Illumination
- Landscaping
- Off street parking
- Sidewalks
- Sewage disposal

15

Erosion and Sediment Control

16

Erosion and Sediment Control

Goal: Prevent sediment from leaving site

- Minimize the extent and duration of the earth disturbance.
- Maximize protection of existing drainage features and vegetation.
- Minimize soil compaction
- Utilize other measures or controls that prevent or minimize the generation of increased stormwater runoff

17

E&S Control Requirements

- Based on area of **earth disturbance**
  - **< 5,000 ft²**
    - BMPs must be installed to minimize E&S
  - **5,000 ft² < area of disturbance < 1 acre**
    - A written E&S plan is required and BMPs installed
  - **> 1 acre**
    - Stormwater (NPDES) permit required
  - – Written plan is also needed when there is a potential discharge to **special protection waters** or required by other regulations (Ch 105)

18

Special Protection Waters

- Am I in a High Quality or Exceptional Value watershed?

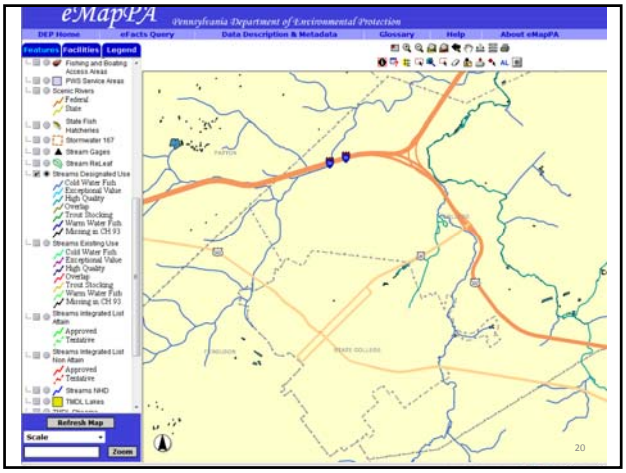
When disturbing >5,000 SF

Chapter 93
http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

eMapPa
http://www.emappa.dep.state.pa.us/emappa/viewer.htm

- Contact County Conservation District

19



20

Erosion Control

Primary strategy – silt fencing

Special protection watershed requires ABACT

- Compost sock

* Contact County Conservation District

21

Construction Access

22

Construction Access

- A **well-planned** site plays a major part in determining the success of a construction project
  - Staging area for building materials/deliveries
  - Parking
  - Avoid utility locations
  - Accessibility for emergency services
  - Temporary driveway for construction

23

Construction Access

Temporary gravel/rock drive

- minimize tracking of soil or sediment into the streets by vehicles and equipment
- limits vehicle movement to the driveway
- compaction of soil to the rest of the construction areas is reduced/minimumized

24

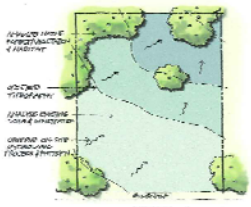
Topography
Grading
Drainage

26

Topography

- The configuration of surface features of a plot of land, which influences where and how to build or develop a site
- The intent should be to minimize the disturbance of existing features
  - Drainage
  - Slopes
  - Cost effectiveness

PA One-Call



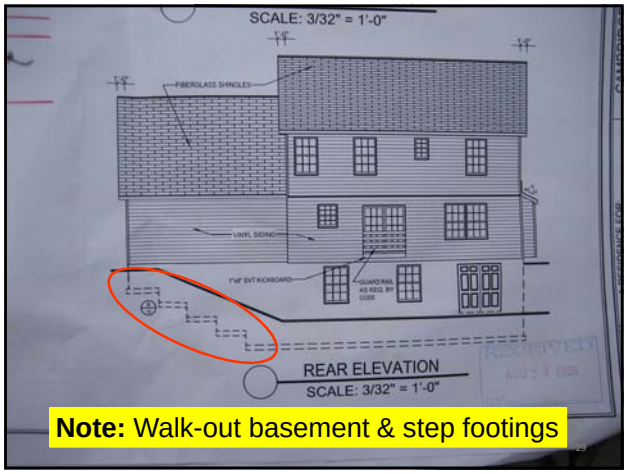
27

Topography

Slopes vs Foundation

- The slope of the lot will generally determine which foundation is most practical
  - home may work better on a sloped lot if you want a "walkout" basement.
  - A flat lot is most practical for a slab on grade home

28



Note: Walk-out basement & step footings

29

Window at grade

Emergency Escape - Section R310

Topography

Site Drainage

- Grade to drain lot
  - Overland flow (from adjacent lot)
  - Rain falling directly on lot
- Low lying lots will collect rain water runoff which can create ponding or unwanted settlement
  - footings and foundations
  - driveways, sidewalks
  - landscaping

31

Topography

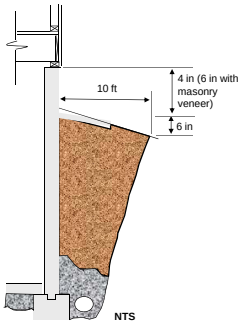
Maintain at least 6 inches of fall within the first 10 feet from the foundation wall to provide proper drainage

Drainage - IRC R401.3

Typically not allowed to tie into storm drain
Never tie in to sanitary drain system

Rule of thumb: First floor 12-18" above grade

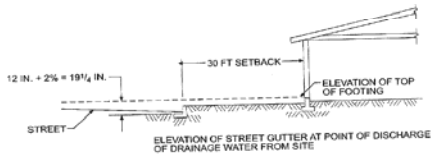
Check max & min slope requirements (local ordinance if applicable)



32

Topography

R403.1.7.3 Foundation elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an *approved* drainage device a minimum of 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the *building official*, provided it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.



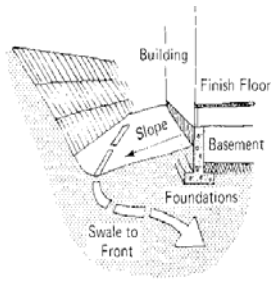
For SI: 1 degree = 0.07145 rad, 1 inch = 25.4 mm, 1 foot = 304.8 mm.

Figure R403.1.7.3
DETERMINATION OF FOUNDATION ELEVATION ON GRADED SITES

33

Over-lot Grading

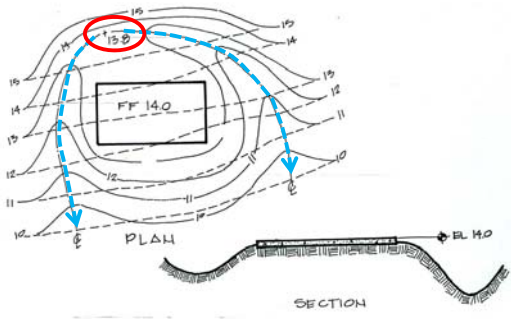
IRC R403.1.7.3



34

Grading for Drainage:

Swale Transition Around a Slab



SWALE TRANSITION AROUND A SLAB

35

Grading Problems to Avoid

- Destruction of existing valuable vegetation
- Extreme unbalance of cut of fill
- Drainage pockets on flat surface or around building
- Erosion due to steep slopes
- Driveway grades

36

Driveway Slope

37

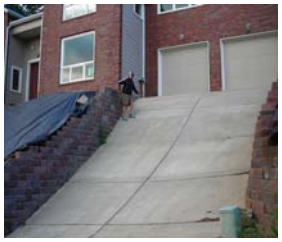
Driveway Slope

- Driveway slope should have a **minimum 2%** grade
  - Proper water drainage
  - Prevent pooling water and winter ice build up
- Driveway slope should have a **maximum 15%** grade
  - Safety
- Driveway slope should **not exceed 10%** below street grade
  - A drainage swale must be provided

* There is no code requirement regarding driveway slope, but there may be a municipal ordinance

38

Driveway Slope



39

Soil Conditions

40

Soil Conditions

- Soil is an essential component in the construction and stability of a house
- Determine soil type before construction
- Since the house is built on soil, structural damage to a house can occur if the soil:
  - Expands
  - Contracts
  - Slides
  - Improperly compacts

National Resources Conservation Service (NRCS) Digital Web Soil Survey

http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

41

Soil Conditions

•**Expansive soils** - clay soils are composed of very fine particles that expand and contract due to changes in the moisture content
- Exert tremendous pressures
- Cause foundation cracking
- Cause slab cracking
- movement on unstable slopes

• If expansive soils are possible, tests should be done by a *certified soil scientist* or a *geotechnical engineer*

• If they exist, construction is still possible
- Specially designed footing/foundation
- More expensive

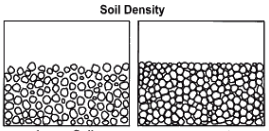
42

Soil Conditions for Structure

Soil Compaction - the method of mechanically increasing the density of soil
- •Increases load capacity
- •Prevents soil settlement
- •Provides stability
- •Reduces water seepage, swelling, and contracting

If proper compaction cannot be achieved, the soil will need to be removed and replaced with an acceptable soil type, or ammended

- consult a licensed a *certified soil scientist* or a *geotechnical engineer*



43

Soil Conditions for Site

- Infiltration
- Percolation
- Depth to water table
- Depth to bedrock
- Avoiding compaction (of yard)
  - For infiltration
  - Lawn growth

44

Septic System Considerations

45

*Chapter 73 of Pa Code

Minimum Absorption Area Required for Septic Tank Effluent

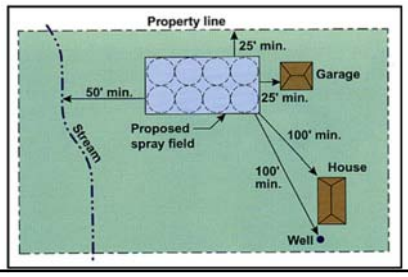
Average Percolation Rate (Min/in)	Square Feet of Aggregate Area per Gallon per Day: All Systems Except Elevated Sand Mounds & Sub-surface Sand Filters	Square Feet of Aggregate Area per Gallon per Day: Subsurface Sand Filters and Elevated Sand Mounds
Less than 3.0 $_{D}$	Unsuitable	Unsuitable
3 – 5 $_{C}$	Unsuitable	1.50$_{AB}$
6 – 15 $_{C}$	1.19 $_{B}$	1.50$_{AB}$
16 – 30 $_{C}$	(Avg. Perc Rate - 15) x (0.040) + 1.19 $_{B}$	1.50$_{AB}$
31 – 45 $_{C}$	(Avg. Perc Rate - 30) x (0.030) + 1.79 $_{B}$	(Avg. Perc Rate - 30) x (0.026) + 1.50 $_{AB}$
46 – 60 $_{C}$	(Avg. Perc Rate - 45) x (0.028) + 2.24 $_{B}$	(Avg. Perc Rate - 45) x (0.022) + 1.89 $_{A}$
61 – 90 $_{C}$	(Avg. Perc Rate - 60) x (0.023) + 2.66 $_{A}$	(Avg. Perc Rate - 60) x (0.020) + 2.22 $_{A}$
91 – 120 $_{ACD}$	Unsuitable	(Avg. Perc Rate - 90) x (0.017) + 2.82 $_{A}$
121 – 150 $_{CD}$	Unsuitable	(Avg. Perc Rate - 120) x (0.015) + 3.33) (1.05) $_{A}$
151 – 180 $_{CD}$	Unsuitable	(Avg. Perc Rate - 150) x (0.014) + 3.78) (1.10) $_{A}$
Greater than 181 $_{CD}$	Unsuitable	Unsuitable

Notes:
A Pressure dosing required.
B One-third reduction may be permitted for use of an aerobic tank.
C May be considered for experimental or alternate proposals.
D Unsuitable for subsurface sand filters

46

Example of Separation

- Separation distance to tank
- Separation distance from absorption area (leach bed)



PA Code Ch. 73.13. Minimum horizontal isolation distances

47

Utility Locations

48

Utility Locations

•PA One-Call

•Locate utilities that will support the site
- Power - red
- Water - blue
- Telecommunication - orange
- Gas – yellow
- Sewer - green

•Incorporate the position of the utility pipes and lines into the design of the home

•Check with Water/Sewer Authority for connection requirements

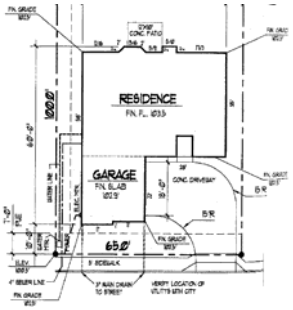
49

Utility Locations

• **Municipal sewer line** – floor elevations should allow for natural drainage from the house

•Limit **trenching** required
- -Less settlement
- -Less soil disturbance
- -Reduce costs

•**Trenching** vs **Tunneling**

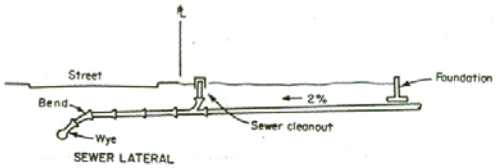


50

Sanitary Connections
Laterals

- Standard size: 4” – 6”
- Typical minimum 2% slope

*Protection of footings - P2604.4



51

Utility Locations

- Be aware of **utility easements**
  - The property owner owns all of the land including the utility easements.
  - Utilities companies have a right to access that portion of land which has been designated a utility easement
  - Should not build anything permanent within these areas

52

Exposure to Sunlight

53

Exposure to Sunlight

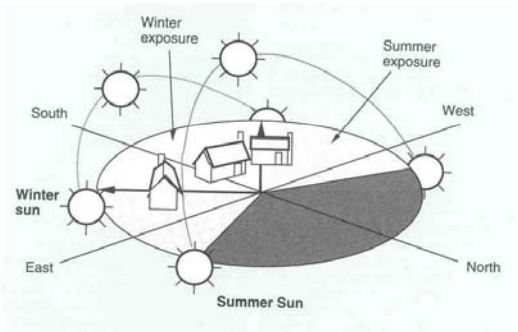
Maximize southern exposure

- Increase energy efficiency
- Reduce the environmental impact of the home
- Increase comfort
- Save Money

- Take advantage of natural light windows and skylights can bring in
- To maximize winter sun and summer shade, orient the home´s long side to within 10 degrees of true south

54

Exposure to Sunlight



55

Orientation & equipment sizing

Cooling Loads Chart - Various Orientations

Room	Area (Sq.Ft.)	Case #1	Case #2
Foyer/Staris	179	50	30
Living Room	168	127	90
Dining Room	144	158	141
Kitchen	156	108	88
Nook	100	152	62
Family Room	270	230	129
Laundry Room	47	12	12
Library	121	125	78
Powder Room	28	0	0
Upper Foyer/Stairs	147	69	0
Master Bedroom #1	200	125	45
Master Bath	116	42	78
Master WIC	64	8	64
Rear Bedroom #2	165	71	8
Hall/Staris	159	13	37
Front Bedroom #4	175	57	13
Bath	58	9	95
Middle Bedroom #3	160	116	9
Totals	**2,456**	**1,474**	**1,038**
Tons		**2.971**	**2.170**

Front faces south

Front faces west

Reduced load by 37%

Summary

-Zoning
-Erosion and sediment control
-Construction access
-Topography/grading/drainage
-Driveway slop
-Soil Conditions
-Septic
-Utility hookup locations
-Exposure to sunlight

57