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# **A**RGHITECT **R**EGISTRATION **E**XAM

**(Site Planning Division)  
San Francisco - AIA**

*Robert Stephen*

# SEMINAR OUTLINE

## ***PART I - SITE GRADING***

- A. GRADING INTRODUCTION..... page 4
  - Grading Vocabulary
  - Contour Lines
  - The Gradient Formula
  - Site Grading Techniques
  - Grading Tips
- B. GRADING APPLICATIONS..... page 7
  - Quiz Solution
  - Sample Problem & Solutions
- C. REFERENCE TABLES.....page 12

## ***PART II - SITE DESIGN***

- A. CIRCULATION DESIGN..... page 14
  - Automobile Circulation
  - Pedestrian Circulation
  - Circulation Design Techniques
  - Quiz Solution
- B. SITE DESIGN..... page 17
  - “Campus” Design Philosophy
  - Site Design Techniques (3-Step Approach)
  - Sample Problem & Solution

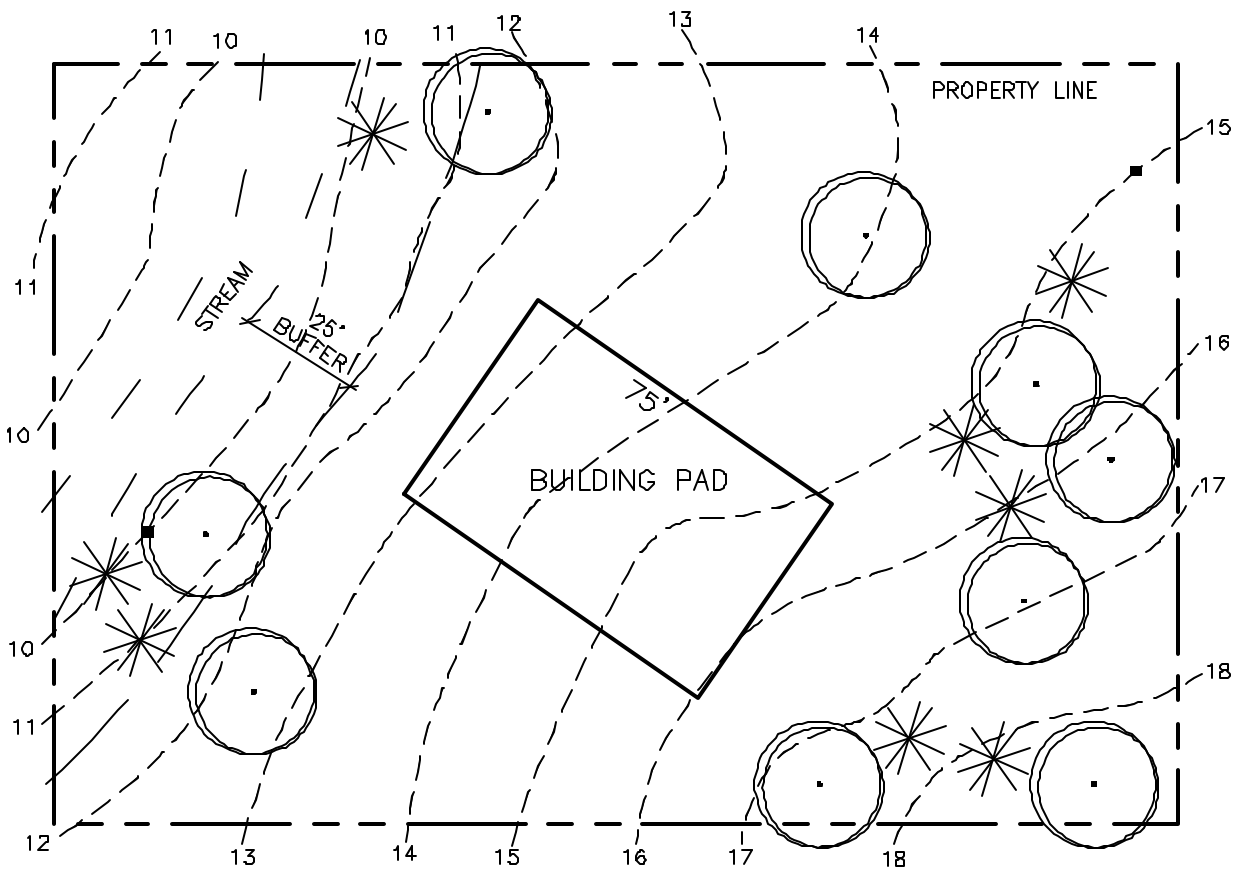
## ***PART III - COMPUTER EXAM TIPS & REFERENCES***

# SITE GRADING

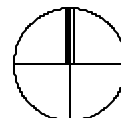
## Site Grading Quiz

A developer has sited a building pad on the site plan given below, and asked you to show a plan to represent the new grades for the site. The site is surrounded by private properties.

1. Regrade the site for the surface water to flow across the building pad and maintain the existing drainage pattern
2. Grade the building pad with a 2% slope (no cross slope is required)
3. The regraded areas of the site outside the limits of the building pad shall not exceed 25%
4. No disturbance is allowed within the stream buffer and the canopies of the existing trees
5. Label the proposed contours



Scale: 1"=40'



# SITE GRADING

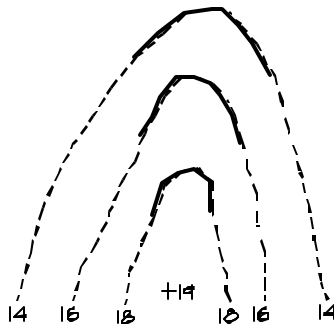
## A. GRADING INTRODUCTION

### Grading Vocabulary

- *Contour Line* - a line made up of points all equal in elevation
- *Gradient* - the rate of regular ascent or descent
- *Swale* - a depressed area of land used to collect and direct surface water runoff
- *Cross-slope* - the latitudinal pitch across an area to increase surface drainage
- *Easement* - land owned by another which entitles the holder to specific limited uses

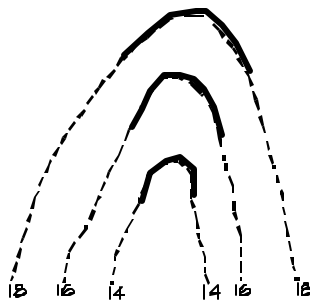
### Contour Lines

- *RIDGE* - the "U"-shape of the contours point to lower elevations

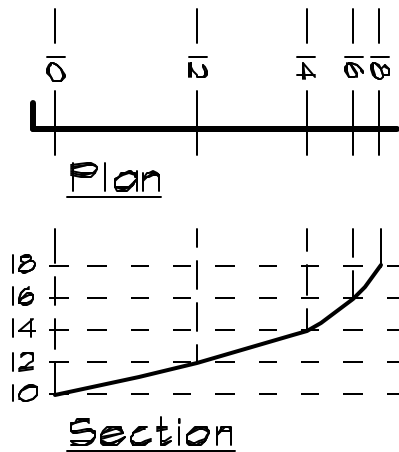


RIDGE SHAPE

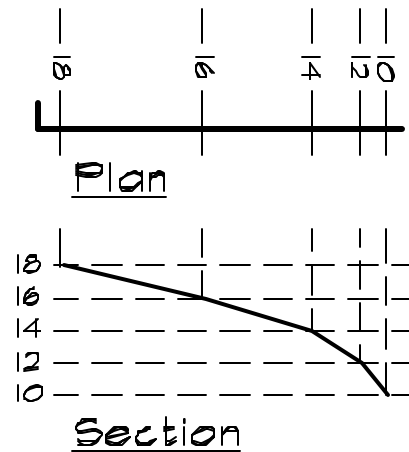
- *VALLEY* - the "U"-shape of the contours point to higher elevations



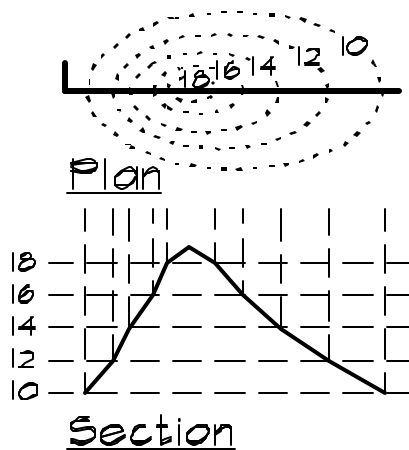
VALLEY SHAPE



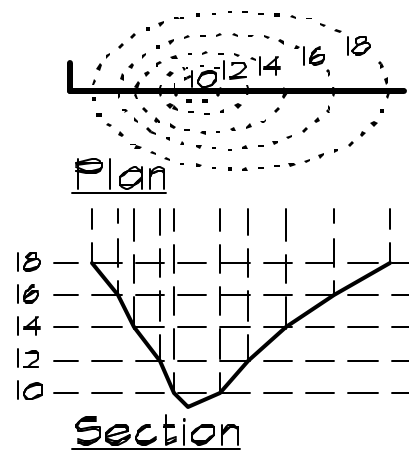
CONCAVE PROFILE



CONVEX PROFILE



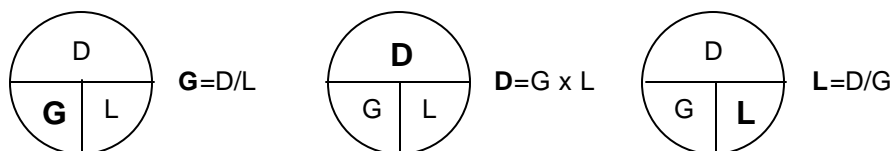
PEAK PROFILE



DEPRESSION PROFILE

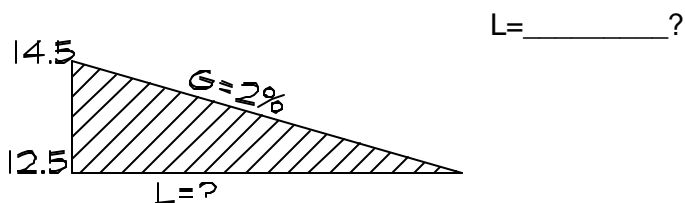
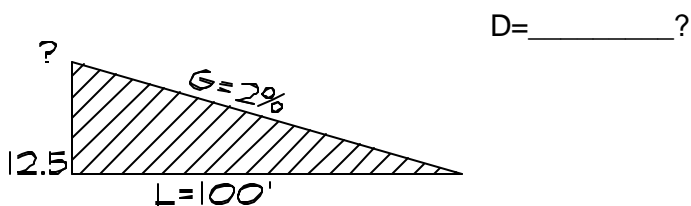
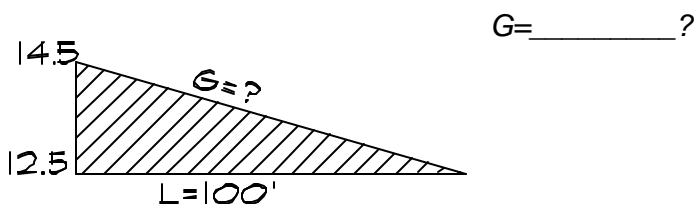
### The Gradient Formula

- The Gradient Formula ( $G=D/L$ )  
 $D$  = Difference in elevation  
 $G$  = Gradient  
 $L$  = Length of run
- Various manipulations of this formula allow you to solve for any missing variable in a gradient problem:



\*Tip: Difference in elevation (D) is a vertical distance and is placed on top of the matrix.

- Formula Examples:



- Memorizing some frequently used gradients and their respective distances in one foot interval contours will assist you in working through your grading problems. By knowing the minimum and maximum gradients allowed for the solution, a simple check over your solution can reduce costly mistakes. Some basics are:

100' between 1' contours (100:1)	=	1% gradient
50' between 1' contours (50:1)	=	2% gradient
20' between 1' contours (20:1)	=	5% gradient
10' between 1' contours (10:1)	=	10% gradient
5' between 1' contours (5:1)	=	20% gradient



*\*Tip: On the computer, draw a circle the diameter of the distance you want to measure - move the circle around to check the gradients between contours.*

## Site Grading Techniques



Analyze existing conditions of the site:

- general flow of water
- existing flow lines for surface runoff
- existing structures, trees, etc. to be saved



Set preliminary elevations of structures:

- analyze existing elevations of structures
- check elevations with adjacent elements
- check relationships between buildings, walks, parking lots, etc.



Modify appropriate contours:

- begin from known points and calculate slope to next contour
- work each contour line completely to be sure to meet to existing
- calculate required slopes and modify all other contours as necessary

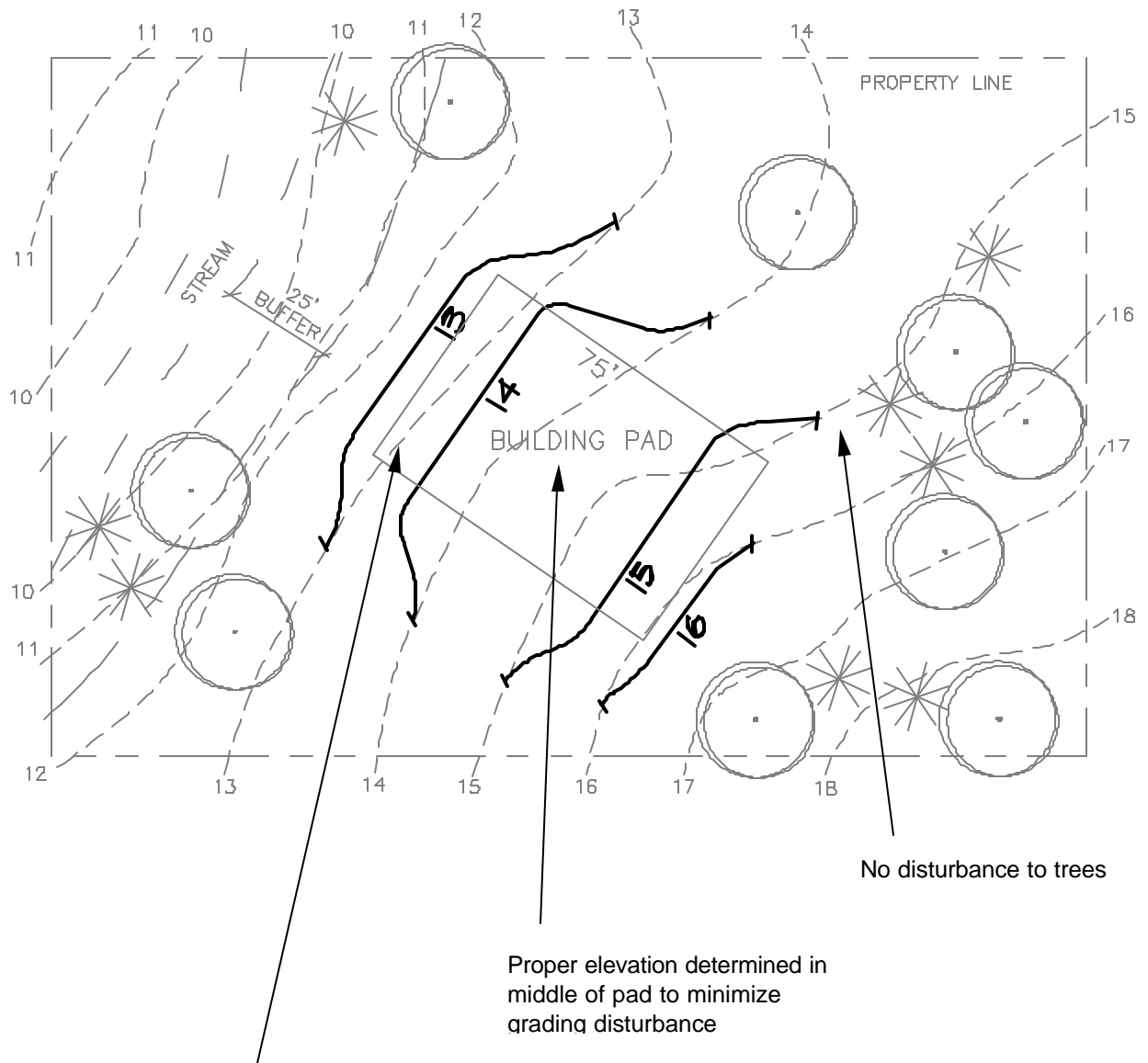
## Grading Tips

- Water always flows perpendicular to contours.
- Closely spaced contours = steep slopes / widely spaced contours = a gentle slope.
- A contour which closes on plan indicates a peak or a depression.
- Contours should never cross each other
- Always slope ground away from structures.
- Grading must not extend beyond property lines.
- Start grading slopes at the top of a fill slope and the bottom of a cut slope.
- Contours at curbs point downhill.

## **B. GRADING APPLICATIONS**

*The above information can be used to solve any grading problem you may encounter on your exam. By understanding these fundamentals and knowing how to apply them to a problem, contour manipulation becomes easy. The following is a sample of a grading problem and solutions to understand how these grading techniques are applied to actual situations.*

## Site Grading Quiz Solution



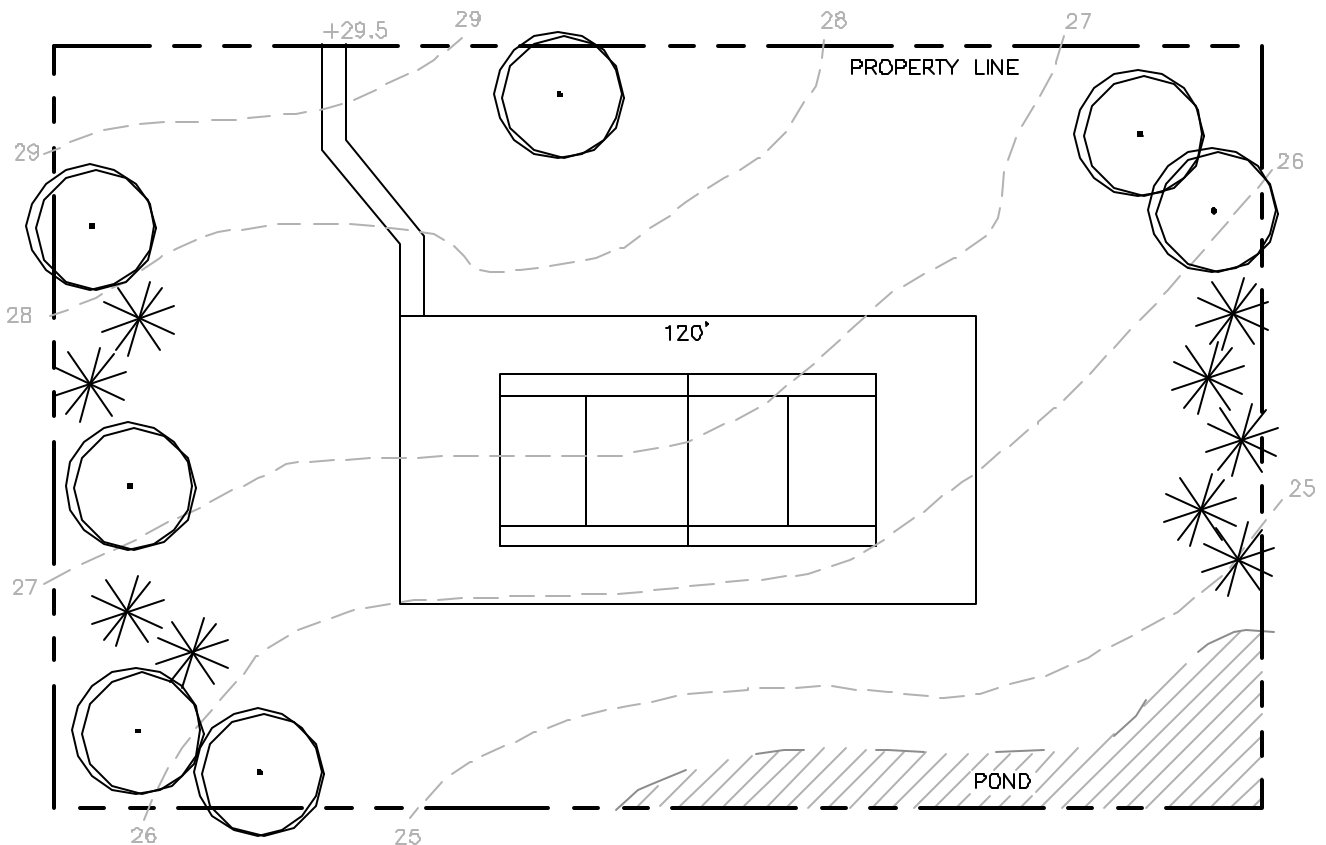
Proper slope shown on pad (2%) with elevations calculated at limits to determine proper locations of grades off the pad at 25% maximum



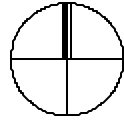
### Sample Problem & Solutions

The city plans to construct a new tennis court and walk in a parcel of land it acquired. The tennis court will be surfaced with asphalt and the walk will be concrete.

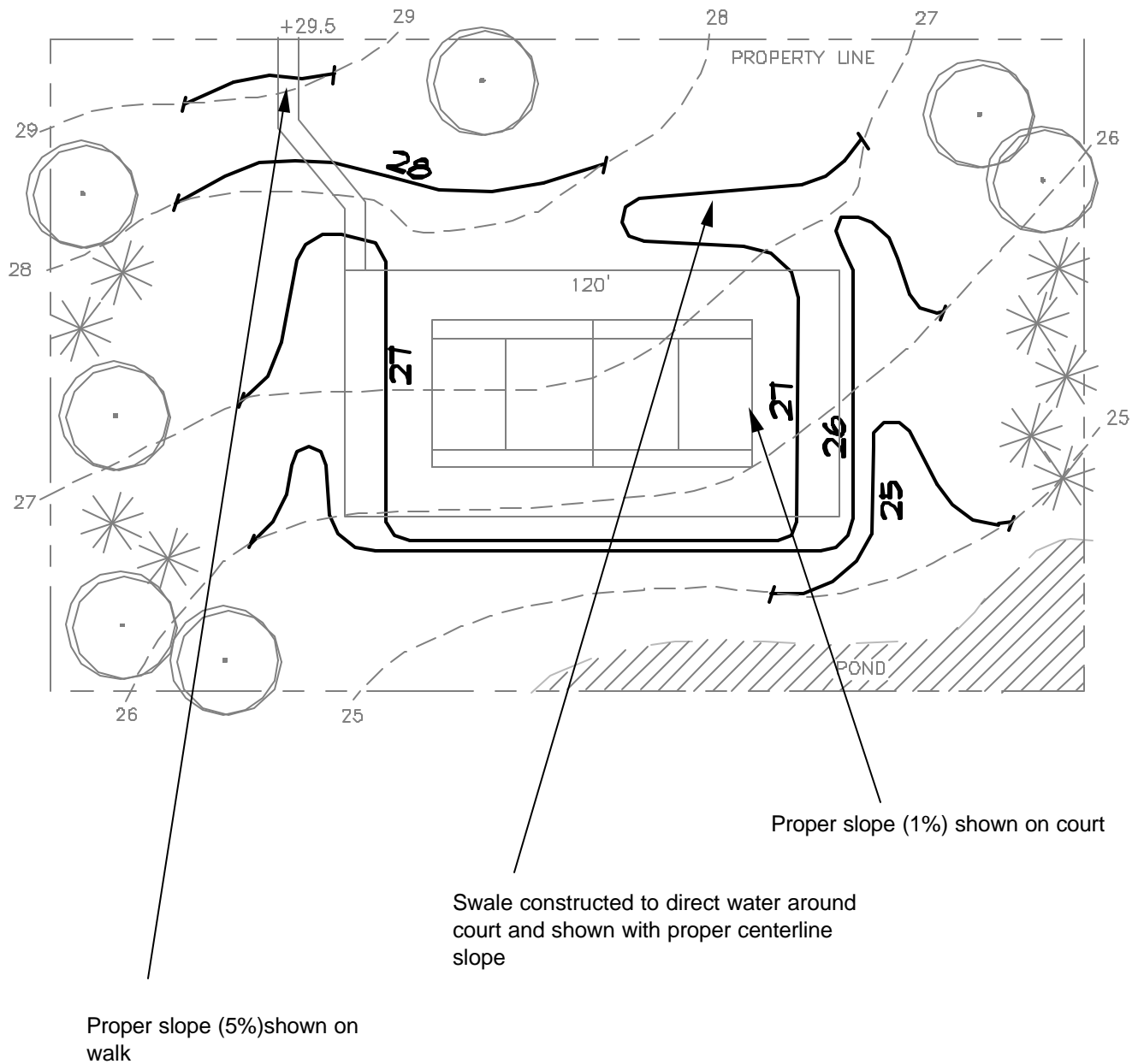
1. Regrade the site for the surface water to flow around and away from the walk and court while retaining the general drainage patterns of the site.
2. The tennis court shall have a high point elevation at the net of 27.5 and a slope of 1% toward the endlines.
3. The walk shall not exceed a 5% slope. Graphically, a slight cross slope shall be shown.
4. The slope of the centerline of a swale shall be a minimum of 2% and a maximum of 5%.
5. The slope on all regraded areas outside the court limits shall not exceed 3:1.
6. The existing trees and pond shall not be disturbed.



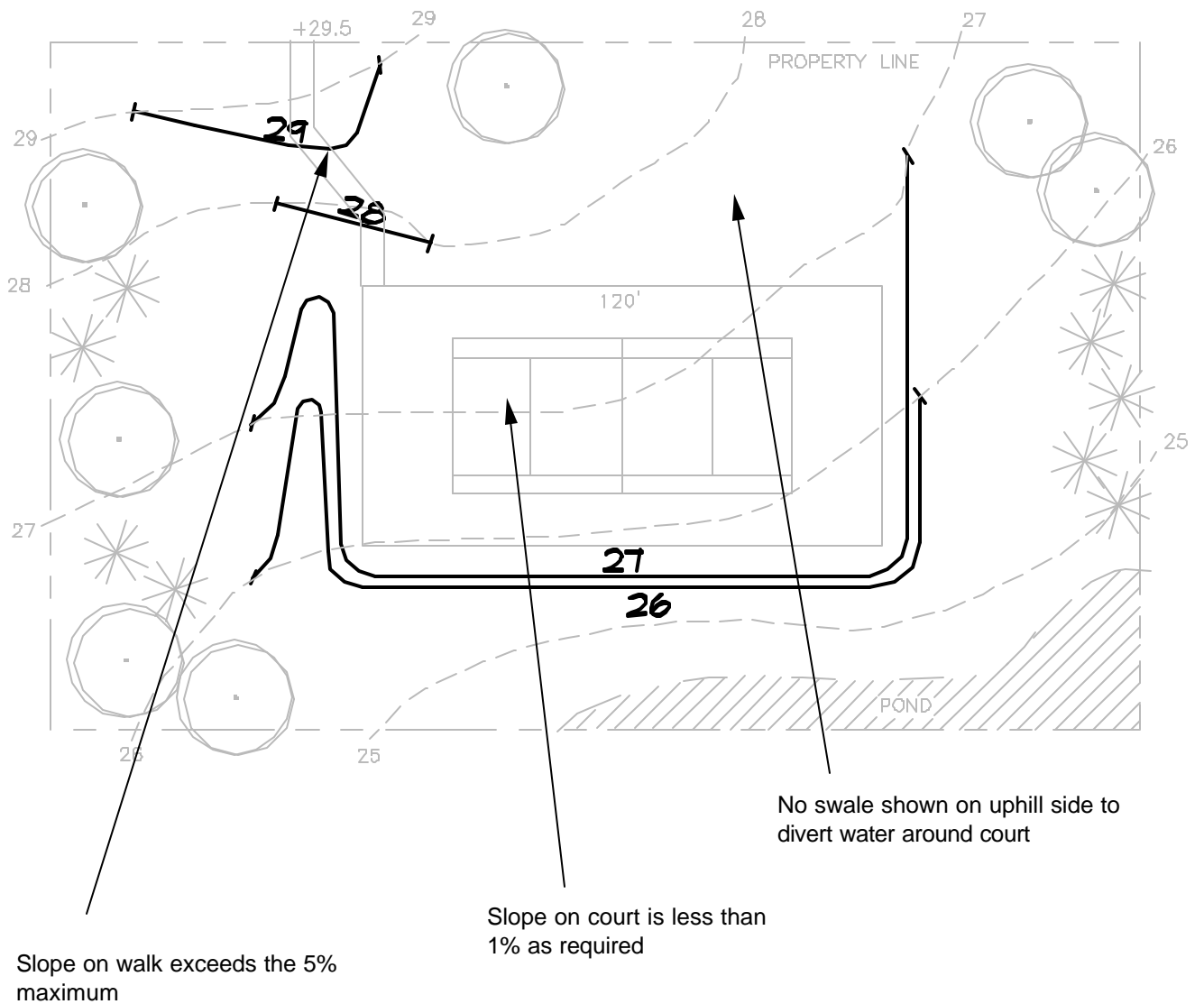
Scale: 1"=40'



## Site Grading - Good Solution



## Site Grading - Poor Solution



## C. REFERENCE TABLES

### STANDARDS FOR GRADING AND DRAINAGE

CONDITION	OPTIMUM RANGE	MINIMUM	MAXIMUM
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#### HARDSCAPE

Asphalt parking lot	2-5%	1.5%	8%
Concrete parking lot	1.5-5%	1%	8%
Driveways	2-8%	flat <sup>1</sup>	20%
Sidewalks	2-5%	flat <sup>1</sup>	10%
Handicap	2-5%	flat <sup>1</sup>	8%
Paved swale	1.5-6%	1%	12%

#### SOFTSCAPE

Lawn, sports fields	2-3%	1.5%	5%
Lawn areas	2-10%	2%	25%
Planted slopes	3-8%	2%	10% <sup>2</sup>
Vegetated swale	2-4%	2%	8%
Around buildings	2-10%	1%	20%

<sup>1</sup> Assumes cross slope of at least 2%

<sup>2</sup> Slopes beyond 10% likely to erode

### DECIMAL CONVERSION TABLE

	0"	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"
0"	.000	.010	.021	.031	.042	.052	.063	.073
1"	.083	.094	.104	.115	.125	.135	.146	.156
2"	.167	.177	.188	.198	.208	.219	.229	.240
3"	.250	.260	.271	.281	.292	.302	.313	.323
4"	.333	.344	.354	.365	.375	.385	.396	.406
5"	.417	.427	.438	.448	.458	.469	.479	.490
6"	.500	.510	.521	.531	.542	.552	.563	.573
7"	.583	.594	.604	.615	.625	.635	.646	.656
8"	.667	.677	.688	.698	.708	.719	.729	.740
9"	.750	.760	.771	.781	.792	.802	.813	.823
10"	.833	.844	.854	.865	.875	.885	.896	.906
11"	.918	.927	.938	.948	.958	.969	.979	.990

### SLOPE/GRADIENT/DEGREE TABLE

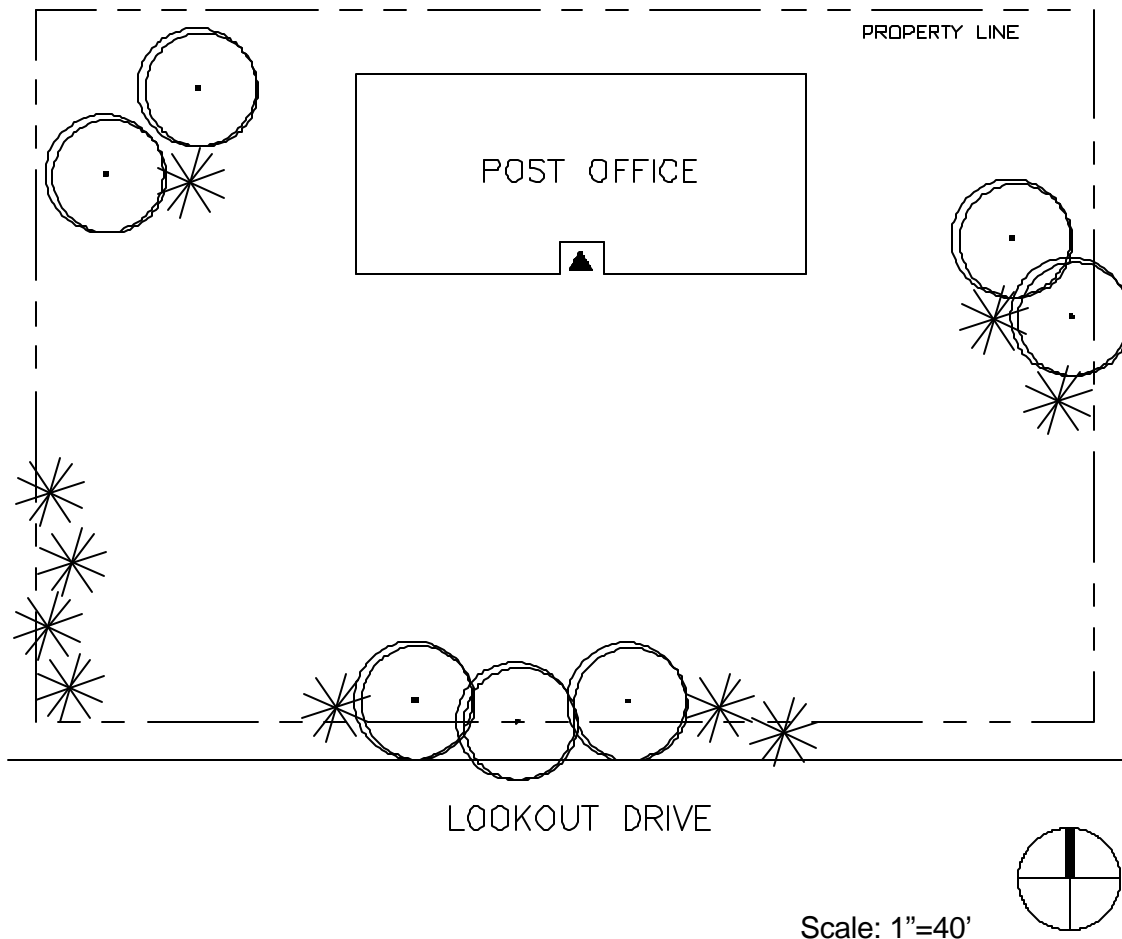
<i>SLOPE RATIO</i> (Horizontal to Vertical)	<i>GRADIENT</i>	<i>ANGLE DEGREES</i> (Approximate Equivalents)
100:1	1%	1°
20:1	5%	3°
10:1	10%	6°
5:1	20%	11°
4:1	25%	13°
3:1	33.3%	17°
2:1	50%	26°
1:1	100%	45°

## SITE DESIGN

### Circulation Quiz

A local post office has built a new branch office located in a rural setting. On the site plan, you are required to design a parking lot and appropriate circulation.

1. Draw a parking lot that will accommodate a total of 25 spaces
  - 21 standard spaces (10'x20') are required
  - 4 accessible spaces (15'x20') are required
  - Parking spaces shall be perpendicular to aisle and parallel parking is not allowed
2. Draw all aisles and drives to provide proper access from street
  - Flow-thru circulation is required
  - Dead-end parking is prohibited
  - All drives shall be 25' wide
  - Multiple curb cuts are allowed
3. The following general restrictions apply:
  - Front-yard setback = 15'
  - Setback from face of building = 10'
  - Parking spaces are not allowed directly in front of entrance
  - All existing site features shall remain undisturbed



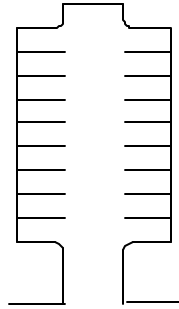
## SITE DESIGN

### A. CIRCULATION DESIGN

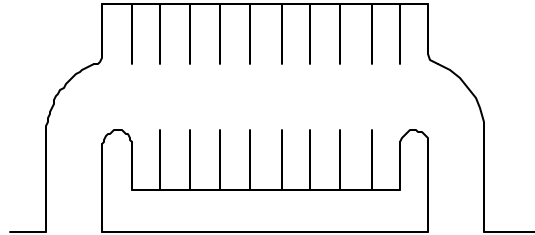
The technique of designing safe, efficient circulation patterns takes practice. Your responsibility as the designer is to provide solutions that are functional. The key is to create simple, straight-forward designs, minimizing the vehicular/pedestrian conflicts, and keeping in mind the purpose of the circulation route in terms of scale relationships.

#### Vehicular Circulation

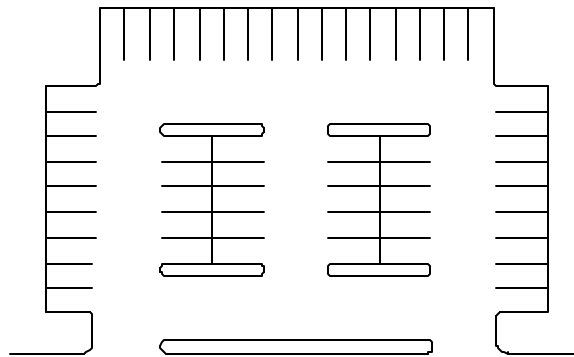
- Minimize disturbance of site by looking for clues for circulation routes (i.e. vegetation)
- Reduce conflicts of service vehicular traffic with public vehicular traffic
- Use two-way traffic aisles and 90-degree parking stall layout to provide efficiency
- Minimize impervious coverage in parking lots by maximizing the use of each drive aisle when possible (i.e. double-loaded)
- Use islands at ends of parking rows to provide safety



*DEAD-END PARKING*

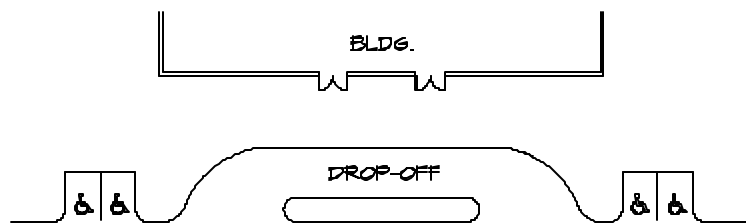


*FLOW-THRU LOT*



*LARGE EFFICIENT LOT*

- Incorporate accessible spaces into overall parking lot design - keeping them closest to the main entrance of the building they are serving
- Design drop-offs and accessible spaces in efficient layouts near the entrances
- Break up large groups of accessible spaces if possible



*ENTRANCE LAYOUT EXAMPLE*



*\*Tip: Remember that accessible spaces shall be located to prevent the passengers from crossing traffic and from having to go behind another vehicle to get to a walk*

## Pedestrian Circulation

- Minimize conflicts and crossings with vehicular traffic
- Create logical circulation routes from one area to another
- Design walks with appropriate widths for the intensity of use

*primary:* (8'-15'+) - major gathering areas, entrances, promenades

*secondary:* (5'-8') - connector walks, smaller scale areas, optimal for two-way traffic

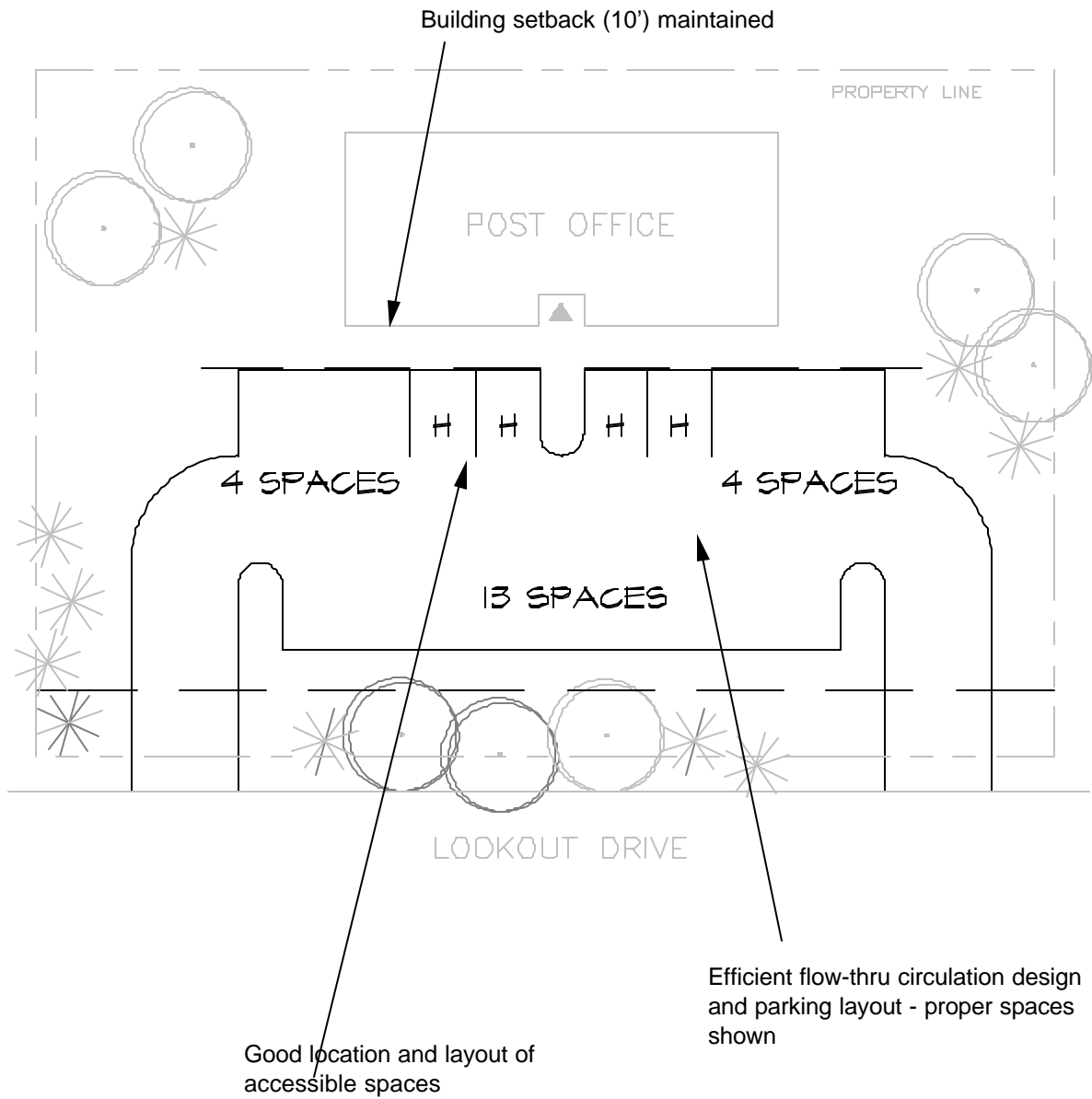
*tertiary:* (3'-5') - small garden scale, one-way traffic

## Circulation Design Techniques

- ☑ Analyze existing conditions of the site:
  - existing natural features to be preserved
  - conditions around existing structures to be served by parking lot and walks
  - existing hardscape areas to be incorporated into design or connected to
- ☑ Determine areas for vehicular and pedestrian circulation routes
  - locate entrance drive(s) and parking aisles
  - calculate parking rows based on aisle configuration
  - integrate accessible spaces closest to building entries along with drop-off areas
  - sketch out pedestrian circulation routes from parking areas to entrances, and other required pedestrian connections
- ☑ Draw layout and check for unsafe conditions
  - remember to maximize aisle use (double-load) and minimize unnecessary pavement
  - provide islands at ends of parking space rows
  - layout pedestrian walks to minimize conflicts with vehicular traffic

## Circulation Quiz Solution



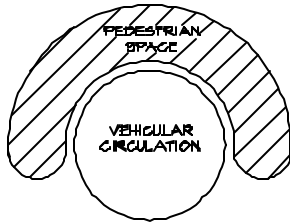


## B. SITE DESIGN

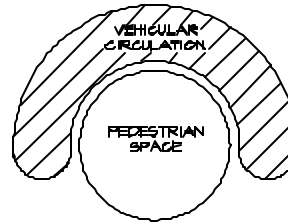
The basis for solving site design problems is the critical thought process used in understanding and resolving a given problem. Designing is essentially a process of relating all the functional and aesthetic aspects into a comprehensive whole.

### “Campus” Design Philosophy

- Design philosophy of unifying uses into functional spaces for safer environments
- Two concepts of “campus” design layout



VEHICULAR CORE -  
PEDESTRIAN PERIMETER USE



PEDESTRIAN CORE-  
VEHICULAR PERIMETER USE

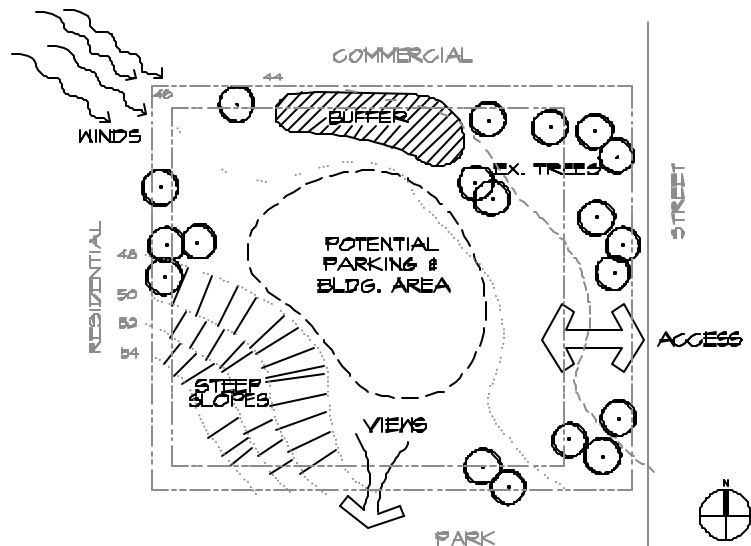
### Site Design Techniques (3-Step Approach)



#### **SITE ANALYSIS**

Process of evaluating and understanding all the physical and environmental characteristics of the site. A thorough analysis is important to perform, leading to instinctive solution ideas for your design process. Considerations are:

- existing natural features to be preserved or enhanced (i.e. vegetation, rock outcrops, water, structures)
- topography of site
- solar aspects of site
- seasonal winds
- on- & off-site views
- adjacent uses
- potential building areas
- zoning restrictions



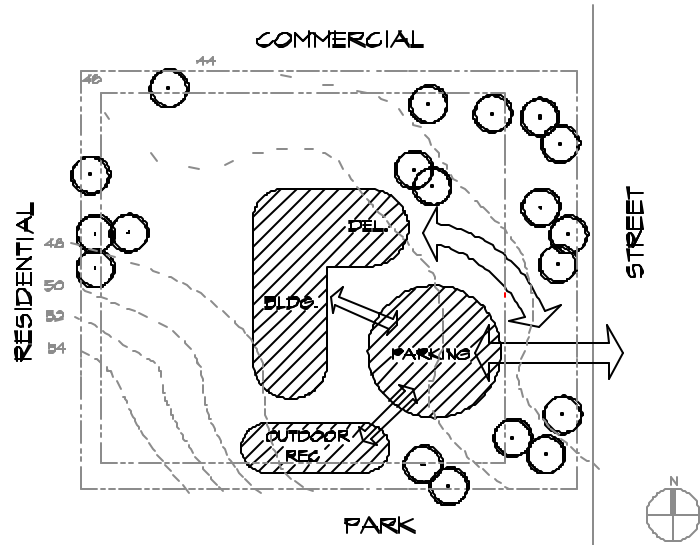
*\*Tip: Since on the computer it will not be easy to make notes on the site plan, quickly sketch out your analysis notes on the given scratch paper .*



#### **CONCEPTUAL RELATIONSHIP**

Process of understanding and diagrammatically illustrating the relationships of program items to one another and to the site. In rough concept, the functional layout of buildings to areas, space to space, and people and objects to areas should be thought out to represent a safe, efficient design for all users. Considerations are:

- diagram the spaces placing the various functions in locations according to site influences
- diagram the vehicular, service and pedestrian circulation routes based on convenience and function
- diagram the structure(s) showing the relationship of indoor/outdoor functions and adjacent uses
- layout basic masses of material indicating function
- consider the practical detail of size and shape of all items



*\*Tip: Again, it will not be easy to sketch concept diagrams on the site plan, so use scratch paper given to lay out ideas .*



## DESIGN SYNTHESIS

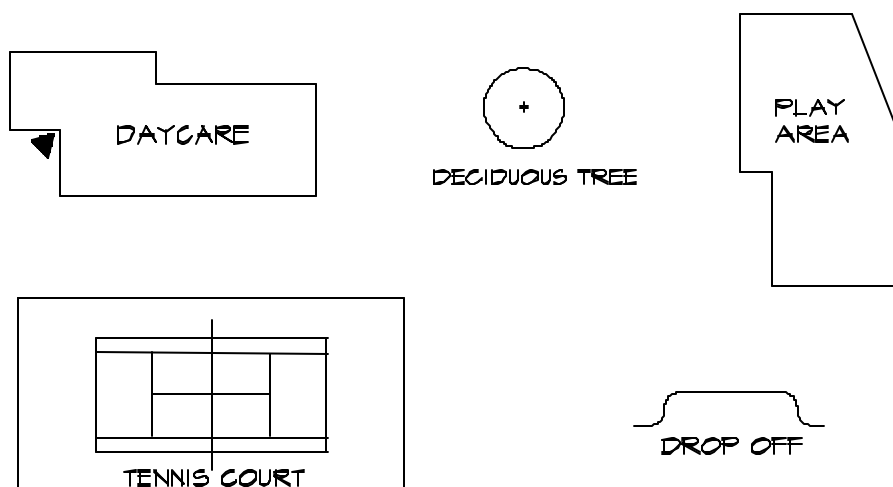
Process of taking your concept ideas to a greater level of design, using the actual program items to scale, shape and configuration to satisfy the design objectives with a functional and aesthetic solution. Considerations are:

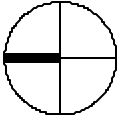
- the design must be responsive to functional requirements
- the ultimate dimensions and character of the material for each item or space
- use straightforward approach to design - you do not have to design the best solution

## Sample Problem & Solution

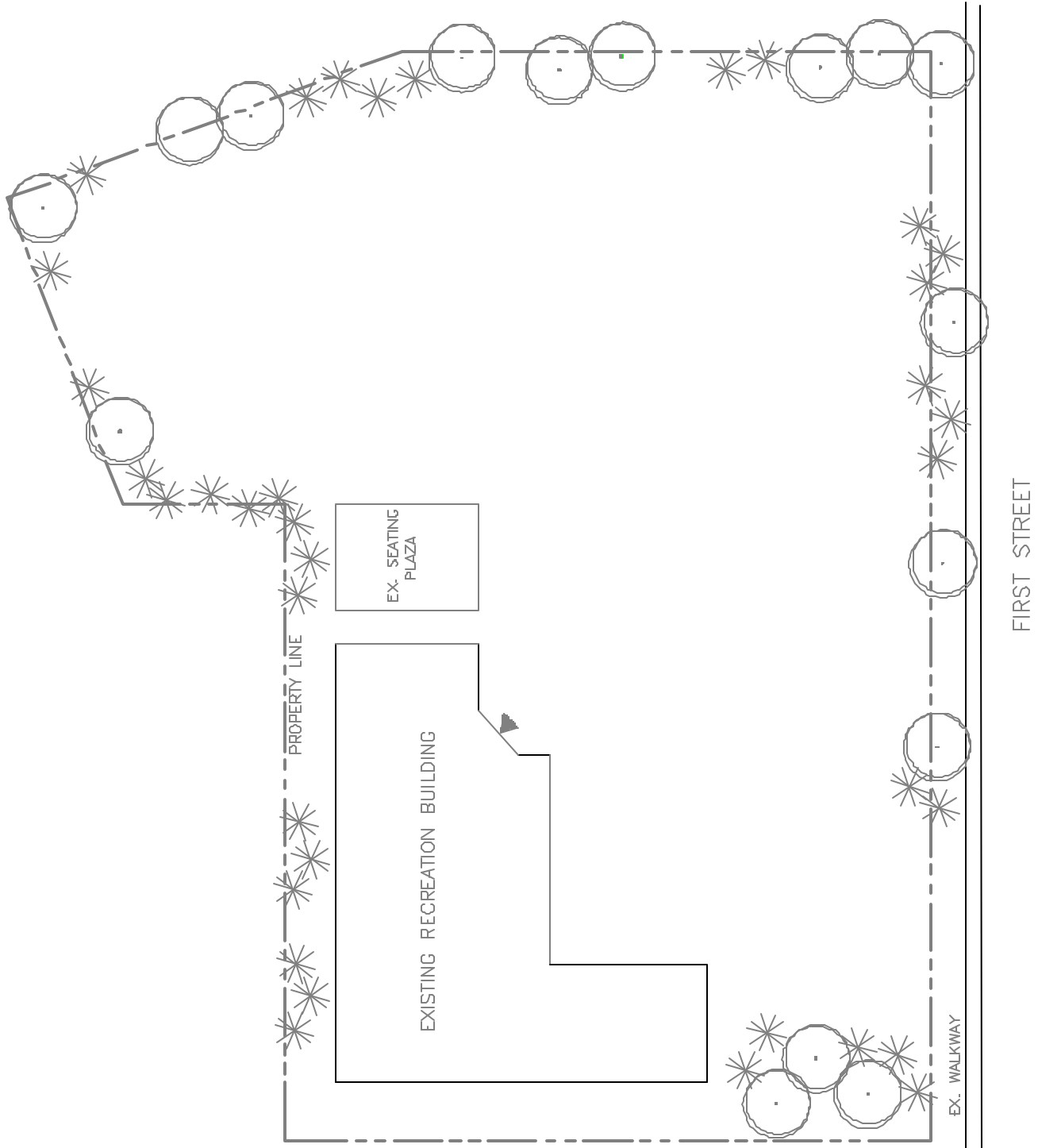
A local Recreation Department has asked you to develop a schematic site plan for the implementation of new daycare facilities. Several new elements are proposed for the site including a daycare building, tennis court, play area, and new parking to serve these new features.

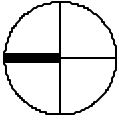
1. Locate and label the daycare building.
  - First street setback = 20'
  - Side-yard setback = 20'
  - Rear-yard setback = 10'
2. Locate the play area adjacent to the daycare building.
  - The play area must be visible from the daycare facility, tennis court and the existing seating plaza
3. Locate the tennis court close to the daycare building and play area.
  - A general north-south orientation shall be considered for the court
4. The play area shall be blocked from prevailing winter winds.
  - The wind shall be blocked by buildings and/or trees
5. Draw a parking area to accommodate a total of 75 cars.
  - 72 standard spaces (10'x20') are required
  - 3 accessible spaces (15'x20') are required
  - Parking spaces shall be 90 degrees to the aisles and parallel spaces are not permitted
  - Individual parking spaces do not have to be shown, however, the number of total spaces per row are required
  - Provide ten (10) new deciduous trees to shade the parking areas
6. Provide a drop-off area to serve each building.
7. Draw the vehicular circulation on the site to access the parking and drop-off areas.
  - All drives shall be 25' wide
  - Dead-end parking areas are prohibited
  - Two (2) curb cuts are allowed off of First Street
8. Connect the tennis court, play area, parking area and the entrances of each building to each other and to the existing walkway along First Street with a continuous pedestrian circulation system.
  - The existing seating plaza shall be considered part of the circulation system
9. The following general conditions apply:
  - No construction is allowed in the setbacks, however, drives and walks may cross to connect to the street and the existing walkway
  - All existing site features shall remain undisturbed



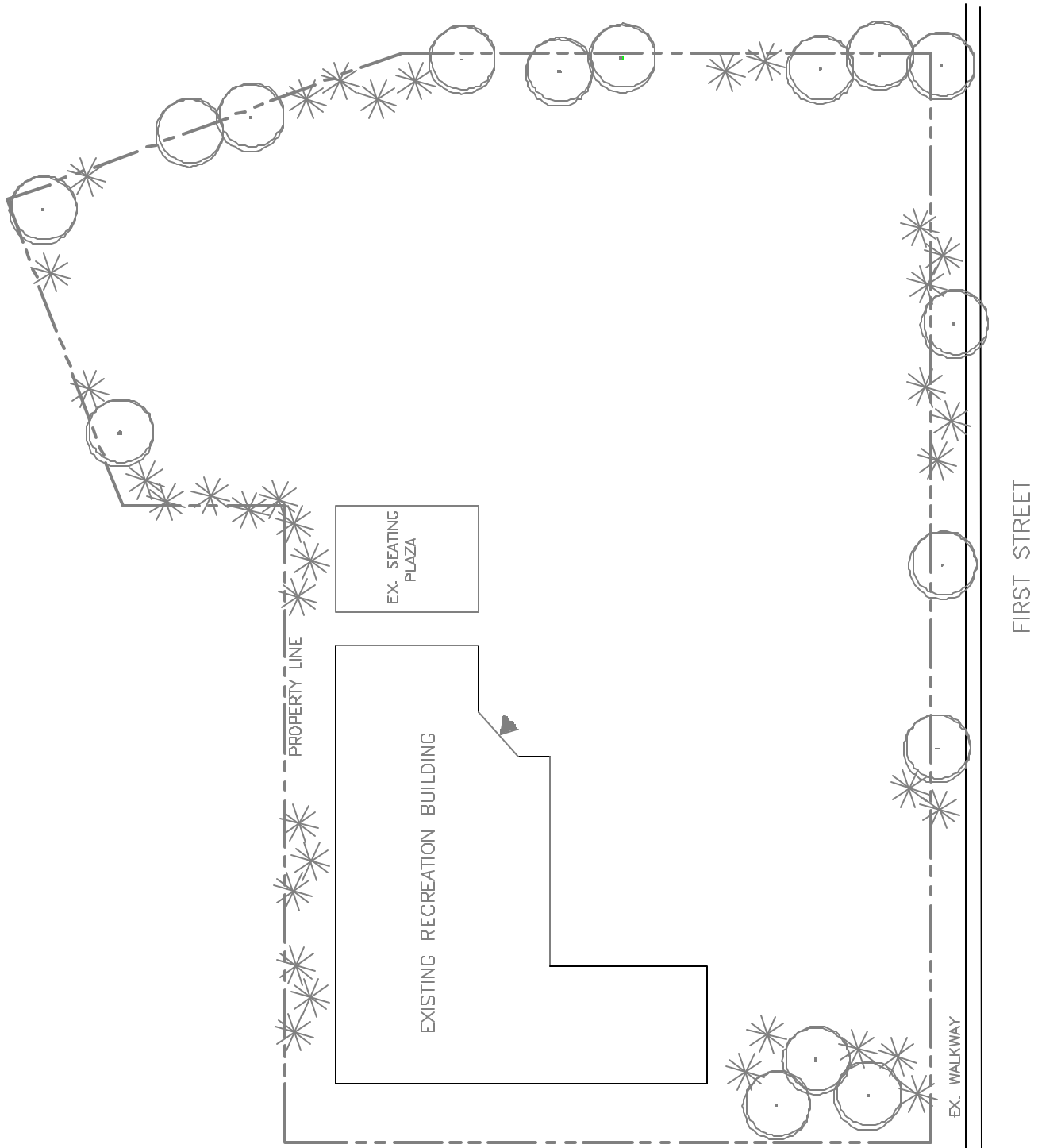


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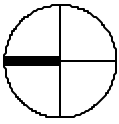




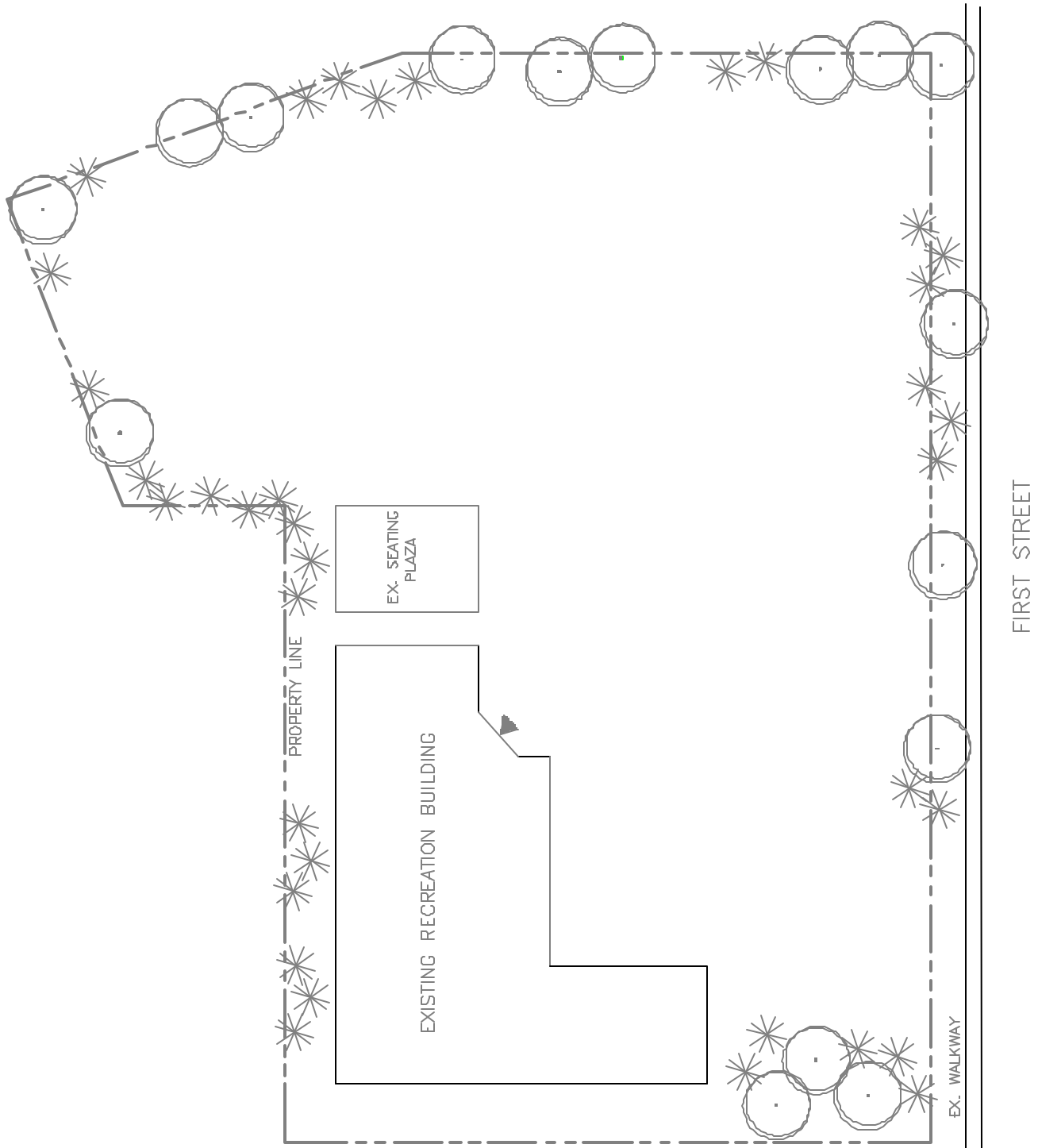
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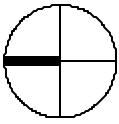
Concept Plan



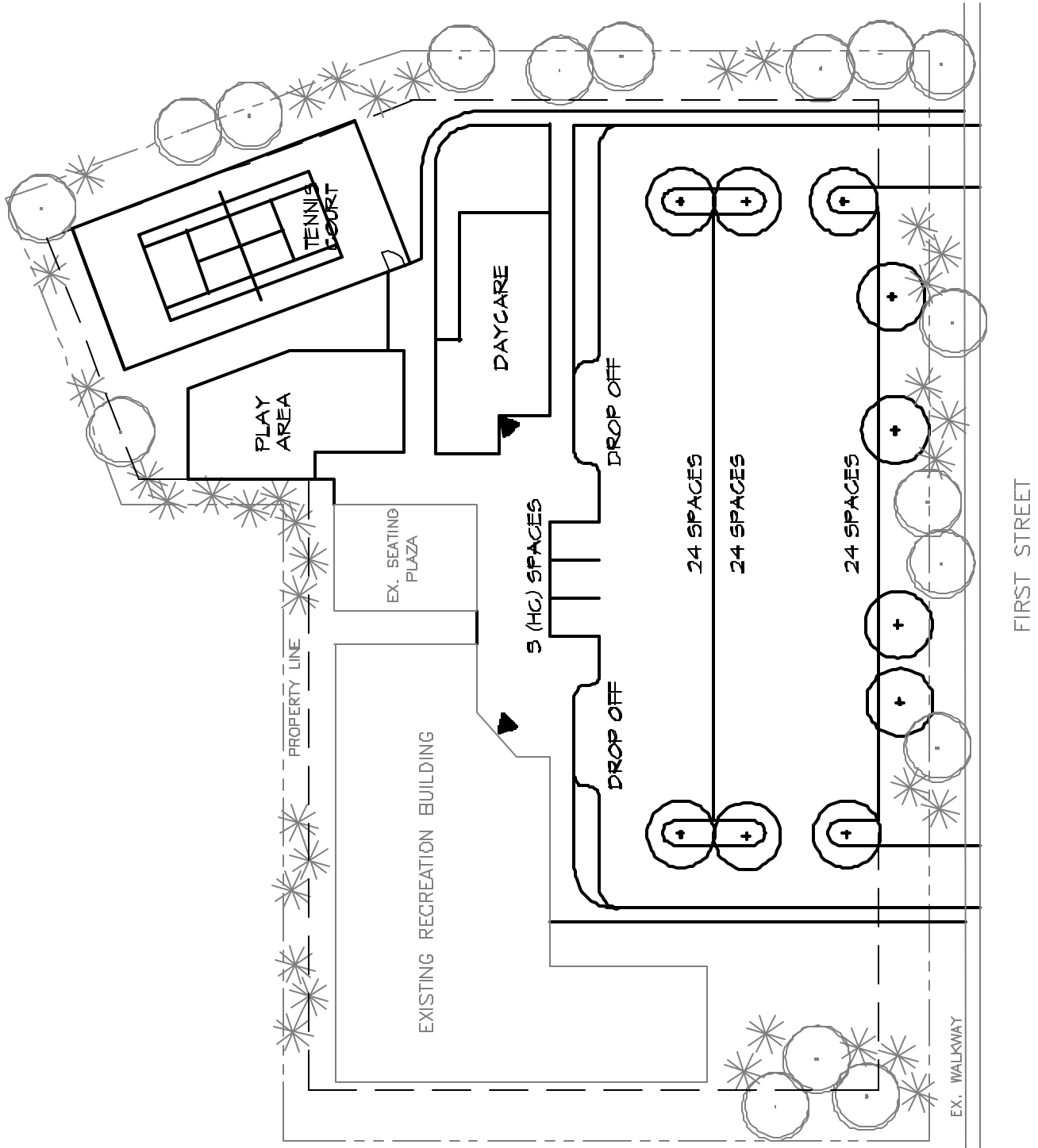
Scale: 1"=60'



Schematic Site Design - Good Solution



Scale: 1"=60'





## COMPUTER EXAM TIPS & REFERENCES

### A. COMPUTER EXAM TIPS

#### Preparation

- Study with friends to bring out your strengths and weaknesses
- Set up a time chart based on your strengths and weaknesses
- Review the tutorial in the exam package from NCARB or schedule practice time at a test facility to get comfortable with the computer techniques
- Discuss strategies with others who have passed the exam and selectively use any pointers
- Become familiar with the test facility and its amenities

#### Starting the Exam

- Briefly toggle through all the vignettes in that section to understand which ones may be easier for you
- Remember you can only revisit the (3) vignettes per section during the allotted time
- Begin with the easier vignettes in each section to build confidence
- Read the vignette descriptions first to understand the context of the problem and take notes on the scratch paper given if necessary
- While reading the program, it may be helpful to toggle the screen to view the site plan and begin visualizing the requirements in your solution

### B. REFERENCES

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