The Art Institute of Seattle

Course Syllabus

Course Title: INT373
Course Number: Studio 4: Advanced Residential Design

Course Description: This course offers in depth study of concepts introduced in Residential Design. Exploration may include advanced issues of human factors, universal design, and sustainability; designing from a global perspective; varying familial structures; specialty areas of the home; and outdoor living spaces. Students create a project suitable for portfolio use.Results from this course are used in INT317 Construction Documents to develop a set of construction drawings.

Course Length: 11 weeks
Contact Hours: 44 hours
Credit Value: 3

Quarter Credit Hour Definition:
A quarter credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than:

(1) One hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for 10-12 weeks, or the equivalent amount of work over a different amount of time; or

(2) At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution including laboratory work, internships, studio work, and other academic work leading to the award of credit hours.

Course Competencies:
At the conclusion of this course the student should be able to:

1. Formulate a written design concept using a client profile.
2. Research, identify, and collect information for a residential space which meets requirements established in the client profile and develop solutions which reinforce the concept.
3. Use sketching, drawings, and 3D models to visualize interior spaces throughout the design process in developing the design package.
4. Utilize programming and space planning techniques to develop design solutions using the vocabulary of art and design.
5. Consider the site location and outdoor living as it relates to the design of the home.
6. Consider sustainable solutions in selection of colors, fabrics, finishes, furniture, fixtures, lighting, appliances, materials, and accessories based on the client's program.
7. Prepare an interior design solution that facilitates the health, safety, and welfare of human activity.
8. Present and defend a design package that professionally conveys the interior design solution.

Course Prerequisites: INT249 Lighting Design; INT284 Studio 3: Residential Design

Required textbook(s): ***Inside Today's Home*,** LuAnn Nissen, Ray Faulkner, and Sarah Faulkner

Required Supplemental Materials: See Instructor's Syllabus Addendum

Grading Scale:
All assignments must have clear criteria and objectives met. All students shall be treated equitably. It will be the student's right to know his/her grade at any reasonable point that information is requested by that student. The criteria for determining a student's grade shall be as follows (on a percentage of total point's basis).

A	100-93
A-	92-90
B+	89-87
B	86-83
B-	82-80
C+	79-77
C	76-73
C-	72-70
D+	69-67
D	66-65
F	64 or below

Method of Assessment: See Instructor's Syllabus Addendum

Attendance Policy:
Students must notify the Registrar's Office if they will be missing two weeks of classes. After two consecutive weeks of absences in all courses students are subject to being administratively withdrawn from school, regardless of notification.

Plagiarism:
Students are expected to meet academic standards of honesty in all aspects of their work at The Art Institute of Seattle. All work submitted, including papers and projects, written and oral examinations, and oral presentations and reports, must be free of plagiarism. **Plagiarism is using the creations, ideas, or words of someone else without formally acknowledging the author or source through appropriate use of quotation marks, references, and citations.**

Examples of plagiarism include using another person's ideas as your own; copying words from a book or magazine without using quotes and citation; paraphrasing another person's work without citation; or presenting designs, art or digital files created by someone else as your own. Any student who is uncertain whether his or her use of the work of another will constitute plagiarism should consult the course instructor before submitting the course work involved. Citation standards and guidelines are available from you instructors and The Art Institute Library.

The Art Institute of Seattle Policy on Plagiarism: It is the policy of The Art Institute of Seattle that students who copy or otherwise plagiarize the assignments, examinations, artwork, media or projects of other individuals are subject to disciplinary action, including failure of the course in which the plagiarized work was submitted or possible termination from The Art Institute of Seattle.

Disability Policy Statement:
"It is AIS's policy not to discriminate on the basis of disability in its educational programs. If you have a disability-related need for adjustments or other accommodations in this class, contact the Disability Services Department at 206-448-0900 Ext 2308."

Process for Evaluation:

• Participation/Progress Grades: A participation grade is given every class to award credit for in-class participation that is only possible by completing prior assignments. In other words, you can only fully participate in class if you have completed previous assignments since in-class activities build upon prior assignments. To earn participation points, you must do assigned work and participate during class time.

- o [2 points]: awarded for students who complete the assignment and participate during the entire class time.
- o [1 point]: awarded for a partially complete assignment and participation during the entire class time. 1 point will also be awarded for limited participation and a fully completed assignment.
- o [0 points]: awarded to all substantially incomplete assignments, late assignments, and for any student that does not participate during class time regardless of completeness of the assignment. Assignments are due at the start of class time. Student submitting late assignments will not receive a participation grade but will have the assignment re-evaluated with the final project.

• Final Project Grade: All previous assignments will be re-evaluated on the due date of the final project for quality and technical correctness. The student is required to correct and enhance all progress assignments including but not limited to the feedback given on those assignments.

• Final Course Grade: The total of the progress grades and the final project grades will be averaged together to determine the final grade for the course.

Classroom Policies:

• All students are expected to arrive at class on time to submit assigned work at the start of class.

• Students are expected to work on previous, current, or future assignments while they are waiting during individual critiques. Students may also critique other students' work.

• Students are expected to have drawing materials available every class.

• Students are expected to have tracing paper and a red pen available at every class.

• Students are expected to bring all previous assignments to every class.

• Late work is handled according to Deadline Policy 1 in the current edition of the Art Institute of Seattle Catalogue.

Syllabus addendum (changes may be announced)

Instructor:
S. Joshua Brincko, Architect, M.Arch, ASFD, NCIDQ cert
Email: jbrincko@aii.edu
Office hours: http://internationalstudio.us/appointments.html

Classroom Policies:

- ASSIGNED WORK IS DUE AT THE BEGINNING OF EACH CLASS TO RECEIVE CREDIT, AND IT **MUST** BE PRINTED AT THE BEGINNING OF CLASS TO RECIEVE CREDIT. LATE WORK WILL RECEIVE NO CREDIT.
- KEEP ALL OF YOUR PROGRESS ASSIGNMENTS.
- DURING YOUR CRITIQUE, CLEAR ALL EXTRANEOUS ITEMS (PURSES, BAGS, REFRESHMENTS, BOOKS, ETC) OFF OF YOUR DESK, AND HAVE YOUR PRINTED DRAWINGS, LIST OF QUESTIONS (TYPED), PREVIOUS ASSIGNMENTS, TRACING PAPER, RED MARKER, AND PENCIL READY.

Drafting Policy:

- All course materials are required to be completed with sufficient drafting standards as learned in previous courses such as Drafting I, Drafting II, CAD I, and CAD II. Hand drafting or any software may be used in this course, and it is the student's decision to choose appropriate drafting tools. It is highly recommended that students do not use Revit in this course since the program is in its infancy of development and also not applicable to the custom nature of the project type.

Attendance Policy:

- Attendance has a very strong impact on success in this course. Design is a process that builds upon all information that has been presented, and an absence typically causes a student to drop a letter grade. It is the student's responsibility to learn all the required information and submit all required work in advance if an absence cannot be avoided.
- Extensions can only be granted with doctor's notes, court hearings, and funeral certificates pursuant to AIS policy

Late Work Policy:

- All assignments must be submitted prior to the assigned due date and time to receive credit. Because of industry standards, late work is not accepted for credit. You may submit late work for feedback, but no grade can be assigned. Because there are about 10 assignments per quarter, 1 missed assignment is approximately 10% of your grade and therefore usually causes your overall score to drop 1 letter grade.
- Late work is handled according to Deadline Policy 1 in the current edition of the Art Institute of Seattle Catalogue.

The Academic Support Center:

- The Academic Support Center, in SC Room 614, assists students in their academic endeavors.
- Drop-in tutoring, tutoring-by-appointment, and testing services are available in the center.
- Students should arrange make-up testing with their individual instructors.
- The Academic Support Center is not an open lab.

References:

- Design and Form. Johannes Itten
- Building Construction Illustrated. Francis Ching
- Architecture Form, Space, and Order. Francis Ching
- Architectural Graphics. Francis Ching
- Design Drawing. Francis Ching
- Metropolitan Home Magazine
- Metropolis Magazine
- Dwell Magazine

- Surface Magazine
- Architectural Record Magazine
- Interior Design Magazine
- International Studio website: www.internationalstudio.us

Criticism:

Critiques, or "crits," are the traditional and essential method of receiving feedback on a design project. The design process relies upon crits to analyze preliminary conclusions as they become realized. At the start of a design project, you do not know the best answer to a multi-faceted complex problem involving the sun, weather, views, privacy, access, circulation, spatial relationships, culture, materials, budget, construction, codes, schedule, and many other factors. Each week, your goal is to evaluate as many potential answers to these problems as possible. The more work you invest in evaluating options, the more analysis may be invested during your weekly crit to evaluate the data to determine best solution to these complex problems. Evaluating these potential options is a scientific process of testing your hypotheses (trial-and-error). A crit is not an attack on your personal taste or personal character – it is a logical analysis to determine the most rational solution. In fact, personal taste and personal character plays no role in any aspect of this course. This course is a design studio, and the incremental development of your project is far more important than the outcome of the project. In an 11 week quarter, you have 10 opportunities to receive a crit during class. To be successful in this course, you must seek frequent meaningful criticism (from peers and faculty) to evaluate as many options as possible, understand what works, and understand what does not work in an effort to develop your project into the best solution in the time allotted.

Program:

Your clients are a middle-aged couple (software developer and real estate developer) with 2 children upgrading from a small craftsman house to a newly built modern row house at 1732 Alki Ave SW with views of the waterfront. They are an active family and intend to take advantage of the activities in their new neighborhood. They would like their row house to be very functional, very modern, and very innovative with many custom designed built-ins and other special features such as a sculptural kitchen island. They do not like the looks of drywall, and they appreciate the textures of stone, concrete, glass, steel, and wood. They would like their home to be showcased in modern design magazines such as Dwell, Architectural Record, Metropolitan Home, Interior Design, etc, and they would also like it to be as sustainable as possible. The couple intends to integrate 3 adjacent row houses (nearly identical) on the property to live in one and rent out the other two. The couple wants the house to be 20 feet wide with 2800 (conditioned) square feet and include a living room that is open to the floor above, kitchen, walk-in pantry, powder room, laundry room, 2 kids bedrooms with shared bathroom, an outdoor courtyard encompassed into the floor plan, a master bedroom suite where the wife can get ready for work without waking the husband, a private balcony for the master bedroom, an entertaining porch, a rooftop deck, and a separate 400 square foot office detached from the house with covered parking between the house and office. They would like to maximize their views as much as possible and ensure that every room has good natural light.

Code requirements: 2009 IRC (including but not limited to)

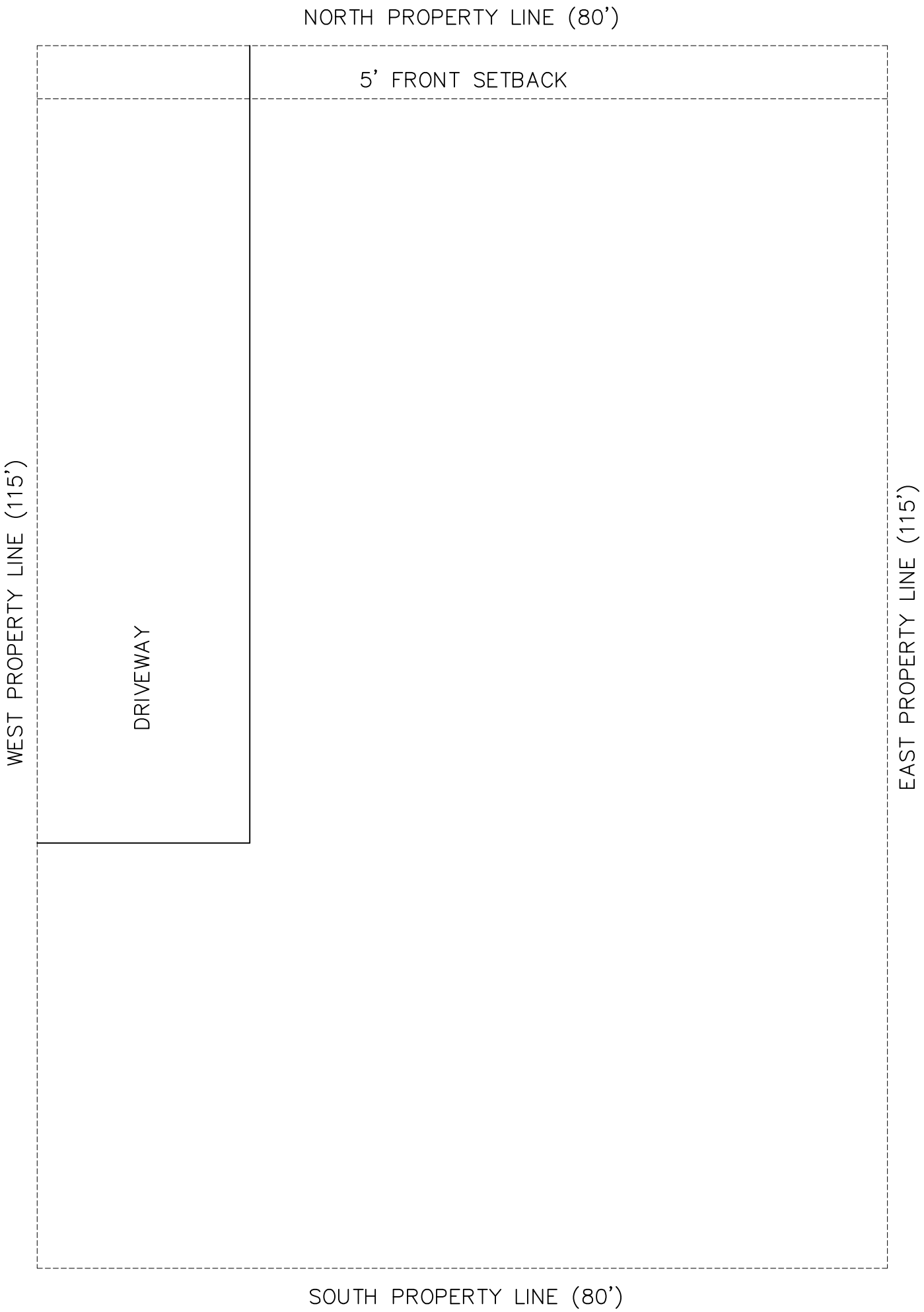
- openings in separate residential units must be separated by a minimum of 5'
- max 7 3/4" risers and min 10" treads with 34-38" handrails with min 4" guards
- 1 smoke alarm per bedroom and also 1 additional per floor
- mechanical ventilation required in all kitchens, bathrooms, laundry rooms
- egress windows required in all bedrooms

Weekly Outline (subject to change):

Week 1	**Lecture:**	Introduction to course; review project expectations; review AutoCAD protocol
	Lab:	Site analysis
	Homework:	Revisions of site analysis and bubble diagrams for 2 options
Week 2	**Lecture:**	Discussion of site analysis, bubble diagrams, floor plans and massing model
	Lab:	Critiques of bubble diagrams;
	Homework:	Site analysis submittal due next week at start of class
Week 3	**Lecture:**	**Site analysis submittal due at start of class**; Discuss pre-design
	Lab:	Critiques of pre-design
	Homework:	Revisions of pre-design
Week 4	**Lecture:**	Discussion of pre-design and sustainability
	Lab:	Critiques of pre-design
	Homework:	Pre-design submittal due next week at start of class
Week 5	**Lecture:**	**Pre-design submittal due at start of class**; Discuss kitchen island
	Lab:	Critiques of island
	Homework:	Revisions of island
Week 6	**Lecture:**	Discussion of island
	Lab:	Critiques of island
	Homework:	Island submittal due next week at start of class
Week 7	**Lecture:**	**Island submittal due at start of class**; Discuss interiors
	Lab:	Critiques of interiors
	Homework:	Revisions of interiors
Week 8	**Lecture:**	Discussion of interiors
	Lab:	Critiques of interiors
	Homework:	Interior submittal due next week at start of class
Week 9	**Lecture:**	**Interior submittal due at start of class**; discuss final submittal
	Lab:	Critiques of final submittal
	Homework:	Revisions of final submittal
Week 10	**Lecture:**	Discussion of final submittal
	Lab:	Critiques of final submittal
	Homework:	Final submittal due at start of class next week
Week 11	**Lecture:**	**Final submittal due at start of class**
	Lab:	Critiques of final submittal

Reminder:

All work is due at the start of class time. Work not ready at the start of class time will not be graded, but may still be reviewed. Incomplete work will be graded if it is submitted at the start of class time.


NORTH PROPERTY LINE (80')
5' FRONT SETBACK
WEST PROPERTY LINE (115')
DRIVEWAY
EAST PROPERTY LINE (115')
SOUTH PROPERTY LINE (80')

Is Seattle ready for row homes?

By AUBREY COHEN, SEATTLEPI.COM STAFF
Published 10:00 p.m., Wednesday, December 1, 2010

VIEW: LARGER | HIDE 1 of 2 PREV NEXT

These six Ballard tow nhouses w ere built under current rules, w ith tw o in front and four behind, around a central auto court.
Photo: Joshua Trujillo/seattlepi.com / SL

0 0
Recommend
Comments (0) Email This
Larger | Smaller Font
Printable Version

Dense Seattle neighborhoods could start looking a lot more like those in cities like San Francisco and Philadelphia, under a proposal the City Council is set to take up later this month.

The plan would let developers build row homes right up their neighbors' side lot lines on in townhouse zones, similar to classic older homes in many other U.S. cities. It's one of many changes aimed at making townhouse development more diverse, attractive and sustainable.

The City Council's Committee on the Built Environment this week unanimously endorsed the plan, which the full council could take up as early as Dec. 13. The changes would apply to the approximately 8 percent of the city zoned for townhouses, but wouldn't impact single-family zones.

In townhouse zones, the city has long allowed townhouses on a single lot to have shared walls, but required them to be set back from side property lines. The idea was to continue a semblance of Seattle's tradition of detached houses and provide some protection to people who continued to live in traditional houses that remained in townhouse zones.

FOLLOW US:

Local Photos Displaying 1-3 of 100

Wall Street protesters in Seattle

Local Knox reaction

Conclusion of Amanda Knox appeal trial

Most Read | Most Commented

1. Hank Williams Jr. yanked from 'MNF' after Obama-Hitler remarks
2. Amanda Knox acquitted
3. Donald Trump: Amanda Knox could 'become a big star'
4. Occupy Seattle encampment grows at Westlake Park
5. Starbucks and Amanda Knox: NY Times

There's widespread agreement that the results of the current rules were often ugly, particularly clusters of homes around an auto court.

"We've seen some really great housing developed, despite some of the things that were in our code, and we've seen some things developed that were really not positive additions to our city," Councilmember Sally Clark said at a committee meeting Tuesday. "We can do better."

Squire Park resident Bill Zosel said that, at the community meetings he attends, community members cite bad townhouses as "the most or one of the most significant problems."

City planners proposed an overhaul of rules governing townhouses and small apartment and condominium buildings more than two years ago. The original plan called for giving developers more flexibility for different (and, hopefully, better) designs by allowing homes to be taller and closer to the street, while also adding new design, open-space and landscaping requirements, and addressing other concerns, such as high fences along streets.

Some people felt that the rules didn't go far enough to allow different kinds of homes, while others said they would allow even-uglier buildings.

Many agree that the recent change allowing attached row homes that go right up to the property lines on either side will allow prettier homes. It will also allow variation that makes for more attractive neighborhoods, Clark said.

"In the last development cycle we saw so much of the same thing over and over again," she said. "What we heard from architects and developers was: 'Well your code makes us do that.'"

The change also would put homes closer to existing neighbors and, over time, could result in block-long rows of houses, such as those that have long existed in older cities. Row homes would have to be set back from neighboring single-family zones, but not from single-family houses that are in townhouse zones.

"I think we realized that trying to force multi-family development to look like single-family development was yielding some really bad product," Clark said Thursday. "We weren't doing anybody any favors."

The new rules would still allow townhouses that aren't row homes. But the current auto-court-style homes would be limited -- allowing just two or three on a typical lot where three or four could go now.

Non-row townhouses could build to the higher density if they put parking at the rear of the lot, off an alley if there is one, and meet green-building requirements. Row houses would, for practical purposes, be limited to three on a typical lot by the width of the lot.

Row home parking is pretty straightforward if there's an alley. The garages go on the alley in a row across the back yard from the houses.

If there's no alley, developers could run a driveway down the side of the lot to the back, which cuts into row-home space, or build parking underground, which is expensive.

1 | 2 Next »

Printable Version Email This Recommend 0

We Recommend

- **Nude Bellevue woman arrested**
- **Cheerleaders' parents sue in nude photos incident**
- **Charge: Dad threatened to shoot teen daughter's naked boyfriend**
- **At issue in Amanda Knox murder trial: How wild was that party…**
- **Foraging for food -- in Seattle**
- **Amanda Knox acquitted**

From Around the Web

- **Why Amanda Knox was originally convicted of murder** *(The Daily)*
- **Unthinkable Poised to Happen on Wall Street. See Disturbing Charts.** *(Moneynews)*
- **The Roman Polanski Interview** *(The Huffington Post)*
- **5 tips for finding unclaimed property** *(Bankrate.com)*
- **7 Reasons Women Experience Depression** *(Lifescript.com)*

makes awkward pairing

6. ESPN pulls intro after Williams' Obama comments
7. NJ jail inmate saves shelter worker from pit bull

LATEST LOCAL HEADLINES

Oak Harbor man arrested after 2 stabbed to death 10:00 p.m.

Human trafficking: Washington works to stop demand 10:00 p.m.

Schools try ice cream, Nikki Minaj to boost attendance 05:16 p.m.

City Council makes it easier for homeless 'tent cities' 02:47 p.m.

Local supporters: 'Amanda is going to need a lot of help' 01:58 p.m.

Is Seattle ready for row homes?

By AUBREY COHEN, SEATTLEPI.COM STAFF
Published 10:00 p.m., Wednesday, December 1, 2010

VIEW: LARGER | HIDE 1 of 2 PREV NEXT

These six Ballard tow nhouses w ere built under current rules, w ith tw o in front and four behind, around a central auto court.
Photo: Joshua Trujillo/seattlepi.com / SL

0 0
Recommend
Comments (0) Email This
Larger | Smaller Font
Printable Version

(Page 2 of 2)

Another option is to have separate front driveways for each home. But that takes away street parking and creates more places where cars can conflict with pedestrians on sidewalks.

"That's a lot for pedestrians to be crossing, and it doesn't seem to serve anybody's interest," Clark said.

The solution that the Committee on the Built Environment adopted Tuesday was a compromise: Require driveways to be at least 18 feet from each other and, on lots too narrow to meet this requirement for all homes, allow two homes to share a driveway.

The plan eliminates required parking altogether in urban villages, which are designed to have services and transit within walking distance, and certain other areas close to transit.

Clark wants to get rid of parking requirements in other areas, leaving the decision up to developers and the market, eventually.

"I would like to get the city out of the business of prescribing how much parking you provide, because I don't think we're particularly good at it," she said.

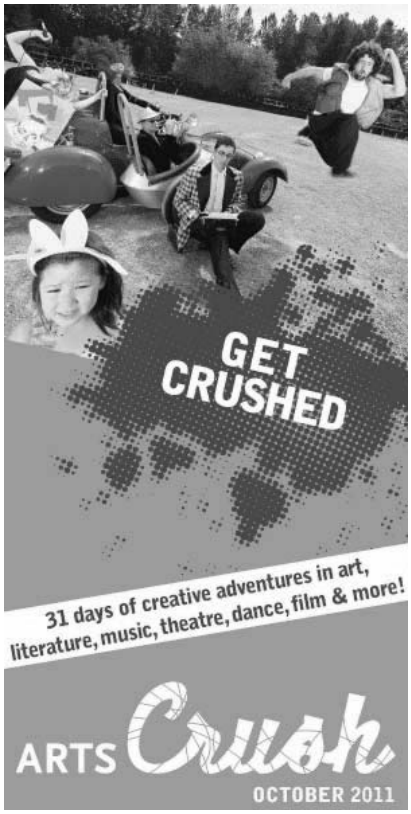
FOLLOW US:

Local Photos Displaying 1-3 of 100

Wall Street protesters in Seattle

Local Knox reaction

Conclusion of Amanda Knox appeal trial



Most Read | Most Commented

1. Hank Williams Jr. yanked from 'MNF' after Obama-Hitler remarks
2. Amanda Knox acquitted
3. Donald Trump: Amanda Knox could 'become a big star'
4. Occupy Seattle encampment grows at Westlake Park
5. Starbucks and Amanda Knox: NY Times

But many existing residents still see parking requirements as needed to ensure streets aren't clogged with parked cars, she added. "We didn't go there yet. I would say that Seattle's probably on the way to that."

Overall, the proposal "does a lot of good things," Zosel said in endorsing the plan Tuesday. "I think that it will make things better in the future."

Architect Bradley Khouri, representing the Seattle chapter of the American Institute of Architects, said the measure "doesn't address everybody's concerns, but it certainly goes a long way to getting us towards the kind of flexibility that we want to see within legislation that will allow great solutions."

But Seattle Community Council Federation Treasurer Chris Leman argued the rules would make things worse, saying: "The so-called solution for townhouses, and there has been a bit of a townhouse problem, is to build taller and larger apartment and condo buildings that are bulkier, that lack meaningful yards and are really a lot worse than even the worst townhouses."

« Previous 1 | 2

Printable Version Email This Recommend 0

We Recommend

- Nude Bellevue woman arrested
- Cheerleaders' parents sue in nude photos incident
- Charge: Dad threatened to shoot teen daughter's naked boyfriend
- At issue in Amanda Knox murder trial: How wild was that party...
- Foraging for food -- in Seattle
- Amanda Knox acquitted

From Around the Web

- Why Amanda Knox was originally convicted of murder *(The Daily)*
- Unthinkable Poised to Happen on Wall Street. See Disturbing Charts. *(Moneynews)*
- The Roman Polanski Interview *(The Huffington Post)*
- 5 tips for finding unclaimed property *(Bankrate.com)*
- 7 Reasons Women Experience Depression *(Lifescript.com)*

[what's this?]

Comments

Add Your Comment

New to the site?

To use commenting, you need to sign up.

Register

Already a member?

Please log in.

Email

Password

(Forgot Password?)

Remember Me

Sign In

Hot Gold Stock - GTSO
GTSO gold play in Far East as Precious Metals head Higher.
www.GTSOGold.com

WA State-Wide Bail Bonds
Immediate 24 Hour At-Jail Service 1-866-530-2245
APlus-BailBonds.com

Best Financial Directory
Find information and unbiased reviews of top Financial
www.wealthvisor.com

Ads by Yahoo!

makes awkward pairing

6. ESPN pulls intro after Williams' Obama comments
7. NJ jail inmate saves shelter worker from pit bull

LATEST LOCAL HEADLINES

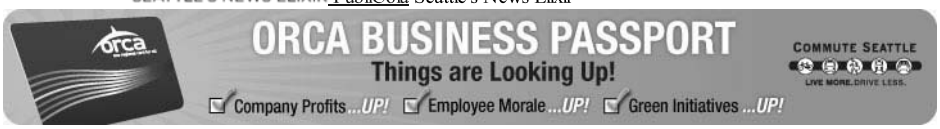
Oak Harbor man arrested after 2 stabbed to death 10:00 p.m.

Human trafficking: Washington works to stop demand 10:00 p.m.

Schools try ice cream, Nikki Minaj to boost attendance 05:16 p.m.

City Council makes it easier for homeless 'tent cities' 02:47 p.m.

Local supporters: 'Amanda is going to need a lot of help' 01:58 p.m.



Rowhouses and No Parking Requirements: Coming to Seattle!

CITY HALL , POLITICS *November 30, 2010 at 5:20 pm Erica C. Barnett*

0

0

Like

The city council's Committee on the Built Environment adopted new regulations governing land use in low-rise multifamily zones this morning that will allow row houses in lowrise multifamily zones (about three stories) and eliminate minimum parking requirements in those zones. The changes are an effort to prevent the kind of ugly, auto-oriented "six-pack" townhouses that dominated Seattle multifamily development through much of the 2000s.

The changes, which only apply in low-rise multifamily residential zones, include:

• Instead of the current generic land-use standards, the new regulations include five different allowed housing types: Cottage housing (collections of small single-family-style houses), row houses (rows of units attached by a single wall), townhouses (attached units that occupy space from ground to roof), autocourt townhouses (townhouses that each have a private garage), and apartments.

• The maximum allowable height would be increased from 25 to 30 feet (basically, from three to a potential four stories)—a change that prompted commenters like Eastlake gadfly Chris Leman to accuse the council of supporting "larger and taller condos… that are bulkier and …. really worse than the worst townhouses" because they would block views, make it impossible to plant trees, and displace low-income housing.

• The size of new developments would be determined by floor-area ratio (the ratio of a building's floor area to the lot on which it is built) rather than simple building footprint, allowing more flexibility in building size.

• Row houses would not be subject to the same density limits as auto-oriented townhouses, allowing them to cover more of a lot.

• The law also includes new design standards to improve the appearance of new low-rise buildings and make them fit better into neighborhoods;

• The changes would reduce the setbacks required between housing and the street (and between low-rise townhouses or row houses and each other), allowing more development on a lot;

• Require developers to provide space for garbage, recycling, and food waste bins for smaller buildings, making it easier for residents of small town houses and apartment buildings to recycle and compost their waste;

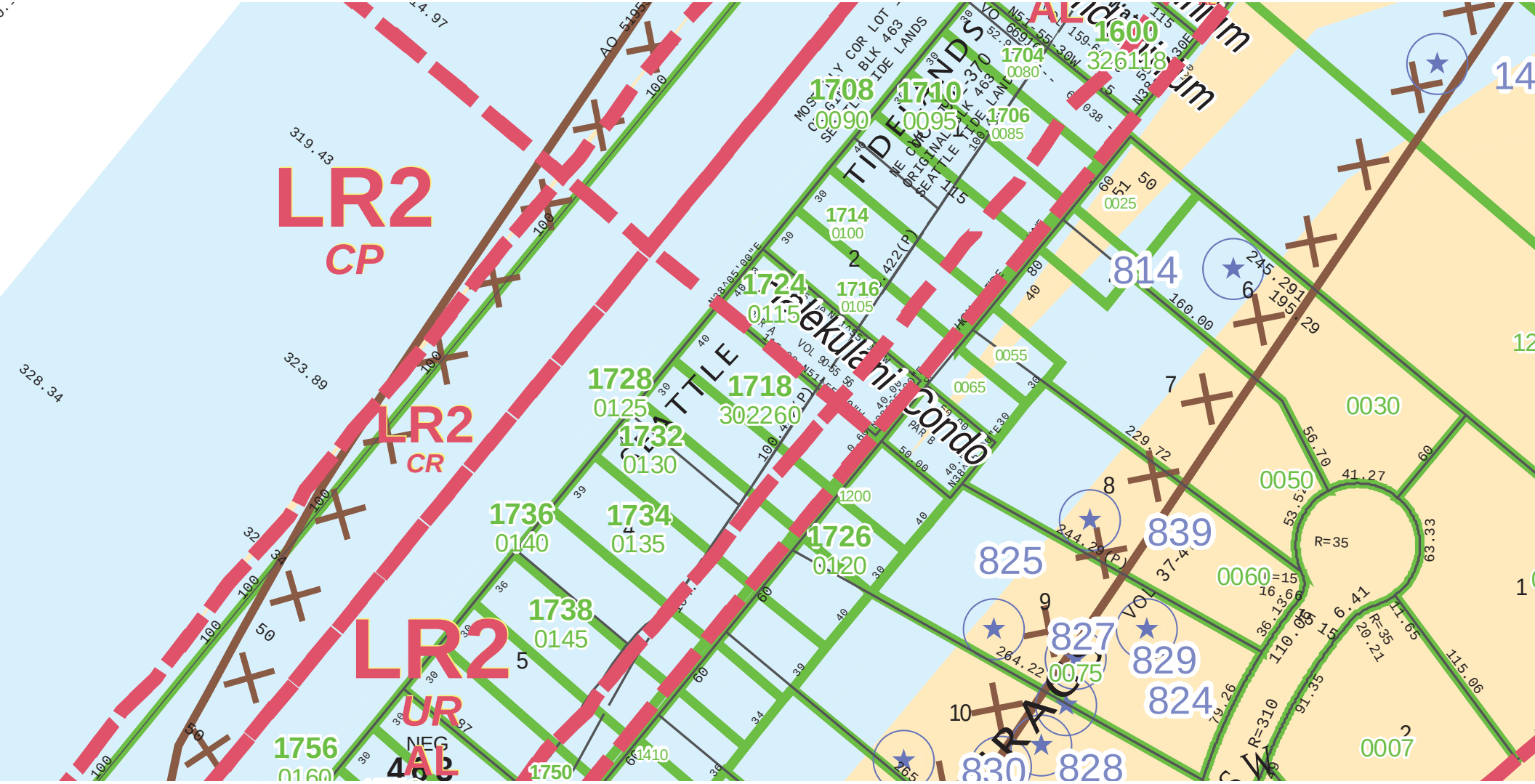
• And, perhaps most significantly, the new law would eliminate the minimum amount of parking developers must build in low-rise multifamily areas (currently one space per unit), allowing developers to build housing without dedicated parking (saving tens of thousands of dollars per unit).

Despite the controversy around the land-use changes, the zones the legislation would impact encompass just 8 percent of the land in the city.

Send Be the first of

DPD GIS

No warranties of any sort, including accuracy, fitness, or merchantability accompany this product.
Copyright 2007, All Rights Reserved, City of Seattle


LR2
CP
LR2
CR
LR2
UR
AL
AL
1600
326118
1704
0080
1706
0085
1708
0090
1710
0095
1714
0100
1716
0105
1718
302260
1724
0115
1726
0120
1728
0125
1732
0130
1734
0135
1736
0140
1738
0145
1756
0160
1750
1410
1200
814
839
825
827
0075
829
824
828
830
0025
0030
0050
0060
0065
0055
0007
R=35
R=310
Mekulani Condo
TIDELANDS
SEATTLE
PLAT
NEG

SEATTLE'S LOWRISE MULTIFAMILY ZONES

IMPORTANT NOTE: Some areas have neighborhood-specific regulations that are not reflected here. Please consult with DPD staff for individual projects.

THIS ZONING CHART IS FOR ILLUSTRATIVE PURPOSES ONLY

General standards are shown. Please refer to the Land Use Code for exceptions and specific regulations. Due to the complexity of the code, zoning questions cannot be answered by phone. If you have questions about Multifamily zoning, please arrange for a paid appointment with a land use planner or ask specific questions via DPD's online land use Q&A at http://web1.seattle.gov/dpd/LUQnA/ . To make a coaching appointment, call the Applicant Service Center at 206-684-8850 or visit the ASC, located on the 20th floor of Seattle Municipal Tower at 700 Fifth Ave.

Regulations common to all lowrise multifamily zones

Green Factor

Landscaping is required to achieve a Green Factor score of .60 or higher (functionally equivalent of landscaping 60% of the lot). Credit is awarded for green roofs, planters, green walls, landsaping and plantings in the adjacent Right of Way.

Amenity Area Requirements

An area equal to 25% of lot area is required as amenity area, with a minimum of 50% provided at ground level. Remaining area may be provided on the roof or on balconies. Shared space must be accessible to all residents, with a minimum area of 250 square feet (SF) and a minimum dimension of 10'.

For Cottage Housing 150 SF of private amenity area and 150 SF of common amenity area per cottage must be provided, plus 150 SF of common amentiy area for carriage house units.

Parking Requirements

- None required in urban villages for lots within 1/4 mile of frequent transit service, in urban centers and station areas.
- All other areas: 1 space per unit, except Alki and portions of the University District where the requirement is 1.5 spaces / unit.
- Parking must be located within 800', or on the lot on the side, rear or beneath the structure.
- Access from an alley is required if an alley is present, with some allowances for access from the street under special circumstances.

Design Standards

For facades that face the street, general design standards require that visual interest be provided by articulating the façade, varying building materials, or using architectural features. These facades must have pedestrian entries and a minimum area devoted to windows. There are also specific design standards for each multifamily housing type.

Streamlined Design Review (SDR)

Streamlined Design Review, an administrative design review performed by DPD staff is required for all townhouse developments with three or more units. SDR is optional for cottage housing, rowhouses or apartment housing types. Projects undergoing SDR are not subject to certain prescriptive design standards, and may be allowed minor adjustments to certain development standards to allow flexibility and improve design.

Design Review

Multifamily projects of a certain size are required to undergo full Design Review, performed by neighborhood Design Review Boards.

Green Building

LEED, Built Green, or Evergreen Sustainable Development Standards required for projects gaining higher FAR or density allowed per SMC 23.45.510.C.

City of Seattle
Department of Planning
& Development
Diane Sugimura, Director
Mike McGinn, Mayor

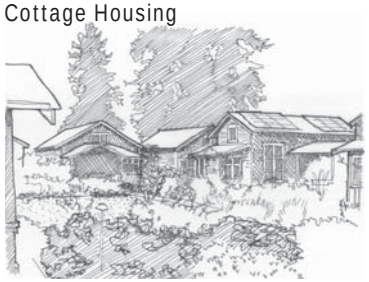
January 2011
Printed on 100% recycled paper containing 30% post-consumer waste

Housing Types:

Development standards apply according to the following housing types: cottage housing, rowhouses, townhouses or apartments.

See SMC 23.84.032 for complete housnig type definitions.

Cottage Housing



Individual cottage house structures are arranged around a common open space. 950 SF is the maximum size allowed for each cottage.

Rowhouse

Rowhouses are attached side by side along common walls. Each rowhouse directly faces the street with no other principal housing units behind the rowhouses. Rowhouses occupy the space from the ground to the roof. Units can not be stacked.*

Townhouse

Townhouses are attached along common walls. Townhouses occupy the space from the ground to the roof. Units can not be stacked. Principal townhouse units may be located behind other townhouses units as seen from the street.*

Apartments

Multifamily housing that is not cottage housing, rowhouses, or townhouses is considered apartments. Apartment units may be stacked.

LR1 - Lowrise 1

The LR1 zone provides a transition between single family zoned areas and more intense multifamily and commercial areas. LR1 is most appropriate for areas outside of Growth Areas***. A mix of housing types similar in scale to single family homes such as cottages, rowhouses and townnhouses are encouraged.

Floor Area Ratio (FAR)**	1.1	1.0 or 1.2	0.9 or 1.1	1.0
Density Limit**	1 unit / 1,600 SF lot area	No Limit	1 unit / 2,200 SF or 1 unit / 1,600 SF lot area	1 unit / 2,000 SF lot area (duplexes and triplexes only)
Building Height	18' + 7' for a roof with minimum 6:12 pitch	30' + 5' for roof with minimum 6:12 pitch	30' + 5' for roof with minimum 6:12 pitch	30' + 5' for roof with minimum 6:12 pitch
Building Setbacks	Front: 7' Average, 5' minimum Rear: 0' with Alley, 7' no Alley Side: 5' minimum	Front: 5' minimum Rear: 0' with Alley, 7' average, 5' minimum Side: 0', 5' on lots next to single family zones	Front: 7' Average, 5' minimum Rear: 7' Average, 5' minimum Side: 5' if building is 40' or less in length, or 7' Average 5' min.	Front: 5' minimum Rear: 10' minimum with Alley, 15' minimum no Alley Side: 5' if building is 40' or less in length, or 7' Average 5' min.
Building Width Limit	60'	60'	60'	45'
Max. Facade Length	Applies to all: 65% of lot depth for portions within 15' of a side lot line that is not a street or alley lot line, and 40' for a rowhouse unit located within 15' of a a lot line that abuts a lot in a single family zone.			
SDR	Optional	Optional	Required for 3 or more units	Optional

LR2 - Lowrise 2

The LR2 zone provides for a variety of multifamily housing types in existing multifamily neighborhoods and along arterial streets. LR2 is most appropriate for areas within Growth Areas***. A mix of small scale to multifamily housing such as townhouses, rowhouses and apartments are encouraged.

Floor Area Ratio (FAR)**	1.1	1.1 or 1.3	1.0 or 1.2	1.1 or 1.3
Density Limit**	1 unit / 1,600 SF lot area	No Limit	1 unit / 1,600 SF lot area or No Limit	1 unit / 1,200 SF or No Limit
Building Height	18' + 7' for a roof with minimum 6:12 pitch	30' + 5' for roof with minimum 6:12 pitch	30' + 5' for roof with minimum 6:12 pitch	30' + 5' for roof with minimum 6:12 pitch or 30' + 4' for partially below grade floor
Building Setbacks	Same as LR1	Same as LR1	Same as LR1	Same as LR1
Building Width Limit	Not applilcable	No Limit	90'	90'
Max. Facade Length	Applies to all: 65% of lot length for portions of facades within 15' of a lot line that is not a rear, street or alley lot line, and 40' for a rowhouse unit located within 15' of a lot line that abuts a lot in a single family zone.			
SDR	Optional	Optional	Required for 3 or more units	Optional

LR3 - Lowrise 3

The LR3 zone provides for a variety of multifamily housing types in existing multifamily neighborhoods of moderate scale. LR3 accommodates residential growth primarily within Growth Areas***. A mix of small to moderate scale multifamily housing is encouraged including apartments, townhouses and rownhouses.

			Growth Areas***	Outside Growth Areas***	Growth Areas***	Outside Growth Areas***
Floor Area Ratio (FAR)**	1.1	1.2 or 1.4	1.2 or 1.4	1.1 or 1.3	1.5 or 2.0	1.3 or 1.5 (1.6 on a street with frequent transit)
Building Height	18' + 7' for a roof with minimum 6:12 pitch	Rowhouses and Townhouses: 30' +5' for roof with min. 6:12 pitch and +4' for partially below grade floor; or +10' for roof with min. 6:12 pitch (no height added for below-grade floor). Note: In some cases development is limited to 3 or 4 stories above grade in addition to the height limit (also applies to apartments).			40' +5' for roof with min. 6:12 pitch; or +4' for partially below-grade floor; 30' limit if within 50' of a single family zone.	30'
Density Limit**	1 unit / 1,600 SF lot area	No Limit	1 unit / 1,600 SF lor area or No Limit		1 unit / 800 SF lot area or No Limit	
Building Setbacks	Same as LR1	Same as LR1	Same as LR1		Same as LR1	
Building Width Limit	No Limit	No Limit	120' Outside growth areas, 150' Inside growth areas		120' Outside growth areas, 150' Inside growth areas	
Max. Facade Length	Applies to all: 65% of lot depth for portions within 15' of a side lot line that is not a street or alley lot line, and 40' for a rowhouse unit located within 15' of a a lot line that abuts a lot in a single family zone.					
SDR	Optional	Optional	Required for 3 or more units		Optional	

** Accessory Dwelling Units (ADUs) are allowed and don't count against the density limit that applies to these housing types.*
*** The higher FAR and density limits apply if the project meets additional standards regarding parking location and access, alley paving, and green building performance (SMC 23.45. 510.C).*
**** Growth Areas include urban centers, urban villages, and station area overlay districts.*

Department of Planning and Development

CAM Client Assistance Memo 417

Seattle Permits

— part of a multi-departmental City of Seattle series on getting a permit

Sun Chart: Determination of Solar Exposure

Updated November 15, 2010

The Seattle Energy Code allows credit for passive solar gains through glazing in Group R occupancy (residential) spaces if the Systems Analysis (Chapter 4) compliance option is used. In addition, the Seattle Land Use Code provides certain benefits for solar collectors with good solar exposure. (See Seattle DPD Director's Rule 13-2002)

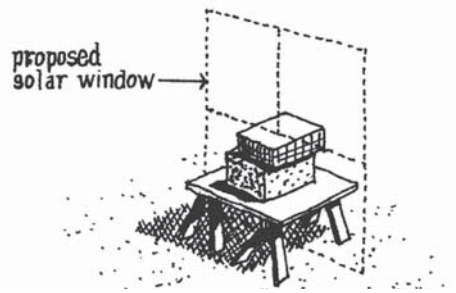
To evaluate and document a proposed window's solar exposure, a sun chart is used (48° north latitude for Seattle). On a sun chart, all objects which could block the sun from reaching the proposed window are shown, as well as the path of the sun on the dates specified. From this information, the number of hours that the window will be in direct sun can be determined.

To complete a sun chart, observations must be made from the actual location of the proposed passive window. The following tools will be required:

- compass } or transit
- protractor } or transit
- a blank sun chart (provided)

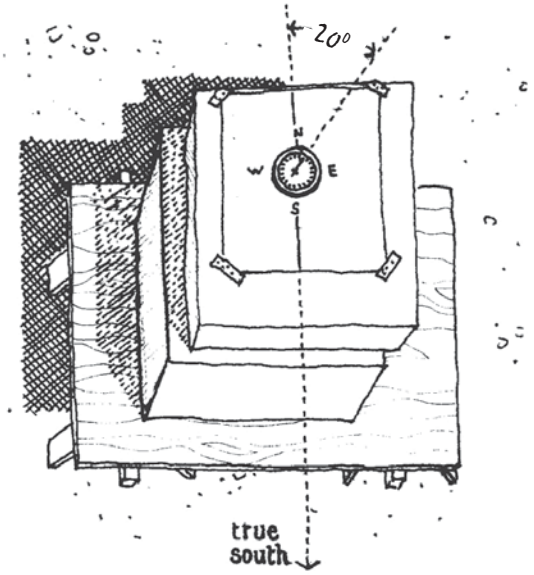
1. Setting Up

The first task is to set up a level surface at the location of the proposed window or group of windows. The surface should be positioned so that it is at the center of where the window or group of windows will be.



2. Orientation

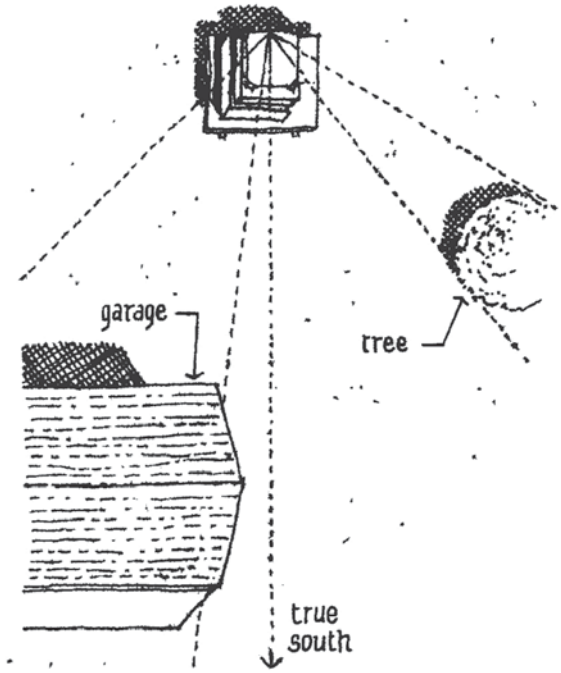
The next step is to establish the direction of true south. This is easiest with a compass where the declination can be set. For other compasses, with the compass lying on the level surface, orient it so that the needle points at 20° east of north. This is to correct for the discrepancy between true north and magnetic north. At this point it is helpful to draw a line, representing the true north-south axis, on a sheet of paper taped to the level surface.



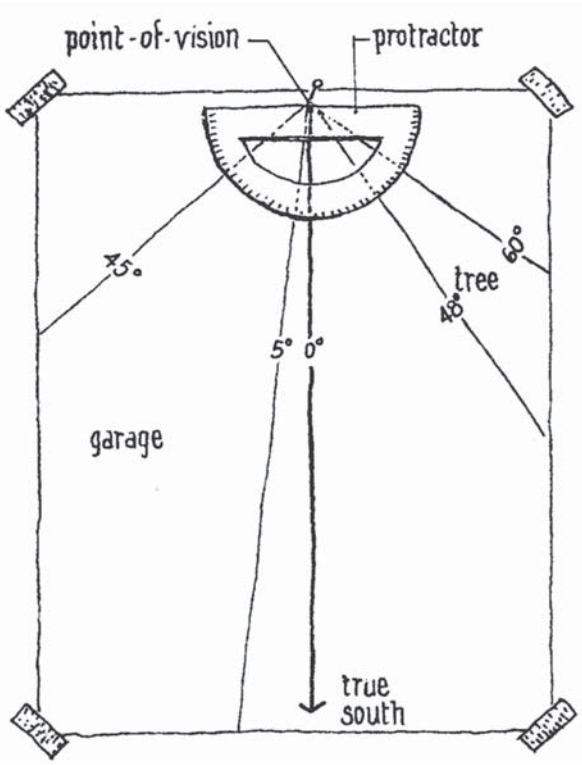
3. Azimuth Angles

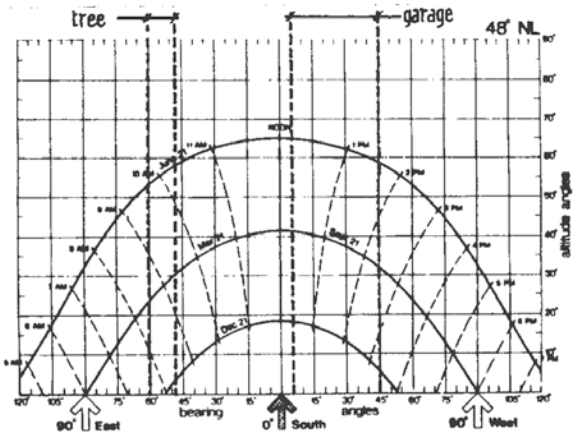
Next, the azimuth angle of each object which may block the sun must be determined. Azimuth angles are measurements in the horizontal plane which represent an angle referenced from true south. To measure the azimuth angles, establish a point-of-vision on the north-south line, at the edge of the sheet as shown. It will be helpful in sighting angles to insert a pin at the point-of-vision. As each object is sighted, draw lines from the point-of-vision representing the edges of the object.

Example: Azimuth Angles



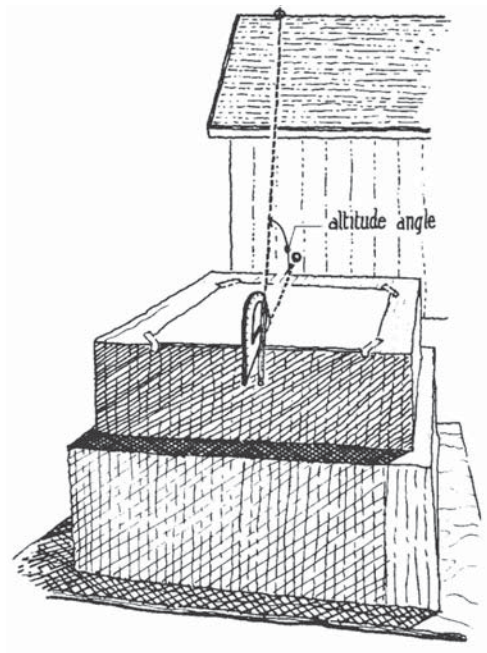
Using a compass or protractor, note the number of degrees away from true south of each line. This information should now be transferred to the sun chart by drawing vertical lines at the angles noted.





4. Altitude Angles

With the azimuth angles established, the next step is to measure the altitude angle of each object. Altitude angles are measurements in the vertical plan which represent an angle above horizontal (level). To measure altitude angles, hold the protractor in an upright position and aim it at each object, sighting along a pencil held against the protractor. The altitude angle can then be read from the protractor where the pencil crosses the scale.

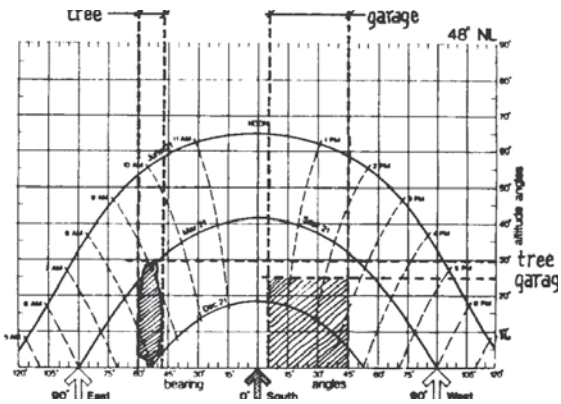


An alternate method of measuring altitude angles is to suspend a weight from a string attached to the reference point of the protractor. With the curved edge down, sight along the flat edge of the protractor. The altitude angle can then be determined from the point at which the string crosses the scale. Subtract 90° from the "string" reading in order to obtain the true altitude angle.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

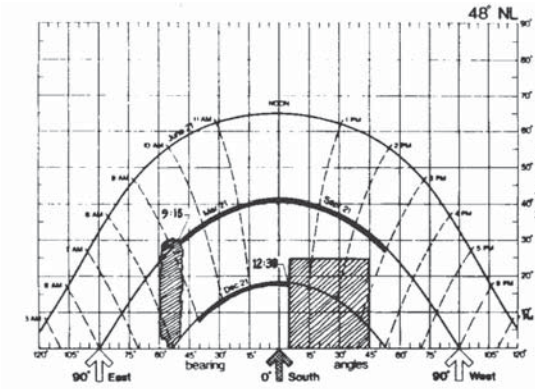
5. Completing the Sun Chart

Using the information obtained in step 4, sketch in the outline or silhouette of each object on the sun chart. Because the sun chart measures angles and not distances, the objects drawn will appear much narrower than they really are.



6. Reading the Sun Chart

With the sun chart complete, the number of hours that the proposed passive solar window or solar system will be in direct sun can be determined for various dates. The important dates vary depending on whether the application is for space heating, service water heating, or pool heating. For instance, DR 13-2002 requires that space heating systems have a minimum of 4 hours solar exposure between 8 a.m. and 4 p.m. on January 21, and 4 hours minimum between 8 a.m. and 4 p.m. on March 21. For service water heating systems, the requirement is 4 hours minimum between 8 a.m. and 4 p.m. on March 21. For pool heating systems, the requirement is 4 hours minimum between 8 a.m. and 4 p.m. on June 21. (Note that DR 13-2002 also contains other criteria.)



7. Documentation to be Submitted

Provide the following with the permit application:

- Completed sun chart indicating the shading by buildings and vegetation, and
- Site plan showing adjacent buildings and vegetation.

FURTHER INFORMATION

For additional copies of this Client Assistance Memo (CAM) or revised versions of it, contact the Seattle Department of Planning and Development (DPD) at (206) 684-8850. All CAMs are public domain documents and may be freely copied without any special permission.

For projects within the Seattle city limits, further information on Seattle Energy Code requirements is available from the Energy Code website at **www.seattle.gov/dpd/energy**.

Access to Information

Links to electronic versions of DPD **Client Assistance Memos (CAMs), codes**, and **forms** are available on the "Publications" and "Codes" pages of our website at **www.seattle.gov/dpd**. Paper copies of these documents are available from our Public Resource Center, located on the 20th floor of Seattle Municipal Tower at 700 Fifth Ave. in downtown Seattle, (206) 684-8467.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

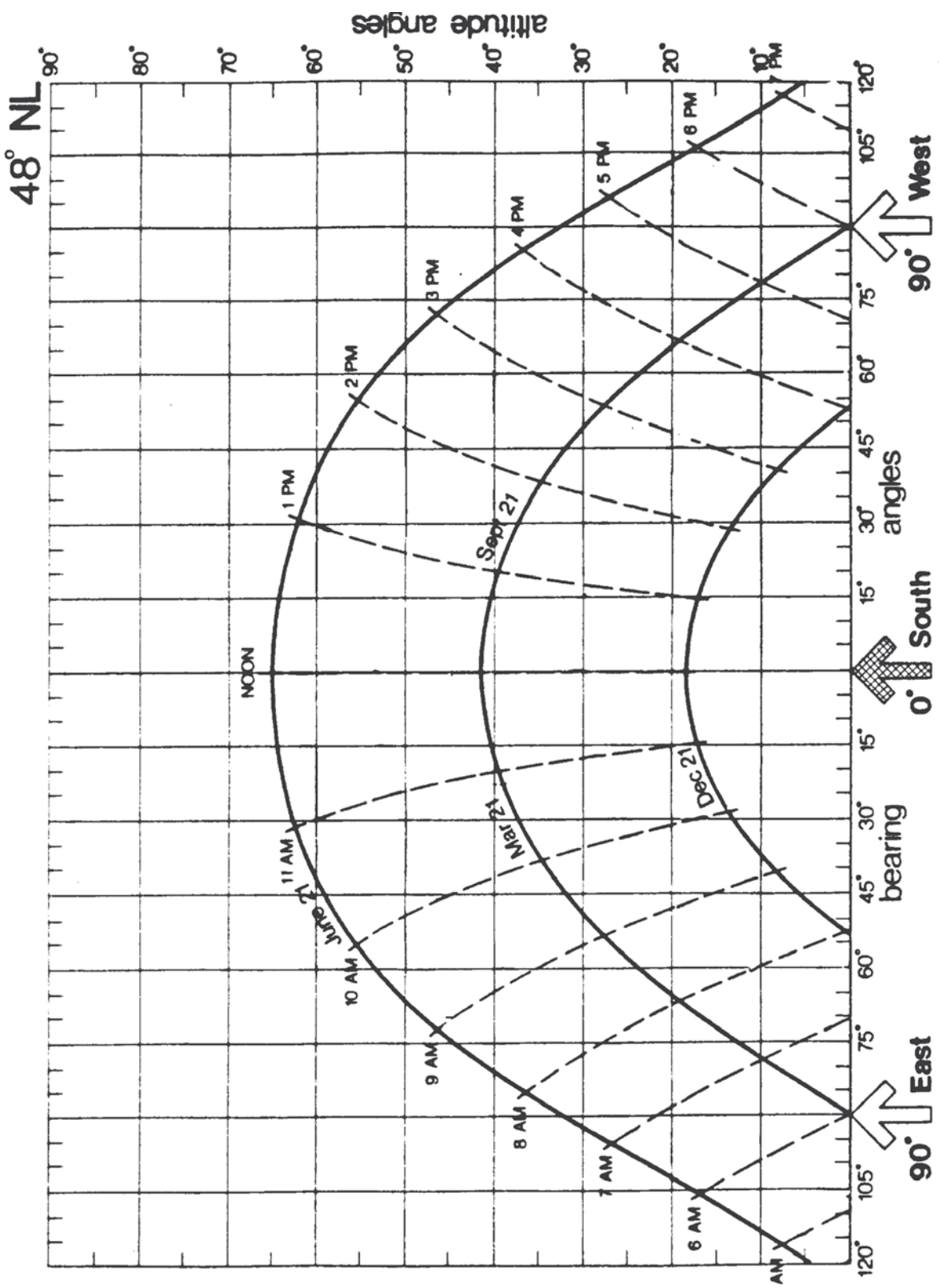


Figure IV-1. Sun Chart for 48° North Latitude

This figure is from Mazria, E., *The Passive Solar Energy Book*, Expanded Professional Edition, Rodale Press, Inc., Emmaus, Pennsylvania, 1979, page 320 (modified).

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

Department of Planning and Development

CAM Client Assistance Memo 420

GREEN Seattle Permits
— part of a multi-departmental City of Seattle series on getting a permit

Solar Energy Systems

Updated Aug. 19, 2009

This Client Assistance Memo (CAM) was developed jointly by the Department of Planning and Development (DPD) and Seattle City Light (SCL), to ensure that the two types of solar energy systems most commonly used in Seattle, electric and hot water, are installed safely and provide maximum benefit to the owner.

In 2008 the City of Seattle was named a Solar America City, one of 25 cities across the country working to accelerate the adoption of solar energy technologies for a cleaner, more secure energy future. The many benefits of solar energy systems include:

- Lower energy bills and energy conservation.
- Clean energy production that helps meet greenhouse gas reduction targets and climate action goals.
- New economic opportunities and green jobs.
- Power from secure, local energy.

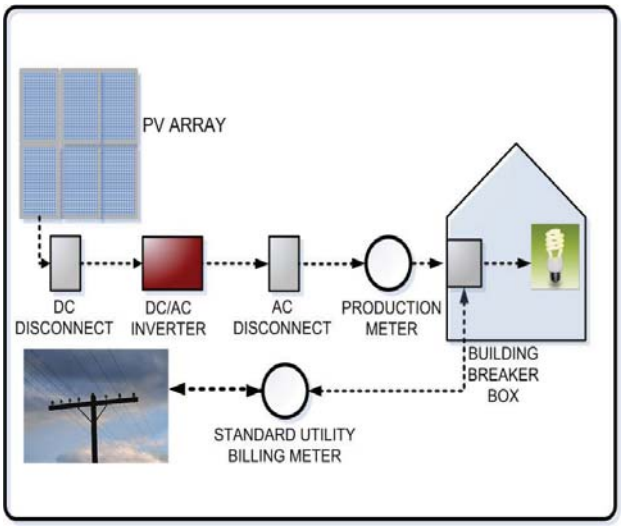
In addition to this CAM, more detailed information on solar access, sizing to fit your project's needs, and performance, is provided in SCL's Guide to Installing a Solar Electric System available at **www.seattle.gov/light/solar**. Much of the information in the guide is applicable to both solar electric and hot water systems.

Solar Electric (Photovoltaic)

Solar electric systems can displace a portion of utility power used to meet home or business electricity needs. Solar electric systems may be operated independently (off grid) or they may be interconnected to the grid. Off grid systems require storage for a back up battery. A grid connected, customer-owned generation system is operated parallel to the SCL electricity distribution system for the purpose of offsetting part or all of a customer's electricity needs.

Net metering refers to an interconnected customer generation system with a meter that reads the net difference between the customer's electricity generation and electricity consumption. Any excess electricity generated by the customer during a billing period is credited to the customer. Seattle City Light offers a net metering program for interconnected systems up to 100 kilowatts (kW). Figure 1 shows the basic solar electric system components.

Figure 1: Typical utility interconnected solar electric system



city green building

Building a Better Seattle

The Green Building Client Assistance Memo (CAM) series is just one of many resources designed to help you build green and create value for your project from initial concept planning to permitting, construction and operation. To learn more, please visit www.seattle.gov/dpd/greenbuilding.

www.seattle.gov/dpd

City of Seattle
Department of Planning & Development

700 5th Avenue, Suite 2000
P.O. Box 34019
Seattle, WA 98124-4019
(206) 684-8600

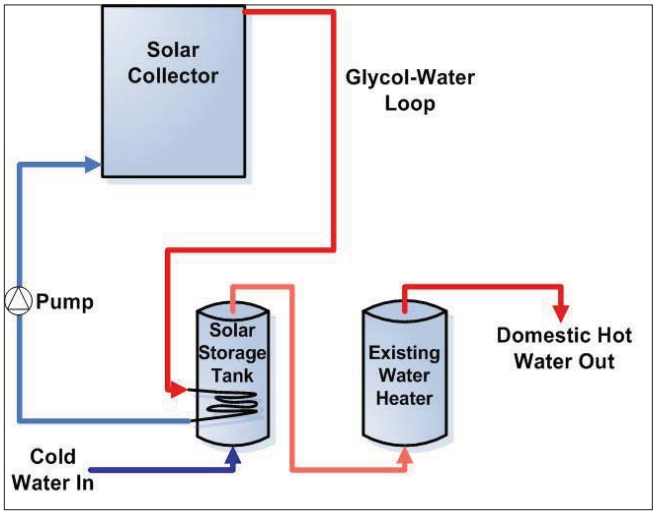
Printed on totally chlorine free paper made with 100% post-consumer fiber

Solar Hot Water (Thermal)

Solar hot water systems can similarly displace some of a home or businesses' energy needs for heating hot water. Augmenting your conventional water heater with a solar hot water system is an environmentally sound way to reduce your electric or gas bills. Figure 2 shows the basic solar hot water system components.

A residential solar hot water system sized to meet 100 percent of summer needs will meet about 30-50 percent of total annual hot water requirements. Your existing water heater can be used as a backup system to ensure you always have hot water, even on cloudy days.

Figure 2: Typical Solar Water Heating System



PERMIT REQUIREMENTS

In general, the person installing the solar system obtains any required permits. For specific information applicants should contact the DPD's Applicant Service Center (ASC) at (206) 684-8850 or **www.seattle.gov/dpd/asc**.

Building Permit

Building permits may be required for solar energy systems when:

- Weight is 1,000 pounds or more (a 2 kW photovoltaic system appropriate for a small household weighs approximately 500 pounds and a typical two collector residential solar hot water system weighs approximately 300 pounds).
- Installation is structurally complex (as determined by DPD).
- Solar projects that require stand alone support structures, or are part of building alterations or additions, valued over $4,000 (not including the value of the solar equipment).
- Project is for a commercial or industrial application.

Electrical Permit

Electrical permits are required for all solar electric systems. Electrical permits (no plan review) for systems up to 26kW may be obtained online, or at the Over-the-Counter (OTC) permit area of DPD's Applicant Service Center (ASC). Electrical systems over 26kW require plan review. Permit fees will vary depending on the size and complexity of the system. Technical questions may be directed to DPD's Electrical Technical Support at (206) 684-5383.

Seattle City Light requires an Interconnection Application and Agreement, which is conditional on final approval of your electrical permit (see Interconnection and Net Metering Requirements on page 5).

Plumbing Permit

A plumbing permit is required when installing a solar hot water system. Plumbing permits are approved and issued by Seattle/King County Health Department Staff. County staff are available at DPD's ASC.

LAND USE REQUIREMENTS

The following information is excerpted from the Seattle Municipal Code (SMC), but does not substitute for complete information provided therein.

In general, alterations and additions to existing buildings must be permitted and conform to lot coverage, height and setback (yard) requirements described in the Land Use Code. Solar collectors are permitted outright as an accessory use. This means the collectors are incidental to and support the principal use of the lot, such as a home or business. Solar collectors are defined as "any device used to collect direct sunlight for use in the heating or cooling of a structure, domestic hot water, or swimming pool, or the generation of electricity" (SMC 23.44.046).

The following information summarizes how solar systems fit in with land use and zoning requirements.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

General Height Requirements

In Single Family and Residential Small Lot zones, solar collectors may be mounted to extend up to 4 feet above the zone's height limit, or extend up to 4 feet above the ridge of a pitched roof. However, the total height from existing grade to the top of the solar collectors may not extend more than 9 feet above the zone's height limit (see CAM 220).

In the Lowrise (multifamily) zone, and Commercial and Neighborhood Commercial zones with 30- or 40-foot height limits, and most shoreline-designated areas, solar collectors may not extend more than 4 feet above height limits (additional height for pitched roofs may not be counted in this measurement). In most other nonresidential zones and the Midrise and Highrise zones, solar collectors may extend up to 7 feet above height limits. However, in the nonresidential zones listed below, additional flexibility is provided.

Additional Height Flexibility for Solar Collectors in Nonresidential Zones

Applicable zones: Industrial, Commercial, Neighborhood Commercial, Downtown, Special Review Districts, and Seattle Mixed zones; Urban Harborfront and Urban Stable shoreline-designated areas

- Because many rooftops in nonresidential zones include a variety of mechanical and architectural features, solar collectors are treated just like those features. Solar collectors may extend up to 15 feet above the maximum height limit, so long as the combined total coverage of the rooftop features do not exceed 25% of the roof area when typical features (such as elevator penthouses) are present. If rooftop features exceed the 25% roof coverage, solar collectors may only extend 7 feet above maximum height limits, except in the Seattle Mixed zone.
- Additional height flexibility is available in the Seattle Mixed and Downtown zones, when screening and design considerations are met. Refer to SMC 23.48.010E and 23.49.008C for details.
- In the Special Review Districts such as Pioneer Square or the International District, solar collectors may extend to meet the height limit or exceed the roof height by 7, 8 or 15 feet, depending on whether various setbacks and rooftop coverage limits are met, subject to review by the District's Board. Refer to SMC 23.66.140 for details.

Protecting Solar Access of Property to the North

In the Single Family and Residential Small Lot zones, a solar collector exceeding the zone height limit must be placed so that it does not shade the property to the north on January 21 at noon any more than a structure built to the maximum permitted bulk for that zone. For assistance in determining solar exposure, please see CAM 417, *Sun Chart: Determination of Solar Exposure*.

In most other zones, the applicant shall either locate a solar collector at least 10 feet from the north edge of the roof, or provide shadow diagrams to demonstrate the lack of additional shading on January 21 as described above. However, this is not required in Downtown or Industrial zones.

Setback and Yard Requirements

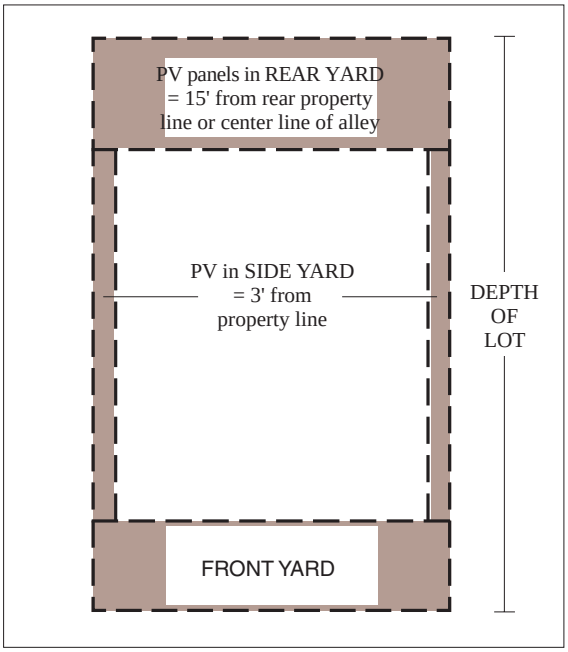
Solar collectors may be located in yards according to the following conditions (see Figure 3):

- Solar collectors are not permitted in a front yard, except for greenhouses that are integrated into the principal structure.
- In Single Family zones, in a rear yard, up to 15 feet from the rear property line. When there is a dedicated alley the solar collector may up to 15 feet (10 feet in Residential Small Lot zones) from the centerline of the alley.
- In a Single Family zone, in a side yard, up to 3 feet from the side property line.
- In Multifamily zones (Lowrise, Midrise, Highrise), solar collectors must be setback 3 feet from the side property line and 5 feet from any principal or accessory structure. The solar collectors in the rear setback must be a minimum of 5 feet from any principal or accessory structure.
- In Commercial and Neighborhood Commercial zones, solar collectors must be set back 5 feet from any principal or accessory structure. Where a lot line abuts a residentially zoned lot, such as Single Family or Multifamily, the required setback is a minimum of 3 feet.
- Other zones do not have specific yard-related setback requirements for solar collectors. However, applicants having projects in Special Review Districts (including Pioneer Square and the International District) should consult with the regulations in SMC 23.66.140C and 23.66.332C for setbacks when solar collectors are rooftop features.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

- For additional information about regulations pertaining to greenhouses and sunshades in Multifamily zones, please refer to SMC 23.45.146.

Figure 3: Solar module setback requirements



Lot Coverage Requirements

Solar collectors do not count as lot coverage if minimum standards are met, including but not limited to height and setback requirements. CAM 220, *Lot Coverage, Height and Yard Standards for Homes in Single Family Zones*, provides details and illustrations.

Nonconforming Residential Uses

A solar collector may be added to the existing principal building on a nonconforming residential lot without forcing the entire building to be brought up to current code standards (SMC 23.42.106).

DESIGN AND INSTALLATION CONSIDERATIONS

Solar Access and Performance

For optimal solar performance your collectors should be in a location that has clear unobstructed access to the sun (free of shading from roofs, trees and other landscape features) for most of the day and throughout the year. During a site evaluation, a solar contractor should evaluate potential collector locations using a tool like a Solar Pathfinder that illustrates annual shade impacts.

Rooftop Structural

For rooftop installations, provide a stable and durable connection to the roof structure for the size and weight of the components used. Take extra care to ensure a leak-proof installation. For unusual, complicated, or heavy installations, consult an experienced building contractor or structural engineer.

In some circumstances, engineering documents may be required to address issues of weight and wind sheer if the solar energy system is surface mounted on a flat roof.

If you are unsure about the structural integrity of your roof, or if it is in need of repair, have it professionally inspected to verify its condition and suitability. It may be necessary to make roofing improvements prior to mounting solar modules.

Electrical

A safe electrical connection of solar equipment to an existing electrical service requires careful consideration and planning. Modifications to branch circuit wiring or the panel board may be necessary. A photovoltaic breaker must be connected to the breaker furthest from the main breaker. Information about all changes to the electrical system must be included in the electric permit application. Be sure to follow all manufacturer installation instructions.

All components of the solar electric system, such as photovoltaic modules and inverters, must be listed by a nationally recognized testing laboratory. Article 690 of the National Electrical Code has requirements specific to Solar Photovoltaic Systems. Seattle City Light's Interconnection Standards specify electrical requirements in greater detail.

Building Integrated Photovoltaics

Solar collectors can be incorporated into building materials such as roof tiles, shingles and insulated glass frames. These materials are known as building-integrated photovoltaics (BIPV). Often, these types of materials cost more than simple solar modules, but the cost of BIPV materials can be offset by the cost of ordinary materials that would have been used, and are no longer needed. Further discussion of BIPV applications is beyond the scope of this memo, however, there are resources listed at the end of this CAM that offer further information.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

INTERCONNECTION AND NET METERING REQUIREMENTS FOR SOLAR ELECTRIC SYSTEMS

Net Metering Benefits and Options

The advantage of interconnection compared to solar electric systems operated independently of a utility grid, is that customers on the grid are assured of electricity needs being met year round regardless of solar availability and the size of system installed. Any excess electricity generated by the customer during a billing period is credited back to the customer. In addition, a battery-less, interconnected system avoids inefficiencies and maintenance costs associated with battery storage.

Subject to inspection, customer-owned grid connected generating systems (solar, wind, biomass, hydro and fuel cell systems), 100 kW or less, qualify for SCL's Net Metering program.

Net Metering Required Forms

To connect to SCL's grid, an Interconnection Application and Agreement is required. The agreement holds SCL customers accountable for meeting specific interconnection standards and safety requirements. Customers are solely responsible for the proper installation and operation of solar electric systems. The system installation and operation must conform with all applicable codes, regulations and manufacturer's safety and operating manuals.

CHOOSING A CONTRACTOR

Although individuals with the necessary construction and electrical experience are not prohibited from installing their own solar electric systems, using a licensed contractor is highly recommended. Considerations for selecting qualified contractors are:

- Do they have a business license?
- Are they licensed for the work you want them to do (mechanical, electrical, structural, etc.)?
- How long have they been in business?
- How many solar energy systems have they installed?
- Will they provide references?
- Have they attended manufacturer, trade association, or other training on solar electric installations?

Please check the Washington Labor and Industries website to learn more about the listed contractor, licensing status, violations, etc.

The North American Board of Certified Energy Practitioners (NABCEP) runs a quality credentialing and certification program for renewable energy professionals. In order to be NABCEP certified, a practitioner must meet installation experience requirements, sign a code of ethics and pass a four-hour exam. Look for the NABCEP seal on contractors' websites. More information about NABCEP and a list of certified installers can be found at their website.

Resource: Labor and Industries: **www.lni.wa.gov/TradesLicensing/Contractors/HireCon**

NABCEP: **www.nabcep.org**

A complete bid for a job will include the total cost of getting a system up and running, including all equipment, wiring, installation, grid connection, permits, sales tax, and warranty.

FINANCIAL INCENTIVES

Federal Tax Credit

Individuals and businesses that install solar energy systems are eligible for a federal tax credit of 30% of the system cost (the total of installation and materials). Individuals use Residential Energy Credits IRS Form 5695 and businesses use the Investment Credit IRS Form 3468. Updated forms can be found on the IRS website, **www.irs.gov**. For questions on the tax credits please consult your tax advisor.

State Sales Tax Exemption

Beginning July 1, 2009, solar electric systems are eligible for a partial reduction or exemption from state sales taxes, depending on the system's size and year of installation. Consult your contractor for details on this tax exemption. The tax reduction/exemption is scheduled to expire June 30, 2013.

Washington Renewable Energy Production Incentive

As of August 2006, Washington State provides financial incentives for electricity generated from renewable energy resources. Eligible electricity producing renewable energy sources include solar, wind and biomass. The incentive is based on the total number of kilowatt-hours of electricity generated between July

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

1 and June 30 (or the closest regular billing cycle) of the following year.

Customers who want to receive the incentive must have a SCL production meter installed.

Customers with eligible generation systems certified by the Washington State Department of Revenue will qualify for annual incentive payments as follows:

- $0.15 /kWh for a PV system with no "Made in Washington" components
- $0.18 /kWh for a PV system with a "Made in Washington" inverter
- $0.36 / kWh for a PV systems with "Made in Washington" panels
- $0.54 / kWh for a PV systems with "Made in Washington" panels and inverter

The program is capped at $5,000 per year per customer and expires in 2020. Further information and application forms are available at **www.seattle.gov/light/solar**.

FURTHER ASSISTANCE

In addition to reading this CAM, you may visit DPD's Applicant Services Center to discuss with a permit specialist or land use planner specific code requirements and installation considerations for your project prior to beginning. General solar-related questions can be directed to the SCL Conservation Helpline at (206) 684-3800.

DPD Applicant Services Center and Public Resource Center

Permit application and issuance, plan review, permit history, publications, self-help computer terminals.

20th floor of Seattle Municipal Tower
700 Fifth Avenue
(206) 684-8850
www.seattle.gov/dpd/asc
www.seattle.gov/dpd/prc

DPD Publications

www.seattle.gov/dpd/publications

- CAM 220, *Lot Coverage, Height and Yard Standards for Homes in Single Family Zones*
- CAM 316, *Subject-to-Field-Inspection (STFI) Permits*
- CAM 417, *Sun Chart: Determination of Solar Exposure*
- Director's Rule 13-2002, *Solar Collectors: Eligibility Criteria and System Efficiency Requirements*

SCL Conservation Resources Division

Information on renewable energy programs, as well as technical assistance and financial incentives for customers interested in improving home or business energy efficiency and saving money on their electricity bill.

Residential and small businesses (Conservation Helpline): (206) 684-3800

Medium and large businesses: (206) 684-3254
www.seattle.gov/light/conserve

SCL's solar homepage lists all necessary interconnection and incentive forms and applications, including the Interconnection Application and Agreement and Interconnection Standards:
www.seattle.gov/light/solar

SCL Service Centers

Interconnection and net metering assistance

SCL North Service Center
(for projects north of Denny Way)
1300 N. 97th Street
(206) 615-0600

SCL South Service Center
(for projects south of Denny Way)
3613 Fifth Avenue South
(206) 386-4200

Northwest Solar Center

A program of the WSU Cooperative Extension Energy Program, the Center provides solar energy resources and educational opportunities.

(206) 396-8446
www.northwestsolarcenter.org

Solar Washington

The local chapter of the American Solar Energy Society, which promotes the development of solar and renewable energy through education and training. Events, articles, newsletter and links are posted on the web.

www.solarwashington.org

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

US Department of Energy

Energy Efficiency and Renewable Energy

This division of the Department of Energy has a focus on enhancing renewable and sustainable energy production. Their web site provides a wealth of information and links to information on types of energy, state information, funding and a consumer guide.

www.eere.energy.gov

Energy Star

Energy Star is a joint program of the U.S. Department of Energy and the U.S. Environmental Protection Agency, providing consumer information on energy efficient products and practices.

www.energystar.gov

Access to Information

Links to electronic versions of DPD **Client Assistance Memos (CAMs), codes** and **forms** are available on the "Publications" and "Codes" pages of our website at **www.seattle.gov/dpd**. Paper copies of these documents are available from our Public Resource Center, located on the 20th floor of Seattle Municipal Tower at 700 Fifth Ave. in downtown Seattle, (206) 684-8467. Additional information on education, incentives and technical assistance to help you build green, please visit **www.seattle.gov/dpd/greenbuilding**.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

Department of Planning and Development

CAM Client Assistance Memo 520

GREEN Seattle Permits

— part of a multi-departmental City of Seattle series on getting a permit

Rainwater Harvesting for Beneficial Use

April 29, 2009

What is Water Harvesting?

Water harvesting is the capture and storage of water for beneficial use. It can be accomplished anywhere water supply is available for collection and a water source is desired or required. To understand the process fully, it is important to understand water harvesting terms.

Rainwater harvesting is the capture and storage of rainwater and is considered the cleanest form of harvested water.

Greywater harvesting is the capture and storage of water that has already been used for non-sewage purposes — from baths and showers to washing machines, sinks and vehicle washing run-off. Reuse of greywater triggers more code requirements and design regulations than the use of rainwater. Some applications are restricted by local code.

Reclaimed water is wastewater treated to levels that allow it to be used for non-drinking water purposes. Reuse of reclaimed water triggers more code requirements and design regulations than reuse of rainwater.

Potable water is clean water — satisfactory for drinking, culinary and domestic purposes, and meets the drinking water standards established by the Washington State Department of Health.

The Cascade People's Center uses rainwater collected from the roof and stores it in a cistern for toilet flushing.

What are the goals and benefits of rainwater harvesting?

Rainwater harvesting provides a host of design benefits that range from reducing owner utility rates and improving landscape health, to reducing combined sewer overflows into Seattle's water supply and reducing demand on the city's potable water systems.

- **Financial benefits**: City of Seattle residents are charged for both the potable water they use and the related sanitary sewer treatment they need to treat used water. Use of collected rainwater helps residents save on potable water use fees and on sanitary sewer use fees.
- **Plant health**: Landscape plants flourish with irrigation from collected rainwater. Rainwater does not contain chlorine (an important additive that keeps potable water safe for drinking), benefiting many ecologically sensitive plants.
- **Water quality**: When it rains, it pours — and during extreme rain events, some of our combined sewers fill to overflowing, pouring into the Puget Sound and contributing water bodies without full water quality treatment. Removing rainwater from the combined sewer systems and redirecting it to

city green building

Building a Better Seattle

The Green Building Client Assistance Memo (CAM) series is just one of many resources designed to help you build green and create value for your project from initial concept planning to permitting, construction and operation. To learn more, please visit www.seattle.gov/dpd/greenbuilding.

City of Seattle
Department of Planning & Development

700 5th Avenue, Suite 2000
P.O. Box 34019
Seattle, WA 98124-4019
(206) 684-8600

Printed on totally chlorine free paper made with 100% post-consumer fiber

cisterns has the potential to lower peak flows and reduce the amount of pollutants that find their way into our natural water bodies

- **Water supply**: Combine a rapidly increasing population with lower annual rainfall and higher temperatures, and the demand for potable water increases dramatically — putting greater pressure on municipal water supplies. Rainwater harvesting reduces this demand.
- **Green building credits**: Many green building systems offer credits for rainwater harvest systems, helping your project reach certification goals.

Rainwater Harvest System Components, Requirements and Design Considerations

A rainwater harvesting system begins at the point of collection and ends at the supply to approved plumbing fixtures and other outlets. Systems typically consist of the following components:

- **Harvest sources**: Unless otherwise approved by the City, only runoff from roof surfaces is allowed for rainwater harvesting collection. To protect the water quality of the rainwater harvested, avoid roofing materials such as copper or zinc that may release contaminants into your system, as well as roofing materials treated with fungicides or herbicides. Consult Seattle Public Utilities to understand any water rights issues that may apply to your project. See the "Regulations, Guidelines, and Design Resources" section of this document for contact information.
- **Collection systems**: Collection systems include gutters and downspouts, as well as the piping and any other conveyance needed to route harvested water from harvest sources to the cistern. All portions of the collection system should be constructed in accordance with Chapter 11 of the *2006 Uniform Plumbing Code* (UPC). See the "Regulations, Guidelines, and Design Resources" section of this CAM.
- **Initial water quality treatment/debris excluders**: Pre-storage treatment must be used to divert debris and/or “first flows” prior to entering the storage system, and to keep leaves and other larger debris from entering and clogging the system. “First flows” are defined as the initial rain that falls during a typical rain shower. These waters convey any sediment that has built up on the roof surface. They typically contain the greatest concentration of pollutants in harvested rainwater. Leaf screens and self cleaning bug screens are a typical choice for

LEED™ Benefits for Water Harvesting

LEED™ (Leadership in Energy and Environmental Design) is a national green building standard created by the U.S. Green Building Council. LEED has programs for commercial and residential construction. Rainwater harvesting can contribute towards the following credits:

- Stormwater Design: Quantity Control
- Water Efficient Landscaping: Reduce by 50 Percent
- Water Efficient Landscaping: No Potable Water Use or No Irrigation
- Innovative Wastewater Technologies
- Water Use Reduction: 20 Percent Reduction
- Water Use Reduction: 30 Percent Reduction
- Innovation in Design: Potable Reduction for Process Water
- Innovation in Design: Education Credit

For more information visit **www.usgbc.org**.

Built Green™ Benefits for Water Harvesting

Built Green™ is a green building program developed by the Master Builders Association of King and Snohomish Counties in partnership with local governments including the City of Seattle. Built Green has programs for single family, multifamily and communities. Rainwater harvesting can contribute to the following credits:

- Install Rainwater Collection System (Cistern) for Reuse
- Prepare a Roof Water Management Plan Showing Best Practices for the Site Soils and Storm Water Infrastructure
- Stub-In Plumbing to Use Greywater Water for Toilet Flushing
- Use Greywater Water for Toilet Flushing
- Plumb for Greywater Irrigation
- Install Irrigation System using Recycled Water

For more information visit **www.builtgreen.net**.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

initial water quality treatment in the Pacific Northwest.

- **Cistern/storage system**: Cisterns can be constructed from a variety of materials and placed in various locations. They can include tanks, pipes, and enclosed portions of buildings — above or below ground level. Construction materials include underground concrete and fiberglass, partial and above ground plastic, and enclosed basement structures. All cistern systems must meet the following criteria:
  - All cisterns must be installed in accordance with manufacturer's installation instructions and the building code.
  - If a foundation is required for installation, then the foundation must be flat and capable of supporting the cistern weight when full with water (in accordance with the building code).
  - Cistern/storage systems that are capable of being filled from both the rainwater harvesting systems and a public or private water system must be protected from cross contamination in accordance with the UPC.
  - Cistern/storage systems must have both access points and drains to allow inspection and cleaning.
  - Cistern/storage systems that are buried below ground level must have a manhole riser that sticks out a minimum of eight inches above the surrounding ground. Manhole covers must be secured and locked to prevent tampering.
  - Any cistern/storage system opening that could allow the entry of personnel must be marked: "danger — confined space."
  - Cleaning of any accumulated sediment on the bottom of the cistern must be possible by flushing through a drain, vacuuming or another approved method.
  - The cistern must have a designated overflow when the volume of the tank meets capacity. The cross section of the overflow must have an area equal to or greater than all of the areas of the devices delivering water to the cistern. The minimum overflow is four inches in diameter. The overflow must be protected with a screen with openings no greater than one-quarter inch.
  - The discharge location for the emergency overflow must be approved by the local authority.

From top to bottom: Cistern inlets, pipe labels, potable water bypass, King Street Station, Seattle, Wash. Images courtesy of MayFly Engineering and Design, Pllc.

  - Cisterns should be designed to prevent mosquitoes and other life forms from entering the cistern system. This can be done with appropriate screening at any opening to the cistern.

While not required, locating the cistern in an area that allows access for replacement in case of failure may be desirable. Consider using opaque containers for an above ground location to minimize algae growth.

- **Delivery/distribution system**: Delivery may be accomplished by a gravity system or include the pumps and pipes needed to move water from the storage system to the end use area. Consider designing a potable water back-up that can operate without electricity in emergency conditions.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

- All distribution system components must be sized and installed to meet the requirements of the UPC.
- As specified in the Seattle and King County Public Health Rainwater Harvesting Policy included in the "Regulations, Guidelines, and Design Resources" section of this document, all pipes, irrigation hose bibs, irrigation outlets and related equipment rooms must include appropriated labeling of the rain water harvesting system.
- Any connection to the domestic potable water system must be protected from cross contamination per the UPC.
- Water must be drawn from at least four inches above the bottom of the tank.

- **Final water quality treatment**: The extent of water quality treatment is dependent on both the quality of the water entering the storage system and the desired reuse. Systems must protect the functions of delivery valves and fixtures and range from simple screens to cartridge filters, UV light, and chlorination. Screen systems and/or basic mechanical filtration are typically adequate for irrigation and toilet flushing reuse.
- **Operations and maintenance manual**: This document should include all operations and maintenance information needed to ensure proper function for the life of the rainwater harvest system. Information should include timing on replacing and/or cleaning filters, removing sediment and other pollutants from storage systems, backflow prevention inspections, valve schedules and operation, backup and cross connection, and seasonal startup and shutdown and freeze protection. It is the property owner's responsibility to maintain the system until abandoned per guidelines.
- **Education program**: Written documentation of this program can be included in the Operations and Maintenance Manual. All users and system operators need to understand how to operate and maintain the system in order to ensure proper function. This can be done with training and/or signage. User behavior to minimize the wasting of water should be encouraged.
- **Public information materials**: Additional information to inform the public of the system benefits and operation can be included in a project through signage. An education program can also be developed to allow non-users (the public) to learn about the benefits and operation of a rainwater harvest system.

Design Process

Rainwater harvesting systems used in structures must be engineered for site specific conditions. This requirement can be waived by the permitting authority for very simple systems. Rainwater systems are required to be submitted for plan review for building and plumbing permit. The UPC, Seattle and King County Public Health procedures title, *Rainwater Harvesting and Connection to Plumbing Fixtures*, and any manufacturer's installation instructions must be followed.

Permits, Inspections and Review Requirements

Rainwater harvesting systems must comply with permitting, planning and zoning requirements, this may include one or more of the following:

- design review
- building permits for cistern footings, foundations, enclosures and roof structures, and may include:
  - zoning review for location and setback
  - grading permits and erosion control plans for underground tanks
  - critical area determinations
- plumbing permits for all systems from the collec-

Structural Support

Consider the weight of a storage system full of water when initially considering a rainwater storage location. What supports or foundations, if any, will be necessary? If a storage system is located within a building, then its full mass must be integrated into any seismic and structural engineering studies. If a storage system is buried underground or located outside of the building, analyze soils in that location and construct foundations as needed. Consult with DPD or the project structural engineer to understand structural requirements for your rainwater harvesting system.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

tion area to the final point of rainwater reuse

- electrical permits for pump and electrical controls
- possible water rights from the Department of Ecology regional office

Before beginning construction check with each authority to determine if permit and inspection is required for your specific project. Before submitting for a permit or plan review, it is important to clarify submittal requirements. Typical submittal requirements include site plans, elevations, isometric drawings of the harvest system and specifications along with manufacturer's installation instructions for cistern, pump and filtration or disinfection components.

Top to bottom: Seattle cistern art, Beckoning Hand Scene, Rain Garden and Overflow, Vine Street, Seattle, Wash. Images courtesy of Mayfly Engineering and Design, Pllc.

Vegetated Roofs

Vegetated roofs "sponge" up a large percentage of the rain that falls on them. This percentage is based on vegetated roof depth and planting materials. In smaller rainfall events, some vegetated roofs will sponge up all rain that falls on them. When figuring rainwater harvest volumes, integrate absorption into design calculations. Depending on the planting materials and roof construction, vegetated roofs may also discolor or contribute a high amount of particulates into your harvest system — this can be managed with appropriate system filters. Consider water uses when selecting rainwater filters. For example, you may desire clearer water for washing clothes or when the water is visible in toilets.

After considering the reduced rainfall volume that comes off of a vegetated roof and the need for additional filtering, determine the cost / benefit of harvesting rainfall runoff from vegetated roof areas.

Rainwater Use Applications

Currently, harvested rainwater may only be used for toilets, urinals, hose bibs, some industrial applications, domestic clothes washing, irrigation and water features. Any other use must be first approved by the permitting authority.

Commercial and Residential System Design Teams

From the earliest stage of design it is important to have all team members participating in the design process. This will allow for identification of team member roles and responsibilities — an important facet of the process, as some design responsibilities will be new to team members who have not previously participated in the design of water harvest systems.

Many simple or residential projects will not require all of the team members that follow. If your design team does not already have a thorough understanding of the process, then adding a sustainability consultant who specializes in rainwater harvesting to your existing team may meet your rainwater harvesting system design needs.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

However, in a more complicated project, it is typical for team members participating in the design process to include the following roles in their design scope:

- **Architect:** Leads and coordinates the design process.
- **Civil engineer:** Calculates rain flow volumes and integrates any other water sources and uses into a water balance to size the cistern volume. The civil engineer designs connections to rainwater and greywater mechanical systems outside of the building footprint and provides direction about overflow to storm systems, ensuring that overflow meets any local design criteria for stormwater quality and/or quantity. The civil engineer will also design potable water connections outside of the building envelope.
- **Landscape designer:** Consults on water harvest projects where harvested water is to be used for irrigation, providing irrigation volumes for water balance calculations and specifying appropriate irrigation systems that work with the water harvest system.
- **Mechanical engineer:** Provides greywater and in-building reuse volumes to be used for water balance calculations, designs roof drainage systems and interior potable water delivery and sewage piping systems, identifies filter and water quality systems to meet reuse requirements, and designs pump and delivery systems for water reuse. Pump and delivery systems may be located outside of the building envelope.
- **Electrical engineer:** Provides power to system elements as needed.
- **Geotechnical engineer:** Provides soil information used to determine if storage system foundations or supports are needed.
- **Structural engineer:** Integrates full storage system loads into seismic calculations and building structural design, and/or determines the need for foundations or supports outside of building.
- **Sustainability consultant** (optional): Consults and collaborates with the design team to ensure LEED or Built Green credit criteria are being met. A sustainability consultant may also facilitate design charrettes to identify commonalities with other sustainable design systems.

Design Collaboration

Early design integration can save in construction costs as the system can be integrated with other building systems and layout. Efforts to reduce water consumption throughout the project support a cost-effective water harvest design solution. Educational and interpretive materials can help encourage water conservation.

When considering site irrigation, a focus on soil health, and the use of drought tolerant and native species planted in an appropriate environment will reduce the amount of water needed for irrigation. Advanced irrigation controllers can further enhance irrigation efficiency. The design of the irrigation system also impacts water usage; for example, drip irrigation systems instead of spray systems will minimize water lost through evaporation.

Indoors, consider using toilet fixtures and urinals with minimal or no water needed for sewage conveyance and clothes washers that require minimal water volumes for operation.

Storage System Sizing

The first step in a water harvest design process is to determine both the owner's annual water reuse goals and the volume of water available for annual harvest. Reuse goals may be directly related to obtaining credits as part of LEED or Built Green certification processes or to meet other owner goals.

A potable water supply should be designed into all systems even if harvest volume is estimated to be greater than reuse volumes. A potable water supply will supplement any water needs not met with the water harvested and will also supply water for maintenance when the storage system is emptied.

Once you have a feel for the size and potable water make-up needs of your system and a location is chosen, it is crucial to communicate and collaborate with your design team on the details of the system. Make sure that the entire system from harvest source to reuse is included in plans and specifications in all phases of the design process.

Regulations, Guidelines and Design Resources

When designing a rainwater harvest system, the following publications may be of use:

Code Resources:

- Seattle and King County Department of Public Health has prepared a Policies and Procedures

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

Title, *Rainwater Harvesting and Connection to Plumbing Fixtures*, with an effective date of January 30, 2007, and a Document Code No. Product/Method #07-001. The purpose of this document is to accommodate rainwater harvesting for certain types of reuse while protecting public health and encouraging the conservation of valuable water resources. This document may be found at **http://www.kingcounty.gov/healthservices/health/ehs/plumbing/~/media/health/publichealth/documents/plumbing/RainwaterHarvesting.ashx**.

- The UPC, as enforced by the Seattle and King County Public Health provides guidance on rainwater and greywater harvesting. UPC Chapter 6, "Water Supply and Distribution" covers potable, non-potable, and reclaimed water use, including "backflow prevention." UPC Appendix J covers reclaimed water for non-residential buildings. This document may be ordered from the Seattle Public Library at **www.spl.org.**

Design Resources:

- The Washington State Department of Ecology provides *Ecology Criteria for Sewage Works Design*, also known as the Orange Book. Chapter E1 on reclaimed water includes discussion on various classes of reclaimed water and their possible reuses. This document can be found at **www.ecy.wa.gov/pubs/9837/e1.pdf**.

Pumps, filters and backflow prevention, King Street Station, Seattle, Wash. Images courtesy of Mayfly Engineering and Design, Pllc.

- The Washington State Department of Health published, *Water Conserving On-Site Wastewater Treatment Systems-Recommended Standards and Guidance for Performance, Application, Design, and Operation and Maintenance*, with an effective date of May 15, 2000. This publication is divided into sections on waterless toilets, greywater systems and subsurface drip dispersal systems for greywater use in irrigation. This publication can be found at **www.doh.wa.gov/ehp/ts/WW/GreywaterFact.PDF**.
- *Implement: Seattle's Sustainable Building Tool* provides a basic tool to evaluate water harvesting strategies. Visit their website at w**ww2.ci.seattle.wa.us/Implement/default.asp**.
- DPD has a rainwater harvesting tool posted on

Design Process

For optimal results, the rainwater harvest system design process should be active, adaptive and thorough. At each stage of the construction document design process, harvest system design assumptions should be verified by all contributing team members. It is common for design assumptions to change — contributing roof areas, irrigation demands and fixture counts, for instance — and it is important that the harvest system design reflects this. At each stage of the construction document process harvest, system design assumptions should be verified by all contributing team members.

Design Challenges

- Current water and sewer rates are low. Lifecycle costs can be analyzed to validate first costs.
- Maintenance is increased compared to traditional potable water systems—the design team should specify system specific maintenance needs in the Operations and Maintenance Manual.
- Increased coordination to address during design process.
- Increase space needed to site system components compared to traditional city water supply systems.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

their Green Factor website. This tool analyzes 10 years of historical rainfall data while incorporating seasonal evaporation to determine collection areas, tank size and irrigation areas for projects based on user input. The Rainwater Harvesting Tool can be found at **www.seattle.gov/dpd/greenfactor**.

- National Sanitation Foundation International is an independent testing and certification organization that provides information on the performance of various filters. Visit their website at **www.nsf.org/** to obtain product information on specific water quality system components.
- The American Rainwater Catchment Systems Association provides guidance on water harvesting. Available on their website is *The Texas Manual on Rainwater Harvesting*. This document as well as other design documents can be found at **www.arcsa.org/resources.html**.

Commercial Case Study Fire Station 10

The City of Seattle's Fire Station 10 facility, located at

Fire Station 10 was designed to achieve LEED Silver rating in accordance with the City's sustainable building policy.

105 Fifth Avenue South, houses three critical facilities for Seattle's emergency and disaster response: Fire Station 10 Operations, the Emergency Operations Center and the Fire Alarm Center. The facility was designed to achieve a LEED Silver rating in accordance with the City's sustainable building policy.

Water Conservation Goals

Fire Station 10 employs a water harvest system that will reuse the majority of the fire drill water used as well as the rainwater that falls on non-driving surfaces

Water Rights

Seattle Public Utilities (SPU) received a water right permit from the Department of Ecology so they can capture and put to use the rainwater that falls on rooftops of structures in the combined and partially separated sewer basins of the City of Seattle. By removing the legal uncertainty regarding rainwater harvesting, SPU hopes to encourage and hasten adoption of this practice.

For a map of combined and partially separated sewer neighborhoods and additional information regarding the water rights program visit **www.seattle.gov/util/About_SPU/Water_System/Projects/RainwaterPermit/.** Contact Paul Fleming at **paul.fleming@seattle.gov** or at (206) 684-7626 for information regarding project permit requirements related to water rights.

Incentives: Seattle Public Utilities

Lower drainage fees: Property owners can apply for a 10 percent credit on their drainage fee. For more information about savings on drainage fees, please visit **www.seattle.gov/util/naturalsystems**.

Financial incentives for businesses and industrial facilities: Another source of incentives for businesses and industrial facilities is through the Saving Water Partnership funded by SPU and other local utilities in King County. For more information contact Phil Paschke, 206-684-5883 or **phil.paschke@seattle.gov**.

Seattle Green Factor bonus: The Seattle Green Factor requires new development in neighborhood business districts to meet a landscaping target using a menu of landscaping strategies. When used for landscape irrigation, rainwater harvesting can provide bonus credits for the Green Factor landscaping requirement. For the Green Factor Worksheet, Planting Area Calculation worksheet, and Rainwater Harvesting Calculation tool, visit **www.seattle.gov/dpd/greenfactor**.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

on the site. The design team estimates that nearly 130,000 gallons of harvested water are projected to be used annually for site landscaping and washing fire facility vehicles.

In addition to capturing rainwater and drill water, conservation goals will be met by installing low-flow fixtures. Water closets have dual-flush (1.1/1.6 GPF) valves. Ultra-low-flow lavatories (0.5 GPM) and low-flow kitchen faucets (1.8 GPM) are specified for the building. In addition, 1.8 GPM showerheads will also be used. Overall, these water-saving fixtures are projected to reduce potable water use by more than 156,000 gallons per year.

Approximately three-quarters of the facility will be covered with a vegetated or green roof, further reducing the stormwater impacts. LEED credits being pursued that the rainwater harvesting system will contribute to include:

- Sustainable Sites Credit 6.1 Stormwater Design: Quantity Control.
- Water Efficiency Credit 1.1 Water Efficient Landscaping: Reduce by 50 percent.
- Water Efficiency Credit 1.2 Water Efficient Landscaping: No Potable Water Use or No irrigation.
- Innovation in Design: Potable reduction for Process Water.
- Innovation in Design: Education Credit.

Water Harvest System

The Fire Station 10 water harvest system captures fire drill water and rainwater that falls on non-driving surfaces that will be used for site landscaping and washing fire facility vehicles. The water captured in the cistern system will undergo a modest level of treatment and will be the sole source of water for plant irrigation. Water from the harvest system will also be available through a hose bib connection for fire personnel to use for vehicle washing purposes. The system was sized in order to meet 100 percent of the demand for both irrigation and vehicle washing. Water reuse for vehicle washing contributes to a LEED Innovation and Design Credit for Process Water Savings.

Design System Components

- **Harvest sources**: Rainwater is collected from the portions of the roof that are not green roofs. Both rainwater and fire drill practice water are captured from non-driving surfaces.
- **Collection systems**: A rain leader system within the building collects roof drainage from contributing areas. A trench drain system collects drill water runoff outside of the building. Both of these systems are conveyed to the storage system with conventional storm drainage conveyance.
- **Initial water quality treatment**: A StormFilter system located in a 48-inch manhole provides initial water quality treatment.
- **Storage system**: A buried 1,500 cubic foot corrugated metal pipe cistern provides storage volume. An overflow from the cistern is connected to the site's detention system in order to meet stormwater flow control requirements.
- **Delivery system**: A pump, located in a vault outside of the building, pressurizes the delivery system. A potable water feed is connected to the pump vault to provide make-up water when the cistern is empty.
- **Final water quality treatment**: The planned uses for the reclaimed water did not require secondary treatment.
- **Operation and maintenance manual**: The design team provided information regarding design intent and operations to be included in the facility operation and maintenance manual.
- **Education program**: Information on the water harvest system was included in the education program developed to meet the LEED Innovation in Design Credit for Education. The city's facility maintenance department is working on a measurement and verification program to incorporate the water use projections made during design and react if resource consumption is outside of the baseline conditions.

Design Team Members

Architect
Weinstein AU Architects & Urban Designers

Civil and Structural Consultant
Magnusson Klemencic Associates

Mechanical Consultant
Notkin Engineers

Electrical and Technology Consultant
Sparling

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

Landscape Architect
Gustafson Guthrie Nichol, Ltd.

Sustainability Consultant
Paladino & Company

Residential Case Study
The Sensible House Project

The Sensible House, a residential home completed in April 2004, was the first house in Seattle to achieve a Built Green™ Five Star designation — the highest level available. This building consists of an 1,800

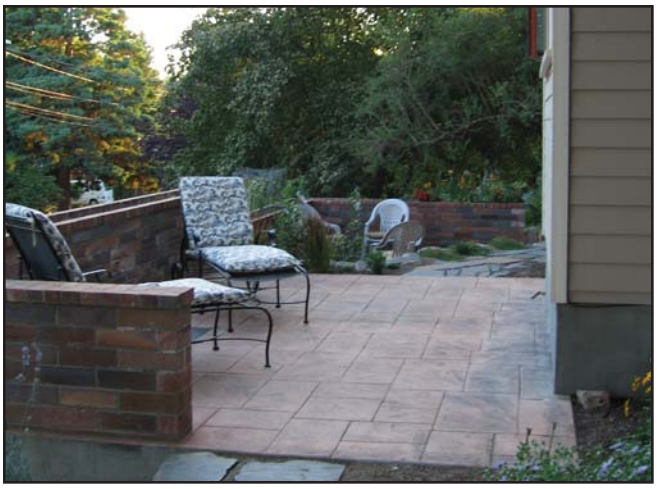
The Sensible House, image from **www.sensiblehouse.org**.

square foot main residence and a 650 square foot accessory dwelling unit.

Green Building Elements

Sustainable building features for The Sensible House include:

- Salvaged materials from the original house.
- A super insulated shell resulting in a heating system about one-sixth as powerful as the average home in this climate.
- Solar powered hot water heater and photovoltaic panels for on-site renewable energy generation.
- An advanced plumbing system that reduces the amount of hot water wasted.
- Improved interior air quality through the use of low-toxic paints, finishes, caulks, and adhesives, as well as avoidance of materials containing urea-formaldehyde.



The rainwater cistern is a waterproofed concrete vault that also serves as a patio in the backyard. Image courtesy of Bob Scheulen.

- Rainwater harvest system.

It is reported that The Sensible House will save over 10,000 pounds of carbon emissions and 115,340 gallons of water each year compared to a typical house.

Rainwater Harvest System

The design elements consist of:

- Rainwater is collected from the roof with a conventional downspout system.
- The downspouts direct the water through a drain pipe capped with a standard window screen to divert debris. The filtered water travels through the drain pipe to the cistern.
- The cistern is a waterproofed concrete vault that was built by the house contractor. The top of the tank is used as a patio in the backyard.
- Water from the tank inlet is diffused at entry into the tank in order to minimize stirring up of sediment that has settled to the bottom.
- The intake from the pump floats to collect the cleanest water from about six inches below the water surface.
- The tank overflow is connected to the city storm sewer.

The delivery system corresponds with the following design elements:

1. The intake for the pump with a floating screen filter to keep sediment from entering the pump.
2. A check valve to help the pump function correctly.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

3. A shutoff valve to control cistern water from the tank.
4. A 240V variable speed motor that keeps the output line pressurized as set by the motor controller.
5. A filter system to keep sediments from the irrigation system.
6. A small pressure relief tank that keeps the system stable when the pump starts up and shuts off.
7. Shutoff valve for cistern water supply to toilets.
8. Shutoff valve for potable water supply to toilets.
9. Reduced pressure backflow prevention to keep cistern water from contaminating potable water supply.

Design Team Members

Water harvest system design team members included:

Owners
Bob Scheulen and Kim Wells

Architect
Ted Granger

Contractor
Jon Alexander, Sunshine Construction

Cistern Redesign Consultant
Mike Broili, Living Systems Design

To Learn More

Buildings located in the City of Seattle that have integrated water harvesting systems include:

- **Northgate Civic Center**
- **King Street Center**
- **Seattle Central Library**
- **Seattle City Hall**
- **Carkeek Park Environmental Learning Center**

Additional rainwater harvesting resources:

- **Seattle Rainwater Harvesting Information**
- **King County Rain Barrel Information**
- **City of Portland**
- **The Texas Manual on Rainwater Harvesting July 2005**
- **Texas A&M Extension Rainwater Harvesting Services**
- **International Rainwater Catchment Systems Association**
- **Water Efficiency for Your Home**

Access to Information

Links to electronic versions of DPD **Client Assistance Memos (CAMs), codes** and **forms** are available on the "Publications" and "Codes" pages of our website at **www.seattle.gov/dpd**. Paper copies of these documents are available from our Public Resource Center, located on the 20th floor of Seattle Municipal Tower at 700 Fifth Ave. in downtown Seattle, (206) 684-8467. Additional information on education, incentives and technical assistance to help you build green, please visit **www.seattle.gov/dpd/greenbuilding**.

LEGAL DISCLAIMER: *This Client Assistance Memo (CAM) should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all code and rule requirements, whether or not described in this CAM.*

1751

123