Cervisia Sermonis

Constructing a Brewery in Harper's Ferry, West Virginia
This thesis book is submitted by David C. Mangum in partial completion of the Master of Architecture Degree from the College of Architecture and Urban Studies and the Graduate School of Virginia Polytechnic Institute and State University. The thesis was defended 22 May 2003 at the Washington-Alexandria Architecture Center in Alexandria, Virginia.

Committee Chairman, Marco Frascari

Committee Member, Jaan Holt

Committee Member, Caren Yglesias
ABSTRACT

In the everyday exists water. It is rarely the focus of the architect nor a guiding principle in a building's planning, design and construction. Too many times it is an afterthought or seen as something that will eternally undermine the physical principles that keep a building standing. This thesis is an attempt to raise water to a position of importance from design to construction, and to establish dialogue between materials and materiality through the design of a brewery.

A place to drink beer and watch the processes of water within the envelope of a brewery where water initiates a conversation between stone, wood, concrete and stainless steel. A place to experience the process of brewing beer from the viewpoint of that very process.
Dedication

To the flowing patience and wisdom of Jaan Holt, Marco Frascari, Caren Yglesias and William Tate for their guidance and swath clearing assistance in helping to create a rushing torrent from many trickling rivulets. To my parents for giving me the opportunity. For Melissa and her tireless efforts and helping me see that elephants do not fly.
Table of Contents

1. Inspiration
2. Confluence
3. Locus
4. Percolate
5. Beer
6. Epilogue
7. Bibliography
8. Vita
A beer is not a metaphor. It does not represent a season, a fair or foul wind. A beer is a willful and deliberate realization of the act of construction. A beer is a combination of ingredients (that in their own right can be metaphors). To build a beer, you need specific materials used in a specific way. A brewery must utilize the same process in order to create a meaningful dialogue between site, materials, and construction.
Inspired by a love of the architecture of beer; that is, accommodating a precious material within material that is not as precious. A brewery produces a liquid that is ninety-four percent water inside its walls, yet is built with the same materials that are designed to keep out one-hundred percent of water. The dialogue of materials to create a structure begins the design process, for me that remains ongoing, with much research still to come. This book is the culmination of one year of study into that dialogue beginning with the pictures below of the American Brewery in Baltimore, Maryland and ruins of the Armory at Harper’s Ferry, West Virginia.
Confluence

Just as the place where a beer is made influences its taste, the site of the brewery influences the means of construction. Learn to give form in a meaningful way. It is a mistake if it is about hydraulics.
Confluence of two rivers

Crossroads of three states
George Washington chose this site as the forge to protect a fledgling experiment. John Brown chose it because he had a crazy idea about freedom. Both men knew that all good and crazy ideas begin at the confluence of rivers, in this case, the Shenandoah River to the south and the Potomac River to the northwest. This site is important for this thesis because it has a past that is fading in an embalmed town where water is no longer the focus, and three states have lost an icon. Industry and tourism can be brought to bear with recreation in the design of a brewery. Just as materials have a dialogue with the material of beer so too must the spirit of the site speak to the nature of the building.

Maryland, West Virginia, and Virginia intersect

The Potomac and the Shenandoah Rivers at Harper's Ferry
Put some constraints on yourself; only then will the Architecture come out of those decisions of site, machinery, path, and meaning. All elements must resonate with genus loci.
Situated on the ruins of the eighteenth-century Armory and early twentieth-century hydroelectric plant, the site proved to be the perfect place to consider water in a brewery. Because water powered all the machines in making weapons and electricity there is a one-mile long race that begins thirty-seven vertical feet above this termination point. Therefore, the brewery takes advantage of water’s natural desire to flow downhill; providing a great start for bringing water into the brewery. By building new upon the remnants of previous industry, the brewery is at once a place where the past meets present as well as where water meets material to create not only a meaningful dialogue, but also beer.
“For it is obvious that nothing in the world is so necessary for use as water . . . consequently we must take great pains in searching for springs and selecting them, keeping in view the health of mankind.” - Vitruvius
“So this design matter is not something to do with a drawing board. It is something you do as you work, as you play. You may get it in the middle of the tennis court and drop your racket and run off and put it down. That is the kind of thing that it is. It is fleeting, it is evanescent. It’s up here where you have to be quick and take it.”

-Frank Lloyd Wright
“If there is magic on this planet, it is contained in water.”

-Loren Eisley

Early sketches show the process of establishing a set of rules for materials within parameters and methods of building. Materials belonging to water; earthy materials like concrete, brick and stone are represented with bold, dark strokes while the tectonic of the brewery is lighter and more refined. Wood, metals and glass are brown and drawn with a pencil instead of a piece of charcoal. Establishing telluric and tectonic roles precedes any building form because without the material of water there would be no way to build, even in the drawing.
Thoughts on water and the shape of a filter become the shape of the water. To process river water into that which can be used for beer requires many layers of sediment arranged in a certain order. At this point, gravity and the relationship of water to earth are driving these forms more than the material, attempting a maximization of gravity to get water from top to bottom all the while moving through layers of sediment creates form from ‘a’form.
The simplicity of a drain as a design principle informs the construction and design of a beer room. Inspired by an architecture of shedding water to a single source brought pieces together and formed a filterhouse. These filter houses accommodate layers of sediment as well as water from the Potomac River as it passes from source to beer providing a constructive language of materials that belong to the earth.
By building up above the level of the original mill race that fed the armory and later the hydroelectric power plant a water trestle needed to be designed to ferry water above the mill trace into the brick filter houses. The utilization of these ideas means building up to a folly and more and more iterations built upon another to create such a complex arrangement of structure that the original idea became lost in the shuffle. Later on, this trestle became the wall carrying water to the beer gardens. The materials of the trestle had no relationship with the water, hence the stone wall that comes later had to become something different entirely to exist at all.
Built upon the ruins of the old powerplant, three filterhouses begin a process of brewing and building. Envisioned as the entrance to the brewery, the massive brick legs allow visitors to enter the brewery as they witness a moment in the filtering process. The support for the brick piers is dependent on a constant supply of water producing a thrust onto the supports keeping them in a constant state of compression. The copper clad face plates are more tectonic and begin a building process that goes from less refined to more refined as the water also gets refined into beer. The steel superstructure supporting the copper panels prevents the legs from spreading and remains in tension as long as the water keeps flowing.

I chose to clad the steel because I did not want a language so tectonic and refined in the beginning of the process where the water was still in a rustic state. By cladding the steel I am trying to in a sense cover-up and smooth a transition of materials.
Water from the Potomac River is too hard and must go through a softening process in order to create water suitable for brewing, as well as drinking, beer. The type of beer brewed and the tastes associated with it are derived in part from the composition of minerals and salts in the water used in the brewing process. For the two types of beer brewed in this brewery; pilsner and Virginia ale, each representing a river in the confluence.
Designed at a scale to provide a massive processive beginning, the filter houses represent an evolution of the early sketch where the water enters the brewery through materials that belong to the earth like brick and stone represented in pencil and charcoal. Here in the computer, brick, stone, concrete and copper are replicated in picture form. The mass really comes from the form and scale of the filter houses. The material success of these forms are manifested through their reliance on material to create an entrance that gives the visitor a sense that water is the most important element in this brewery.
The Roman impluvium as well as the Alhambra in Spain inspired this brewery. Both use water as part of the first encounter a person has with the building, an introduction into a clean and fresh environment. The brewery has to be a sterile environment, much like a domicile during the time when the Alhambra was built. Likewise, the first act in entering a Roman house was to cleanse the feet and hands from the dust and debris that had accumulated and begin anew. In the brewery a similar place is meant to give the visitor a first look at water, up close, and feel the mist, change in temperature and humidity that having a great amount of water in one place provides.
As the water terminates its trip from up-river it is brought into the building via the three poured concrete channels that form the entrance roof. The water cascades down onto white oak planks as it is brought into the first area of filtration. Light from windows along the entrance illuminates the falling water giving the visitor a sense of water’s transparency, and also providing a unique lighting of the space. As one enters along the stainless steel walk and into the brewery, they are at once confronted with water as a material and as an element of the earth. Leaving the filter houses as a secondary entrance, this becomes the primary entrance and the visitors’ first experience with water.
Moving the entrance from the filter houses begins a series of false stars and fragmentation. Dam it, and the water is stagnant and has no where to go and there is material association. The brewery becomes more about finding ways to fit all the ideas in at any cost, rather than a thoughtful approach to water and beer. At this point, beer is not even an issue as there are just a few beer-garden ideas floating around summed up in the sketch below. As the failure of the filter houses becomes a hootenanny (an unrecognizable fallacy that was once a good idea) and the design moves further from the original material sketch, the flaws increase exponentially. Three separate areas denote three separate functions: the filter houses, the beer garden that incorporates long German style tables, and the brewery. There is no connection between elements and more importantly between materials supporting the brewing and filtering processes. Nothing governs the flow other than the flow itself and by relying too much on the movement of water and not assigning responsibilities to functions or materials, the fragmentation spins out of control and the design begins to fall apart.
(When the levee breaks). Assigning roles to materials and processes in something as simple in an old movie poster theme provided the spark of inspiration that tied ideas of filtering and building into a structure that at once signified the importance of beer in a design built around water.
Technology has a close relationship with experimentation; for beer, that is the relationship with brewing. Brewing is constant experimentation. Play the game between change in material and change in substance.
Does the building become more refined from an internal locus or an external one? This question is studied in these two models as an attempt to define where the water as well as the brewing of the beer will originate in the building. An inside-out mentality or an outside-in? Ultimately, the question is answered with material and the stone wall that provides the conduit for water from the Potomac River. These two models were instrumental in beginning the study into the heart of the brewery.
As a result of the inside-out study, the central ‘spine’ of the brewery became a massive Seneca sandstone masonry wall and informed the rest of the building. The sandstone is a deep red, rough and earthy material, perfect for carrying the unrefined water from the river to different filtering locations. It drives the materials in the rest of the brewery as it too is driven by the brewing process. In the study models above the wall is the central element and the origin of material discussion. One would think in this case for there to be a progression to the refinement of materials, it makes sense to assume such force driving the refinement of beer and materials.
In a raw and unfiltered state the sandstone and the water are one in the same. In this case they are the beginning of the dialogue of materials relating simultaneously to the making of beer and the making of architecture. There is some references in the section, but the overall idea is to build from the wall out. After all, if the beer is to begin there, so too should the building.
In the landscape plan, there is accommodation for parking cut into the hillside on the southern edge of the site that connects with the brewery by way of a footpath underneath the existing railroad tracks. By walking under the railroad bed the visitors’ viewshed is compressed as they approach the brewery and then the full vista is released upon their exit from the tunnel; and only then are they shown one small corner of the brewery. An attempt to find the playfulness of scurrying under the train. The only way to see the building in its entirety is from a boat in the middle of the Potomac River.

Surrounding the grounds of the brewery are native plants to the area that accentuate the importance of water, natural sieves that filter the water from the southern hill and roadway above. Water from these sources is stored in a fountain that keys the entrance to the tunnel, taking the visitor from their car and into the world of beer.
The seventy gallon beer vat serves as the module that drives the building into further detail by adding dimensionality to the large stone wall and the skeleton that is beginning to form around it. A beer vat is eight feet wide by sixteen feet tall and makes a pretty good square with which to start dividing into a golden section.
The beer supposedly begins in the brewery, but in this case engages a process that begins much further upstream in the Potomac River; about a mile upstream to be exact. To transport the water elegantly from river to brewery and filtered into beer, a hootenanny was created early on in the project, an elevated system that snaked its way above the original mill race of the Armory and into the brewery by way of a farce. After studying the details of the landscape further as well as thinking of a larger view, the elevated mill race disappeared in favor of the original Armory system. This way, the path of water could be celebrated by visitors and create a more beautiful conveyance for what would soon become beer.
Dimensioning with beer tanks leads to an elegance of production within the frame work of the brewery, not just in beer making, but also building.
A Piranesian vision of brewers traversing up and down, side to side and all at once at different levels is the impetus for taking the previous drawing into three dimensions. It is apparent that the vats are held up by concrete arches resting on sandstone cisterns. More refined, however, are how the people move. The stairs are built of the same concrete as the arches between the cisterns, but are articulated with stairs to carry brewers from one level to another, or from process to process.
Building out from the water carrier showed how important water is here in the brewery as well as in the building process. Water in most of today’s buildings is an afterthought and its materiality not considered. Here, as evidenced by the water wall forming the central spine and unifying element, water is the center. The building embodies the drain; water is evident in everything here from the superstructure to the cleaning of the beer vats. The tectonic language is derived from the process of making beer, the materiality of beer becomes the material in a building. That is, just as the water is refined into beer, the building is also part of that process as seen in the model to the left - the brewery is speaking a tectonic language of refinement from the large sandstone gutter all the way out to the sophisticated facade shielding the fragile beer from harmful sunlight. Everything is a filter.
The drain defines the elements of water and begins a process of brewing and building.

The process of beer creates a language of material and pushes a dialogue of making.

That which is built when water is considered as material is architecture.
A cathedral of beer. The grain silos are supported by an independent structure that also serves as the entrance to the brewery. Similar to the impluvium of the entrance in the first iteration, this entrance uses falling grain to create a sense of arriving. Made of cast-in-place concrete, the forms are derived from the act of holding grain, which is different than that of holding beer or water. Grain is somewhat refined when it arrives at the site. The material, concrete, reflects that sophistication by supporting the silos while at the same time providing an entrance.
In an effort to give the visitor a tactile experience with water and to isolate the cooking of beer, the entrance expands to include the boilers in line with the grainhouse. As this is the first material representation in beer-making it should be the place where the visitor experiences the brewery first. The place to touch the process while pausing to take the first steps to the inside.
Built by the process of cracking grain and boiling water for beer the entrance facade is a welcoming transitional journey embarked upon by a thirsty beer patron or curious architect eager to begin the dialogue of material and substance.

After the grain is cracked and ready to cook it is taken up the cast in place concrete wall by way of an Archimedes’ screw to the brewing level. Three triangular towers embrace the boilers at lower level and the boiling pots on the upper level. The dialogue between grain, water and beer begins at this juncture and is defined by a refinement of material leading the visitor deeper into the nature of the brewery and of beer itself.
The architecture is a consequence of water and water a consequence of architecture.

The first and largest of three beergardens looks south out onto the railroad while providing the beer drinker with a respite after entering through the grain house. The materials of Seneca sandstone, cast in place concrete, wood and water come together here for the first time in the brewery. Visitors drinking their first beer here see water cascading down the large brick wall into the filter and ultimately travelling into the very hand of the same drinker.

As water travels further from the source and becomes more refined into beer, the material that is associated with the function and role in the brewing process also is refined. Here brick is used for the wall and filter, cast in place concrete and wood for the floor of the beergarden and, of course, water ties it all together by providing a visual as well as material reference.
The proximity of the beergarden to the railroad is an attempt to ac-
quaint the visitor with the history and place that makes Harper’s Ferry
unique. Innovative modes of transportation beginning with water lead-
ing up to the railroad have made Harper’s Ferry a destination and a
center for industry for a long time. By opening the brewery to the rail-
road and making each dependent on one another ties the history of the
place to the making of today.
Cutting a section through the path of travel from the first beergarden to the second by way of the manufacturing floor shows the dialogue of materials in detail. The Seneca sandstone wall supports the brewing floor and moves water from the river to the filters and into bellies. Also supporting the roof, the wall unifies the section by providing a central focus not only because of the importance of water, but also because it divides the space into brewing areas and gives a visual cue of where the visitor should go next. Of course they are going to wander, that’s the point, but letting them think they are deciding for themselves is not so different than deciding for them by providing a dialogue of material that leads to wayfinding.

The tectonic of carrying the beer vats is a specific response to the enormous weight of the vats when filled with beer. After all, elephants don’t fly and should be properly supported. The carriers are constructed of cast-in-place concrete and are an independent system from the floor and the wall and are a place for visitors to touch the materiality of beer by feeling the temperature of the vats through touching.
The remembrance of construction and the dialogue that is created by building eventually creates a thesis of beer and a place for beerdrinking. A drain, support, and a place to drink are attempts to make form in a meaningful way through constant dialogue and not just about hydraulics.
A longitudinal section cutting the brewery along the Seneca sandstone water wall shows the phenomenological path of progression for the visitor. From the first beergarden to the bathrooms cascading with water, onto the sausage grill in the center of the drawing and into the third and final beergarden drinkers are travelling against the current of water rushing above them in the cast in place aqueduct. Each part of the brewery provides a lucid dialogue of materials and construction while at the same time creating a wonderful space to drink beer and be happy and to see where that glass of beer in your hand came from.
The structure shown in section spans from the central water wall to the exterior wall and supports cisterns and columns that intersect the space. No columns are on the brew floor or brewing platforms as those areas are supported by the beams shown in the previous transverse section. The structural dialogue follows the rules of the conversation between materials; it is a direct result of the consequence of construction. As in the plan, the tectonic detailing becomes more sophisticated from ground to roof with the most detail and connectivity happening at the roof.
The playfulness of the structure supporting the roof is grounded by the staid and regimented repetition of the four legged beer vat holders. By engaging in the dialogue of material through building this transition came about naturally and through a series of ideas from the very first sketch. The roof is not shown for clarity and only the framing is visible. As in the roof, the floor is treated in the same way with the same constructive consequences.

The tectonic of the exterior wall is that of a thin, transparent skin that envelops a complex constructive and manufacturing process. The visitor is confronted with a long cathedral ceiling and views to the end of the brewery where the water enters to begin the process. On the way to the second beergarden is also the place of the bathrooms and a break from the open and somewhat noisy first beergarden. In this place there is only the sound of making beer and the quiet rush of activity and the everpresent sound of water from the aqueduct above.
Transverse section through earth, river, second beergarden and sausage grill
“So the building tells us something about the water passing over the roof and the water tells us about the building; and in this way both water and water-covered surface shape each other by telling us about the other and about themselves.” - Le Corbusier
The second beergarden is a lookout and a look-in. It is the second place to see the filtration process of water’s journey into beer as well as providing a vantage point to the Potomac River. Water is carried to the filters over a glass roof enclosed space and drops down along the glass facade of the porch. Once the door is opened water cascades down the sides thanks to a trough catching and diverting the water over the door and away from the patron and into the filters. Water enters the filters by way of an opening in the floor and then cascades over Seneca sandstone feet that support the second level of the beergarden. The upper portion of the beergarden is more of a winter destination because of the large amount of glazing and natural warming properties of glass enclosed space. The lower portion is cave-like and cool for summertime drinking. Also, the sound of water cascading down the sandstone feet and into the filters can be heard and more importantly, felt as the humidity of the space increases during the brewing process.
A pause in the progression through the brewery, the second beergarden provides a respite and also a place for food. Food in a brewery is as important as what makes up the content of the building; an amalgamation of material each with its own purpose and meaning, so too the beer. In this brewery a food that naturally logically compliments these criteria for material and meaning is sausage; as it is a combination of materials that form a whole. Not taken as the parts, it is a sum with all materials working together in one form; so naturally it is the choice for a brewery that sets out to accomplish the same mission. In the center of the water wall is a retractable grill that is used when it is time to cook sausages. If there is a food request other than sausage then there is another brewery somewhere that serves it.
The third beergarden is the final place for beer drinking and brings the visitor back to the beginning of the process and inside the water wall. The colonnade provides for small tables with room enough for a few glasses of beer. There are also filters here in the sandstone wall underneath the floor and a view to the river. The tables are made of wood and are subject to getting wet. This is the wettest of the three beergardens and the materials need to be able to endure constant moisture. Therefore, Seneca sandstone, red wester cedar and stainless steel are used so that they may naturally age as the beer ages too.
The third beergarden is located at the beginning or end of the brewery; depending on whether you are water or a visitor to the brewery. This is the place where the beerdrinkers’ journey culminates as they witness the entire process of water entering the building at the meeting of earth and stone. The Seneca sandstone wall merges with the old mill trace to provide the transition from one material to another as well as to create a place to drink. At this point, the beerdinker is inside the water carrying wall and can feel the thickness, wetness, and mass of the wall as it touches water for the first time. My intention is to have water spilling over the wall, engaging the stone in a play of material that embodies a transformation that is to take place between materials and construction of those materials into beer or into a building. Water is that material.
Epilogue

Water is present in every aspect of our lives, from the frost we scrape off the window in the morning to the shower or bath we take that same evening. We enjoy the sound of it falling on our houses while inside we are warm and dry. It helps us relax and keeps us alive; but where is it in our buildings? It is relegated to the service of our needs within bathrooms, at water fountains accessible to no one, bottled and shipped to used for drinking or turned into bad coffee. It is not celebrated in the least, not even in fountains that eschew the basic nature of water in favor of an imposed aesthetic of stone, glass or steel that must be cleaned daily to ensure that which sullies the fountain is made to look pure. This dialogue of materials began as a study of water and its role in design and construction. Water is a material and should be given the same reverence as stone, concrete, wood or steel. In this thesis it is part of a dialogue of materials in an attempt to construct not only a building that abide by the rules of construction set forth by water, but also to build a delightful beer. A brewery and a river are not so different. With the right thought and constructive dialogue between materials the design can use water in a way that celebrates it, while giving the visitors a warm and dry place to spend a rainy afternoon.
Bibliography


David C. Mangum

EDUCATION

2000 - 2002  Virginia Polytechnic Institute and State University. Blacksburg, VA
1992 - 1995  James Madison University. Harrisonburg, VA Bachelor of Arts, History

WORK EXPERIENCE

September 2004 - Present  HKS, Inc. Richmond, VA
Engaging the practice of Architecture

September 2003 – September 2004  BCWH Architects Richmond, VA
Produced construction documents and participated in schematic and design development of Residence, Elementary School and Medical Suite.

May 2002 – November 2002  Oak Grove Restoration Company Laytonsville, MD
Supervised research and restoration of historic properties. Managed numerous subcontractors. Performed various carpentry duties.

May 1997 – June 1998  Pat Schell Restorations Raleigh, NC
Stabilized or reconstructed historic elements in antebellum farmhouses and slave cabins. Restored antique windows and flooring.

May 1996 – October 1996  Parks’ Fly Shop Gardiner, MT
Guided patrons to fishing destinations in and around Yellowstone National Park.

HONORS


Chosen as a distinguished instructor for window restoration seminars during “Restoration and Renovation Conferences” in Washington, DC and Charleston, SC.

Featured on Home and Garden Television Network’s “Restoration and Renovation 1999” television special.

Selected for JMU International Internship Program’s top position: Assistant to a Member of Parliament.

Accepted as a candidate for early graduation from James Madison University.

STUDY ABROAD/TRAVEL

June 2001 – August 2001  American Institute of Austria Vienna, Austria Studio 03: Architecture Summer Study
June 1999 – August 1999  Urban Affairs and Planning in Cuba Havana, Cuba Design and Planning in Havana, Trinidad and Santa Clara

SKILLS

Carpentry, Microstation, AutoCAD, VIZ 4, drafting, digital imaging/publishing, photography, watercolor.

INTERESTS

Travel, fly-fishing, hiking, mountain biking, building furniture, gardening.