The Postdiluvian Dwelling on the Deltaic Plain[1]

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> *"…So the hurricane passed, - tearing off the heads of the prodigious waves, to hurl them a hundred feet into the air, - heaping up the ocean against the land, - upturning woods. Bays and passes were swollen to abysses; rivers regorged; the sea marshes were changed to raging wastes of water. Before New Orleans the flood of the mile-broad Mississippi rose six feet above the highest watermark. One hundred and ten miles away, Donaldsonville trembled at the towering tide of the Lafourche."*[2]
> Lafcadio Hearn, *Chita: A Memory of Last Island,* 1889.

Isle Derniere (Last Island) is a barrier island off of the coast of Louisiana that had been a vacation destination for antebellum South Louisiana society. On August 10, 1856, a hurricane passed over the island followed by a tremendous tidal surge. Once the storm had passed and rescuers arrived from the mainland, it was discovered that more than two hundred people had been lost and the island's architecture had been decimated. This was neither the first nor the last time, as hurricanes Katrina and Rita most recently demonstrated, that a severe climatic condition would alter both the physical and societal landscapes of the Louisiana Gulf Coast.

AN ELAVATED ECOLOGY

> *"Savage fishermen, at some unrecorded time, had heaped upon the eminence a hill of clam-shells, - refuse of a million feasts; earth again had been formed over these, perhaps by the blind agency of worms working through centuries unnumbered; and the new soil had given birth to a luxuriant vegetation."*[3]
> Lafcadio Hearn, *Chita: A Memory of Last Island,* 1889.

For millennia climate and hydrology have influenced not only the natural landscape of the Mississippi Delta region, but it also has informed how humans, over the past 4,000 years, have adapted to such a hydraulic terrain.[4] Prior to French colonization, indigenous inhabitants of the low lying marshes and swamps built, with shells (the residue of millions of meals) and other refuse, elevated sites ("ecological islands") on which there was the possibility of residing above the deltaic plain. These mounds are believed, by archaeologists, to have been deliberate constructions and, only secondarily, locations for garbage disposal. They were, in essence, purposefully created islands of biodiversity in a relatively "monotonous sea of grasses." [5]

There are, throughout the deltaic landscape of southeast Louisiana, ridges of higher than normal ground flanking and following the paths of rivers and bayous. These "natural levees" have been formed over millennia by the deposits of silt during the seasonal overflowing and resulting flooding of watercourses. These ridges are the highest and driest terrain in what generally is a marsh/swamp landscape. Early European settlers built their communities on these natural levees, and it wasn't until the advent of mechanical pumping in the late nineteenth century that the lower elevations could be substantially and permanently occupied. The areas of New Orleans that experienced the least, if any, flooding during the Hurricane Katrina aftermath were on these ridges – especially those along both banks of the Mississippi River. That is why early post-Katrina planning proposals recommended relocating all displaced-by-flooding residents to

this higher ground. However, once emotions and political realities set in, that land use strategy was rapidly abandoned.

The early French settlers in the lower Mississippi Valley, and New Orleans specifically, were versed in a building technology found in provincial France – it was a timber frame type construction with an infill material of stone or slate. However, in south Louisiana where there is an absence of rock, *bousillage* (a mixture of mud and dried Spanish moss) was substituted. This method of infilling was probably gleaned from the local Indians who also used it for their dwellings. Later, bricks were used by the settlers as an infill material, and this technique is called *briquette entre poteaux*. The sills of these early buildings sat directly on the moist ground and rapidly suffered from decay and insect infestation. Having learned from this dilemma, the colonists began raising their structures on cypress blocks or posts in the ground (*poteaux en terre*) – a building technique imported from French Canada. Often the bottom sections of the cypress posts were burned to char the wood as a protection against decay. However, in the extremely wet soil conditions of South Louisiana, even that precaution did not prevent wood rot. As soon as clay kilns were established, brick was used as piers to support the floor sills of the colonial buildings. Gradually these brick piers became higher as a result of seasonal flooding and a need for protected under-the-structure storage space. The raised Creole cottage and plantation house are the results of this raising of the main floor eight or more feet from natural grade.

Living above high water, even for those who dwelled on the higher terrain of the "natural levees," had been a preoccupation for occupants of the Louisiana deltaic plain since human habitation began. The Mississippi River and its distributaries would annually overflow their banks during spring when snow melt and rains throughout the drainage – a vast territory ranging from the Rocky Mountains to the Ohio Valley - would increase the volume of water flowing to the delta. More marginalized people were forced to live, out of necessity, in much lower areas. One example is "Manila Village," so named because this collection of raised wood frame structures in Barataria Bay, south of New Orleans, was the base for a community of Filipino shrimp fishermen. Photographs show numerous pitched roofs, wooden structures raised above the bay on slender stilts, as well as vast platforms for drying shrimp. The community was destroyed during a hurricane in 1965, and the only remnants are decaying clusters of piles, former building stilts, peering above the water at low tide.

A SUBSIDING TERRAIN

During the first two centuries after the founding of New Orleans most of the population resided on the natural levees and ridges that existed within the city's footprint. Beyond these elevated slivers were uninhabitable swamps and marshes. However, with the invention of the "Wood pump" during the early part of the last century these low lying areas were much more efficiently drained, and the City's growing population was able to expand toward Lake Pontchartrain. It was the late nineteenth and early twentieth-century neighborhoods created on the drained terrain that experienced much of the Post-Katrina flooding.

At first, houses built in these drained wetlands followed the vernacular tradition of earlier south Louisiana construction and were raised on brick piers – although not very high, usually only two to three feet above grade. However, after World War II, almost all new buildings were placed on less expensive and easier to maintain, or so it was thought, concrete slabs-on-grade. To make matters even more problematic, the former swamp and marsh land that had been drained is composed of a high content of organic material. Once this material was exposed to air, it decomposed and the terrain subsided. Many areas that were previously at, or even slightly above, sea level are presently as much as eight feet below. At its founding, ninety percent of what constitutes present day New Orleans was not below sea level; therefore, the description of New Orleans as a below sea level city is not historically valid but is relatively accurate for the present. (Forty percent of the city sits at or above sea level and sixty percent is below). Nevertheless, the result of this modern day subsidence is that many of these postwar buildings settle unevenly, and require that sand periodically be pumped under their slabs in order to retard additional settlement. Because of this subsidence condition, all recent construction in these former wetlands now requires piles to be driven under the building footprint.

THE POSTDILUVIAN DWELLING

Since the disastrous flooding that followed Hurricane Katrina, there have been several officially commissioned land use plans for the City of New Orleans, as well as the nearby Gulf Coast communities. Almost all of these planning recommendations have been eroded, if not totally ignored, because of economic and political forces. On the Mississippi Gulf Coast, casino interests with their insistence on having a beachfront location have practically trumped all sensible proposals. In New Orleans it has been even more complicated, as various neighborhood groups have voraciously opposed any suggestion that they not rebuild in their pre-Katrina location, despite the serious flooding that occurred.[6] Politicians, fearing a negative voting bloc, have uniformly capitulated to their constituents' demands, even if it appeared against the best interest of the City and the people themselves.

Therefore, to date it has been not at the city-level, but at the grass roots neighborhood strata, where some progress toward rebuilding the flooded areas has taken place. Various organizations, such as the more conservative Habitat for Humanity, the local Preservation Resource Center, and church groups have assisted neighborhood residents in the construction of detached traditional type housing in some of the devastated areas, notably the Ninth Ward – especially in the infamous "lower ninth." At the same time, Tulane University School of Architecture's URBANbuild design/build program has constructed, with student and faculty involvement, remarkable student-designed houses in the area known as Central City. Seemingly, because the Katrina flooding high water level at their building sites was in the two to three foot range, the implemented URBANbuild projects, while progressive in design and technology, have not exceeded, by much, that first floor elevation. (Three feet is the height above grade now required by FEMA for any dwelling in order to qualify for flood insurance.) Also, the neighborhood in which the Tulane design/build houses are sited contains mostly late nineteenth and early twentieth-century shotgun type dwellings, as well as a fair number of post-War houses on concrete slabs. In that context, a raised cottage typology is more of an anomaly. Therefore, none of the Tulane houses have had to address the problems, both architectural and social, of a dwelling with a first habitable floor eight to ten feet above grade – a necessary height for major flood avoidance but a relative disconnect from the social dynamics, both positive and negative, found on the street.

A very visible array of post-Katrina dwellings – principally visible because of the film actor Brad Pitt's promotional and philanthropic activity - is located in the Lower Ninth Ward. These new houses are close to where there was a serious breach in the levee containing the Industrial Canal, the early twentieth-century man-made waterway connecting the Mississippi River with Lake Pontchartrain. The developer's guidelines stated that the houses must be five to eight feet above grade and engineered to withstand flood surges. Future expansion, cost and sustainability, as well as rooftop safe havens are all stressed in the project brief.[7]

The intention of providing replacement housing for families who lost their homes in the flooding is extremely well meaning, but the concept of commissioning a disparate group of architects, some who are unfamiliar with the fine grained morphology of older New Orleans neighborhoods, is somewhat problematic. It remains to be seen if even a hundred of these one-off, architecturally expressive houses can make a community. The local architect Errol Barron has stated,

> *"Make It Right encouraged individual performances rather than a choral work. Pitt and his developers did not understand the need for a repetitive prototype that would capitalize on that particular New Orleans aspect of urbanity, 'ensembleness' – not 'mini villas' for the indigent."*[8]

Even though the flooded portions of the Lower Ninth Ward primarily developed during the twentieth century and lacked a uniform architectural typology, the repetition-with-variety of the typical New Orleans neighborhood has been overlooked in this beneficent development. The tightly sited shotgun house and the Creole cottage, with their many variants, are the defining elements of the older New Orleans streets. There is a mysterious quality about the traditional working class New Orleans streetscape with its rows of weathered facades fronting sidewalks barren of trees, the tightly closed shutters, and the curved catenaries of utility lines vanishing to infinity. More than any other American city that I can imagine, New Orleans, in its Latin cloak, shields layers of secrets and conspiracy behind those shuttered facades. Truman Capote wrote in 1942," New Orleans streets have

Fig.1. Wheatley Elementary School, 1954 – Charles Colbert Architect (photograph by Frank Lotz Miller)

long, lonesome perspectives; in empty hours their atmosphere is like Chirico,…(they) acquire qualities of violence."[9] (In fairness, however, current zoning requirements – a suburban mindset overlaid upon the Lower Ninth Ward – prevent dwellings from abutting the front property line.)

An encouraging project coming from postdiluvian New Orleans is the Global Green USA international design competition's first award scheme. The competition brief required a net zero energy affordable housing and community center development in the Holy Cross neighborhood, also in the Lower Ninth Ward. The program included a twelve unit multi-family housing building with community center including a day care facility and a community meeting room. It also included the placement of six single family homes on the site, which is adjacent to the levee and the Mississippi River. The relative inclusiveness of the program will lead, I believe, to a more cohesive community driven architecture.

BUILDINGS WITH LEGS

Throughout the twentieth century, New Orleans architects and engineers have wrestled with the problem of building on and above this low-bearing strength, hydrological terrain. Even buildings on the higher natural ridges have experienced subsidence. The twenty-one-story Charity Hospital, built in 1937, on a site not much more than a mile from the Mississippi River (thus on the natural levee), experienced a settling of fourteen inches within four years after completion, but has since stabilized.[10] Its fate currently is in danger for other reasons. During the 1960s, engineers began utilizing a multi-section precast, pre-stressed concrete pile technology that was able to bear on Pleistocene sand and clay formations – the closest thing to bedrock under New Orleans - at minus 200 feet or greater below natural grade. The forty-five story "Plaza Tower" of 1964 and the fifty-two story "One Shell Square" of 1969 are auspicious examples of that development.[11]

At a much smaller scale, Engineer William Mouton, Jr. has experimented with raising two and three story buildings above the floor plain with the use of pre-stressed concrete friction piles. The friction pile, instead of being driven deep enough to reach a high bearing substance such as consolidated clays, which might be as much as one-hundred feet below the surface in the deltaic region of southern Louisiana, relies on cohesive soils to "grip" the surface of the piles with "friction," thus providing bearing in the shear plane. Rather than interrupting the piles at grade or at the first habitable level, as is normally done, Mouton's piles are continuous from below grade to the roof. With the addition of attached precast floor and roof slabs, a rigid, economical matrix

of support is formed, thus a separate structural system is not superimposed over the traditional grid of piles. The difficulty of this technology is alignment. It is extremely difficult to drive piles in an exact plumb configuration, and for that reason this technology has not become wide spread.

During the middle of the twentieth century several architects on the Tulane faculty successfully experimented with the raised modern building with both technical and aesthetic success. Charles Colbert designed a public school that, in its sectional *parti*, suggested a resistance to the serious flooding to come a half century later. His Wheatley Elementary School classroom structure, built on an undersized site, is elevated on two sections of support that carry floor-to-roof cantilevered steel trusses. Classrooms are located within the structural envelope, and broad exterior stairways provide vertical access. While the architect's initial intention was not driven by flooding concerns, but to provide a covered play area on a limited site and an economical concentration of piling; nevertheless, a raised structure gracefully hovering above the flood plain has resulted. This structure, while in need of deferred maintenance, survived the Post-Katrina deluge with no significant damage.

The Diaz-Simon Pediatric Clinic, also by Charles Colbert, and built four years after the Wheatley Elementary School, is elevated, not because of possible flooding, but in response to another undersized site and to take advantage of the one natural feature – a large live oak tree. The architect felt that the young patients who would be visiting the clinic would be less stressed if the children's waiting room would, "seem to rest among its branches and was calculated to evoke the thrill of a tree playhouse."□ Set in an older New Orleans neighborhood, the three-bay raised volume, with its vertical cypress siding and large expanse of glass, appears to levitate above the ground plane on two slender round columns. In reality the majority of the structural loads are carried by the building's ground level core, recessed from the façade by one structural bay. The ambivalence of structure is offset by the celebration of required vertical circulation with a floating stair and landing that seem to defy gravity. A low exterior wall further anchors the building to its site. Here is a raised building that clearly expresses its levity, but also acknowledges its connection to the ground plane.

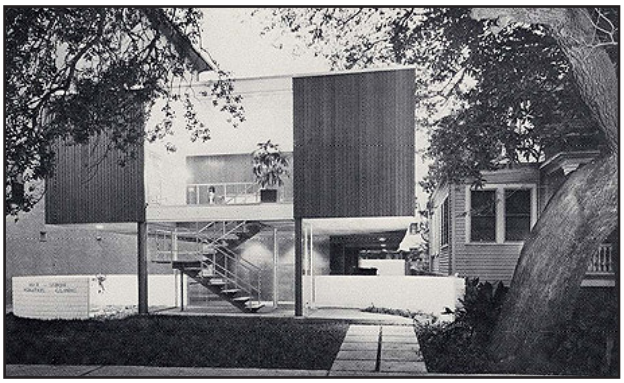

Fig.2. Diaz-Simon Clinic, 1958 – Charles Colbert Architect (photograph by Frank Lotz Miller)

Another example of a raised building warranting study is the Dominican Street house, of 1956 by John Lawrence, later Dean of Tulane's School of Architecture. Again, a limited-in-size site demanded that the building, of reduced footprint, be carefully positioned within a cluster of mature live oak trees. Here we find a simple volume sheathed in the thinnest of wooden membrane and raised on the most minimum appearing steel columns. The living spaces are on the ground level for facile connection with the garden landscape, while the sleeping areas float up into the oak canopies. Clearstory glazing above all first level partitions allows the upper volume to float in perceptual space.

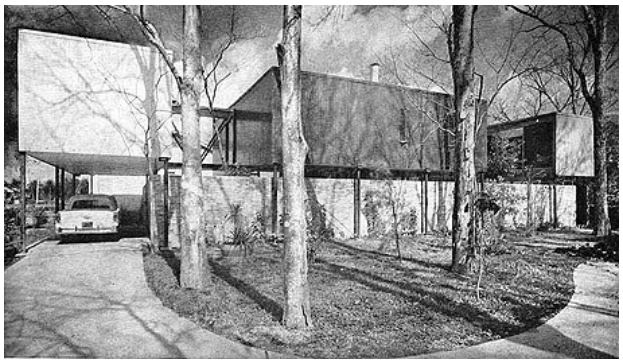

Fig.3. The Tiller Residence, 1956 - Lawrence, Saunders & Calongne Architects (photo by Frank Lotz Miller)

The same year, John Lawrence, along with architects William Calongne and William Saunders, explored a similar idea, in a suburban setting, with the Tiller Residence. Here are three pure volumes linked by diaphanous bridges and floating on slen-

der columns above the flood prone deltaic plain (this neighborhood did experience flooding during the aftermath of Hurricane Katrina). Once again we see a building that has the majority of its habitable space clearly raised, yet it is visually anchored to the ground plane by the use of the non-structural masonry wall of brick – a regional material.

THE NEW ORLEANS STUDIO

During the spring semester of 2007, my fourth-year design studio engaged the problem of designing a raised dwelling for a typical New Orleans neighborhood – one that had experienced serious flooding following Hurricane Katrina. Research was conducted on the morphology of nineteenth and early twentieth-century neighborhoods, as well as New Orleans dwelling types.[13] The project brief stated:

> While there exists in New Orleans a tradition of very habitable and climate responsive domestic architecture, notably that constructed during the nineteenth century, a literal reinterpretation of those models, though currently promoted by some architects and developers, is not the best response to the imminent danger of future storms, as well as contemporary lifestyles. It is true that these traditional models offer valuable instruction toward building on such precarious terrain; however, they can be much improved upon by the incorporation of newer technologies along with more progressive design concepts appropriate to this era.[14]

Students were asked, for this project of six weeks duration, to develop a new dwelling type, with growth/expansion potential and hurricane/flooding resistance for a typical level New Orleans lot of 32' frontage by 120' depth. All habitable spaces were to be a minimum of eight feet above existing grade. The materials and construction technologies were their decisions; however, they were encouraged to research and explore the use of non-conventional systems that might lead to economy of construction, sustainability, and durability. Issues of context compatibility, social engagement with the street, and accessibility were dealt with on a scheme by scheme basis.

The first project below was nicknamed the Tarpon because of its gill-like vents for natural ventilation. Raised on wooden stilts, the dwelling is a mating of the "shotgun" typology for the living, dining and master bedroom side with the more private "side hall" plan for the additional sleeping spaces and bath. The horizontal slipping of the two sections and the absence of permanent siding - adjustable louvers function as the dwelling's skin - allow for constant cross ventilation. An amply sized deck, as well as the entire structure can be insect screened for maximum use, and removable insulated wall panels would allow for thermal control during colder days and nights. The ground level is to accommodate not only covered parking and expendable storage, but also social activities such as seafood boils, automobile maintenance, and even a cottage business. The inverted roofs serve as rainwater channels.

The second project, while utilizing steel from shipping containers, could be constructed of wood as well. This scheme is both house and houseboat depending on conditions. Normally, the building would function as any land based two-story dwelling with living, dining, kitchen and one bed and bath on the ground floor. The second story contains additional bedrooms and a bath. A front porch allows for neighborhood interaction, and a second-story deck provides views and a protected outdoor space. The roof also acts as a rainwater-harvesting device. If flooding would occur, the building, with its substructure of pontoons, would be released from its more permanent foundation and allowed to float. Four channel-shaped masonry piers, some containing flexible and disconnectable utilities, would guide and anchor the dwelling in its rise to flood level. In this scheme the normal first floor-at-grade condition resolves the problem of the social disconnect experienced in many raised dwellings. However, during flood conditions, both occupants and possessions have a high chance of survival.

CONCLUSION

On the deltaic plain of the lower Mississippi Valley, indigenous people altered the local topography by building mounds of refuse – an early form of recycling- in order to reside above flood level. Early European settlers in the region learned to raise their buildings on brick piers for the same reason. Gradually, as confidence in the flood protection actions of governmental agencies increased, the floor levels of building lowered, reaching their most precarious position with the slab-on-grade. In post-diluvian New Orleans, precedent, common sense, and prudence would dictate that on flood prone

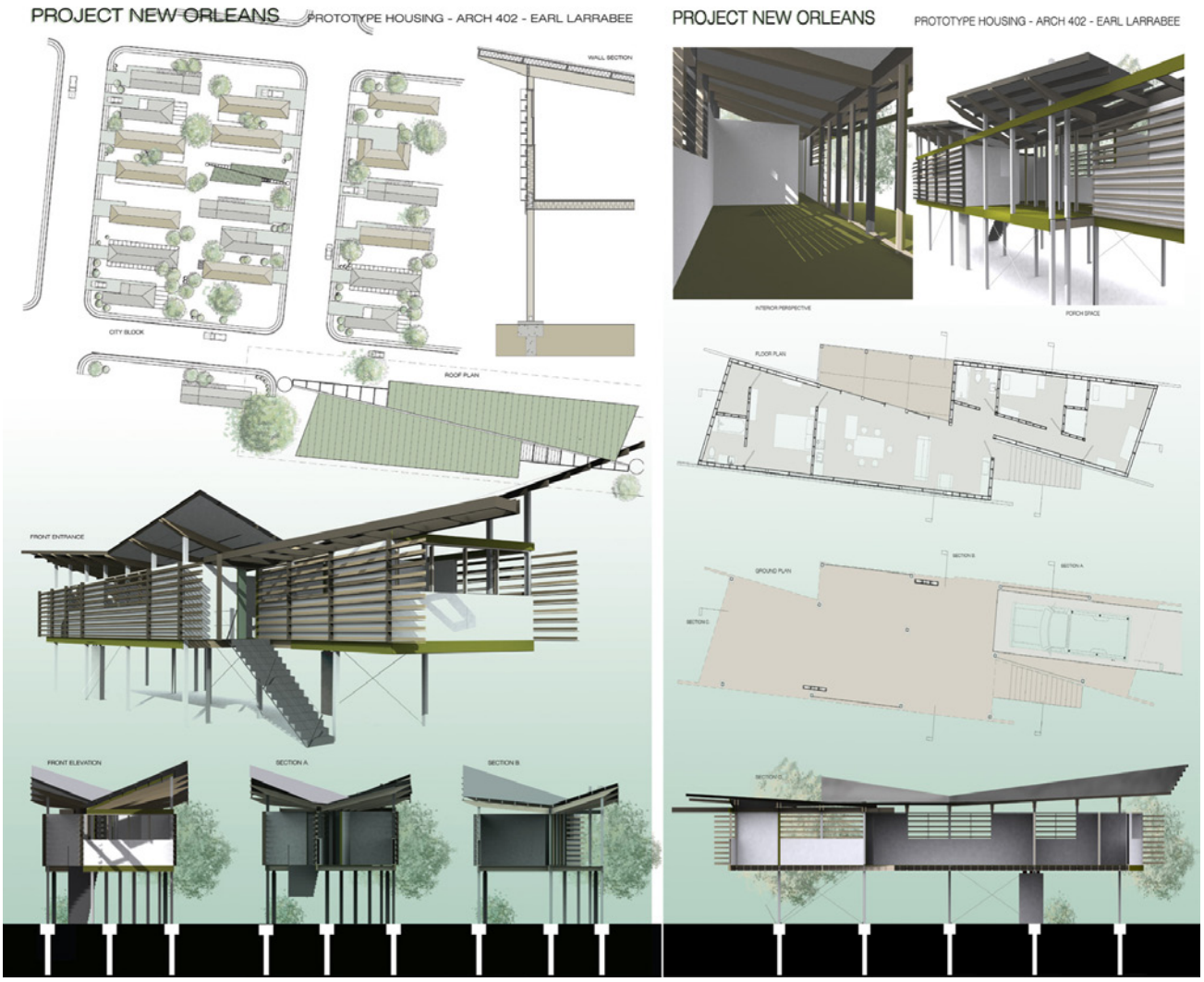

Fig.4. Post-Katrina Dwelling – "Tarpon House" - Earl Larrabee, 4th-year studio project.

sites habitable spaces should be situated above the predicted high water mark. The technology to accomplish this strategy readily exists, but how it is achieved architecturally is problematic. Adding to the dilemma is the issue of habitable space, especially urban housing, that has been removed from the ground plane. How is integration, both physical and social, with the site and community accomplished? The postdiluvian condition of New Orleans and the Mississippi Gulf Coast has evoked new and healthy discussions on appropriate ways of building on such a hydrological terrain. However, other than a few exceptions, all of the post-Katrina architecture to date appears as conventional built-on-grade dwellings that are simply lifted on wall, columns or piers. While this approach might pre-empt serious flood damage, it does not advance the art of the raised building or assist in making a neighborhood or community.

It is now without doubt that many residents of low lying New Orleans neighborhoods are not retreating to higher ground. They are rebuilding on the exact same sites from which they fled. Therefore, for the imminent new construction in these flood prone basins it would seem helpful to look backward, with critical selectivity, to the Creole models of building, vernacular types such as the "camel-

Fig.5. Post-Katrina Dwelling – "Float House" - Grant Noonan, 4th-year studio project.

back" with its second floor on the rear portion of the dwelling, as well, as some of the raised and progressive regional modern architecture of mid-twentieth-century New Orleans, as discussed earlier. At the same time we should look forward to more integrated clusters of habitat, respecting past fine-grain, medium density neighborhood patterns, but utilizing advanced material and construction technologies, as well as appropriate strategies of site integration. This is admittedly an extreme and ironic example given the environmental degradation the petroleum industry has wrought, but offshore oil platforms might provide some clues. Their locally implemented fabrication methods, their formidable resistance within severe weather zones, and their stand alone capability are all relevant for a postdiluvian deltaic society. Lest this tectonic expression is too harsh for popular and permanent habitation, then the oft-cited Dutch models of wetland housing would be helpful and inspiring.□ In any case, the rebuilding of postdiluvian New Orleans and the surrounding coastal areas offers a rare opportunity for innovation within the context of a remarkable cultural and geographic platform.

ENDNOTES

1. The use of the biblically derived term "postdiluvian" as a metaphor for the this period following the flooding of New Orleans after hurricane Katrina must be credited to the Tulane University geographer, Richard Campanella.
2. Lafcadio Hearn, Chita: A Memory of Last Island, (New York: Harper& Brothers, 1889), 52.
3. Ibid., 66.
4. Tristram R. Kidder, "Making the City Inevitable: Native Americans and the Geography of New Orleans," in *Transforming New Orleans and its Environs*, Craig

Colten, ed. (Pittsburg: University of Pittsburg press, 2000), 12.
5. Ibid., 12.
6. The earliest proposals recommended that the residents, of areas that experienced severe flooding, vacate their neighborhoods and relocate to higher ground – the "natural levees" of the city. A high number of flood victims vehemently opposed these recommendations. Interesting, a white paper released in 2007 indicated that there is enough undeveloped or underdeveloped above-sea-level land in New Orleans to accommodate as much as a 67,000 additional population. See Richard Campanella, "Above-Sea-Level New Orleans: The Residential Capacity of Orleans Parish's Higher Ground," Center for Bioenvironmental Research, Tulane and Xavier Universities, April 2007.
7. Kristin Feireiss, Ed., *Architecture in Times of Need*, (Munich: Prestel, 2009), 122.
8. Errol Barron, "Rebuild New Orleans by Appreciating its Past," *Louisiana Cultural Vistas*, spring 2009, 6.
9. Truman Capote, *Selected Writings*, (New York: The Modern Library, 1963), 255-256.
10. Lloyd A. Held, Jr., "History of Driven Piles in New Orleans," *The Louisiana Civil Engineer*, February 2004, 5 – 6.
11. Ibid., 20.
12. Charles Colbert, *Idea: The Shaping Force*, (Metairie: Pendaya Publications, Inc., 1987), 72.
13. Carrie Bernhard and Scott Bernhard, *An Introduction to New Orleans House Types*, forthcoming publication. A shorted version can be found in Kristin Feireiss, Ed., *Architecture in Times of Need*, see Carrie Bernhard, "New Orleans Urban Structure and Housing Typology," (Munich: Prestel, 2009), 100-108.
14. Studio project description by the author, spring 2007.
15. See Joe Palca, "Dutch Architects Plan for a Floating Future," All things Considered, National Public Radio, November 15, 2009. Also, a Morphosis designed and UCLA student built floating dwelling has recently been placed in the Lower Ninth Ward.