Solid to fluid to solid: wastestream constructions

]**Tobiah Horton**[1]

[1]Rutgers University, New Brunswick, New Jersey

ABSTRACT: The purpose of the study is to explore concepts from three built landscapes that reveal a time-based expression of fluidity and solidity of the waste stream. The theory, design, and implemented form of three built works by the speaker will reveal the movement and fluidity of the waste stream (reused materials cycles) contrasted to the solidifying mass of redeployed construction and demolition waste and sedimentary landform (stormwater as landshaper). The study seeks to enrich and connect the discussions around stormwater and waste management by showing that infrastructure built from waste hard materials poetically activates sites of stormwater disposal. Reuse landforming will be proposed as a productive solidification of the waste streams of stormwater sediment and construction debris. The paper seeks to enrich discussions of the evocative embodiment of change and stasis within built infrastructural landscape works. The importance of this theoretical research and experimentation/testing by implementation lies in pursuing and fostering the potential to see current material streams as potentialities. Like situations of potential energy, viewing the solid as a potentially movable mass, and likewise the fluid as a solidifying form can lead to relevant and evocative strategies for problems associated with C&D waste management, stormwater infrastructure and sea level rise.

Keywords: Wastestream, Construction, Landscape, Stormwater, Materials

INTRODUCTION

The land is composed of materials. Energy moves these materials, by forces of nature and humans alike. To harness and utilize the energy already invested in materials, both in their structure but also their deployment, involves redirection. Redirection implies a knowledge of where something is coming from, its former trajectory (usually on a path or towards an end that is undesirable), and then an assertive intervention that changes course. Redirection also suggests a flow of energy already in motion. At a structure's end of life, energy still embodied in component materials is at a threshold, where decisions are made to determine further expenditures of energy in transformation or disposal. Design with reuse, which I will pair with water and wetlands regenerative design, is a harnessing of energy already present and working structurally within materials, and redirecting that energy to new uses. Pairing repurposed construction and demolition waste with the recapture of stormwater and landbuilding sediment creates strategic methods for building protective and regenerative landscapes. Coastal and near-coastal conditions of flooding, erosion and pollution call for a reconsideration of degraded, underutilized and abandoned sites for repurposing. Directed towards suitable areas, wetlands creation, both freshwater and tidal, is a recapture of squandered land, material and energy. This paper will discuss the waste streams of stormwater and demolition debris as they embody and represent movement of material (potential or capacity) and solidification of form (land building, energetic stasis, and protection). The redirection becomes twofold, on the one hand materials that are degraded by use or demolition are redirected from a typical wastestream movement (even a recycling stream) and the general movement of materials as they have in the past narrowly supported human ends, are redirected to support natural processes. If only a longer view of the human/land interaction, the redirection of materials out of disposal to continued use, especially in support of wetlands creation signifies an ultimately anthropocentric interaction with fluid systems emerging within hardening edges. A goal of the

paper is to generate strategic ideas for an extension of the scale of practice; generalizing and abstracting from the level of the small basin to a large urban watershed and wasteshed.

1.1. The wastestream: materials source

The waste stream is already in motion. The power of the image 'waste stream' is that it taps into the complex geography of the hydrologic cycle and applies it to another very complex system that is not visible in the same way as streams, ponds, wetlands and the oceans. Perhaps a more fitting analogue for the general waste stream would be another specific waste stream; sediments and attached pollutants in watercourses. This waste stream is largely invisible until it chokes shipping channels, advances eutrophication or overwhelms sewage treatment plants as a part of the combined sewer flow. Streams have always carried loads of sediment, it is one way that material is shifted about the surface of the earth, laying down new topography and providing nutrients for growth. But the great increase in loads of sediment from anthropogenic sources, the pollutants that cling to them, and the havoc caused on human infrastructure systems poorly designed for stormwater's properties have created sediment, and stormwater itself as a type of waste. Stormwater as considered as a waste requires the same type of redefinition as other wastes. If waste is defined as those things no longer considered useful by a user group – which may flora, fauna or other- the material needs to be passed on to another "user group" that can process or benefit from what remains of the embodied energy. The created wetland is an example of this behaviour, where a set of materials that is in excess or rendered dysfunctional by a group is allowed to be carried into an area populated by species that may make use of, or at least chemically alter the waste material.

The Willow Patch project in Cazenovia, NY is a one acre stormwater receiving wetland intervention that repurposes demolished sidewalks to build mitigation structures. The demolition material originates from the stormwater catchment area; water and (metaphorically) concrete are determined to be no longer useful and are allowed to flow downhill into the Willow Patch. The reuse of flat, smooth concrete in a broken and uplifted manner functionally reflects its transformation from runoff generator/amplifier to energy dissipater and detainer. Behind the weirs and berms stormwater pools and drops much of its sediment, salt and pollutant load. Plants begin to uptake the stormwater and some of the pollutants, microorganisms in the rhizosphere fix and break down other chemicals, and sediment is laid down by gravity in the still pools or is caught on shoots and stalks in the flow path. As the flows of water and also construction waste meet resistance along the routes to disposal, they pool behind check dams or in transfer station yards. These pools (or piles) are great reservoirs of potential energy embodied in material.

At a small scale, the Willow Patch demonstrates landbuilding by stormwater sedimentation.

1.2 Material out of place

Part of what defines waste is ‘material out of place’, that is, in the wrong place and probably also in the wrong place at the wrong time (impeding a particular activity). The material has to be moved to a place that it can be; where it can sit, sink, be processed, stockpiled, reformulated, consumed, incinerated or otherwise dealt with. This transportation movement is a primary cost of dealing with waste. Another traditional cost is disposal, from landfilling to incineration (and the landfilling of ash). But in more recent efforts to capture some value from the waste stream, such as recycling or cogeneration, some energy is recovered from the material – in recycling some part of its material composition or structure is incorporated into new products whereas in incineration for power generation the basic energy value of the raw material is used, used up and detrimental byproducts released. With stormwater the great potential value of the often nutrient rich sediments suspended therein is treated as waste material by scuttling the flows downstream as quickly as possible and by capturing sediments in a monocultural basin. Sediments and C&D wastes are less materials out of place than materials without a reutilization framework. The energy embodied in the materials of sediment and C&D waste can be redirected to build new wetland containments, and reconfigure former tidal areas that have been filled. Excavation of coastal urban landfill areas can create additional acreage of energy absorbing wetlands while leaving intact or modifying bulkheads and jetties for wave attenuation, benthic habitat and public access.

The Stapleton Cove on the northeast shore of Staten Island is a small tidal cove covered by the remnants of maritime industry; an undulating concrete decked relieving platform supported by rotting timber piles, bent and drooping rails heading into the water or off into dense thickets of hardy shrubs. Under the platform, behind the piles, the sea meets stormwater from a nearby CSO discharge. A scheme for a WRT/Margie Ruddick-led project, proposes to dismantle and arrange the concrete slabs to continue the line of wave attenuating timber piles, creating a sheltered zone behind which a new expanse of sea grass could emerge. A resource efficient way to create a protected zone for shoreline protection, the project envisions at a small scale how the post-industrial waterfront can be partially salvaged, partially redeployed to serve the new “industry” of soft engineered coastal buffering.

The Stapleton “Cove” as it appears today, upper left. A proposal to reuse material from the concrete deck and the timber piles to create a tidal wetland was advanced by WRT/Margie Ruddick.

1.3 Solid to Fluid: moving the material

Demolition turns solid to fluid, a stable edifice to a pile of material that has to be moved. In construction, the goal of cut/fill balance and even recycling can lead to devaluation of demolition materials. The concept of the watershed is perhaps useful when thinking about motion in waste streams. In a watershed all droplets of water that fall and are not infiltrated into the ground or evapotranspirated drain towards the lowest point in the watershed. The conceptual significance for waste streams is the idea of a dispersed material that becomes collected, here by human agency rather than by gravity. Economies of collection, markets and material value determine sizes and shapes of wastesheds. But importantly, it is the systems for reuse or recycling that changes the character and performance of the wasteshed.

There is potential in something envisioned or operating as a “stream”. The waste “stream” name tells us of its movement and implies a source and perhaps a destination as well. So the materials in the stream are in motion, or at least need to be moved from source to destination. An energy is involved. This energy is charged at the accepted, agreed upon and/or market rate for the movement of a pound of matter across a unit of landscape. (A tipping fee is also involved, perhaps not a measure of energy, but of land value, which can probably be traced back to energy). For as the value of the material, as it was configured decreases the value of the land upon which it sits pushes and strains this

structure, cracking it diminishing it more until it finally collapses as if under the weight of the value of the land and buildings around it. Value as weight and pressure from the neighborhood inward towards the center of the building, then downward to its lowest point collapsing into its basement. Material that does not fit in the basement, (air, space, life sucked out a well compacted basement may swallow 4 stories of material) will be transported offsite. Like a reservoir perched above the lower valley, a mass of material sits awaiting transport. Or, in an alternative scenario, one that cycles back around to the watershed analogy – construction waste like stormwater should stay where it falls. Like design for infiltration, C&D waste can be incorporated into the designs and design can reconfigure the wasting process in order to salvage, adaptively reuse and reprocess materials onsite. One such "infiltration" of construction waste material into the landscape is the Queens Plaza Project.

As an interruption in the smooth city pavements and the typical disposal stream, the Queens Plaza project opens and uplifts the sidewalk in reused concrete medians. As startling as the 6 lanes of traffic, the 6 story-high subway lines above or the deafening shriek of the steel wheels on curving track – the geological rise of "urbanite" appears to flow out of the ground (or the past) through and with the lanes of traffic (and the stormwater) downhill towards the Queensborough Bridge and the East River. It could be said that the sidewalk witnesses the life of the street. A flat continuous expanse slowly gives way to time's forces, and then broken open in demolition, the irregular edges reveal random patterns of aggregates. Rows and layers of these now unique slabs of concrete are like stories infiltrated into design by reuse's blockage of the wastestream's flow.

Wastestream flow: Queens Plaza's reused sidewalks constructed as a flowing landform of the DOT project's discarded material in the 'discarded' infrastructural spaces leftover from roadway construction.

1.4 Redirections: fluid to solid

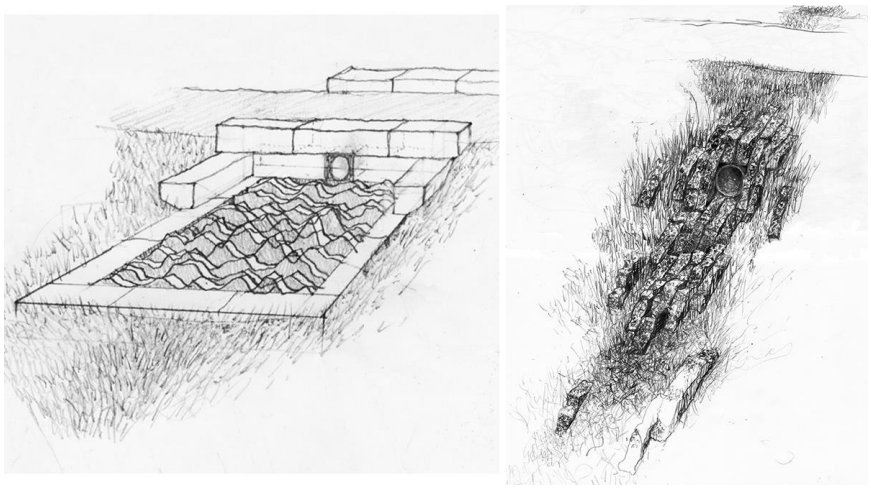
Redirection implies strategy, foresight and planning. If accumulation suggests a condition, social or environmental, that allows material to gather in a specific place and time. For in some systems accumulation is a valuable occurrence, in others, such as the dump, it signifies a ceaseless march towards closure. But what we see in the accumulation of layers of biodegrading and compacting reeds and grasses may be not so remarkably different than the layers of discarded accumulation now being tapped for energy production. As accumulation may imply disuse, or at least a very infrequent use such as a low intensity use (for example, viewing, as in a collection), accumulation in terms of energy and movement may illuminate the waste stream discussion. If waste, as with generally underutilized items, sits still awaiting processing and disposal it may be

thought of as “pool” or “reservoir”. The pile of debris and the volume of sediments can be seen as a reservoir of potential energy, if the energy already invested in it can be captured and reused. Part of the process of moving to a reuse design model is envisioning current arrangements of material (buildings, infrastructures and waste materials produced by built systems, e.g. stormwater) as material resources. Intervening in the already required movements of these materials after demolition or runoff realizes diversion/redirection from the wastestream into a reuse stream. The results are reuse systems/infrastructures and stormwater management devices that redirect materials to landbuilding activity. Energetic forces; gravity and trucks begin to generate a movement of the material, and with this movement we may begin to think about a flowing stream of waste. This moving stream becomes solid in myriad reuse designed forms, but sediments and C&D wastes can effectively join together in recreating a buffering coastline and upland wetlands. For it may be the dual solidification of runoff producing uplands and filled lowlands that creates much of the flooding landscape of today.

1.5 Hard and Structural: deposition

Within the frames of landform, banks, levees, dikes and berms a highly manipulated floodplain spreads out, appearing horizontal. Before the controls, even more so than when they now fail, the floodplain was a dynamic push and pull between erosion and sedimentation, between building land and scouring it away. This dynamic relationship between water and the particle of sediment has been altered, ignoring the essence and function of what each are, only to redefine them both as waste materials. In service of agriculture, or to gain valuable land adjacent to shipping – wetlands and shorelines have been filled in, creating a hard edge where there was once a soft yet resilient buffer. Likened to sponges or breath, the tidal wetlands that used to inhabit the world’s estuaries have been solidified in an armouring that seems to just increase the sea’s energy, multiplying its force to eventually find that soft part to take. If the rivers and oceans seem meant to erode, they are also meant to build – especially in that rich brackish zone where fresh and salt waters mix, the zone where the expanses of that tough softness grows and dies, builds and sinks.

The concrete beam and block wall support this little pocket of protected space in which I sit to write. If a landscape that had had certain value for humans, utilitarian, then picturesque and a certain ecological value that was not fully realized until recently. But while the beam and column might not be the right metaphor, it may lead to a connection between building demolitions and a productive reuse. The wind energy hits the concrete and the force is transmitted to the rebar and spread across tugging at its connections spreading the force to withstand the lateral push of the wind. And the wind and waves pounded the dunes and dissipated through miles of reeds and grasses in the tidal wetlands that covered 200 million square miles in 1620. Outcrops, reefs, the deep structure of barrier islands or even the solidifying mass of wetland soils compacted, densified and sinking by their own weight – these elements form some of the generative structures, which, when waters flow through, begin to direct land building activities. The dialog between useless waste and productive material has as much to do with systems; with timing and location, as it does with any physical characteristic of material. Here the streams of stormwater and demolition wastes can be directed to new sites. The flow slows, there is pooling, energy appears gone and material falls from suspension. Waters recede, that which delivered the material is no longer visible, a remnant or trace of something fluid and moving remains in the form. A growing or expanding hard edge encourages more collection of material, sediments are held in place by roots of spartina, protected from the waves in eddies behind rubble.



Rubble contained and dispersed in sketches for Womrath Park in Philadelphia. The physical design reflects the passage of C&D waste and stormwater from architectonically controlled systems to a more open and dispersed bioengineered application.

CONCLUSION
Uncontrolled

Like infiltration of rain, soils and debris can be kept close to where they are generated – captured in small scale systems higher in the watershed - to reduce the overall volume downstream. Dredge and inert fill material (select construction and demolition waste) can create the bones of new wetlands, interior and coastal – to trap and use sediments to build a new dynamic topography that is water formed and fed. Sediments will reach the estuary as they are meant to; structures can be built to redirect the accumulations towards the building of protective wetland zones. These control devices may be built from the decaying structures of the post-industrial waterfront. The wetland construction may involve partial excavation behind eroding bulkheads shored up with additional clean demolition materials. As in the Stapleton Cove, the confluence of a stormwater flow, tidal yet protected conditions, and existing abandoned materials and structures create a laboratory for conversion of a post-industrial site to a created tidal wetland. At the Stapleton Cove the flow and movement of “waste” materials may come to a temporary stillness, a new stasis that signals a new identity in use for stormwater, sediment and C&D waste. And perhaps, as in the small examples of wetland creation at the Willow Patch and Womrath Park, control structures built from rubble concrete could form a temporary solidification of the waste stream. In time, when mature wetlands develop, hard structure could be shifted again, moved and repurposed to build other sedimentation zones. It may be this state of being in motion that defines a material as a cost rather than a resource. Perhaps when a material is in process, undergoing change or part of a dynamic system that it becomes harder to classify as useful. But now our understanding of the human utility of natural systems may extend not just to coastal protection provided by wetlands systems, but also to a new understanding of waste. For as oft stated, there is no waste in nature, the unused nutrients/energy from one process is the food for another.

REFERENCES

Bataille, Georges. 1988. *The Accursed Share*. Zone Books: New York.

Kirkwood, Niall, ed. 2001. *Manufactured Sites: Rethinking the Post-Industrial Landscape*. Spoon Press: New York.

Thompson, George F., Steiner, Frederick R., eds. 1997. *Ecological Design and Planning*. Wiley: New York.