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The Chrematistic Waterfront: Paying for the environmentally sustainable waterfront.

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Abstract: Is it possible to develop a sustainable public realm on the water that is resilient to climate change while conforming to the expected financial return of a typical waterfront development? This paper argues that by connecting the public realm to water in its many different forms, salt water, fresh water, stormwater, and the specific ecological environments associated with these types, we can move beyond the formulaic and stereotypical waterfront development into a new space that is environmentally and socially sustainable.

Key words: Sustainable Waterfront Planning, Property Development, GIS Analysis, Feasibility Modelling.

1. Introduction

How can new waterfront development based on environmental remediation be financed by convention real estate models ? This paper explores the question through the development of a design case study using the Wynyard Point in Auckland New Zealand. Wynyard Point or the Point Precinct is a part of a larger waterfront development site in the Wynyard Quarter (Architectus, 2007). The author has carried out a number of investigations of the environmental issues and possible remediation strategies for the site. For a closer description of the research findings please see the author's previous publications. (M.A. Bradbury, 2015). This paper describes the case

study site, the environment issues, and possible remediation/ rehabilitation strategies. The paper then examines the cost of the remediation and what kinds of financial strategies could be employed to pay for this work.

Wynyard Quarter, Auckland, New Zealand.

The Wynyard Quarter is situated on the western side of the Auckland CBD, New Zealand between the Westhaven Marina and Viaduct Harbour. The Wynyard Quarter started life as reclamation in the 1930s; the site was used for warehousing, the fishing industry and most importantly as an industrial fuel store. This western zone has been undergoing a slow redevelopment from an industrial wharf and tank farm to a new consumerist waterfront over the last 20 years.(M.A. Bradbury, 2015)

The Master Plan

Peter Walker, (Walker, 1996) an American landscape architect, was commissioned in 2003 to develop a master plan. The basis of this plan was the establishment of two axes that connect the site to the city; a north/south axis from the existing Victoria Park to the northern tip of the reclamation and a west/east axis from the Wynyard Quarter to the CBD via Quay Street. This plan was modified by a local Auckland architectural practice, Architectus, (Architectus, 2007) in a report prepared in 2007. The proposed building programme is contained in the indicative framework section of the report. The Wynyard Quarter is approx. 38.8 ha. Of this area 5.8 ha. Is to remain as existing marine related industries, mainly on the Westhaven marina side. The main body of the site is a development zone of approximately 21 ha. The rest of the site is to be allocated as public space. The development site is broken into three zones; the Point Precinct at the northern end of the site is zoned mainly as residential. The middle zone, the Jellicoe Precinct, has a more complex social and building programme, which relates to its role as part of a structural urban axis linking the Wynyard Quarter to the CBD. The Central Precinct is the largest zone from Jellicoe Street to Fanshawe Street, a third of this site is owned by another party, Viaduct Holding Group. This zone is devoted to mostly residential and commercial use with small percentage of retail. The total build out for the whole quarter is approximately 1.1 million square metres.(M.A. Bradbury, 2015)

The Case Study Site: Wynyard Point / Wynyard Quarter.

The design programme for the Point Precinct is out lined in the WQ urban design framework (Architectus, 2007)

4.3.1 Point Precinct Key Concepts:

A. The overall built form will establish a wharf related character with a maximum height of 27m. Smaller scale development sites (approx. 60m x 60m) are divided by the Daldy Street axis which connects to Point Park.

B. The Daldy Street axis terminates in Beaumont Plaza, which will function as a pick-up and drop-off area and location for passenger transport.

C. A grid of 10m wide east-west lanes aligned perpendicular to the Wharf Axis will visually connect the Point Precinct to the CBD and harbour.

D. Active edges will define the Beaumont Street and Brigham Street frontages. Canopies and verandahs will provide shelter at street level for pedestrians.

E. Retail and entertainment uses and a possible cultural facility will activate the Point Park.

F. Wynyard Wharf will be activated by development which compliments its use as a public space as important marine related infrastructure.

G. Wynyard Wharf and Point Park will establish a regional public open space destination. (see fig.1)

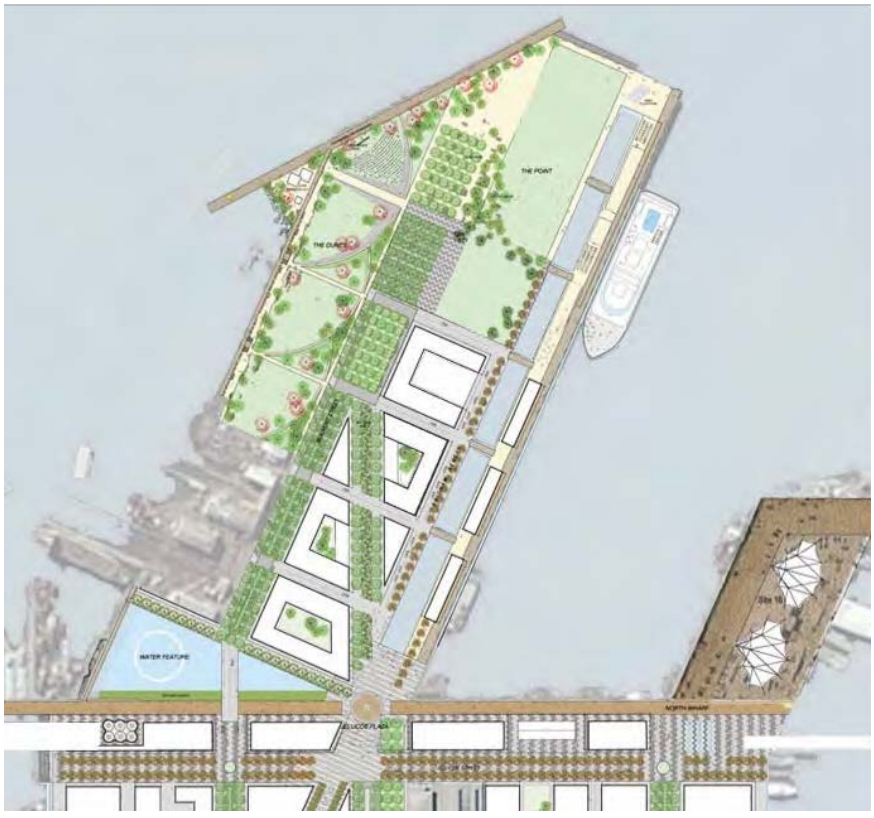

Figure. 1

Proposed Wynyard Point Master Urban Plan

The size of the Point Precinct is approximately 8 ha. The proposed real estate development area is confined to the southeast corner of the site, with the rest of the site zoned for public space and a suggested 'iconic' public building.

The two spread sheets below give the total GFA for the Point Precinct (table 1) and a preliminary feasibility study of the building of the residential area (table 2)

WP Apartments GFA	
Site footprint (m2)	3600
FAR	3.61
GFA m2	12996
Max building height, 27m(8 floors)	8
Typical floor area m2	1624.5
Total sites	4
Total site GFA m2	51984

Table.1

Wynyard Point Apartments. Architectus Master plan **Feasibility Study**					
	%	m2	cost	rental /m2	income
Value of the scheme					
Retail net area					
Office Net area					
Residential net area		51840	10000		518400000
total income					
Total Value					518400000
Cost of scheme					
Retail					
Office					
Residential		51840	5000		259200000
Professional fees	12.50%				64800000
contingency	5.00%				12960000
Development Finance					
Construction and Planning	10.00%				25920000
Letting and legal fees	15.00%				38880000
Sales fees	2.00%				5184000
Adverting and marketing					
Developers profit on cost	20.00%				51840000
SITE VALUE					
24 months					
Present Value					2300000
Less Acquisition cost					
SITE Value today					
Total Cost					461084000
Value - Cost					57316000

Table.2

Wynyard Point Environmental Problems

However the Wynyard Quarter and by extension the Point Precinct has a number of serious environmental issue. The issues and the proposed remediation strategies have been explored in a number of papers and book chapters by the author (M. Bradbury, 2011; M.A. Bradbury, 2012, 2013; M.A. Bradbury, 2015). The results of this research are summarized below.

Sea Level Rise

The local stormwater outlets for Wynyard Quarter are on average one metre above the mean high tide level. With the anticipated sea level rise of one metre these outlet will become blocked. In the event of a storm event in the Freemans Bay catchment the resulting stormwater will be unable to discharge, this will resulting in wide spread flooding. The site is also vulnerable to flooding from storm surges.

Contaminated stormwater

The discharge of contaminated stormwater is a major issue for the Wynyard Quarter. While small-scale stormwater remediation wetlands have been installed, these measures only address the local effects of the new urban configuration. The stormwater discharge from the larger Freemans Bay catchment is concentrated in a 4m-diameter pipe with a single discharge point under the North Wharf. After heavy downpours there is highly visible harbour contamination that leads to toxic sedimentation around the wharf area. This problem will only be exacerbated by the expected storm events due to climate change

Point Precinct : Environmental Remediation Strategies

Sea Level Rise

To protect against expected sea level rise and associated storm surges a 30m buffer zone at the edge of the development to absorb storm surges is proposed. To ensure this buffer remains in good ecological health the buffer is linked to the construction of a 6.5 Ha. ecological patch. This patch, the size and planting is based on the Meurk and Hall model. (Meurk & Hall, 2006). To understand the necessary size and connection of the patch a study of the location and types of surrounding parks is made. The only urban park within 1km of Wynyard Quarter is Victoria Park. Though there are large trees around the open park, these are not substantial enough to be considered a 1.56Ha medium patch. Within a 5km radial area, there are some parks large enough to be 6.5Ha core patches. On the isthmus, there are 4 parks within 5km; these are Auckland

Domain (2.7km), Mt Eden (3.9km), Western Springs (4.6km) and Cox's Bay Reserve (2.8km). All of these parks are made up of open space and native trees. Across Auckland Harbour, there are two patches within the 5km radius; these are, Leroy's Bush Reserve (3.5km) and Kauri Point (4.2km). These reserves are both made up of mostly native species with some open space. With the construction of the Wynyard Quarter ecological patch an important link for native flora can be made in an inner city site. This helps to increase the ecological health of the proposed vegetation programme.

Stormwater Production and Treatment

The Freemans Bay catchment covers an area of 244Ha, of which 72.7% is an impervious surface (178Ha). The impervious surfaces are made up of building, roofs (64Ha) and roads, driveways and footpaths (114Ha). This leaves 27.3% (66Ha) as pervious surfaces made up of, parks, lawns and vegetated buffers. The result is the production of a large amount of storm water flowing under the Wynyard Quarter to discharge at the sea edge. The pipe outlet sits below the high tide mark and is frequently filled with seawater. This results in the stormwater backing up to cause some surface flooding, especially when storm events coincide with high tides.

Production of stormwater

During a two-year storm event, the impervious surfaces of the Freemans Bay catchment produces 132, 940m^3 of water run off.

Remediation of Stormwater-Wetland treatment at the end of the pipe.

In accordance with Auckland Council's TP10 (Council, 2003) a third of stormwater volume should be collected for treatment resulting in a first flush water volume of 44, 300m^3.

Wetland Size Calculations

Auckland Council TP108 details wetland construction calculations. These calculations are presented as a guide based upon regulations in TP108. Banded bathymetry is the preferred wetland design method. This features a wetland with 0-1m deep storage pools, these should account for 40% of the surface area, with 60% of the wetland area 0-0.5m deep. The forebay can be up to 2m deep to slow the flow of incoming water and should store 15% of the over all volume of the wetland. The wetland size calculations presented here are all derived from these conditions. For a wetland to effectively treat the stormwater flows from the existing Freeman's bay catchment, a wetland would have to be sized accordingly. For a wetland to effectively treat the 41,

636m3 of water run off during a two-year storm event, the wetland must be approximately 5.4Ha.(M.A. Bradbury, 2015)

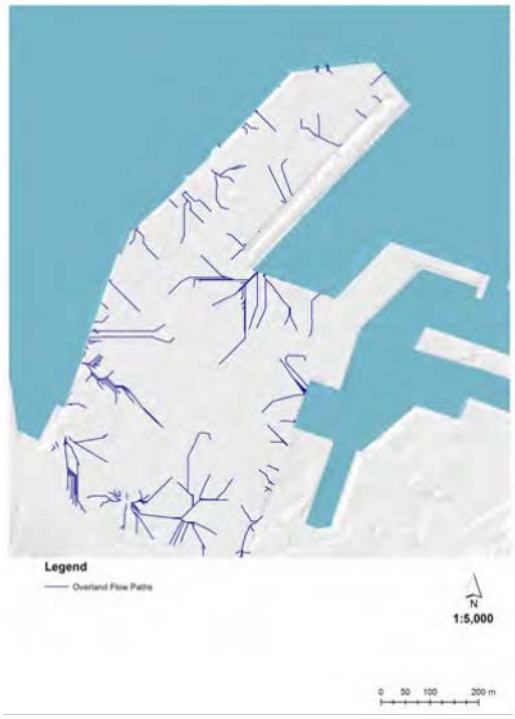

Figure. 2

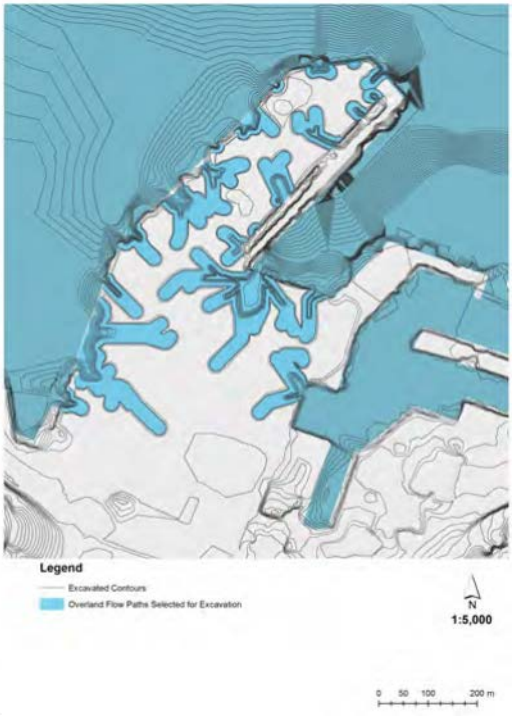

Figure. 3

Environmental Remediation Landscape

The integration of a coastal surge defense with the stormwater treatment operation generated the idea of a dispersed wetland network rather than a one large central pond. Existing over land flow paths on the site where determined through GIS mapping (fig.2). These overland flow paths were buffered to 30m initially as a waterway protection measure (fig.3). The resulting area, was large enough to collect stormwater from the catchment and become a dispersed wetland system. The overland flow paths that drained directly to the harbour were selected to become remediation wetlands.

The local high tide rises to 1.5m above mean sea level, so each wetland was excavated to a lowest level of 2.0m. Some wetlands were excavated below the high tide level to provide a greater coastal edge and the opportunity for coastal ecological restoration. With the overland flow paths excavated, approximately 60% of the excavated area will be fresh water wetland, with the coastal edge reserved for restoration. The fresh

water wetland ground level is at 2.5m with 1m deep pools excavated to 2.0m. This is high enough to prevent the tide flowing in to the wetlands, though with sea level rise, these environments may become brackish, rather than fresh water. The opportunity for the restoration of native salt meadows could be exploited.

The excavation of the wetlands resulted in 116, 320m^3 of soil being removed. By filling the remaining site the existing ground level of 3.0m above mean sea level can be raised to 3.7m. This raises the ground level to be higher than the expected sea level rise, a new high tide line of 2.5m. The construction of a 30m wide buffer around the coastline as public space and coastal restoration results in storm surge protection, an increase in local bio-diversity, and better urban ecological connections (fig.4).

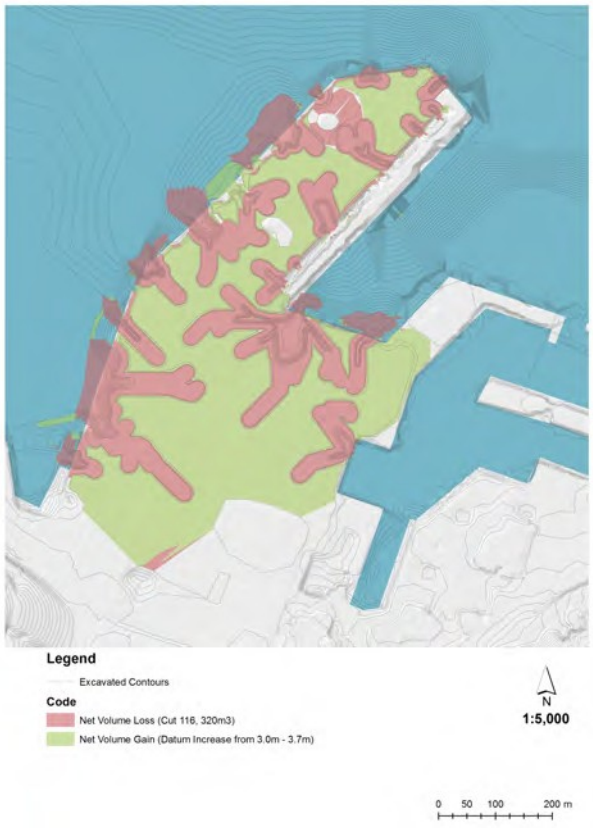

Figure. 4

Demolition and Remediation Costs

The costs of the demolition and remediation of the Point Precinct are considerable. The first order of costs is removal and disposal of the existing tanks. The second issue is the stripping and remediation of the existing contaminated fill. This cost of this work is a topic that has been debated between the Auckland Waterfront and Mobil,

the multi national petroleum company that has leased the tanks (Edmunds, August 25 2015). However the concept of excavating the overland flow paths for stormwater remediation wetlands might be an opportunity to both remove the contaminated fill and provide a new remediation environment. Placing the contaminated fill on site and carrying out soil remediation via phytoremediation (Rock, 2001) again lessens the cost of disposal of the contaminated fill. The last cost is the construction of the new park.
The cost of the demolition and removal of all the existing tanks $134 m2 x3.62 ha. = $ 4,850,800
The cost of fill remediation is $84.00 m2 x 8 ha. = $ 6,720,000.
The cost of relocating fill is $60.00 m2 x 8 ha. = $ 6,979200
The cost of the wetland construction is $200 x 3.5ha. = $ 7,000,000
The planting of the new park is $400 x 4.5ha. $ 18000000
The total cost of the environmental rehabilitation and park construction is $43,550,000 (table 3).

Financing the remediation programme

How might we go about financing the cost of the remediation work and the provision of a new park (43.5 million)? If we look at the feasibility study for the Architectus Precinct residential development we can see a profit of 57,316,000 (table 2). Could the remediation cost be paid from this? Two obvious problems are the shape of the remediation landscape precludes the building of a conventional urban block arrangement and two the cost of the entire site needs to be considered in any new feasibility study.

However there are a number of real estate financing operations that can be use to pay for the new landscape, these include looking at different urban forms and increasing allowable GFA (Quinn, October 31, 2014) Thinking about an alternative urban strategy, if we look at the proposed remediation plan we can see there are about 6 sites available (fig. 5) Taking the master plan building GFA of 51840 m2 from the WQ UD plan and dividing by 6 sites, we then get 6 building with a GFA of 8640 m2 each. Taking a standard apartment footprint 30 x 20 =600m2 (Perez, 11 May 2010.) We can divide the individual site GFA of 8640 m2 by a 600 m2 floor plate to give a typical fourteen floor building.

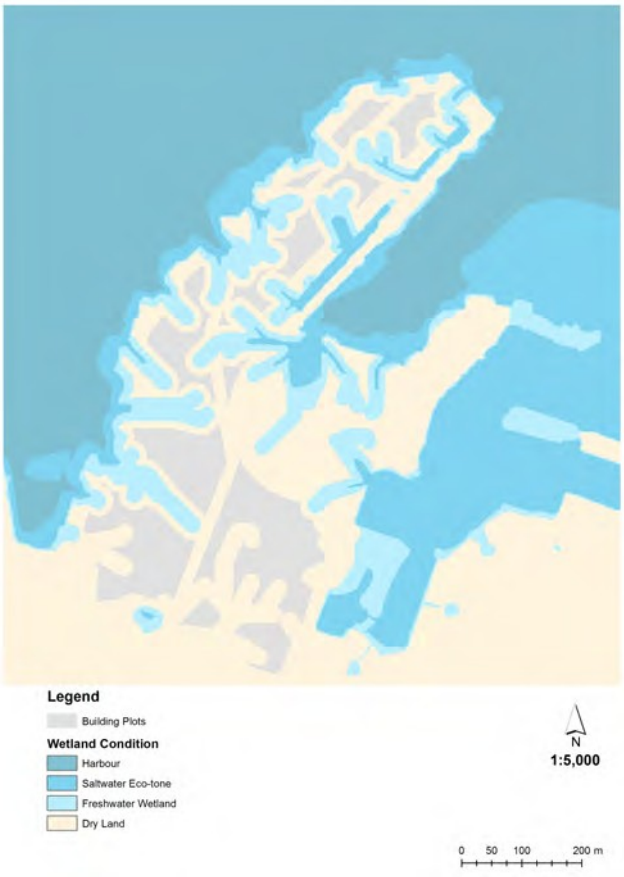
Legend
Building Plots
Wetland Condition
Harbour
Saltwater Eco-tone
Freshwater Wetland
Dry Land
N
1:5,000
0 50 100 200 m

Figure. 5

Wynyard Point PARK						
	%	m2	cost	rental /m2	income	profit/loss
Value of the allowed building						
retail net area						
Office Net area						
Residential net area		51840	10000		518400000	
total income						
Total Value						
Cost of building						
Retail						
Office						
Residential construction		51840	5000		259200000	
Professional fees	12.50%				64800000	
Contingency	5.00%				12960000	
Total Cost of Building					336960000	181440000
SITE VALUE						
24 months						
Present Value (GV of 8ha. WP)					62200000	
Less Acquisition cost						
SITE Value today						
Environmental clean up and						
new park construction						
Demolition of the tanks		36200	134		4850800	
Fill Remediation		80000	84		6720000	
Fill placement m3		116320	60		6979200	
Wetland Construction		35000	200		7000000	
New Park		45000	400		18000000	
Total remed cost					43550000	
Infrastructure						
Road/ Site Works		30000	300		9000000	
Total cost of building,cleanup						
and site value					389510000	
						128890000
Development Finance						
Construction and Planning	10.00%				38951000	
letting and legal fees	1.00%				3895100	
sales fees	2.00%				7790200	
adverting and marketing	0.05%				194755	
Total					50831055	
Finance plus other costs					440341055	78058945
developers profit on cost	20.00%				88068211	
Total cost					528409266	-10009266

Table.3

The most obvious point of this spread sheet is by including the cost of the entire site $62,200,000 plus the extra cost of the environmental remediation $43550000 and the extra infrastructure $ 9,000,000 has lead to a deficit of approx. 10,000,000. To pay for this extra work the use of increasing the allowable GFA has been explored.
An example of a city that has used the manipulation of a site's FAR to ensure a greater GFA and consequently a great developer contribution is Vancouver. In fact Vancouver has been so successful with this particular mechanism, that its has given rise to a particular urban trope, Vancouverism. The city of Vancouver website succulently describes Vancouverism as;
"Vancouverism" is an internationally known term that describes a new kind of city living. Vancouverism combines deep respect for nature with enthusiasm for busy, engaging, active streets and dynamic urban life. Vancouverism means tall slim towers for density, widely separated by low-rise buildings, for light, air, and views. It means many parks, walkable streets, and public spaces, combined with an emphasis on sustainable forms of transit. We achieve this liveable, high-quality urban design through creative planning, combined with: Carefully crafted development policies, guidelines, and bylaws Extensive consultation with residents, businesses, and experts Ongoing revaluation of where we are as a city, and where we would like to go ("Urban planning, sustainable zoning, and development," 2013)
The particular urban form that Vancouver has adopted over the last twenty years is a tall, skinny apartment tower with large podium that fills a city block and offers a range of street edge activating experiences. The specific building control policy governs certain zones of the city where tall residential building are permitted to a certain height. The quid pro quo for this particular building form is outlined in the General policy for Higher Building 'In addition, all Higher Buildings should be considered with careful effort to provide a lasting and meaningful public legacy to Vancouver and should include careful consideration of the following: The buildings should achieve community benefits (i.e. as a recipient site for density transfers; retention of important heritage components; provision of significant cultural or social facilities; or provision of low cost housing.'(Services, May 6, 1997 Amended February 1, 2011, November 20, 2013 and June 25, 2014).
The payment for community benefits is derived from the allowance for extra building height (and the associated extras profit for the developer). The extra height for the

building is governed through the mechanism of the Community Amenity Contribution. The amenities that Vancouver has developed in the last 20 years such as affordable housing, childcare facilities, parks, art galleries have been paid for by the CAC. Here is how C. Grey; a City of Vancouver planner describes how CACs are calculated;

'In the second stage, the land value impacts of the proposal, revised in response to the urban design and planning review, are evaluated by the City's Real Estate Department to determine the total increase in land value (the 'lift' again) that the proposal would generate, and to negotiate with the developer the percentage of the lift that would be invested in CACs. The real estate analysis is, in concept, straightforward. A rezoning that adds density is equivalent to providing land i.e. a 20% increase in density is the same as a 20% larger site, or, to look at it another way, the larger project could proceed on a site that is 20% larger without a rezoning. The negotiations are – surprise, surprise – more complex than just determining the value of land/sq. ft. of floor area and multiplying by the additional floor space requested, though that is often the starting point. The cost of the rezoning, perhaps the need to add an additional floor of underground parking, additional risk, etc. all has to be taken into account. That said, agreeing on what the total lift might be is usually not that difficult or contentious – or at least shouldn't be. The percentage to be invested in CACs is more contentious, as there is no 'rule' that says what is fair or not. The City claims to have converted 70% of the lift into CACs for the downtown single site rezoning's, though there is some doubt that the CAC share was really that high as the marginal cost of adding a few floors to a tower is a lot less than the average cost of construction, which is what would normally be used in the City's real really that high as the marginal cost of adding a few floors to a tower is a lot less than the average cost of construction, which is what would normally be used in the City's real estate analysis, the marginal cost being difficult to estimate looking from the outside in. In any case, it is in the City's and the developer's interests to cut a CAC deal and they usually do.' (Gray, 2012)

Vancouver has married a typical and wide spread planning mechanism, the developer contribution, to a special urban form, the tall skinny high rise building, making an urban virtue out of a development necessity and at the same time derived considerable social amenities.

Vancouverism in the Wynyard Quarter

How can we use the CAC model to pay for the remediation landscape of the Point Precinct? 70 % of the 'uplift' or profit on allowing the developer to build extra GFA would be taken as a development contribution to pay for the cost of the environmental remediation and park construction. The cost of building an extra floor is 600m 2 x $ 5000.00 construction cost = $ 3 million, the selling price is $10,000 m2 = $ 6,000,000. The profit on this floor is 20 % of $ 6 million. = $1,200,000. The development contribution for each extra floor (Vancouver CAC 70% of the profit), sic 840000 CAC.

WP Park, Extra GFA	m2		Profit /Loss
			-10009266
Typical apartment floor plate	600		
selling price	600	10000	6000000
construction cost	600	5000	3000000
Profit 20 % selling price	0.2		1200000
70% of profit= CAC	0.7		840000
How many extra floors are required			-11.915793

Table.4

The WP Park feasibility study (table 3) shows a loss of $ 10,009,266. If these costs are to be paid from the allowance of extra GFA , then from the table 5 we can see that a development contribution from the construction of an extra 12 floors will be required. We are allowing 6 towers at 14 stories sic add an extra 2 floors to each tower, = six sixteen story tower (fig. 6).

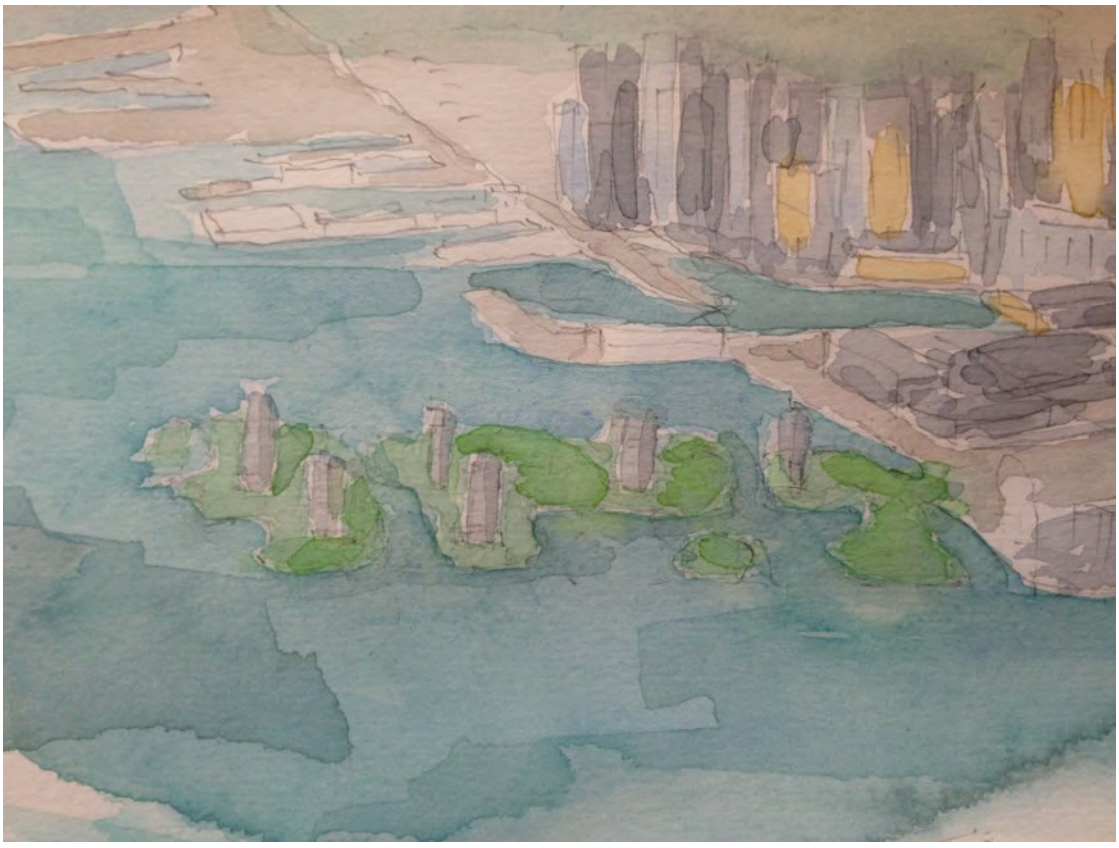

Figure.6

Conclusion

The landfall of Hurricane Sandy on Manhattan in 2012 and in particular the flooding of Wall Street have necessitated a sudden examination in North America of how to make cities on the water more environmentally sustainable. Many of the assumptions about the planning, development and financing of waterfront cities are now questionable, how can the development of a waterfront city brand or a new waterfront promenade combat increasing storm surges and sea level rise ?

The debate over how sustainable the island of Manhattan is after Hurricane Sandy has highlighted 10 years of research and scholarship into the effects of climate change on urban waterfront. The publication and exhibition of, ' Rising Currents: Projects for New York's Waterfront',(Oppenheimer, Barry, & Rodin, 2011) in 2010 is now looking particularly prescient.

In 2014, as a result of the damage of Hurricane Sandy, Rebuild by Design, an organization made up of representatives from U.S Department of Housing and Urban

Development, the NYC Mayor and Governor and the Rockefeller Foundation, ran a worldwide competition to develop innovative design solutions to protect Manhattan. The winner was the BIG U entry developed by BIG and Dutch One Architecture. The winners articulated a series of design propositions to protect the Manhattan littoral through a series of soft and hard engineering structures. However the question of how these measures and the many other speculative waterfront remediation projects that have been produced in the last two years, will be paid for. This paper attempts to address what will become a critical question in the changing landscape of waterfront development

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