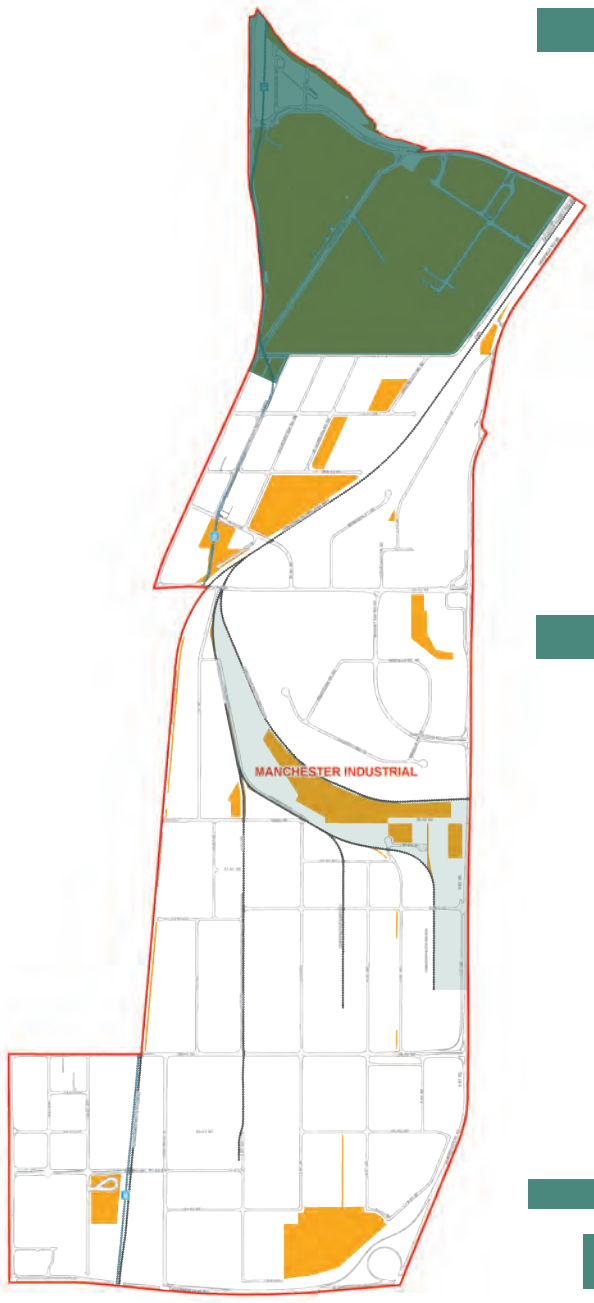
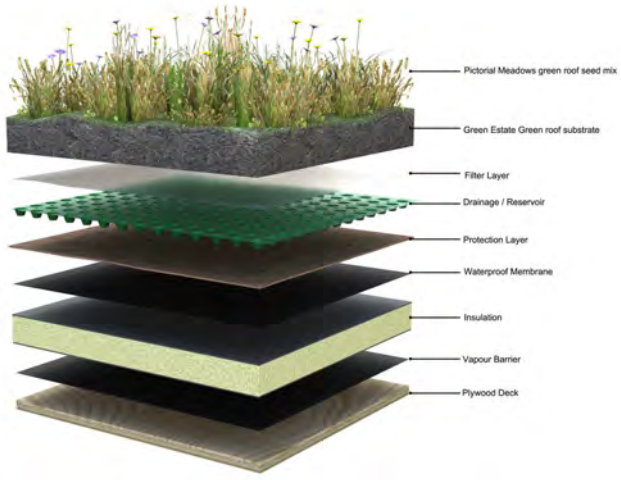
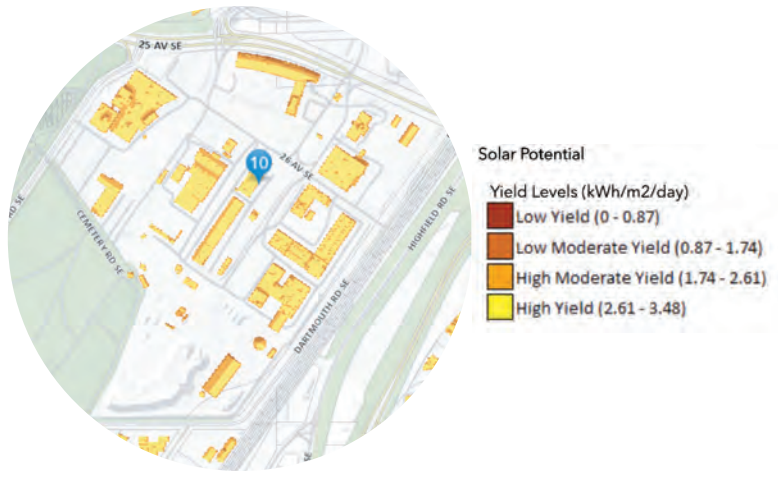
Food In Manchester



Green Roofs

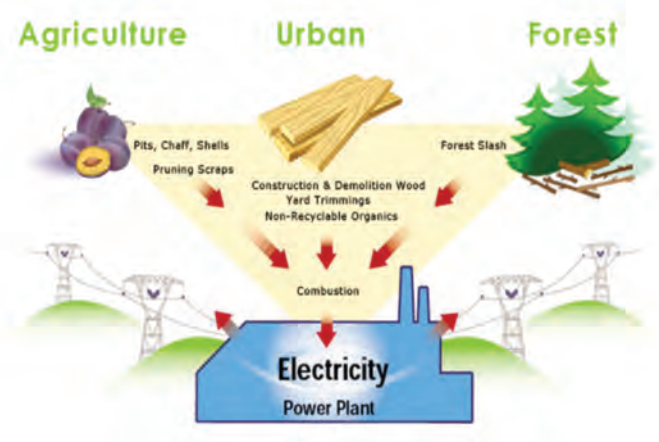


Solar Power



Community Gardens

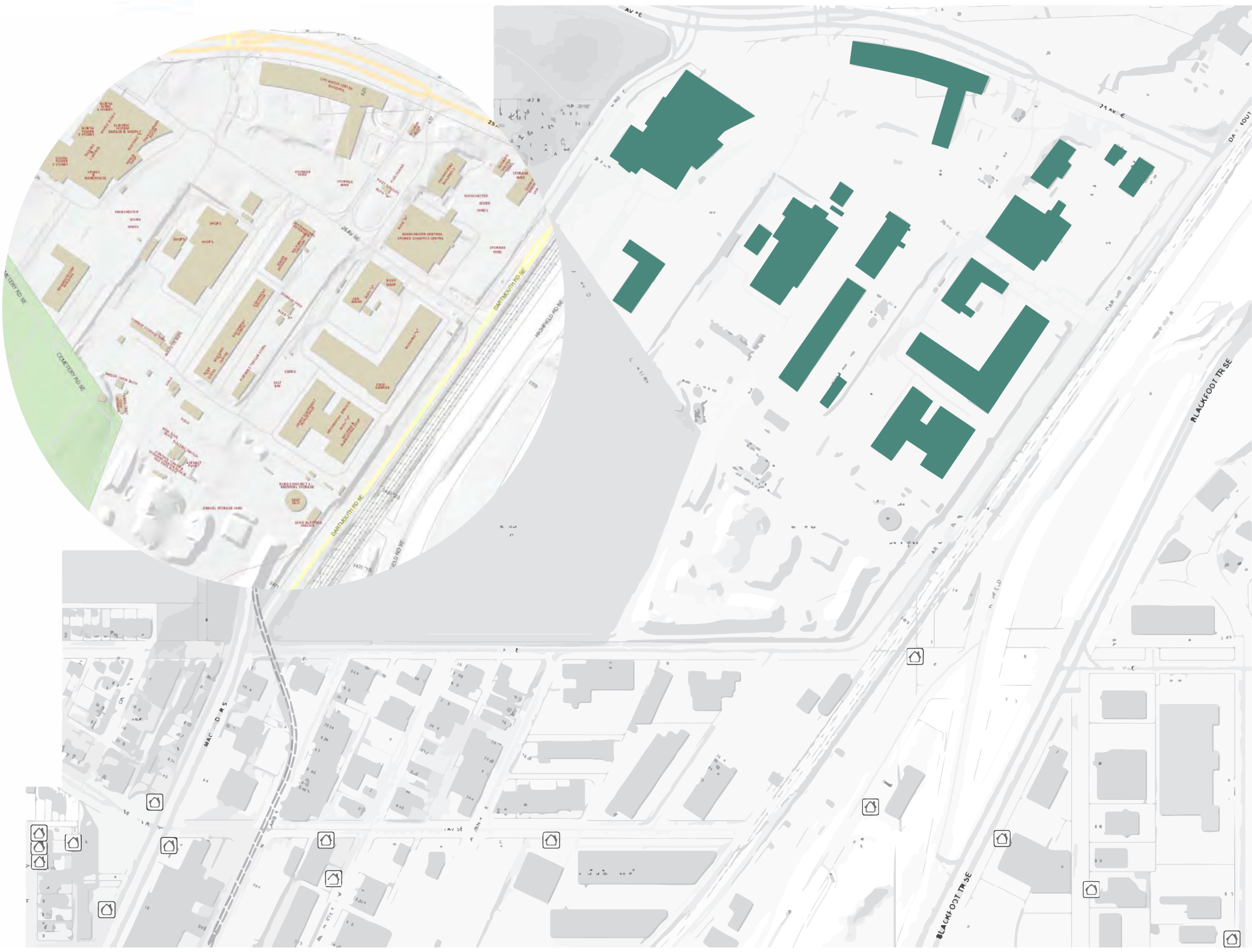
Biomass Energy



Aquaponics Farming

Vertical Farming

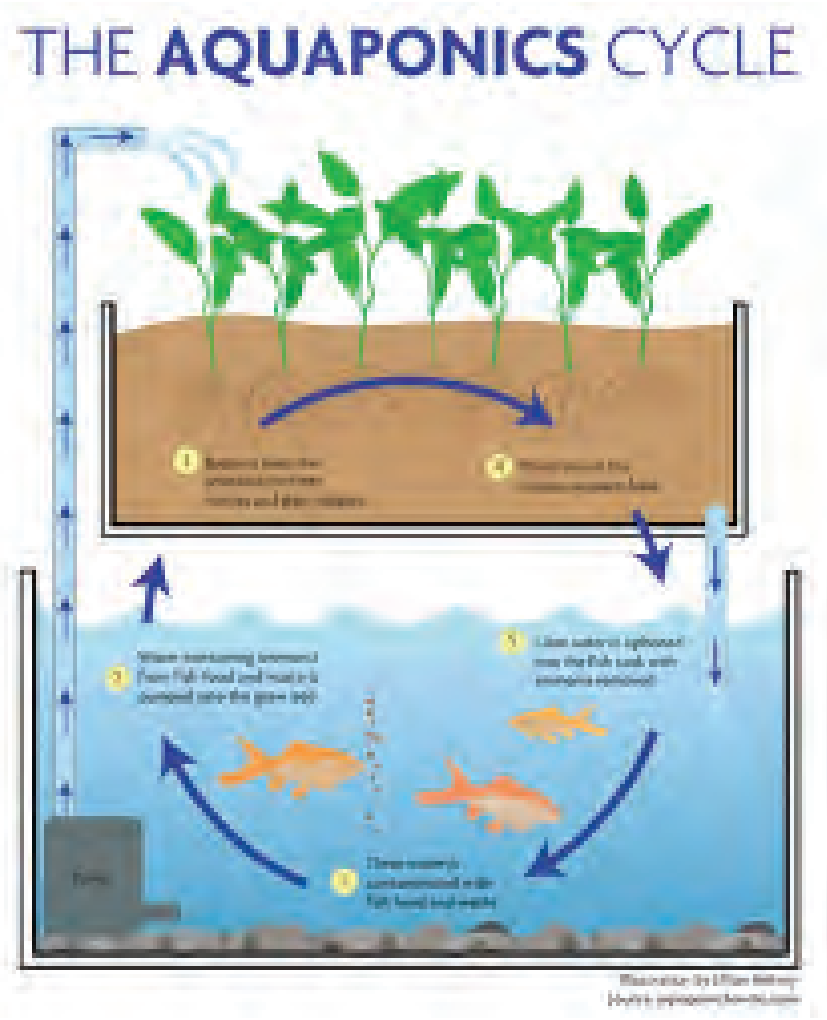
Rooftop Greenhouses



Aquaponics in Manchester

An aquaponics farm is unique because it offers individuals to build and run city farms that will harvest sustainable fish and vegetables profitably in the middle of the city. With just coming ecology and economy the aquaponics systems create a unique sustainable closed loop system. Most foods that travel to city supermarkets make an environmentally costly journey either by plane, train or truck before it turns up on supermarket shelves, the aquaponics system would reduce CO2 emissions generated by transporting food long distances. In theuse of the aquaponics system, fish excretions especially the ammonia excreted through the gills are converted into nitrates that at the end serve as fertilizer. The fish are raised at a lower level while vegetables and fruit are grown in hydroponic beds above. This unique arrangement uses water very sparingly at only 200 litres are required to produce 1 kilo of fish much below the average 1,000 litres that would be used in a conventional fish farm.

If the aquaponics farming system would be implemented in the Manchester district within the City of Calgary, if would offer inhabitants with a sustainable method of raising fish and food with substantially less water, land and labour than traditional agriculture. Aquaponics is not only sustainable, but it is a resilient farming system that provides wellness and better nutrition, it is a natural process that mimics natural lakes, ponds, river and waterways on earth. The only input in the aquaponics system would be fish food, the system would have no herbicides, pesticides or other chemicals.



Deep Water Culture Beds: DWC Beds

DWC Beds					
Total Beds	Raft (sq ft)	Plant Spaces (32 per bed)	Heads per week	Annual Heads	Basil Annual lbs
3	27	96	19	998	135
4	36	128	26	1,331	180
5	45	160	32	1,664	225
6	54	192	38	1,997	270
7	63	224	45	2,330	315
8	72	256	51	2,662	360

DWC Beds: 32 planting species in each bed with transplant to harvest time of 5 weeks.

Lettuce Varities: Romaine, Bibb, Salanova, Butterhead, Baby Greens
Herbs: Basil, Parsely, Mint, Thyme, Rosemary, Cilantro
Cooking Greens: Collards, Mustard, Kale, Chard, Bok Choy

Media Beds: Fruiting and Vining Crops

Media Beds			
Total Beds	Media bed (sq ft)	Tomatoes in lbs	Bell peppers in lbs
3	27	304	135
4	36	405	180
5	45	506	225
6	54	608	270
7	63	709	315
8	72	810	360

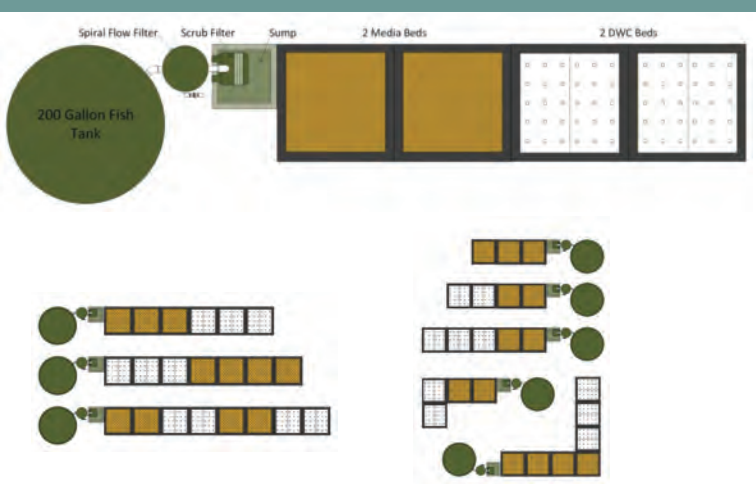
Media Beds: can harvest a wide variety of crops, example of harvest - 4 tomato plant per media bed with a yeild of 45lbs of tomatos per plant.

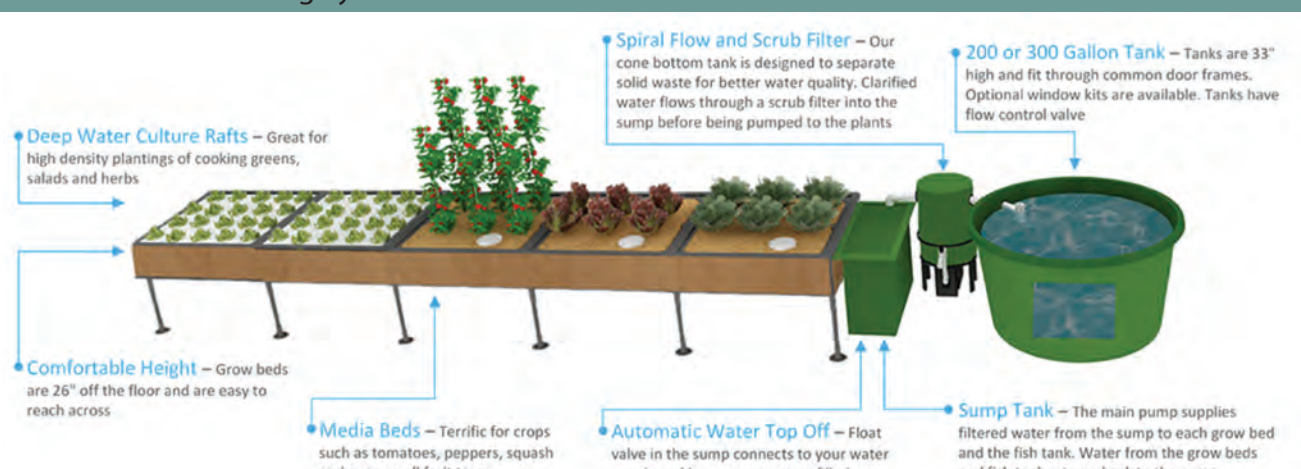
Varities: Tomatos, Peppers, Eggplants, Pole Beans, Squash, Cucumbers, Strawberries, Dwarf Fruit Trees

Benefits of Aquaponics Farming:

a. 1/6th of water used to grow 8 times more food per acre compared to traditional agriculture
b. all natural fetilizer source for fish food
c. efficient, sustainable, highly productive
d. produce free from pesticides and herbicides, fish free fram hormones and antibotics
e. allows continous production of food
f. integrated system is sustainable and earth friendly

Modular Farming System

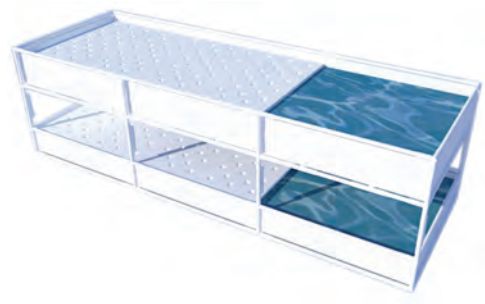




Growasis Modular Raft System

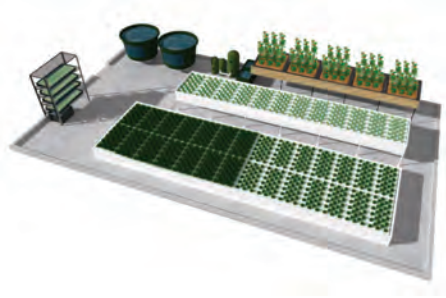
Growasis Double Decker – Number of Planting Spaces[1]																
Width\Length	8'	12'	16'	20'	24'	28'	32'	36'	40'	44'	48'	52'	56'	60'	64'	68'	72'
2'	112	168	224	280	336	392	448	504	560	612	672	728	784	840	896	952	1008
4'	224	336	448	560	672	784	896	1008	1120	1224	1344	1456	1568	1680	1792	1904	2016

Growasis Ground – Number of Planting Spaces[1]																
Width\Length	8'	12'	16'	20'	24'	28'	32'	36'	40'	44'	48'	52'	56'	60'	64'	68'	72'
2'	56	84	112	140	168	196	224	252	280	308	336	364	392	420	448	476	504
4'	112	168	224	280	336	392	448	504	560	612	672	728	784	840	896	952	1008
6'	168	252	336	420	504	588	672	756	840	924	1008	1092	1176	1260	1344	1428	1512
8'	224	336	448	560	672	784	896	1008	1120	1224	1344	1456	1568	1680	1792	1904	2016



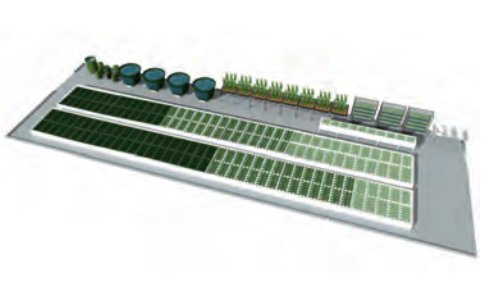
Growasis Elevated – Number of Planting Spaces[1]																
Width\Length	8'	12'	16'	20'	24'	28'	32'	36'	40'	44'	48'	52'	56'	60'	64'	68'	72'
2'	56	84	112	140	168	196	224	252	280	308	336	364	392	420	448	476	504
4'	112	168	224	280	336	392	448	504	560	612	672	728	784	840	896	952	1008
6'	168	252	336	420	504	588	672	756	840	924	1008	1092	1176	1260	1344	1428	1512
8'	224	336	448	560	672	784	896	1008	1120	1224	1344	1456	1568	1680	1792	1904	2016

Flourish Farm Model System



Flourish Farm 23 x 40' Production and Energy Estimates								
Annual heads of common leafy greens based on different average culture times in DWC[1]			DWC Info		Media Beds	Microgreens*	Fish**	Energy***
4 Weeks	5 Weeks	6 Weeks	Total sq ft	Total Planting Spaces[1]	Tomatoes[2] (est. lbs)	10" x 20" Flats	Live Weight (lbs)	Watts per hour
13,104	10,483	8,736	320	1,120	675	208	254	476

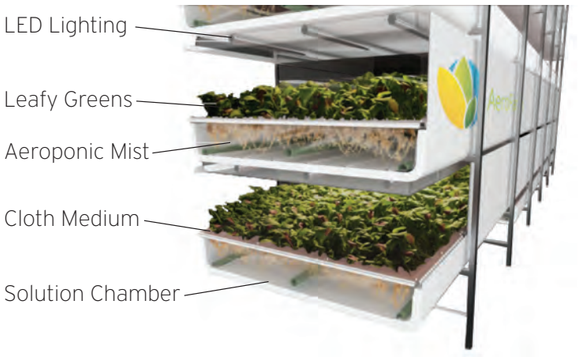
Flourish Farm 30 x 52' Production and Energy Estimates								
Annual heads of common leafy greens based on different average culture times in DWC[1]			DWC Info		Media Beds	Microgreens*	Fish**	Energy***
4 Weeks	5 Weeks	6 Weeks	Total sq ft	Total Planting Spaces[1]	Tomatoes[2] (est. lbs)	10" x 20" Flats	Live Weight (lbs)	Watts per hour
26,208	20,966	17,472	640	2,240	675	416	535	807



Flourish Farm 30 x 96' Production and Energy Estimates								
Annual heads of common leafy greens based on different average culture times in DWC[1]			DWC Info		Media Beds	Microgreens*	Fish**	Energy***
4 Weeks	5 Weeks	6 Weeks	Total sq ft	Total Planting Spaces[1]	Tomatoes[2] (est. lbs)	10" x 20" Flats	Live Weight (lbs)	Watts per hour
52,416	41,933	34,944	1320	4,480	1,080	624	867	930

Potential For
Vertical Farms In Manchester

Precedents:					
Name	**Location**	**Area Served**	**Square Feet**	**Harvests Per Year**	**Food Produced**
Aerofarms	Newark, NJ	Regionally (50km radius)	69,000	30	2,000,000lbs/year



Food Production:

Most Common Crop:

Also Possible:

Lettuce:

0.21kg/sqft
Conventional Farming
(Amount Produced)

21kg/sqft
Vertical Farming
(Amount Produced)

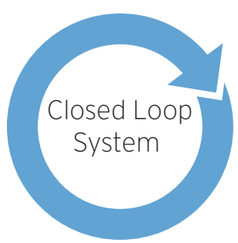
11.7kg/person
Consumed In A Year

1,170,000kg/year
Needed For Manchester

**Grain is possible but not economically viable due to costs of running farm*

- Uses less than 1% of land required to produce the same amount of crops.
- Can grow the same crop in half the amount of time.
- Year round growing allows for 30 harvests per year.

Water:



95% Less Water
Than Conventional Farming

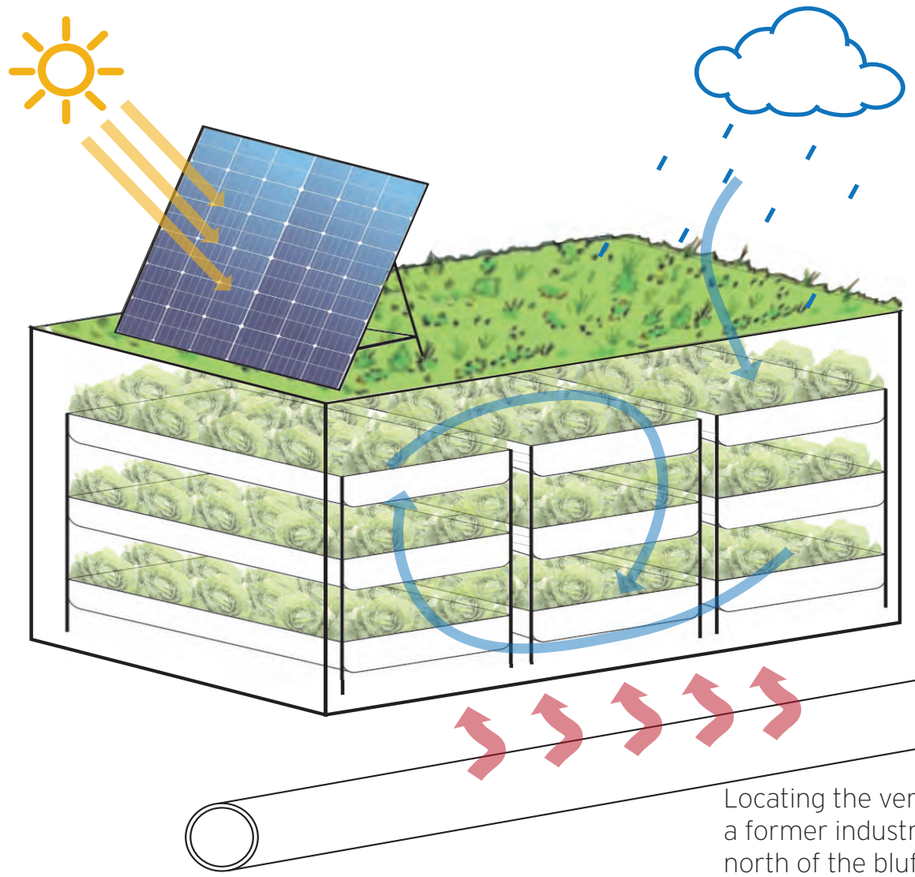
40% Less Water
Than Hydroponics

Energy:

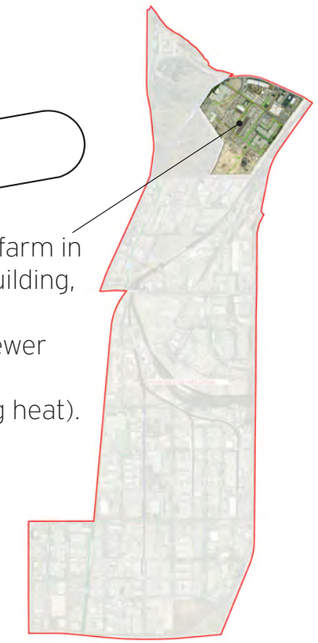
20x Greater than arable area
Area of Solar Panels Required

Artificial Lighting —— All LED lights

Climate Control —— Especially with Calgary's climate



By incorporating solar energy and a heat recovery system we can try and limit the amount of energy coming from the city. By incorporating solar panels with a green roof, not only will the panels be more efficient, but we can harvest water, use what we need, and supply the rest to other buildings. By locating the vertical farm in an industrial building close to a sewer line, we can incorporate a heat recovery system to help mitigate the amount of energy needed for climate control.



Locating the vertical farm in a former industrial building, north of the bluff in Manchester, where sewer lines head towards Bonnybrook (emitting heat).

Cost:

$1.43/kg
Conventional Farming

$6.75/kg
Vertical Farming

Benefits:

- Faster growing time + longer season = more food produced
- Can reduce transportation emissions as its grown locally
- No soil needed
- Longer shelf life + no food lost to pests = less food waste

Feasibility:

Depending on how much energy we could produce ourselves, through heat recovery and solar energy, vertical farming may not be currently viable for Manchester, due to the high amounts of energy required.

However, it may become more viable in the future, with LED lights becoming more efficient, and energy demands lowering.
With climate change it may become necessary to use vertical farming or something similar. With our changing climate we may see a decrease in arable land and in water. Vertical Farming may be the solution to these climate concerns.

It can also produce enough food for the community, providing food security. Food security may also become a requirement in the future due to our changing climate and the potential pandemics of the future.

Rooftop Greenhouses in Manchester

Rooftop farming is a sustainable agricultural solution that is capable of producing fresh produce all year round without consuming additional land. Greenhouses are a particularly effective tool to grow food in winter cities at a fraction of the water and energy costs required for traditional farming.

Even a small amount of rooftop greenhouses could enhance the food supply within Manchester and Calgary as a whole:

11,000 sq ft (0.1 ha) = fresh produce for 120-600 people

Within the northern section of our site, there is roughly **99 ha** of available rooftops on city-owned land. If **1%** of this area was converted into rooftop greenhouses, these farms could provide fresh produce enough vegetables for the current population of Manchester (approx. 750 people).

Lufa Farms, Montreal

- 3 Rooftop Farms
- 138,000 sq ft of space
- Over 200 tonnes of food/year
- Feed 10,000 people/week

Gotham Greens, Brooklyn

- 1 Rooftop Farms
- 60,000 sq ft of space
- Over 100 tonnes of food/year

Fig. 1 Conceptualization of closed rooftop garden system

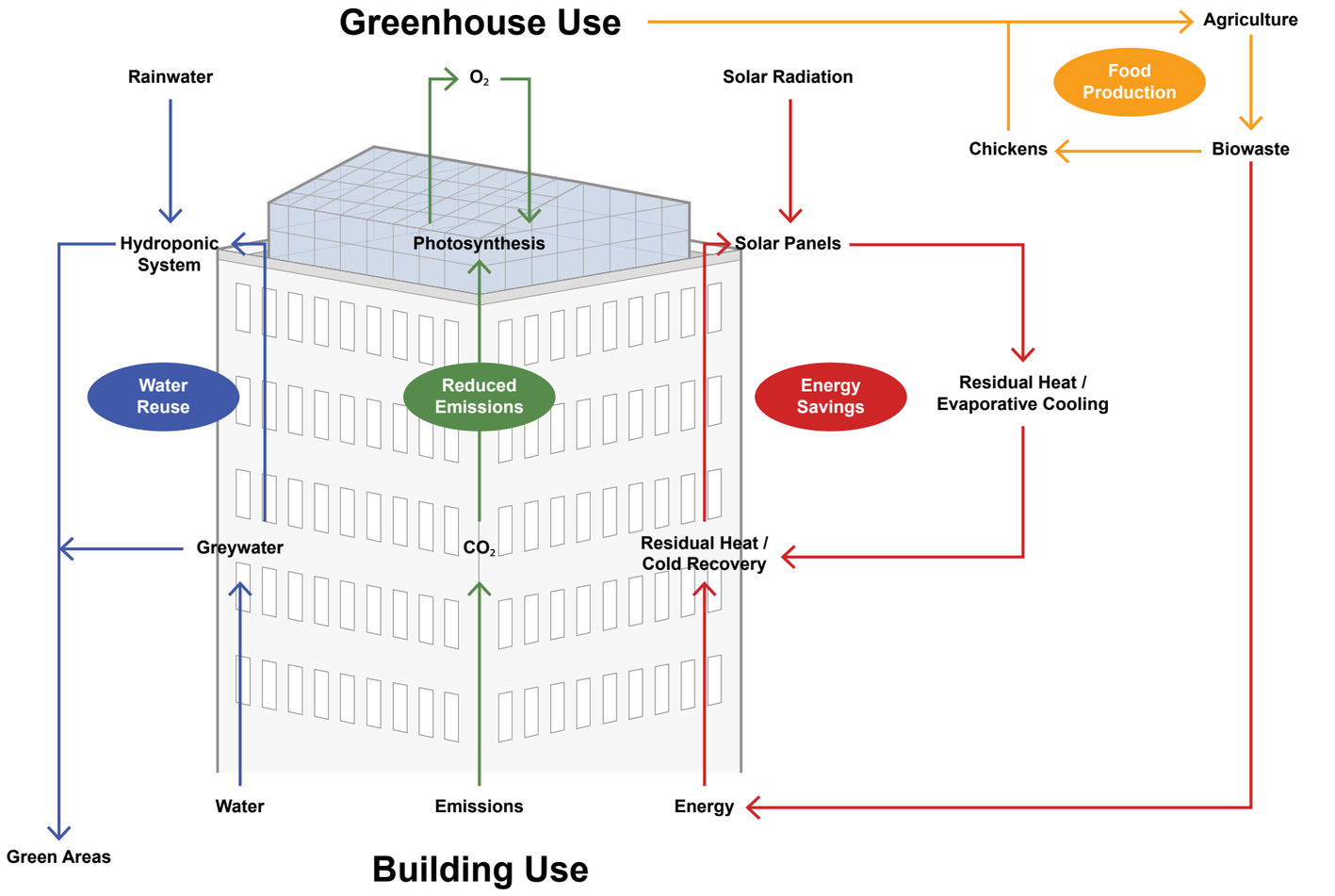
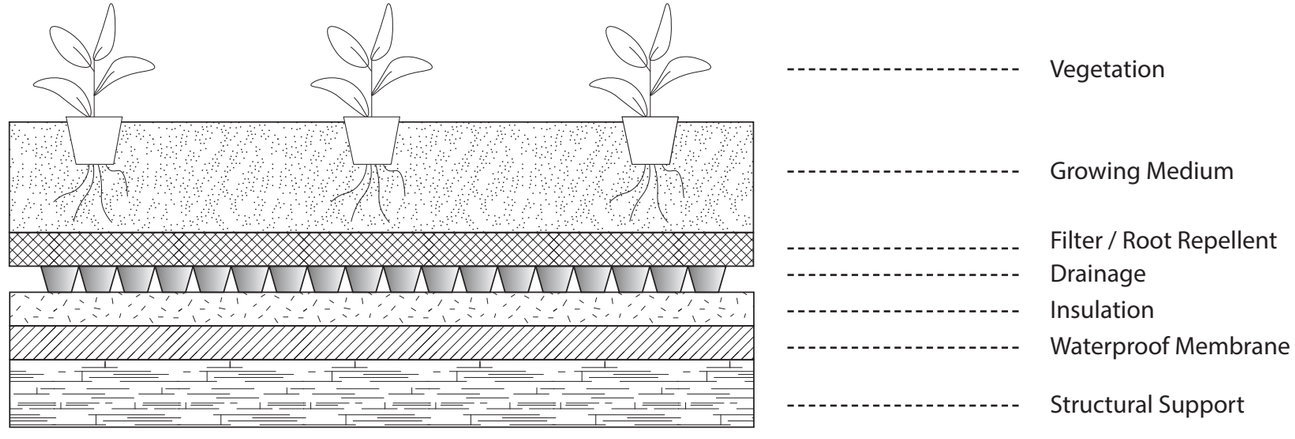


Fig. 2 Cross section of green roof



Machester's New Grocery List

Manchester Food Hub

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