Aquaponic Programming for Virginia Growers

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The Big Picture

- Population growth (~2.1 billion increase over the next 30 years) – requires a 30-50% increase in food production to sustain.
- We will need an additional 1.5 billion acres of arable land and 1,400 km^3 of freshwater per year (at least!) to sustain this.
- By 2050, arable land/person = 1/3 from what it was in 1970.
- Currently at maximum sustainable annual freshwater consumption (4,700 km^3).
- Exacerbated by climate change (indirect and direct effects)

Extreme Weather Events in US

Year	1980-2009	2010-2019	2020-2021
# of storms	153	128	42
storms/year	5.3	12.8	21
Total $ (Billion)	$1,090	$919	$258
$/year	$37.6	$91.9	$128.9

Source: NOAA Billion Dollar Weather and Climate Disasters

Biggest Weather Threat to Agriculture?

- While tropical storms/cyclones caused the most damage overall ($1.2 Trillion since 1980), FAO report states that drought will be the biggest threat to agriculture.

- Therefore freshwater = key resource for sustaining population growth.

Thought provoking question:

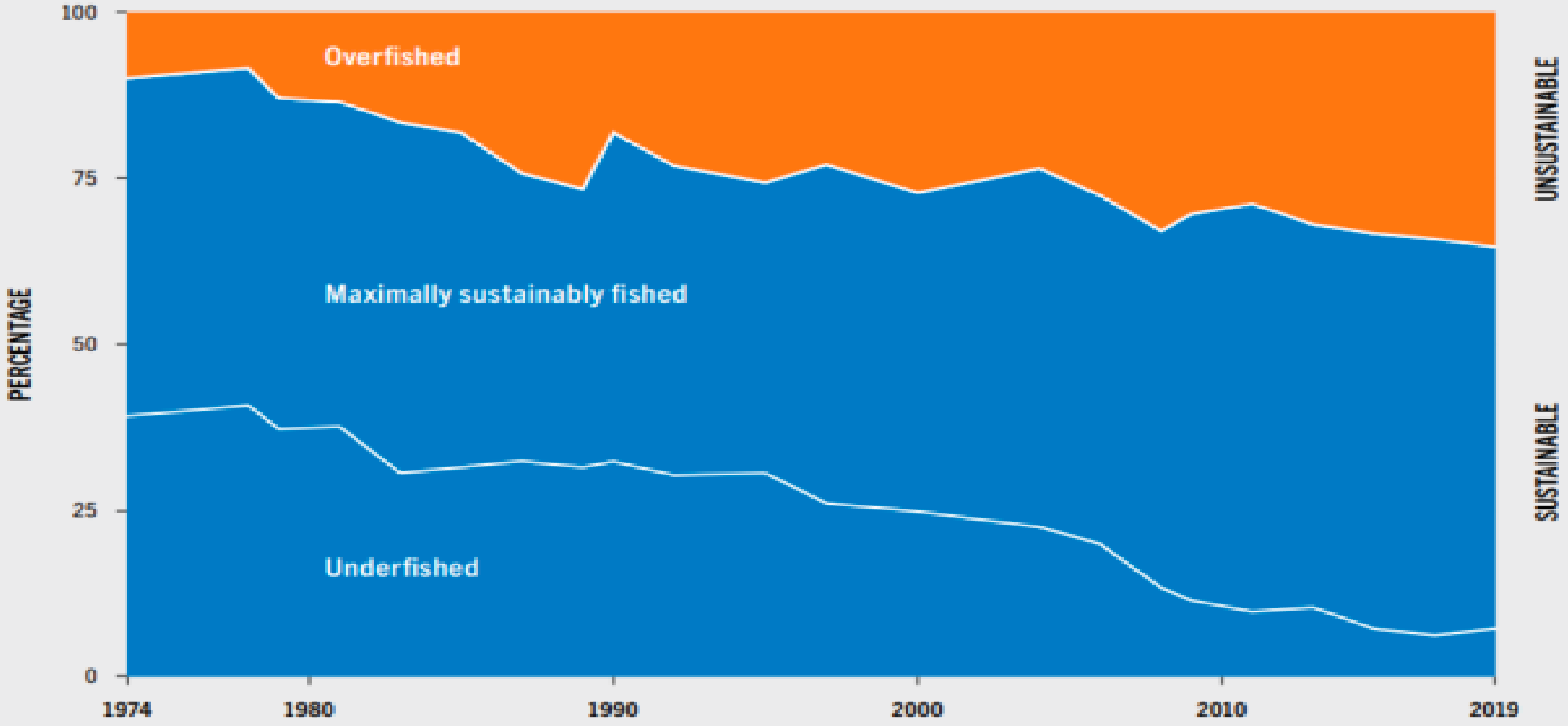
How are droughts handled in the US?

- Droughts are typically handled with decreased municipality usage (showers, land care, car washes, etc.) in the US

- However, agriculture accounts for 70-90% of US **CONSUMPTIVE** water usage.

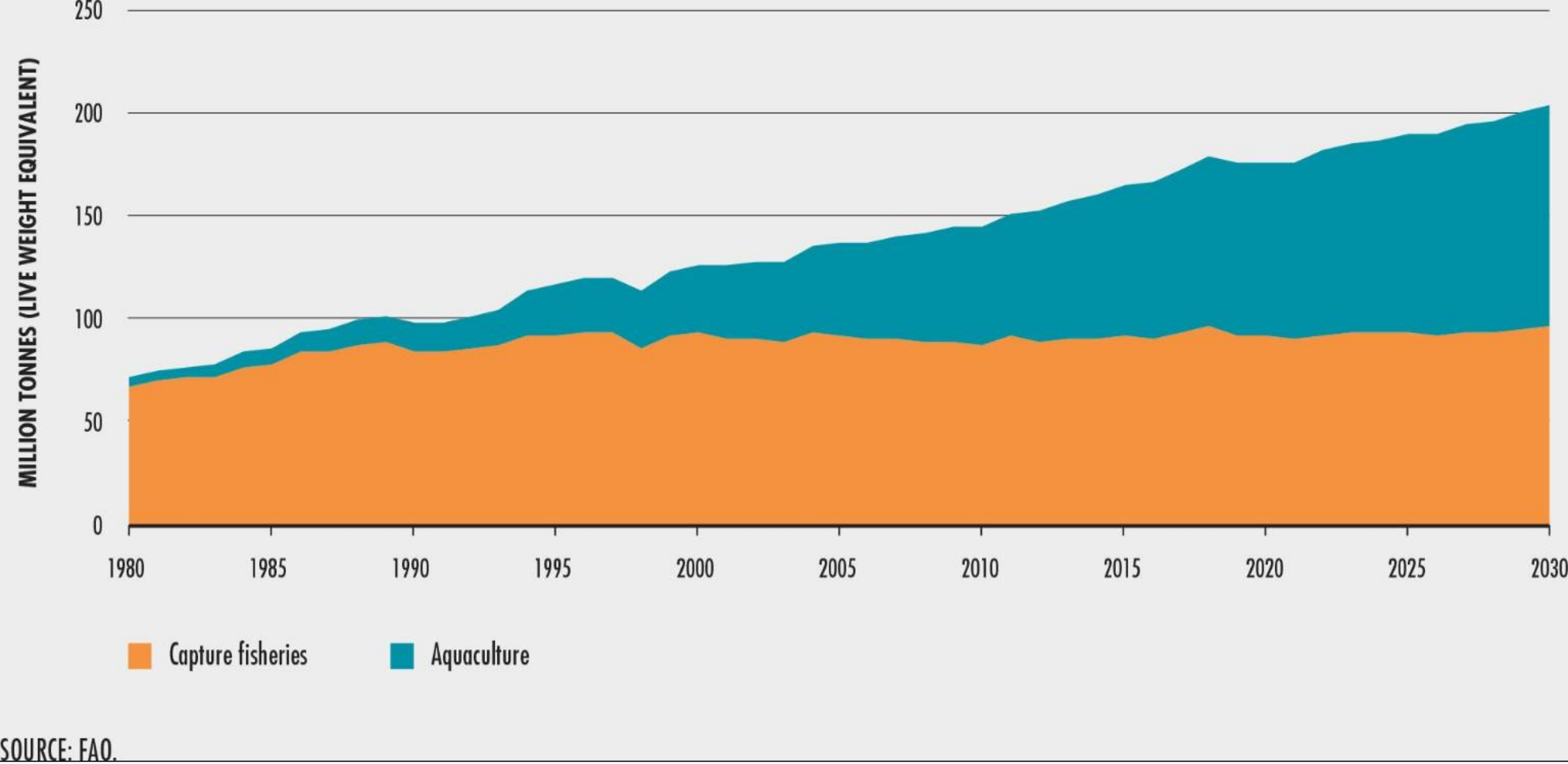
Fun fact: In 2021, Water started being traded on the stock market as a commodity for the first time.

FIGURE 23 GLOBAL TRENDS IN THE STATE OF THE WORLD'S MARINE FISHERY STOCKS, 1974–2019



SOURCE: FAO.

Source: FAO, Global trends in the state of the world's marine fish stocks, 1974-2019.



Source: FAO - State of The World Fisheries and Aquaculture 2020

Why Aquaponics?

- Fish are the most efficient animal we farm (space, water, nutrients)
- Organic plant production is possible*
- Can be located anywhere with access to freshwater and electricity (rural, urban, rooftops, etc.)
- Multi-disciplinary learning tool
- Reliance on biologically derived nutrients seems to benefit plants
- More productive using less resources
- Co-production of fish and plants
- Big push in VA for CEA**

SUPERIOR Fresh

30X MORE FOOD

Superior Fresh is more efficient than traditional farms. We grow 30x more food per acre!

WATER USAGE

Water is our most precious resource; our farm ensures every drop is used as efficiently as possible.

5 LBS : 30 LBS

For every 5 lbs of fish food, we can grow 5 lbs of salmon and an additional 25 lbs of organic vegetables.

COMPOSTING

We waste nothing; anything coming out of our fish and greenhouse is converted into compost. It is then returned to the soil on our surrounding 800 acres.

Aquaponic Programming Thinking

- Who are the existing producers and how can VSU be a resource for existing producers in VA?
- How can we make VA an attractive location for potential producers/companies?
- How can we drive innovative for the industry? What benefit does aquaponic production bring to VA? (Eutrophication/conservation; year-round local food; educational/community tool; etc)

Key areas:

1) Public perception (marketing, surveys, resource usage metrics, etc.)

2) Farmer support (stocking programs, workforce development, educational videos/offerings, producer guides, etc.)

3) Innovative (vertical, alternative design, alternative species)

4) Value-add (freeze drying, non-edible production, mineralization/closing loop)

Aquaponic Programming

Short-term (1-year)

- ***Pilot-scale*** replicated research systems
- MADE-U (V.2) (x1)
- Extension Agent Training and Public Build Workshop

Mid-term (2-3 years)

- Innovative/alternative production demonstration (UA + VSU Grant)
- Continuous generation of resources (producer guides, factsheets, data sets, etc)
- Continuation of workshop/hands-on learning opportunities
- Economics of AQP + Market analysis of VA
- Development of workforce pipeline
- Further development of MADE-U (x5 more units)

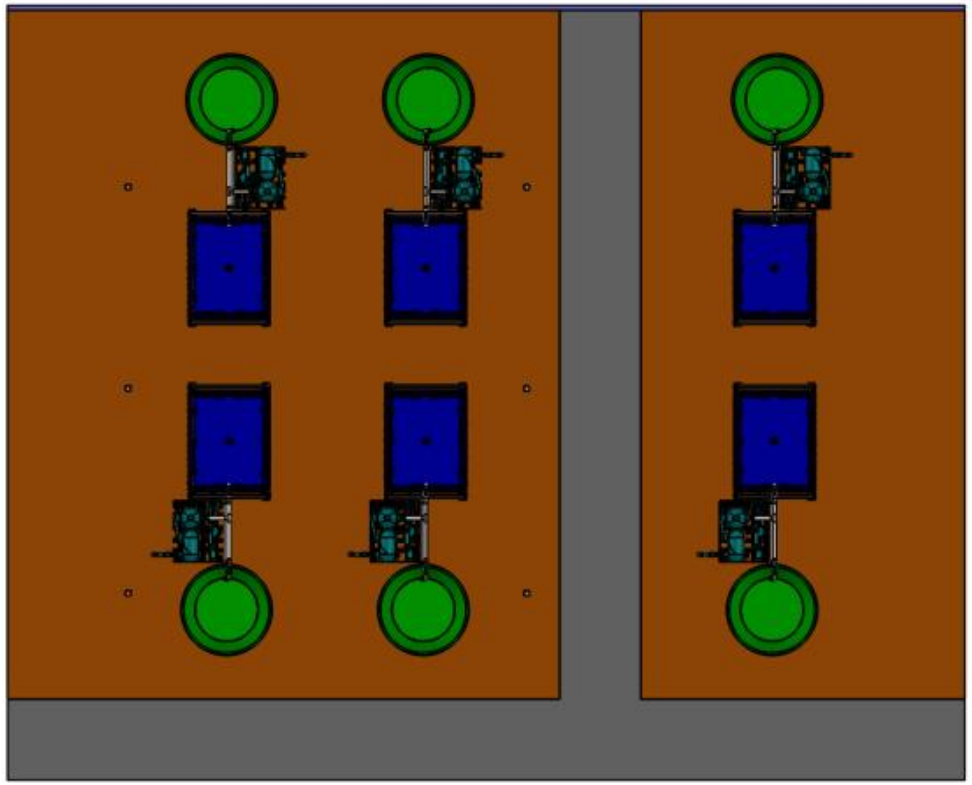
Aquaponic Programming Continued

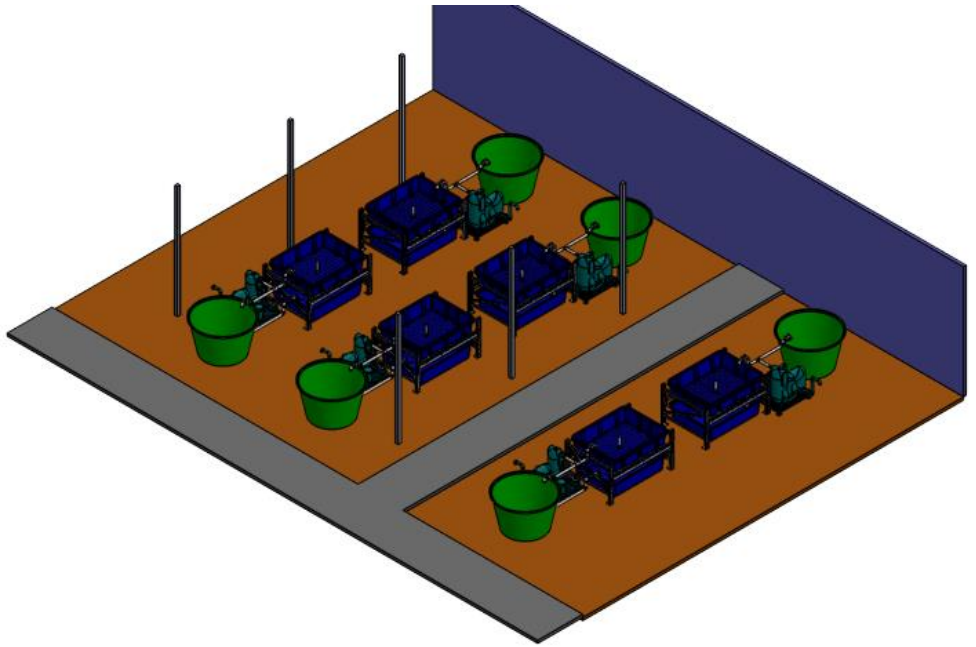
Long term (3-5 years)

- Stocking program (fish and plants)
- Working with producers/companies looking to establish AQP in VA
- Archive of educational materials (videos, factsheets, producer guides, etc.)
- Multi-state collaborations
- VSU Indoor COE*
- Established workforce pipeline

****Not set in stone – always open to ideas/what is needed****

Pilot Scale Replicated Research Systems





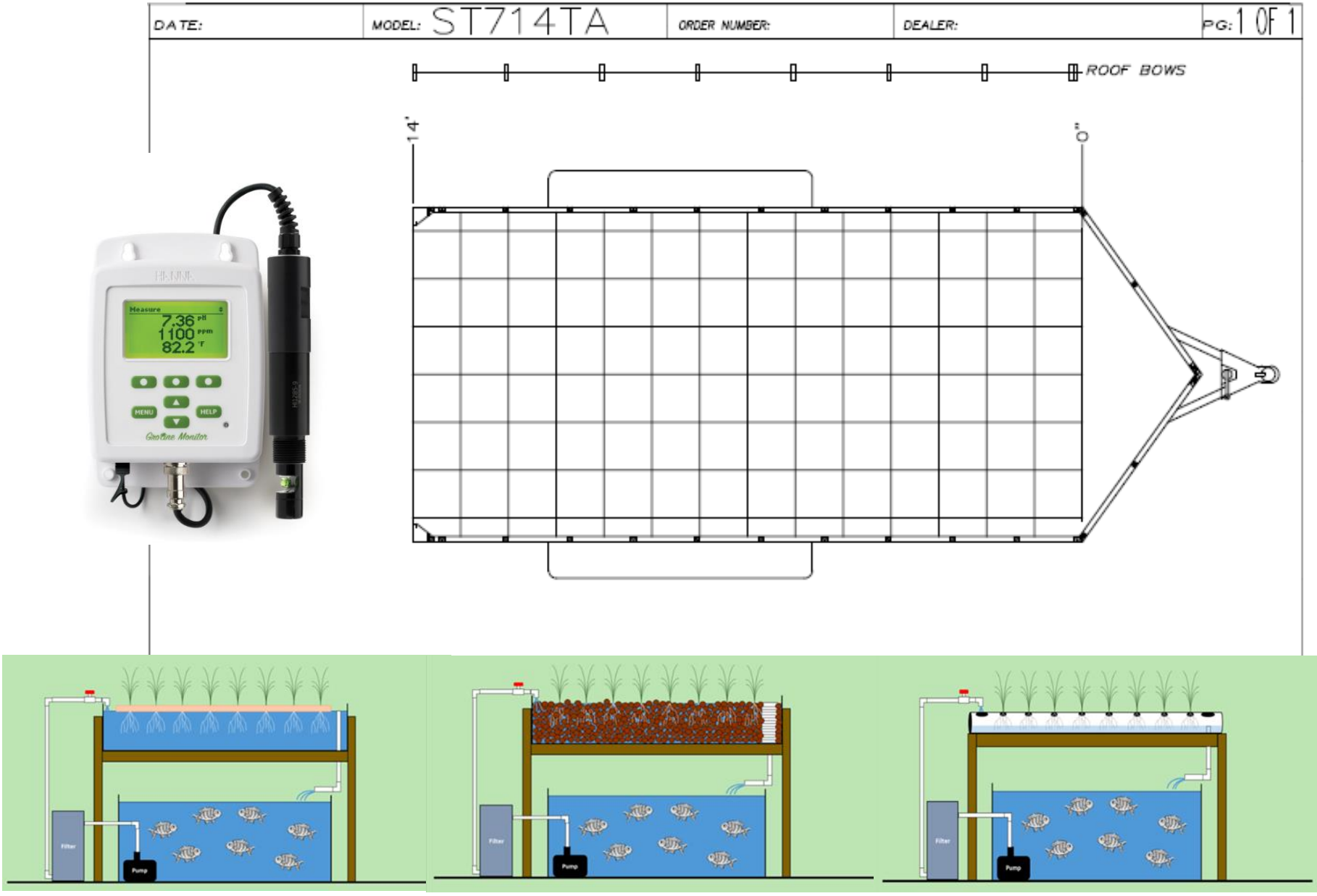
Located within Controlled Environment Greenhouse at Randolph Farm (VSU)

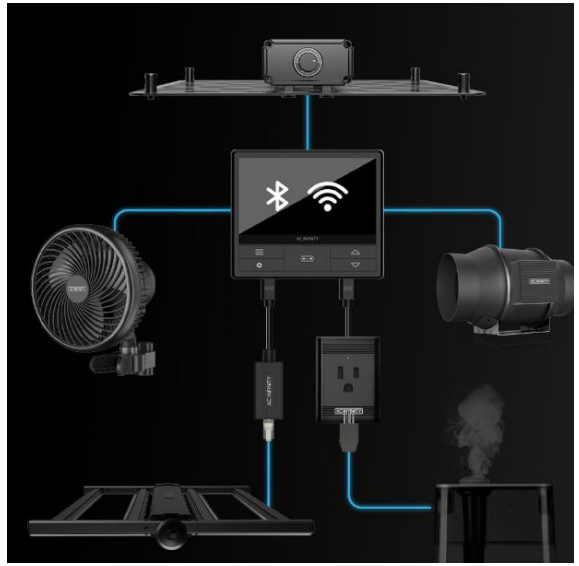
Total System Volume – 300 gal
Fish Tank Volume – 175 gal
Sump Tank Volume – 100 gal
Other System Volume – 25 gal

Mechanical Bead Filter (AST 2000)
Grow Beds (1.8 m^2)
Airstones in Sump and Fish Tank
Ability to be Decoupled

MADE-U (V.2) – Mobile Aquaponics Demonstration and Education Unit

- Conceptualized in 2016; formalized in 2017
- COE partnership turned VSU Venture
- Just in 2023 has been to 6+ events of various stakeholders; estimated average exposure of 500 people per event
- 10,000 + impressions since formalization





6 units strategically located throughout the state and “operated” by extension agents with our support

Extension Training and Public Workshop

- Training of extension agents/state-wide introduction of VSU and aquaponics programming; needs assessment

- Public workshop – 1-day formalized training (classroom and hands-on) as well as tour of VSU facilities

Workshop will include the following classroom lectures:

- Introduction to aquaponics (basic learning) (1 hour)
- Water quality in aquaponics (45 min)
- Fish and plant health in aquaponics (1 hour)

Hands on training includes:

- Filleting fish (45 min)
- Food safety protocols (45 min)
- Plant lifecycle overview (45 min)

Workshop will also include tour of VSU facilities; food and beverages likely provided

Questions?

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