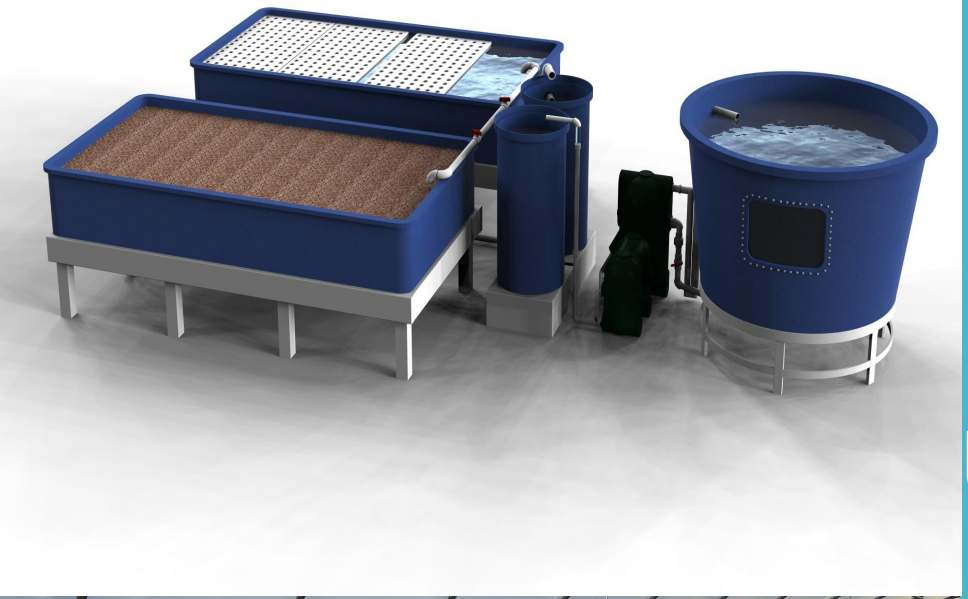


Demonstration of a Small Scale De-coupled Aquaponics System Utilizing Floating Bead Bioclarifier and Airlift Technology

Paul Begue, AST System Designer

SA Aquaponics SMALL SCALE

AST™ BEAD FILTER SOLUTIONS

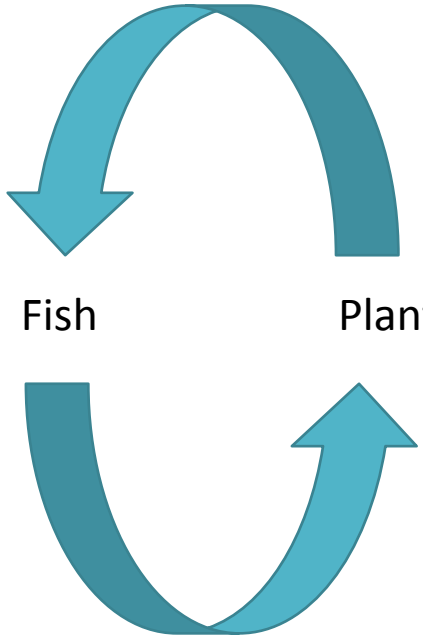
Background

- 2017 was an entry year for AST aquaponics
- Entry success with 3 commercial systems utilizing de-coupled architecture
- 2018 marked concrete design and implementation
- Focus on RAS and collaboration with hydroponics experts

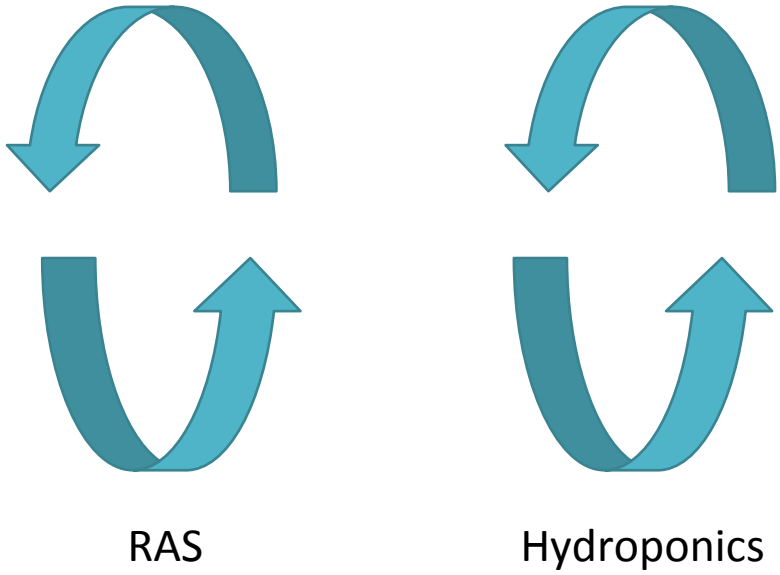
Colorado Aquaponics

AST FIT Systems

System Design Options

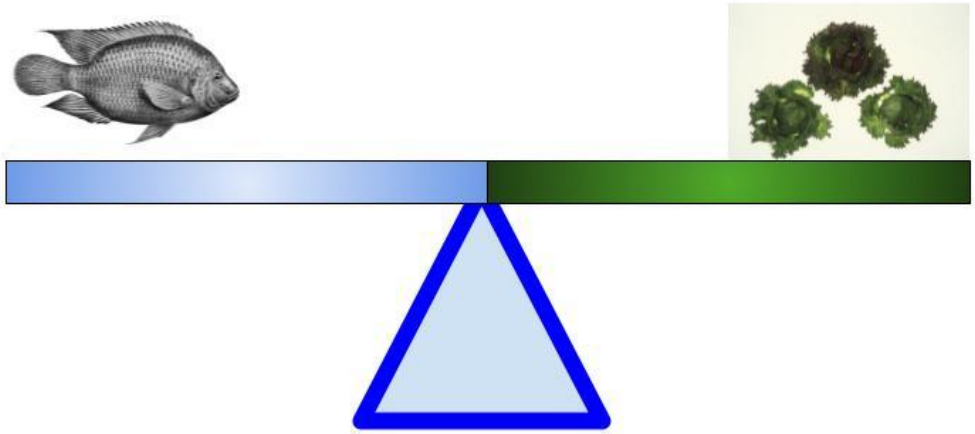


Coupled

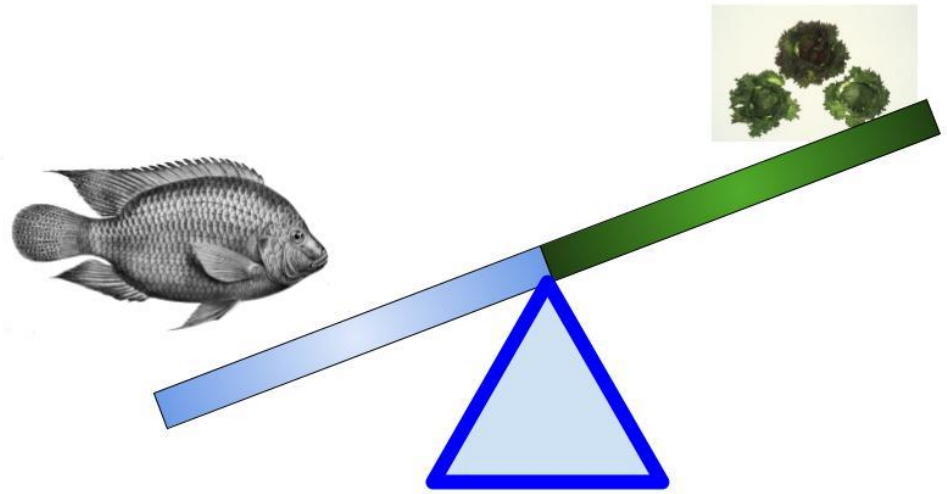


De-Coupled

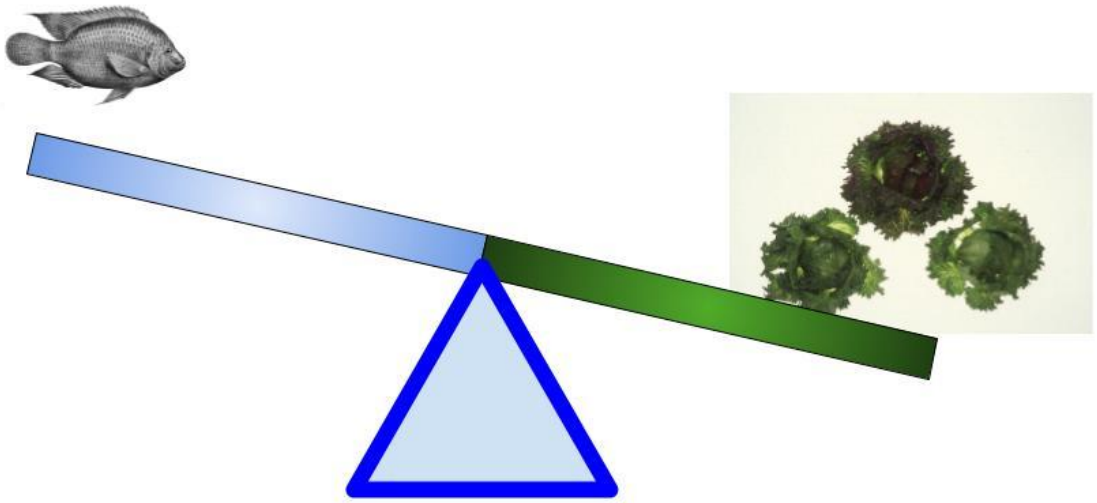
Balance?



Fish Heavy

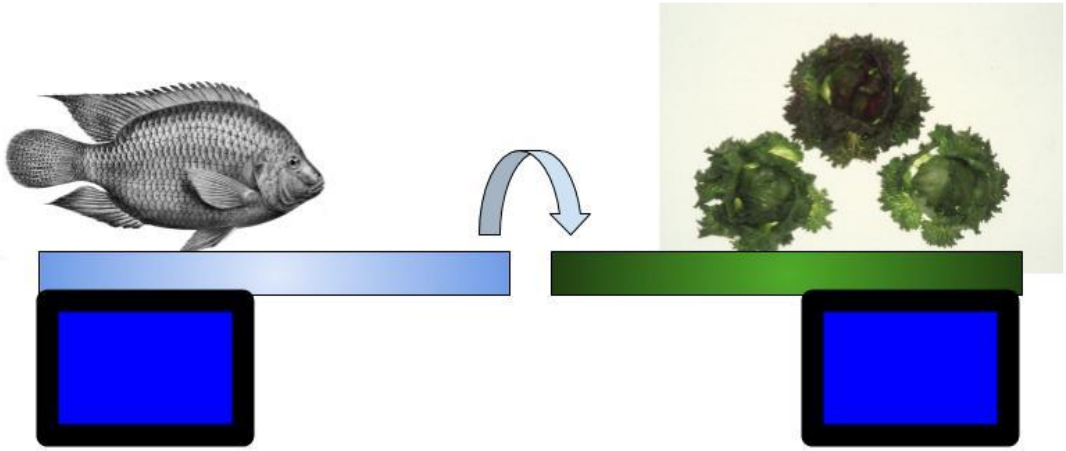


Plant Heavy



Balance Both

De-coupled System
25-50% more efficient



Coupled vs Decoupled Systems

BENEFITS

	Coupled Systems	Decoupled Systems
Minimal Water Loss	✓	✓
More Efficient Solids Control	✓	✓
Auto-pneumatic Backwashing	✓	✓
Minimized Mechanical Equipment	✓	✓
Concentrated Sludge	✓	✓
Compact Footprint	✓	✓
Maximized Nutrient Utilization		✓
Optimal pH Control		✓
Optimal Temperature Control		✓
Disease Control		✓
Better Biosecurity		✓
Lower Energy Use		✓

Coupled vs Decoupled Systems

BENEFITS	Coupled Systems	Decoupled Systems
Minimal Water Loss	✓	✓
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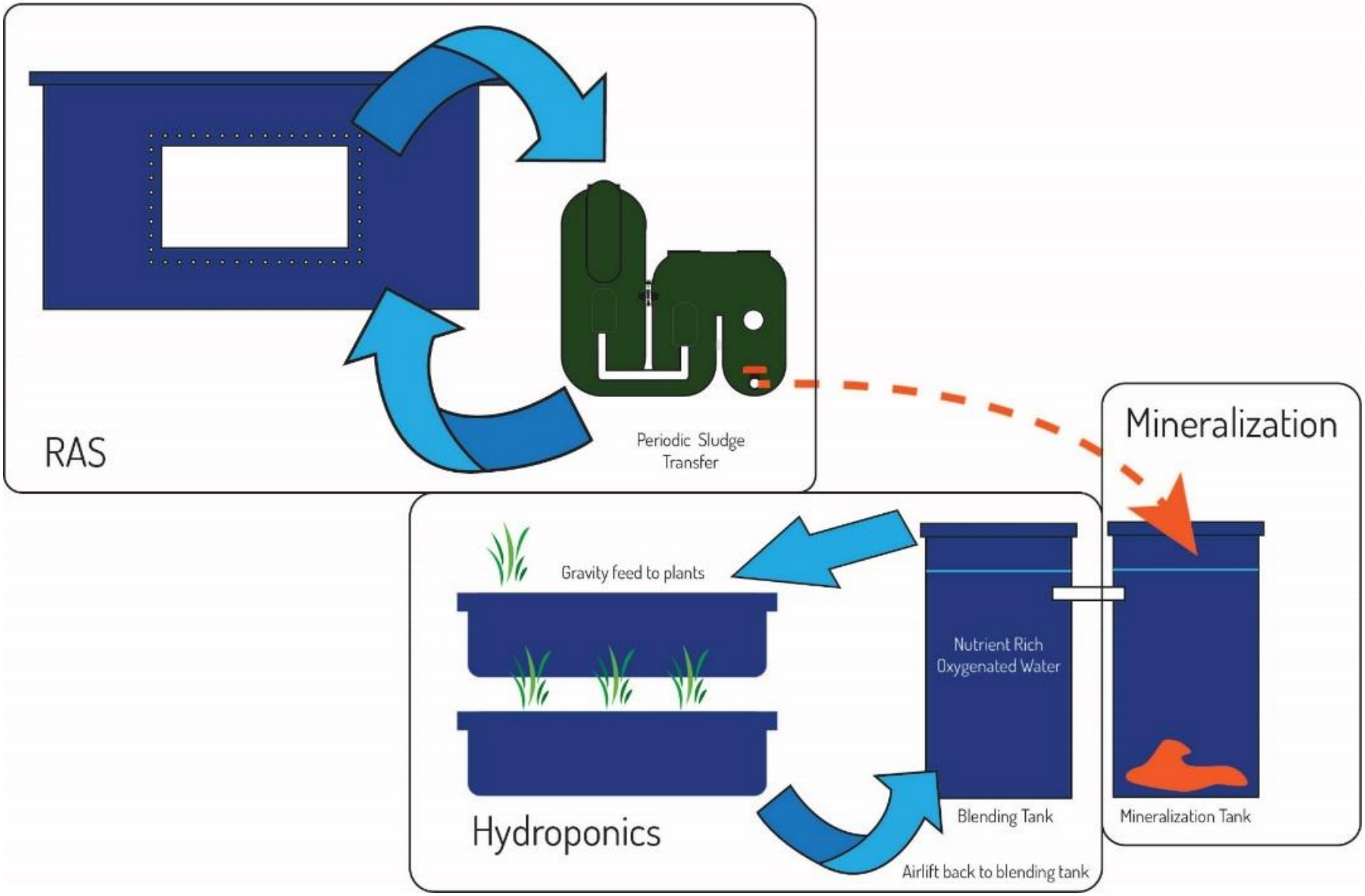
Concentrated Sludge	✓	✓
Compact Footprint	✓	✓
Maximized Nutrient Utilization		✓
Optimal pH Control		✓
Better Biosecurity		✓
Lower Energy Use		✓

Click to add text

25-50% More Efficient!

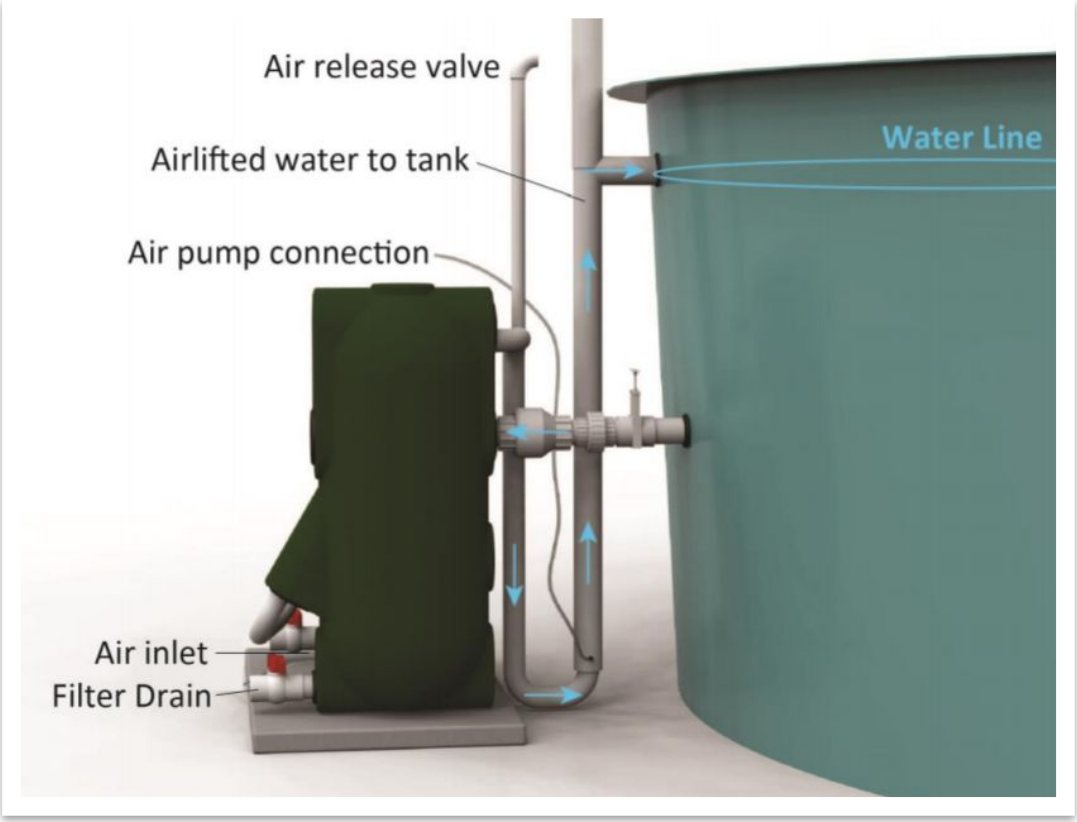
Commercial Applications

Decoupled Aquaponics: System Diagram

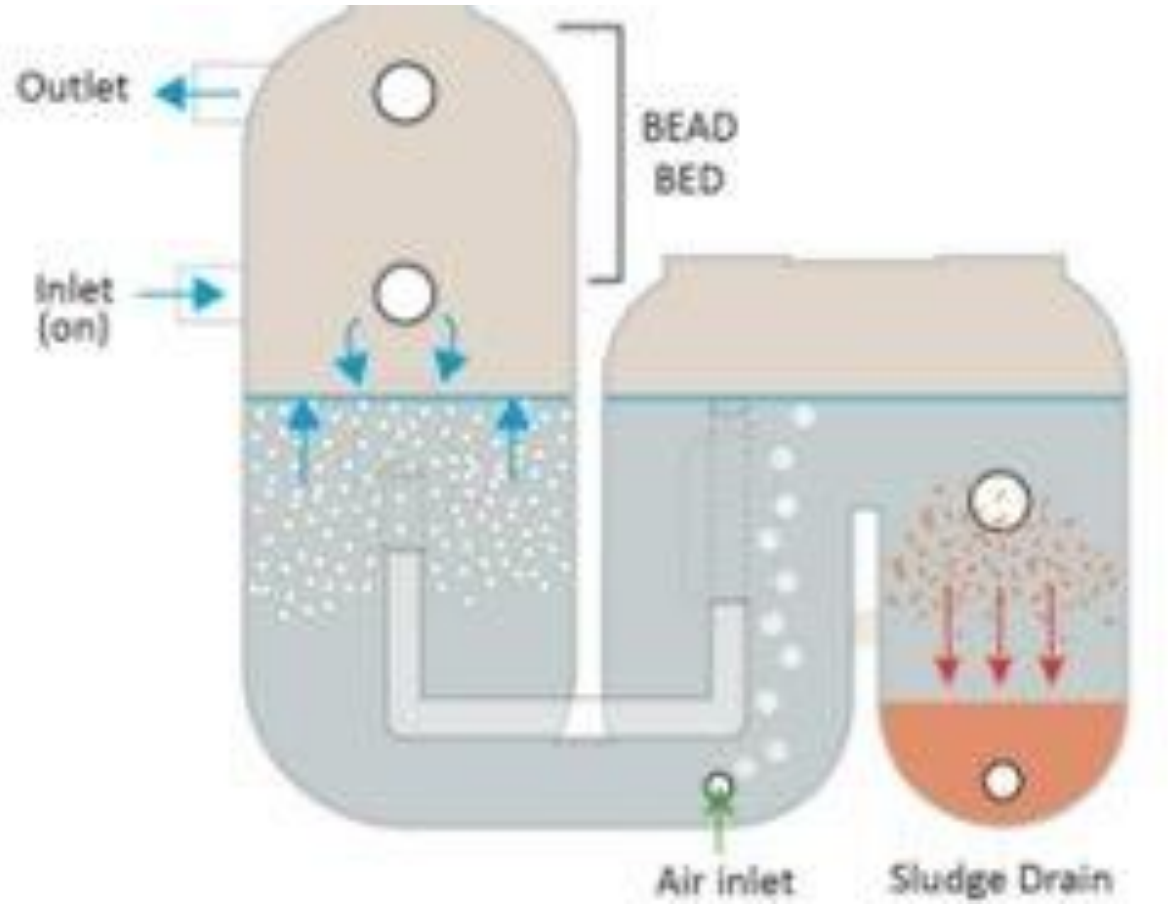


AST Endurance Filter

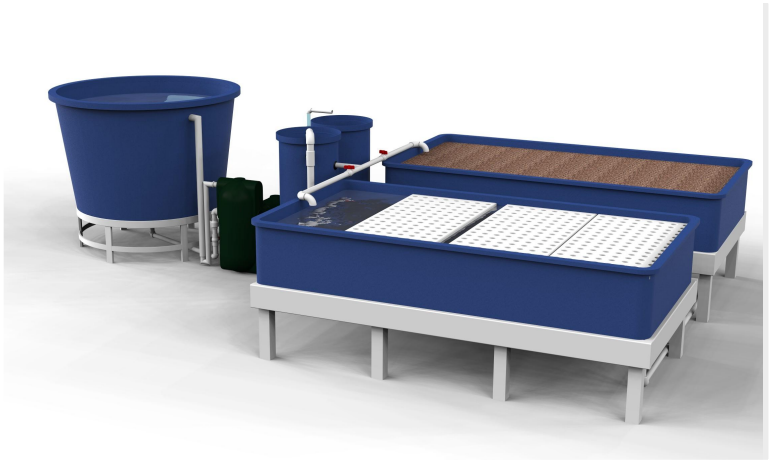
- AST Endurance 2000
- Gravity feed, airlift return configuration
- PSD (pneumatic sludge discharge)

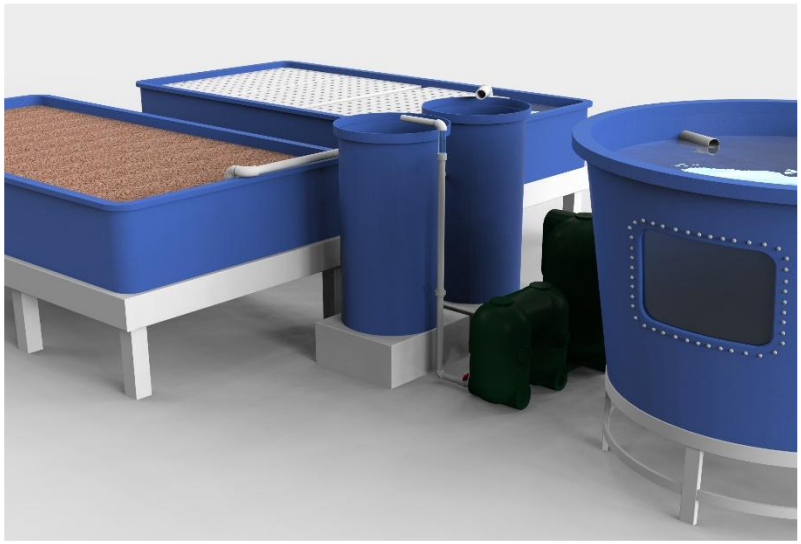


AST Endurance



Small Scale System Design



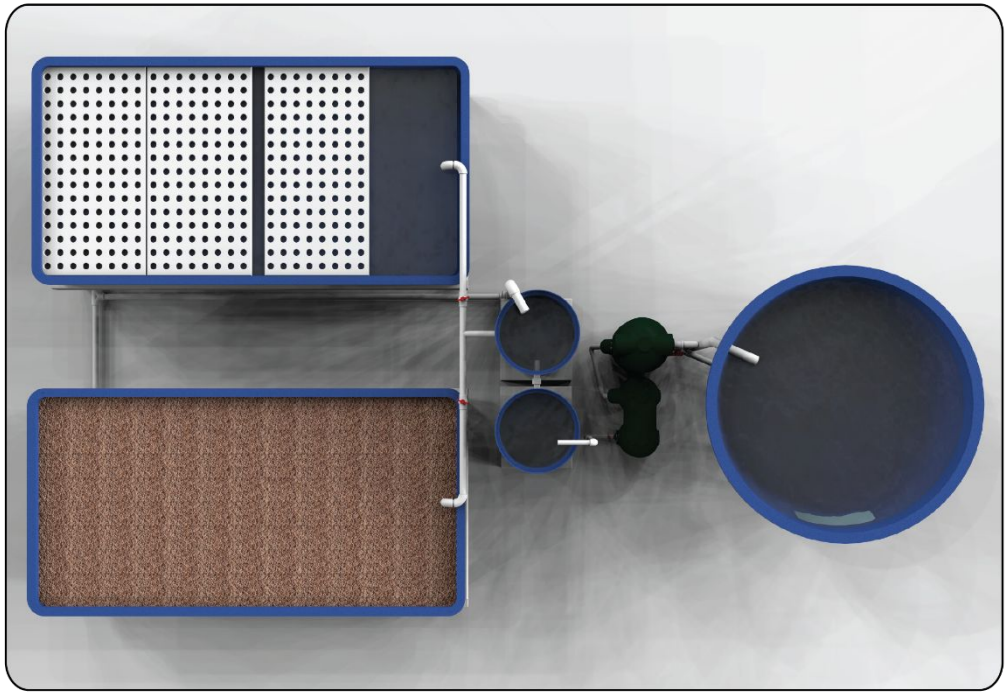


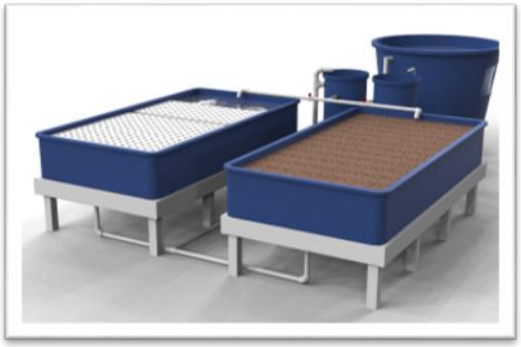
System Components

Part 1: RAS

Part 2: Mineralization

Part 3: Hydroponics





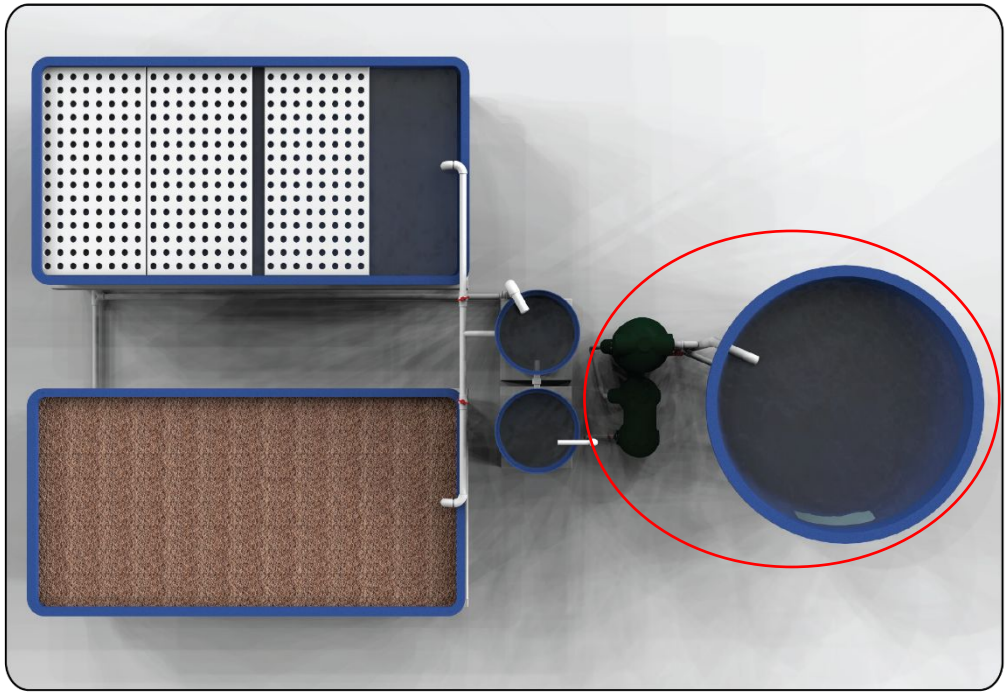
System Components

Part 1: RAS

Part 2: Mineralization

Part 3: Hydroponics

Endurance 2000 Bio-clarifier designed with aquaponics in mind!



Recirculating Aquaculture System

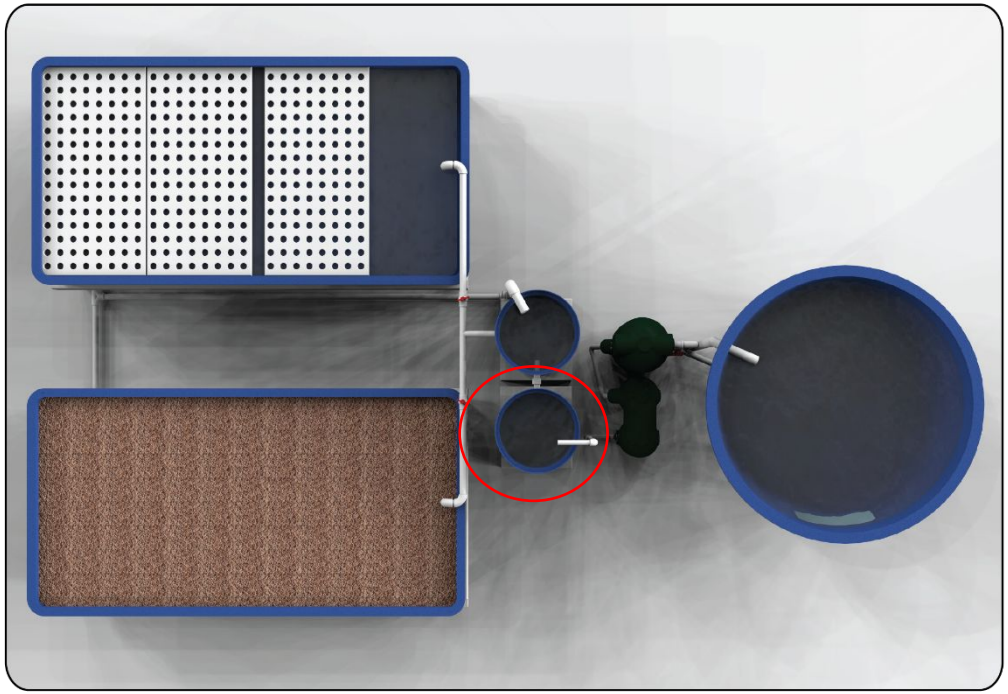
System Components

Part 1: RAS

Part 2: Mineralization

Part 3: Hydroponics

Aerobic digestion – avoids foul odors and bulking of solids



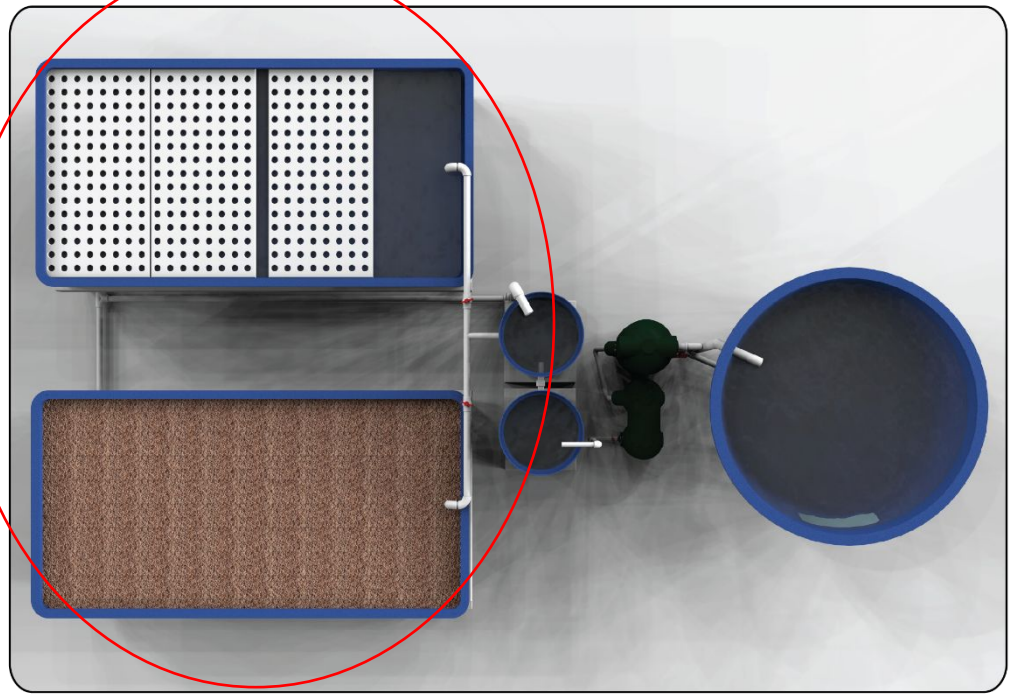
System Components

Part 1: RAS

Part 2: Mineralization

Part 3: Hydroponics

De-coupled @ 20 g/m2 feed rate ratio



Part 1: RAS

- Feed Rate: 150g/day (40% Protein/10% Fat)
- Current Density: 0.08lb/gal
- Flow Rate: 10-15 gpm

WQ	
NH_3	0.51 mg/L
NO_2	0.3 mg/L
NO_3	10.3 mg/L
pH	7.8
D.O .	6.9 mg/L
Alk	200 mg/L
Temp	24˚C
Hard	150 mg/L

Part 2: Mineralization

- Sludge Discharge:1 liter/backwash @1-3% solids
- Aeration: 0.5CFM (Linear Air Pump)
- Settling Column
- Sludge Residence Time: *20-30 days
- Aerobic sludge digestion

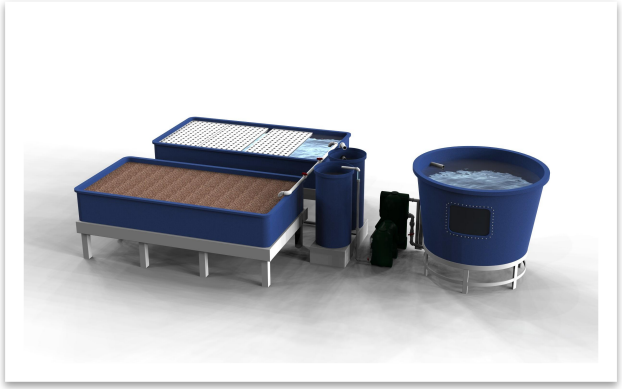
WQ	
% solids	1-3%
pH	7.8
D.O.	6.9 mg/L
Temp	24˚C

Part 3: Hydroponics

- Application: Deep Water Culture
- Crop: “Bibb” Lettuce
- Density: 37.8 plants/m^2
- Flow Rate: 8-10 gpm (airlift)
- Seed to Harvest: 42-49 days
- pH Control: Sludge digestion process + manual addition of phosphoric acid (85%)

WQ	
NH_3	0.038 mg/L
NO_2	0.56 mg/L
NO_3	8.22 mg/L
pH	6.5
D.O.	6.9 mg/L
Alk	200 mg/L
Temp	24˚C
Hard	150 mg/L

Inputs



- Total Water Use (7.6 gal/day)
- Feed 150g/day @40%Protein, 10% Fat
- Light 400 watt Metal Halide 18,6 (7 days a week) Qty 4
- Air pumps:

  Backwash – 2 watt Diaphragm compressor

  Airlift and aeration – 261 watt,200LPM Linear air pump

Outputs

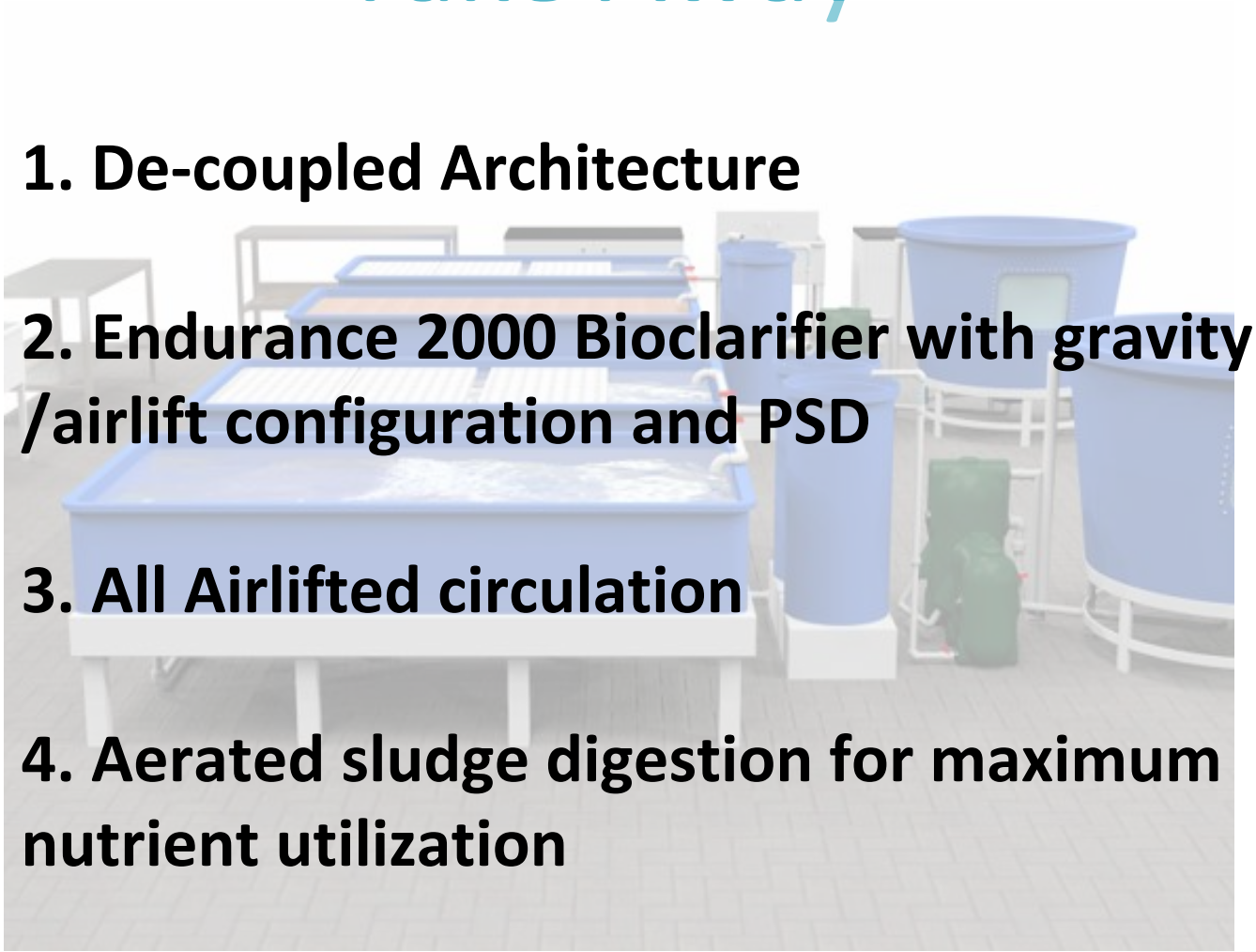
Capacity:

- Leafy greens at 232 cells
- 0.5lbs/gallon (species dependent)

Annual Output:

- Leafy Greens: 1728 Heads of Lettuce
- 300 lbs of fish (six month grow out)

Take Away



1. De-coupled Architecture

2. Endurance 2000 Bioclarifier with gravity /airlift configuration and PSD

3. All Airlifted circulation

4. Aerated sludge digestion for maximum nutrient utilization

Visit Small Scale Aquaponics in Booth 17

www.ASTfilters.com