BULLITT FOUNDATION

Mission-Driven Infrastructure Multi-charrette Workshop

Bullitt Grant Report Slide Deck | March 1, 2021

SERA Architects | Long Haul Capitol Group | URBAN.SYSTEMS

OMSI

Introduction to the OMSI District Project

- **A special site - 23 acres of downtown riverfront with OMSI at its heart**
  - 1 million annual visitors to OMSI.
- **A multi-stage planning, design and development project**
  - ~ 230,000 sq. ft. of existing buildings
  - ~ 2.3 Million sq. ft. of new, mixed use space, potentially including: Office, Residential (Affordable & Market), Hotel, Makerspace, Retail, Education, Health Care
- **A partnership with the Affiliated Tribes of the Northwest Indians - with a new center and waterfront experience**
- **A cutting-edge, integrated "District" concept**
- **A mission to build leading systems and concepts that are widely applicable**

Our hosts and stakeholders

Ken Wilson

VP of Campus Development
OMSI
(Oregon Museum of Science and Industry)

Jill Sherman

Founding Partner
Edlen & Co

Don Sampson

Climate Change Project Director
ATNI
(Affiliated Tribes of Northwest Indians)

Goals & Outcomes for the Workshop Series

➔ Catalogue District Systems Best Practices

- Assemble industry leaders from all relevant disciplines to identify “state-of-the-shelf” and “state-of-the-art” technologies and best practices
- Catalogue the elements for an advanced *and* pragmatic integrated district system concept
- Inform the planning for the OMSI District development, so that it’s best-positioned to meet aspirational standards

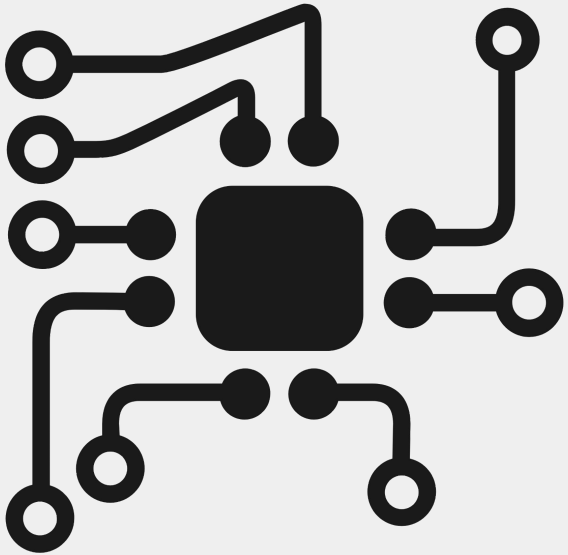
Goals & Outcomes for the Workshop Series

➔ Explore Integrated District Systems

- Explore the synergies and systems integration opportunities of (hard) infrastructure and (soft) circular economy systems at the district scale
- Test hypothesis that multiple systems, including energy, thermal, water and waste optimize at development scales bigger than individual buildings

➔ Generate Interest

- Begin building a coalition of neighborhood, community and city leaders committed to the OMSI District
- Generate interest in the marketplace for OMSI and its district development



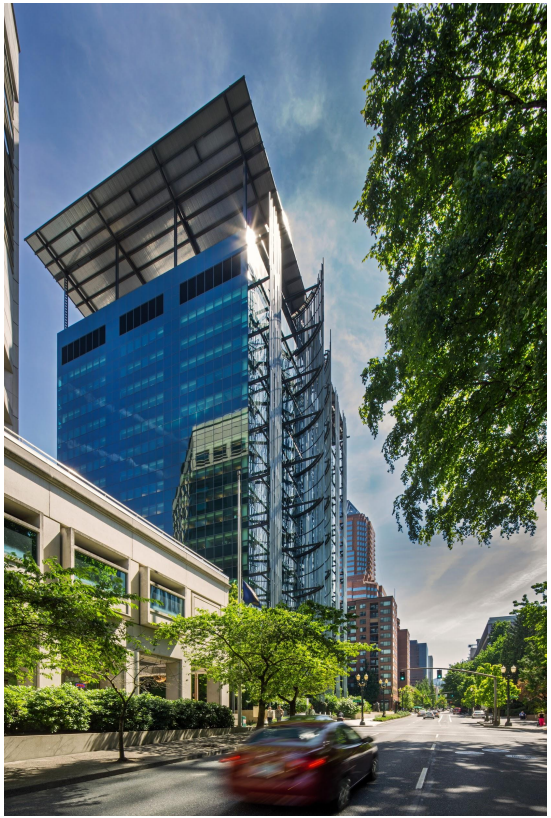
Goals & Outcomes for the Workshop Series

➔ Digital Systems

- Explore how to monitor and quantify the resource flows so as to measure the district's performance as a center for sustainability.
- Explore strategies to open an interactive channel of communication with OMSI visitors through which to inform them and deliver the services they expect from the community destination.
- Explore ways to simplify payment systems and allocate charges to ensure excellent value and effective revenue generation.
- Explore strategies to deliver relevant information in every interaction so visitors leave with a better understanding of the world around them than when they arrived.

Why focus on the District Scale?

Green Building Scale

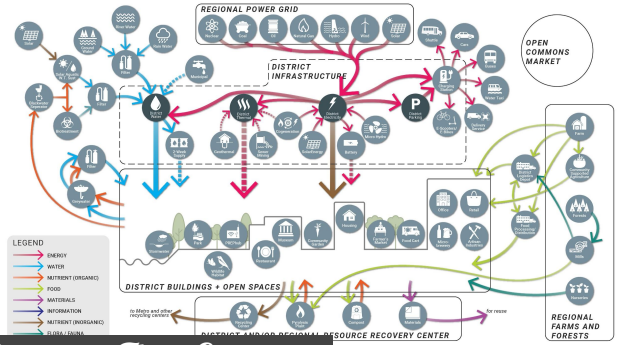


The District Scale

- ➔ Different systems optimize at different scales
- ➔ Different financing and business opportunities to achieve high performance

Meta / Regional Infrastructure Scale

Introduction to District System Concept (DSC)



Resource Flow Concepts

District Systems

➔ **An integrated DSC for:**

- Advanced infrastructure systems (the "Core 4")
  - Water
  - Electricity
  - Thermal energy
  - Smart mobility as service
- Food systems
- Nutrient flows
- Materials management
- Flora/fauna habitat and urban ecology
- Information management

➔ **The workshop advanced the concept over three charrettes in 6 weeks.**

The Workshop's Multiple Charrettes

Originally envisioned as a two day, in-person workshop, COVID-19 arrived and forced us to alter our methods:

- Three separate virtual charrettes + a report out meeting to OMSI's leadership and stakeholders
- Average attendance:
  ~65 people from over 55 organizations
- Resulted in greater participation by industry practitioners (due to removal of travel obligation and costs) and...
- MUCH greater participation and diversity of community and institutional participants

Lesson learned: Virtual workshops are possible, and can result in greater outreach and inclusivity

Charrette 1 (Nov 5 - 3 hours)

- ➔ Project introduction
- ➔ Disciplinary breakouts to advance core infrastructure systems

Charrette 2 (Nov 19 - 3 hours)

- ➔ Interdisciplinary breakouts to interconnect core and additional soft system elements and flows

Charrette 3 (Dec 3 - 3 hours)

- ➔ Both interdisciplinary and disciplinary "deep-dive" breakouts to advance both aspects.

OMSI + Stakeholders Update (Dec 10 - 2 hours)

- ➔ Review and discuss the workshop process and outcomes with OMSI's leadership, district stakeholders and workshop participants

Our virtual charrette technology

w/Breakout Rooms

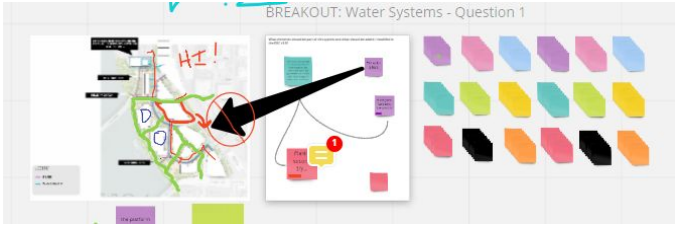
Verbal conversation
Chat
Facilitator
Note taker
Recorded

Collaboration Space

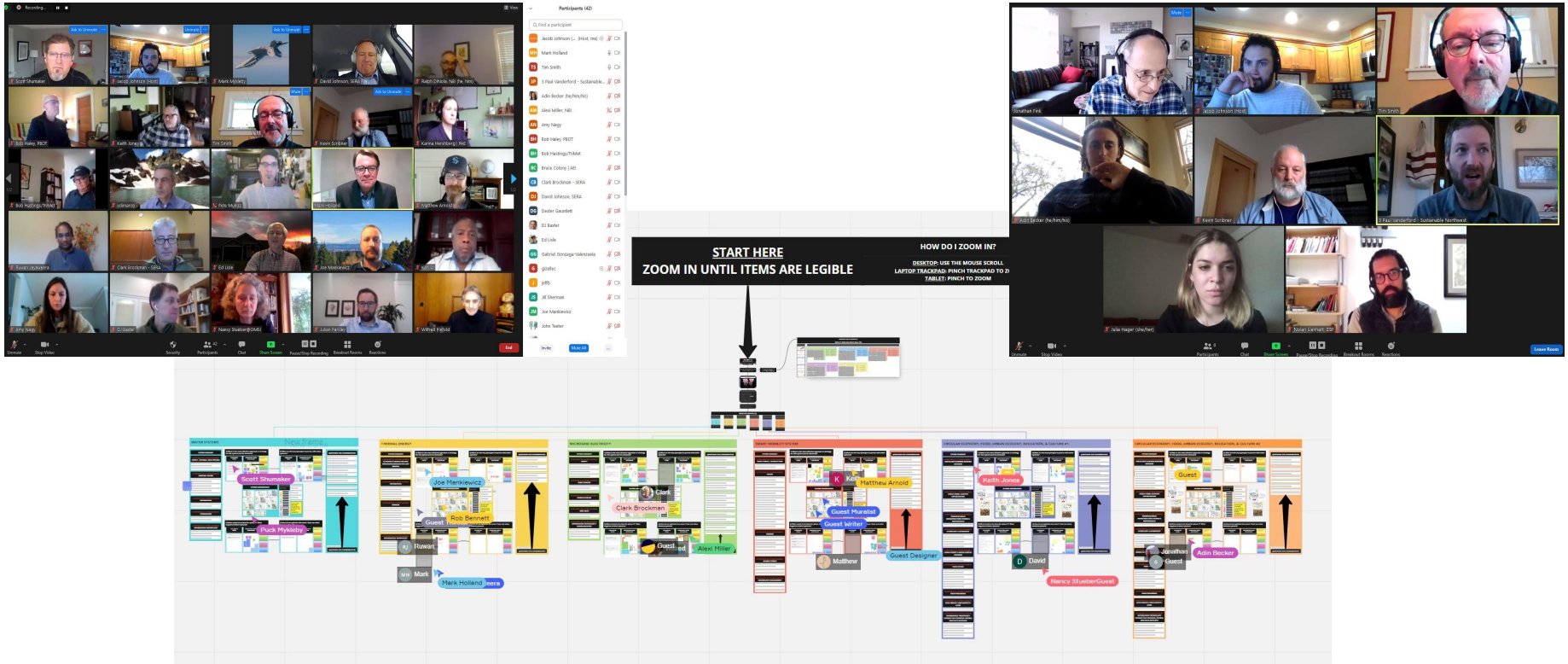
Easy to use - write, draw, etc...

Some preset sheets

Easy to add as many sheets as needed



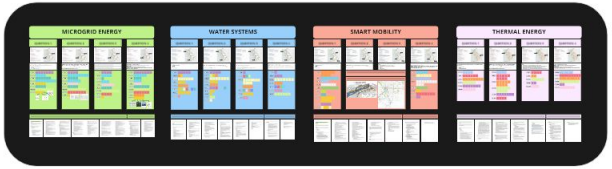
Online charrettes - Zoom + Miro



Online Charrettes - workshop content

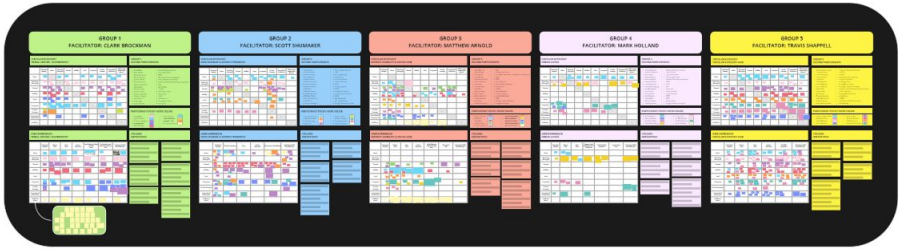
CHARRETTE #1

This workshop focused on breaking subject matter experts into groups of expertise.



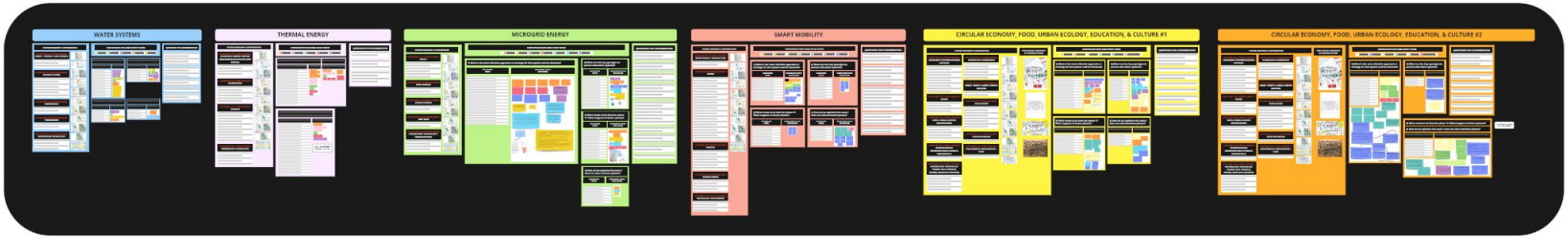
CHARRETTE #2

This workshop focused on integrating various experts into groups focused around circular economy and the user's experience with the district.



CHARRETTE #3

This workshop brought our expert groups back together to discuss synergies between various systems and phasing strategies for development.



Please follow this link to the Miro board to review the content of all of the charrettes

New to Miro Board? There are detailed instructions on how to zoom and navigate within the link itself

Charrette #1 - Disciplinary focus example

THERMAL ENERGY

QUESTION 1	QUESTION 2	QUESTION 3	QUESTION 4
			

Thermal

SOME POTENTIAL COMPONENTS:

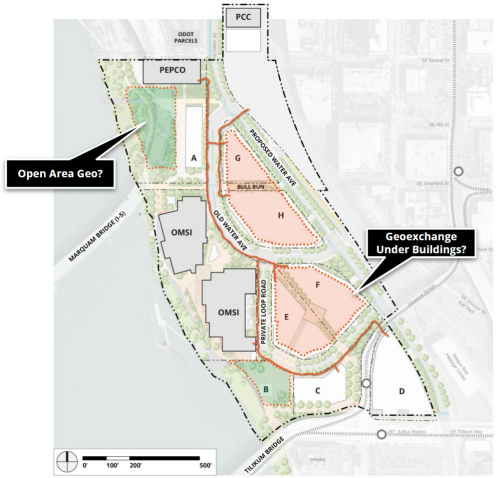
- Central Utility Plant (CUP)
- Geoexchange strategies
- Shared Thermal Loop
- Thermal Energy Storage
- Fuel Cells
- Natural Ventilation
- Waste Heat Recovery

EARLY ASSUMPTIONS

- All CCMP Parcels Connected
- All Electric District
- Buildings Optimized for District Thermal

EXAMPLE QUESTIONS:

- Centralized vs Decentralized CUP?
- 4-Pipe vs 2-Pipe Systems?
- Thermal storage in parking garage?
- Heat Island effect?
- Geoexchange viable here?



Thermal Energy – Question(s) 4

1) What data do we need to be tracking?

2) What feedback information / systems do we need to have to optimize performance?

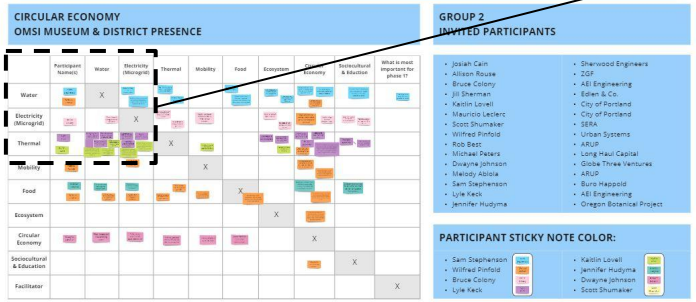
3) What challenges / barriers lie in front of us on this front?

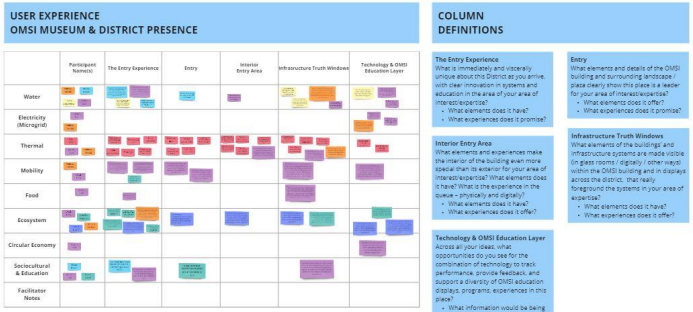
4) Where/how can we communicate this information – to change behavior and to provide educational opportunities?

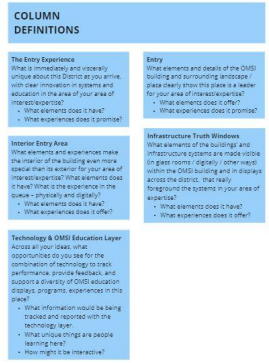
Vince DiMarco	submetering is important - cant manage what you can't track	need to educate potential tenants on district energy and benefits / reliability	St Paul Minnesota District Energy is great example of successful system		
Lyle Keck	Display and transparency on use to influence behavior	Occupancy and density of use	Mix of automatic and manual controls with tracking and overrides	Tenant level submetering	Understanding of process/equipment use vs. regulated or controllable use
Rob Best	Submetered heating and cooling use by unit/tenant and into building	Carbon intensity on the grid hour by hour (or more frequent)	Energy price (kWh, capacity, ancillary services) in real-time and forward markets	Connect use data and predictive use to carbon and price to optimize dispatch of thermal and power systems	

Charrette #2 - Interdisciplinary Focus Example

GROUP 2
FACILITATOR: SCOTT SHUMAKER

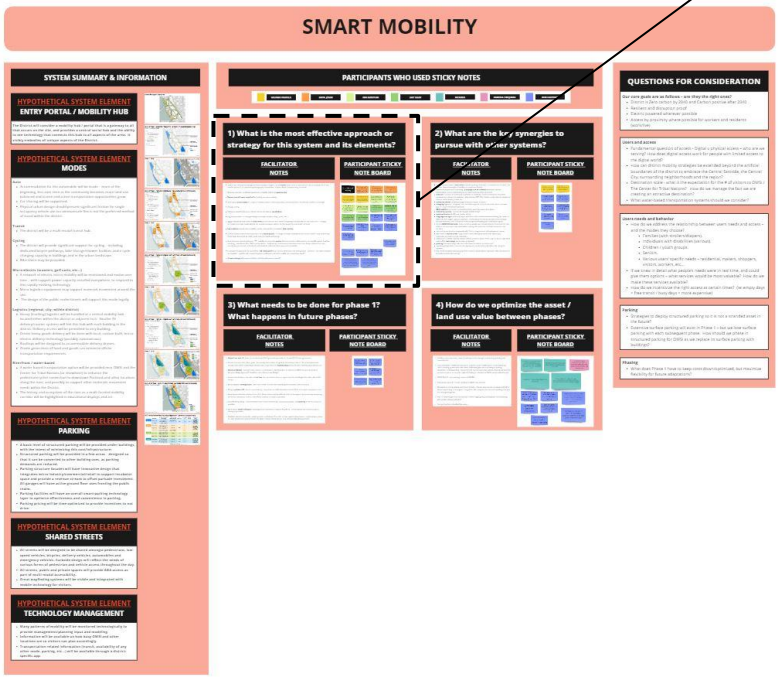






Participant Name	Water	Electricity (Microgrid)
Water	Sam Stephenson Wilfred Pinfold X	Opportunities for microturbines Avoid use of water resources for cooling unless there is surplus water, inclusive of ecosystem demands
Electricity (Microgrid)	Bruce Colony Move thermal energy between systems	X
Thermal	Lyle Keck Kaitlin Lovell Use large volumes or consistent flow as a heat source/sink Water storage can double as thermal energy storage Recover heat from waste water Energy:Water Nexus at building scale, district scale, grid scale Respect and manage water temperature impacts to natural systems If you use water for thermal, need to account for both quantity and quality. Even in microhydro or heat exchange systems like Cornell's Lake Source Cooling there are losses of water quality (temperature) Water remains in place and is not transported across the site (ie. geothermal/groundwater cooling	Storage used to decouple production from demand (both elec. and thermal) Variety of renewable sources, controls to optimize Real-time understanding of carbon Consider drinking water imports into the site with microturbines. Can we look to similar systems for the stormwater downspouts (gravity flow) wind and solar are important considerations for energy, however also have considerations with bird migrations and storage; consider paired systems that can use water as storage

Charrette #3 - Disciplinary + Interdisciplinary Focus Example



What is the most effective approach or strategy for this system and its elements?

what zoning challenges have been considered for parking	Participation/Coordination with 2040 Freight Plan	Work with business community in Central Eastside for distribution center space opportunities / sub-leasing	Wayfinding to greater Portland for micromobility - Green Loop/Springwater/Esplanade
Make the OMSI Max station a welcoming transit hub. It should be a place where you are comfortable changing modes and a place where many options are available.	From the MAX station it should be easy to get to where you want to go anywhere in the development or downtown Portland. Wayfinding, active transit (protected walkways)	Prioritize pedestrians first in all phases so as not to have to retrofit later	Ensure all paths to transit are clear, inviting, and leverage time while people wait
ID major user groups and solve for each of them (eg office worker vs. family visiting	Shared vehicles for apartmends	Human-centric approach, giving priority to light and shared vehicles instead of cars	Real-time info on public transit options
Sustainable rewarding mechanisms for clean transportation options	EV chargers in urban furniture (lampposts, kiosks, buildings)	Mobility needs to be a P3 ecosystem	Mobility needs to be reliable, convenient, safe and secure 24/7/365
How will sky mobility be accommodated? E.G. - drones	Shared mobility needs shared communications platform	River based mobility needs to be accommodated	Equity needs to be front & foremost in all mobility means and systems

Workshop Key Takeaways

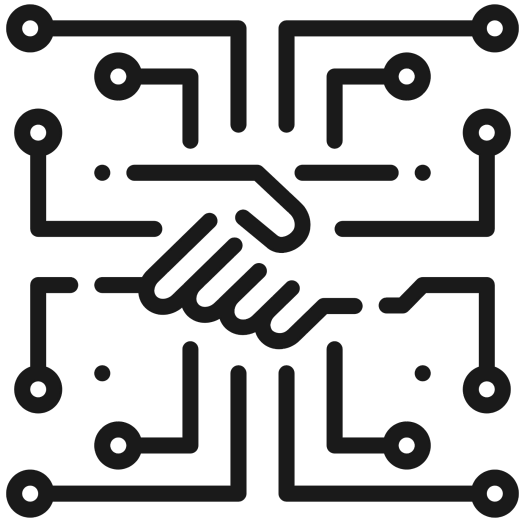
- **District Scale over Building Scale.** There was expert consensus that OMSI's ambitious performance goals will be more easily attained with district-scale infrastructure.
- **Mimic Natural Systems.** To the greatest extent possible, infrastructure systems should be modeled after their analog natural systems (e.g. our society's water systems should better mimic the hydrological cycle than they currently do).
- **Think Circular systems.** Many of the systems being considered are circular in nature and should be designed with this in mind (e.g. connecting energy, water, food, and materials systems for reuse and recovery).
- **Fractal, nested systems.** There will be systems within systems at the OMSI site, the buildings themselves will be subsystems of the District, and the District will be nested within many larger, overlapping systems in the neighborhood and the City. (Centralized systems can support critical operations, decentralized can support reduced operations in non-critical areas.)

Workshop Key Takeaways

- **Systems need to balance.** All of the disciplinary groups discussed how their various systems needed to "balance their loads" and define the "sources and sinks" in order to properly map the web of interactions between systems.
- **Impact capital is key.** The lower capital cost of impact investment offers new business models capable of front-loading the needed capex is likely to be key for scaling and replicating district infrastructure.
- **Phased development and programming matters.** Different infrastructure systems have different sensitivities to loads and service requirements. The business model success of the district prior to full build out will in part be dependent on management of the building programs and sizes during each phase. Early scenario planning to identify various options will be critical to multi-phase success.
- **Remember the people.** All of this engineering and technology is being considered for the benefit of PEOPLE!

Digital Systems Workshop Key Takeaways

- **Equipment Space and Conduits.** To enable OMSI to remain a showcase for smart infrastructure space to house equipment and conduits links to these spaces will be required
- **Agile development not Waterfall planning.** To Achieving OMSI's aspirational performance goals will require inter-system coordination, and ongoing optimization over time (i.e. a digital and operational paradigm of continuous improvement)
- **Equity is a core element of excellence.** The data and services need to be equitably distributed and available. All the groups prioritized the critical importance of designing the infrastructure and data systems with equity in mind
- **Remember the data.** Optimizing across systems and understanding externalities is best done with both objective and subjective data. (e.g. encouraging members to shift away from private vehicles requires understanding both vehicle availability and travel times, along with user's motivations and expectations)
- **Remember privacy.** Data collection and use policies need to ensure the data is being collected and the purposes to which it is being put are clear. Personal data should not be held by OMSI but by visitors and requested when needed.



Workshop participants (61 organizations contributing on their own time!) - Building OMSI's District Community

Consultants

- AEI Engineering
- Ameresco
- Arup
- Biohabitats
- Buro Happold
- CollinsWoerman
- DKS Associates
- Globe Three Ventures
- PAE
- Panasonic
- Puttman Infrastructure, Inc.
- Rick Williams Consulting
- Sherwood Design Engineers
- Sustainable Water
- ZGF

NGOs & Local Businesses

- Annie's Urban Farm
- Center for Sustainable Infrastructure
- City of Roses
- EcoDistricts Institute
- Ellen MacArthur Foundation
- Energy Trust of Oregon
- Evergreen Museum
- Food Corps
- Friends of the Green Loop
- Modelado Foundation
- New Buildings Institute
- Oregon Botanical Project
- PDX Urban Gardens
- Salmon Safe
- Sustainable Northwest
- Sustainable Northwest Wood
- We All Rise

Public Agencies & Utilities

- City of Portland
- Metro
- National Renewable Energy Laboratory
- PBOT
- PGE
- Prosper Portland
- TriMet

Workshop participants (61 organizations!) - Building OMSI's District Community

Tribal Representatives

Affiliated Tribes of Northwest Indians (ATNI)

Columbia River Inter-Tribal Fish Commission

Nez Perce Tribe

Universities (Including Students & Graduates)

Lewis & Clark College

Pitzer College

Portland State University

University of Oregon

University of Puget Sound

Technology Consultants & NGOs

Forth Mobility

Technology Association of Oregon

The Wave

Ubiwhere

VertueLab

Development Core Team

Amplified by Design

Edlen & Co

Farkas Group

Holland Planning Innovations

Long Haul Capitol

OMSI

SERA Architects

Shiels Obletz Johnsen

Urban Systems

Infrastructure Workshop

Historical Context

Patrick Doherty

Co-Founder
Long Haul Capital Group LLC

History and Developer Team

2017 Snohetta Master Plan Complete

2018 OMSI selects Master Developer team:

- Gerding Edlen (now Edlen & Co.)
- SERA Architects
- Urban Systems
- Long Haul Capital Group
- Farkas Group

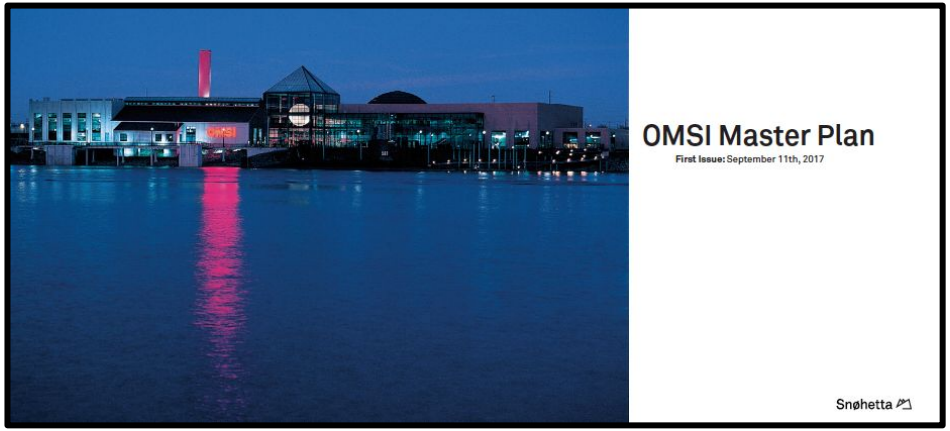
2019 Sustainable Infrastructure Matrix and Goals Complete; Financial Modelling Started

2020 Center for Tribal Nations Integration, Fundraising through Bullitt and Metro, Central City Master Plan Expansion

- ATNI
- CRITFC
- PAE
- Amplified

Why This Team?

- → Track record of delivering sustainability and inclusion
- → Commitment to integrated and cooperative systems
- → Expertise in open platform digital optimization
- → Ability to deliver long-term, impact financing



Principles and Goals

CENTER FOR EXCELLENCE

COMMUNITY DESTINATION

CENTER FOR SUSTAINABILITY

REVENUE GENERATOR

Goals

Partnership with Native community, Tribal & Intertribal organizations

Net zero carbon by 2040; carbon positive thereafter

Transit-oriented; pedestrian-centric; bicycle infrastructure

Net positive water

Climate and seismic incident resilience and post-incident response

Authentic stakeholder engagement using the Civic Ecology process

Circular economy node with net zero waste

Urban wildlife habitat & Salmon Safe certification target

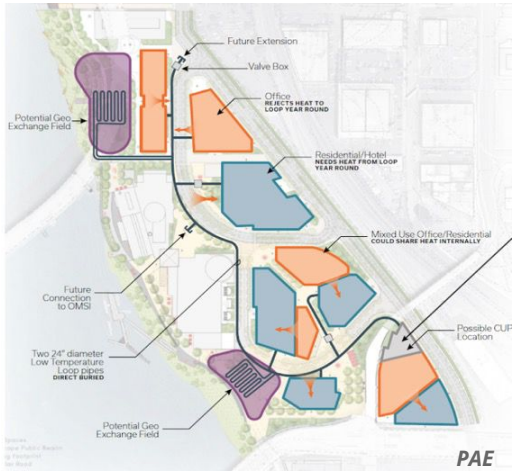
Maker space and innovation ecosystem

Willamette River Restoration & Waterfront Education Park

Next-generation sensor network

Re-purposeable structures

Tenants aligned with OMSI mission



Affordable & market-rate mix of housing, office, retail & other uses

Integrated data system

Advanced building performance analytics

Freight reduction plan

Innovative Financing to Meet our Goals

- Philanthropy lets us push the envelope: **grants from Bullitt Foundation and Metro**
- NewCo established to develop Core 4 of OMSI Infrastructure: **InfraCenters LLC**
  - Partnership between Long Haul Capital Group and SERA Architects
  - Infrastructure developer for the OMSI Redevelopment
  - Impact equity absorbs pre-construction risk
- 99-year ground lease allows us to think--and finance--long-term
- Green asset market is undersupplied, attracting institutional capital to replicable projects
- **Desired Pathway:**
  - $0 CapEx Cost to OMSI
  - Reduced operating expenses
  - New 501c3 funding

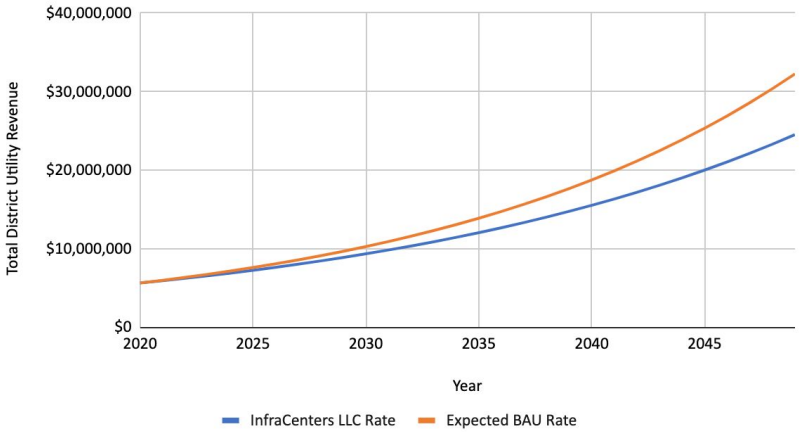
Core 4: Baseline Financial Model

"Core 4" Strawman (InfraCenter) Major Components

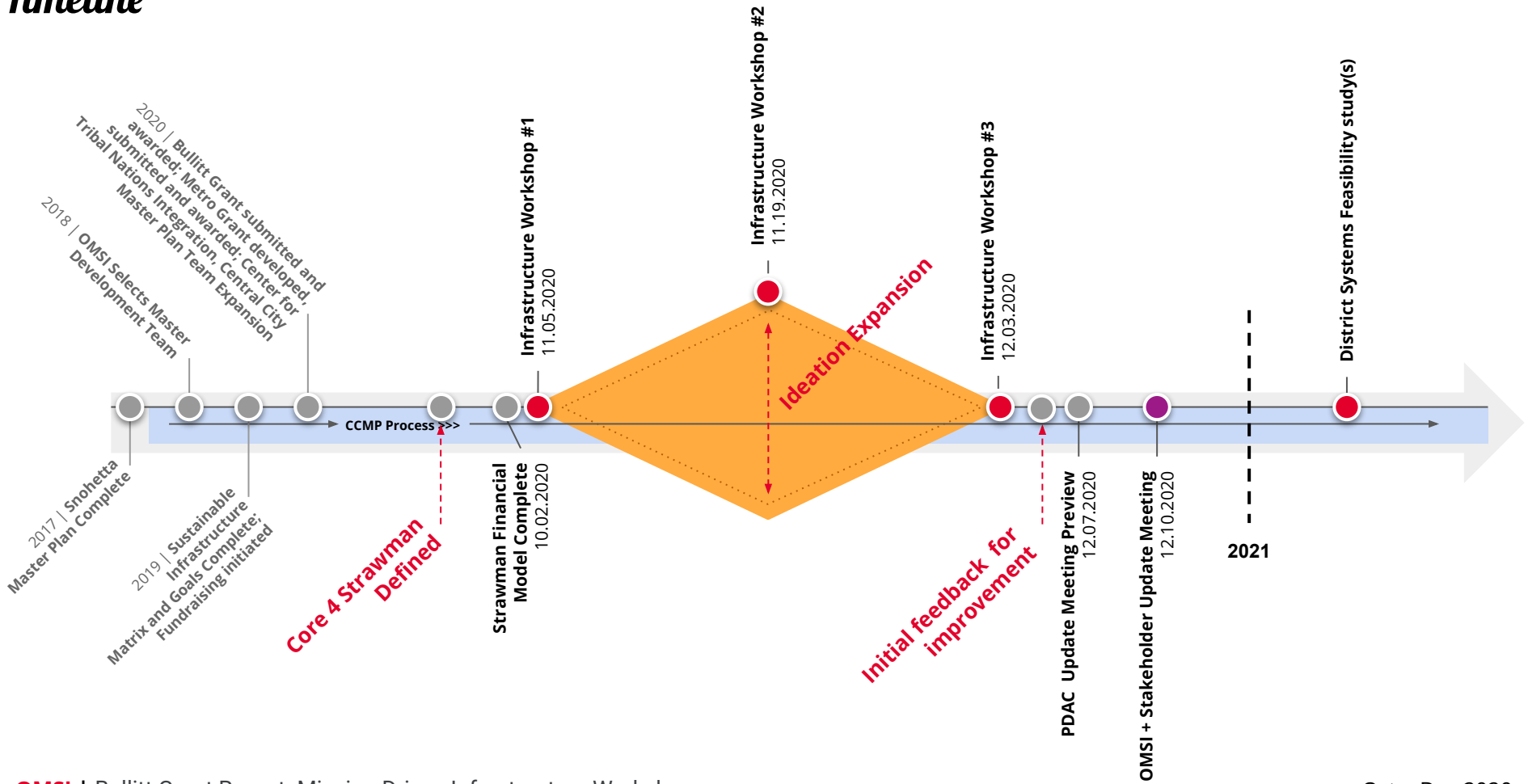
- Building podium core & shell integrated with the Center for Tribal Nations
- 1.6MW solar PV array
- 5 MW, 4 Hr energy storage
- District Microgrid Wiring
- Wastewater treatment & reuse
- Potable water production system ready
- District piping & Division Street wastewater lift pump
- District heating & cooling with thermal loop
- 705 parking spaces
- 304 parking stackers
- 100 Vehicle-to-Grid EV chargers
- Digital Optimization
- Exposed elements for OMSI educational mission

CapEx	
$22,392,650	Pre-Construction Soft Costs
$126,735,058	Construction Costs (Hard & Soft)
$157,860,628	Total CapEx
$56,816,561	Equity
$101,044,067	Debt

Utility Rate Discount vs. BAU



Timeline


2020 | Bullitt Grant submitted and awarded; Metro Grant developed, submitted and awarded: Center for Tribal Nations Integration, Central City Master Plan Team Expansion
2018 | OMSI Selects Master Development Team
2017 | Snohetta Master Plan Complete
2019 | Sustainable Infrastructure Matrix and Goals Complete; Fundraising Initiated
CCMP Process >>>
Core 4 Strawman Defined
Infrastructure Workshop #1 11.05.2020
Strawman Financial Model Complete 10.02.2020
Infrastructure Workshop #2 11.19.2020
Ideation Expansion
Infrastructure Workshop #3 12.03.2020
Initial feedback for improvement
PDAC Update Meeting Preview 12.07.2020
OMSI + Stakeholder Update Meeting 12.10.2020
2021
District Systems Feasibility study(s)

Infrastructure Workshop

The “Core 4” District Systems Key Takeaways

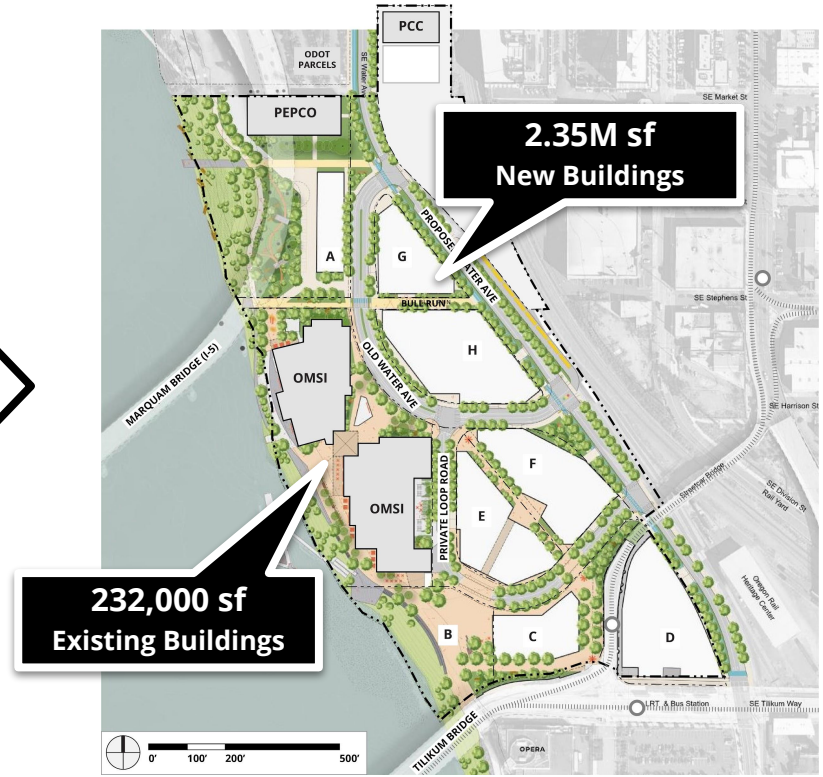
Scott Shumaker M. ASCE
Principal
SERA Architects

Clark Brockman AIA, LEED Fellow
Principal
SERA Architects

Context & Programming

...transforming parking lot to neighborhood...

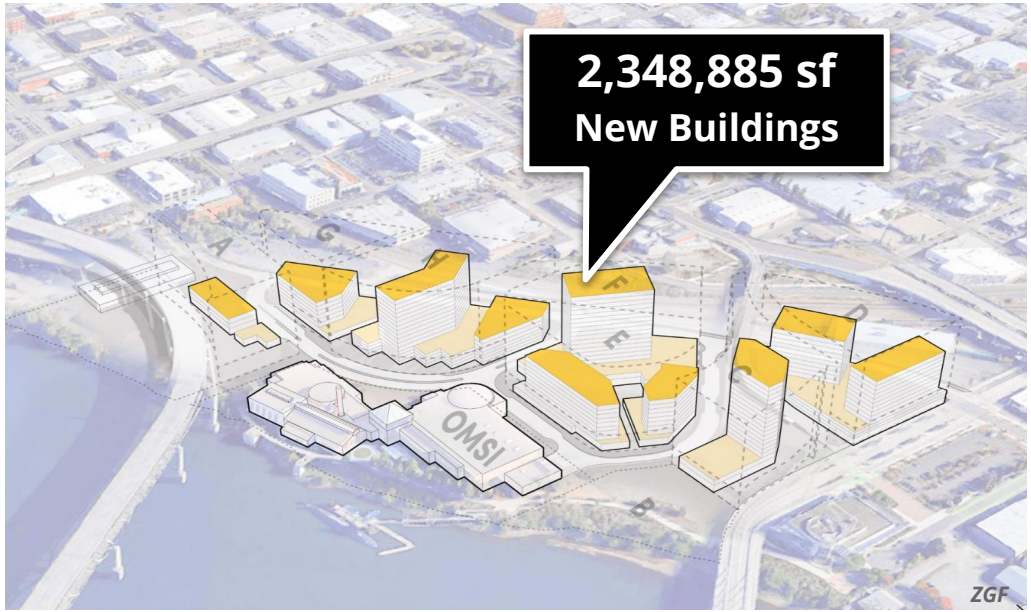
Today | Existing Conditions



Tomorrow | Master Plan Build Out

Preliminary Program & CCMP Propositional Massing

- **208,000 sf Existing OMSI**
- **24,000 sf Existing Pepco**
- **1,080,000 sf Office ***
- **937,500 sf Residential ***
- **216,000 sf Ground Active *^**
- **115,385 sf Hotel ***
- **124,695 sf Parking-Below ***
- **653,340 sf Parking-Above ***



**Market forces will govern both program and sf*
^Ground floor active (e.g. retail, maker, market, botanical garden)

Site Context

Waterfront Trail + Riparian Zone Enhancement

Existing OMSI Buildings to Remain

Masterplan Concept: Access to Water

Transit & Ped/Bike -Only Bridge (Connection West)

Streetcar Loop (PDX)

Masterplan Concept: Proposed Water Ave (New Public ROW)

Masterplan Concept: Old Water Ave (Exist. Public ROW)

Masterplan Concept: Ped-Friendly Street (New Private Street)

Regional Light Rail & Downtown Streetcar Transit Stop

Water Systems

SOME POTENTIAL COMPONENTS:

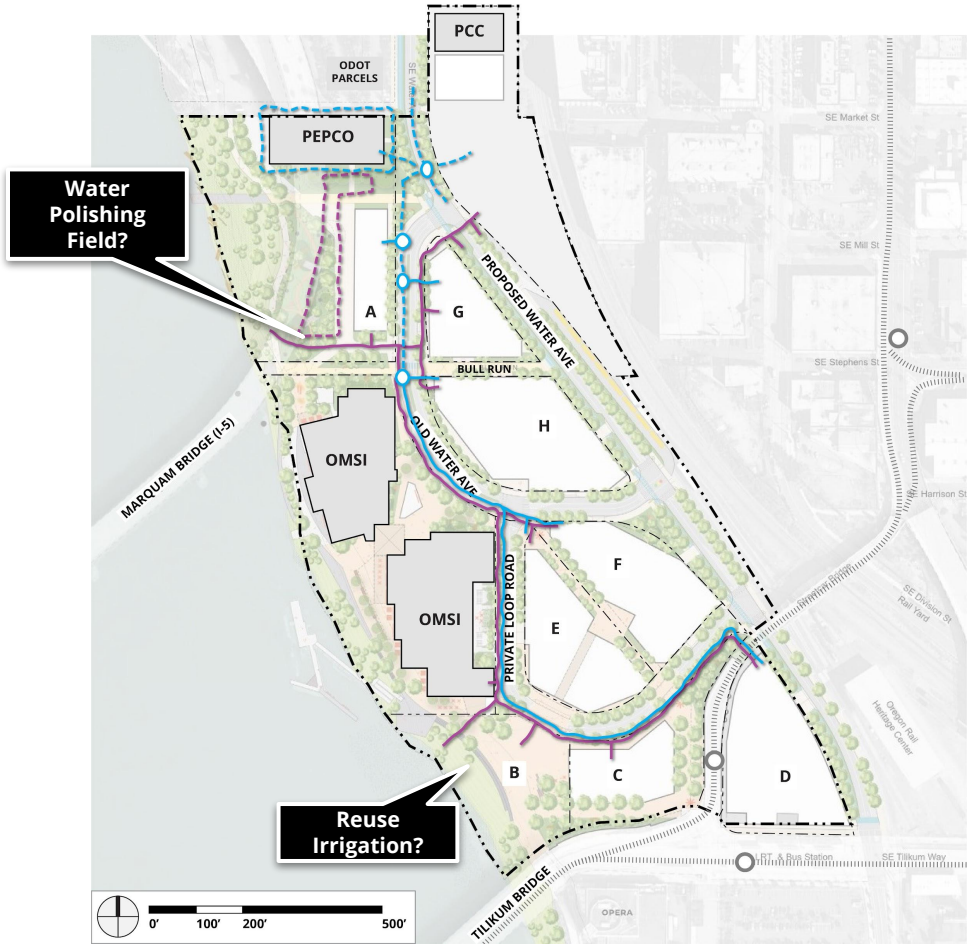
- ➔ Water Treat and Reuse
- ➔ Omsi Water Education Kiosk
- ➔ Atmospheric Water Pilot
- ➔ Potable water generation
- ➔ Rainwater Capture
- ➔ Greywater Capture
- ➔ Blackwater Capture
- ➔ Nutrient Recovery

EARLY CONSTRAINTS AND ASSUMPTIONS:

- ➔ Existing wastewater inadequate
- ➔ New sanitary sewer lift station required
- ➔ Live within rainfall budget
- ➔ All parcels connect to WWT+Reuse system

EXAMPLE QUESTIONS:

- ➔ Source water for treatment?
- ➔ Uses for reuse water?
- ➔ Should District provide future potable water?
- ➔ Climate Change adaptations?



Water Systems

Workshop Key Takeaways

➔ MIMIC NATURE

- The system's water balance and design should **mimic the local hydrological cycle**
- **Create a water master plan** so each phase of development contributes to a coordinated whole

➔ EQUITY & EDUCATION

- Save bull run water for potable uses by using re-use water for all non-potable needs, and live within the rainfall of the site to **reserve high quality water for future generations**
- Leverage OMSI's strengths and mission to **use these water systems to educate the public**

➔ DEVELOPMENT PHASING MATTERS

- District planning needs to acknowledge that **development patterns will influence the system design** and implementation, starting with Phase 1

Electrical Microgrid Systems

SOME POTENTIAL COMPONENTS:

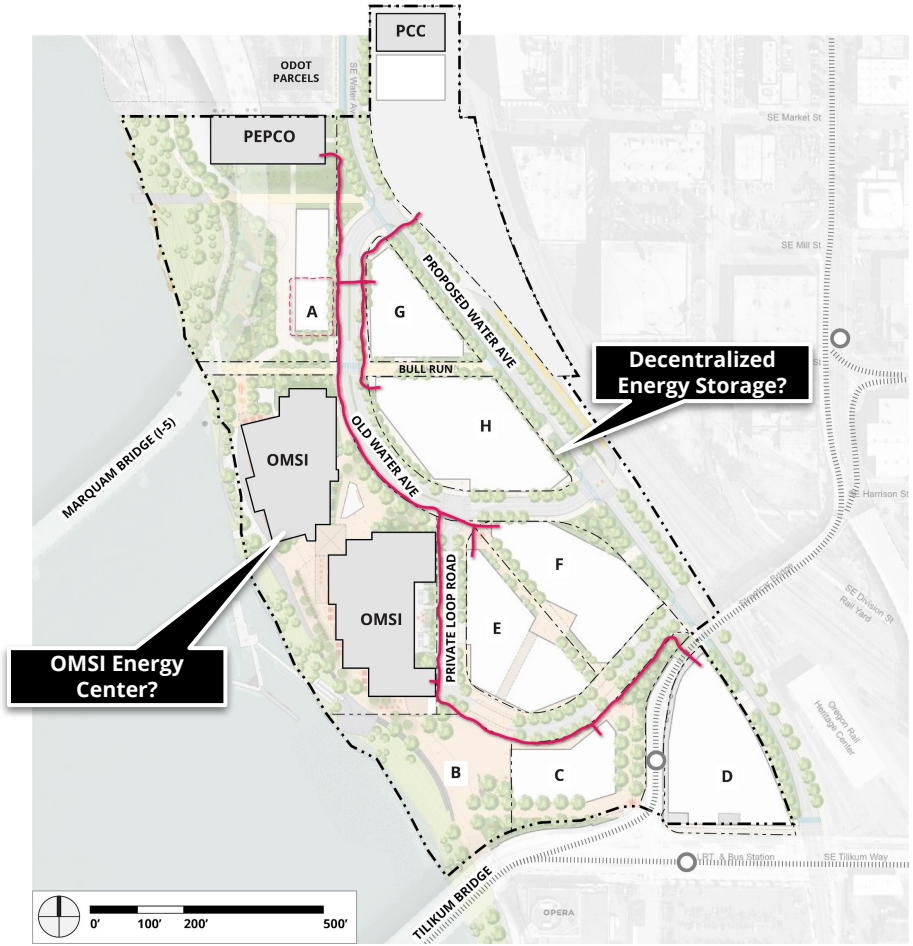
- ➔ Solar PV Generation
- ➔ Electricity Storage
- ➔ Microgrid operability
- ➔ 2-way Chargers
- ➔ Smart Building Controls
- ➔ Micro-hydro
- ➔ Low-voltage capable

EARLY ASSUMPTIONS:

- ➔ District will be “all-electric”
- ➔ Zero Carbon by 2040
- ➔ ~1.6 MWh On-Site Generation
- ➔ ~5 MWh Battery Storage
- ➔ Smart Buildings Interacting with Power grid

EXAMPLE QUESTIONS:

- ➔ Centralized vs decentralized storage?
- ➔ Most applicable generation strategies?
- ➔ Interaction between solar PV and heat island mitigation
- ➔ Other renewables?
- ➔ Mobility charging? (Including EVs, school buses, and shuttles)



Electrical Microgrid Systems

Workshop Key Takeaways

➔ PROSUMERS & SUCCESS METRICS

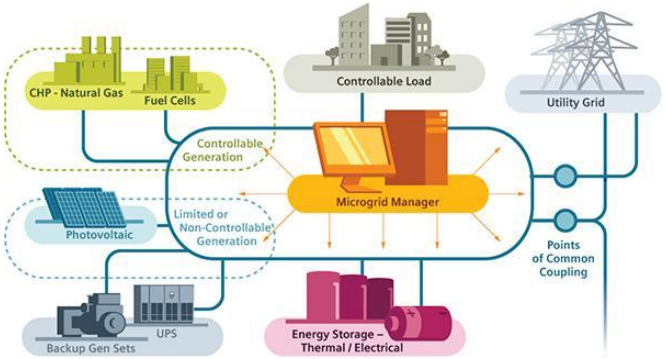
- **The buildings and the District will be "prosumers"** (producers and consumers) – big implications for business models
- **Buildings are now "resources" *and* "storage devices"** acting as part of a larger system - "the microgrid"
- **Use carbon as the operative metric** (as opposed to energy saved and energy produced) - move beyond "Net Zero Energy (NZE)" to "Net Zero Carbon (NZC)"

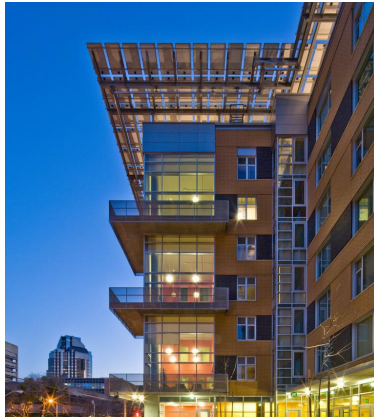
➔ RESILIENCY & BOUNDARIES

- **Microgrids are inherently fractal in scale**: Development phases can each be developed as a microgrid, each will be "nested" within the district microgrid, which is "nested" within the utility's various "nested" grids
- **Expand reach of these systems beyond hard district boundaries** to expand the benefits they can provide to the community

➔ OVER-BUILD ELECTRIC INFRASTRUCTURE IN THE INITIAL/EARLY PHASES

- **The business models benefit from early over-development** – you can find uses for the excess capacity outside the district as the the district matures





Thermal Energy Systems

SOME POTENTIAL COMPONENTS:

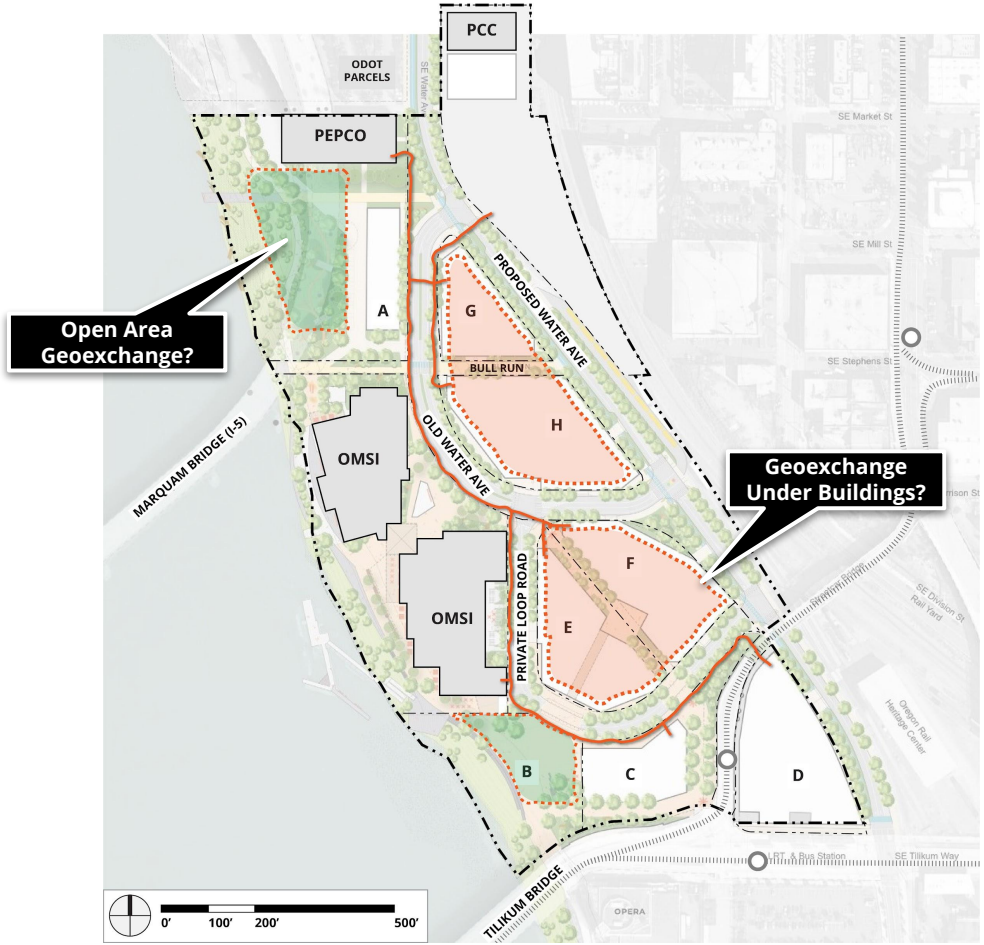
- ➔ Central Utility Plant (CUP)
- ➔ Geoexchange strategies
- ➔ Shared Thermal Loop
- ➔ Thermal Energy Storage
- ➔ Fuel Cells
- ➔ Natural Ventilation
- ➔ Waste Heat Recovery

EARLY ASSUMPTIONS

- ➔ All CCMP Parcels Connected to District Thermal System
- ➔ District will be “all-electric”
- ➔ Buildings Optimized to Leverage District Thermal System

EXAMPLE QUESTIONS:

- ➔ Centralized vs Decentralized CUP?
- ➔ 4-Pipe vs 2-Pipe Systems?
- ➔ Thermal storage in parking garage?
- ➔ Heat Island effect?
- ➔ Is geoexchange viable at this site, in this climate?



Thermal Energy Systems

Workshop Key Takeaways

➔ **USE AN INTERCONNECTED, MULTI-TECHNOLOGY, PHASED THERMAL LOOP**

- 2-pipe, ambient water loop
- All buildings in District are connected
- Thermal sharing is key – “No BTU left behind.”

➔ **MULTIPLE ELECTRICITY-DRIVEN, HEAT-EXCHANGE ENERGY SOURCES**

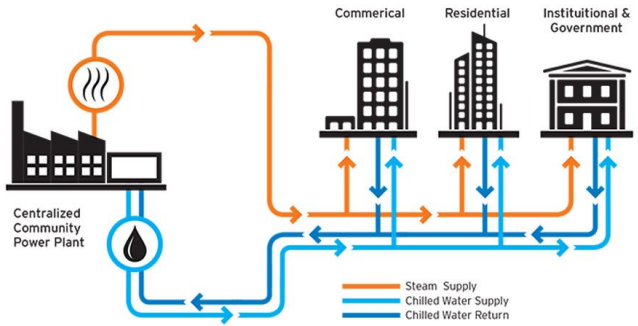
- Within buildings and building masses
- Geoexchange
- Water/wastewater
- Air
- Adaptable for different buildings, phases, and future technologies

➔ **BUILDING EFFICIENCY OPTIMIZED BY DISTRICT THERMAL SYSTEM**

- Utility partnerships can change the business models
- Thermal sources customized to building programs and phases

➔ **ADVANCED INFORMATION TECHNOLOGY**

- To optimize multi-systems management
- Employ thermal value pricing and marketplace systems
- Integrate with OMSI education program opportunities



Mobility Systems

SOME POTENTIAL COMPONENTS:

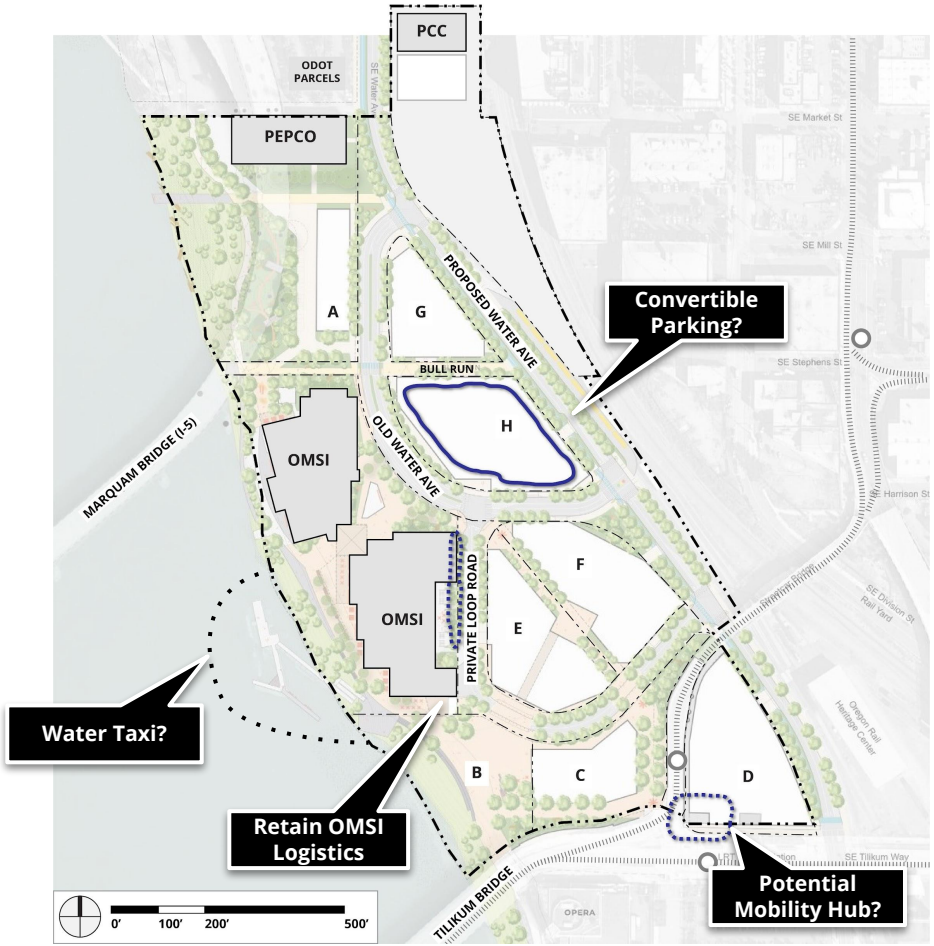
- ➔ Enhanced Transit Corridor
- ➔ Parking Drawdown
- ➔ Shuttle Charging
- ➔ Drone Deliveries
- ➔ Parking Demand Management
- ➔ Water Taxi
- ➔ Micro-Mobility Hub
- ➔ Predictive Trip App
- ➔ Convertible Parking
- ➔ Below-grade Logistics

EARLY ASSUMPTIONS:

- ➔ Existing OMSI surface parking to be replaced in phases
- ➔ Future demand for auto parking will diminish significantly over time
- ➔ District will support charging of multiple electric modes
- ➔ OMSI logistics area will be retained

EXAMPLE QUESTIONS:

- ➔ How to keep from over-building structured parking?
- ➔ Impact of future mobility changes on OMSI's mission?
- ➔ Leverage adjacent Transit?
- ➔ Innovative Logistics opportunities?



Mobility Systems

Workshop Key Takeaways

- **THE OMSI MAX STATION "MOBILITY HUB" SHOULD BE A CLEAR POINT OF FOCUS**
  - Transparently concentrate transport, social activities, and education in at this key arrival / departure point
- **MOBILITY MUST BE INTEGRATED AND MULTI-MODAL**
  - A full range of options must be accessible and apparent
  - All modes linked physically, digitally, and experientially
- **TO ENSURE EQUITY, MOBILITY MUST BE VIEWED AS A RIGHT RATHER THAN A PRIVILEGE**
  - Prioritize people needs over vehicle and technology efficiency
- **PUT PEDESTRIANS FIRST**
  - Ensure that every area of the district is highly walkable
  - Advocate for proximate districts to enhance walkability too
- **MAKE E-VEHICLES THE PREFERRED MODE OF TRANSPORT TO/FROM THE DISTRICT**
  - Charging stations for all scales of vehicles everywhere
- **REDUCE NEED FOR AUTO STORAGE**
  - Draw down on auto parking over future
  - Reduce demand for SOV use through incentives, behavioral change
  - Increase curbside pick-up/drop-off and parking

Infrastructure Workshop Facilitators

Master Facilitator:

Mark Holland RPP
President
Holland Planning Innovations Inc

Areas of Facilitation:

Water Systems
Smart Mobility
Thermal Energy
Microgrid Electricity
Circular Economy

Infrastructure Workshop

District System Concept "Straw Man" (DSC 2.0)

Developed by SERA Architects solely for the purposes of eliciting "deep dive" discussions in Charrette #3 *(i.e. This is NOT an actual development plan)*

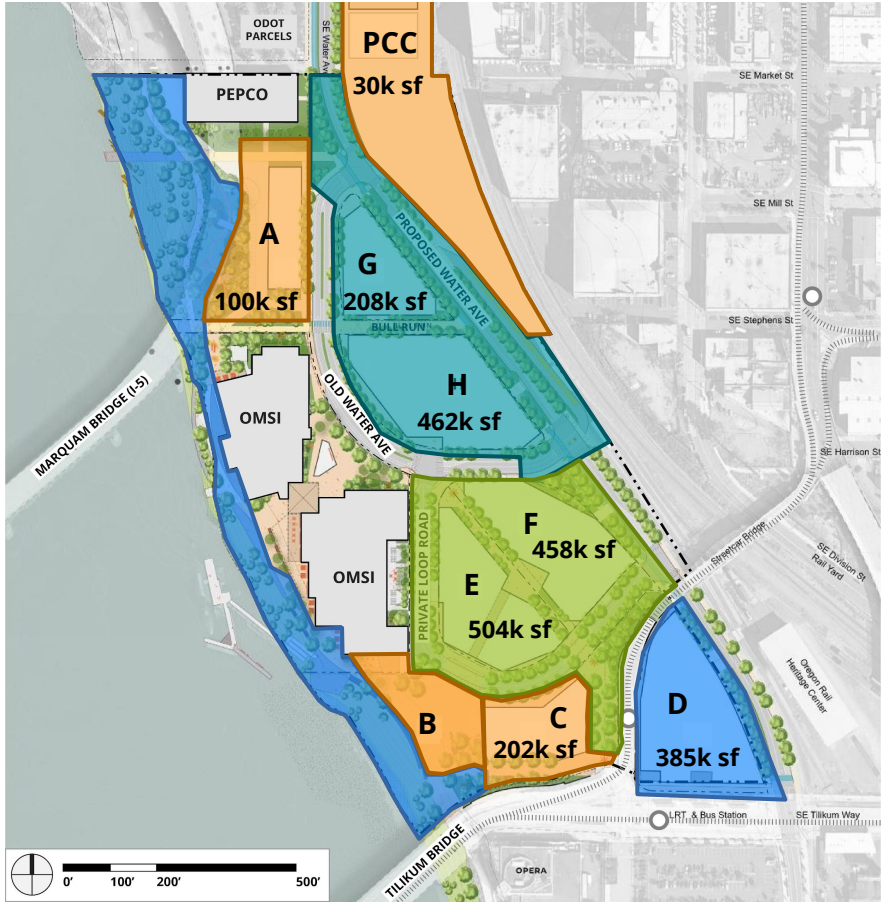
Current Masterplan (in progress)

DSC 2.0 All Phases - Open 2040 "Straw Man"

Hypothetical -- Developed for discussion purposes only

Note (Charrette Process Finding):

- In Charrette #1 it became clear that it was challenging for the engineering subject matter experts (SMEs) to provide detailed comments and feedback without having a specific development proposal to react to.
- Not surprisingly, the scale and mix of building program uses, by phase, are very important for assessing district scale infrastructure strategies.
- The following "Straw Man" development and phasing plan was developed to provoke more detailed, discipline-specific discussions in Charrette #3.



2,349,000 sf - Cumulative New Construction Program

LEGEND

- Phase 1
- Phase 2
- Phase 3
- Phase 4

DSC 2.0 Development Phase Summary

Hypothetical -- Developed for discussion purposes only

	Parcel Area	Building Development (by program)	Total Building Development Area	PV Generation	# Parking Stalls	Battery Storage	Cumulative Totals
PHASE 1	Parcel D: 1.46 ac	Office/Commercial: 250k sf Hotel: 115k sf Active Ground Floor: 20k sf	385,000 sf Bldg 204,000 sf *Parking	300kw	508	5Mw	****385,000 sf** **Resi Units: 0** **Parking: 508** **PV: 300kw** **Battery: 5Mw**
	Parcel TBD	Central Utility Plant: SF TBD					
PHASE 2	Parcel A: 4.49 ac	Office/Commercial: 80k sf Active Ground Floor: 20k sf	100,000 sf		80		****717,000 sf** **Resi Units: 200** **Parking: 1,713** **PV: 600kw** **Battery: 5Mw**
	Parcel C: 1.47 ac	Residential: 187k sf (200 Units) Active Ground Floor: 15k sf	202,000 sf	300kw	0		
	PCC: 2.85 ac	Active Ground Floor: 30k sf Above Grade Parking: 450k sf	30,000 sf of Bldg 450,000 sf *Parking		1125		
PHASE 3	Parcel E: 1.58 ac	Office/Commercial: 250k sf Residential: 188k sf (200 Units) Botanical/Active G.F.: 66k sf	504,000 sf	200kw	197		****1,679,000 sf** **Resi Units: 600** **Parking: 2,070** **PV: 1.1Mw** **Battery: 5Mw**
	Parcel F: 1.28 ac	Office/Commercial: 250k sf Residential: 188k sf (200 Units) Active Ground Floor: 20k sf	458,000 sf	300kw	160		
PHASE 4	Parcel G: 0.84 ac	Residential: 188k sf (200 Units) Active Ground Floor: 20k sf	208,000 sf	200kw	0		****2,349,000 sf** **Resi Units: 1,000** **Parking: 2,070** **PV: 1.6Mw** **Battery: 5Mw**
	Parcel H: 1.73 ac	Office/Commercial: 250k sf Residential: 187k sf (200 Units) Active Ground Floor: 25k sf	462,000 sf	300kw	0		

*Above Grade Parking counts as FAR **AG/UG Parking SF not included in Cumulative Building Totals

DSC 2.0 Phase 1 - Open 2025

Hypothetical -- Developed for discussion purposes only

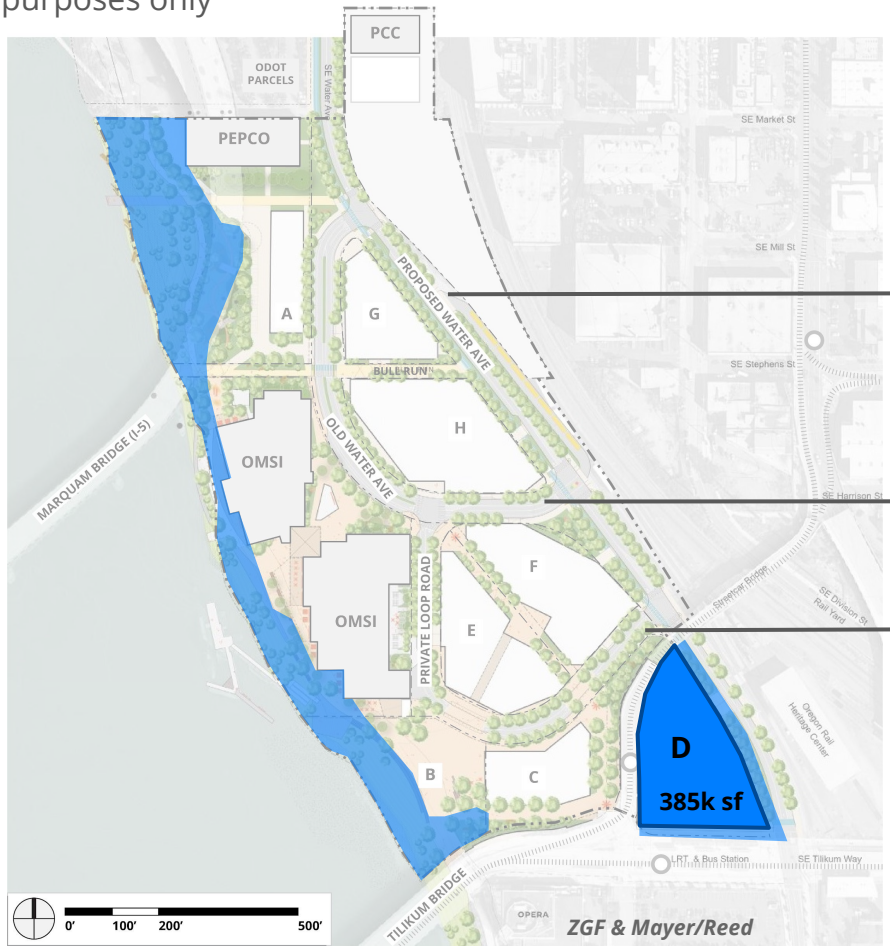
385,000 sf - Cumulative Built Program

Parcel D

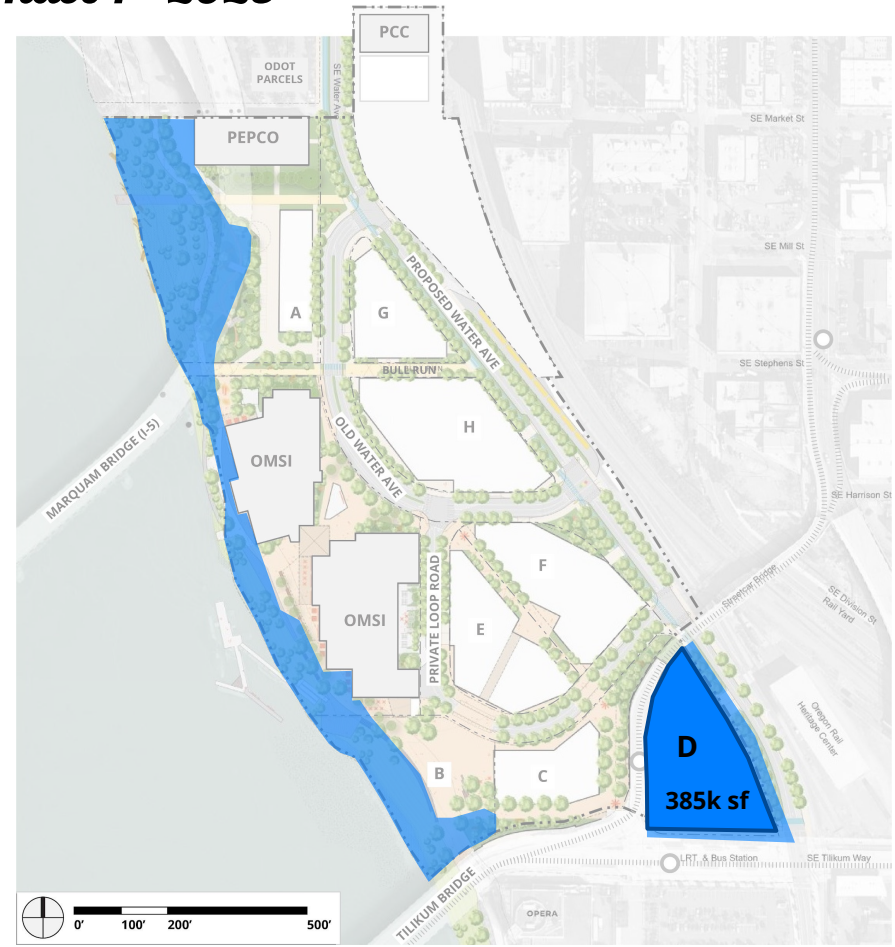
- 1.46ac - Parcel area
- 385k sf - Total Building Development
  - 250k sf - Office/Commercial
  - 115k sf - Hotel
  - 20k sf - Active Ground Floor
- 508 - Parking stalls
- 300kw - PV Generation
- 5Mw Battery storage

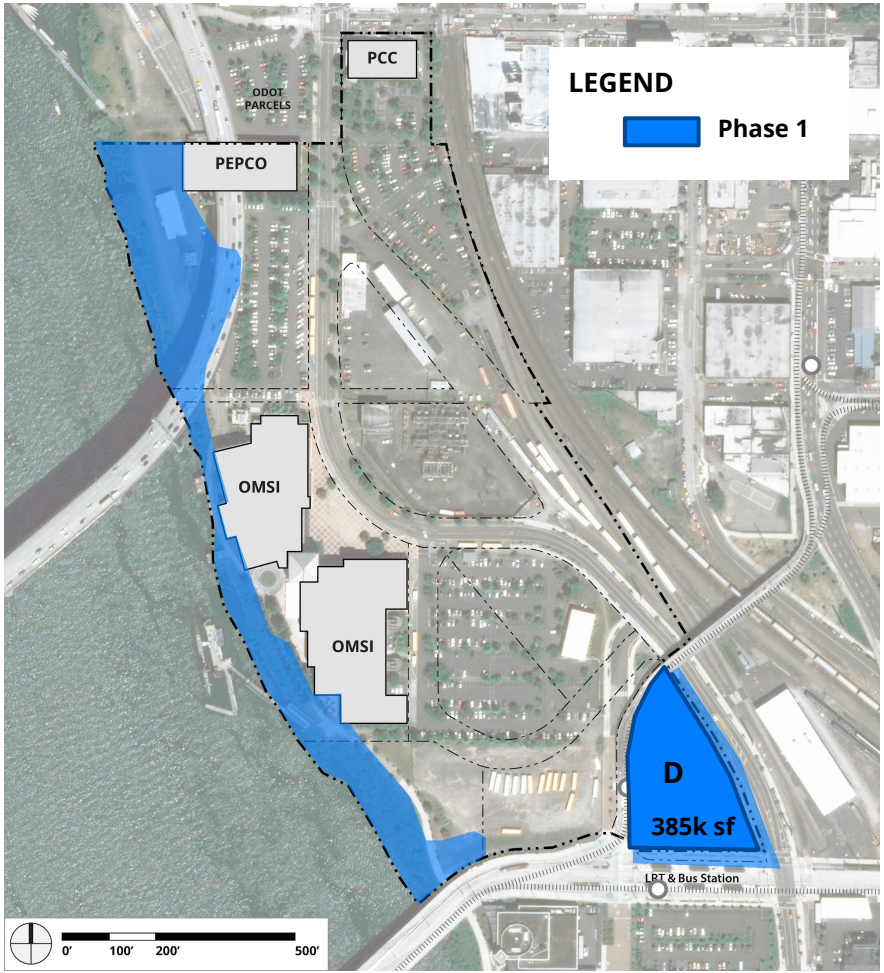
Parcel TBD

- ~50k sf Central Utility Plant?



Phase 1 - 2025*





*Hypothetical -- Developed for discussion purposes only

DSC 2.0 Phase 2 - Open 2029

Hypothetical -- Developed for discussion purposes only

717,000 sf - Cumulative Built Program

Parcel A

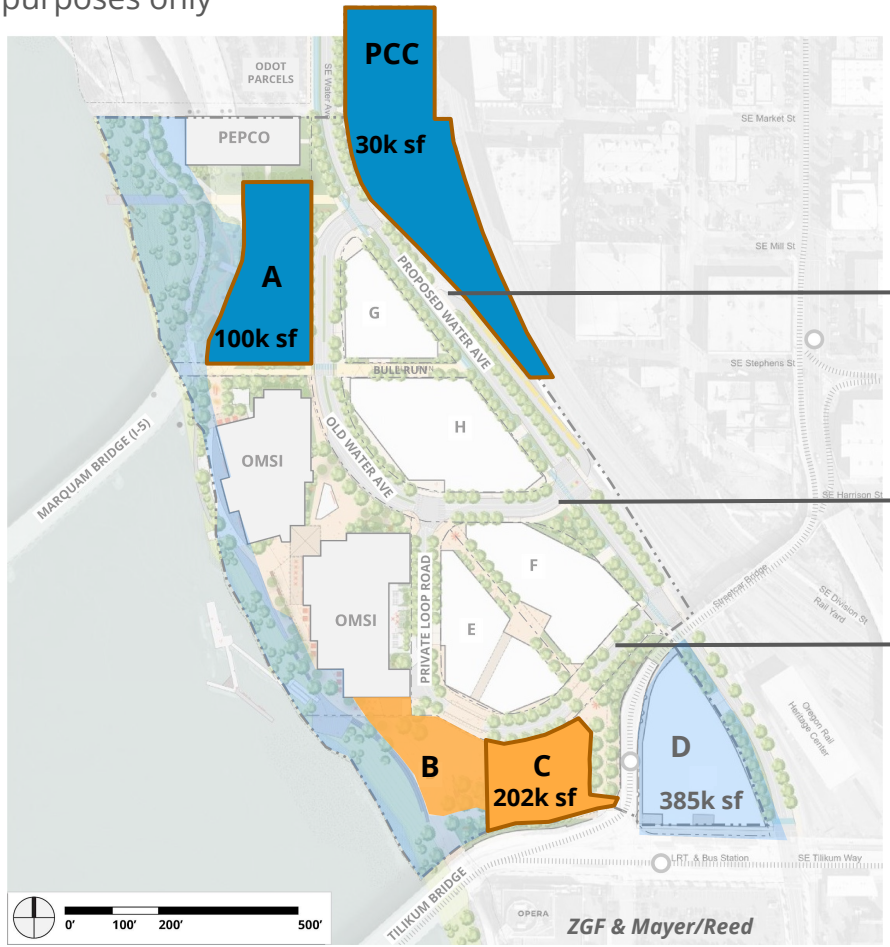
- 4.49ac - Parcel area
- 100k sf - Total Building Development
  - 80k sf - Office/Commercial
  - 20k sf - Active Ground Floor
- 80 - Parking stalls

Parcel C

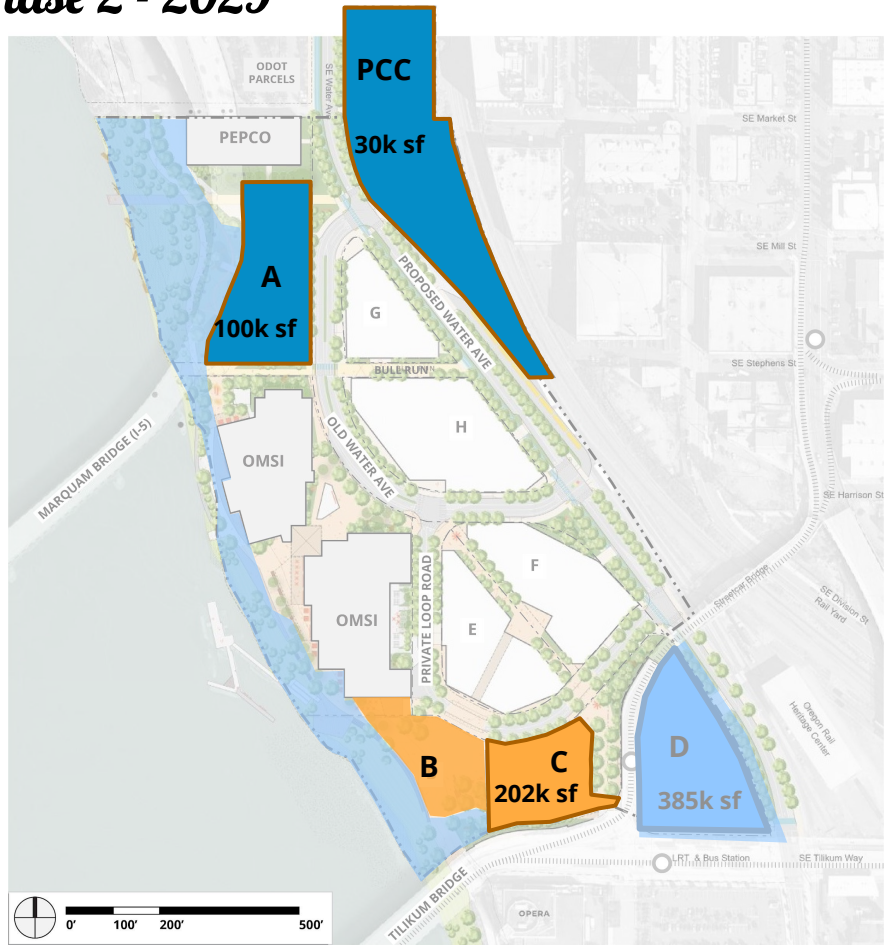
- 1.47ac - Parcel area
- 202k sf - Total Building Development
  - 187k sf - Residential (200 Units)
  - 15k sf - Active Ground Floor
- 0 - Parking stalls
- 300kw - PV Generation

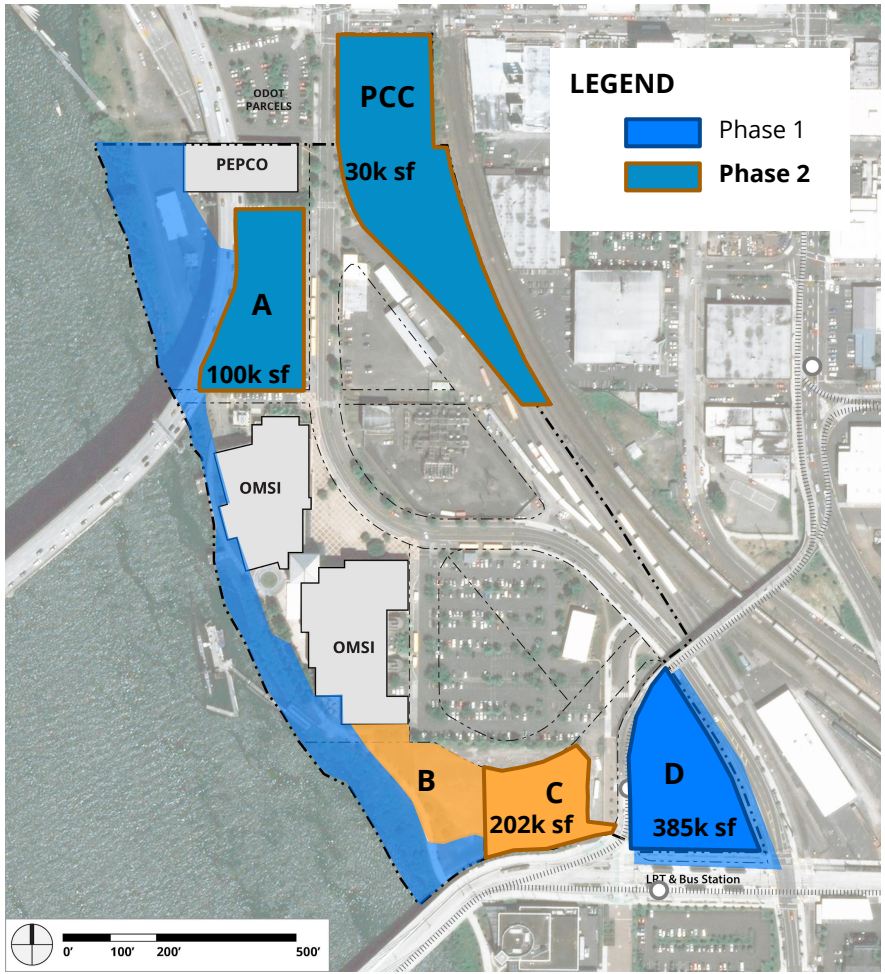
PCC

- 2.85ac - Parcel area
- 30k sf - Total Building Development
  - 30k sf - Active Ground Floor
- 1,125 - Parking stalls



Phase 2 - 2029*





*Hypothetical -- Developed for discussion purposes only

DSC 2.0 Phase 3 - Open 2035

Hypothetical -- Developed for discussion purposes only

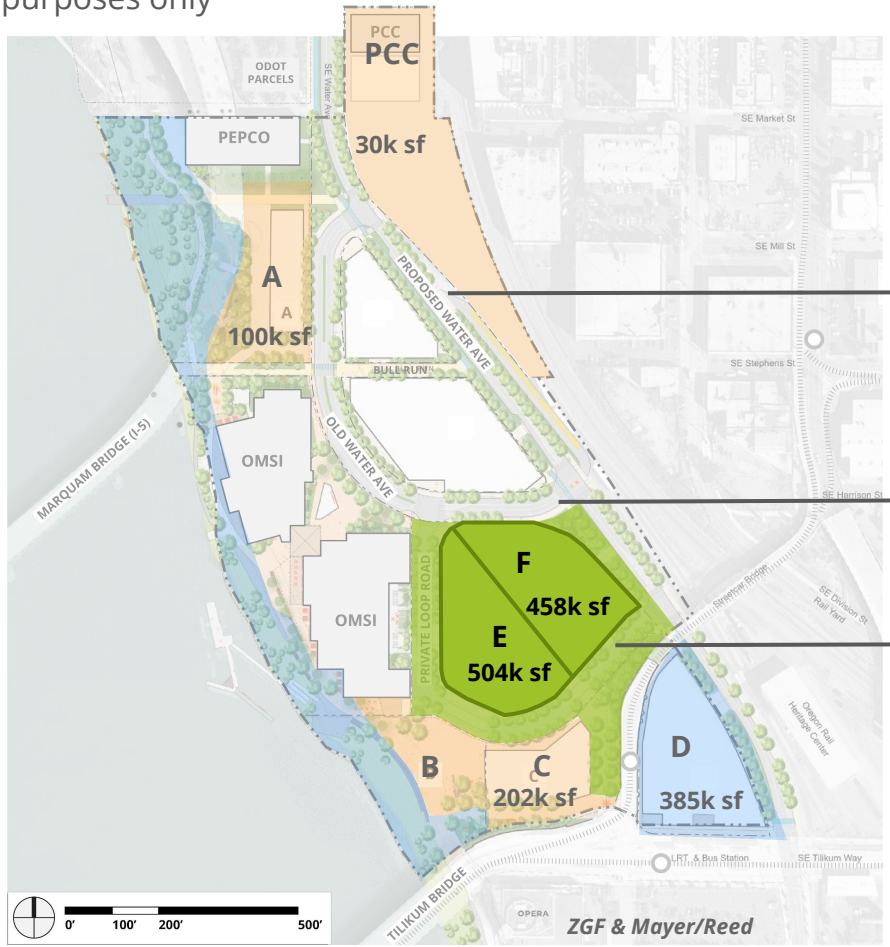
1,679,000 sf - Cumulative Built Program

Parcel E

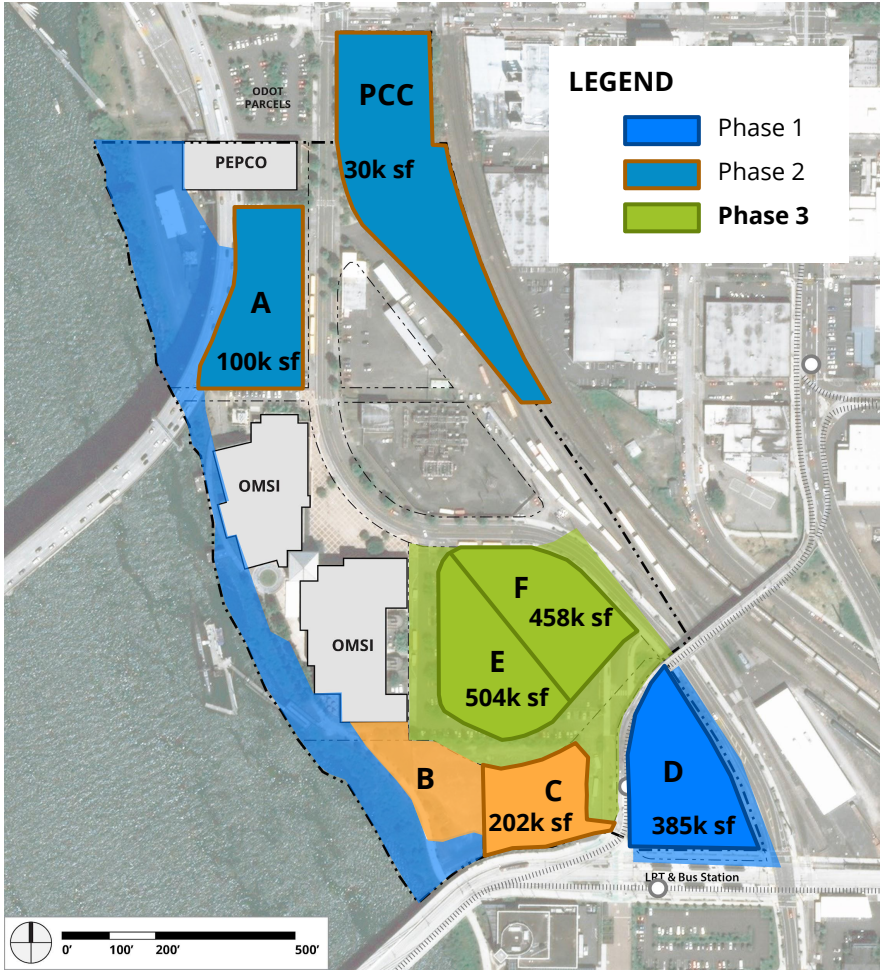
- 1.58ac - Parcel area
- 504k sf - Total Building Development
  - 250k sf - Office/Commercial
  - 188k sf - Residential (200 Units)
  - 66k sf - Botanical/Active Ground Floor
- 197 - Parking stalls
- 200kw - PV Generation

Parcel F

- 1.28ac - Parcel area
- 458k sf - Total Building Development
  - 250k sf - Office/Commercial
  - 188k sf - Residential (200 Units)
  - 20k sf - Active Ground Floor
- 160 - Parking stalls
- 300kw - PV Generation



Phase 3 - 2035*



*Hypothetical -- Developed for discussion purposes only

DSC 2.0 Phase 4 - Open 2040

Hypothetical -- Developed for discussion purposes only

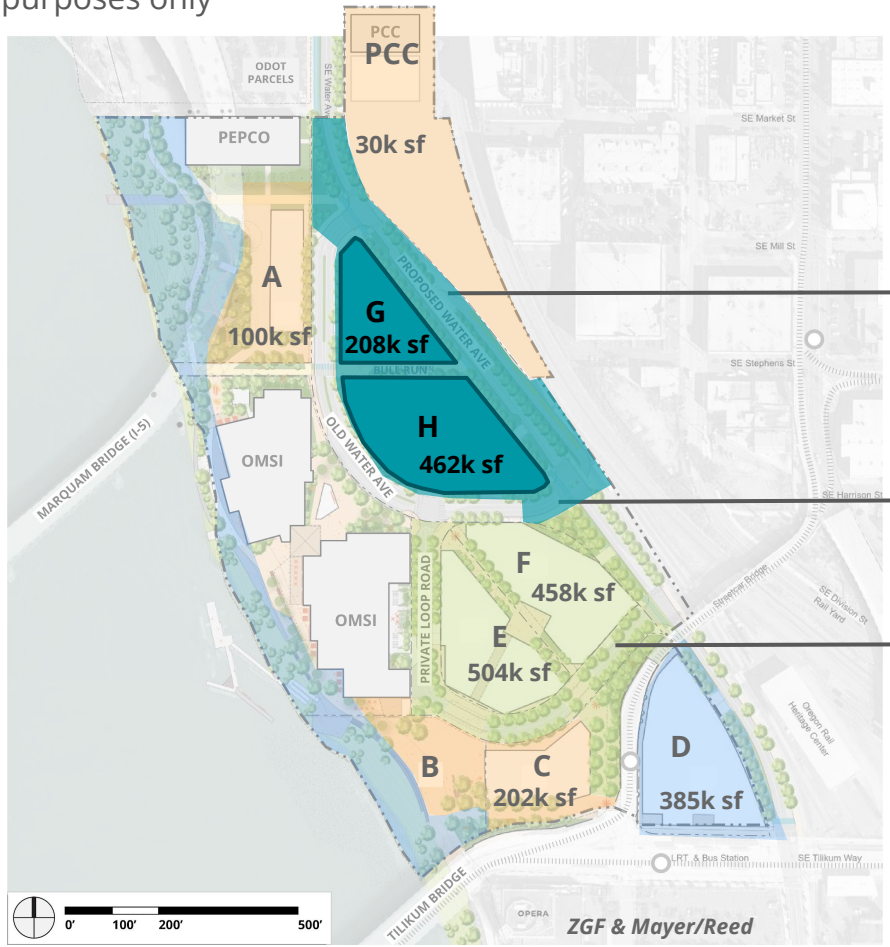
2,349,000 sf - Cumulative Built Program

Parcel G

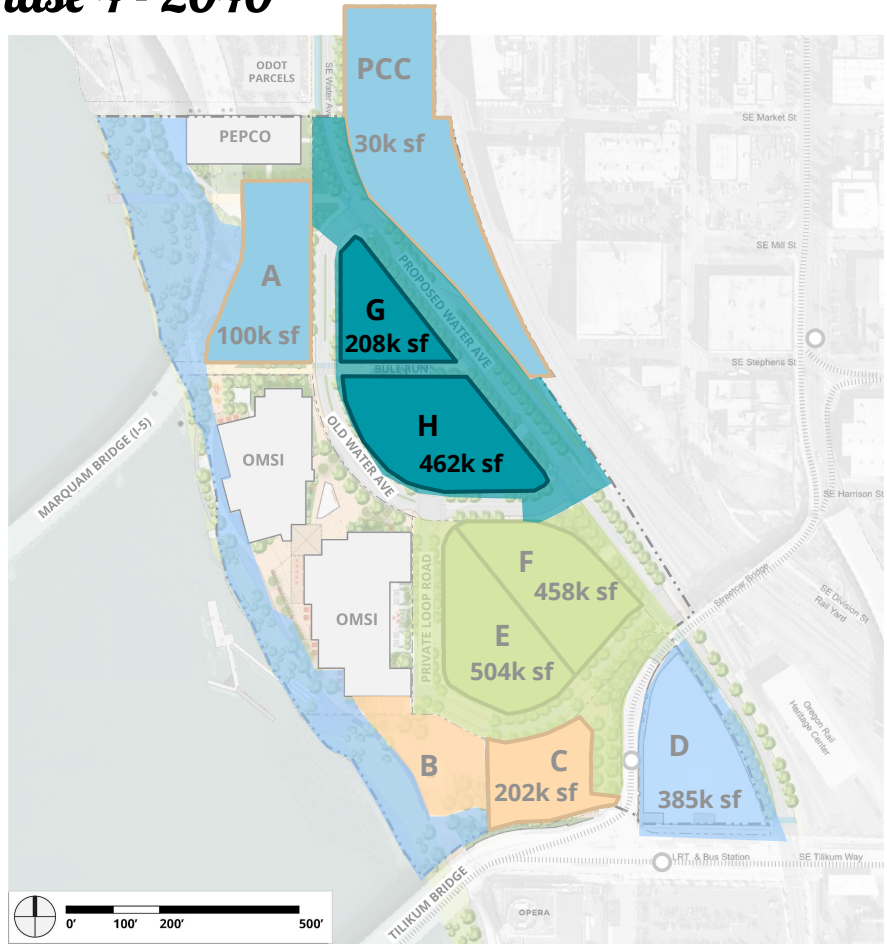
- 0.84ac - Parcel area
- 208k sf - Total Building Development
  - 188k sf - Residential (200 Units)
  - 20k sf - Active Ground Floor
- 0 - Parking stalls
- 200kw - PV Generation

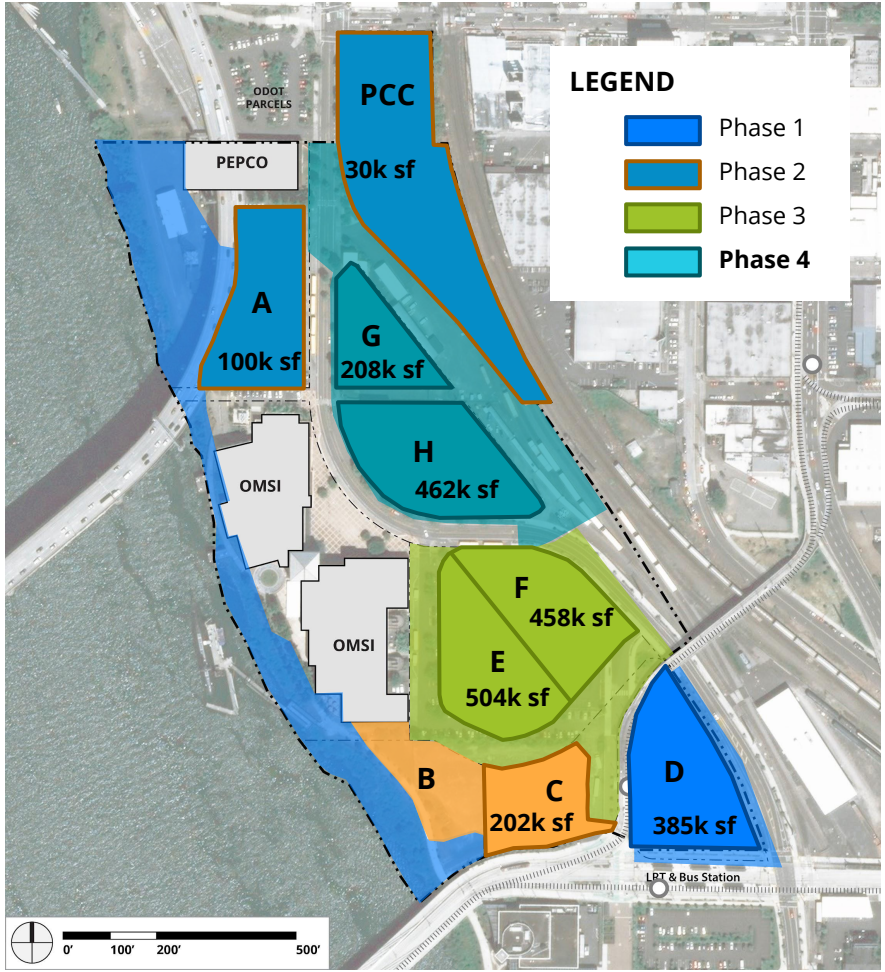
Parcel H

- 1.73ac - Parcel area
- 462k sf - Total Building Development
  - 250k sf - Office/Commercial
  - 187k sf - Residential (200 Units)
  - 25k sf - Active Ground Floor
- 0 - Parking stalls
- 300kw - PV Generation



Phase 4 - 2040*





*Hypothetical -- Developed for discussion purposes only

Infrastructure Workshop

Resource Reutilization, & Urban Ecological Systems Key Takeaways

Tim Smith AIA, AICP

Principal
SERA Architects

Overview of Integrated District Systems, All Based upon Circular Economy Principles

"CORE FOUR" Utilities and Services Systems

District Energy Systems

District Thermal Systems

District Water Systems

District Mobility Systems

Resource Reutilization and Urban Ecological Systems

District Social, Culture, Educational Systems

District Integration with Buildings and Public Spaces

District Food Systems

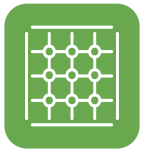
District Material Use, Reduction, Reuse and Recovery

Cross Disciplinary Integrated Strategies from Workshop #2

A water & energy infrastructure nexus

An energy dynamo

An energy mobility nexus



The thermal grid

Food everywhere

Everything is a classroom and a teacher

A Tribal cultural experience

The river

A timeless and technological landscape

A District hydrological cycle

A one-planet, value-added, upcycling, equitable economy

A familiar but much more connected place

Visible infrastructure

Green infrastructure

Social, Cultural and Education Systems

SOME POTENTIAL COMPONENTS

- Circularity-inspired business and training networks
- OMSI and Tribal Nations opportunities
- Active systems to monitor, inform, educate and motivate
- Gamification of circular systems for educational experiences
- Circularity task force created for perpetual stakeholder engagement
- Social entrepreneurial support provided to disadvantaged for training on circular economic practices

EARLY ASSUMPTIONS

- Equity, diversity and inclusion enabled by strong experiential educational programs.
- Storytelling is central to the success.
- Public art can educate on timeless tribal tradition and contemporary issues.

EXAMPLE QUESTIONS

- How can the project be grounded in place and tradition?
- How can all of the rich systems be made visible for learning?
- Where can art and culture manifest in the fabric of the project?
- How can we engage all people of the community?

Social, Cultural and Education Systems

Workshop Key Takeaways

- **Approach the project as a living system**
  - Learning from tribal culture and tradition, design and plan for the project to be supportive to the environment
- **Enable equitable and inclusive opportunity for all people**
  - In the beginning, reach out to underserved people in the community to enable them to participate. At later stages, educate and enable people and businesses to succeed in circular economic strategies
- **Promote STEM education toward Circular and Regenerative Systems**
  - Provide educational experiences that allow people to adopt circular and regenerative system practices
- **Establish and maintain stakeholder engagement in perpetuity**
  - Incorporating circular economy thinking into the district will require ongoing commitment to education, and conversations about benefits, principles, strategies and tactics.

Integration with Buildings and Public Spaces

SOME POTENTIAL COMPONENTS

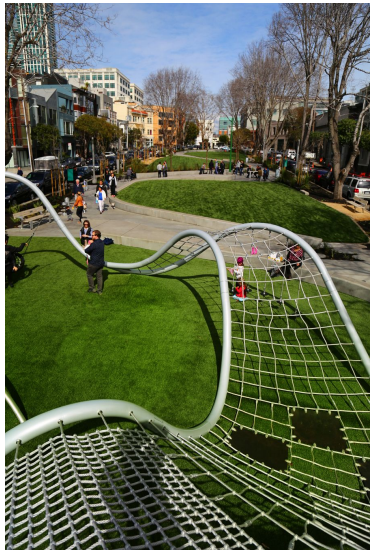
- Foregrounding infrastructure systems and performance
- Hydrology and riverfront opportunities
- Urban forest and urban habitat network
- Uses are planned and zoned for diversity
- Light industrial space provided for material recovery and upcycling
- Facilities provided for sharing of resources

EARLY ASSUMPTIONS

- The riverfront is a unique opportunity for the project
- Buildings and spaces will need to be planned to facilitate best practices in circular economy, education and training
- The entire site, at all phases of development can be purposed for human and ecological health and wellness

EXAMPLE QUESTIONS

- How much building space is needed to support the circular economy programs for education, training and production?
- How can we engage with people to program the waterfront uses for the diverse program needs?
- What trees and plants will promote human and ecological health and wellness most effectively?



Integration with Buildings and Public Spaces

Workshop Key Takeaways

- **Create a Resilience Hub**
  - The OMSI development should provide and demonstrate many different types of refugia for protection from a wide range of hazards including heat, earthquakes, wildfire, pandemics, eruptions, riots, etc.
- **Start with waterfront development**
  - Establish strong visual, programmatic and cultural connections to the river; past present and future
- **Optimize for current use and anticipate future change of use**
  - Optimize the use of undeveloped parcels and build building of all types that anticipate changes of use over time
- **Render sustainable biological and technical systems visible**
  - Allow people to understand and experience the systems of the site as the models of integrated sustainable and regenerative development that they intend to be.
  - Incorporate into phase one to establish district DNA

Food Systems

SOME POTENTIAL COMPONENTS

- ➔ Growing and processing local food
- ➔ Selling and serving local food
- ➔ Greenhouses
- ➔ Composting and organic digesters
- ➔ Local Food Hub
- ➔ Native foods
- ➔ Links to regional organic food growers and processors
- ➔ Advanced district gardening

Great Lakes Food Hub Network

EARLY ASSUMPTIONS

- ➔ There will be horizontal and vertical food systems in the district.
- ➔ Organic materials will be used in biological cycles for nutrition and soil health, inspired by native traditions.
- ➔ Food businesses will be present on site and will have affiliations with others off site

EXAMPLE QUESTIONS

- ➔ Where will the food systems best be located throughout the project?
- ➔ How are the logistics of food systems to be addressed?
- ➔ How can associations be created with nearby food businesses and new businesses be created at OMSI?

Food Systems

Workshop Key Takeaways

- **Develop sustainable food systems on site**
  - At each stage of the project provide healthy sustainable nutrition options for people
- **Create relationships with surrounding food systems**
  - Engender business, education and resource relationships with complimentary food systems in Portland and the region
- **Celebrate food as a demonstrative regenerative strategy**
  - Design and implement food systems that are ecologically regenerative as an educational experience
- **Create food systems as equitable and inclusionary business strategies**
  - Provide opportunities for people to build and grow creative businesses around food and dining systems
- **Prefer ecologically positive food systems**
  - Promote and prefer food systems and sources that are ecologically positive on site and off site.

Material Use Reduction, Reuse and Recovery

SOME POTENTIAL COMPONENTS

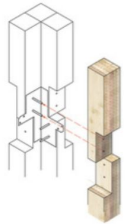
- ➔ Ethically sourced, safe and sustainable materials preferred
- ➔ Low embodied carbon materials preferred
- ➔ Materials to be designed for disassembly recovery and reuse
- ➔ Sharing economy strategies utilized
- ➔ Products of services strategies
- ➔ District collection and source systems
- ➔ Buildings designed to anticipate adaptive reuse

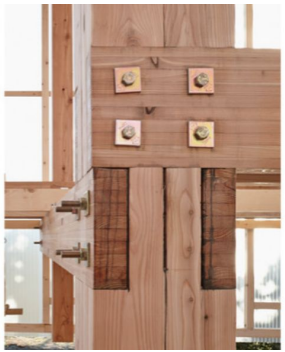
EARLY ASSUMPTIONS

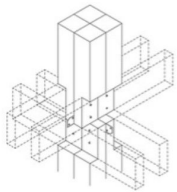
- ➔ Preferred material and product sourcing strategies can be established for the district.
- ➔ Material consumption reduction businesses can be established in the district.
- ➔ Design standards can be established to promote material use innovations.

EXAMPLE QUESTIONS

- ➔ What material collection strategies can be developed with existing local businesses?
- ➔ What purchasing programs can be implemented to reduce cost premium for better materials ?
- ➔ What material upcycling opportunities exist?



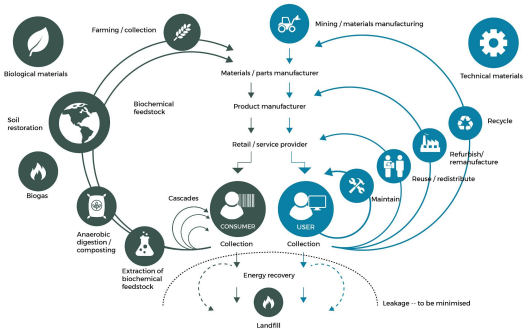




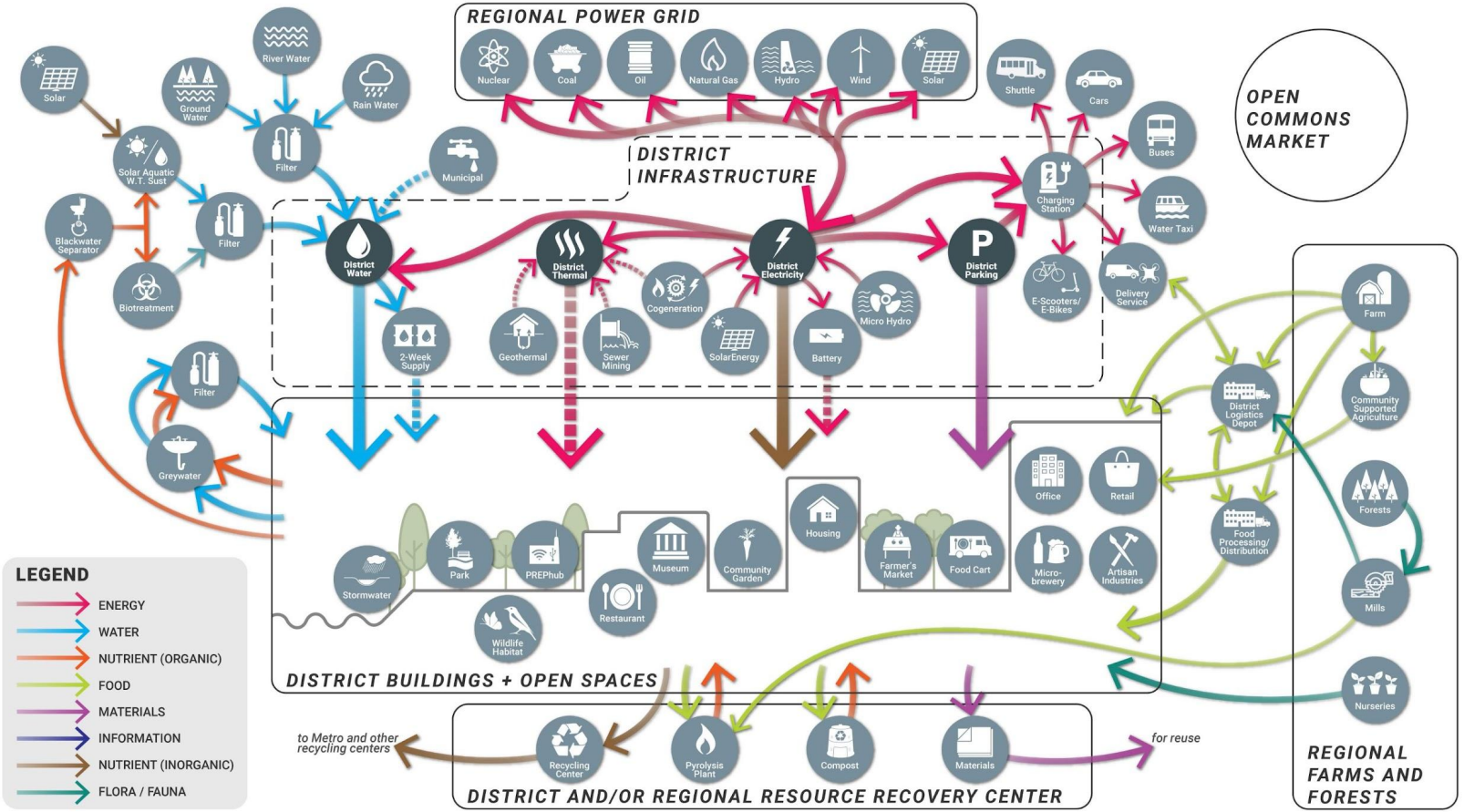
Material Use Reduction, Reuse and Recovery

Workshop Key Takeaways

- ➔ **Develop carbon neutral material use strategies**
  - ◆ Build with alternative and upcycled materials with healthier properties, low embodied carbon and responsible sourcing
- ➔ **Develop timber sourcing supply chains that increase the health of tribal forests and tribal resources**
  - ◆ Research and develop beneficial supply chain ecosystems to meet the need of building at OMSI with tribal resources
- ➔ **Source materials and products that holistically represent the project values**
  - ◆ Define procurement systems to select and purchase preferred materials and products
- ➔ **Promote reduced material consumption through sharing economy strategies**
  - ◆ Create business opportunities for small local companies to provide options to share goods to reduce consumption and waste.



District System Flow Map "Straw Man"



Infrastructure Workshop

Digital Systems

Wilfred Pinfold

CEO
URBAN.SYSTEMS

Separate Digital Systems Workshop Participants

- Addressed the technical challenges of building a community market by bringing together national and international influencers
- Explored issues of portability, interoperability, extensibility and equity
- Outlined a program that would build the tools, datasets, methods and policies that would enable systems thinking in the use of resources and services

FORTH Empowering Mobility
inrupt
Panasonic CITY NOW
Nez Perce Tribe Treaty of 1855
Portland State University
Ellen MacArthur Foundation
Portland General Electric
Technology Association of Oregon
Metro
TriMet
Autodesk
NREL National Renewable Energy Laboratory
VertueLab Green Technologies for Good
ubiwhere Suiting the Future

Privacy and Agency

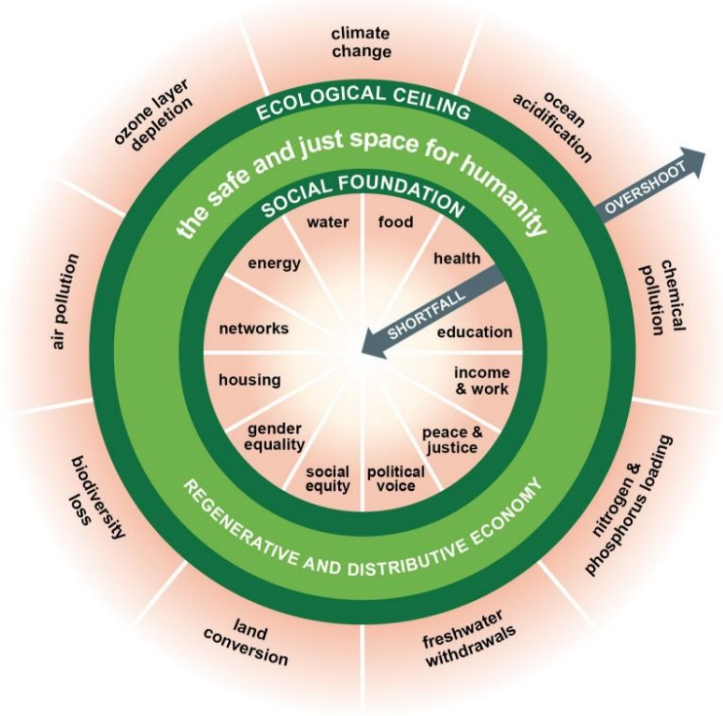
- Previous efforts to build data driven municipal services have been based on centralized data systems (Data lakes, data warehouses)
- These centralized systems suffered three problems
  - Are targets for identity theft and privacy invasion
  - Robs citizens of their agency
  - Potentially invade citizen's privacy
- **Key Principle:** A system that federates data leaving data ownership in the hands of the individual, business or agency responsible for it addresses all three of these problems

Google's "Smart City of Surveillance" Faces New Resistance in Toronto

Local organizers in Toronto have united to push Google out of their government.
The Intercept, Nov 13 2018

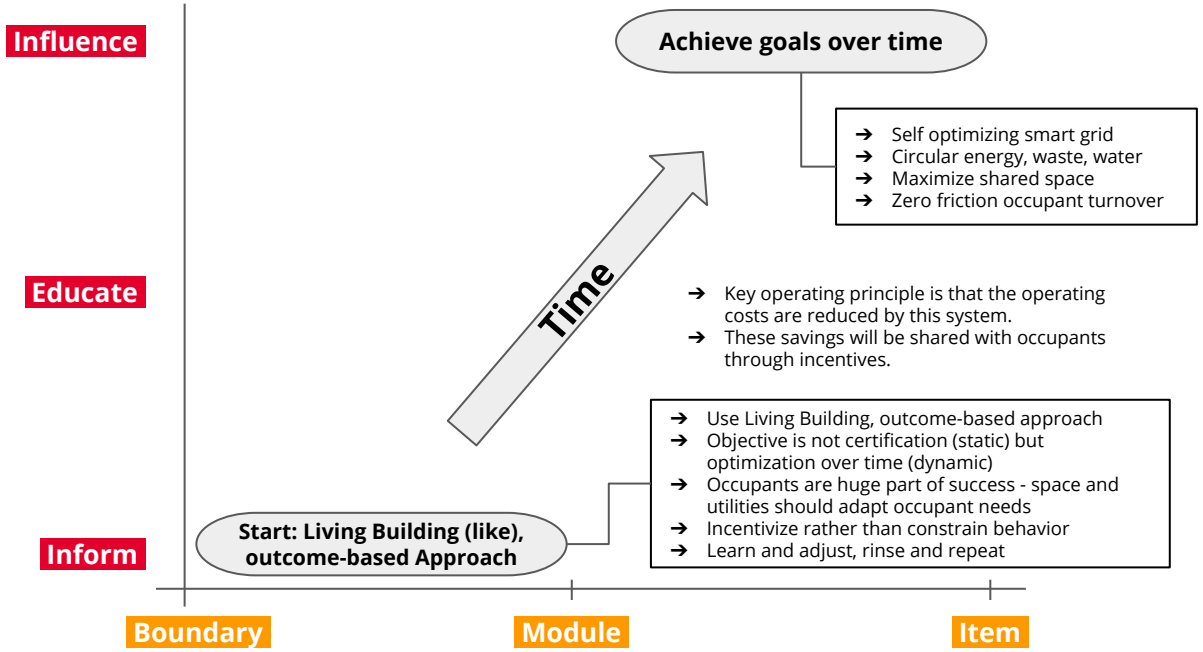
A framework that balances sustainability and equity

- The initial objective of building a sustainable community through the principals of the circular economy had broad support.
- This framework however did not directly address issues of social equity.
- As part of the team's efforts to incorporate circular economy thinking into our equitable development efforts the team has begun to investigate the relevance of the Doughnut Economy model and will be exploring this further as the project advances.



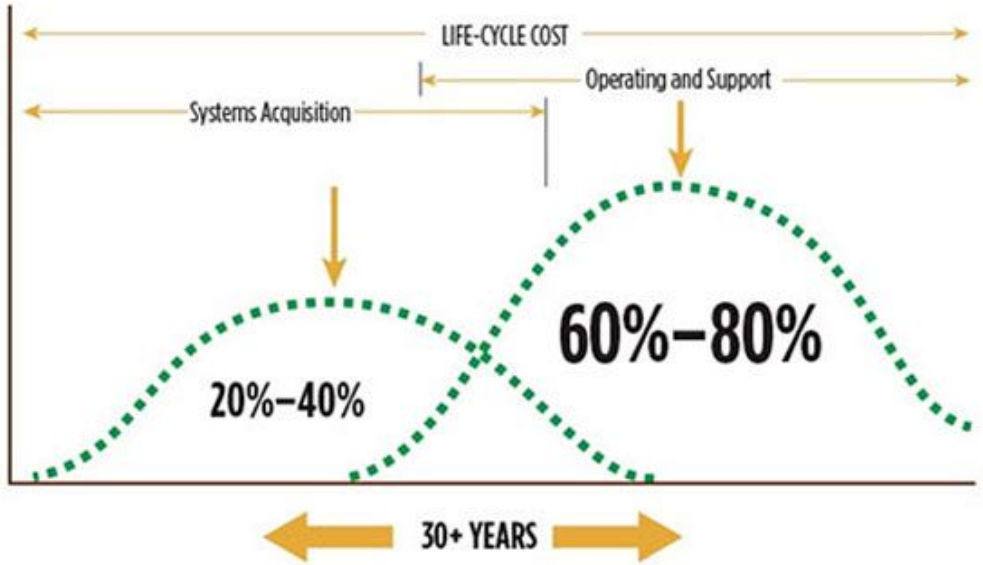
Agile Development Methods

- Agile development methods are common in software development
- They have been shown to reduce risk, accelerate innovation and reduce cost
- They are now being applied to large combined hardware and software programs with great success
- There are huge opportunities to using then in real estate development and management



Engineering Approach

- Minimize permanent structures
- Design for reuse and repurpose
- Address the 3-30-300 rule*
- Use reduced cost of information
- Customize for better experience
- Change expectations



Defense Acquisition University Website

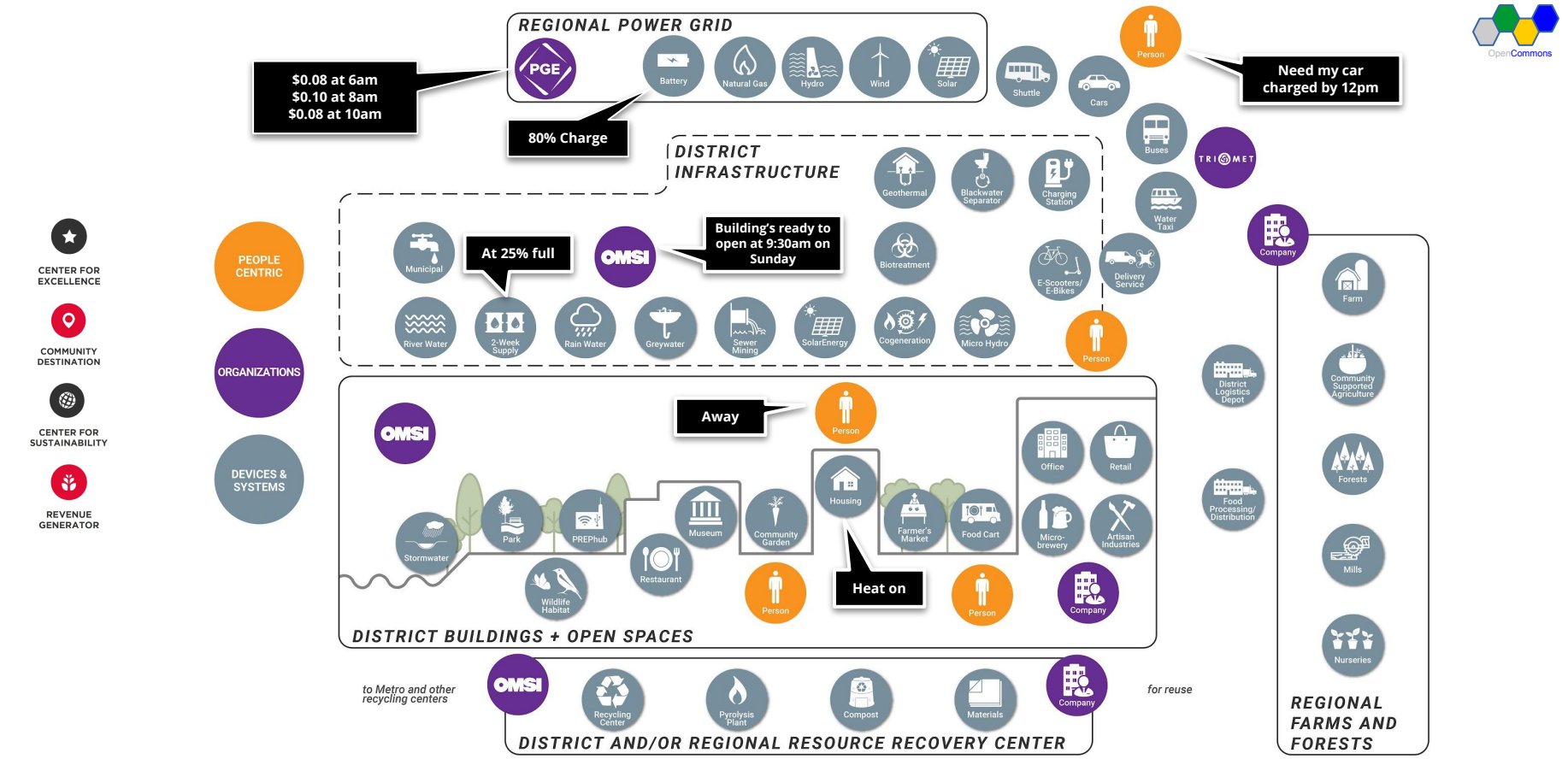
* The JLL 3-30-300 rule illustrates the average order of magnitude between a company's costs for utilities, rent and payroll (*all per square foot, per year*) - $3 for utilities, $30 for rent, $300 for payroll

Standards Deliver Improvements in Cost, Interoperability, Portability, and Extensibility

- Two barriers currently exist to effective use of technology in delivering municipal services.
  - Many current smart city information and communication technologies deployments are based on custom systems that are not interoperable, portable across cities, extensible, or cost-effective.
  - A number of architectural design efforts are currently underway (e.g. ISO/IEC JTC1, IEC, IEEE, ITU and consortia) but have not yet converged, creating uncertainty among stakeholders.
- Working with NIST and its partners we plan to implement systems based on the newly standardized IES-City Framework.

Digital Infrastructure -- Open Commons -- Community Market

Context Sensitive REST API (NGSI-LD & solid-client API)



Digital Systems Next Steps

Around the Region

Reaching beyond the museum campus through outdoor science camps, traveling programs, teacher professional development, and virtual connections, OMSI is committed to accessibility across our region.

→ **Begin to collect Transit data, Freight Data, Parking Data, Location Data, in order to develop a baseline to Guide development, and real time incentive adjustments**

→ **Optimize/ Incentivize Transit to/From Excellent last mile (walk, bike, EAV)**

→ **Understand, track, incentivise optimum transit use**

Parking without $80M+ investment and monetize what you have ←

Disincentivize SOV trips (2035 plan 60%) ←

Digital Systems Workshop Facilitators

Areas of Facilitation:

Open Software Development
Data and Data Standards
Application Programming Interfaces
Privacy and Security
Devices and Sensors
Digital Twin
Incentive Programs

Infrastructure Workshop

Summary / Where do we go from here?

Patrick Doherty

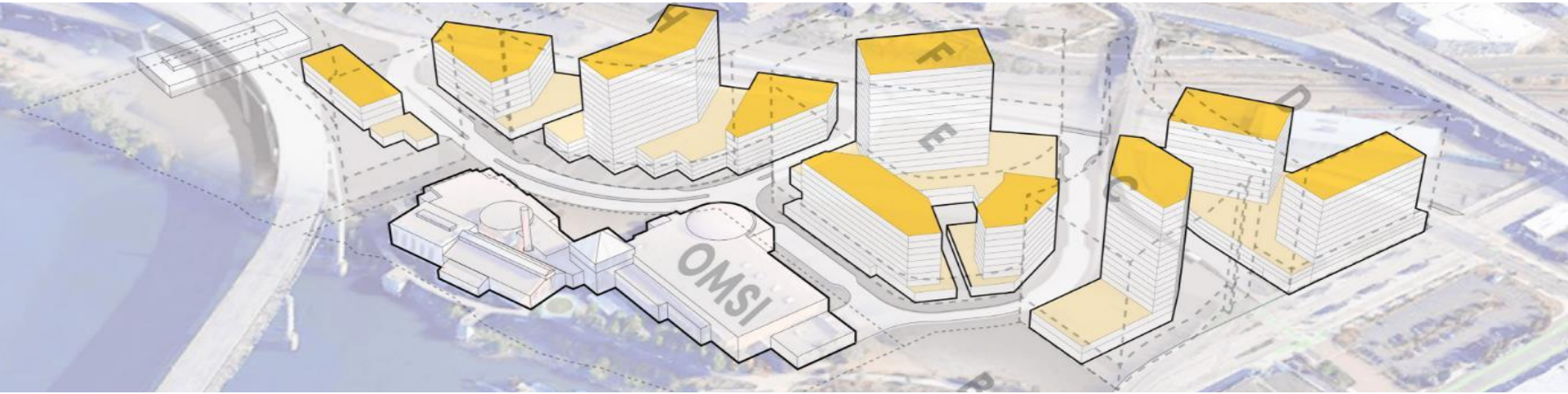
Co-Founder
Long Haul Capital Group LLC

In Summary

The charrettes have validated and expanded our understanding:

- The infrastructure technologies are ready
- The digital optimization technologies are ready
- Impact financing can deliver integrated infrastructure at zero cost to OMSI
- Integrated district utilities will amplify OMSI's education, sustainability, community, and revenue goals

What Comes Next



- ➔ OMSI & redevelopment partners will integrate the Bullitt workshop findings with the Metro 2040 Equitable Development Grant / Center for Tribal Nations (announced Jan. 2021)
- ➔ OMSI and InfraCenters LLC to sign district utility master developer MOU, Spring 2021 (pending legal and governance review)
- ➔ InfraCenters LLC to begin feasibility study to integrate lessons learned into OMSI's mission-driven infrastructure design and development strategy, Spring 2021 (Pending MOU & investment)
- ➔ InfraCenters, LLC vendor team selected, full design work begins Q1 2022.
- ➔ **District utilities & Phase 1 buildings construction start, Q1 2023**


Thank You!
OMSI Bullitt Grant Team:
OMSI
SERA Architects
Long Haul Capitol Group
URBAN.SYSTEMS

Appendix

Infrastructure Workshop

"The Circular Economy"

A presentation made by Darien Sturges of the Ellen MacArthur Foundation at the beginning of Charrette #2 to introduce the Circular Economy concept for the day's discussions.

ELLEN MACARTHUR FOUNDATION

MAVA

PEOPLE'S POSTCODE LOTTERY

POSTCODE GREEN TRUST

SUN

Eric & Wendy Schmidt Fund for STRATEGIC INNOVATION

BlackRock

DANONE

DS Smith

Google

H&M Group

INTESA SANPAOLO

PHILIPS

RENAULT

SOLVAY

SCJohnson

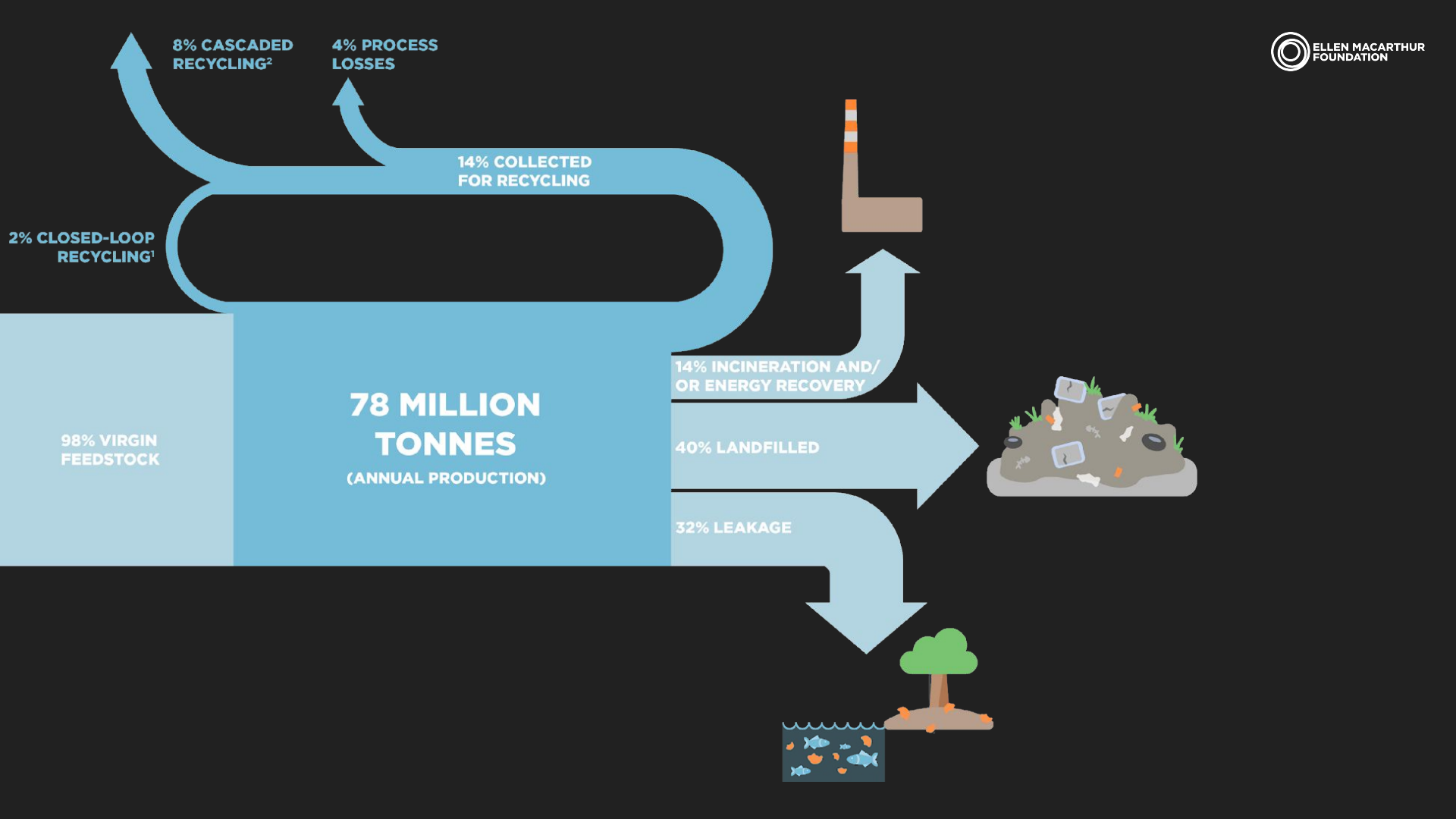
Unilever

THE CIRCULAR ECONOMY


WERNER
5416T

91% of plastic
is not recycled

80% of e-Waste
is not recycled


8% CASCADED RECYCLING[2]
4% PROCESS LOSSES
14% COLLECTED FOR RECYCLING
2% CLOSED-LOOP RECYCLING[1]
98% VIRGIN FEEDSTOCK
78 MILLION TONNES
(ANNUAL PRODUCTION)
14% INCINERATION AND/ OR ENERGY RECOVERY
40% LANDFILLED
32% LEAKAGE


40% of all food produced in the US is thrown out.
Clothing is worn for half as long as 10 years ago.
60% of office space is unused (including work hours).
The average car spends 92% of its life parked.

Everything around us has been designed.

"Design is the first signal of human intention.”
- William McDonough


Maintain/Prolong
Recycle
Circular economy
Refurbish/ Remanufacture
Reuse/Redistribute

Circular Principles

1

Design out waste and pollution

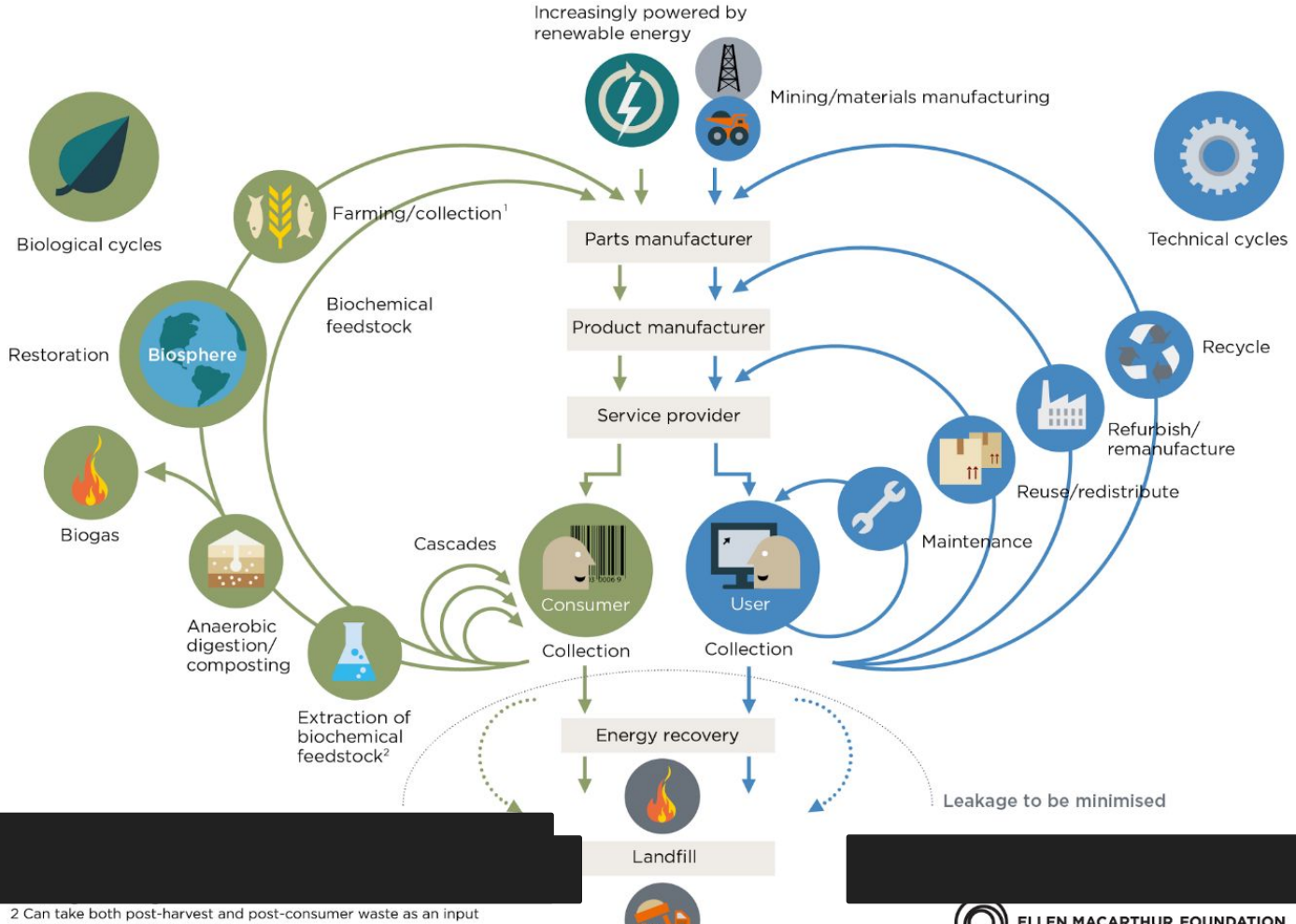
2

Keep products and materials in use

3

Use healthy materials and safe chemistry to enable perpetual cycling of finite resources

CIRCULAR ECONOMY - *an industrial system that is restorative by design*



2 Can take both post-harvest and post-consumer waste as an input

ELLEN MACARTHUR FOUNDATION


CHWP4
CWP4
kaer
kaer
kaer

Product as a Service

Kaer Air Conditioning

- Prioritizes **access** over **ownership**
- **Kaer** (Singapore) takes responsibility for the design, installation and operation of the air-con system, to avoid over specification and ensure the system runs more efficiently.
- Kaer uses IoT data sensing, AI and analytics to constantly fine-tune and optimize the system in real time.
- Building energy consumption is reduced up to 70% and building operating costs reduced by 10 - 20%; more profits and better customer relationships for Kaer.

PRESSURE IMPREGNATION

Impregnation with Burnblock for Solid Wood, Modified Wood, Plywood and more...

PLYWOOD TREATMENT

Natural fire retardant solutions for industrial manufacturing of plywood.

EN45545 PUBLIC TRANSPORT

R10; HL1/HL2/HL3 (flooring); R1; HL1/HL2 (walls); R7; HL1/HL2 (exterior walls)

TEXTILES AND FABRICS

Textiles and Fabrics for End Use and Industrial Purposes.

COATINGS

Matched Lacquer and Paint for Burnblock treated products.

FIBER BOARDS

Naural fire retardant solutions for OSB, MDF and other fiber boards.

NATURAL FIBERS

Natural fire retardant solutions for natural fibers and natural fiber products.

FIT TO PURPOSE

Tailor made natural fire retardant solutions for special products.

Circular Building Products

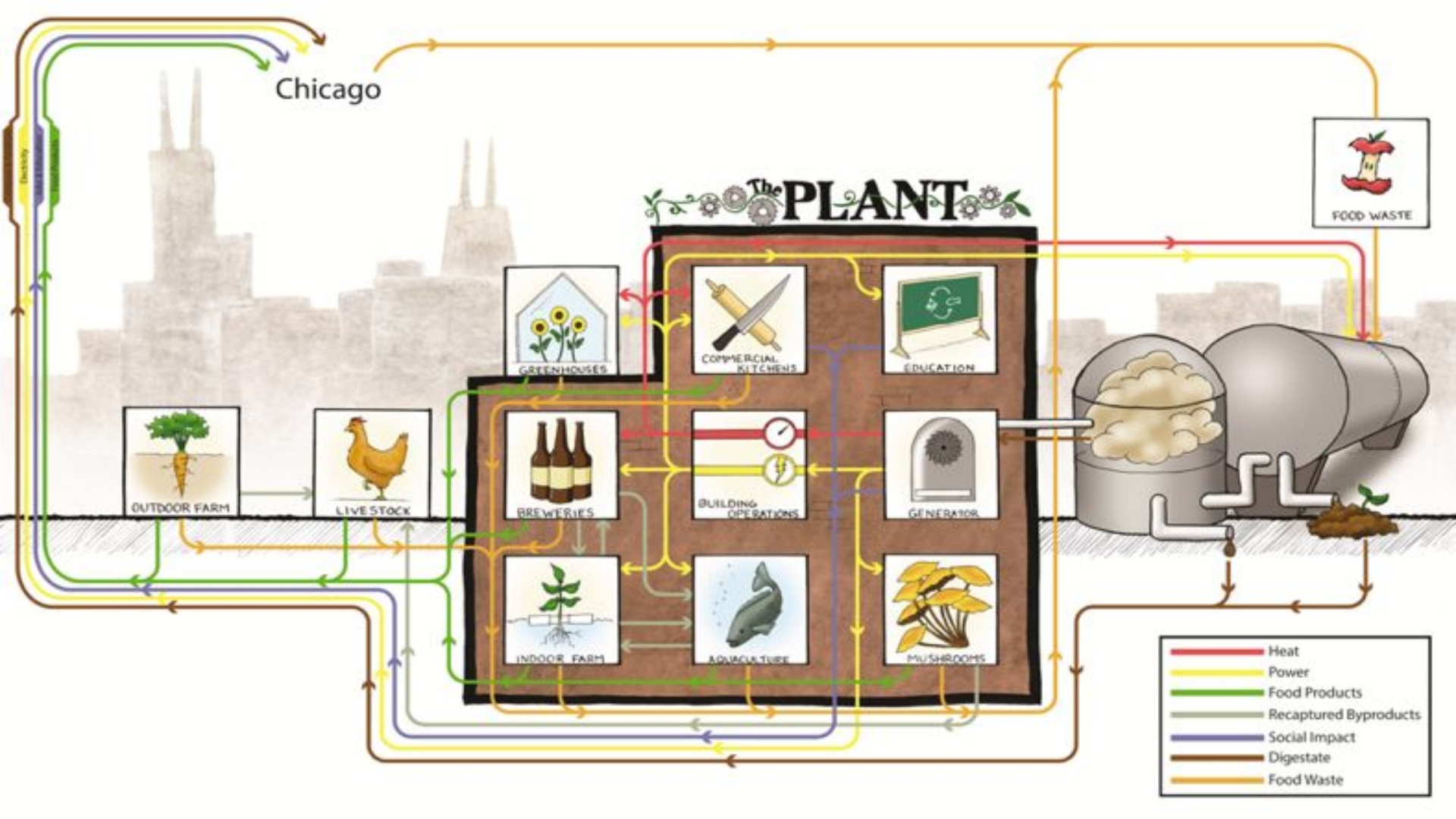
Cross Laminated Timber (CLT)

- Cross Laminated Timber (CLT) is becoming a preferred building material in the region for many reasons including the ability to lower the embodied carbon of buildings
- Example of a C2C Certified Material that is assessed in the stringent C2C Protocols
- Can be designed for disassembly, recapture and reuse
- Opportunity for a local company to Certify a system in C2C as well

Circular Building Products

Bio-based Fire Retardant

- C2C Gold Certified
- Made with biological nutrients
- Can be safely returned to the soil


Chicago
The PLANT
FOOD WASTE
GREENHOUSES
COMMERCIAL KITCHENS
EDUCATION
OUTDOOR FARM
LIVESTOCK
BREWERIES
BUILDING OPERATIONS
GENERATOR
INDOOR FARM
AQUACULTURE
MUSHROOMS
Heat
Power
Food Products
Recaptured Byproducts
Social Impact
Digestate
Food Waste

Food System - The Plant Chicago

Synergistic food production in an impoverished community

- Connects 16 food production businesses on the site of a former meatpacking plant
- For-profit / non-profit partnership
- Co-location of small food businesses facilitates collaboration and material flows
- Collects food waste from nearby industries to feed into their anaerobic digester, which produces biogas that is used on-site