
RAP
Rose Villa
Resiliency
Action Plan
July 2022

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Rose Villa Resiliency Action Plan (RAP) Team

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We gratefully acknowledge all of the individuals who contributed research and expertise to this report.

Amendment to Report from March 22, 2023

General:

1. This report is a synopsis of the Workshop sessions in Stage 1; much of the content of this report includes goals, strategies, timeframes and cost estimations that will evolve over time with the input of RAP consultants, leadership residents and staff.
2. This report is not to be distributed to those outside of the RV RAP Workgroup and RV Consultant Team unless otherwise notified in writing.

Information in Report that has changed as of March 22, 2023:

1. The timeframe of Stage 2 has shifted. It commenced in 2023 (not 2022) and will continue for at least a year or two (not 6 months). This and future Stages, and their associated goals/strategies may continue to evolve.
2. Structurally hardening existing buildings may not be feasible from a logistics/cost perspective.

New information not included in Report regarding Stage 2 focus for 2023:

1. The focus of Stage 2 in 2023 is focusing on the following:
    a. Community engagement through Resident Work Group
    b. Feasibility and cost estimation for structural and energy retrofits of the classic cottages, with a focus on addressing the lowest performing buildings first.
    c. Updating FFE recommendations to install more efficient fixtures, appliances and equipment during RV renovations
    d. GIS mapping of campus for more resilient operations, planning and emergency response
    e. Indoor air quality improvement work

Amendment to Report from May 31, 2023

Sustainability vs Resiliency Goals:

1. The core goal of the RAP is Resiliency. Sustainability goals are complimentary but separate and deserve their own focused plan. Because sustainability is also a goal for the Rose Villa community, Rose Villa will be developing a Sustainability Action Plan that will also be multiyear, multimodal, and involve residents in productive ways. We will be able to identify where each plan supports the other as this unfolds. Integrating sustainability goals that are not resiliency-related dilutes the Resiliency focus of this critical plan that addresses emergency preparedness and response.

Mass Plywood Panel Retrofit Approach:

During Stage 2 analysis, the RAP team explored the feasibility of using a Mass Plywood Panel (MPP) approach for our classic cottage energy and structural retrofit proposal. We met with Mark Fretz and his colleague Jason Stenson at the UO who are leaders in the research and development team of this emerging technology in the US. In talking through the logistics of a MPP approach, it became clear that this technology is not ready for implementation in our regional market yet. There are not yet manufacturers of this technology in our region, and our regional Counties/Cities have not yet permitted such a retrofit solution before. Additionally, attaching heavy and rigid prefabricated panels to the exterior of Rose Villa cottages would trigger mandatory (rather than voluntary) seismic upgrades to the whole structure which would require us to include work that is not deemed necessary to achieve RV's RAP goals within a reasonable budget and timeframe. That said, our structural resiliency team remains open to new technologies, but we're currently proposing a more standard high-performance retrofit approach to the classic cottages with exterior insulation and seismic reinforcement.

Rose Villa Resiliency Action Plan (RAP) Overview

WHAT is the Rose Villa Resiliency Action Plan (RAP)

Founded in 1960, Rose Villa is a nonprofit, single-site continuing care retirement community (CCRC) located on 22 acres overlooking the Willamette River in Portland, Oregon. Rose Villa has a mission of *supporting older adults to live the life of their own choosing*, within and beyond its campus. Maintaining operations that facilitate safety, communication, transportation, and critical care of Rose Villa residents and staff is of the utmost priority.

In recent years, a global pandemic coupled with multi-day power outages, wildfires, ice storms, extreme heat events, and other severe weather due to climate change have all impacted Rose Villa 's ability to maintain safe, stable operations on campus. Additionally, the looming potential of a large Cascadia earthquake is impossible to ignore now that the campus leadership is aware there is a 37% chance that a 7.0 earthquake in our Cascadia Subduction Zone will occur in the next 50 years, according to seismologists.[1]

Recognizing these risks, Rose Villa leadership made the decision to invest in a Resiliency Action Plan (RAP), a cogent framework to be used to guide Rose Villa's next steps for creating a more resilient campus. At its core, the RAP is a summary of high-level recommendations intended to inspire and inform the development of Rose Villa's Capital Improvement Plan, Facilities Maintenance Plan, Resilience Design Guidelines, and Emergency Response Plan.

This report is the first deliverable (Stage 1) in a multi-staged approach to resiliency planning by Rose Villa. By having a clear plan in place, and a clear understanding of the costs and benefits of resiliency measures, Rose Villa will have increased confidence and conviction to dive into the next Stages of the RAP. To minimize the costs associated with

[1] https://www.oregon.gov/oem/hazardsprep/Pages/Cascadia-Subduction-Zone.aspx

implementing the RAP, the team carefully considered how to stage goals and sequence synergistic strategies. In this way, resiliency measures build on each other logically and efficiently over time.

WHO developed the Rose Villa Resiliency Action Plan (RAP)

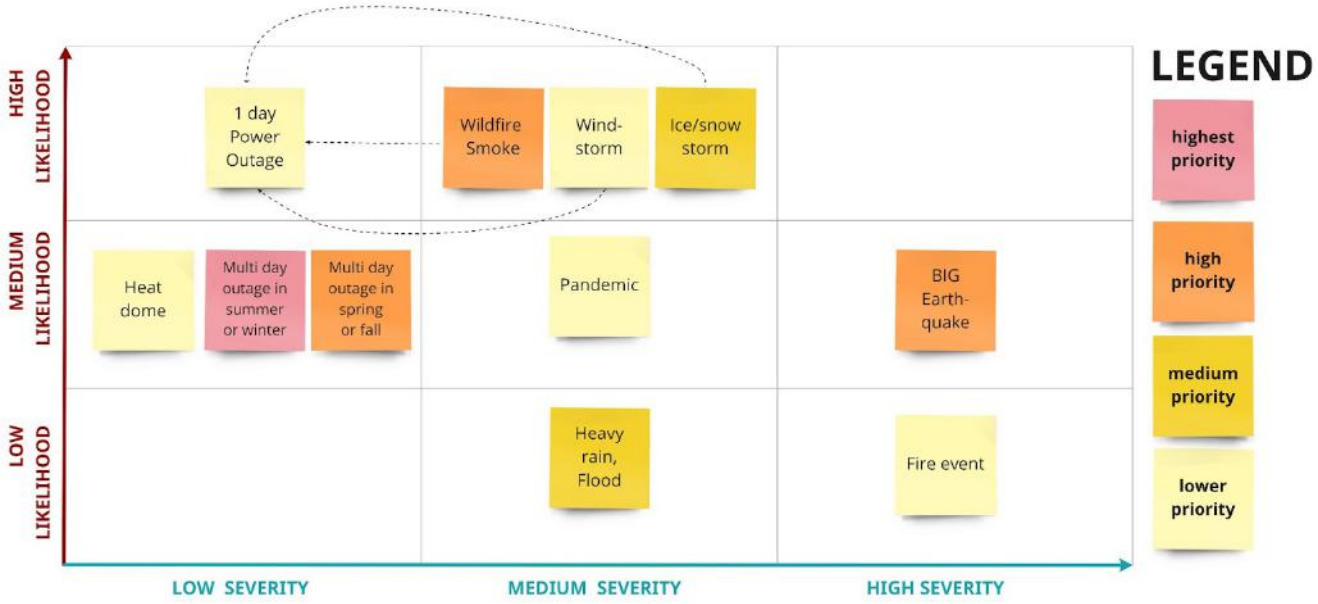
The RAP was created collaboratively with the following resiliency consultants who led Rose Villa leadership through a series of workshops from January to June 2022: Ed Quesenberry of Equilibrium Engineers consulted on structural resiliency, especially as it pertains to seismic events. Karina Hershberg, Ben Burnett, and Marc Brune of PAE provided their expertise on campus energy and water resiliency. Laura Squillace of Green Hammer led the collaborative process and summary report, while Mike Liggett and Alex Boetzel of Green Hammer provided additional consultation and high-level cost analysis. The Rose Villa team consisted of Vassar Byrd, Tina Moullet, Bob Judd, Alex Nemeth, Derek Felsinger, and **Jim Willeford**. It will be primarily the role of Jim and Tina, along with new Operations/Maintenance staff, to shepherd the next RAP Stages.

HOW does Rose Villa define “resilience”?

As with any organization, resilience has a specific yet layered meaning to Rose Villa. Rose Villa’s definition of resilience focuses on safety, stability, and sustainability. Safety and stability refer to Rose Villa’s need to continue operations during and after acute events such as wildfires, heat waves or winter storms. Such events can lead to power outages that last hours, days and even weeks. When developing the RAP, the team agreed that “resilience” is not synonymous with “disaster-proof.” Instead it signifies a capacity to resist and recover from acute, disruptive events. Rose Villa can plan and prepare, but can’t prevent all the risks associated with climate change, natural disasters, and other unpredictable events. As Jim Willeford cleverly put it, “No one can afford to be God-proof.”

Benefits of Resiliency Planning	Resident & Staff **Safety**	Operational **Stability**	Resident & Staff **Stress Reduction**	Campus **Sustainability**	Long-term Cost **Savings**

During our Visioning Workshop, Rose Villa was asked to prioritize potential risks. Following is a snapshot of this discussion, which determined that a multi-day power outage is the highest priority event for which to mitigate. However, Rose Villa also determined a strong need to address the effects of wildfire smoke and plan for a large earthquake.



BENEFITS of resiliency planning

Investing in resiliency planning mitigates risk and improves the overall safety of residents and staff. A resiliency plan helps ensure Rose Villa's operational stability, which also reduces the stress experienced by staff and residents. A more resilient campus results in a more sustainable campus, which is a core value of both Rose Villa and its residents. According to Rose Villa, many current and potential Rose Villa residents are attracted to living there because of the organization's sustainability and resiliency efforts. Their residents want to be part of the solution and leave a positive legacy for future generations. Resiliency measures result in long-term savings on operational and maintenance costs. Finally, all governmental emergency relief services that Rose Villa doesn't need to access due to its resiliency measures become available to other community members in the region who need it. It takes a village.

TIMELINE

The RAP has a 13-23 year timeline broken into five Stages. Time frame durations will be refined during Stage 2 analysis, and further refined during Stage 3 when budgets are developed by Rose Villa through the Capital Improvement Plan.

RAP PHASES	Stage I	Stage II	Stage III	Stage IV	Stage V
Duration	1 year	2 year	1 year	5-10 years	10 years
Year Complete	2022	2024	2025	2030-2035	2035-2045
Goal	**Set Goals** + Propose Strategies	**Refine Analysis** of Costs & Strategies	**Meet Goals of Life-Safety** & Guiding Docs	**Meet goals of** Shorter-term Sheltering	**Meet goals of** Longer-term Sheltering Goals

Stage I is accomplished with the completion of six participatory workshops and this summary RAP Report.
Stage II commences soon after Stage 1's completion to develop and prioritize specific costs, timelines and actionable steps to complete Stage III - Stage V RAP strategies.
Stage III begins as soon as Stage II planning and collaboration with Rose Villa allows and in coordination with Rose Villa developing its Guiding Documents***.**
Stage IV begins when the Guiding Documents*, are drafted and budgets developed to implement Stage IV strategies.
Stage V begins when Stage IV goals are met and continue until the RAP goals are achieved.
* *Capital Improvement Plan, Facilities Maintenance Plan, Emergency Response Plan and Resilience Design Guidelines*

Careful thought went into the phasing of the RAP's goals as well as identifying the synergistic relationships between proposed strategies, so that efforts and investments build on each other in an efficient and logical way. As ideal as a logical stepwise approach is, like building maintenance, resiliency planning is an evolving and continuing effort. Therefore, the RAP should be considered a living document that can and should get updated over time. For instance, the phasing timeframes may need to adjust based on updated budgets, emerging technologies, shifting priorities, etc. The time frames associated with each Stage are guidelines and ideal 'due dates', if the goals and associated strategies can be accomplished sooner, all the better.

SCOPE of the RAP

The RAP applies specifically to Rose Villa's existing campus and considers the potential of adjacent properties that may become part of the campus in the future. The Resilience Design Guidelines (see the 'Resilience Design Guidelines' chapter near the end of this report) apply to new and existing buildings, and relevant to future developments Rose Villa pursues off-campus. Furthermore, the general approach and philosophy embedded within this RAP should be applied to all future planned developments.

Key Attributes of Rose Villa's Resiliency Strategies

Overall, **resiliency strategies** are to be:

- **SYNCHRONIZED** with each other to:
  - Minimize cost by combining retrofit work that's planned for the same area (e.g. reduced mobilization time).
  - Minimize disruption to residents and staff by the reducing number of times retrofits occur in their space(s).
  - Optimize the development of the Capital Improvement Plan, Facilities Maintenance Plan, and Emergency Response Plan. We recommend Rose Villa complete "Synchronicity Reviews" during the development of these Guiding Documents.
- **SCALED** to maximize benefits such that:
  - Energy efficiency, water efficiency, and seismic retrofits, occur at a full building scale.
  - Energy generation + storage, and water collection + storage systems occur at a neighborhood scale.
  - Shelters and key emergency services, such as emergency medical shelters, occur at a campus scale.
- **PHASED** to ratchet risk mitigation levels up sequentially so that:
  - PHASE II Goals prioritize resident, staff and community buy-in to the RAP, taking easily attainable first actionable steps to improve campus safety and development of the Guiding Documents (the Capital Improvement Plan, Facilities Maintenance Plan, and Emergency Response Plan).
  - PHASE III Goals prioritize the ability to safely evacuate the campus and further development of the Guiding Documents.
  - PHASE IV Goals prioritize the ability to shelter in place short term (1-2 weeks).
  - PHASE V Goals prioritize the ability to shelter in place longer term (2-4 weeks or more).
- **BENEFICIAL,** independent of whether an emergency event ever occurs, for:
  - People by improving comfort, air quality and water quality as well as reducing anxiety about disasters.
  - Planet by reducing reliance on resources such as dirty fossil fuels and precious water supplies.
  - Profit by reducing energy bills, water bills, and maintenance requirements, while improving marketing profile to attract future residents.

ROSE Petals: Resilient Operations and Sustainable Environment

The concept of ROSE petals emerged from recognizing Rose Villa desired a visionary approach to resilience and sustainability on campus. **Resilient Operations and Sustainable Environment (ROSE)** is a distributed approach to resilience at a variety of scales with multiple benefits. ROSE Petals refer to the various retrofit and new campus infrastructure—ROSE Homes, ROSE Havens, ROSE Ports, ROSE Lots, and ROSE Pavilion— proposed in this report. The ROSE Pavilion is the only new resilient structure proposed. The other ROSE petals consist of existing homes, carports, parking lots, and community service spaces that will be upgraded to meet resilience goals. This approach provides key redundancy to better ensure reliable operations in an earthquake. Second, it allows for residents to be accountable for their own resilience at the scale of the ROSE Home and ROSE Ports in case it takes days for RV staff to mobilize operations at ROSE Lots, ROSE Havens and the ROSE Pavilion. Third, it allows Rose Villa to phase resilience interventions into campus infrastructure in such a way that is financially feasible.

ROSE Petals:

- **ROSE Homes:** Existing homes that have received structural, energy, and water resilience retrofits.
- **ROSE Ports:** Existing carports that are upgraded to provide energy resilience at a neighborhood scale.
- **ROSE Lots:** Existing parking lots where tents are set up to provide services if buildings aren't occupiable.
- **ROSE Havens:** Existing community spaces* that provide key services and space for sheltering in place.
- **ROSE Pavilion:** New covered platform(s) for outdoor gatherings near gardens with river views that provides off-grid generation and storage of energy and water, composting toilets, an outdoor kitchen, and a safe place for many to shelter if they cannot re-occupy their homes.

***Potential ROSE Havens**

Below is a list of key spaces on campus that either A) need to maintain operations in an emergency because they serve critical services, or B) provide a large enough community space to potentially serve as shelter for residents and staff who may not be able to reoccupy their home immediately. To help ensure ROSE Havens are operational after a large earthquake, these spaces/ and the services provided there will require a reliable source of energy and water, as well as sufficient structural resilience. In Stage 2, the RAP team can revise this list to be more comprehensive, and refine the resilience needs of each space.

1. South Main: Kitchen, dining and lounge
2. Schroeder Lofts: Medical clinic, daycare and community space(s)
3. Madrona Grove: Kitchen, community space(s)
4. North Main: Auditorium and pool (for water resource)
5. CAB: Community room
6. Other: TBD

	ROSE Homes	ROSE Ports	ROSE Havens	ROSE Lots	ROSE Pavillion
Locations	**Homes**	**Carports**	**Indoor Community spaces and critical service spaces**	**Parking lots and Phase 3 Courtyard**	**Lower Laurie lot**
Disaster Resilience	Power Outage Wildfire smoke Heat Wave/Dome Ice/snow/wind storm *Possibly Earthquake/fire*	Power Outage Earthquake	Earthquake	Power Outage Wildfire smoke Heat Wave/Dome Ice/snow/wind storm *Possibly Earthquake/fire*	Power Outage Earthquake
Phase 1 & 2	**Analysis**	**Analysis**	**Analysis**	**Analysis**	**Analysis**
Phase 3	**Replace inefficient** fixtures, appliances, equipment at end of product's life --- Require **power packs** and **bottled water** storage in as part of ReadyForce home kits	---	**Stock emergency supplies** in labeled storage areas within or near Havens	Procure and store **bucket toilet system** with pop up tents for deployment to ROSE Lots	---
Phase 4	**Seismic reinforcement** of pre-1975 homes -- **Efficiency Retrofits** to reduce energy by 25% and water use by 13% -- **Microgrid installation**	**PV powered charging stations** for electric vehicle carshare program and emergency power supply	**Seismic reinforcement** of one more Havens buildings --- Install **Rainwater Catchment** that irrigates landscape and provides potable emergency water when filtered properly	**Procure and store large tents** and other emergency supplies for deployment to ROSE Lots	---
Phase 5	**Efficiency Retrofits** to reduce energy by 50% and water use by 25% -- **Microgrid installation**	---	---	---	**Construct ROSE Pavilion** with battery backed up PV, Large potable water cistern, composting toilets, an outdoor kitchen and a large covered platform with River views for social events an emergency shelter


RAP Map of
Resilient Operations
& Sustainable Energy Petals
ROSE Homes
ROSE Ports
ROSE Havens
ROSE Lots
ROSE Pavilion
Willamette River
Denny Road
Garden Grove
Community Gardens
ROSE Pavilion
Location of the ROSE Pavillion is not set and is in the process of being reconsidered per results of ongoing studies and discussions
Laurie Avenue
Yellow House Store Supplies
Future Afford. Housing Develop
Future Afford. Housing Develop
ROSE Haven CAB
SW Classic Cottages
Rose Ct.
The Oaks
South Central Cottages
Rosewood Lane South Pocket Cottages
Central Pocket Cottages
NW Classic Cottages
Wild Rose Drive
ROSE LOT
New Facilities Operations Building
Courtney Road
SE Classic Cottage
ROSE LOT
Schroeder Avenue
ROSE Haven Health Clinic, Rec. Rm as Shelter, Daycare
Schroeder Lofts
ROSE LOT
Trillium Townhomes
Madrona Grove
ROSE LOT
Potential Future Property For Garden or...
ROSE Haven Kitchen, Dining, and Lounge as Shelter
South Main
Main Street
ROSE Haven Auditorium
North Main
ROSE LOT
ROSE Haven Pool
North Pocket Cottages
Schroeder Avenue
Wild Rose Drive
NE Classic Cottages
River Road
ROSE LOT

RAP Goal Chart

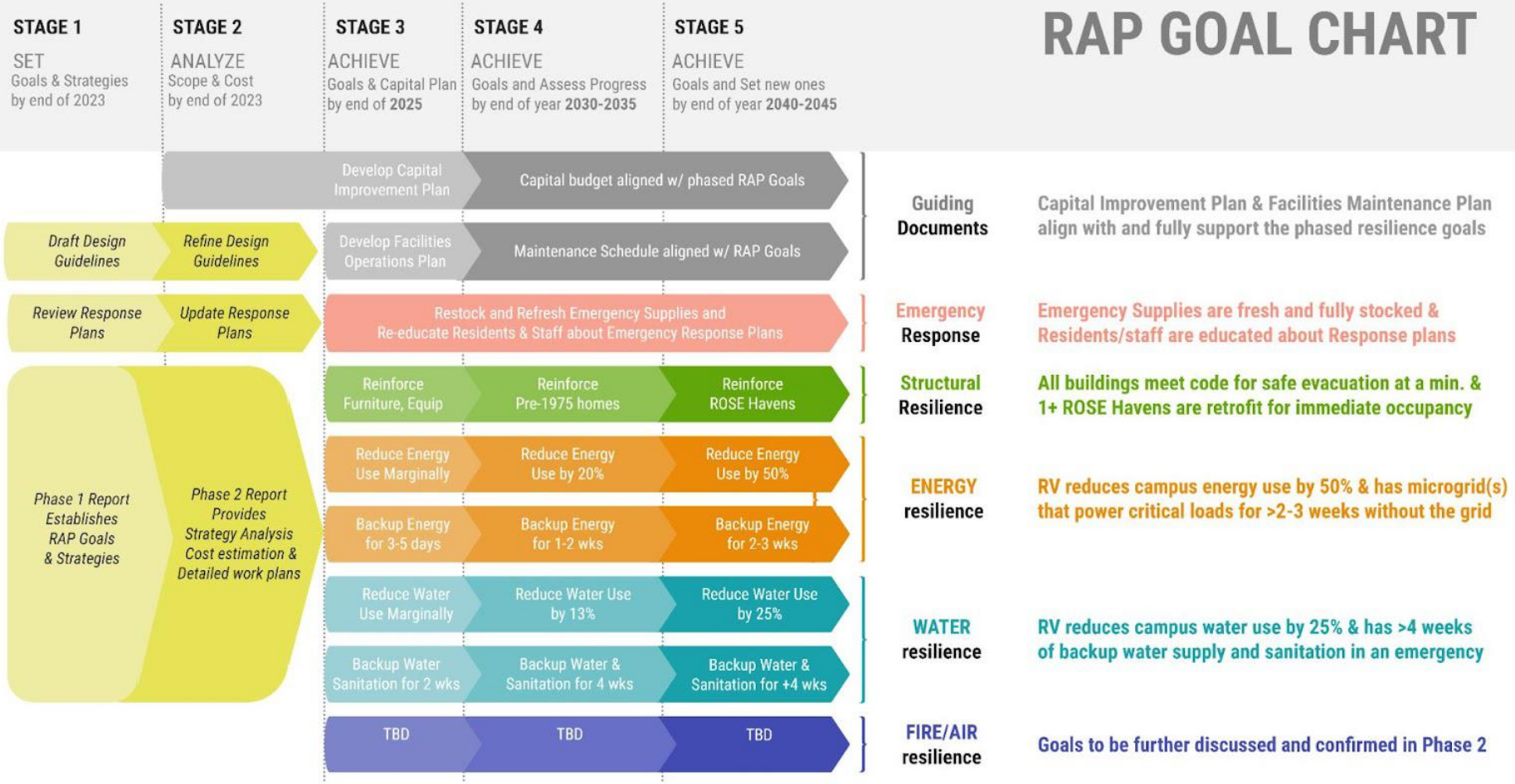
The RAP Goal Chart on the following page summarizes all the goals and stages included in the RAP and how the goals and stages interrelate. This is a living document meant to be updated as often as necessary throughout the RAP process to reflect key revisions. For example, Rose Villa may decide to add staged goals for Fire Resilience and/or decide to shorten the duration of Stage 3 or extend the duration of Stage 5. Both revisions, if made, should be reflected in this chart.

Stage 3 is an important inflection point because it is when Rose Villa will finish the initial Guiding Documents, including the Emergency Response Plan, the Capital Improvement Plan and the Facilities Maintenance Plan. The concept, set forth by Rose Villa leadership in our Visioning Workshop, is that the Stage 1 and 2 analysis will deeply inform the development of the Guiding Documents and intentionally align the capital budget and maintenance plans with the RAP. Without this alignment, the implementation of the RAP will not be feasible.

Goals are Ambitious and Achievable

The goals in this timeline are undoubtedly ambitious and still can be achieved with proper investment of time and resources. It's worth noting that continuous independent operation off the grid is near impossible; not even the military has come close to achieving this goal, according to Jim Willeford. After weeks of providing sheltering in place with off-grid energy and water supplies, evacuation may turn out to be the best answer for residents so that rebuilding and remediation can happen safely and efficiently.

ROSE VILLA'S
RAP GOAL CHART



Overview of Structural + Seismic Resilience at Rose Villa

GOALS

Rose Villa has two goals for structural resilience on campus. The first goal is retrofitting older (pre-1975) residential buildings to meet current structural code, which would enable occupants to safely evacuate in the event of a large earthquake. The second goal is retrofitting specific mixed-use buildings to meet Category IV Immediate Occupancy standards, which may help residents shelter-in-place on campus, even if it's not within their primary residence.

CONSIDERATIONS

Per Carlson's Geotechnical Reports from 2012 and 2017, the Rose Villa campus appears to be built on stable ground, with low susceptibility to liquefaction, slope instability, and lateral spreading. Therefore, when planning for improved structural resilience at Rose Villa, the most significant hazard is a Cascadia Subduction Zone earthquake. According to the *2013 Oregon Resilience Plan*: "Very large earthquakes will occur in Oregon's future, and our state's infrastructure will remain poorly prepared to meet the threat unless we take action now to start building the necessary resilience."[2] There are also known faults nearer to Rose Villa that could be sources of earthquakes that are more frequent than those emanating from the Cascadia fault. There is a 37% chance that an earthquake of 7.1+ magnitude will occur in the Cascadia Subduction Zone in the next 50 years. This event will be felt throughout the Pacific Northwest. This probability has led many government and non-government entities to undertake seismic resilience planning and retrofits to improve the safety of their structures.

For the purposes of this RAP in Stage 1 Study, structural resilience studies and recommendations are calibrated to current building code requirements. It is important to understand that the basis of the building code is collapse

[2] https://www.oregon.gov/oem/documents/oregon_resilience_plan_final.pdf

prevention and life safety, NOT resilience. Therefore, the RAP team used the building code's risk category classification system as the basis for defining relative levels of resilience. Relative seismic forces can be translated into levels of retrofit required for each RAP Stage. The code defines four distinct risk categories:

- **Category I** : Buildings that represent a low risk to human life in the event of failure (e.g. barns, storage).
- **Category II:** All buildings that are not Category I, III, or IV. (e.g residential, office, retail buildings).
- **Category III:** High-occupancy structures (e.g. educational facilities, theaters, gymnasiums, stadiums).
- **Category IV:** Buildings that are essential to community recovery or that pose significant risk if damaged (e.g. hospitals, emergency response facilities, emergency shelters, fuel storage facilities, etc.).

Each category has force magnifiers and construction standards, which decrease the probability of failure as you go from Category I to Category IV. Buildings in Category I and Category II have a conditional probability of failure of 10% under the maximum credible earthquake. This probability reduces to 5% for Category III and 2.5% for Category IV. Because structural resilience is defined primarily by the time it takes to restore the building to a safe condition after an earthquake, it stands to reason that a Category IV structure would be classified as more resilient than a Category II building. While this tie between risk category and resilience is not exact, it provides a framework conducive to developing campus-wide plans such as this RAP.

FINDINGS

All post-1975 buildings on the Rose Villa campus were most likely designed to Category II provisions of the code that was in effect at the time the buildings were built. Although code provisions, especially those relating to seismic design, have changed significantly since 1975, light-framed wood structures built after 1975 have proven to fare relatively well during earthquakes. As such, the focus of the structural assessment performed as part of this RAP study focused on buildings built prior to 1975.

FEMA P-154 Rapid Visual Screening of Buildings for Potential Seismic Hazards[3] provided the basis for our assessment of the pre-1975 buildings. The *FEMA P-154* assessments resulted in numerical scores for each building studied. These scores provide a scale of relative resilience, as those with lower scores relative to others will likely sustain more damage and therefore take longer to restore to a safe, functional state after an earthquake.

All pre-1975 buildings included in the structural assessment are one-story wood-framed structures on a concrete foundation. This type of structure has proven to fare well in earthquakes, primarily due to being relatively lightweight and structurally redundant (numerous independent pieces as opposed to systems with fewer, isolated elements). With the exception of Southwest Cottage 306, the studied structures all had FEMA P-154 scores of 2.0 or greater. Structures with scores of 2.0 or greater are identified as having relatively low risk of collapse or risk to life safety during an earthquake. Given their vintage and P-154 score, it is likely that most of the pre-1975 buildings fall slightly short of Category II classification under current code when it comes to expected performance.

RECOMMENDED OPTIONS for Pre-1975 Buildings

To meet the stated structural resilience goals Rose Villa has for their community, we have the following recommendations related to structural upgrades for heightened structural resilience:

- Retrofit to current code provisions for Category II buildings at a minimum.
- Retrofit to current code provisions for Category IV buildings if Rose Villa wants to achieve a higher level resilience for any structure on its campus, since the incremental cost to improve from Category II to Category IV is not significantly more than from Category II to Category III, especially for light-framed wood structures such as those included in the assessment.*

[3] https://www.fema.gov/sites/default/files/2020-07/fema_earthquakes_rapid-visual-screening-of-buildings-for-potential-seismic-hazards-a-handbook-third-edition-fema-p-154.pdf

- Consider replacing some pre-1975 buildings with new buildings if there is a strong desire for significantly more sustainable and resilient homes that improve occupant satisfaction (Category II-IV).

**For instance, if opening up a building's walls during a retrofit, the cost difference of installing a 2x4 (for Category III) versus a 4x4 or 6x6 (for Category IV) is nominal, but the energy performance difference is significant. Similarly, to go from Category II to Category IV involves doubling the nailing-in-roof sheathing, which results in a minor cost difference for heightened resilience.*

PHASING

In general, as the RAP progresses over time through its various stages, the level of seismic resilience on campus increases. More specifically, Stage 3 and 4 goals focus on ensuring Life Safety structural standards[4] are met across campus (at a minimum) whereas the goal of Stage 5 is to gain the capacity in certain buildings to shelter in place in what are called ROSE Havens after an earthquake. The phasing should be flexible as Rose Villa may find (during Stage 2 analysis) that it makes more sense to achieve higher structural resilience levels in the pre-1975 homes (during Stage 4).

[4] https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=101

Phase	Phase III	Phase IV	Phase V
Resilience Goal	**Life Safety**	**Life Safety and possibly Longer-term Sheltering**	**Longer-term sheltering**
Structural Strategies	**Secure free-standing** furniture, equipment to walls and/or roofs	**Reinforce all pre-1975** homes to be meet Category II risk level (possibly Category IV)	**Reinforce ROSE Haven(s)** for immediate occupancy (Category IV risk level)

NOTE: **Phase 1 and 2** are not included in this summary as they are focused on analysis of all of goals and strategies rather than implementation.

SYNCHRONIZATION

In order to maximize cost savings and minimize disruption to campus operations, the RAP team recommends implementing the following retrofit efforts at the same time:

- Structural upgrades and enclosure upgrades to buildings when it's time to replace siding and/or roofing.
- Structural upgrades to buildings when it's time to install photovoltaic panels on rooftops.
- Structural upgrades to buildings when it's time to perform interior remodels/refreshing.

The Facilities team can leverage the RAP Facilities Database to document which structural upgrades are practical per home and/or per neighborhood and coordinate when these restructural retrofits should optimally occur. Refer to Additional Resources Chapter for a link to the RAP Facilities Database.

ADDITIONAL BENEFITS

Heightening Rose Villa's structural resilience to earthquakes would result in numerous benefits to its triple bottom line (people, planet, and profit). The energy, water, and cost savings resulting from retrofitting pre-1975 buildings far

outweigh the costs of having to rebuild those same buildings in the aftermath of an earthquake. Perhaps the most important benefit of committing to structural resiliency over the next decade is preserving the safety and continued prosperity of the Rose Villa community. The peace of mind resulting from residents knowing they are safe can improve the health of residents and staff, which is invaluable.

POTENTIAL PARTNERSHIPS

Most government funding for seismic improvements is available to government-owned facilities (schools, city halls, etc). As a nonprofit, Rose Villa might be able to attract private investors, foundation grants, or low-interest loans. In the future, the Rose Villa RAP could be seen as a model program, which could enable Rose Villa to charge consulting fees for assisting other organizations with resiliency planning.

Stage 2 Structural Resilience Goal: Additional Analysis to inform Capital Planning

Stage 2 will include an analysis of structural resilience measures, along with their associated upfront costs and payback periods. This analysis will allow the team to develop a plan to achieve the structural resilience goals set out in the RAP. Following are some outcomes we expect from these studies. Note that costs are rough estimates. If Rose Villa requests a more accurate Stage II cost estimate, the consulting team can produce one.

~$5k Complete a *ASCE-41* seismic study of typical pre-1975 cottages to clarify upgrade costs for all pre-1975. The consulting team would use *ASCE 41*—a quantitative and qualitative assessment standard that provides an accurate assessment of seismic vulnerability and potential retrofits—to develop more accurate cost models.

~$3k Evaluate cost/benefit of retrofitting appendages to pre-1975 cottages. Recommend removal, retrofit, or replacement.

~$5k-10k Complete a geotechnical investigation of the Northwest portion of campus. This part of campus has a natural spring and riprap fill. Studying it would help the team determine if the site is suitable for building a new structure that could serve as an emergency shelter.

~$3-5k/year Negotiate a dedicated on-call contract with an engineer emergency responder certified through a program that is compliant with Federal Resource Typing Standards such as CalOES Safety Assessment Program or International Code Council Disaster Response Inspector Program. This would give Rose Villa the ability to accelerate its post-earthquake response by getting buildings evaluated after an emergency event without having to request responders from the local jurisdiction.

<$1k Develop Structural Resilience Design Guidelines for New Construction to guide future RV's resilient development.

~$0k Mass plywood panels (MPP)* presentation and discussion with Mark Fretz, Associate Research Professor and Associate Director of Outreach at the University of Oregon.

*The University of Oregon and Oregon State University, in collaboration with the TallWood Design Institute, developed a MPP retrofit assembly designed for upgrading aging multi-family housing, which is energy inefficient and improves lateral force resistance. The MPP retrofit assembly employs digital workflows and small diameter logs (down to 5") to create an economically viable energy/seismic retrofit model for the West Coast. They are currently looking for organizations that are interested in partnering on a pilot project.

NOTE: Total Stage 2 fee, including consultant fees, to be refined upon request by Rose Villa.

Stage 3 Structural Resilience Goal: Minor Retrofits for Life Safety while Capital Planning

While Rose Villa is refining its Capital Improvement Plan, Facilities Maintenance Plan, Emergency Response Plan, and Resilience Design Guidelines, there are numerous easy and affordable structural resilience upgrades that can be accomplished by the Facilities Operations/Maintenance team, Ready Force leaders, and independent living residents that should NOT require significant capital planning:

~$100/ea	Strap non-roof equipment to walls, especially when servicing equipment.
~$1000/ea	Anchor roof equipment to roof, especially when servicing equipment.
~$100/ea	Strap tall, narrow cabinets and shelving units to walls; install cabinet door latches.
~$700/ea	Install gas shut-off valves that are seismically-activated.

Stage 4 Structural Resilience Goal: Retrofit Pre-1975 Homes for Safe Evacuation at least

During Stage 4, the priority is to improve the structural resilience of older buildings that do not comply with current structural code requirements to reduce the chances of injury or death during a seismic event. However, as mentioned in the Structural Resilience Overview chapter, it may be prudent to go beyond Life Safety standards to provide some chance that these buildings will be occupiable after an earthquake. Rose Villa has three primary options:

- Option A: Retrofit all pre-1975 buildings to current code requirements for Risk Category II structures to help ensure the safety of occupants during the earthquake.
- Option B: Spend approximately 30% more on structural retrofits than Option A to gain compliance with Risk Category IV code requirements.
- Option C: Replace inefficient buildings that no longer meet code with new, high-performance, residential buildings that meet RAP priorities for resilience, sustainability, comfort and aesthetics.

Note: Option B would greatly improve structural resilience, as there is a high probability that the retrofitted buildings could be occupied after the earthquake, thereby minimizing the need for Rose Villa to find shelter for displaced residents. This decision can be made during Stage 2, as options and their relative costs are evaluated in more detail.

Option A: **Risk Category II Improvements to Pre-1975 Independent Living residences for safe evacuation**

~$15-20/SF **Foundations:** Pour thickened slab footings where lacking at demising walls (1’ W, 1’ D, w/ rebar).

~$5-10/SF **Wall to Foundation Connection:** Bolt Sill Plates at perimeter walls and interior demising walls @ 4’ O.C. w/ Simpson Titen HD bolts.

~$4-8/SF **Wall Ends to Foundation Connections:** Install hold-downs at ends of every primary perimeter shear wall segment over 8 feet long. Assume Simpson HDU2 and one additional 2x4 or 2x6 stud at each wall end.

~$4-8/SF **Roof to Interior Wall Connection:** Add framing and Simpson A35 clips, if necessary, to connect interior demising walls to roof sheathing.

~$4-8/SF **Roof to Exterior Wall:** Install framing clips from perimeter blocking to top plates of exterior wall. This could be done by either installing L clips from inside (patch drywall or synchronize with interior remodel/turn-over) or installing A35F from outside (patch siding or sequence when replacing siding).

~$4-8/SF **Shear Walls:** Replace drywall with plywood at interior demising walls.

~$1-2/SF **Shear Walls:** Renail existing sheathing at exterior walls (synchronized with siding replacement).

~$10-15/SF **Shear Walls:** Install sheathing if not present or damaged (skip sheathing doesn't qualify).

~$2-10/SF **Appendages:** Remove or replace patio coverings to meet structural code requirements.

~$50-90/SF **TOTAL**

Option B: Category 4 Improvements to Pre-1975 homes to better ensure ability to occupy after earthquake

~$50-90/SF **Everything listed in Option 1.**

~$5-10/SF	**Foundations:** Pour 30% larger slab footings where lacking at demising walls.
~$5-10/SF	**Walls to Foundation:** Add 4x6 or 6x6 posts & Simpson HDU5 hold-downs at wall >8' long walls.
~$2-4/SF	**Roof to Wall:** Install H2.5A clips from rafter to top plate & add 30% more A35 clips than Option A.
~$2-4/SF	**Roof Shear:** Renail roof sheathing to roof framing for increased strength and stiffness.
~$64-118/SF	**TOTAL**

Option C:	**Replace existing Pre-1975 residential building(s) with new, efficient, resilient building(s)**
~400/sf	Deconstruct and build new high-performance residential buildings to Category IV standard.

Stage 5 Structural Resilience Goal: Retrofit ROSE Haven Buildings to Category IV

During Stage 5, the priority can shift from increasing the structural resilience of older residences, part of making them ROSE Homes, to structurally hardening some of the larger mixed-use buildings to house ROSE Havens. The following buildings were identified as ideal locations for ROSE Havens because of the critical campus services (medical, food, water, communications) and the large community spaces they provide, which can serve as temporary shelters. The proposal is to upgrade one or more of these buildings to meet the requirements of Risk Category IV structures to increase the probability of immediate occupancy after an earthquake. Buildings designed to Risk Category IV requirements are designed for forces that are 1.5 times greater than those required for Category II buildings. The upgrade from Risk Category II to Risk Category IV should also reduce the probability of structural failure by 400%, a significant positive step to structural resilience.

Proposed ROSE Haven Locations

- **South Main** because of its kitchen facilities and large community rooms.
- **North Main** because of its pool resource and large community room(s.)
- **Schroeder Lofts** because of its Medical Clinic, Daycare, and community room(s)
- **Madrona Grove** because of its role in ensuring the safety of assisted living residents.

From his experience as a resiliency consultant, Ed Quesenberry, strongly recommends that Rose Villa harden the entire building, rather than specific rooms, for several reasons:

- Structure above/below/adjacent to the ROSE Haven rooms must be hardened as well so that ROSE Haven rooms are accessible and safe to occupy after the event.
- MEP systems that serve these ROSE Havens could fail if they are not anchored or braced to Category IV standards, creating significant hazards such as a fire, flooding, etc.

- Resilience is all about reducing the time between the event and return to normal operation. The hardening of specific rooms as opposed to whole buildings is counter to this goal, as it does not address limiting damage to the whole building.

Category IV Improvements to entire building containing ROSE Havens

$25-50/sf Hardening ROSE Haven building(s) to Category IV structural standard.

$TBD Stage 2 Hardening ROSE Haven building(s) mechanical, electrical, plumbing, finishes, fixtures, and equipment.

Overview of Energy Resilience at Rose Villa

"The most stressful disaster event (on campus) is a multi-day power outage because systems related to communications, comfort, and safety (currently) fail. - Tina Moullet, Rose Villa executive director, during Stage 1 Visioning Workshop

During our Visioning Workshop, Rose Villa set a goal to achieve energy resilience within ~20 years, which it defines as: In the instance of a long-term municipal power outage, a campus microgrid (or a campus of smaller microgrids) will reliably power 100% critical loads to allow residents and staff to shelter in place for at least 2-3 weeks. A solar photovoltaic panel system with batteries can theoretically provide energy indefinitely during sunny days in the summer and shoulder seasons. Similarly, if gas and/or diesel fuel can be reliably procured, generators can also run indefinitely.

To achieve this ambitious and achievable goal, Rose Villa must significantly reduce the energy use intensity (EUI) of its campus to ensure the critical loads on the microgrid system(s) are minimized. By reducing the campus EUI by ~50% (to be refined in Stage 2), the microgrid(s) will improve resiliency and stay operational for a duration that is inversely proportional to this energy savings.

Introduction

A microgrid is a system of energy resources such as PV panels and storage (e.g. batteries), along with special electrical infrastructure such as distribution boards, system controls, etc., configured in a way that allows a building or campus to operate with or without grid power. A microgrid has the ability to provide both resiliency and sustainability benefits.

When the grid is operational, microgrids can be a sustainability solution by allowing buildings to dynamically choose when to use grid power and when to operate with onsite resources. For example, when the grid energy supply comes from fossil fuels that produce more emissions than renewables, the microgrid can optimize the use of onsite renewables and storage to minimize its reliance on the dirtier grid power. This strategy is one of the most important ways to decarbonize building operations while helping improve grid reliability.

When power from the grid is unavailable due to weather or other events, microgrids become a critical element for energy resiliency**.** Onsite batteries provide a source of short term backup power, and when partnered with onsite renewables such as PV panels, the combined system has the potential to operate indefinitely. To ensure a truly robust system, it is recommended that onsite diesel generators also be included for the resiliency operation. The use of fossil fuels can be minimized by utilizing the PV and batteries first with only supplemental support from the diesel or gas generator. A microgrid with multiple resiliency energy resources would provide Rose Villa with the ability to support critical loads for an extended period of time, potentially even beyond the 2-3 week goal, depending on weather conditions and operating loads.

Optimizing for Size

There are two key considerations when sizing a microgrid: Power and Energy.

- The power rating of the microgrid refers to the maximum expected peak load that needs to be supported.
- The energy needs of a microgrid are determined by how long it needs to support the loads demanded. To use a fossil fuel analogy, the distance the microgrid can “drive” depends on how much gas is in the tank and the miles-per-gallon rate of consumption during the drive.

Both factors—power and energy—significantly impact the size, cost, and operating duration of the microgrid resources. All factors can be improved with energy efficiency measures (EEMs). This is why the team recommends Rose Villa consider EEMs for their multiple benefits: lowering operating costs, improving comfort, reducing operating emissions, and minimizing the microgrid requirements.

Each EEM impacts the microgrid sizing. Some EEMs such as high efficiency heat pumps for both space conditioning and hot water will reduce the overall energy needs of the building, which reduces the daily normal operating load. This allows the microgrid energy capacity to support more loads and for a longer time. Other EEMs will help reduce the peak power needs of a building. For example, a Passive House envelope can reduce the amount of cooling needed during a heat wave, or heating needed in a cold snap. This can provide a critical reduction to the *peak* load in addition to reducing the normal operating load. Decreasing the amount of power capacity that the system needs can help reduce the size and cost of batteries.

Reductions to both of these elements—peak power and energy capacity—are important in optimizing the size of the microgrid's generation and storage resources. EEMs and other Rose Villa building improvements should be considered within this system wide context including the multiple benefits they can provide to the Rose Villa campus.

Phasing

When designing buildings, it's critical to first reduce the energy loads with EEMs, then right-size building equipment, and finally right-size PV and battery systems for these minimized loads. However, for a long-term campus retrofit**,** this linear phasing may not always make sense. Situations will likely arise where installing PV before all EEMs are implemented is logical because of the need to replace a roof or because tax incentives for PV have a limited timeframe. If a PV system is oversized initially, a microgrid can discharge and/or store the excess power in a way that further reduces operational emissions for additional sustainability benefits. Therefore, the dates associated with Stages are to be

considered guidelines rather than critical start dates. That said, there are some measures that should be addressed sequentially. For example, it is important to complete enclosure upgrades prior to HVAC upgrades.

Another consideration when designing for future microgrids is sometimes it can be worthwhile to purchase the electrical equipment to allow the facility to be “microgrid ready”—even if it’s more powerful than is needed at the time. It’s important to include provisions in the capital planning for these future ready elements since the initial cost might be higher than the minimum needed today, but the long term investment will be better optimized.

Energy Resilience Action Plan Implementation

Phase	Phase III	Phase IV	Phase V
Load Reduction Goals	**Some Reduction** in Energy Use	**20% Reduction** in Energy Use	**50% Reduction** in Energy Use
Energy Load Reduction Strategies	**Energy efficient retrofits** to building lighting, appliances, heaters	**Energy efficient retrofits** to building envelopes and equipment/systems	**Energy efficient retrofits** continued from Phase 3 and Phase 4
Resilience Duration	**3-5 days** or more if we can refill generators	**1-2 weeks** or more when sunny &/or if refill generators	**2-3 weeks** or more when sunny &/or if refill generators
Energy Supply & Storage	**Existing Generators** and home power packs	**Microgrid** system(s) including **ROSE Ports** w/ EV charging stations	**Microgrid system**(s) including **ROSE Pavilion**
Safety/ Reliability	Install **gas shut-off** valves at meters	**Convert Power Source** to SE River Rd Feeder for 2 Classic Cottage neighborhoods	**Convert all gas powered** equipment to electric

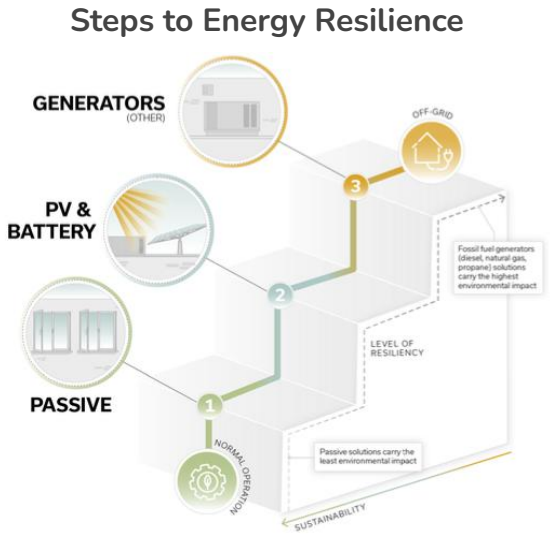
NOTE: **Phase 1 and 2** are not included in this summary as they are focused on analysis of all of goals and strategies rather than implementation.

Synchronization

In order to maximize cost savings and minimize disruption to campus operations, Rose Villa should consider implementing the following retrofits at the same time:

- Enclosure upgrades and structural upgrades to buildings when it's time to replace siding and/or roofing.
- Enclosure upgrades when pre-wiring for critical loads panel, PV, batteries, and microgrid.
- Underground microgrid infrastructure (at least conduit) if/when replace/fix underground pipes.
- Structural upgrades that would allow for the added weight of future PV panels.

The Facilities team can leverage the RAP Facilities Database to document which homes have inefficient fixtures, equipment, and appliances that need replacing, and coordinate when replacement should optimally occur. Refer to the Additional Resources chapter for a link to the RAP Facilities Database.



Scaling

For several reasons, this plan proposes investing in a distributed microgrid system at various scales (i.e. at individual ROSE homes, neighborhood ROSE Ports, community ROSE Havens, and a campus ROSE Pavilion) rather than a centralized microgrid. First, a distributed system provides for energy supply/storage redundancy which is a key element of resilience planning. Second, by distributing energy generation/storage systems and associated charging stations at a home and neighborhood scale, Rose Villa could help ensure its residents could easily access these energy resources from/near their home and maintain awareness of where and how these systems work during an emergency. As neighbors, they can provide for each other at these smaller scales (home, neighborhood) if/when Rose Villa staff are not available. By providing energy generation and storage systems at larger scales too (ROSE Havens and ROSE Pavilion), Rose Villa can more efficiently provide critical services that require power (i.e. medical, food, communication) to large groups of residents and staff.

A distributed system requires more maintenance simply because there are more systems. It also limits the equipment sizes to the space available at local scales instead of larger PV and battery systems in more spacious areas of campus. Despite these limitations, the benefits to Rose Villa of the distributed system, including the ability to more incrementally invest and install the systems, outweigh the advantages of the centralized approach.

Added Considerations

If Rose Villa were to invest in smaller distributed microgrid nodes, it is possible that eventually the nodes could be knitted together into quadrants, or even a full campus microgrid network.

Given the unique relationship Rose Villa has with Portland General Electric (PGE) and/or the Energy Trust of Oregon (ETO), there could be an opportunity for a strategic partnership to achieve the microgrid, which could serve as a pilot

project for other sites in PGE territory. For example, PGE might be able to help establish the infrastructure that would better facilitate a centralized approach.

Triple Bottom Line

There are many direct and indirect benefits of better energy management through microgrids. The most apparent financial benefit is the ability to respond to future time-of-use rates that would allow the campus to forgo higher rates during times of higher use by emphasizing the use of energy produced or stored on site. Less direct and nonetheless impactful is the ability to continue operations and mitigate costly disruption of operations.

This continuing operation during severe weather and other events that typically disrupt the power supply benefits both residents and staff. Residents are safe, healthy, and comfortable, while the staff have the necessary resources to provide required services and care.

Finally, in addition to responding to fluctuating rates, the microgrid can utilize onsite energy storage to forgo the grid's dirtier, high-emissions energy in times of peak demand. This would reduce Rose Villa's dependence on fossil fuel-based power plants, which come online to respond to increased demand.

Potential Partnerships

Microgrids, onsite renewables with storage, and energy resiliency are all topics receiving increased attention and investment at federal, state, and regional levels. This could create opportunities for Rose Villa to receive outside funding to help with development of the systems. These programs often prioritize historically underserved communities, making Rose Villa less competitive given its resident demographic and urban location. However, there are some funding programs Rose Villa could access. Following is an initial, though not comprehensive, list of agencies to monitor for funding opportunities:

- FEMA (Federal Emergency Management Agency)
- DOE (Department of Energy)
- ODOE (Oregon Department of Energy)
- IRA (Inflation Reduction Act or other federal climate action legislation)
- PGE (Portland General Electric - particularly PGE's new battery and resiliency partnership program)
- ETO (Energy Trust of Oregon)

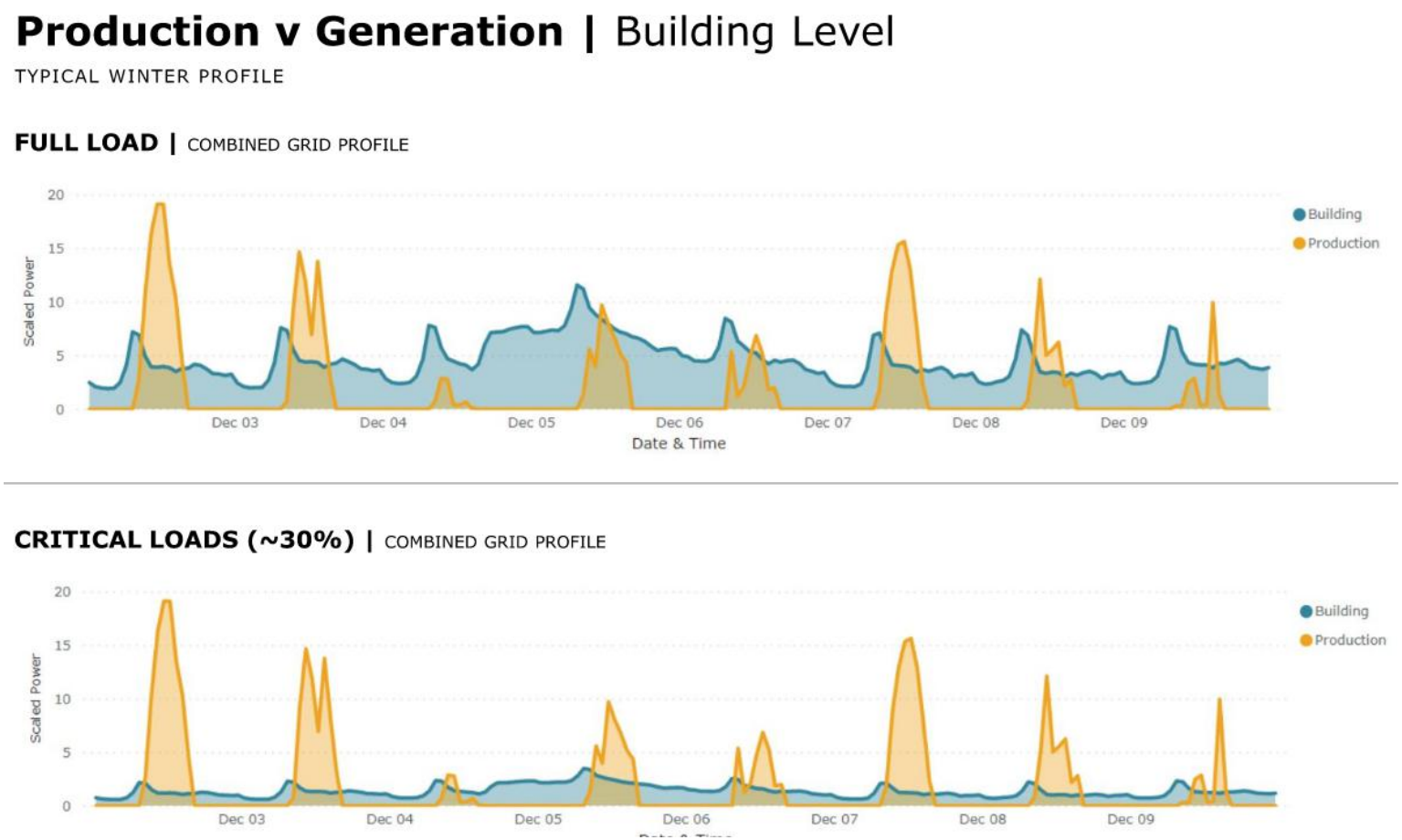
Key Findings

For this initial study, a high level model of the campus energy use and potential production was evaluated. The energy use model was based on typical models for similar building types calibrated for Rose Villa's historic actual usage. The potential energy production was calculated for PV system sizes based on the available roof areas for all the buildings on campus. It was assumed that PV would eventually be located on all available roofs in the Rose Villa campus, including all residential buildings. The neighborhood scale analysis for loads and PV and battery sizing was based on the South Central Cottages as the example condition.

The key finding of the initial modeling was that supporting the full loads of the existing buildings with PV and batteries during all seasons will be challenging. The amount of available solar resources during winter months is exceeded by the existing building loads. This indicates Rose Villa must determine the functions in each critical facility and focus on supporting those critical loads first during low production times or in the event of a power outage. Based on the current loads, the initial study found that loads would potentially need to be decreased to a third of normal levels to comfortably operate during the winter low production months. Over time, as EEMs are implemented and building loads decrease, additional services can be added. But even then, the initial study results indicate that some level of load reduction will always be necessary during seasons with lower solar generation.

During the summer months, when PV production is greatest, it is likely that most, and potentially all, normal loads could be supported with a PV and battery microgrid, particularly at the single building and neighborhood levels.

Following are results for winter and summer conditions at a single building scale. Analysis for neighborhood scales and full campus scales are included in the Additional Resources chapter.

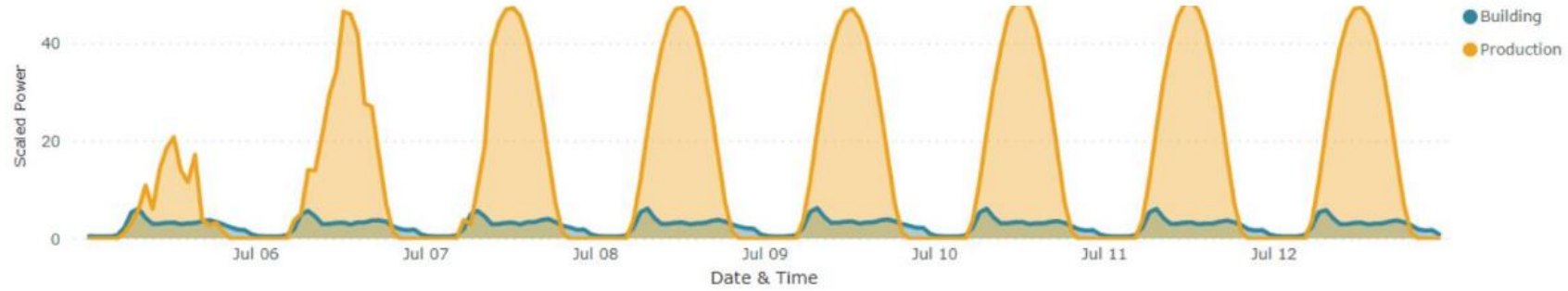


Preliminary Model Results for Building Loads as Compared to Winter PV Generation

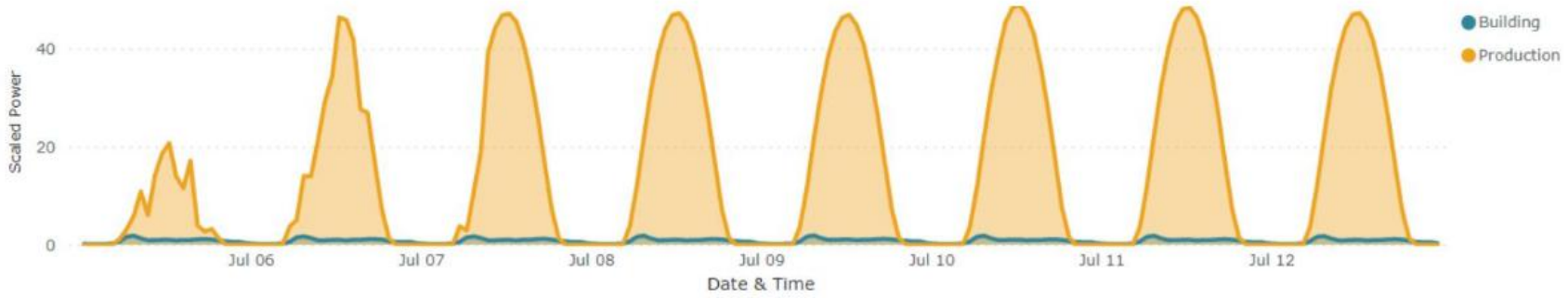
Production v Generation | Building Level

TYPICAL SUMMER PROFILE

FULL LOAD | COMBINED GRID PROFILE

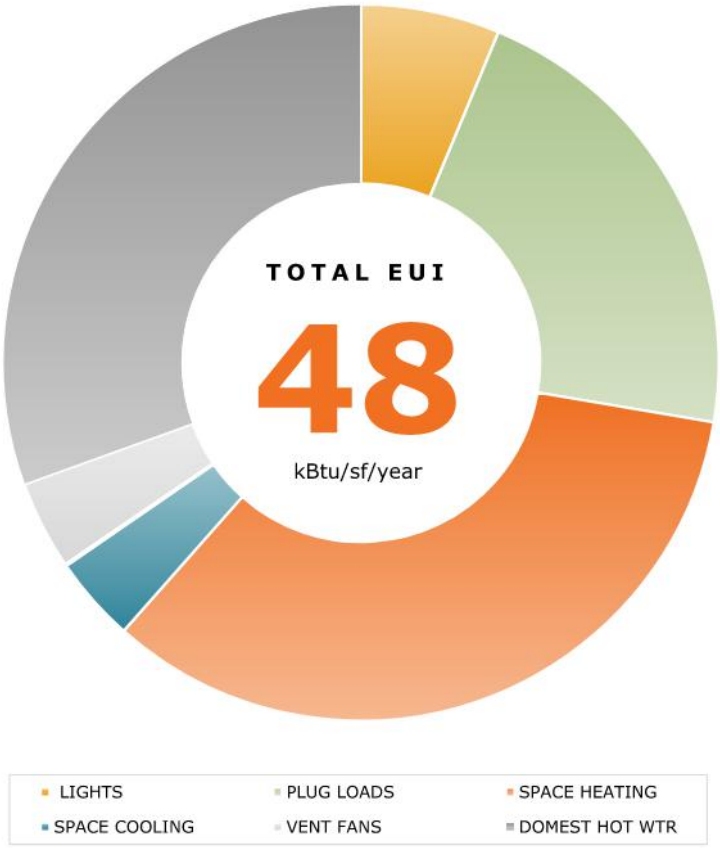


CRITICAL LOADS (~30%) | COMBINED GRID PROFILE



Preliminary Model Results for Building Loads as Compared to Summer PV Generation

The initial study also found that there are likely good opportunities to reduce the operating loads through strategic EEMs. The initial estimate found space heating and hot water heating to be the largest load categories. These can be improved through envelope upgrades and system replacement with the highest efficiency heat pumps when existing systems reach end of life. These load decreases will help bring the generation potential more in balance with the needs.



Typical Energy Use Breakout for the Rose Villa Buildings

- Focus on least energy efficient buildings as well as building/spaces that are to serve as ROSE Havens.
- First reduce energy loads with passive efficiency upgrades, then right-size systems that actively use energy.
- Invest in PV when tax incentives and funding opportunities make it most cost-effective and/or in conjunction with roof replacements.

Stage 2 Energy Resilience Goal: Additional Analysis to inform Capital Planning

During Stage 2, we will deeply analyze the options, upfront costs, and payback periods included in this plan, which will help Rose Villa chart a clear course to achieve its energy resilience goals. Below are some expected outcomes based on specific studies. Upon request by Rose Villa, the costs associated with implementing this work can be developed.

Energy Efficiency Measures (EEMs) including ways to incrementally reduce the campus EUI

- Recommendation on whether to retrofit or replace the pre-1975 buildings w/ new, efficient, resilient buildings.
- Recommendations for which EEMs to implement in which buildings to meet EUI reduction goals based on a detailed energy model by building type to clarify critical loads, desired loads, and peak loads. This would inform the energy generation and storage system recommendations that are stated below.

Energy Generation and Storage Systems (EG&SS) including steps to develop campus-wide microgrid(s)

- Recommend a phasedd microgrid roadmap that accounts for existing and emerging technologies and incentives.
- Recommendations for energy generation type, size, scale, and locations on campus based on energy models.
- Recommendations for energy storage type, size, scale, and locations on campus based in part on energy models.
- Recommend how to leverage existing energy generation/storage systems on campus (e.g. Trillium's PV).
- Recommend additional loads to be served by the existing South Main generator that once served Madrona Grove.
- Evaluation of energy generation and energy storage system sizing in the context of economic optimization for participation in PGE's demand response programs.
- Technology assessment, particularly around electric vehicle (EV) charging options.

Stage 3 Energy Resilience Goal: Reduce EUI & Redistribute backup power while Capital Planning

This stage focuses on capturing two strategies for addressing “low hanging fruit”. The first is reducing campus energy needs by implementing numerous simple, low-cost, energy efficiency measures. The second is reallocating onsite power generation and storage capacity on campus to ensure that critical campus services that relate to health, safety, communications, and transportation are reliably provided for in an emergency for 3-5 days.

Energy Efficiency Measures (EEMs)

To reduce campus energy needs during Stage III, Rose Villa can choose to implement numerous EEMs that are easy, quick, low-cost, and relatively non-invasive to the residents. These EEMs would occur during resident turnover and/or at the product’s end of life (EOL). The rough order of magnitude (ROM) costs below are for materials only and the idea is that if these replacements are done at the end of the product’s useful life, the material and labor premium cost could be considered $0. Additionally, the operational savings of replacing lights and appliances can have a payback period of a few years.

~$0 - 20 ea.	Replace inefficient bulbs with LED bulbs.
~$0 - 1500 ea.	Replace inefficient appliances with EnergyStar rated appliances.
~$0 - 1000 ea*	Replace resistance electric or gas water heaters with electric heat pump water heaters*.

**Replacing gas water heaters equipment at the end of life with a commercial heat pump water heater can be cost-neutral. That equation can change if electrical service and infrastructure upgrades become necessary—however, the 2-4x increase in efficiency quickly amortizes this investment. Replacement of multiple electric resistance hot water heaters in a building with a single heat pump boiler system that can serve 3-5 homes each, similar to Trillium*

Townhomes and at The Oaks, can also reduce the premium to upgrade from electric resistance to heat pump hot water heaters and improve efficiency by 3-4x.

Energy Generation and Storage Systems (EG&SS)

Currently there are five existing sources of onsite energy generation and/or energy storage on the Rose Villa campus:

- 100-kW diesel generator that powers critical loads for S. Main and formerly Madrona Grove (duration tbd).
- TBD-kW generator at Madrona Grove that powers critical loads for both Madrona Grove and S. Lofts for 3-5 days.
- TBD-kW and quantity of personal power packs that independent living residents purchased for their energy backup supplies.
- 29.97-kW photovoltaic system on Trillium Townhomes with conduit ready to connect to S.Lofts (no battery yet).
- 38.25-kW PV on The Oaks (no battery).

The South Main building has a 100kW diesel generator that provides emergency energy for critical loads. See below for a comprehensive critical loads list provided by Bob Judd during Stage 1:

- **E-S1P**: Emergency systems including fire alarm system, emergency lighting (interior and exterior), generator accessories (lighting, receptacle, battery charger, strip and jacket heaters).
- **N-S1P**: Food service equipment including walk-ins, refrigerators and freezers, hood, ovens, coffee brewer, water heaters & circ pumps, select kitchen receptacles, lighting & receptacles in electric & telecom rooms, elevator, fireplace, separate telecom panel (see below,) and a few receptacles in areas like reception, formal dining, etc.
- **N-S1T**: Main telecom room in South building, including rack receptacles, split system HVAC, rooftop receptacle above telecom room, and sewage pumps.

This generator previously also served the old Madrona Grove, which was deconstructed. Now there is significant available capacity that must be reallocated to additional critical loads within the South Main building. This generator can back up additional loads that will make sheltering in place and operating critical services easier, safer, and more comfortable during an outage. Following is a list of some of the additional loads to be considered for backing up with the generator at South Main. Stage 2 will clarify these desired loads and what energy needs can reliably be supplied by this generator's remaining capacity for a period of 3-5 days.

1. **Transportation:** Provide charging capability for existing electric Surrey fleet of vehicles.
2. **Shelter**: Heating, cooling, ventilation, and lighting in community spaces that serve as ROSE Havens.
3. **Communication:** Additional communication services if necessary.
4. **Additional refrigeration:** Confirm that all desired refrigerators are backed up for food and medical purposes.

The new Madrona Grove building has a dedicated building generator that serves its most critical loads, including egress lighting and elevator power. This generator also provides essential egress lighting and power to the elevator in Schroeder lofts**.** Our current understanding (to be verified in Stage 2) is that critical services such as the medical clinic and daycare may not be backed up. To provide back-up power for these critical services in Schroeder Lofts, RV can either a) purchase a generator, or b) connect to Trillium's photovoltaic power and add battery storage.. Schroeder Lofts is close to being ready to receive this back-up power from Trillium due to the forethought of campus planners who installed conduit between the two buildings. The primary things that need to be added is a battery system and either a smart panel (or critical loads panel). More PV panels can be added on the roof of Trillium Townhomes Residence F. And at The Oaks, additional energy could be provided to the ROSE Haven at Schroeder Lofts by installing a battery system with a conduit that runs from the Oaks to a "smart panel" at Schroeder Lofts.

And last, but not least, it's important to consider the powerful role residents can play in meeting their critical energy needs during a power outage. Encouraging (or requiring) independent living residents to have their own personal power packs such as the Goal Zero Yeti 400[5], would provide essential energy where it's wanted/needed (in the home) at a low to no upfront cost to RV. The Goal Zero Yeti could supply power for a few lights (11w if LED), smartphone charging (10-20w), CPAP (30-60w), and possibly laptops (50w), TVs (200w) and/or other devices, depending on the system size.

Below is a summary of the recommended measures detailed above with some very ROM cost estimates. If there are any critical loads that provide essential community services related to health, safety, communications, and transportation that are not yet covered by campus generators for 3-5 days, RV should strongly consider backing them up in this stage.

~$ 500/ea	**ROSE Home:** Recommend residents have personal power stations for critical home loads (400Wh)*.
~$ TBD Stage 2	**ROSE Haven:** Reconfigure generator to serve additional loads of S. Main Community Rooms.
~$ 60k for 75kW	**ROSE Haven:** Install generator to serve additional important loads at Schroeder Lofts**; OR
~$ 43k-62k**	**ROSE Havens**: Install more PV at Trillium (~6.4kw) & add batteries (~19 kwh) to serve Schroeder
Lofts loads*; OR	
~$ TBD Stage 2	**ROSE Havens:** Install batteries at The Oaks and install conduit and smart panel to Schroeder
Lofts***.	

* Such as the Goal Zero Yeti Power Stations: https://www.goalzero.com/collections/portable-power-stations
**To supply power for additional services during an outage such as in the medical clinic, daycare and community spaces to have additional power during emergencies.
***Assume $3/watt for PV and $15-20k for battery system. Higher costs for the Tesla brand.

[5] https://www.goalzero.com/products/goal-zero-yeti-400-portable-power-station

Stage 4 Energy Resilience Goal: Reduce EUI by 20%; Provide Critical Loads for 1-2 wks

After the CIP and FMP are developed in Stage 3, Rose Villa can implement the EEMs and EG+SS systems that are budgeted for. In this way, we aim to reduce the overall campus EUI by 20% and provide onsite energy for critical loads across campus for 1-2 weeks (or more if the sun is shining). This ambitious goal is only possible if we install PV panels on essentially all of the available campus rooftops and couple them with battery storage systems. This includes installing PV on existing carports which create ROSE Ports when coupled with EV charging stations.

Energy Efficiency Measures (EEMs) that reduce campus EUI by 20%

Below are the recommended EEMs; refer to the Resilience Design Guidelines chapter for details on performance metrics such as R-values. Stage 2 analysis will clarify where we implement these EEMs– whether it's on the most inefficient buildings (the pre-1975 cottages), and/or on the most important buildings (South Main, North Main, and Schroeder Lofts that provide the most important services, especially during emergencies). When sequencing, it is critical to complete enclosure upgrades prior to upgrading HVAC equipment. This will allow “right-sizing” of the heating and cooling equipment and further improve efficiency, comfort, and first as well as operating costs. Additionally, when increasing airtightness, it’s critical to also increase ventilation rates*. Implementing these EEMs will likely involve vacating each resident from his/her/their home during construction. It will be critical to plan accordingly andt minimize impacts on residents.

Note, making replacements at the end of the product’s life, will reduce the cost for the material and labor to $0. Refer to the Resilience Design Guidelines chapter in this plan for details about the following recommended measures.

~$ 5-10 /sf	Increase insulation in existing wall cavities.
~$ 5-10 /sf	Increase exterior wall insulation.
~$15-20 /sf	Replace windows and doors.
~$ 3-5 /sf	Increase airtightness.
~$10-40/sf	Upgrade HVAC equipment.
~$1-2/sf	Insulate accessible cold and hot water supply lines.
~$1300sf	Install drain water heat recovery.
~$0-1000/ea.	Replace gas and/or electric resistance water heaters with heat pump water heaters (HPWHs)s.* (Refer to the Resilience Design Guidelines Chapter).

**Replacing gas and/or electric resistance water heating equipment at the end of life with a heat pump water heater can be cost-neutral or result in cost savings when considering the significant energy saving potential over the lifetime of the equipment, which is 3-5 times more efficient than gas and/or electric resistance water heaters. That calculation can change if electrical service and infrastructure upgrades become necessary. However, the 3-5x increase in efficiency obtained by heat pump water heaters quickly amortizes this investment.*

Energy Generation and Storage

The goal of Stage 4 is to independently generate and store enough energy to power critical loads for 1-2 weeks. Power generation will come primarily from on-site renewable clean energy with associated batteries from rooftop PV; however, some capacity will continue to be provided by existing gas/diesel generators. PV panels will be installed on building rooftops (locations to be determined in Stage 2) as well as on carports and on the proposed ROSE Pavilion. The associated battery systems will be stored nearby, likely outside. The batteries will have grid-interactive and load management control capabilities to keep the systems balanced. Finally, electric panels will have been retrofitted to newer product options which include space for PV and battery connection and automatic load shedding capabilities.

This initial study included a high-level model of the battery size needed to support up to 7-days of operation at a 30% level of normal loads (or 14 days of operations at 15% of normal loads). The results from South Central Cottages as the example building are outlined below. The summary is that a single unit, about the size of a refrigerator, could likely support some level of basic loads within each residence of a single building. This analysis can be further refined in future studies and expanded to consider other building types on campus.

LG RESU16H-Prime Battery	
Weight (lb)	**350**
Dimensions (WxHxD,ft)	**2x4x1**

1 LG RESU16H-Prime Battery		
	1 Day	7 Day
Installed PV Capacity *(kW)*	**70**	**70**
Estimated Yearly PV Production *(kWh/yr)*	**69,000**	**69,000**
Battery Nameplate *(kW)*	**7**	**7**
Battery Capacity *(kWh)*	**16**	**16**
Number of Annual Passing Days	**352**	**350**

Battery System to Support Up to 7-Days of Operation at 30% Loads in one South Central Cottage Building (Note: In certain conditions, additional load reductions would be required.)

The energy resiliency systems can be installed in a phasedd approach in partnership with the EEMs and structural upgrades discussed elsewhere in this report. Each neighborhood should have its own PV, battery, and load control systems installed as part of these other facility upgrade efforts. More centralized facilities, such as the ROSE Pavilion, can be developed as part of their own initiatives.

With battery technologies evolving very quickly, it is hard to predict the best option this far in advance. Currently, lithium-iron-phosphate batteries are the favored technology, but this could likely change. It's possible other technologies, such as iron-flow batteries, which have a larger footprint, will be more cost-effective in the future. They are more environmentally benign and are better suited for long duration support (such as overnight).

In all cases, the prices are decreasing every year; so while batteries might be less affordable in the short term, they will likely become more economically feasible in the coming years. The various technologies and their environmental and financial impacts can be evaluated in more depth in Stage 2.

ROSE Ports

A ROSE Port is a system devised of emerging but rapidly evolving technologies that, if strategically installed throughout the campus, could provide multiple benefits.

A ROSE Port would consist of PV and storage installed on the roof of each eligible carport. The PV would directly provide electricity for EV charging stations, which would serve a proposed Rose Villa EV car-sharing program (which cuts down on car ownership on campus as a side benefit). Neighborhood residents could also charge personal devices at each ROSE Port.

A communication device could be established at these ROSE Ports to enable residents and staff to make calls during an emergency. To make room for the battery infrastructure, an analysis of space within existing carports would be to be conducted.

Due to the uncertain ability to move cars after an earthquake, planning to shelter under ROSE Ports is not recommended. Consider prototyping a ROSE Port at one carport first and if it's successful, deploy it to other carports on campus. Potential funders might consider investing in the prototype due to its unique and multi-faceted approach to sustainable living and neighborhood resilience, including and utilizing existing infrastructure.

~$500/ea.	**ROSE Homes:** Provide personal power packs to each residence for critical loads (if not in Stage 3)
	or...
~TBD/Stage 2	**ROSE Homes:** Install PV panels and Goal Zero battery at residential buildings.
~TBD/Stage 2	**ROSE Havens:** Install PV panels and Goal Zero battery at S. Main, N. Main, S. Lofts and/or Madrona.
~$30-50k**	**ROSE Ports**: Create one prototype by installing PV and an electric charging station at the carport.
~TBD/Stage 2	**ROSE Ports:** Create EV sharing program w/ charging stations at carports on campus.

**Assumes $3/watt for PV and $15-20k for battery system. Higher costs for the Tesla brand.

Stage 5 Energy Resilience Goal: Reduce EUI by 50%; Provide Critical Loads for 2-3 wks

Energy Efficiency Measures (EEMs)

In Stage 5, continue to implement the strategies outlined in Stage 4 to reduce the campus EUI an additional 30% to reach the final goal of 50% EUI reduction campuswide. At the end of Stage 4, the team will likely need to reassess the sequencing of EEMs to ensure Rose Villa is on target to meet its goals..

Energy Generation and Storage (Microgrid)

The goal of Stage 5 is to achieve longer-term sheltering in place. The campus must be able to independently generate and store enough energy to power 100% of critical loads for at least 2-3 weeks. To achieve this goal, Rose Villa must invest in a microgrid—either a single campus microgrid or the recommended series of multiple independent microgrids throughout campus (discussed in the Overview section of this report).

Each of these approaches has the potential to achieve the goal of 100% of critical loads for 2-3 weeks for all regularly occupied buildings. In either case, Rose Villa will have made significant progress in implementing EEMs upgrades to all buildings and installation of PV and battery systems to create the foundation for the energy resiliency microgrid(s).

The ROSE Pavilion is slated for completion in Stage 5 and would have rooftop PV panels and batteries that provide emergency energy if/when this space is utilized as a shelter after an earthquake. Refer to the Water chapter in this report for details on additional resilience measures this ROSE Pavilion provides.

Finally, Stage 5 is the deadline for replacing all gas-powered appliances and equipment with electric options. This has safety, sustainability, and resilience benefits.

$TBD Ph. 2*	**ROSE Homes:** Install PV panels and associated batteries on residential building rooms.
$TBD Ph. 2*	**ROSE Havens:** Install PV panels and associated batteries at S. Main and maybe N. Main & Sch. Lofts.
$TBD Ph. 2*	**ROSE Pavilion:** Construct ROSE Pavilion with rooftop PV, battery storage and charging station.
$TBD Ph. 2*	**ROSE Campus Microgrid:** Interconnection of the various local microgrids into an integrated system.

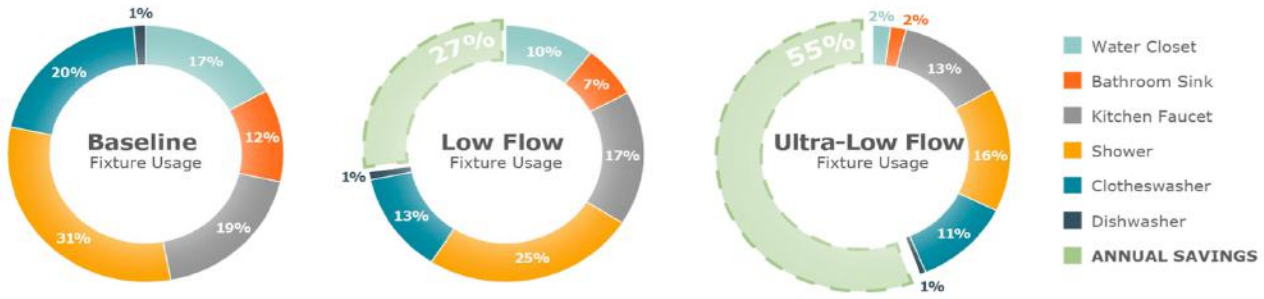
* Assume $3/watt for PV, $750-$1500/kWh of battery storage, $1200-$2500/EV charging station. There are too many variables to place a ROM cost to this yet. Will be analyzed in Stage 2.

Overview of Water Resilience at Rose Villa

In our Visioning Workshop, Rose Villa set a goal to achieve water resilience within ~20 years. Rose Villa defined water resilience as: Distributed water storage systems and emergency sanitation facilities to provide 100% critical needs for drinking water, washing, and sanitation for at least 2-3 weeks in the instance of a long-term municipal water outage*. To achieve this ambitious but achievable goal, it's advantageous to significantly reduce the campus water use intensity (WUI).

While energy conservation measures result in direct cost savings on both energy resiliency systems and energy bills, water conservation measures that have the potential to reduce the campus WUI by ~25% are expected to achieve savings in water bills.** However, Rose Villa can fund water resiliency measures by allocating the cost savings from lower water bills to fund such investments. Below are the assumptions used to size the emergency water storage needs and human waste facility sizes as well as a graph showing typical water use breakdowns.

Typical Water Use Breakdowns



- **Current campus population**
    - ~400 residents on campus
    - ~180 staff work on campus
- **Independent living turnover duration**
    - ~13 years
- **Current water-efficient fixtures**
    - ~ 50% of fixtures are already high efficiency currently.
    - ~ 50% of irrigation is high efficiency (drip and/or on sensors)
- **Current water use on campus**
    - ~ 1350 CCF/month
    - $130,000/year water bill
- **Minimum water stores needed per FEMA recommendations**
    - 1 gallon/person/day (half-gallon for drinking and half-gallon for washing/cooking); include pets in calculation

*Note that a cessation of municipal water supply will likely only occur if there is a large enough earthquake or a water contamination issue. There is a 37% chance of a large earthquake (7.1 magnitude or greater) in the next 50 years.
**For resilience planning the water infrastructure should be considered unusable, so efficiency of current plumbing is irrelevant, and storage becomes the primary resilience goal for water in a seismic event.

Phasing

Whereas the recommended water efficiency measures (WEMs) are the same across Stages 3, 4, and 5, the WUI reduction goal ratchets up from a non-specified percentage in Stage 3, to a 20% reduction in Stage 4, and a final 50% WUI reduction in Stage 5.

When phasing water storage measures, start with low-cost strategies in Stage 3 such as requiring a 2 week supply of bottled water, and storing the hurricane filter that Rose Villa already owns near the pool for wash stations. In Stage 4, the campus' renewable supply of water is intentionally increased by adding a rainwater catchment system(s). The final stage adds a large potable water cistern under the ROSE Pavilion to serve as an extra 2-week supply of water.

Human waste management systems get more expensive with each stage: Stage 3 (with either a baggy and/or bucket system) is the least expensive while Stage 4 (porta-potties distributed at key ROSE petals) and Stage 5 (composting toilets at the ROSE Pavilion and possibly and the future Facilities Operations building) require more investment.

Water Resilience Action Plan Implementation

Phases	Phase III	Phase IV	Phase V
Load Reduction Goals	**Some Reduction** in Water Use	**13% Reduction** in Water Use	**25% Reduction** in Water Use
Load Reduction Strategies	**WaterSense** fixture/equipment replacement when needed	**WaterSense** fixture/equipment replacement when needed, irrigation req'd	**WaterSense** fixture/equipment replacement continued
Resilience Duration	**2 weeks**	**2 weeks** or more when rainy	**4 weeks** or more when rainy
Supply & Storage	**Water bottles** and Filter ROSIE & pool Life Straws	**Rainwater Catchment** system for irrigation (filtered for emergency)	**Water cistern** underground Rose Pavilion
Sanitation	**Bucket system** or baggy system	**Portapotties** flat-packed	**Composting toilets** at ROSE Pavilion

NOTE: **Phase 1 and 2** are not included in this summary as they are focused on analysis of all of goals and strategies rather than implementation.

Synchronization

To maximize cost savings and minimize disruption to campus operations, consider implementing the following retrofits simultaneously:

- Replace fixtures/appliances/equipment when completing deep energy and structural retrofits.
- Install the roof rainwater catchment infrastructure when repairing/replacing roofs.
- Replace inefficient irrigation system(s) when installing rainwater harvesting system(s), or prior to that.
- Install underground water cistern before/during constructing the PV pavilion.

The Facilities team can use the RAP Facilities Database (that was developed for the RAP) to track which homes have inefficient fixtures, equipment, and appliances that need replacing as well as when maintenance is due. Refer to the Additional Resources chapter for a link to the RAP Facilities Database.

Scaling

For several reasons, it's beneficial to invest in a distributed system to provide emergency water/sanitation at various scales (e.g. at individual homes, neighborhood ports, building havens, and campus pavilion) rather than a centralized water distribution system. First, a distributed system provides redundancy, which is key for resilience planning. Second, by distributing some water supply/sanitation services at a home and neighborhood scale, Rose Villa will better ensure residents can easily access these resources from/near their home and maintain awareness of where and how these systems work during an emergency. Neighbors can provide for each other at these smaller scales (home, neighborhood) if/when Rose Villa staff is not available to help. Additionally, by providing water supply and sanitation facilities at larger scales (ROSE Havens and ROSE Pavilion), Rose Villa can more efficiently provide critical services that require water (eg. medical, washing, sewage management) to large groups of residents/staff.

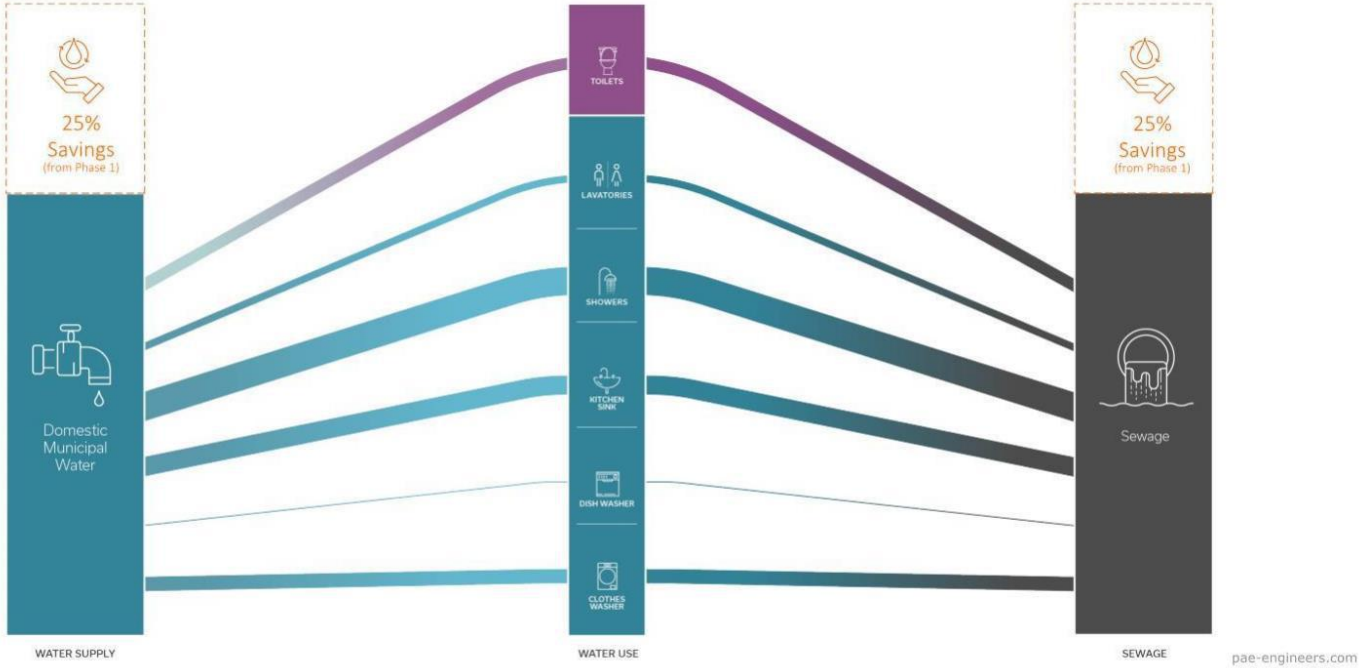
Note: A distributed system at various scales would require more maintenance simply because there are more supplies and systems to manage.

Triple Bottom Line

The financial return on investment (ROI) associated with replacing many of the campus' inefficient water fixtures, equipment, and irrigation systems to be high efficiency is relatively small, but quick. The payback is typically less than one year for measures that can be self-installed on fixtures that use hot water (showerheads, lavatory, and kitchen sinks). The payback period for direct replacement of appliances is approximately 10-15 years for washing machines and longer than the service lifetime for dishwashers. However, the marginal cost for replacing these appliances with high efficiency appliances at end-of-life is minimal. Water closets represent over 15% of water use, but a long service life and a payback period of 20-30 years makes replacement difficult to justify on ROI alone at current water rates. As the cost of water increases over time, the return on investment for all fixtures and appliances would increase and be more significant.

The impact water efficiency measures have on conserving precious water resources is significant. A 20% reduction from current use rates represents nearly 2.5 million gallons per year in water savings, while a **50% reduction leads to 6 million gallons per year of savings**.

Water Savings from Water Efficiency Measures



Lastly, the impact these resiliency measures have on the community is immeasurable when accounting for the peace of mind, pride, and heightened safety they provide to Rose Villa residents and staff. These benefits extend to the community beyond Rose Villa's campus, as well. All governmental emergency relief services that Rose Villa doesn't need to access due to its resiliency measures become available to other community members in the region who need it. It takes a village.

Potential Partnerships

Rose Villa should consider connecting with the Oaklodge Municipal Water District to better understand if/how the organizations could work together to achieve resilience measures that benefit both parties in the event of an emergency.

There are no published grant programs available through Multnomah County or the state of Oregon. FEMA grants are plentiful, but geared toward state and local governments. Given this dearth of outside funding sources, Rose Villa should consider establishing a ROSE endowment to help fund the development of some resilience measures, particularly the ROSE Pavilion that would be a new amenity that would benefit all current and future residents.

Key Findings

- Water resilience efforts should focus on securing clean water sources rather than managing human waste. The latter can be managed rather rudimentarily in an emergency and does not need expensive solutions to ensure safety.
- A living machine (i.e. an ecological wastewater treatment facility that utilizes vegetation and other living organisms to biologically clean blackwater in a series of tanks) was considered but ultimately discarded as a viable resilience measure on campus for several reasons. It would require a significant amount of area as well as a lot of maintenance, and it would need to be sized to handle several hundred people's sewage waste.
- It's far easier and safer to filter rainwater than greywater to achieve safe, drinking quality water due to human biological contaminants typically found in greywater. Rainwater is also a renewable resource during an emergency, whereas greywater will not be accessible when the municipal water supply is non-operational.
- Water from the Willamette River will not be clean enough to filter for safe drinking water because of contaminants. This is due, in part, to sewage that will likely enter the river from the nearby water treatment plants) after a large earthquake. There may also be industrial run-off contaminants that are difficult to filter out.

Stage 2 Water Resilience Goal: Additional Analysis to inform Capital Planning

In this stage, we will deeply analyze the options, upfront costs, and payback periods outlined in this chapter in order to chart a clear course to achieve our water resilience goals. Below are some outcomes we expect from these studies. The cost of this consultant scope of work will be developed upon request by Rose Villa.

Water Efficiency Measures

- Calibrate water reduction estimate (and associated savings) to Rose Villa's water bills and update recommendations for replacement of specific fixtures, appliances, and equipment by building.
- Provide refined Resilience Design Guidelines for water efficiency. (Refer to the Resilience Design Guidelines chapter for more information.)

Water Storage and Sanitation

- Detailed recommendation for how to create wash stations that use filtered salt water from the pool.
- Detailed recommendation for a rainwater harvesting system for irrigation and emergency water use.
- Detailed recommendation for ~12,000 gal. potable water cistern including size/type/location.

Human Waste Management Measures

- Detailed recommendation for emergency bucket system and/or baggy system for Stage 3.
- Detailed recommendation for emergency porta-potty or Groover toilet brand/quantity/location stored for Stage 4.
- Detailed recommendation for permanent composting toilet brand/quantity for Stage 5.

Stage 3 Water Resilience Goal: Reduce WUI + Secure 2 wk water supply while Capital Planning

This stage focuses on ensuring Rose Villa has enough water for drinking and essential washing/cooking for all residents and staff for 2 weeks. This stage can also address human waste management needs by providing options in the event toilets are not functional. And lastly, this stage incrementally reduces WUI on campus by replacing inefficient water fixtures/systems with more efficient options when the fixture/systems requires replacing or major repair. All of this can theoretically be done while Capital Investment Plans and Facility Maintenance Plans are being developed.

Water Efficiency Measures (WEMs)

Rose Villa can implement some WEMs that are easy, quick, low cost, and relatively non-invasive to the residents. These WEMs should occur at: 1) resident turnover 2) the product's end of life (EOL), or 3) a time when the cost/effort of significant repairs warrants replacement—whichever comes first. The approximate costs below are for materials only and if these replacements are at the end of the product's useful life, the material (and labor) cost could be considered $0. Additionally, the operational savings of replacing fixtures, appliances, and equipment can have a payback period of ~1-3 years. Refer to the Resilience Design Guidelines chapter for more details.

Water Efficiency Measures

~$ 0- 60 ea.	Add aerators with faucets.
~$ 0-1500 ea.	Replace inefficient plumbing fixtures appliances with WaterSense labeled options.
~$ 2/SF.	Replace inefficient irrigation with drip irrigation and smart controls (WaterSense).

Water Storage and Filtration

FEMA recommends every person and pet has a minimum 2-week emergency supply of potable water (1 gal/person/day) after a catastrophic event such as a large earthquake. This assumes about a half-gallon for drinking and half-gallon for sanitation and food preparation per person per day. Following is a summary of Rose Villa's current emergency water supply.

Current Bottled Water Supplies (for drinking, washing, and cooking)*

- **Madrona residents** have a 2 week supply
- **IL residents** have a 0-5 days** supply
- **Staff** have a 0-5 days** supply

**According to the* ReadyForce Emergency Response Guide *and Stage 1 Workshop responses.*
***Values noted as a range starting at zero because emergency water storage is not currently required.*
***This does not account for an additional 30-80 gallons of water (or more) that can be gleaned from water heaters.*

The easiest and most cost-effective way to ensure that everyone on campus has FEMA's recommended emergency supply of water is to require all independent living residents and staff to maintain their own 2-week supply of water bottles (or provide these bottles to them biannually; Refer to the Emergency Supply Chapter for more information).

Additionally, Rose Villa can leverage its existing saltwater pool as a source of water for washing if the water is filtered or boiled for at least a minute. (Unfortunately, because it's a saltwater pool, desalination treatment would be necessary to produce drinking water. A desalination treatment system (i.e. reverse osmosis) is currently prohibitively expensive.) Rose Villa could filter this saltwater with their existing hurricane filter (160 gal/hr) or small filters (e.g. Life Straws). To reduce the need to transport this filtered washing water, Rose Villa could set up wash stations in/near the pool area (see

measures below for details) being careful to ensure runoff greywater from these wash stations does not contaminate the saltwater pool supply. Additionally, Rose Villa may want to invest in some solar showers (or have an event where residents design and build their own system) to raise the water temperature to more comfortable levels, but this is not necessary. Following is a summary of the measures described above.

It's important to note that the ROSIE tank system at Schroeder Lofts contains greywater (from showers, tubs, sinks, etc), not rainwater, so it cannot be filtered or boiled to create safe drinking or cooking water. This is because the risk of consuming harmful bacteria, parasites, cysts, and chemicals is too high, even in an emergency.

Water Storage and Sanitation Measures

~$ 150/ea.	Require or provide 2 weeks of bottled water in each independent living residence (for drinking, washing, cooking).
~$ 150/ea.	Require or provide 2 weeks of bottled water for all staff (stored in offices and labeled supply rooms).
~$0	Store existing hurricane filter at pool for emergency use (for washing purposes only)
~$ 200/ea.	Purchase several portable solar shower systems with makeshift curtains.
~$ 75/ea.	Purchase camping sink faucets* with 5-gallon buckets for washing stations at ROSE lots and pool

*Hand washing station

Human Waste Management

The need for reliable potable water (for drinking, washing, cooking) is far more critical to secure in an emergency than properly disposing of human waste. In all likelihood, the nearby sewage treatment plants will be broken and may dump unfiltered effluent directly into the Willamette River. If need be, Rose Villa can do the same. Or dig holes. But to maintain some semblance of sanitation and order on campus during an extended water outage, this plan includes two low-cost options during Stage 3.

Option 1: **Baggy System**: In an emergency, residents/staff would use baggies that go over toilet seats. The bags would be deposited in a designated place on campus. The latter part of this plan diverges from the plan outlined in the ReadyForce Guide (refer to the "Other Resources" section) that states the Rose Villa staff would pick up baggies from residents' front porches, as this proposition has staffing issues. To implement this strategy, Rose Villa would connect with ReadyForce liaisons to learn where these presumed 12,000 baggies are stored on campus. One issue with the baggy system is that it would generate a lot of plastic waste that will not decompose quickly.

Option 2: Bucket System

Alternatively, a bucket system is a more ecological system for managing human waste. Here's how it works: 5-gallon buckets are equipped with a snap-on plastic toilet lid. Some are filled with either coconut coir or biodegradable kitty litter to receive primarily solid human waste (some liquid waste is okay). The other buckets are for liquid human waste only and thus do not need coconut coir or biodegradable kitty litter. These bucket toilets can be stationed at neighborhood nodes, perhaps at/near ROSE Ports and/or ROSE Havens. (This is particularly helpful if residents and staff aren't able to re-enter their homes until they are confirmed to be safe for re-occupancy by the ASC-certified engineer). When buckets are full, ReadyForce and/or Rose Villa staff will transfer wastes into a designated dump zone as far from human habitation on campus as possible. For liquid wastes, this could be the Willamette River. For solid wastes, a hole can be dug, or Rose Villa can invest in some 80-gallon metal drums. After a year, this "humanure" will decompose to a state that is safe to apply at the base of non-edible landscaping for use as a fertilizer.

Human Waste Measures

~$ 40/ea.	Purchase 60* five gal. buckets, toilet lids and either kitty litter or coconut coir compressed bricks,
~$ 50/ea.	Purchase 60* pop up Privacy Shelter for bucket toilets

~$ 0	Locate the 12,000 human waste bags mentioned in the *ReadyForce Emergency Response Guide*

NOTE: Costs are material only, and do not include labor.

*Quantity of 60 is based on Oregon Structural Specialty Code minimums for water closets in a dormitory or congregate living facility.

Stage 4 Water Resilience Goal: Reduce WUI by 13%; Install rainwater collection system

Stage 4 includes three distinct water-resilience goals. The first is to significantly reduce water use intensity (WUI) on campus, ideally by at least ~20%. The second is to create a renewable source of on-site water in case of a municipal water outage/shortage. And the third is to invest in a human waste management system that is more sanitary and civilized compared to the more affordable bucket and/or baggy system proposed in Stage 3 .

Water Efficiency Measures (WEMs)

To reduce campus water use, Rose Villa would continue to implement the same WEMs introduced in Stage 3. These WEMs would occur at whichever instance occurs first: 1) resident turnover, 2) at the product's end of life, or 3) when they require significant repair that warrants replacement—whichever comes first. There is one exception and that is irrigation controls. By the end of Stage 4, Rose Villa will have replaced all of the inefficient irrigation controls on campus (even if it's not at the end of its useful life) and more efficiently utilize the rainwater catchment system.

~$ 200-400/ea.	Replace inefficient irrigation controllers w/ WaterSense labeled controllers.
$ 0-2,000/ea.	Utilize WaterSense certified professional and/or WaterSense Water Budget Tool.[6]
$ TBD Stage 2	Upgrade the existing irrigation systems to meet WaterSense compliant design.
~$ 2,000-TBD/ea.	Add demand-controlled recirculation system*.
~$ 0- 60 ea.	Add aerators with faucets.
~$ 0-1500 ea.	Replace inefficient plumbing fixtures appliances with WaterSense labeled options.
~$ 2/SF.	Replace inefficient irrigation with drip irrigation and smart controls (WaterSense).
~$ 0-1500/ea.	Replace gas and electric resistance water heaters with heat pump water heaters (HPWHs).

[6] https://www.epa.gov/watersense/water-budget-tool

*A water recirculation system such as the one installed at Trillium Townhomes ensures the hot water response time is reasonable. Typical buildings are able to reach hot water temps in less than 10 seconds. With a water recirculation system the occupant is less likely to waste water by running it until it is adequately warm. A recirculation system can be retrofitted into existing homes without adding new piping. Water recirculation systems are typically activated by motion sensors in bathrooms and push buttons in kitchens.

Water Storage and Filtration

Rose Villa can implement a rainwater harvesting system to ensure a renewable source of water (and reduce water bills). The rainwater harvesting system can consist of one large and centralized collection system near the South Main ROSE Haven for instance, or it can consist of smaller, decentralized collection systems throughout campus. Either way, this collected rainwater can and should be used to efficiently irrigate the campus landscape during non-emergency times. If and when an emergency cuts off the municipal water supply to Rose Villa, rainwater harvested during the rainy season can be filtered or boiled to become safe for drinking, washing, and cooking. In this way, Rose Villa can potentially extend its off-grid water supply significantly. Note: Underground water storage tanks are more seismically resilient to above-ground water tanks and there will be a need to invest in resilient piping and connections that withstand seismic activity.

The size of the rainwater cistern will be refined in a Stage 2 study based on Rose Villa's goals for emergency service and water savings. There are three trade-off considerations with the cistern, the size (and associated costs), the minimum volume of water reserved for emergency preparedness, and the amount available for garden irrigation or other non-potable uses (and associated water savings). The *effective* size of the cistern for non-emergency use and water savings is reduced by the minimum level kept at all times for emergency use. Note: This only applies to cisterns designed for rainwater capture; cisterns storing municipal water will not contribute to any water savings.

~$TBD Ph.2 Install a rainwater catchment system(s) connected to efficient irrigation systems.

Human Waste Management

In Stage 4, Rose Villa can choose to upgrade the human waste management systems from the baggy or bucket system, to a porta-potty or Groover portable toilet system. When stored, Groover toilets (including privacy tents) take up 10 times less room than collapsible porta-potties (~40 cubic feet for a collapsible porta-potty versus 4 cubic feet for a groover toilet plus tent). They also cost one-fourth of the price of a porta-potty and they require far less assembly. Another benefit of Groovers is that they don't rely on chemicals. There are only two identified issues with the Groover portable toilet system. One is that it requires some water to flush the toilet. However, Rose Villa could utilize ROSIE's greywater or pool's saltwater. The second issue is that it would need to be emptied at least daily rather than the ~2 weeks it typically takes a porta-potty to fill up. Emptying Groover tanks is relatively easy given the campus' proximity to the Willamette River.

or

~$ 800-850/ea. Purchase 60* flat-packed (or foldable) porta-potties, or
~$ 150-250/ea. Purchase 60* groover toilets with pop up privacy tents from REI*.

NOTE: Tents cost $0 in this Stage if they were already purchased in Stage 3.
NOTE: Costs are material only and do not include labor.
*The quantity of 60 is based on the Oregon Structural Specialty Code minimums for water closets in a dormitory or congregate living facility.

In an emergency, either toilet system can be deployed in clusters to neighborhoods on campus (listed below). Porta-potties typically last about 2 weeks before they need to be serviced.

- Courtyards near Schroeder Lofts' ROSE Haven.
- Roundabout near Madrona Grove's ROSE Haven.
- Street near South Main's ROSE Haven.
- Near neighborhood ROSE Ports.
- Near gardens and future ROSE Pavilion.

Stage 5 Water Resilience Goal: Reduce WUI by 25%; Install water cistern at Pavilion

There are three distinct water-resiliency goals in Stage 5. The first is to significantly reduce water use intensity (WUI) on campus by ~50% compared to pre-RAP WUI levels. The second is to create a large reliable source of on-site potable water that does not require filtering. And the third is to invest in a human waste management system that is more sanitary and civilized compared to the more affordable bucket and/or baggy system that is proposed in Stage 3 .

Water Efficiency Measures (WEMs)

To reduce campus water by half, Rose Villa would need to continue implementing the same WEMs that were introduced in Stage 3. By the end of Stage 5, Rose Villa will have replaced all inefficient fixtures, appliances, equipment on campus (even if it's not at the end of its useful life) so as to meet the 50% WUI goal.

~$ 200-400/ea.	Replace inefficient irrigation controllers w/ WaterSense labeled controllers.
~$ 2,000-TBD/ea.	Add demand-controlled recirculation system*.
~$0- 60 ea.	Add aerators with faucets.
~$0-1500 ea.	Replace inefficient plumbing fixtures appliances with WaterSense labeled options.
~$ 2/SF.	Replace inefficient irrigation with drip irrigation and smart controls (WaterSense).
~$0-1500/ea.	Replace gas and/or electric resistance water heaters with heat pump water heaters

Water Storage and Filtration

For water storage, the plan calls for installing a ~12,000 gallon underground water cistern under the ROSE Pavilion (refer to Map). This cistern will be filled with potable water from the local municipality. During non-emergency times, this water can be used to water the adjacent gardens (and perhaps supply a sink at an outdoor garden station and/or at an outdoor kitchen for use at social events). During an emergency when municipal water is not available, this cistern is

sized to provide up to an **additional ~24 days supply of drinking/cooking/washing water for all 400 residents and 100 staff (out of 180 staff total) on campus**. This is based on the FEMA standard of 1 gal/person/day.

The size of this municipal water cistern can be refined in a Stage 2 study based on Rose Villa's goals for emergency service and water savings. Similar to the sizing of the rainwater cistern, there is a three-way trade-off between the size (and associated cost) of a cistern, the minimum volume of water saved for emergency preparedness, and the amount available for garden irrigation or other non-potable uses. The *effective* size of the cistern for non-emergency use is reduced by the minimum level kept at all times for emergency use. Note that cisterns storing municipal water will not contribute to any water savings.

Human Waste Management

Permanent composting toilets, which could serve as an amenity during non-emergency times, should also be considered. Such toilets could be installed at the ROSE Pavilion to serve as ecologically-sound commodes for people that are either gardening and/or attending events at the Pavilion. Composting toilets could also be installed at the new Facilities Operations building that has yet to be designed or constructed. Rather than creating hazardous waste, composting toilets generate a fertilizer that can be safely applied at the base of non-edible landscaping. They also serve as great amenities to display Rose Villa's commitment to sustainable living.

Fire Resilience at Rose Villa

During the Visioning Workshop, resistance to fire events, including smoke from distant wildfires, was identified as a priority. This topic was not comprehensively addressed in the Workshop Series. This chapter will set the stage for future discussions on this topic. The following section explains four ways Rose Villa can increase fire resilience on campus. The RAP team can develop specific goals for fire resilience during Stage 2 if this is of interest to Rose Villa's leadership.

Air Quality

When air quality becomes unsafe due to smoke particles (or other environmental causes), Rose Villa can rely on their buildings' HVAC systems to filter the air—*if* they have the right filters on hand. Our current assumption is that most of Rose Villa's HVAC systems have MERV 11 air filters that are not sufficient at filtering out hazardous smoke particles.

MERV 13 filters typically advertise that they can filter out ~90% of small particulates (PM2.5) that are harmful to human health. Testing done by Stephen Aiguier of Green Hammer and other air quality experts indicate otherwise. Their studies show that only about 70-75% of small particulates are filtered out of indoor air during smoke events. The remaining ~25% of particulates left in the air are so deleterious to human health that it's worth using a minimum MERV 15 filter, which has an effective filtration rate of ~90%.

MERV 13 or higher filters restrict air flow and create static pressure that can stress an HVAC system. It is for this reason that we recommend that Rose Villa store MERV 15 (or higher), if such filters can be sourced that fit into filtration cabinets, and only install them temporarily when the poor air quality is anticipated. The air flow of these HVAC systems should also be turned down to a low setting to further reduce stress on the system due to static pressure. During Stage 2, Rose Villa can take stock of its existing HVAC air filters to confirm their size and MERV ratings, and then purchase and store appropriately-sized MERV 15 or higher filters for emergency use.

Air filtration at ROSE Haven's can be accomplished by deploying HEPA and Carbon filtration systems as part of system upgrades in those spaces during Stages 3-5. These systems and recommendations and the timing priority for deployment will be further evaluated and fine tuned during Stage 2.

Fire Resistive Materials and Landscape

If there is a fire on Rose Villa's campus, buildings will more easily catch fire if their exterior materials are flammable. Below is a list of Resilience Design Guidelines to follow to reduce the flammability of campus' buildings and landscape. For more information, review the *Safer from the Start document on Firewise Communities: A guide to Firewise-Friendly Developments.*[7]

- Roof and roof elements: Use asphalt, fiber-cement, tile, concrete, and metal materials.
- Siding elements: Use stucco, brick, and fiber-cement materials.
- Vents and openings: Screen with metal mesh no wider than ¼".
- Windows: Install double-pane (min), or tempered glass windows.
- Building maintenance: Remove needles, leaves, and twigs from under decks, porches, gutters, etc.
- Landscape**:** Create a "fuel-free zone" within 3-5 ft of buildings, remove dead/dying vegetation, replace fire-prone plants with Firewise plants[8], and thin out trees within 100 feet of buildings to keep tree canopies from touching one another.

On Site Water for Fire Fighting

[7] https://www.nfpa.org/-/media/Files/Training/certification/CWMS/SaferFromtheStart.ashx
[8] https://surviving-wildfire.extension.org/selecting-firewise-plants/

If a wildfire is burning close to campus, Rose Villa should consider preemptively hosing down its buildings and landscape to help prevent fire spread onto campus. There are currently three large sources of water that can be used to fight fires on campus—the pool, ROSIE, and the Willamette River. Once all RAP measures have been implemented through Stage 5, there will also be a large cistern of water below the ROSE Pavilion. Any and all of these water sources could be theoretically used to hose down the campus if Rose Villa invests in a hose system to do so. This concept needs further consideration and expert consultation.

Fire Drills

Fire drills are an important way for residents and staff to remember what to do in the case of a fire on campus. Consider adding a fire drill procedure to the ReadyForce Emergency Response Guide e and/or Campus Emergency Planning documents. Reviewing these procedures at annual or biannual events is also critical to ensure that everyone on campus knows what to do during a fire emergency.

The RAP consultant team is available to help develop Fire Resilience guidelines, goals and strategies further if Rose Villa is interested.

Emergency Response Plan

Rose Villa has numerous Emergency Response Plans in place including the ReadyForce Emergency Response Guide (see Additional Resources chapter), which were reviewed by the consultant team. (Note, there is a Madrona Grove Emergency Response Plan that was not reviewed in this Stage 1 analysis.) The key takeaways include:

- Rose Villa has some outstanding Emergency Plans in place, thanks in large part to the ReadyForce team.
- The ReadyForce Emergency Response Guide includes a number of assertions that need confirming, or revising. Refer to the Emergency Response Goals for Independent Living Matrix at the end of this chapter for a summary, or assertions that need confirming.
- A survey of where all the existing emergency supplies are stored would be very useful.
- Designating a staff member to be responsible for Emergency Response Planning should be considered.
- A campus map or maps would go a long way to clarifying where resources are on campus in an emergency.
- ROSE Lots are existing parking lots that can be turned into emergency response stations if a large earthquake renders most/all of the buildings unsafe to occupy until they can be certified as safe to reoccupy.
- A ROSE Refresh Party would be a fun and effective way to “refresh” emergency supplies and “refresh” resident and staff understanding of what they and others can/should do in emergencies.

ROSE Refresh Party

There’s several critical elements to effective Emergency Response Plans. One is that the emergency supplies need to be fully stocked, accessible, and locatable during any type of disaster event. Another element is that residents and staff must be adequately informed about what to do in various emergency situations. In light of these two critical elements, it is recommended that Rose Villa host an annual ROSE Refresh Party during which residents and staff restock emergency supplies, re-learn what to do in an emergency and have fun connecting with their resilient community. Educational

events that week could include friendly competitions for which neighborhoods can conserve the most water and/or energy. This can also serve as a good time to request endowments to support larger RAP efforts such as the ROSE Pavilion. Around the same time of year as the ROSE Party, Rose Villa can annually update all Emergency Response Plans.

Emergency Supply Storage

According to the ReadyForce Guide there are a myriad of emergency supplies stored throughout campus. Current Rose Villa leadership will work with ReadyForce to confirm the location and quantities of these supplies. If any of these emergency supplies are stored in places that will likely be difficult to access, RV should consider moving these supplies. For instance, the hurricane water filter is currently stored in the basement of South Main, which may be inaccessible after an earthquake. Consider creating a structurally resilient storage area within the proposed Facilities Operations Building that will have a greater likelihood of being accessible after a large disaster like an earthquake. In that way, everyone will know where to access critical supplies in an emergency.

Campus Utilities Map

A Campus Utilities Map will help ensure quick and comprehensive action is taken during an emergency response and routine maintenance and operations on campus. Items to include on such a map are listed below.

- **Water:** water supply lines, sewer lines, manholes, water shut off locations, water storage locations, sanitation facility locations, etc
- **Energy:** Power lines and feeds, Transformers, Gas shut off locations, Battery and Generator locations, etc
- **Fire Suppression:** FDCs, Standpipes, Fire Hydrants, Fire Doors, etc.
- Other TBD in Stage 2

Campus Emergency Response Map

A Campus Emergency Response Map will help ensure quick and comprehensive action is taken during an emergency response on campus. Items to consider including on such a map include:

- **Water:** Emergency Water storage locations: emergency Human waste management locations, emergency Water filter locations, water shut off locations, etc.
- **Energy:** PV and Battery locations, generator locations, ROSE Port locations, gas shut off locations, etc.
- **Fire Suppression:** FDCs, Standpipes, Fire Hydrants, etc.
- **ROSE Petal locations:** ROSE Haven, ROSE Port and ROSE Pavilion locations with note of services and supplies
- **Emergency supply storage locations** (outside of ROSE Petals): includes consumable and non consumables
- Other TBD in Stage 2

Following is a brief summary of suggested goals and strategies for RAP Stages 2 and beyond.

Stage 2

- Review and revise the Emergency Response Goals for Independent Living* created in RAP Stage 1.
- Develop a Campus Emergency Response Map and/or Utility Map; consider leveraging GIS.
- Review and revise the *ReadyForce Emergency Response Guide* to reflect current preparedness w/ ReadyForce.
- Review and revise the Madrona Grove Emergency Response Plan if it has not been updated recently.
- Review and revise other Emergency Planning documents that are currently in John Schallberger's file folder.
- Create a comprehensive resource where all plans are stored, and create a plan for updating them.
- Refine the intended function of ROSE Lots and the supplies needed (e.g. porta potties, washing stations, tents).

Stage 3

- Ensure adequate budget is allocated during Capital Planning to meet the stated Emergency Response goals.
- Ensure Facilities Maintenance Plan accounts for any required maintenance of emergency supplies/equipment.

Annually at ROSE Refresh Party (led by ReadyForce and an RV liaison)

- Refresh emergency supplies; donate old but non-expired items to a local Food Bank.
- Refresh residents' and staffs' understanding of Emergency Response Plans and what they personally can do.
- Inform residents and staff about RAP progress.
- Host a fun competition for which neighborhoods can conserve the most water and/or energy.
- Host a fundraiser and/or consider encouraging endowments to help support large ROSE petal projects.
- Invite outside organizations to tour the campus' resiliency amenities.
- Update the ReadyForce Guide and any/all other RV Emergency Response Plans.

*A draft of the Emergency Response Goals for Independent Living from Stage 1 is included on the next page. A link to the document is also in the Additional Resources Chapter.

Emergency Response and Supplies Matrix

EVENT	SUPPLY	CURRENT STATUS OF SUPPLIES/SERVICES FOR INDEPENDENT LIVING RESIDENTS per ReadyForce Guide **To be confirmed ** (this doesn't not comprehensively include Madrona Grove supplies/services)	ACTION ITEMS in addition to confirming current status, revising ReadyForce guide as needed, moving supplies to safer storage areas and documenting where items are stored and confirm what is required vs recommend for residents to have in their home kits. Connect with John Scott and Steve Morris	ROSE HOMES (Phase 2-5) existing IL homes w/ additional emergency resiliency	ROSE LOTS (Phase 3-5) existing parking lots w/ temporary tents for emergency services and/or shelters	ROSE HAVENS (Phase 3-5) existing community rooms w/ additional emergency resiliency	ROSE PAVILION (Phase 4-5) new PV-covered open shelter w/ amenities	ROSE PORTS (Phase 4-5) existing carports with PV & electric charging stations
• Earthquake • Winter storm (freezing) • Municipal water contamination	**Clean Water Supply**	• Madrona Grove has 2 weeks of emergency water stored • IL Residents MAY have bottled water stored • RV has containers for transporting water from water dispensing areas RV will set up • 780 gallons of water stores on campus in • 500 gallon Plastic vats with cages plus gallons stored in garages. Confirm w/ John Scott. • 20 hoses and paper cup supply (confirm purpose) • Partnership w/ Williamette View to have access to water from their well in an emergency • Hurricane Water Filter w/ 160 gal/hr capacity • RV will set up water dispensing areas • RV has containers for transporting water from water dispensing areas RV will set up (confirm)	• RV to refresh stored water if older than 2 yrs • Jim/Bob to connect with Williamette View in regards to resiliency and well • Confirm if have emergency hand sanitizer supply	**Bottled Water** • 1 gal/person or pet/day for 2 weeks **Life Straws** • Life straw to filter water from Water Heater, dehumidifiers, etc.	**Water station** for washing/drinking • with any/all clean water sources • and/or Hand Sanitizer	**Rainwater collection and filtration** **Pool water filtration** • Hurricane filter at pool • Water station for washing/drinking **Water station** for washing/drinking • with any/all clean water sources • and/or Hand Sanitizer	**Underground cistern** (potable) **Outdoor Kitchen** • sink for washing using clean water from cistern below Pavilion	• Rainwater collection and filtration possible
• Earthquake • Winter storm (freezing) • Municipal water contamination	**Human Waste Management**	• 12,000 waste bags to provide to residents. Placed on toilet, then sealed, left on porch to be picked up by staff.	• Confirm if you want to use the bag system • Figure out where bags stored; document it • Revise ReadyForce Guide to state that residents are responsible, not RV, for transporting sealed waste bags to designated area(s) on campus.	**Toilet Bag System** • Distributed by ReadyForce. • Disposal plan to be resolved • Hand sanitizer	**Temporary Toilet System** • Pop up tents with bucket toilets &/or • Pop up tents with Groover toilets &/or • Hand sanitizer	**Toilet Bag System** • Distributed by ReadyForce. • Disposal plan to be resolved	**Composting Toilets**	• If there's room under carport RV could set up the same systems here as are listed in the ROSE Lots
• Power Outage • Winter Storm • Earthquake	**Power Supply**	• Battery backup landline phones & internet for 2 hrs via UPS backup! *entire campus on VOIP. Increase duration. Will VOIP work if cell service goes down via Intranet?* • Flashlights required at IL homes • Recommend rechargeable batteries for medical devices. • RV sets up warming stations if temps drop when no power • Portable generators that can provide recharging of electronic devices within 72 hours. *4-5 in Rose Court* • Generator services Madrona and some of Schroeder (egress only and maybe some outlets) • Generator powers South Main	• Confirm where we can store portable generators if they are needed/desired	**Small Personal Power Station** • Goal Zero Yeti 400 or sim req'd for charging devices, minimal lighting **Microgrid** • that can power critical home loads including heating, cooling, lighting, refrigeration, charging devices, etc. • with PV+battery, &/or generators	**Portable generators?** • for powering warming/cooling huts, refrigeration for medical supplies, charging devices, radio, etc.	**Microgrid** • that can power critical loads including heating, cooling, lighting, refrigeration, charging devices • with PV+battery &/or generators • Provide emergency circuits with shore-based generator in S.Main, N.Main, Schroeder, Madrona.	**Microgrid** • that can power critical loads including lighting, charging devices, refrigeration • with PV+battery	**Microgrid** • that powers electric vehicles and other device charging • with PV+battery (no generator)
• Power outage	**Communications**	• Hand crank radio recommended at IL homes • Neighborhood buddy system w/ RF • Daily Zoom mtgs daily at 4pm • Regular Emails, robo-calls, printed information Have you used this system? • Walkie-talkies • RF leaders have 2-way radios and battery-powered bullhorns. *How are these recharged? Stored*	• RV to think about HAM radio and other alterative communication. • Confirm how the backup power to communication systems operates in an outage	**Hand Crank Radio** • required or just recommended? **2-way Walkie talkies** • stored by ReadyForce members	**Radio** • generator powered **2-way Walkie talkies** • generator powered	**Radio** • generator powered **2-way Walkie talkies** • generator powered	**Radio** • PV+battery powered **2-way Walkie talkies** • PV+battery charges	**TBD** **Campus intercom?**
• Winter Storm	**Transportation**	• RV will remove ice/snow from walkways. • RV contracts with snow removal contractor for roads. • Gas powered Gator has a snow removal blade. • Shoe tracks for safe walking by staff • Studded tires on one of their Scion cars	• Consider getting chains? • Consider getting more sand? and snowmelt.	N/A	N/A	**Vehicle Charging Station** • possible if extra capacity in S. Main generator	**Vehicle Charging Stations** • Could charge other RV fleet vehicles if electric	**Vehicle Charging Stations** • Could charge other RV fleet vehicles if electric
• All events	**Medical Supply**	• Madrona Grove's status not recorded here yet • Maintain 3 wk supply of medications in all IL homes • Recommend First aid kits in each home • Recommend rechargeable batteries for medical devices. • Portable CPAP machines w/ battery available from RV. *How many and where stored?* • Place a HELP or OK sign in your window after a quake. *(Do residents have these?)* • RV to provide first aid kits to each neighborhood in neighborhood storage cages • RV to provide a medical treatment area for injured residents and transport to treatment area. Also refrigeration of medication.	• RV to decide which ROSE Petals should have Medical Treatment Areas	**First Aid supply kits** • required or recommended? **Medical Device charging** • personal power station or PV+battery	**First aid station** • staff under tents with supplies • including refrigeration for medicines	**Medical Clinic in Schroeder** • consider structurally reinforcing • confirm has reliable energy supply **First aid station** • in other ROSE Havens if necessary	**First aid station (optional)** • staff under tents with supplies • including refrigeration for medicines	N/A
• Large Earthquake • Long-term power outage	**Temporary Shelter**	• RV will store 10 rolls of 3 mil plastic sheeting, stable guns, 10 rolls of duct tape and will provide debris clean up services. *Add zipties, parachord and others! Confirm location stored.* • RV has neighborhood Earthquake gathering sites (Confirm where) • Have tent canopies with no side walls. Confirm how many. • RV has air mattresses. Confirm how many. • Agreements with Elks Club and Williamette View during an emergency if one entity is functional and the other not. • RV will provide portable heaters and/or AC to homes if residents can't run their. *~30 AC, not sure about heaters, but not enough for everyone.*	• Where these neighborhood Earthquake gathering sites are? • Review Agreements with Elks Club and Williamette View during an emergency if one entity is functional and the other not. Meet with both entities.	**Construction Supplies** • for fixing windows, roofs, etc.	**Tent Canopies** **Air Mattresses?**	**Air Mattresses?** **Construction Supplies** • for fixing windows, roofs, etc.	**Air Mattresses?**	• Could possibly serve as shelter (if move cars) but not ideal
• Earthquake • Power Outage	**Food Supply**	• ReadyForce recommended IL residents have 3 weeks worth of food supplies. • Within 72 hrs, RV will provide 1 hot meal for 3 weeks. *What about cold meals for those first 2-3 weeks?* • Refrigerated food in S.Main refrigerators is currently slated to help feed staff on campus	• Require or provide Staff to also have __ days of food supply? Where stored?	**FOOD STORAGE** • Require 3 weeks worth of food supplies.	**FOOD AID DISTRIBUTION** • Service organizations could set up food distribution here	**KITCHEN** • In South Main and Madrona • Ensure kitchens have reliable power source during outage to operate	• possibly food distribution here • possibly stored food supply here • garden also potentially offer fresh food	N/A
• Wildfire Smoke • Poor Air Quality	**Air Quality Supply**	• Recommend having portable air filter • RF Instructions for what to do with HVAC system (RV to update this section of RF Guide with Phase 3 bldgs). This is great but needs more specificity. • RV will provide N95 masks (where stored? enough?) • Go to common areas (ROSE Havens) that will have portable air scrubbers set up (have enough?) RV has 2 currently.		**Portable air filter** • required or recommended? **MERV 15 filters** • installed by staff into HVAC system temporarily during poor air quality events **N95 masks**	N/A	**Portable air filter/scrubbers** • only have 2 currently **MERV 15 filters** • installed by staff into HVAC system temporarily during poor air quality events **N95 masks**	N/A unless Rose Villa decides to make this a building with walls :)	N/A

Resilience Design Guidelines

The guidelines below are intended to form a Basis of Design for any new construction or major retrofit project. Note: If retrofit projects are staged, it is critical to complete enclosure measures first and HVAC equipment upgrades second. This will allow right-sizing of the heating and cooling equipment and further improves efficiency and comfort while reducing operating costs. Note: The following is a first draft of the Resilience Design Guidelines, and it is not yet comprehensive.

Design Guidelines Legend

Structural Efficiency and Resilience

Energy Efficiency and Resilience

Water Efficiency and Resilience

Fire and Air Quality Resilience

Insulation

Walls and Cantilevered Floor Insulation (R30)

- Cavity Insulation:
  - Blown-in Fibrous Insulation. Drill and fill insulation for retrofits.
- Exterior Insulation:
  - For 2x4 walls: add 4” minimum of R4/inch continuous exterior insulation
  - For 2x6 walls: add 2.5” minimum of R4/inch continuous exterior insulation
  - For 2x8 walls: add: 1.5” minimum of R4/inch continuous exterior insulation
- **Synergy**: combine exterior insulation with airtightness improvements and seismic upgrades, and when cladding replacement is required.

Roof/Attic Insulation (R60)

- Attic: Loose-fill insulation. Note, remove existing insulation and air seal attic floor prior.
- Roof Deck Insulation: Rigid Polyisocyanurate with reflective barrier, Rigid EPS, or low-GWP XPS insulation.
- **Synergy:** combine roof deck insulation with airtightness improvements and seismic upgrades and when roofing replacement is required.
- **Short Term:** Attic Insulation and Airtightness is an easy, stand-alone retrofit energy efficiency measure.

Floor (R16-20)

- Slab on Grade: Continuous 4” EPS insulation and thermal break OR equivalent R-Value with Perlite.
- Floor over unconditioned crawl, or basement: Insulate floor framing cavity.
- **Short Term:** Floor cavity insulation could be a simple upgrade, including VB on crawl floor.

Airtightness (goal max. 0.1 cfm/sf @ 50 Pa)

- Attic: Tape or seal joint between ceiling finish and framing as well as all penetrations by MEP.
- Retrofit: Aerobarrier (aerosolized, synthetic acrylic sealant)
- New Construction/Cladding Removal: Execute air barrier through taped and sealed sheathing or membranes

Mechanical

- **Balanced Ventilation with Heat Recovery:**
  - Sensible Recovery Efficiency (SRE) better: ≥75%, Best: ≥85%
  - Fan Efficiency 0.4 W/cfm or 2 cfm/W
- **Ductless heat pumps:**
  - HSPF ≥10.5
- **Rooftop Units:**
  - Energy Star or CEE
  - **Short Term:** Retrofit or replace Roof Top Units
- **Refrigerants:**
  - Consider monobloc heat pumps
  - Consider low-GWP refrigerants
- **HVAC Filters:**
  - Design system to allow filters with a minimum MERV 13 rating in HVAC equipment.
  - Have special-order MERV 15+ or HEPA filters readily available in storage to install temporarily during poor air quality days (e.g. a wildfire smoke event.)
  - Alternatively, or in addition, stock stand-alone air-purifiers with HEPA and carbon filtration capacity for additional contaminate-removal capacity.

Electrical

- LED Retrofits:
  - Replace all incandescent or Sodium-vapor lamps with LED lamps immediately.
  - Replace all fluorescent lamps with LED at EOL.
- Energy Star Appliances
  - Replace all appliances with Energy Star “Most Efficient” at EOL.
- Advanced Lighting Controls
  - Install vacancy sensors (preferred) or occupancy sensors in common areas.
  - Utilize light-level tuning and daylight harvesting where feasible.

Plumbing

- **Low-Flow Fixtures:** All new and replacement water fixtures (i..e. toilets, bathroom faucets, showers, clothes washers) should meet or exceed WaterSense flow rates.
- **Recirculation system:** Utilize demand and temperature-controlled recirculation systems
  - Control type must be aquastat, on-demand, or learning control.
  - Prevent crossover at shower fixtures, install ASSE 1016 approved valves with integrated check valves or add a check valve when updating fixtures.
- **Pipe insulation:** Insulate all cold and hot water supply lines.
  - Cold Water Lines (size=insulation thickness): <1.5”=0.5” / ≥1.5”=1.0”
  - Hot water and recirculation lines: <1.5”=1.0” / ≥1.5”=2.0”
- **Drain Water Heat Recovery (DWHR)**: These passive systems can recover up to 60% of the energy in wastewater from showers.

Water Heating Equipment

- **Heat Pump Water Heater**
  - System must meet a System Coefficient of Performance (SCOP) of ≥3.0
  - System must meet the most current version of NEEA's Advanced Water Heating Specifications
  - Consider consolidating equipment and increasing the number of homes on a single system.
- **Anchor roof equipment** to roof and strap non-roof equipment to walls per seismic requirements.

Utilities

- **Install gas shut-off valves** that are seismically-activated until natural gas is phasedd out.

Landscape

- **Irrigation System** must meet WaterSense Water Budgeting Tool's Landscape Water Allowances.

Furniture

- **Strap cabinets** that are tall and narrow and shelving units to walls
- **Install cabinet door latches** to prevent contents from falling.

Firewise

- Follow NFPA's Firewise Guide when selecting exterior building materials and designing landscaped areas.
- Rated Roofing Material: Composite shingles, metal, clay, and cement tiles
- Fire-resistant materials for exterior walls: Cementitious siding, plaster, stucco, and masonry
- Enclose eaves and soffits. Vent openings should be covered with ⅛" metal screen (ensure sufficient net open area)

Glossary

EEM: Energy Efficiency Measures: Retrofit strategies that improve the energy efficiency of a building(s)

EOL: End of Life: as it pertains to building components that are no longer deemed operational or maintainable

EUI: Energy Use Intensity: an indicator of a building's energy efficiency, like a miles-per-gallon rating for buildings

IL: Independent living (residents/residences), as opposed to the residents living in Madrona Grove's assisted living facility

RAP: Resiliency Action Plan: a cogent framework that guides Rose Villa the steps of creating a more resilient campus

ROSE: Resilient Operations and Sustainable Energy: a distributed approach to resilience at a variety of scales that has multiple benefits

ROSE Petals: Various campus infrastructure that are either retrofit or constructed to increase resilience including:

ROSE Homes: Existing homes that have received structural, energy and water resilience retrofits

ROSE Ports: Existing carports that are upgraded to provide energy resilience at a neighborhood scale.

ROSE Lots: Existing parking lots where tents are set up to provide services if buildings aren't occupiable.

ROSE Havens: Existing community spaces that provide key services and space for sheltering in place

ROSE Pavilions: New covered platform for outdoor gatherings near gardens with river views that provides an off-grid generation and storage of energy and water, composting toilets, an outdoor kitchen and safe place for shelter if residents cannot re-occupy their homes

UPS: Uninterrupted Power Supply: provides uninterrupted power to a load when the input power from PGE fails

WEM: Water Efficiency Measures: Retrofit strategies that improve the energy efficiency of a building(s)

WUI: Water Use Intensity: an indicator of a building's water efficiency, like a miles-per-gallon rating for buildings

Additional Resources

Resources generated during RAP Stage 1:

RAP Facilities Database dated March of 2022: https://greenhammer.box.com/s/9fpn1ii9oyjfxjdt0oftlheym86fj74b

PAE's Energy Resiliency Workshop Presentation: https://greenhammer.box.com/s/56xlgueayywxkq14w2v6r186jure1437

Emergency Response and Supplies Matrix: https://greenhammer.box.com/s/bxl7h8omtmofnlitdrjb7xqpieqpl14f

Resources from Rose Villa

***ReadyForce Emergency Response Guide*:** https://greenhammer.box.com/s/wrgtn8rfdd70pobmbmrm2v2s4zo79mim

Resources from Other Organizations

***Oregon Resilience Plan*:** https://www.oregon.gov/lcd/NH/Documents/Apx_9.2.3_OR_Res_Plan_Final_OPT.pdf

FEMA Food and Water in an Emergency: https://www.fema.gov/pdf/library/f&web.pdf

Firewise Communities: A Guide to Firewise-Friendly Developments
https://www.nfpa.org/-/media/Files/Training/certification/CWMS/SaferFromtheStart.ashx

Mass Plywood Panels:
https://issuu.com/buildhealth/docs/2020-2021_consortium_report_2_published_forest_to_?fr=sMjMzMDE3MzM2MDk

https://issuu.com/buildhealth/docs/2020-2021_consortium_report_1_published_mpp_retrof?fr=sNTVlMDE2NDU3ODA

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