Planning for Upland Expansion: Developing a Framework for Community-Informed Housing Design to Support Indigenous Resilience in the Context of Dynamic Coastal Landscapes.

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Abstract

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The Shoalwater Bay Indian Tribe on the Pacific Coast faces many challenges, including the increasing impacts of climate change and the risks of a dynamic coastal landscape. For those reasons, they are planning for upland expansion, which involves moving their existing community from an at-risk location on the tidelands of the coast to a safer location further inland.

This thesis will argue that community-based design processes are critical to developing meaningful design solutions. Through an active partnership with the Shoalwater Bay Indian Tribe, this thesis strives for the collaborative development of a design framework for high-performance building that reflects the community's values and goals. The developed document is intended for use throughout the design processes of upland expansion, which involves moving their existing community from an at-risk location on the tidelands of the coast to a safer location further inland. Qualitative and quantitative methods are used to investigate the process of community-based design for sustainable architectural frameworks. This thesis explores design planning methodologies, provides insights on how to conduct community-informed design research, and ultimately strives to contribute to resilient and sustainable design processes which prioritize community involvement.

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A RESILIENT FRAMEWORK FOR UPLAND EXPANSION

How processes of co-design, resilient design practices, and community partnerships can form a meaningful, place-based framework for design

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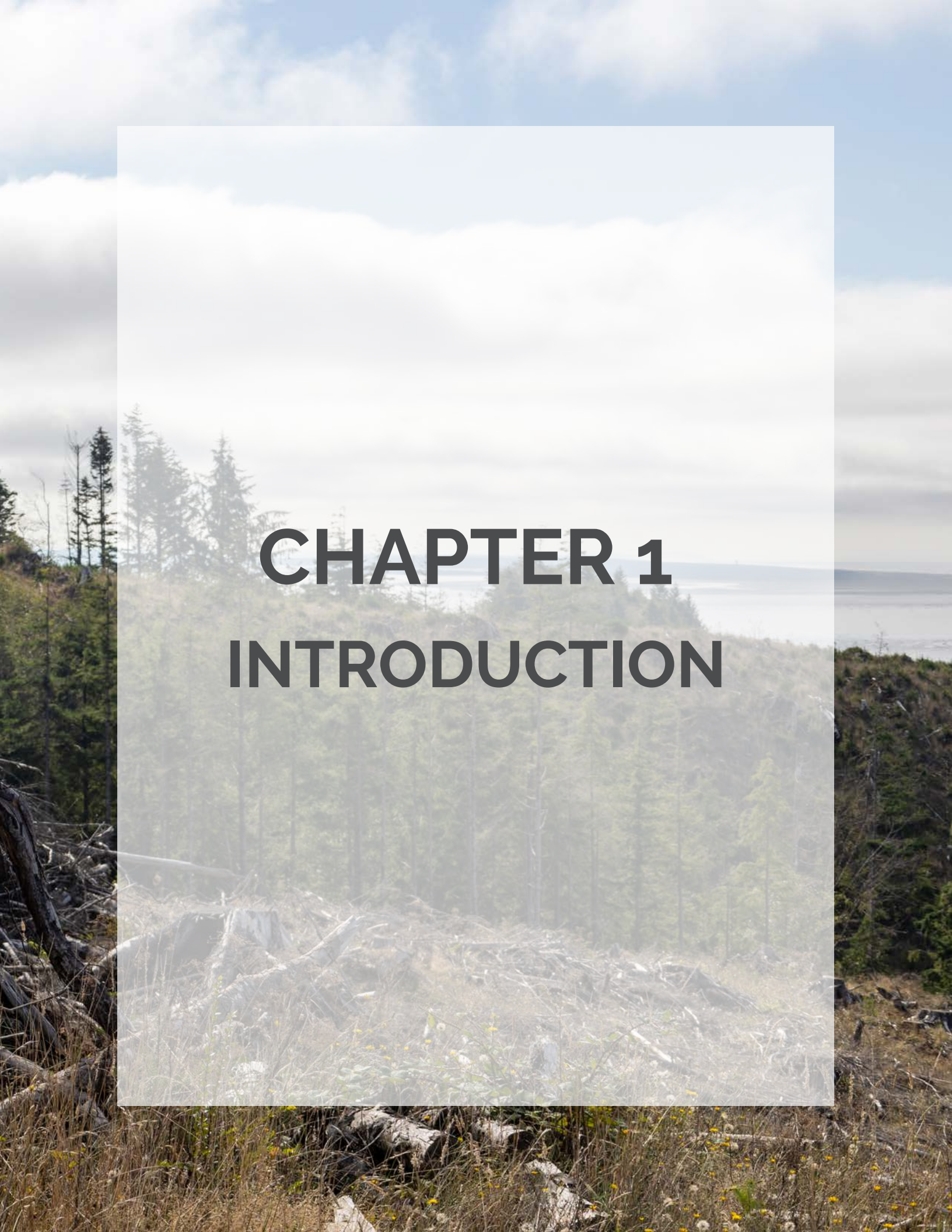


CHAPTER 1
INTRODUCTION

1.1 Acknowledgments

I acknowledge the Coast Salish peoples - past, present, and future - of the Dkhw'Duw'Absh, Duwamish, Muckleshoot, Suquamish, Tulalip and other Coastal Salish tribes on whose traditional lands we study, work, and gather.

I want to express my deepest gratitude to the community members of the Shoalwater Bay Indian Tribe who have generously shared their stories, perspectives, ideas, and future dreams with me as part of this thesis process. Thank you for welcoming me, and always inspiring me with your resilience and strength.

Thank you to my thesis committee, Rob Corser and Julie Kriegh, for your guidance through this process. I also want to thank all the other CBE faculty members, and community partners who collaborated with me this year to support this project.

Finally, thank you to my support system, my friends and family, for the continual encouragement you have provided me through all of the long days and late nights of developing this project.

1.2 Abstract

This thesis explores design and planning methodologies, to provide insights on how to conduct community informed design research, and strives to contribute to resilient and sustainable design processes which prioritize community involvement. Through an active partnership with the Shoalwater Bay Indian Tribe, this thesis strives for the collaborative development of a set of design recommendations focused on high-performance building that reflects the community's values and goals. The developed document is intended for use throughout the process of upland expansion, which involves moving the existing community from an at-risk location on the tidelands of the coast to a safer location further inland. Qualitative and quantitative methods are used to investigate the process of community-based design for sustainable architectural frameworks. This thesis will argue that community-based design processes are critical to developing meaningful design solutions.

1.3 Problem Statement

The impacts of climate change include high risks of tsunami events, eroding shorelines, and climate change. These pose a direct risk to the safety and wellbeing of the Shoalwater Bay Indian Tribe and the land they currently inhabit, which is a sea-level reservation near Tokeland, Washington on the Pacific coast.

1.4 Research Question

What are the processes to develop a set of ***culturally significant design recommendations that will support***

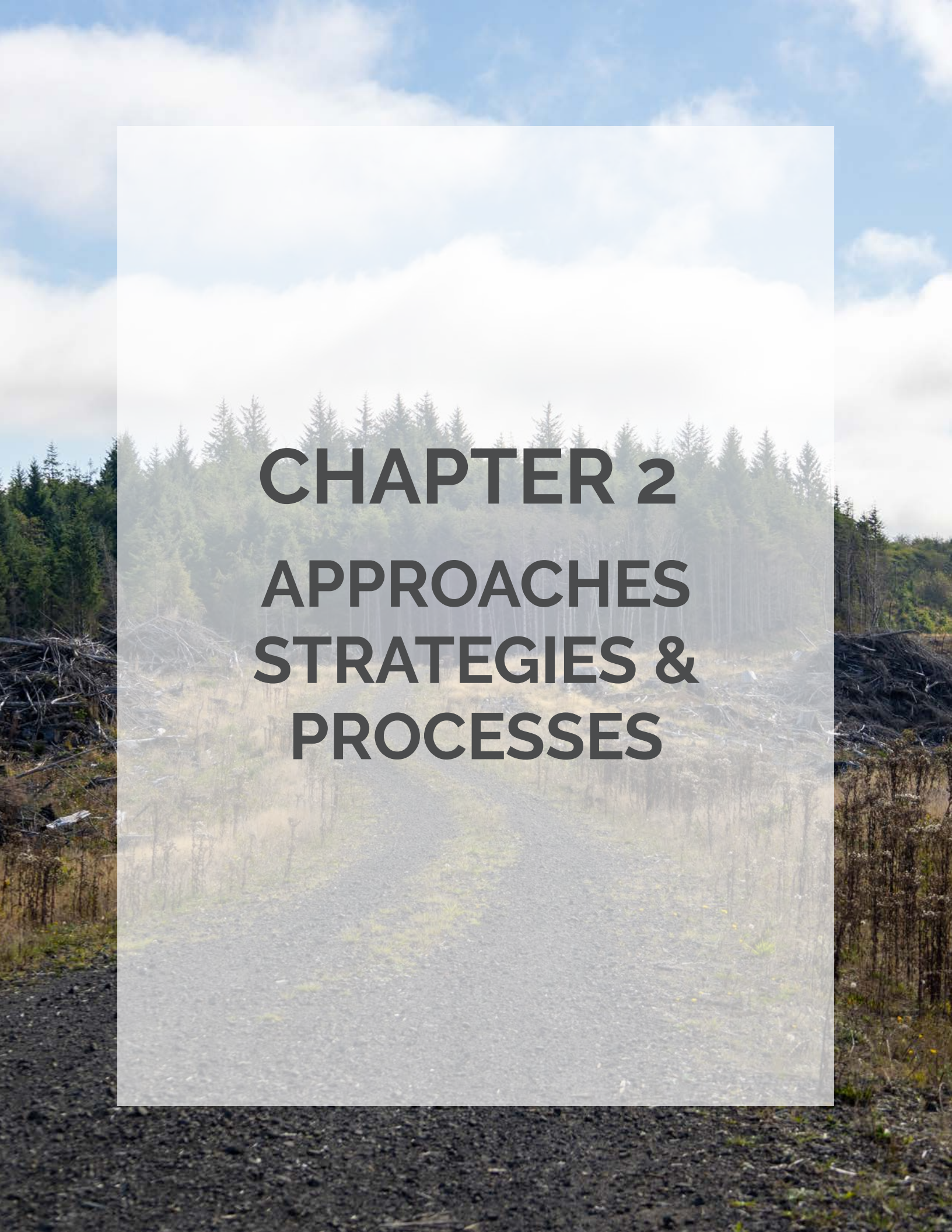
community-based, self-sufficiency, resiliency, and sustainability for an Indigenous community facing the threats of land loss in a dynamic landscape affected by the climate crisis?

1.5 Thesis Statement

This thesis co-creates strategies with the Shoalwater Bay Indian Tribe to help plan for the process of "upland expansion", which involves moving their community from the coastal tidelands to an inland site. Through an active partnership with the Shoalwater Bay Indian Tribe, this thesis involves the ***collaborative development of a design framework for high performance housing that reflects the community's values and goals***. This thesis will argue that ***community based design processes*** are critical to developing meaningful design solutions.

1.6 How to Use this Thesis

For the Shoalwater Bay Tribal Community this thesis will provide a framework to support upland expansion. This framework will include a set of recommendations that integrate and synthesize community values with the key principles of a set of selected sustainable architectural approaches. This document is intended for use throughout the design processes of upland expansion. The framework proposed may also be applicable to other communities facing similar challenges. Finally, the methods explored here will be helpful for designers engaged in participatory design processes supporting equitable and meaningful engagement with communities as co-designers.



CHAPTER 2

APPROACHES STRATEGIES & PROCESSES

2.1 Literature Review

2.1.1 Climate Threats Facing Communities on Dynamic Coastlines

Coastlines are becoming more susceptible to erosion, floods, and greater dynamism over time due to the combined effects of natural factors and human impacts (Hutchison et al., 2021; Rizzo & Giorgio, 2020). One study of dynamic coastlines and the impact they have on ecosystems and the hazards they pose to inhabitation found that there is high variability in the rate of change on coastal landscapes. One study used case studies to examine morphological changes of coastlines across a variety of time scales, climate change scenarios, and varying levels of human intervention with the goal of identifying indicators of risk for communities located along eroding coastlines. Some of these indicators include sand composition, vulnerability to coastal storm events, (Rizzo & Giorgio, 2020) Another study collected and analyzed a toolbox of strategies for dynamic coastal landscapes to mitigate the impact of potential hazards. The study identified a wide range of strategies to mitigate the impact of changing landscapes and climate threats that are deeply tied to the specific conditions of a particular coastline and ecosystems to support sustainability of coastal communities . Effective strategies include hybrid responses that combine practices of managed retreat (moving to safer locations), ecosystem based adaptations (restoring natural features that reduce rate of erosion), accommodation strategies (focused on urban planning and design responses to adapt at risk buildings, infrastructure and communities), and soft protection (such as dune rehabilitation and sand nourishment). This study advocates that coastal

adaptation must be planned on large scales with broad stakeholder involvement (Bongarts Lebbe, et al., 2021).. By providing tools to respond to the risk of coastal erosion, local communities can adapt to changing coastal environments and plan for future sustainability and resilience.

The stretch of coastline along South Beach between Westport and the Tokeland peninsula in Washington State is one of the most dynamic and quickly changing coastlines on the West Coast (Hutchison et al., 2021). This makes the communities along this coastline more vulnerable to hazardous scenarios and threats. One climate threat for this area is rising sea levels and shoreline erosion due to climate change. This is due to warming oceans and corresponding sea level rise, as well as increased storm activity which increases coastal erosion (Rizzo & Giorgio, 2020). For the communities living along the coast, such as the Shoalwater Bay Indian Tribe, this loss of land and property is a direct threat to their future well-being.

A large concern for the South Beach coastal communities is the threat of an earthquake and tsunami. Several factors place this region at risk if there is an earthquake. First of all, due to the location of the Cascadia Subduction Zone, the magnitude of an earthquake is likely to be high. Secondly, most of the coastal development is less than 10 feet above sea level, so evacuation distances to safety are greater, and levels of destruction from a resulting tsunami would be higher (Wood et al., 2015).

A variety of factors inform the level of risk and the best approach for tsunami preparedness and safety. A study of coastal communities in the Pacific Northwest found that there are varying levels of vulnerability for the communities along the Washington Coast which should inform the appropriate risk reduction strategies and indicate where to spend resources to support community resilience (Wood et al., 2015). Using correlational methodologies to develop an analytical framework, this study integrated demographic sensitivity, population exposure, and evacuation potential to identify the communities at the highest risk from a tsunami event in this region. Previously, research measuring population vulnerability focused on individual aspects of the vulnerabilities. The development of analytical frameworks focuses on the intersections and complex interrelationships between vulnerabilities to determine more comprehensive and responsive plans for hazard mitigation. This research found that there are higher levels of demographic sensitivity to emergency events such as an earthquake and tsunamis for the tribal communities in the study area (Wood et al., 2015). Given the higher risk, these communities should prioritize education efforts to ensure the safety and preparedness of community members.

The climate threats and impacts from climate change discussed previously, which imperil the Shoalwater Bay Indian Tribe, have motivated their community to prioritize acquiring nearby land that will be a safer location for their community to continue thriving into the future. The upland expansion provides the opportunities for the Shoalwater Bay Indian Tribe to build culturally specific and meaningful buildings and to design a community that is as environmentally sustainable as possible.

2.1.2 Climate Resiliency & Social Justice

A large part of existing research about the climate hazards of dynamic coastlines is centered around the responsibility of humans in worsening these threats and preventing or mitigating them in the future. Human activity on the coast, and inland in the connected watershed have been shown to have a direct worsening impact on coastal erosion and the corresponding loss of land (Rizzo & Giorgio, 2020). Central to the issue of climate resiliency is its intersection with social justice. When working with historically marginalized communities, who often face the most direct impacts of climate change and climate crisis, there is an opportunity to provide those communities with more self-governance, self-sufficiency, and to provide the tools and knowledge that center on new opportunities for equity. Research has shown the benefits of supporting transformative resilience on the ground by empowering historically marginalized communities (McMillan et al., 2022). The use of qualitative research, which requires deep involvement with the communities being impacted, is central to this type of work that aims to help co-develop empowerment and transformative climate resilience and social justice in low-income and/or marginalized communities. Two bodies of existing research use approaches that address the intersection of resilience and social justice in working with and empowering historically marginalized communities. These approaches are (1) Transformative Climate Resilience (TCR), (2) Community-based Participatory Research (CBPR), and (3) Asset-based Emergency Preparedness (ABEP) which are summarized below.

2.1.2A Transformative Climate Resilience

The first approach to consider is Transformative Climate Resilience (TCR). This is the exploration of the complex interactions between components of systems to increase resilience in all interconnected facets of the system as a whole. TCR is an approach that enables vulnerable communities to cope effectively and make use of opportunities to adapt with the goal of long term sustainable resilience. TCR has three main criteria. These include the approach being adopted at a much larger scale, exploring new approaches towards flexibility for a particular resource system, and transforming places to be more adaptable (McMillan et al., 2022; Denton et al., 2014). Denton claims that transformation occurs within a range of spheres (Figure 1) and attention to transformations within all three spheres is necessary to achieve TCR.

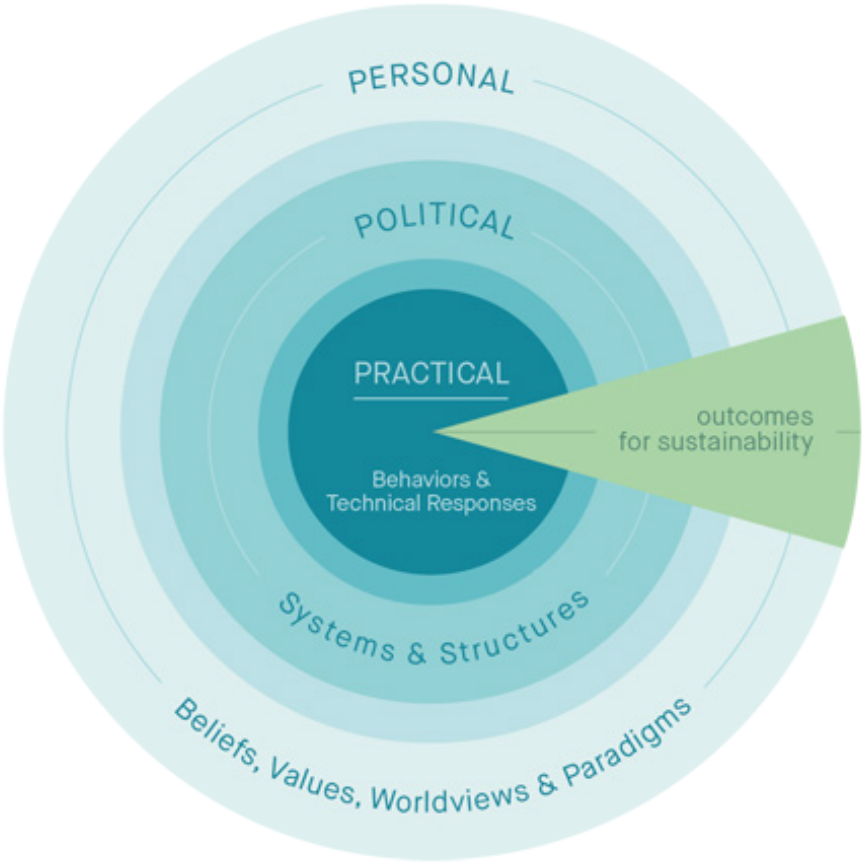


Figure 1. The three spheres of transformation where transformational changes toward sustainability may be initaited through TCR

Using this understanding, one research project carried out fieldwork in nine Eastern Asian countries. The research teams worked together with community members in disproportionately low-income and marginalized communities that also live in areas vulnerable to climate change. The research concluded that the transformative resilience approach not only empowers the community, but also creates an environment where all participants, from researchers, planners, policymakers, community leaders, and community members are gaining knowledge and perspective about resilience from multiple perspectives (McMillan et al., 2022). The possibilities to operationalize these results make them a valuable framework and approach to consider when working with similar communities. Since this approach is based on the specific qualities, values, and priorities of the community, additional research would be required to apply it to the cultural context, and values of the Shoalwater Bay Tribe, or any other historically marginalized communities facing climate threats and desiring to develop impactful resilience. The role of researchers in this framework is to work as knowledge mediators and form networks of connections across multiple communities and at different scales by collecting, analyzing and communicating different resilient strategies that can help suppor climate resilient adaptations in communities. McMillan suggests that becoming a liaison on behalf of the community to larger groups of stakeholders and policymakers is a role that researchers can contribute in empowering marginalized communities. One limitation of this approach is that it requires a long timeframe and additional funding for a wider scope of engagement. The TCR approach and the qualitative research it supports places projects on a much longer timeline than

traditional research and engagement or funding methods typically support. This might result in a smaller impact if a project is limited by the scope of its intervention since transformative resilience takes more time. However, if this framework is operationalized successfully, the limitations in timeframes and funding for research are not likely to be a major impediment to the project. This is because projects under the TCR framework are not solely dependent on the researchers, but also enable community members to carry the work forward after the research period has ended.

2.1.2B Community-Based Participatory Research

Another approach that is helpful to consider when engaging in design work with tribal communities is Community Based Participatory Research (CBPR). CBPR is a collaborative process and approach that involves community members throughout all phases of design and research as equitable and valuable partners in the processes of research (Minkler, 2005; Faridi et al., 2007). One concern with this process is the loss of expertise and specialized knowledge since it is more focused on community members who might not have the formal training or knowledge that outside researchers and professionals would bring. However, in the CBPR process, those expert voices could still be present, in addition to a primary focus on the community input and perspectives. Similarly to the Transformative Climate Resilience approach, using the CBPR process also requires a longer timeframe for projects which might be challenging with scope and funding constraints.

The Shoalwater Bay Tribe has previously participated in a qualitative research project that used the CBPR process to guide a circle study focused on building trust between community members and researchers, focused on improving and empowering the health and well-being of the community. The research was conducted via a partnership between Native People for Cancer Control at the University of Washington, and five tribes in Washington, Idaho, and Montana. The researchers partnered with community members using a study circle format which produces an egalitarian circle of engagement, learning, and collaboration, emphasizing that all participants had things to learn from each other regardless of background, expertise, or identity. The engagement with tribal partners using a Community-Based Participatory Research methodology developed a set of ethical principles that informed the ongoing partnership. These principles included respecting tribal sovereignty, promoting transparency, hearing community priorities, learning from each other, and taking collective action.

In partnership with Indigenous Tribes, including the Shoalwater Bay Tribe, this study developed three key practices or principles essential to community engagement and successful collaboration between designers, community members, and researchers. These central principles centered on building relationship with the community, social justice, and increased community resilience. First, an ongoing commitment is critical for building trust and relationships between the community members and other stakeholders. Second, direct collaboration with community members is an act of centering, amplifying, and empowering community voices that

will help ensure that the proposed solutions are intrinsically grounded in what the community values and deems significant. Third, maintain a posture that encourages new learning and fosters candidness, and supports cautious action for all involved. This gives local perspectives, approaches, and knowledge an equal weight to the outside perspectives of researchers, subject experts, or other professionals (Blacksher et al., 2016).

2.1.2C Asset-Based Emergency Preparedness

Working with communities using these community-based engagement approaches recenters climate threat mitigation strategies on comprehensive well-being instead of relying heavily on typical hazard mitigation, risk assessment, and planning strategies. Traditionally, hazard mitigation includes hazard scenario planning that results in strategies for hardening buildings to withstand climate hazards, or removing them from threatened areas. In contrast to these traditional hazard mitigation planning, an emphasis on social justice as the basis of community engagement and design necessitates qualitative engagement and relationship building with the affected community members over time. Existing research emphasizes asset-based approaches to climate threat preparedness. This approach emphasizes existing and developing community assets as the key to resilience and sustainability in the face of inevitable change due to climate crises and dynamic landscapes (Freitag et al., 2014). Community assets can describe the social, financial, physical, environmental, and human resources already present in the community that support human wellbeing. These include the skills, capacity, and knowledge of

residents, the networks and connections in a community, and the physical and economic resources of a place. Asset based approaches value the capacity, skills and knowledge and connections in individuals and communities. Importantly, a research method known as appreciative inquiry was found to be key in a study of asset-based community resilience. The fundamentals of appreciative inquiry include defining, discovery, dreaming, designing, and delivering the emerging strategies to help communities realize their goals (Figure 2).

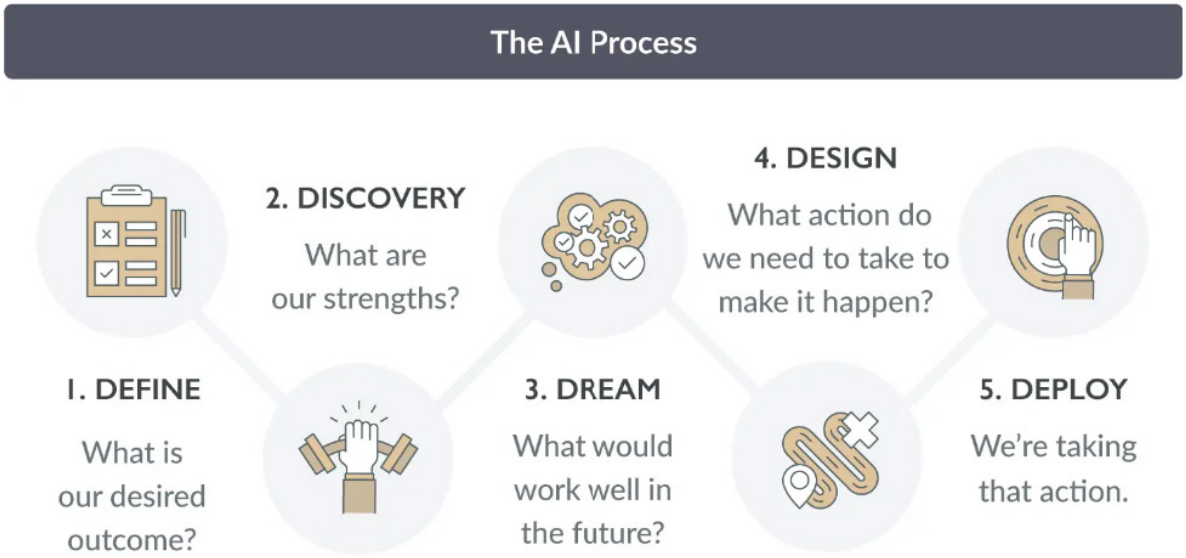


Figure 2. The five principles of the appreciative inquiry process and research method.

This research engaged three communities in participatory adaptive planning which appreciative inquiry methods to emphasize local systems of resilience. By focusing on the strengths of a community (rather than the hazards they face) researchers defined climate resilience as the capacity to adapt and absorb change while retaining community identity and maintaining quality of life. This approach supports local levels of community building and self-sufficiency by recognizing that in the

event aftermath of a sudden hazard (eg. earthquake and tsunami), connection to larger-scale support will likely be lost. This also supports the flexibility of infrastructure, such as transportation, energy, and food systems, to serve multiple purposes in the aftermath of a hazard. The goals of building relationships and trust on a neighborhood scale between commnunity members also help empower communities to be self-sufficient, by not relying on vulnerable power and water sources with access to reliable food sources in an emergency. Self sufficiency Using an approach for design that emphasizes the assets already existing in a community, empowers future resilience with future development by starting from what is already established supports place specific and culturally appropriate planning for hazards.

Climate resilient design processes and approaches that center on social justice and the empowerment of historically marginalized communities have many benefits. These include developing plans for future resilience and self-sufficiency that include choices and options for the community to pick the best course of action, ultimately benefiting community wellbeing, livelihood, and increased capacity for adapting to hazards (McMillan et al., 2022; Denton et al., 2014; Freitag et al., 2014). Given the demographics and climate threats facing the Shoalwater Bay Tribe, the design approaches that focus on climate resilience and social justice are likely to foster and center community engagement in the development process and planning for their move to safer land.

2.1.3 Indigenous Approaches and Strategies for Resiliency

The previously discussed approaches for climate resilience and social justice emphasize making space for marginalized communities and letting them teach research partners and designers of Indigenous communities for resilience. The risk of generalizing these approaches as a replicable, portable system that can be plugged into any community is problematic. The desire to make design processes accessible to any Indigenous community becomes an oversimplification and continues to subtly reinforce decentering Indigenous perspectives and colonialist power dynamics (Akama et al., 2019; Reitsma et al., 2019). It is critical to develop design approaches based on social-justice principles that empower Indigenous communities while striving to develop strategies for their resilience.

The partnership of Indigenous communities with other professionals, consultants, government institutions, and surrounding communities requires care and consideration in the process of co-design using responsive, respectful, reciprocal, and relational approaches. Some examples of these co-design principles include prioritizing relationship and trust building, understanding how different cultures can work together, and prioritizing the need to honor, respect and protect relationships between community members and researchers. If not carefully deployed, design processes and approaches to foster resilient community development risk perpetuating colonialism by decentering and disregarding Indigenous practices and knowledge. In an attempt to find the balance between co-designing and providing subject expertise, without disregarding Indigenous perspectives, a collection of case

studies explore how decolonized co-design can be respectful, reciprocal, and relational for the most beneficial impact on all stakeholders in a project. These case studies reveal several strategies that appear to be successful in centering Indigenous frameworks in design processes with non-native participants. One approach that was common across a variety of projects included leaning into the "third spaces" where language, culture, and collaboration work outside of typical binary perspectives. Through the creation of third spaces where community members and researchers and partners can co-design together. This process can result in an atmosphere of cultural hybridity which challenges static cultural binary oppositions. Cultural hybridity describes a more nuanced approach towards understanding cultural differences. Hybridity helps to soften the differences between the self and the cultural other. This approach suggests that by setting aside development processes representative of historical colonization (eg. traditionally dominant power structures exhibited historically by national governmental policies, capitalistic societies, and/or academic/scientific research institutions), opportunities for culturally relevant, place specific design approaches are possible (Reitsma et al., 2019).

Another common and effective strategy that has been revealed through case studies is creating space for Indigenous storytelling. Storytelling centers on Indigenous perspectives and gives power to communities by connecting deeply with their history, resilience, and land (Aman et al., 2013). These Indigenous approaches give space to challenge colonization and settler mindsets in design

projects, generating a richer integration of Indigenous shared values that provide a foundation for resiliency in the design of space and development of place moving onto safer land. In addition, there is research that supports the idea that remembrance is an element of resilience. For Indigenous communities, storytelling helps complete the cycle of processing past instability and trauma, while recalling past resilience and adaptivity to better prepare for future scenarios of change. Storytelling emphasizes adaptation as an important factor in being resilient to changes across time (Finkbeiner, 2015). By allowing these communities to remember previous challenges, prepare for future challenges, and reframe the unknown as an opportunity for growth and expansion.

The body of research centering on Indigenous design and development approaches utilizes case studies and research through design to support goals of richness in design that accrue from prioritizing decolonizing co-design processes. The Shoalwater Bay Tribe has shown resilience in the face of health crises, climate change, limited access to land and resources, and the constant threat of displacement from their land due to the previously discussed climate threats. One example of this is the construction of the nation's first tsunami vertical evacuation tower (Figure 3). Completed in August 2022, this structure was built near the reservation and was funded by the tribe in partnership with FEMA. The construction of the tsunami evacuation tower is an example of how the tribe is investing in ongoing community safety and prioritizing future safety in the event of a tsunami. This example shows how the community continues to prioritize future wellbeing by

putting money, time, and passion to save not only their own community, but the broader community in the area (Washington Military Administrator, 2022).

Figure 3. The Tsunami Vertical Evacuation Tower completed in 2022 that was funded and spearheaded by the SBIT in partnership with FEMA to support community resilience.

Another example of how the SBIT has shown resilience is in their Pulling Together for Wellness team and action plan to continue developing a healthy and resilient community. In recognition of these efforts, the tribe was awarded the Robert Wood Johnson Culture of Health Prize in 2016. The Pulling Together for Wellness team helps the community take steps to improve and maintain the physical, social, emotional and spiritual health of the community. These efforts are central to planning for hazard mitigation, upland expansion, and future resilience. In all of these areas, their Indigenous identity must be central to all development efforts.

2.2 Sustainable Architectural Approaches

Looking toward the future, expansion to the uplands, the continued growth of resilience and capacity for self-sustainability and communal care are central goals for the Shoalwater Bay Indian Tribe (SBIT). Exploring different sustainable architectural design frameworks and standards for “green” architectural development are particularly relevant approaches that are well suited to contribute to the centering of Indigenous priorities in general and the values of the SBIT specifically. Some of the architectural sustainability approaches that can support the community values, resilience, and sustainability of the SBIT include the Passive House building standard, the Living Building Challenge framework, the Justice 40 Iniative, and the One Planet Living framework. Existing research has focused on how these approaches promote resilience and sustainability in the face of climate threats (Isle, 2018). The centering of Indigenous voices also allows the development of culturally responsive architecture. A core value of the Shoalwater Bay Indian Tribe is prioritizing resilience in the care of the tribal members. An important priority for the upland expansion is building housing for residents. Studying sustainable architectural approaches can play a part in developing a framework for culturally appropriate buildings and homes. The architectural and construction standards, guidelines and methods discussed below (Passive House, Living Building Challenge, Justice 40 Iniative, and One Planet Living) are promising tools that can be further analyzed and adapted to maximize self-sufficiency and resilience while minimizing the environmental impacts of new development in the uplands for the Shoalwater Bay Indian Tribe.

2.2.1 Passive House

Passive House is a design and performance standard for emergy efficient buildings through low energy consumption or operational energy (Passive House Institue 2023; Pitts, 2017; Causone et al. 2017). Passive House has five key design considerations (Figure 4). Passive House buildings must be **1) thermally insulated**, requiring a continuous, well insulated thermal envelope that keeps the building environment comfortable for the climate and season. Passive House standards also require **2) airtight construction**, which requires an airtight barrier that protects the building from air leakage, which can cause heat gain and loss, ultimately improving the thermal comfort. The level of insulation and airtight barriers constitutes **3) reduced thermal bridge design.** Thermal bridging describes an area of building construction which has significantly higher heat transfer than the surrounding materials. Thermal bridging can contribute to high levels of energy loss, which is why it is important to limit thermal bridging through continuous, well insulated construction assemblies. Given the airtight requirements of this standard, Passive House requires a thorough **4) controlled ventilation strategy** to ensure adequate air quality. This can include mechanical ventilation systems, which supply fresh air to interior spaces. This results in buildings with improved livability in their indoor environments since they are less dependent on mechanical heating and cooling systems, instead utilizing natural operable ventilation systems. The final design consideration is **5) highly performing windows and doors**. These will help the building benefit from solar gain and cooling opportunities, without creating drafts.

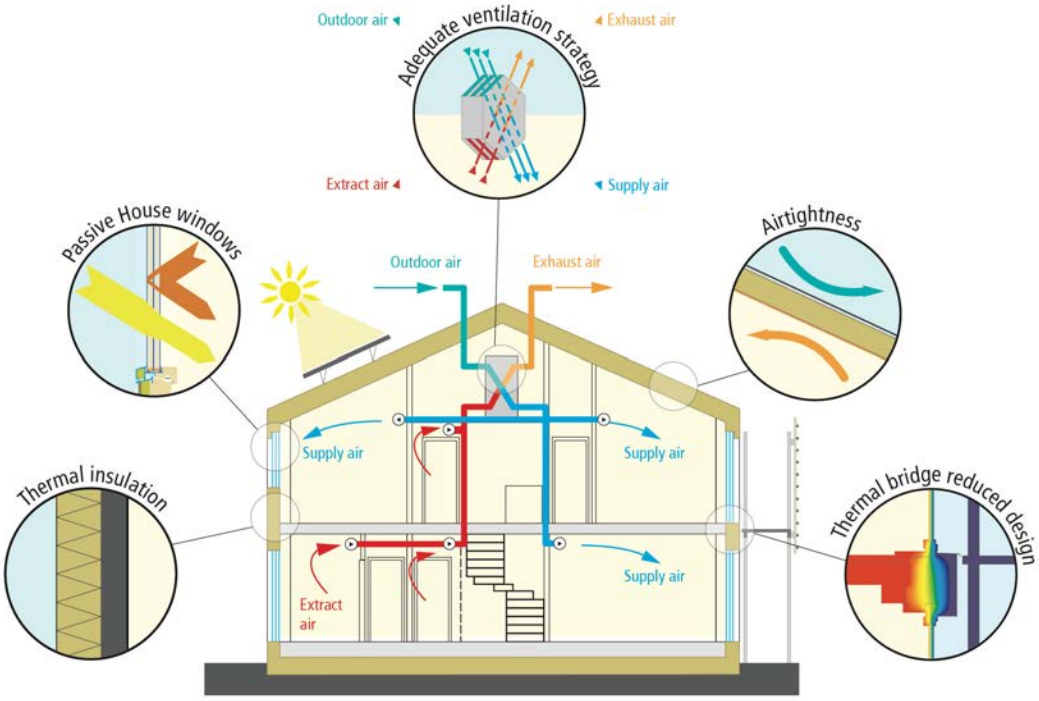


Figure 4. The 5 design considerations of the Passive House Building Standard
Source: Passive House Institue

There are many benefits to following the Passive House standards. The buildings constructed to these standards have a more comfortable and healthy internal environment, that is highly responsive to the conditions of the local climate. A house built to Passive House standards requires minimal heating and cooling due to high levels of insulation and construction assembly, which translates into cost savings over time. This standard results in buildings with low-energy demand for heating and cooling with lower energy bills; continuously filtered air for improved indoor air quality removing particulates, smoke and allergens; increased livability due to the draft free indoor environment; and low maintenance over time due to the use of high-quality low-carbon materials and construction methods. Additionally, Passive House structures have a low environmental impact (reducing both operational and embodied carbon emissions), contributing to the well-being of the inhabitants and the land that it is placed on.

The Passive House standard was developed in Northern Europe (Passive House Institue 2023), but it is easily adapted to different climate zones. To ensure the best performance of a house built to Passive House standards, some adjustments are required based on the climate conditions the building is located within. The land of the Shoalwater Bay Tribe, is classified by the Koppen-Geiger Climate Classification as a Csb climate zone with a Mediterranean climate (See Chapter III for more detailed climate analysis of the site). Regions with this climate classification have mild winters and warm summers. There are unique challenges and opportunities with Passive House performance in this climate. One challenge is building cooling, due to level of solar radiation and high ambient temperature. There is high potential for night time ventilative cooling due to a wide diurnal temperature range in the summer. A case study of a Passive House project in Sicily, Italy which shares similar climate conditions to Tokeland, WA suggests some adaptations of Passive House design principles to specialize it to the Mediterranean climate. The findings indicate some additional design adaptations that would help ensure that Passive House strategies are appropriately responding to the specific climate of the selected site (Causone et al., 2017). The suggested design considerations include the following as additions to the basic Passive House strategies discussed above. Proper Building orientation and shape to respond to solar heat opportunities and protect from unwanted wind. Adequate thermal insulation of the building envelope will reduce heat loss during the heating season and reduce heat gains during the cooling season. Utilizing thermal mass of the building optimizes passive heating and cooling opportunities. Adjustable solar shading and ventilation allows for optimization of

solar gains during the cold seasons and minimizing overheating in warmer seasons. Rely on natural ventilation, especially at night. Using mechanical ventilation with heat recovery and by-pass options will prevent unwanted heating from the outside. Based on the outcomes of this case study, there are additional design options to consider in order to create the most responsive building to the climate. This extra consideration is important to ensure that the benefits of the Passive House design will be optimized.

The centering of Indigenous voices also calls for the development of culturally responsive architecture. A core value of the Shoalwater Bay Indian Tribe is prioritizing resilience in the care of tribal members. An important priority for the upland expansion is building housing for residents. For that reason, developing a framework for culturally appropriate buildings and homes is very important. The Passive House building performance standard developed as a foundational architectural framework can help support Indigenous resilience and care by adapting culturally appropriate forms and features while also being highly responsive to the environment (Hildebrand, 2020). Historically, the types of housing that Indigenous communities have been provided to date by the US governmental housing programs such as HUD have often been insufficient and of poor quality resulting in substandard housing conditions. The HUD housing that was built on reservations was built to federal codes, and they were constructed without regard for local climate. As these poorly constructed homes age they contribute to concerns about indoor air quality and resident health (Seltenrich, 2012). In a research

study with several First Nation Tribes, qualitative surveys were conducted to understand how better housing can support resiliency for tribal members. These community members expressed that the desire for energy efficiency is coming from within the community, as they recognize that lower energy consumption makes them more self-sufficient and less reliant on government solutions, systems and funding. Another common reason for supporting Passive House implementation was the fundamental connection to place that it requires. The connection to place is important on multiple scales for Passive House buildings to be successful. This spans from the site level, where it informs building orientation and design, to the larger environmental level where it is informed by climate data (Hildebrand, 2020; Cassidy, 2022). A benefit of this standard is it's high degree of environmental responsiveness that can better adapt to climate changes and maintain interior comfort levels.

Additional research is needed in this area to produce the support and policy changes that would be needed to implement Passive House standards in Indigenous communities (Hildebrand, 2020). Some of the barriers to the implementation of Passive House include funding limitations, limited construction knowledge and skills, and lacking awareness of the benefits of Passive House which would provide an economic justification for the higher upfront building costs and foster a culture of care within communities. Opportunities for the development of education, careers, and local economic enterprises producing prefabricated Passive House panels and buildings will be discussed in Chapter 5.

2.2.2 Living Building Challenge

The International Living Futures Institue (ILFI) is an organization that has developed several certification programs to work towards reconciling humanity's relationship with the natural world (ILFI, 2022). This can be achieved on a range of scales, from individual buildings to entire communities to promote environmental resilience and health for all inhabitants and the environment. Across the range of certification programs that they offer, their mission is to support the thriving of communities in balance with natural ecosystems to create a society that is "socially just, culturally rich and ecologically restorative" (ILFI, 2022). The program that is most relevant for this partnership with the SWBIT is the Living Building Challenge (LBC). This voluntary program complements Indigenous values such as interrelationships with nature, restorative habitat practices, and minimizing environmental impacts.

On the individual building scale, the Living Building Challenge establishes a set of performance metrics that provide a framework for design, construction and the symbiotic relationship between people and all aspects of the built environment (ILFI, 2022). The LBC has seven performance areas, or "Petals". Each petal is subdivided into detailed, actionable imperatives (Figure 5). **1) The Place Petal**, strives to restore a healthy relationship with nature. The imperatives for this petal articulate where it is acceptable to build, and focus on the protection and restoration of places once thay have been developed. The results from this petal include communities which prioritize pedestrian uses over automobiles, and setting aside a portion of land for

restoration and preservation. **2) The Water Petal**, is focused on creating developments that operated within the water balance of a given place and climate. The imperatives for this petal focus on achieving net-zero water use and recycling 100% of the stormwater onsite to reduce water pollution and waste. **3) The Energy Petal** requires all buildings to rely solely on renewable forms of energy. By prioritizing renewable energy systems, natural daylighting, and other energy reducing strategies the imperatives focus on achieving net-zero energy use. **4) The Health & Happiness Petal** aims to create environments that optimize physical and psychological health and well being. **5) The Materials Petal** endorses materials and products that are safe for all species throughout time. The imperatives for this petal require all project specifications to avoid Red List materials. **6) The Equity Petal** supports a just and equitable world by requiring adequate access to fresh air, sunlight, and natural waterways for all. **7) Finally, the Beauty Petal** celebrates design that uplifts the human spirit. These efforts include incorporating artwork into designs and creating aesthetically pleasing spaces for all.

Figure 5. The 7 Petals of the Living Building Challenge
Source: International Living Futures Institue

Communities that have followed the LBC guidelines can achieve high levels of self-sustainability by utilizing renewable energy and high performance building systems, prioritizing care for physical and mental well-being, choosing healthy and sustainable materials, and understanding building and material lifecycles.

A limitation of the ILFI certification programs is the upfront cost of construction, which can be prohibitive for lower-income communities. While there are different levels of certification, the benefits of gaining certification do not entirely outweigh the cost of meeting the constraints of the certification system for communities with fewer assets to support development or who must rely on federal funding for projects. Additional upfront costs can be due to additional design, modeling, systems, and material costs (Seattle DPD. 2015). Additionally, certification is based on actual performance, and requires audits of building performance, which is another barrier for communities that might not have systems of performance analysis already established.

2.2.3 Justice 40 Iniative

The growing threats of climate change disproportionately impact communities of color and low income households (Tessum et al., 2021). The Justice 40 Iniative was established by President Biden in January, 2021. The Justice 40 Iniative is an accountability framework centered on racial justice and equity to guide federal climate investments directly to “front-line” communities. This federal iniative aims to target 40% of climate and clean infrastructure investments to “front-line”

communities (Callahan, et al., 2021). Front-line communities are defined as communities that have been historically and systematically impacted by poverty, pollution, disinvestment and other inequities.

There is a wide range of disparities that these communities face. The Justice 40 Iniative is designed to address these often compounding disparities. The first inequity is disproportionate, cumulative exposure to pollution and uneven distribution of climate impacts, which has associated health risks. These communities also often experience unequal local government resources, community capacity, and opportunities. Since many households in "front-line" communities are working class households, they may face disproportionate occupational impacts during the transition to a clean economy, and uneven distribution of the costs and benefits of green investments and environmental programs designed to subsize access to clean technology (Callahan, et al., 2021). There are three guiding principles for addressing these disparities using this framework (Figure 6). Investment must be **1) justice driven** and strive to resource and center disadvantaged communities. The impact and outcomes are **2) community powered**. This means efforts are centered on transformational change from the bottom up. Finally, it strives for **3) accountable change.** This principle aims to institutionalize equity and justice into government agency practices, policies, and systems.

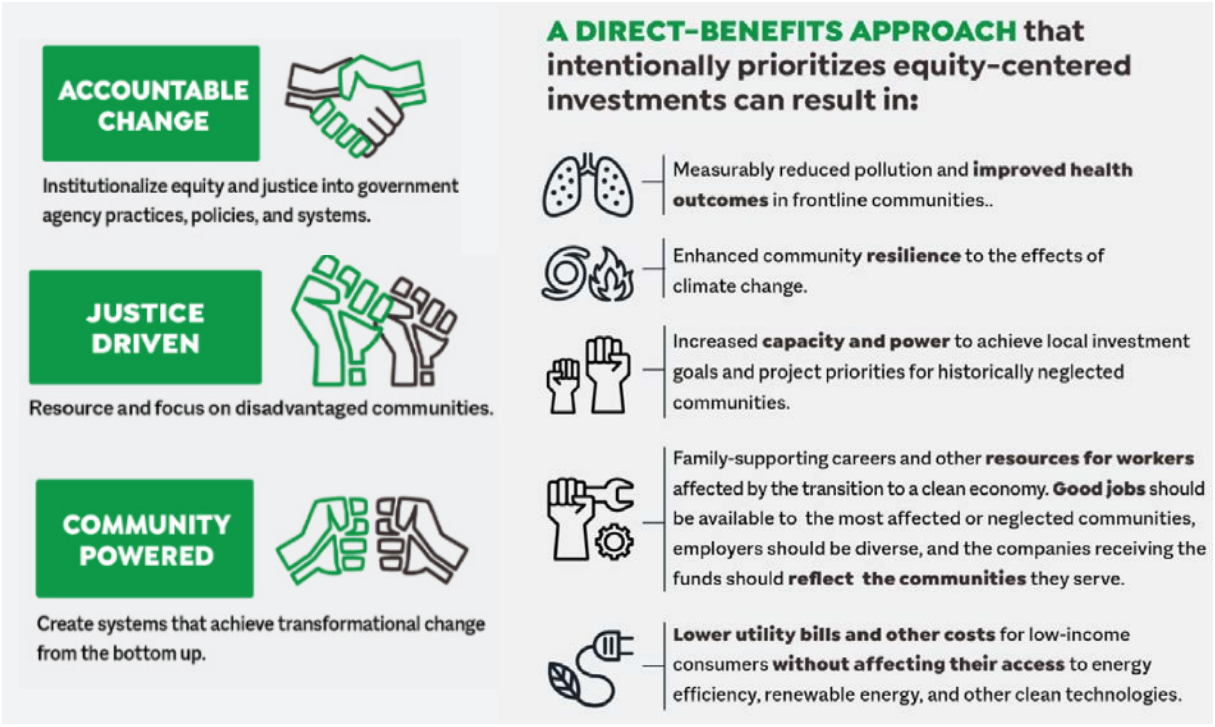


Figure 6. The key principles of theJustice 40 Initiative
Source: Justice 40 Initiative

Since Indigenous communities are identified as “front-line” communities that have experienced the type of systematic disinvestment that this framework is targeting, they can directly benefit from the efforts and goals of the Justice 40 Initiative. The utilization of a direct-benefits approach results in tangible positive outcomes for “front-line” communities as a result of the focused investment. These outcomes may include reduced pollution and improved health incomes, enhanced community resilience to climate change, increased capacity and power for local investment goals, resources for workers, and lower untility costs without affecting access to energy efficiency and clean energy systems.

The Justice 40 Iniative faces some limitations in its implementation since it is a fairly new framework. Implementation systems are still being developed and tested at a

range of scales. While there is some literature on the recommended methods for applying this framework, the longterm success of these methods is yet to be determined.

2.2.4 One Planet Living

One Planet Living (OPL) is a sustainability framework that was developed by BioRegional, a purpose-led sustainability consulting organization. One Planet Living adopts a holistic vision of a world where everyone can live happily within Earth's resources (Bioregional, 2019). The OPL framework is based on the understanding that global consumption of resources is currently occuring at a greater rate than available resources on Earth. For that reason there is a need to transition to new systems that are more balanced and fit within the available resources to ensure long term sustainability (Bioregional, 2019). OPL focuses on the development of sustainable action plans with detailed goals and guidance for effective implementation. The creation of action plans is intended to be a collaborative, co-designed effort between community members to create a specific plan for the challenges and opportunities of a specific site.

OPL has ten principles which work together toward environmental, social, and economic stability (Figure 7). Each principle is connected to goals, actions, and has steps for implementation, and measurable key performance indicators (KPIs). The first principle is **1) Health & Happiness**, which strives to increase and support high levels of social, mental and emotional health. The KPIs for this petal includes

satisfaction levels of residents with the goal of annually increasing or sustaining high levels of satisfaction. The **2) equity and local economy** principle is focused on creating safe, equitable places to live and work which support local prosperity and international fair trade. The KPIs for this principle include percentage of affordable housing provided, number of jobs, and economic value generated during construction. The **3) culture and community** principle nurtures local identity and heritage by empowering communities to foster a sense of place and belonging with a culture of sustainability. The KPIs include levels of community interaction and community involvement and engagment. The **4) land and nature** principle aims to protect and restore land and marine systems for the benefit of people and wildlife. Measurements of the percentage of land area that has functional green surfaces are the KPIs which help aim for increased natural species and increased carbon storing capacity of the land. This connects to the **5) sustainable water** principle which guides communities to use water efficiently and protect local water resources. The KPIs for this principle include percentage of water use and water recyling. Supporting the health and wellbeing of residents is the focus of the **6) local and sustainable food** principle which promotes sustainable, humane farming and healthy diets. The **7) travel and transport** principle reduces the need to travel, encouraging low-carbon transport. The KPIs for this principle include reducing car reliance, and supporting pedestrian and non-automobile transport systems. **8) materials and products** endorses selecting materials that are from sustainable sources. The KPIs for this petal require embodied carbon and life cycle analysis to aim for reduced material consumption. The aim to reduce consumption directly ties

into the **9) zero waste** principle focused on reducing consumption, and recycling to achieve zero wate and zero pollution. The target for this principle is aiming for zero construction waste to be sent to the landfill. Finally, the **10) zero carbon energy** principle aims to make buildings energy efficient and supply all energy with renewable energy sources.

Figure 7. The 10 principles of the One Planet Living Framework
Source: Bioregional One Planet Living

Communities that have followed the OPL framework experience a range of benefits. These can include saving money by increasing efficiency, improving risk management by relying less on vulnerable supply chains, fostering innovation by exploring new approaches for energy and other building systems, and operating within the limits of our planet through actionable steps and a clear plan for future development (Bioregional, 2019).

Some limitations of the OPL framework include limited resource requirements and structure (Gerhards, et. al., 2021). The ambitious goals of OPL can involve resource requirements that are not always fully offset by costlier energy, materials, community infrastructure or human resources. A lack of benchmarks and comparable data also makes performance assessment more challenging.

2.3 Precedent Analysis of Participatory Community-Engaged Design

The goal of including Indigenous voices in the high-level planning processes is to imagine a future that affirms and operationalizes Indigeneity to the benefit of the existing Indigenous communities and to support their ongoing and future wellbeing and resiliency. There are several examples of participatory community-engaged design processes with Indigenous communities. Case study analysis of three different approaches to participatory community-engaged design with Indigenous communities can provide reccomendations for how to successfully partner with communities. This analysis can help inform the community engagement process, which is an important part of the active partnership of this thesis with the Shoalwater Bay Tribe. The methodology of this thesis will be explored in greater detail in Chapter 3. The three case studies analyzed in this section provide examples of Indigenous communities that have had success with participatory design processes.

2.3.1 Pine Ridge Reservation

Indigenous-led efforts to reimagine planning processes can provide a wealth of knowledge and opportunities outside of Western planning systems and approaches. Participatory processes help create a vision of hope for the future by empowering and involving community members to recognize that they have the drive, motivation, and capability to create change for themselves. One example of this type of Indigenous-led development and planning efforts is found on the Pine Ridge Reservation in South Dakota. The Lakota tribal community was faced with ongoing challenges of unemployment, poor living conditions, and inadequate housing (APHA, 2016). Through efforts to plan for a more resilient future, the community formed the Thunder Valley Community Development Corporation (TVCDC). This is a community development corporation committed to eight initiatives that strive to empower all community members to improve their health, culture, and environment by strengthening their cultural identity (TVCDC, 2022) . This is an example of a community driven vision for change that asks the community members what they really want for their future. The methodology of the TVCDC is centered around restoring self-determination and prioritizing Indigenous empowerment within planning and design practices.

The strength of the TVCDC doesn't come from any component of its development plan, but from the way its leaders have combined many different principles to build off each success and learn from failures. The system they have developed has allowed them to reimagine their future by creating a replicable template for what a

future-facing, regenerative community could look like. This approach to urbanism and participatory design processes could be applied on a larger scale on other reservations, or even beyond in the urban spaces of the 21st-century. This project was Indigenous led. There were some hurdles to achieve the community's goals. Some of these challenges include limited resources, lack of precedents, and a lack of access ot funding. Despite these challenges, this project resulted in a range of impactful outcomes. The TVCDC have raised money to buy land and plan for a redevelopment of their community that reimagines a more self-sufficient, cost-effective, health-conscious, way of life. Through this program, the reservation now has a robust job training program, permaculture infrastructure, and development plans that empower community members to build well-constructed homes to accommodate a range of households (TVCDC, 2022). This demonstrates that self-led community-based efforts can empower communities to advocate for the future they imagine, while contributing valuable knowledge and context to cater proposed solutions to their specific community.

2.3.2 Saskatoon Municipal Planning

Collaborative co-design frameworks can be developed through participatory and community-based engagement. Co-design can be a dynamic and multi-faceted process that shapes planning and policy that prioritizes Indigenous sovereignty, cultural identity, and ambitions for the possibilities for more equitable futures. Despite these possibilities, Indigenous-specific policy has often focused on what these communities lack instead of considering the richness of what they can offer

(Prusak et al., 2016; Fawcett et al., 2015). One example that analyzes these co-design processes is the most recent development of the municipal plan for urban policy and design in the city of Saskatoon in Saskatchewan, Canada. The planning focused on widespread community dialogue and engagement.

An analysis of the process and co-design efforts with Indigenous residents in Saskatoon focused on three metrics: 1) **Indigenization**, which refers to the incorporation of Indigenous ways of knowing, being and doing into spaces that are have not historically included them. Indigenizing planning processes involve the recognition of sovereignty, ties to the land, and validating Indigenous claims to self-determining autonomy. While this is more commonly practiced with rural Indigenous communities, Indigenous peoples living in urban areas are often excluded from modern treaties, despite claims to their traditional land. 2) **Co-production** which is an approach to Indigenizing planning which recognizes the value in lived knowledge, varied perspectives, and sharing policymaking positions with Indigenous communities. Rather than creating separate Indigenous-specific policies, co-production planning efforts result in the reworking of mainstream planning instruments to support Indigenous communities. 3) **Coexistence** refers to the complex ways that people attach meaning to space, and how that influences the multitude of connections that can be simultaneously held by a space for different groups of people**.** The outcome of the analysis found that there continue to be shortcomings in attempts bridge Indigenous and Western planning traditions (Fawcett, et al., 2015). This demonstrates how counteracting colonizing systems of

planning and design requires Indigenous planning practices to coexist in parallel relationships with Western planning practices. In considering community-engaged, participatory partnership with Indigenous partners, there are continuing opportunities to strive to better achieve the goals of Indigenization, co-production and coexistence. By leaning more into co-design frameworks, this can result in equally valuing the Indigenous knowledge and academic knowledge that is brought to the project by each participating group.

2.4 Summary

The existing body of research on climate resiliency and social justice (Rizzo & Giorgio, 2020; McMillan et. al., 2022; Denton et al., Minkler, 2005; Faridi et al., 2007; Blacksher et al., 2016; Freitag et al., 2014), and Indigenous approaches and strategies for resiliency (Akama et al., 2019; Reitsma et al., 2019; Aman et al., 2013; Finkbeiner, 2015) is beneficial for understanding different responses to the challenges that face Indigenous communities that are vulnerable to the impacts of climate change, such as the Shoalwater Bay Indian Tribe. As discussed, challenges facing this community include climate threats (Hutchison et al., 2021; Rizzo & Giorgio, 2020; Bongarts Lebbe et al., 2021; Wood et al., 2015), the oppressive nature of colonized hazard mitigation, and the lack of existing Indigenous frameworks focused on planning for resiliency to support the goals of the upland expansion on an environmental and social level.

This review of existing research has established that social justice, Indigenous well-being, architectural innovation, and hazard preparedness are unable to be

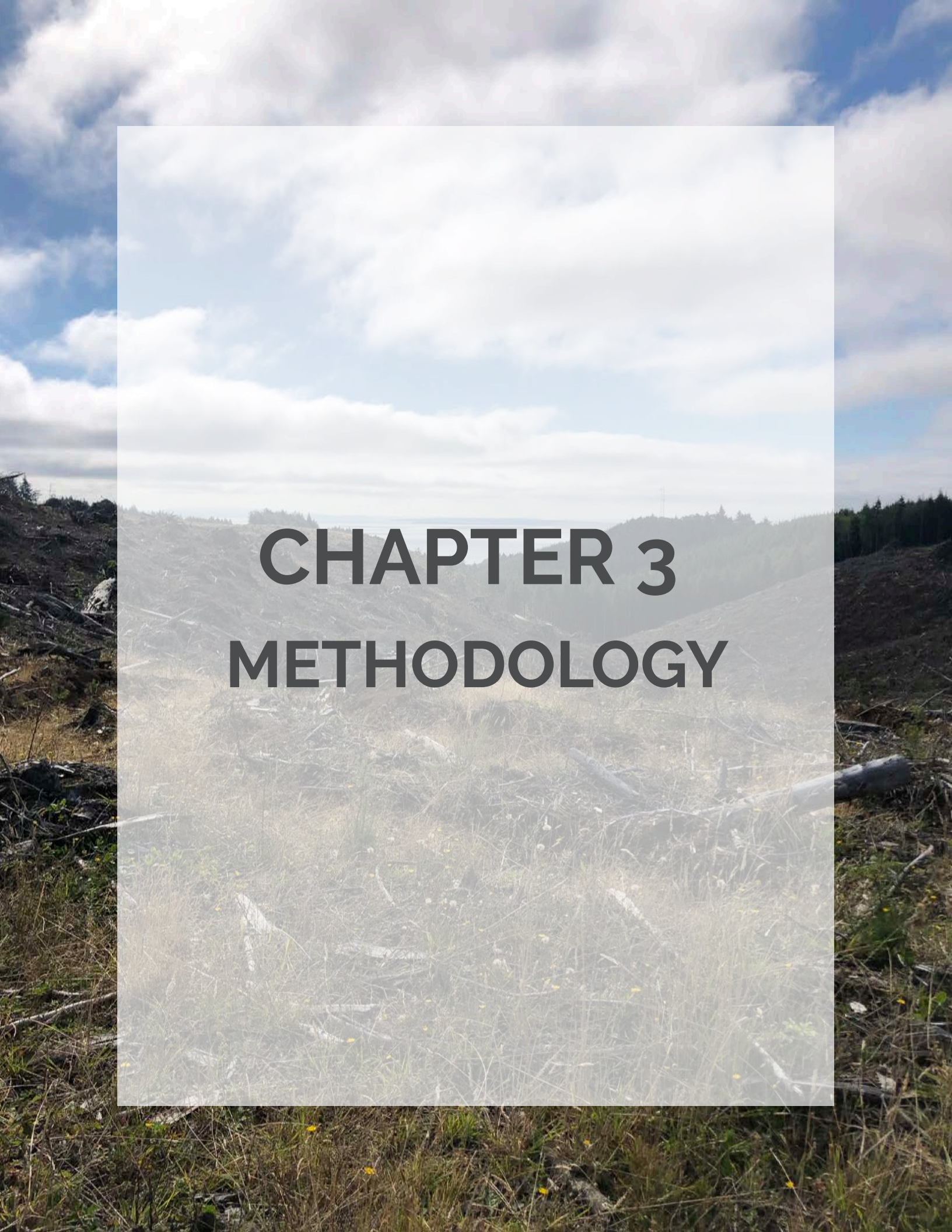
separated from each other when considering the values, goals, opportunities, and challenges facing the Shoalwater Bay Tribe. The process of planning for upland expansion inherently connects to the reframing of hazard mitigation practices to more clearly center the perspectives and values of the Shoalwater Bay Tribe. Key to the processes of upland expansion for the Shoalwater Bay Indian Tribe are the themes of climate resilience, community self-sufficiency, and the centering of community values by consultants and researchers (SBIT, 2020). The mission of the tribe, which informs their goals for the upland expansion, is "to become self-sufficient and provide for the spiritual, social, economic and health of tribal members, while honoring traditions of the past and leaving a responsible legacy for future generations" (SBIT, 2020). It is important to understand the different components informing the processes of upland expansion to help the Shoalwater Bay Indian Tribe leverage the move to the upland site as an opportunity to increase resiliency, self-sufficiency, environmental sustainability, and comprehensive wellness.

On a community-wide scale, the values of the Shoalwater Bay Indian Tribe directly inform the priorities and processes that will support upland expansion to a safer area where they are planning to develop their community. The location of the tribe is within the larger context of a dynamic coastline which faces significant impacts from climate change. Therefore, climate resiliency and social justice are central values to the future well-being of the community. The analysis of key principles from existing sustainable architectural frameworks, such as the Living Building Challenge, Justice

40 Initiative, Passive House Building Standard, and One Planet Living Principles, helps identify action steps that will support the goals of the tribe and their vision for their ongoing future resilience and well-being. On a building scale, these sustainable architectural frameworks provide a tangible identification of steps to achieve the priorities and goals for resilience that the tribal members have communicated to planning and design partners. The realization of sustainable, low-waste, healthy, well-designed, and high-performing housing will continue to support adaptability, resilience, and inhabitant health which all support larger cycles of care and well-being in the community as a whole.

However, there is a gap between existing architectural frameworks for building sustainable housing, and the specific goals of the Shoalwater Bay Tribal community. The existing architectural frameworks are not culturally specific to the values of the Shoalwater Bay Tribe as an Indigenous community. The context of the partnership supporting this thesis, between non-tribal partners and the Shoalwater Bay Indian Tribe, supports developing relationships to better understand community values that are informing the Tribe's approach to planning for the upland expansion. **This partnership will result in the co-design of a *community-informed housing framework for housing design in the uplands* that reflects the values of the community and identifies areas of overlap with the key principles from the previously identified architectural, sustainable frameworks to support resilience.** The goal is that the developed housing framework will reflect the values of the Tribe, and synthesize them with more technical architectural systems to provide

recommendations for how housing in the upland site can respond to the communal values, goals and the conditions of the site to create the type of resilient housing that the community desires.



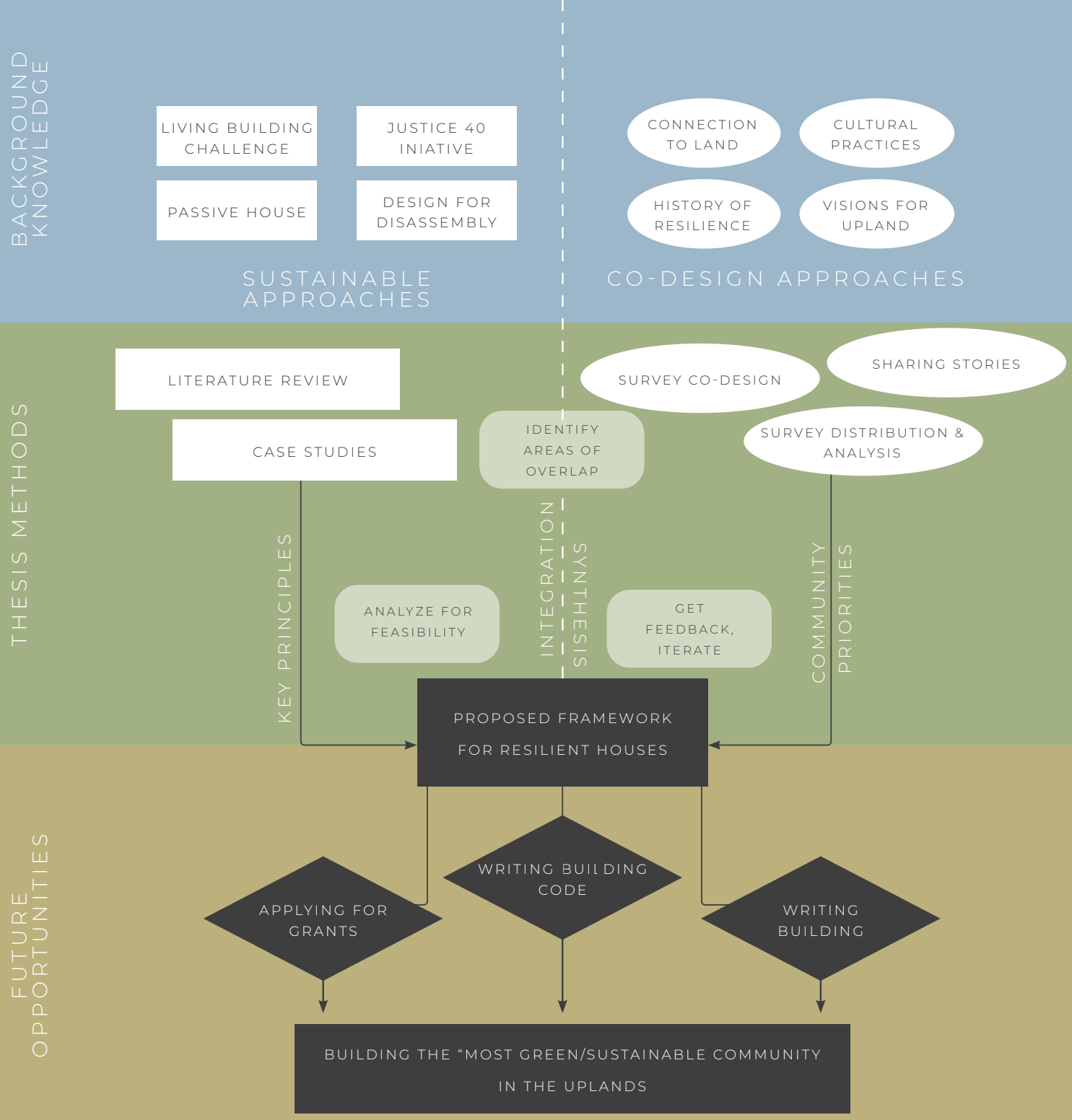
CHAPTER 3
METHODOLOGY

3.1 Thesis Goals and Objectives

This thesis focuses on the Shoalwater Bay Indian Tribe in Tokeland Washington. The outcome of the thesis will focus on co-creating a community-informed framework for housing recommendations to be applied in the early planning phases of upland expansion, which can then inform decisions throughout later phases of design and planning. Even though sustainable, resilient, and responsive building standards could impact more than just one community, the community partners at the Shoalwater Bay Indian Tribe are the sole and specific focus of the thesis.

3.2 Methodology

The methodology of this thesis will be focused on action research and co-design in partnership with the Shoalwater Bay Tribe (Figure 8). Action research is a form of systematic inquiry, that prioritizes reflection and bridges the gap between theory and practice. Action research is a methodology that tackles real-world problems in participatory, collaborative, and cyclical ways in order to produce both knowledge and action (O'Leary, 2007). This collaboration involves the co-development and analysis of a qualitative value survey and ongoing engagement opportunities with the community members, to provide opportunities for feedback from the community.



INTEGRATING ARCHITECTURAL SYSTEMS + COMMUNITY VALUES TO PROPOSE A RESILIENT HOUSING FRAMEWORK

Figure 8. Thesis methodology and scope diagram

3.2.1 Qualitative Survey Co-Design & Development

A central part of this research is the co-design of a community survey that would serve the purpose of collecting qualitative data on community preferences regarding housing systems, and building strategies. The survey instrument used in this research was designed to better understand community preferences as a central component of the recommended design framework for housing in the upland site. The methods to be used include several collaborative, co-design conversations with the community liaison, Jamie Judkins, and a community working group of tribal members. These conversations will result in a qualitative survey sent to the Shoalwater Bay Tribal community.

3.2.2 Survey Instrument & Distribution

The survey will be developed utilizing online survey software. The survey distribution will be facilitated by the community liaison, and the Tribal Communications and Media Specialist. The survey will be advertised through a flier that is developed with the community liaison (Figure 9). The digital distribution method is intended to reach community members who live in the area, in addition to community members who do not live locally, in order to collect a comprehensive understanding of a broad range of community preferences. The fliers will also be posted in communal areas on the reservation to encourage participation from various community members.

Figure 9. Survey Flier distributed to community

3.2.3 Survey Results & Analysis

The analysis of the survey results will serve the purpose of collecting and understanding the values and priorities of the community, which will be the foundational basis of the developed framework. Using quantitative analysis and synthesis of sustainable frameworks and community values, the analysis will result in a framework that is architecturally based on resiliency and sustainability and is grounded in the priorities and values of the community.

3.3 Site Selection & Analysis

The Shoalwater Bay Tribe currently resides on the tidelands of the most rapidly eroding portion of the Pacific Coastline (Hicks, 2021). Located in a highly dynamic

landscape that faces increasing environmental volatility, the Tribe is at risk of losing the land their buildings are currently built upon to sea level rise and coastal erosion.

Given the resilience of the Tribe, they have started preparing for an upland expansion to a safer site further inland. The site selected for this project is a 220-acre area of land situated further inland and higher up in elevation from the coast (Figure 10). The Tribe selected this site due to its proximity to the current location of the tribal community, which is located directly in Tokeland Washington on the shoreline of the northern coast of Willapa Bay in Grays Harbor County.

Figure 10. Site map of Upland Site (outlined in red), lowland site marked with red star

3.3.1 Climate Analysis

The climate of Tokeland is classified by the Koppen-Geiger Climate Classification as a Cool-summer Mediterranean (Csb) climate zone with a Mediterranean climate. The International Energy Conservation Code classifies this area as Climate Zone 4, which is a Marine climate. (Figure 11) As such, the climate experiences warm and dry summers with rainy and mild to chilly winters. Cool ocean currents contribute to the climate and precipitation levels. The coast experiences high levels of rain, with about 75.6 inches of annual rainfall (Figure 12). The average temperature in the summer is 67.8˚F, and the average temperature in the winter is 36.0˚F (Figure 13). The upland site experiences higher levels of wind with predominant winds coming from the Southwest. The average wind speed ranges from 6.1 to 10.4 mph with seasonal maximums in the range of 40 mph to 60 mph (Figure 14).

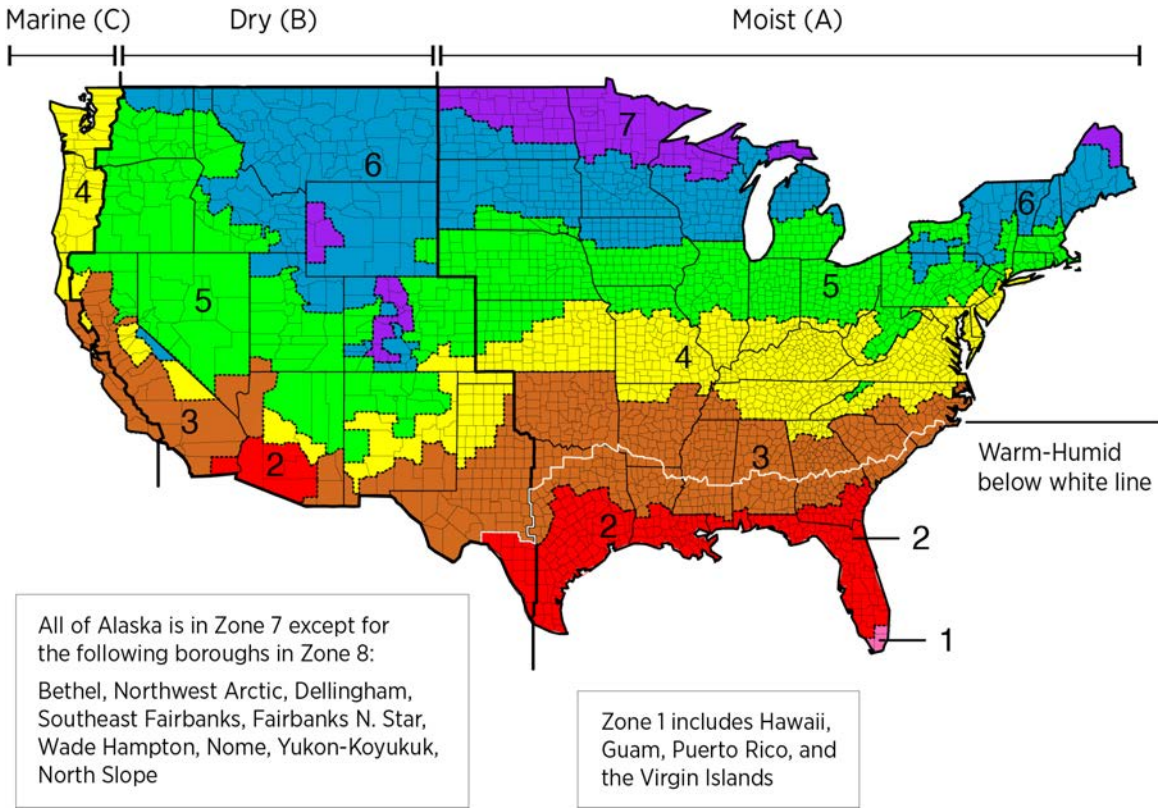
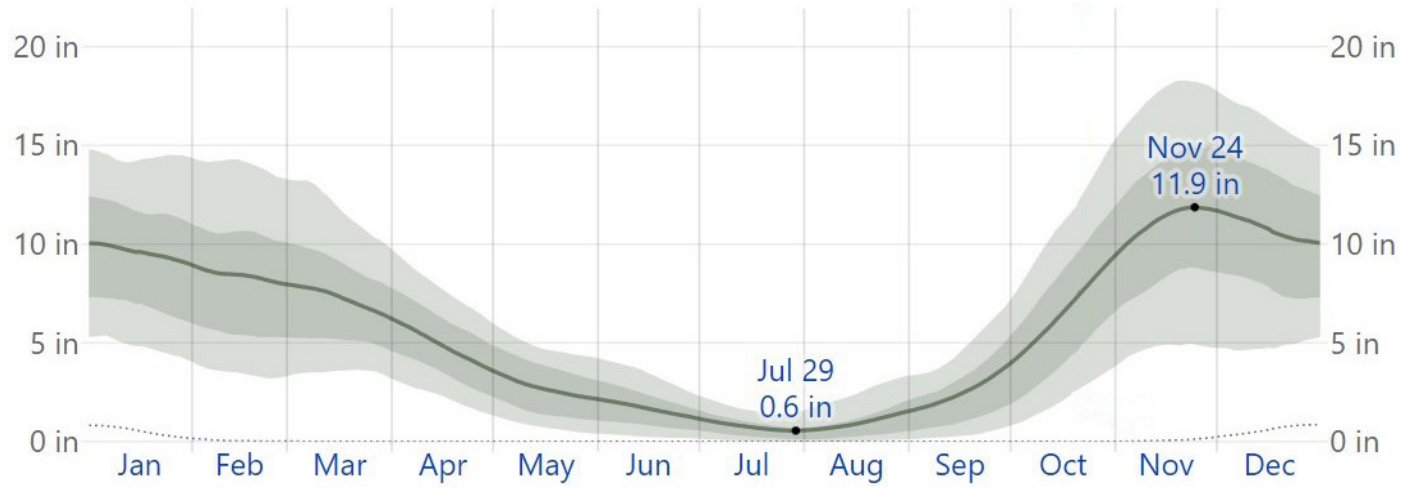


Figure 11. Climate Zone Classification Map
Source: IECC



The average rainfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average snowfall.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	9.6″	8.4″	7.3″	4.9″	2.6″	1.7″	0.7″	0.9″	2.4″	6.5″	11.4″	10.7″

Figure 12. Average Annual Rainfall
Source: Weather Spark

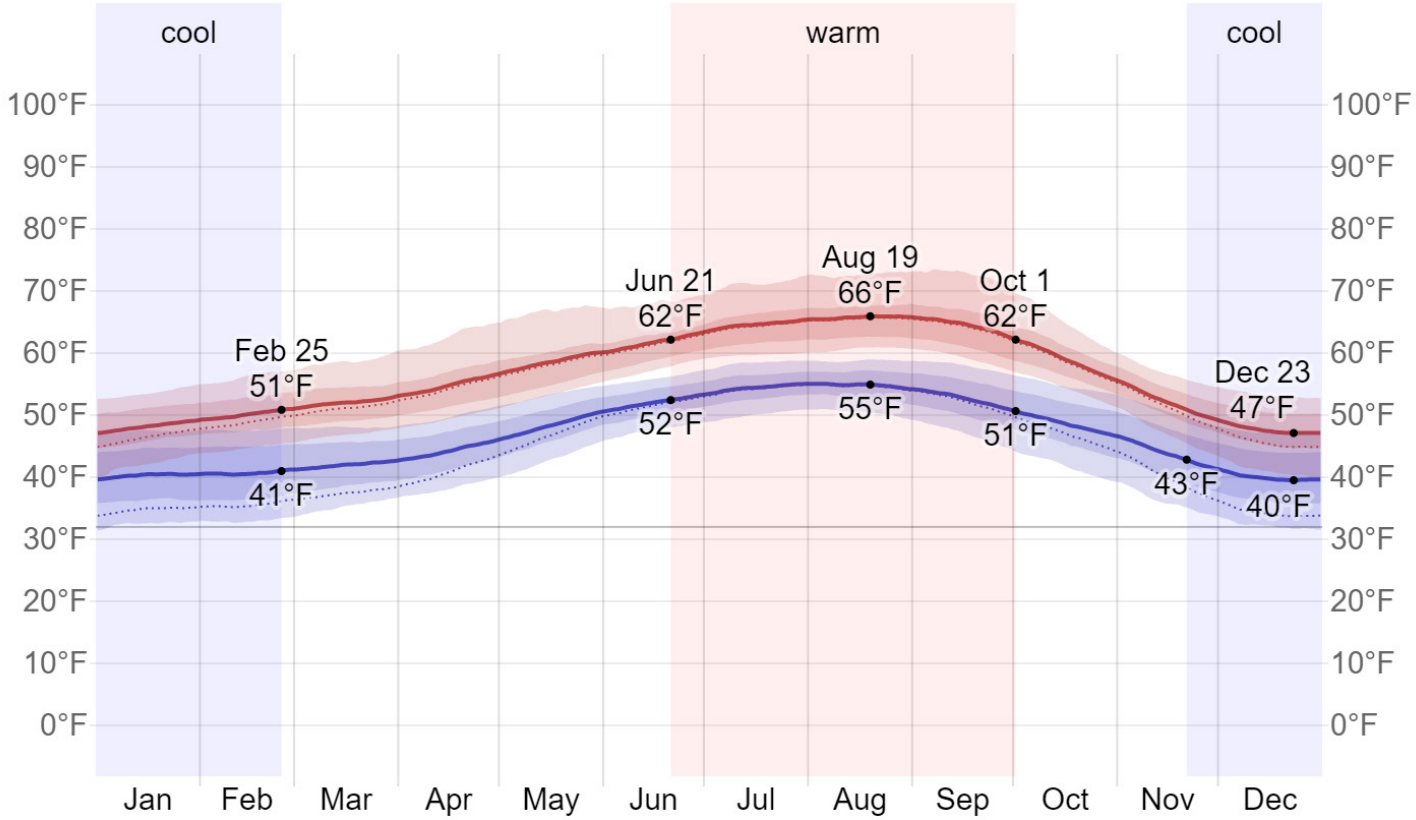


Figure 13. Average Annual Temperature
Source: Weather Spark

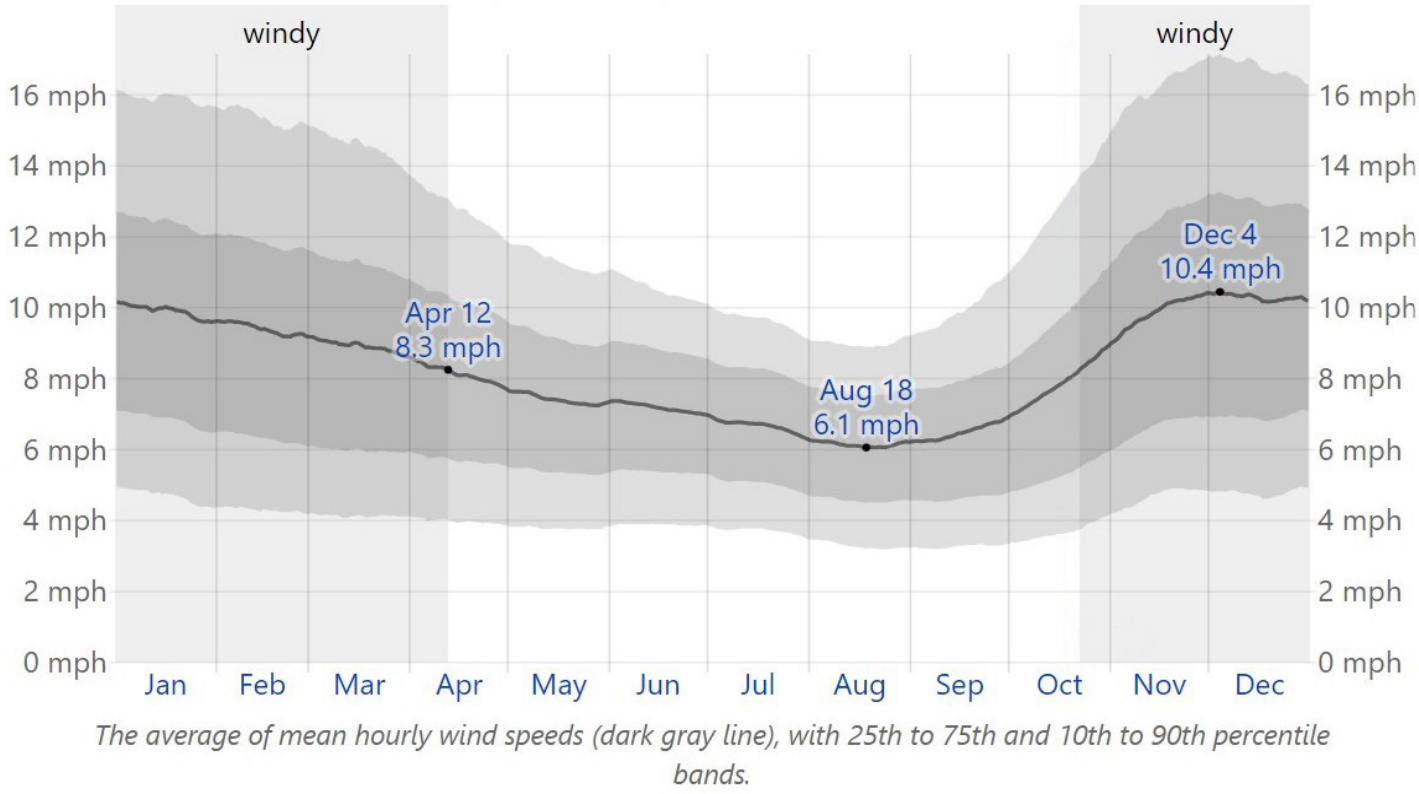


Figure 14. Average Annual Wind Speed
Source: Weather Spark

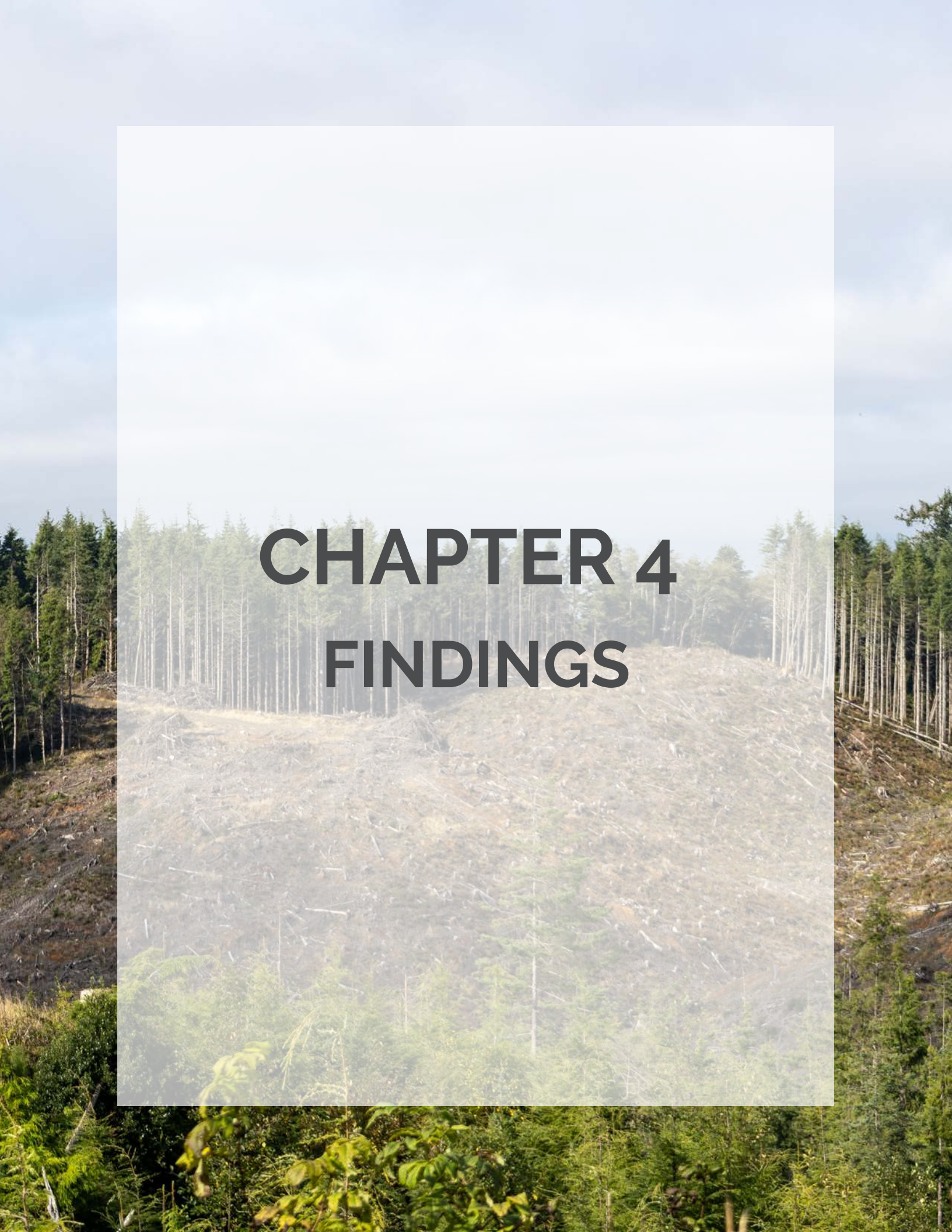
3.4 Summary

The site and climate analysis directly inform design solutions. Based on this analysis the design strategies that are most appropriate for this area should include the following strategies: natural daylight and ventilation, PV solar for energy, Passive House design for airtight high-performance building enclosures, and smaller compact floorplans.

Siting of houses should face most of the glass area to the south for maximum winter sun exposure, but with overhangs to fully shade in summer. Evergreen/Coniferous trees should not be planted in front of windows to limit shading. Glazing should be triple pane and high-performance. Passive House design in overcast climates should use low-mass tightly sealed, well-insulated construction to control air (heat) leaks and transfer.

Developing compact and efficient floorplans will help reduce the amount of energy required to heat and cool the buildings. Given the Plank-House typology that is significant to the Shoalwater Bay community and cultural history, incorporating some components of that layout will create connections to past cultural significance, and can contribute to more efficient building performance. Traditional passive homes in cold clear climates had efficient floorplans with central heat sources (such as a ductless mini-split HRV), south-facing windows with strategies to avoid glare off the water, and roofs pitched for wind protection. The inclusion of sunny, wind-protected outdoor spaces can extend living areas in cool weather. Additionally, locating garages or storage areas on the side of the buildings that face the coldest wind helps insulate the building by providing a wind buffer. Creating efficient floorplans reduces excessive floor area, which reduces wasted heating and cooling energy, which is important for meeting the desire for low-energy and self-sustaining building systems.

Extra insulation (super insulation) might prove cost-effective, increasing occupant comfort by keeping indoor temperatures more uniform with no drafts. Small well-insulated skylights (less than 3% of floor area in clear climates, 5% in overcast) reduce daytime lighting energy and cooling loads and help mitigate glare. Due to higher levels of insulation, ventilation systems (HRV) are necessary to ensure indoor air quality while conserving energy.



CHAPTER 4
FINDINGS

4.1 Co-Design Processes

4.1.1 Community Engagement

Having meetings with community members has been a central component of this research. Ongoing community engagement has been beneficial for continuing to deepen the partnership between the researchers and the tribal community members. From October 2022 through December 2022, there were three separate community engagement events (Figure 15) that served the purpose of building relationships and developing trust between the researchers from the University of Washington and community members, collecting stories, and better understanding community priorities and preferences when considering moving to the uplands. Providing opportunities for community members to provide feedback and engage with the project in a variety of ways. The community helped identify the key values and goals that they have for upland expansion (Figure 16), and throughout the community engagement process, the researchers were able to collect community quotes which also helped facilitate a deeper understanding of the community preferences (Figure 17).

Figure 15. Community Engagment Events (Autumn 2022) with the Shoalwater Bay Indian Tribe

COMMUNITY VALUES

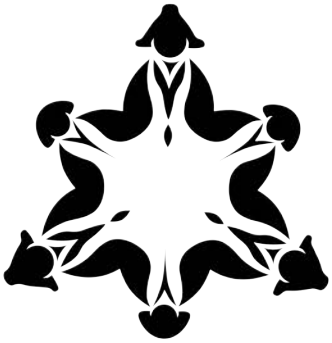
These values were described by Tribal members as key values and goals of the community. These values are considered the key elements of a resilient community.

These icons were created in collaboration with Jamie and Madison Judkins.

HEALTH & WELLNESS

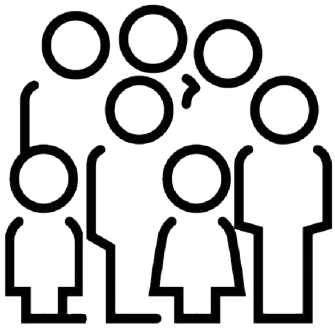
"Our elders and our ancestors taught us that health is a holistic thing" - Earl Davis

"Culture is Health" - Jamie Judkins & the Pulling Together for Wellness Team



CULTURE & COMMUNITY

"I want to see our cultural art and representation built into everything." - Tribal Member

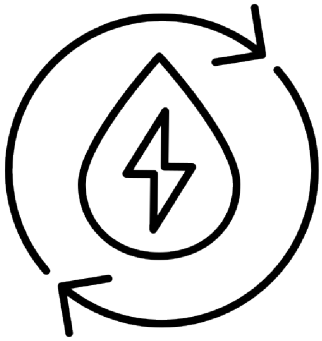


SEVEN GENERATIONS

"We've been talking about moving to the Upland our whole lives." - Tribal Member

STEWARDSHIP

"The Tribe maintains deep connection with their ancestral homelands including the ocean bay, beaches, coastal water ways, rivers, and forest lands" - Tribal Coastal Resilience Project Overview



SELF RELIANCE

"Go with the flow but don't let it flow over you." - Tribal Member

Figure 16. Community Value Icons co-developed with Shoalwater Bay Tribe

COMMUNITY QUOTES

These quotes were shared by community members during community engagement events from Autumn 2022 to Spring 2023..

> One of our biggest teachings is that everything is connected.

> It's about rolling with what comes at you, working with what you're given.

> We don't have enough houses, we need housing that fits a greater number of people.

> What we're doing is not for us, it is for the people after us. All tribes are survivors.

> I would hate to lose cultural sites and community sites.

> I believe we can build the most green, most sustainable, and most resilient community in the Uplands.

> We don't want our buildings to look like "city" buildings.

> We need to start. We need to start funding ourselves and doing it right.

> It's about feeding the soul, not just the body.

> If you built 80 houses right now, they'd be filled in a few months.

Figure 17. Community Quotes from Community Engagement

4.1.2 Qualitative Survey Co-Design & Development

In addition to broader community engagement opportunities, a number of smaller focus group meetings occurred over the course of several months, from January 2023 through April 2023. The purpose of these meetings was to co-design the qualitative community survey and to gain feedback and suggestions from community members before distributing the survey. The purpose of the community survey was to better understand the values and priorities of the community as they relate to the key principles of the selected sustainable architectural frameworks (as discussed in Chapter II). A beta survey was sent to a focus group, which was comprised of four community members. These included the Tribal Heritage and Cultural Director, two tribal planners, and a representative from the Natural Resources Department. There was a round of changes to the survey that occurred from these co-design meetings, and they helped contribute to a more comprehensive, culturally resonant, and clear survey.

There were several key outcomes from the co-design process with community members. Across the course of several meetings in person and over Zoom with the community liaison, we gained valuable feedback to help limit the use of jargon, ensure that the questions were clear, and ensure that the survey instrument would be easy to use for the community members. A significant outcome of the co-design process was the decision to develop the final survey in collaboration with another researcher at the University of Washington who is also doing research with the Shoalwater Bay Tribe. Both researchers were originally developing independent

surveys that would be distributed to the tribe across the same timeframe. The community liaison was very clear in communicating the desire that the surveys should be combined so the community would only have to complete one survey. Given their identity as an Indigenous community, it was reiterated that they have historically been over-surveyed by researchers.

The need to collaborate with another researcher added another component of co-design to the research process. Initially, we met to share the scope and focus of our research, to find areas of overlap, and share the separate questions that we developed independently. Some of the challenges of combining the surveys were ensuring that the finished survey instrument would be succinct while still asking comprehensive questions for each of our research goals. Additionally, we designed a flow and order of the combined questions to ensure the survey was delivered as a cohesive whole.

4.2 Community Survey

4.2.1 Survey Instrument

Several online platforms were explored as the survey instrument. The initial platform that was tested was Google Forms. Several factors led us to move from that platform to SurveyMonkey. First, there were limitations in the survey structure. Google Forms doesn't allow questions to have conditional branch logic, which was a desired feature to collect greater detail on personal preferences. Additionally, we received feedback that the Tribe was more familiar with SurveyMonkey. Switching

platforms not only allowed more detailed structuring of the questions, but it was also in alignment with the community preferences for the survey. This helped with ease of delivery and allows the tribe to keep the survey for their own records and potential future use.

The survey was composed of 39 questions, after combining the questions from each researcher. The component addressing housing preferences included 17 questions that were developed for this study based on design standards, sustainable architectural frameworks, and critical community considerations. (See Table 1 in Appendix for Survey Variables). The survey collected the following variables:

Housing and socio-demographic characteristics. Housing characteristics were obtained with questions about household size, composition, length of housing tenure, and the need for accessible accommodations in housing.

Priorities and Preferences for Housing in the Uplands. The survey also included a set of questions to better understand community preferences for housing on the uplands. These questions included housing considerations, construction considerations, economic considerations, activities on the land, communal buildings, energy systems, and water systems.

Transportation and Mobility Needs. This portion of the survey was developed by the partnering researcher. These questions aim to help understand the travel behavior, regional travel, and transportation and mobility needs of the community now and at the various stages of upland development. The goal of these questions is to inform the transportation needs assessment to a large degree. For the purposes of this

study, those results have been separated upon analysis. To reference their findings see Granados, S., 2023.

4.2.1 Survey Distribution

There were two methods for the survey distribution, online and in-person. The online survey was distributed to the Shoalwater Bay Indian Tribe as a flier that was sent out over email and posted in communal areas on the reservation. The final survey was reviewed by the Tribal Administrator, who has helped design surveys for the Tribe in the past. The community liaison also approved the final survey and the flier before distribution. The survey was distributed to the community by the community liaison. The flier was posted in the museum, and tribal center, and emailed out to all tribal members on April 6th, 2023. It was also posted to the Tribe's social media accounts and included in the Tribal newsletter. The survey remained open for 2 weeks, closing responses on April 21st, 2023. The second form of survey distribution was in person. This occurred on April 7th, 2023 the primary researcher visited the reservation and manned a table in the tribal center. The purpose of the in-person survey distribution was to encourage community members to participate in the survey, to provide access for elders who might not be comfortable taking it online, as well as answering any questions from community members. This form of engagement helped collect responses and raise awareness about the survey among the community members. Community responses to the survey were mixed, with some community members disinterested in participating, while others were enthusiastic to provide their feedback.

4.3 Survey Results & Analysis

While the method of online survey distribution was quick, inexpensive, and used the preferred reputable survey platform, the data that was collected required extensive cleaning due to the infiltration of bots. This was an unexpected outcome from the survey distribution. It became evident that there was a large volume of bot responses since the survey received 360 responses within the first day which is almost the entire number of tribal members.

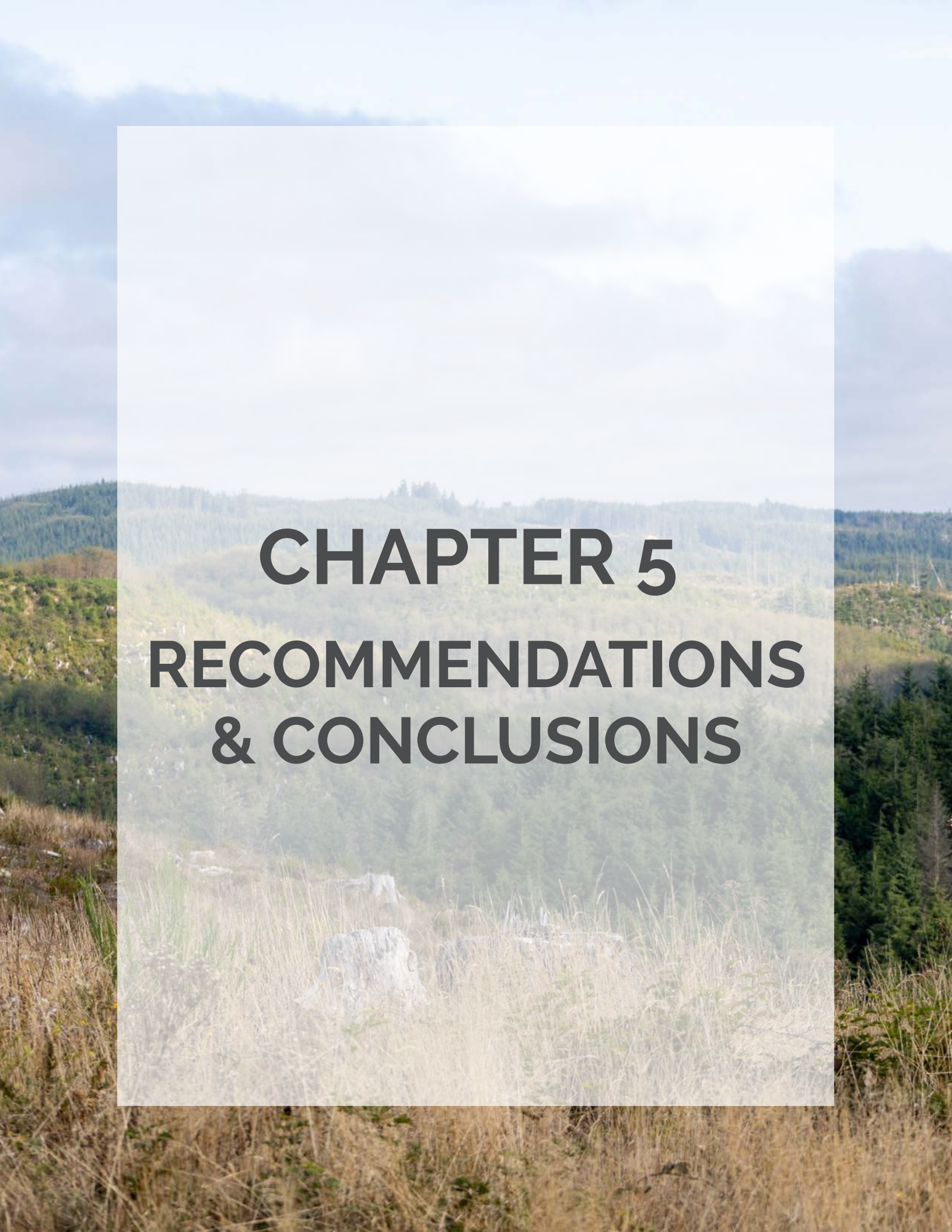
Given the issues with survey response integrity, the process of analyzing the results required an extensive amount of cleaning and filtering to ensure that the bot responses were not included in the data analysis. A study on methods for cleaning data that had experienced bot responses suggests several steps for data cleaning. These included removing incomplete responses, removing outlier response times, removing duplicate answers to qualitative questions, removing responses with conflicting data, removing duplicate IP addresses, and screening the submitted emails for bot-generated responses (Griffin et al., 2022).

Based on the studied research on data cleaning processes, the data cleaning for the survey responses included sorting the responses by several filters. The first filter was response time. Given the length of the survey and the average amount of time that it took respondents to complete the survey, responses less than 10 minutes were filtered out. Of the remaining responses, they were filtered by IP Address. The surveys that had repeating IP Addresses from areas outside the region were filtered

out, including several responses from other countries. After the data cleaning, there were 25 responses that were identified to be legitimate. Seven of these were received from the in-person survey distribution, and the remaining sixteen were received from the online survey distribution.

Given the infiltration of bot responses, the survey distribution with a direct link to the survey was not the best method for the integrity of the survey. A better distribution method could have been requiring multi-step access. Additionally, advertising the opportunity to receive a gift card directly on the fliers might have increased the percentage of the bot and illegitimate responses.

The results of the community survey indicate several important considerations. The survey data yielded important baseline information to address the similarities and differences between existing sustainable architectural frameworks and community preferences.



CHAPTER 5

RECOMMENDATIONS & CONCLUSIONS

5.1 Design Recommendations

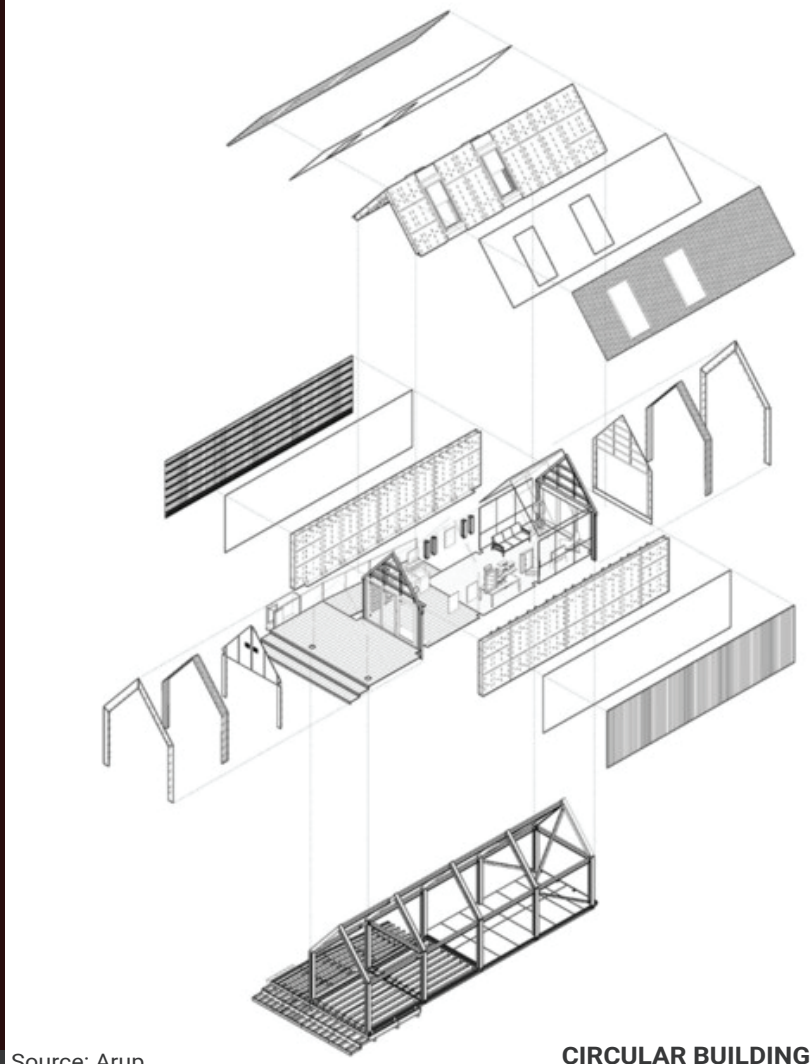
Based on the survey results, the data analysis, and identified areas of overlap with the analyzed sustainable frameworks, five categories were identified to synthesize and produce recommendations for considerations and opportunities to help the SBIT develop sustainable housing in the upland site. These categories are housing considerations, economic considerations, construction considerations, water systems, and energy systems. Each category is explored below in greater detail.

01

HOUSING CONSIDERATIONS

HOUSING CONSIDERATIONS

Housing considerations include ***housing location, proximity to neighbors, and design choices that support envionments of health and beauty within homes.*** Housing priorities are highly personal and reflect the individual values and needs of the household. Houses that can ***adapt to changing stages*** of life will support ongoing and future resiliency. Since housing is also ***deeply conected to its surroundings*** and the environment, the ways they interact is important to consider.



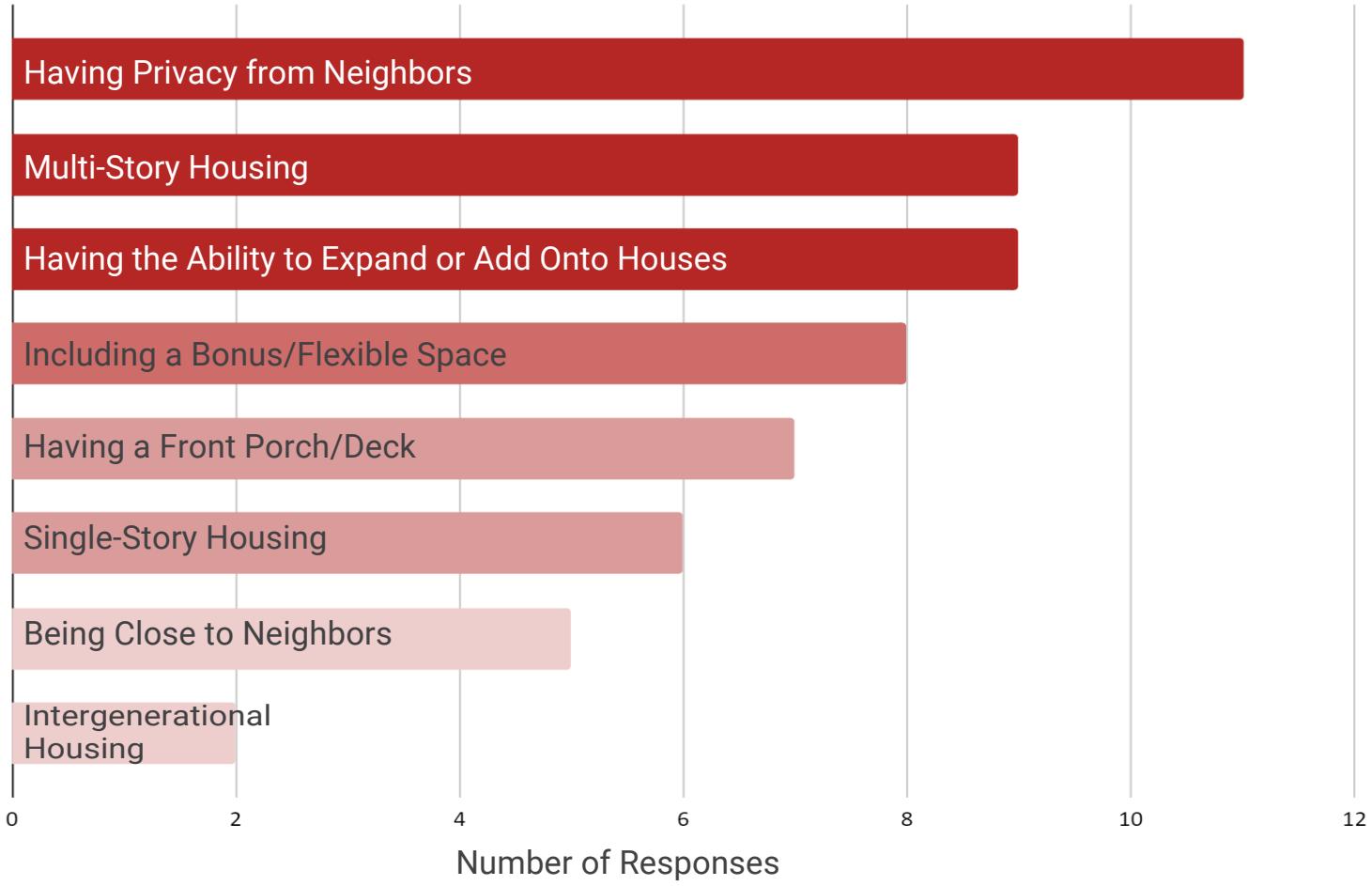
Source: Arup

CIRCULAR BUILDING DESIGN

To provide a sense of place, connect to the local culture and natural heritage, actively nurturing a sense of community. - One Planet Living Culture & Community

What we heard from the **SBIT.**

We asked community members to **Select the top three most important features and economic considerations when thinking about building housing in the upland site.** These were their responses:



> I hope we can build houses that support every stage of life. I want homes we can live in for our whole lives and for future generations.

> We've talked about moving to the uplands our whole lives.

Key Principles:


Self Reliance


Culture & Community


Stewardship


Health & Wellness


Seven Generations

01 / Modular Construction to Support Adaptability

02 / Connect Interior & Exterior Environments

03 / Design for Changing Life Seasons

04 / Incorporate Areas for Cultural Art in Housing

05 / Incorporate Privacy into Homes & Surroundings

Principle	*Living Building Challenge*	*Passive House*	*One Planet Living*	*Justice 40*	*Community Values*
01	Materials Petal	Prefabricated Construction Methods	Materials & Products Zero Waste	Increased Capacity/Power	
02	Health & Happiness Petal Place Petal	Cost Effectiveness	Land & Nature Health & Happiness Culture & Community	Improved Health Outcomes	
03	Equity Petal Health & Happiness Petal	Comfort Prefabricated Construction Methods	Equity & Local Economy Culture & Community	Improved Health Outcomes	
04	Beauty Petal	Ecological Impact	Culture & Community Health & Happiness	Reflecting the Community Served	
05	Place Petal Health & Happiness Petal	Dynamic Performance Control	Land & Nature	Reflecting the Community Served	

Looking Forward
HOUSING CONSIDERATIONS

Housing considerations in the uplands have opportunities to prioritize a range of options and accomodate different household preferences. Given the expressed desire for privacy and a larger area to potentially place buildings, considerations of views and privacy might inform placement and orientation of homes. Designing homes that have flexibility and adaptability will accomodate changing desires from households over time contributing to longevity and resiliency. Connecting homes to cultural art and incorporating connections to nature and the site surroundings can reflect cultural identity and values in housing design.

1 Explore Design Choices to Support Housing Flexibility

As household needs change with different stages of life (e.g., aging or households growing or shrinking) having housing designed to support flexibility and adapt to new needs (i.e., modular or accessible construction) will enable longevity for households.

2 Prioritize Connections to Nature

Connection to the natural environment can contribute to higher levels of happiness, designs can emphasize interconnectedness and relationships between residents and the land. These connections can be formed through outdoor gathering spaces and flexible spaces that open to outside.

3 Opportunities to Orient Homes to Emphasize Views & Privacy

Given the location and amount of space available in the uplands, there are chances to orient homes to capture views. The placement of homes can help create privacy by strategically placing them to reduce feelings of crowding. This can also be accomplished through landscaping

Case Study
Whidbey Dogtrot

Location: Coupeville, WA

Architect: SHED Architecture & Design

This single family residence is compact, low maintenance, and embraces its site surroundings. Simple building forms blend interior and exterior spaces. The dogtrot form creates a covered breezeway that emphasizes the site orientation and views. The breezeway provides interior flexibility with the primary living area separated from a flexible area that can host guests or function as a home office. A well proportioned balance between privacy and views is accomplished by incorporating expansive windows with the texture, warmth and local character of cedar siding.

02

ECONOMIC CONSIDERATIONS

ECONOMIC CONSIDERATIONS

Economic considerations for future development include ***cost to build, construction methods, and opportunities for economic enterprises to support local economy and economic growth.*** Resilient economic growth considers a green economy, employment and decent work for all, and social protection. ***Through promoting systems of sustainability, inclusivity and equity local economies can be strengthened and supported.***

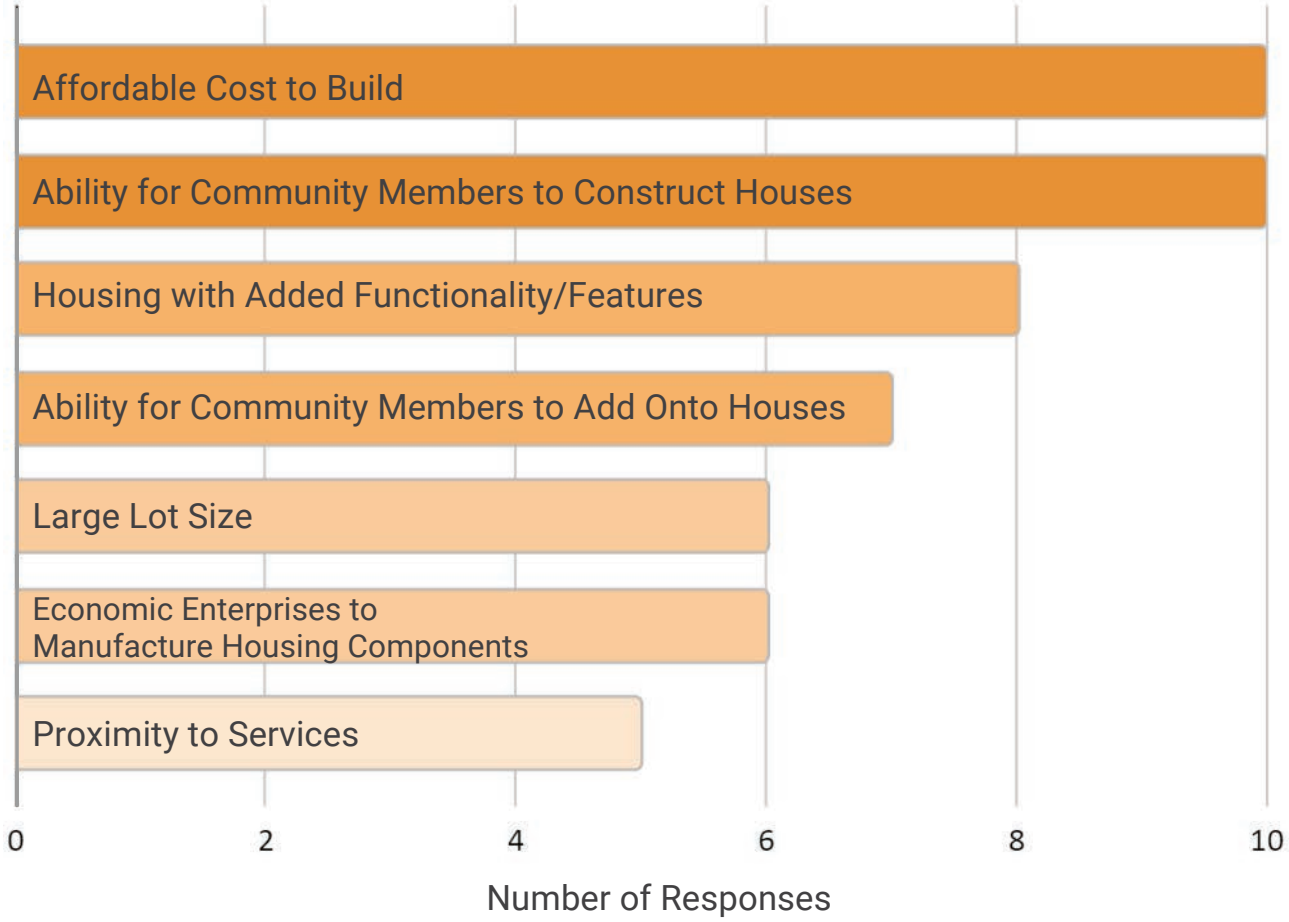
Modular Construction Facility

Source: Bensonwood

To foster diversity and create a vibrant, equitable, and resilient economy where a significant proportion of money is spent locally.
- One Planet Living Equity & Economy Imperative

What we heard from the **SBIT**.

We asked community members to **Select the top three most important features and economic considerations when thinking about building housing in the upland site.** These were their responses:



> No one else will be able to design my home exactly the way I want. I want residents to build their own homes.

> I want houses built in already logged areas. I do not want more clear cuts.

Key Principles:


Self Reliance


Culture & Community


Stewardship


Health & Wellness


Seven Generations

01 / For Affordability Analyze Initial Costs versus Life Cycle Costs

02 / Empower Community Members to Construct

03 / Local Economic Enterprises Support Construction

04 / Build in Areas Already Suited for Development

05 / Support Self-Sustaining Building Systems

Principle	*Living Building Challenge*	*Passive House*	*One Planet Living*	*Justice 40*	*Community Values*
01	Materials Petal Energy Petal	Cost Effectiveness	Materials & Products Zero Carbon Energy	Increased Capacity/Power	
02	Equity Petal	Cost Effectiveness	Equity & Local Economy Culture & Community	Resources for Workers	
03	Equity Petal	Prefabricated Construction Methods	Equity & Local Economy	Resources for Workers Increased Capacity/Power	
04	Place Petal	Ecological Impact	Land & Nature	Enhanced Resilience	
05	Energy Petal Water Petal	Dynamic Performance Control	Zero Carbon Energy Materials & Products	Lower Utility Bills and Costs	

Looking Forward
ECONOMIC CONSIDERATIONS

Economic considerations for developing housing in the Uplands can prioritize water catchment and reuse. Given a high amount of rain for most of the year, water cisterns and water storage systems are a good option to leverage natural water supply. Storm water management strategies in the landscaping around houses are crucial for ensuring that runoff water is not polluting the watershed. To anticipate the potential impact from an earthquake and storm events, it is important to plan for backup water systems that can provide water without relying on vulnerable energy sources that might be damaged. Striving for Net-Zero water use will have the most positive environmental impact, and will reduce energy demand by reducing unnecessary water use.

1 Opportunity for National Funding

Federal programs (e.g., the Justice 40 Initiative) have grant funding that could be available to help fund construction. Being able to provide evidence that resilient development is a priority might help qualify for funding.

2 Possibility for Education & Jobs

Training community members how to construct their homes can provide local jobs, supporting and bringing revenue back to the local economy. Additionally, training in resilient construction methods will provide transferable knowledge and skills.

3 Chance for Economic Enterprises

Exploring economic enterprises (e.g., building component manufacturing), to support upland construction could create sources of revenue. Economic enterprises can increase economic development, opportunities and community investments.

Case Study
Place of Hidden Waters

Location: Puyallup, WA
Architect: 7 Directions Architects

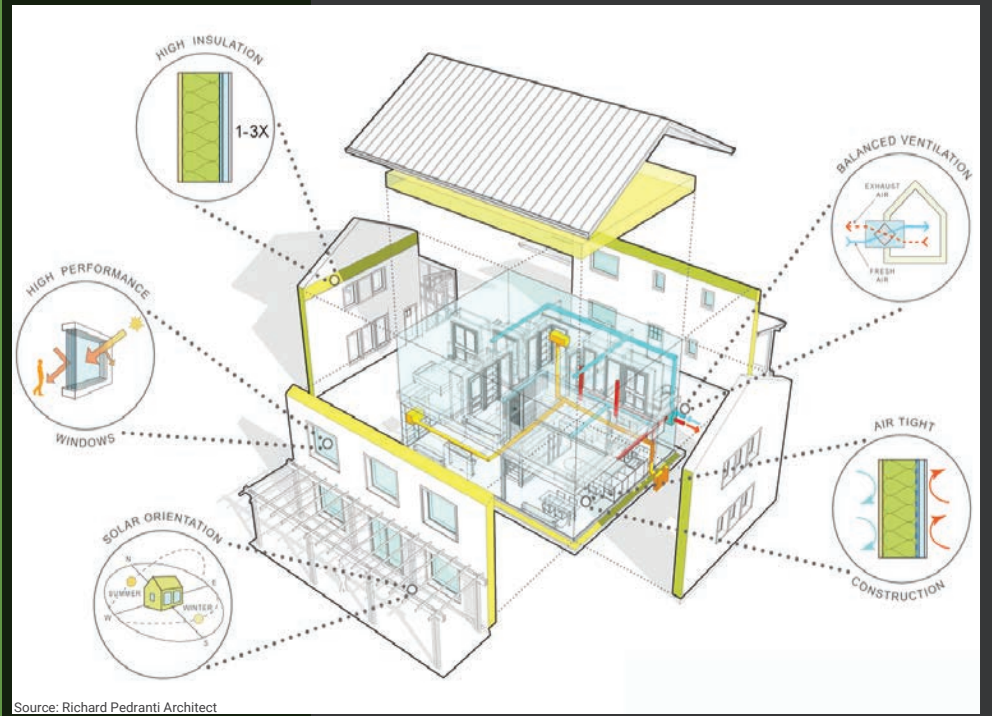
This multi-family townhouse residence is constructed to be affordable and resilient. Th design was informed by the desire to be culturally responsive, sustainable and affordable. Built by tribal members from the Puyallup Nation Housing Authority, this provided job opprtunities and training apprenticeships to learn construction skills. This project demonstrates how affordable tribal housing can also achieve high levels of sustainability for a positive environmental and cultural impact.

03

CONSTRUCTION CONSIDERATIONS

CONSTRUCTION CONSIDERATIONS

Construction considerations explore how homes are built, and the short and longterm impacts for a range of design decisions. Primary considerations include the material selection, material sourcing, building siting and the construction methods. Construction decisions can have a large environmental impact, and directly inform the building life cycle and performance. Prioritization of construction decisions that support environmental wellbeing, building longevity, and inhabitat health and comfort will help produce buildings that are long lasting and well-built.

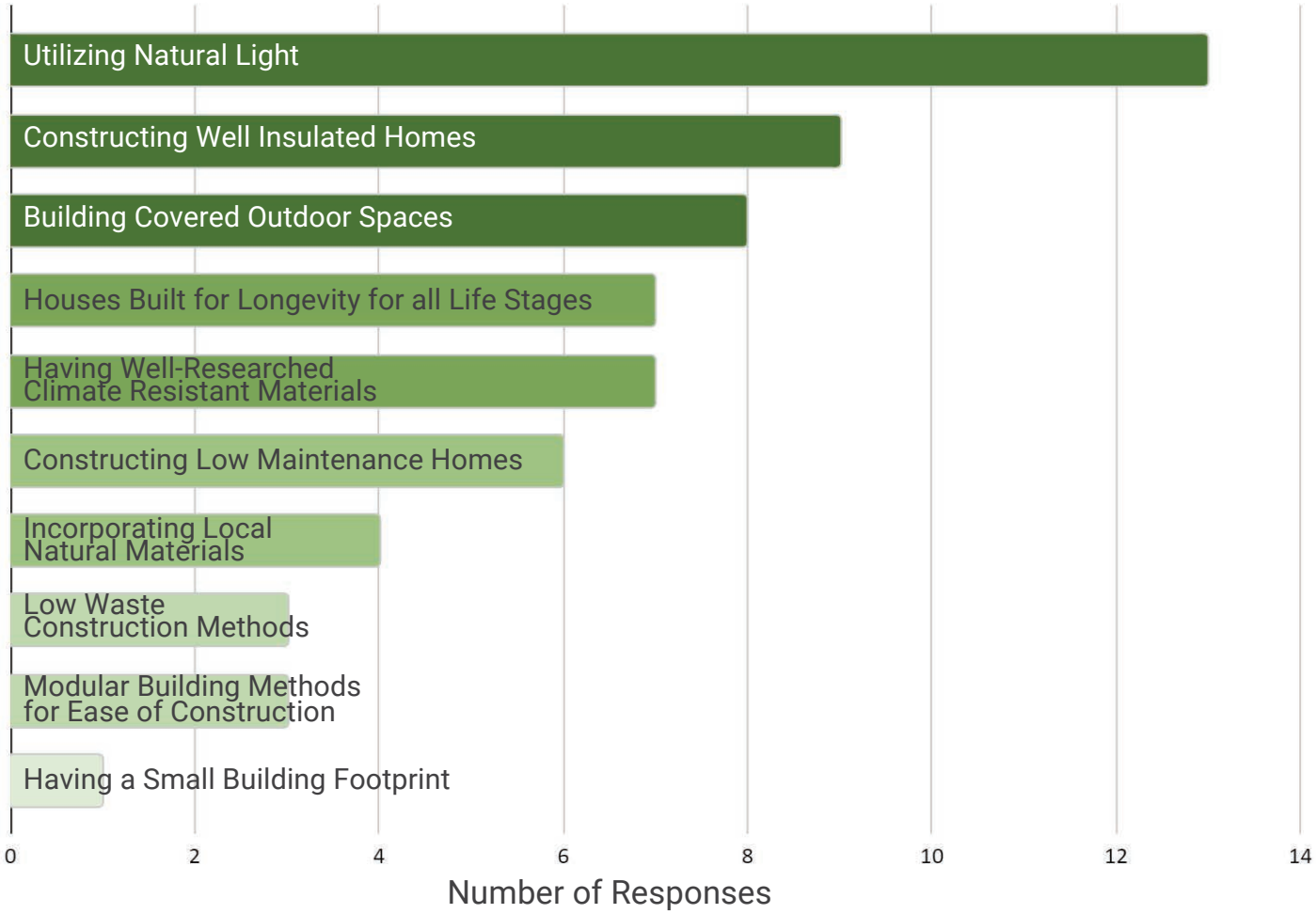


Source: Richard Pedranti Architect

Help create a materials economy that is non-toxic, ecologically restorative, transparent, and socially equitable. - ILFI Materials Petal Intent

What we heard from the **SBIT.**

We asked community members to **Select the top three most important features and construction considerations when thinking about building housing in the upland site.** These were their responses:



> I'd like to see homes that incorporate some modern wood accents with the inclusion of natural elements in addition to cultural elements intertwined throughout.

> We don't want the buildings to look like "city" buildings. I want to see our cultural art and cultural representation built into everything.

Key Principles:

Self Reliance | Culture & Community | Stewardship | Health & Wellness | Seven Generations

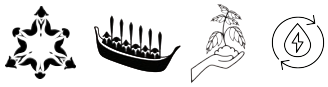
01 / Select Building Materials to Support Health

02 / Thoughtful Site Placement of Homes

03 / Optimize Construction with Modular Strategies

04 / Well Insulated Homes to Maximize Comfort

05 / Conduct Life Cycle Analysis for Environmental Impact

Principle	*Living Building Challenge*	*Passive House*	*One Planet Living*	*Justice 40*	*Community Values*
01	Materials Petal Health & Happiness Petal	Prefabricated Construction Methods	Materials & Products Zero Waste	Improved Health Outcomes	
02	Health & Happiness Petal Place Petal	Daylighting Strategies	Land & Nature Health & Happiness	Enhanced Resilience	
03	Energy Petal Equity Petal	Prefabricated Construction Methods	Materials & Products Equity & Local Economy	Enhanced Resilience	
04	Health & Happiness Petal	Maximize Building Performance	Materials & Products Health & Happiness	Improved Health Outcomes	
05	Place Petal Health & Happiness Petal	Ecological Impact	Land & Nature Equity & Local Economy	Enhanced Resilience	

Looking Forward
CONSTRUCTION CONSIDERATIONS

Construction Considerations in the uplands have opportunities to prioritize building methods and materials that support health and wellbeing of the environment and building inhabitants. The placement and orientation of buildings can support optimal solar orientation for heating and cooling and natural ventilation. Site orientation can also provide protection from the elements. Construction methods, such as modular and prefabricated building stratgies, provide opportunties for standardizing building assemblies, shortening construction time, and creating long-lasting, well constructed homes. Material choices have opportunities to respond to climate conditions, while designing contemporary and culturally responsive homes.

1 Source Non-Toxic Materials

Materials that support human and environmental health are central to the quality of housing. Avoiding materials that are toxic (e.g., no Red List Materials) can ensure that buildings are not polluting their inhabitants and site surroundings.

2 Explore Airtight, Well Insulated Construction

High levels of insulation ensures energy efficiency. Using modular construction optimizes the building envelope, prevents leaks, ensures adequate insulation, and improves building performance through standardization. Well insulated homes can achieve more comfortable, less variable interior conditions.

3 Prioritize Local, Natural Materials

Sourcing local material has the benefit of reducing carbon emissions from material transportation. Local and natural materials provide the opportunity to support and strengthen the unique, and culturally significant character of the site.

Case Study
House & Workshop Weilstrabe

Location: Stuttgart, Germany
Architect: Acre Designs

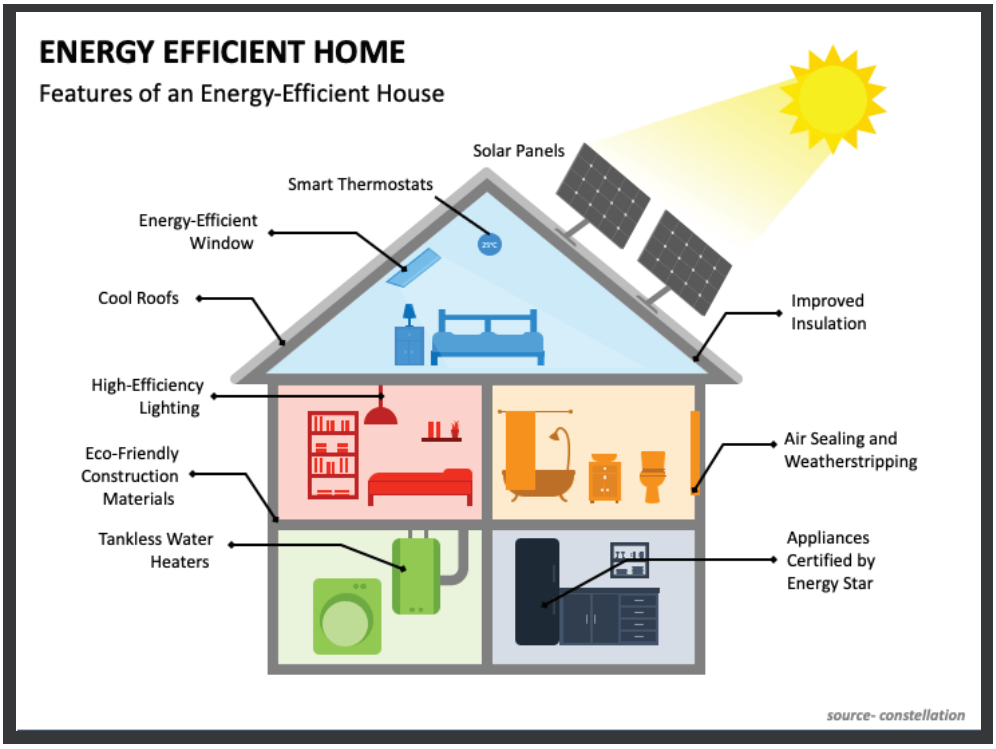
This 6 unit multi-family residence is high performing and responds to its site character through material choices. Choosing reusable wood for the facade strengthens the surrounding site character, contributes to the longevity of the building and aging beautifully. A high performance building envelope features a highly insulated building skin and high perfomance south facing windows to ensure that the interior envrionment is comfortable and to support net zero energy use.

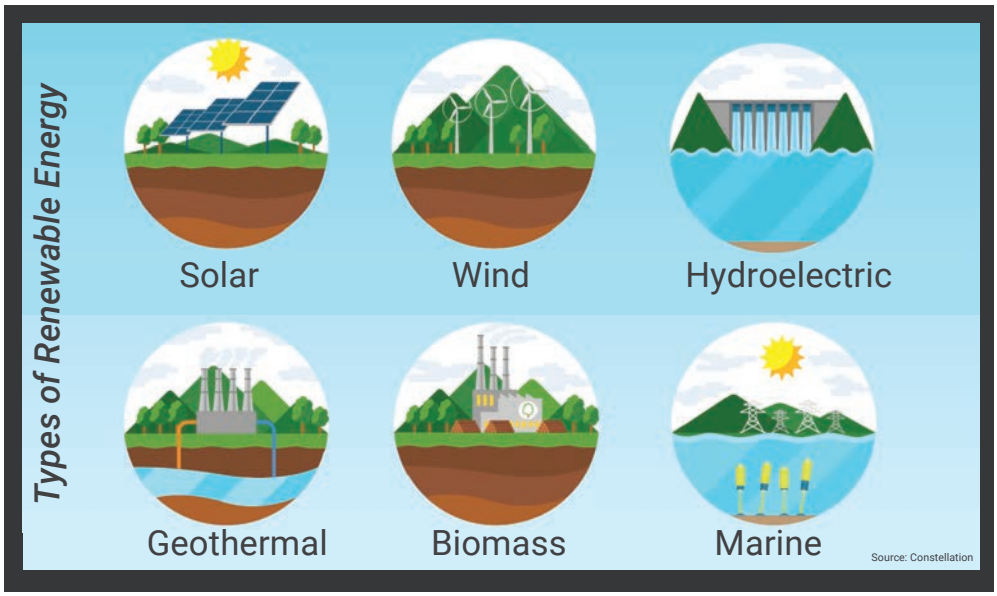
04

ENERGY SYSTEMS

ENERGY SYSTEMS

Energy systems describe the methods for supplying energy to a community. Most energy systems include HVAC, lighting, water heating systems, and energy use for appliances, etc. The source of the energy for these systems has historically been dependent on fossil fuel, which has had a negative impact on the environment and is not sustainable. Exploring renewable energy sources and efficient energy performance has the benefits of reduced energy costs, decreased carbon footprint, and independence from the energy grid.





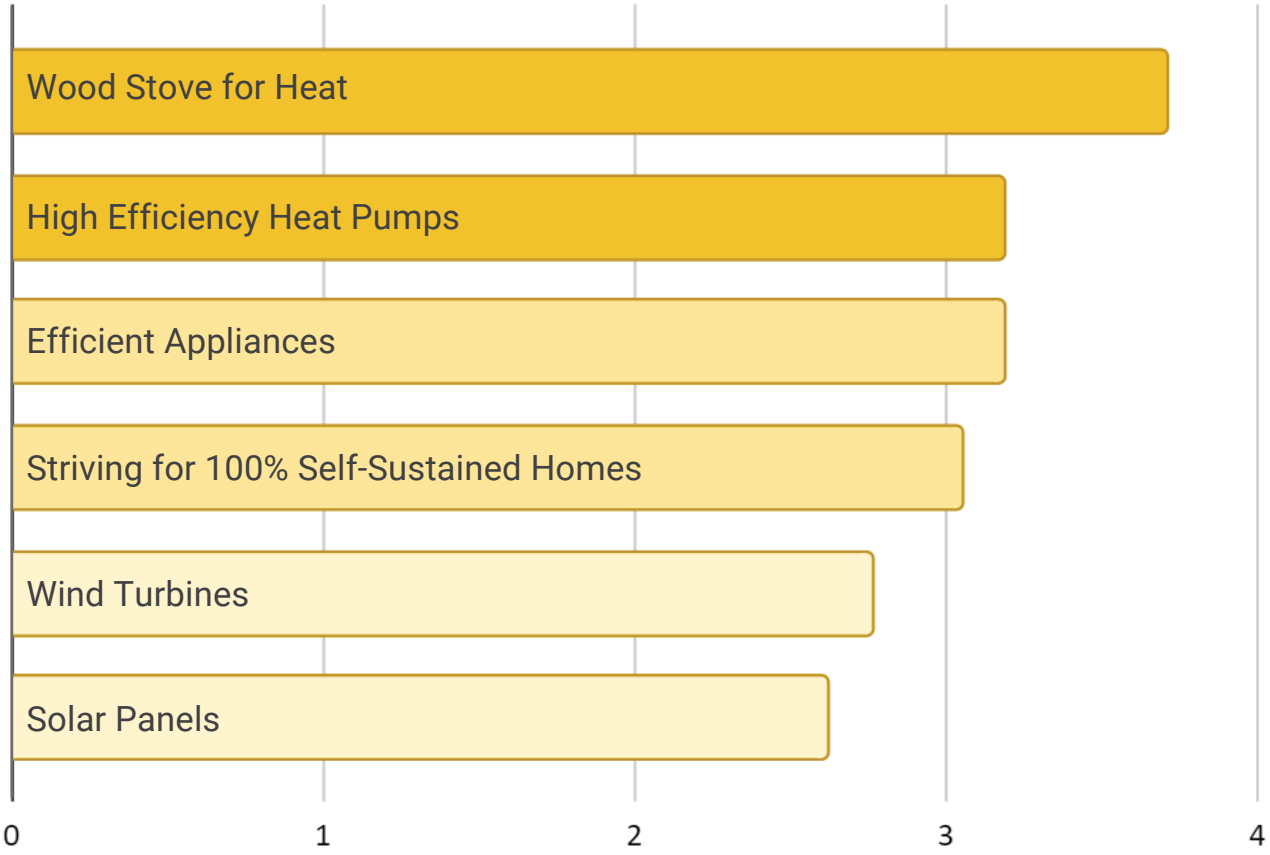
Treat energy as a precious resource and minimize energy related carbon emissions that contribute to climate change. - ILFI Energy Petal Intent

What we heard from the **SBIT.**

We asked community members to

Rank (from highest to lowest) how important these features and energy system considerations are when thinking about building housing in the upland site.

These were their responses:



> Designing to include Eco-friendly utilities will help save money, while also contributing to a positive environmental impact in our homes.

> I think the upland development has the potential to be the most green, most sustainable, and most resilient community.

Key Principles:

Self Reliance | Culture & Community | Stewardship | Health & Wellness | Seven Generations

01 / Reduce Energy Use Within Houses

02 / Improve Efficiency of Heating & Cooling Homes

03 / Invest in Low Carbon Renwable Energy

04 / Provide Backup Energy Systems

05 / Track Energy Consumption Over Time

Principle	*Living Building Challenge*	*Passive House*	*One Planet Living*	*Justice 40*	*Community Values*
01	Energy Petal	Resilience	Zero Carbon Energy	Lower Utility Costs	
02	Energy Petal	Cost Effectiveness	Zero Carbon Energy	Enhanced Resilience Lower Utility Costs	
03	Energy Petal Health & Happiness Petal	Carbon Footprint	Zero Carbon Energy	Enhanced Resilience	
04	Energy Petal	Resilience	Health & Happiness	Enhanced Resilience	
05	Energy Petal	Ecological Impact	Zero Carbon Energy	Lower Utility Costs	

Looking Forward
DESIGN OPPORTUNITIES

Energy Systems in the uplands have opportunities to prioritize renewable energy sources. High efficiency appliances and mechanical, electrical, and plumbing systems (ie. heat pumps and heat recovery ventilators) will ensure thermal comfort for residents and minimize energy consumption. To anticipate the potential impact from an earthquake and storm events, it is important to plan for backup energy systems that can provide energy without relying on vulnerable energy sources that might be damaged. Striving for Net-Zero energy use will have the most positive environmental impact, and will reduce energy costs, in addition to reducing harmful emissions from non-renewable energy sources.

1 Opportunities for Cleaner Wood Heat Sources

Wood stoves can be a reliable source of heat, not dependent on the energy grid. Wood fuel is readily available in the area. When choosing a wood stove, picking one with EPA certification will minimize the resulting pollution from burning processes.

2 Prioritize High Efficiency Appliances

High Efficiency Appliances (ie. Energy Star) decrease energy usage by as much as 50% of standard fixture usage. This lowers energy use and reduces utility bills. Lower energy use makes it easier to rely on renewable energy sources by lowering demand.

3 Explore the Development of Energy Use Assessments

Achieving energy efficient houses requires ongoing measurement of energy use. Monitoring energy use through post-occupancy studies and adjusting energy available will contribute to ongoing resilience by responding to changing energy demands and future climate impacts.

Case Study
Good Haus

Location: Nevada City, CA
Architect: Atmosphere Design Build

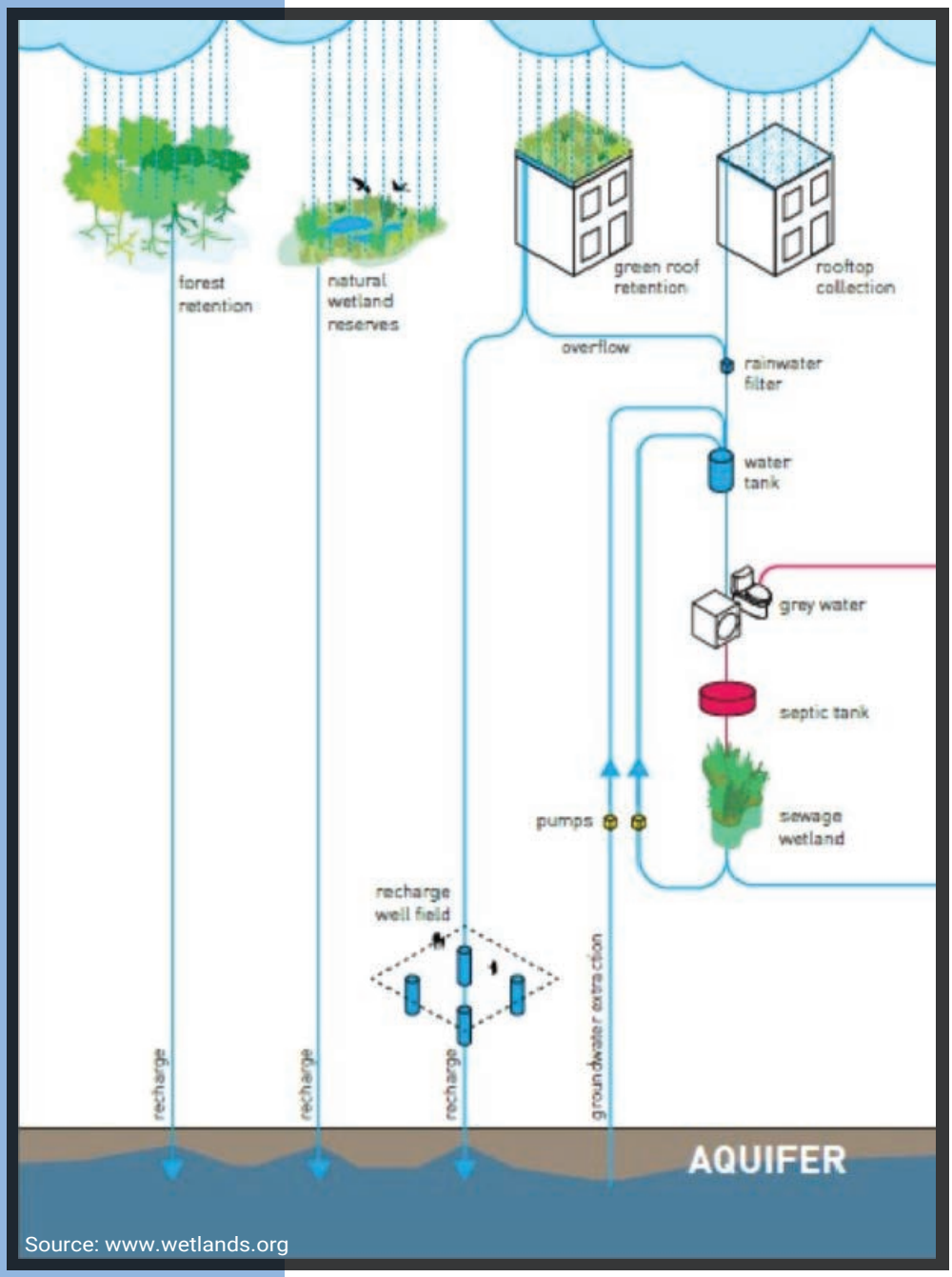
This single-family residence is designed as an intersection between design and performance. Informed by a highly site specific design, the house is enhanced by the highest level of energy efficiency, achieving net zero energy performance. Energy efficient systems include a CO2 heat pump, heat recovery ventilation, efficient ductless mini splits, and photovoltaic panels. The resulting design explores the relationships between resiliency, health, efficiency, comfort, beauty, and playfulness.

05

WATER SYSTEMS

WATER SYSTEMS

Water systems describe the methods for supplying water to a community. Most water systems consist of a water source, a storage tank, and a system of distribution, with steps for treating the water to ensure the drinking quality of the water. On a larger scale, water systems can also include systems that help manage the flow of water across the site. These include irrigation systems and methods for stormwater treatment. Water systems have a direct impact on water quality, water supply, and the health of the watershed and envrionment.



Source: www.wetlands.org

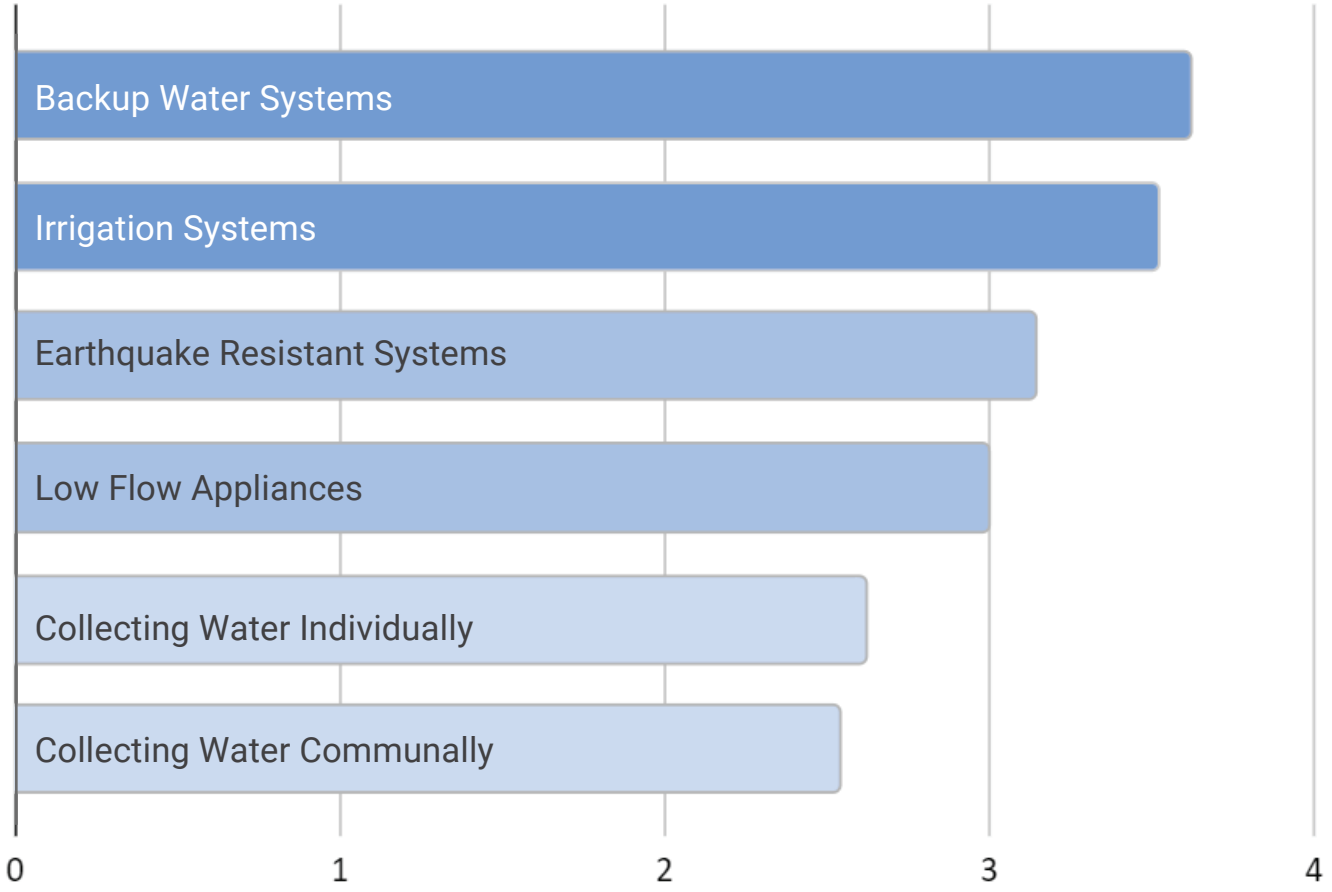
Realign how people use water and redefine "waste" in the built environment so water is respected as a precious resource - ILFI Water Petal Intent

What we heard from the **SBIT**.

We asked community members to

Rank (from highest to lowest) how important these features and water system considerations are when thinking about building housing in the upland site.

These were their responses:



> To prevent landslides we need to consider runoff management strategies, maybe rain gardens could help with this.

> I hope we can find ways to collect and store rain water in the winter when we have lots of rain, to help provide water in the drier seasons.

Key Principles:

Self Reliance | Culture & Community | Stewardship | Health & Wellness | Seven Generations

01 / Capture Rainwater to Recycle

02 / Reduce Water Use within Houses

03 / Treat Stormwater Runoff

04 / Reduce Reliance on the Water Grid

05 / Implement Closed Loop Waste Water Systems

Principle	*Living Building Challenge*	*Passive House*	*One Planet Living*	*Justice 40*	*Community Values*
01	Water Petal	Resilience	Sustainable Water	Enhanced Resilience	
02	Water Petal	Cost Effectiveness	Sustainable Water	Enhanced Resilience Lower Utility Costs	
03	Place Petal Water Petal	Ecological Impact	Land & Nature Sustainable Water	Enhanced Resilience	
04	Water Petal	Resilience	Sustainable Water	Enhanced Resilience	
05	Water Petal	Ecological Impact	Sustainable Water	Enhanced Resilience	

Looking Forward
WATER SYSTEMS

Water Systems in the Uplands have opportunities to prioritize water catchment and reuse. Given a high amount of rain for most of the year, water cisterns and water storage systems are a good option to leverage natural water supply. Stormwater treatment strategies in the landscaping around houses are crucial for ensuring that runoff water is not polluting the watershed. To anticipate the potential impact from an earthquake and storm events, it is important to plan for backup water systems that can provide water without relying on vulnerable energy sources that might be damaged. Striving for Net-Zero water use will have the most positive environmental impact, and will reduce energy demand by reducing unnecessary water use.

1 Opportunity for Water Cisterns

Water cisterns catch rain water and allow for that water to be recycled. This strategy helps manage storm water by reducing runoff. The water can be recycled for flushing toilets and watering gardens, lowering water consumption.

2 Prioritize Low Flow Fixtures

Low flow plumbing fixtures (e.g., Water Sense) decrease water usage by as much as 60% of standard fixture usage. This decreases water waste, lowers energy use, and reduces utility bills. Lower energy use makes it easier to rely on renewable energy sources.

3 Explore Backup Water Systems

Backup water systems (e.g., Constant Water) provide water in the scenario of well pump failure and loss of water supply due to a storm or emergency outage. Given the environmental hazards of the area, providing backup water systems ensures consistent water access.

Case Study
Birch Case Study House

Location: Bellingham, WA
Architect: [bundle] design studio

This single family residence has achieved net zero water use. **Rain catchment was designed for all water use.** A closed loop “off grid” water system supplies water and on-site infiltration treats greywater and storm water. Exterior landscaping also incorporates storm water management through **green roofs, rain gardens and permeable driveway paving** helping treat water that runs through the site.

5.2 Limitations

5.2.1 Survey Limitations

Some of the limitations of the survey were the number of responses that were received, which is a very small percentage of the total number of Tribal members. This means that the community feedback used to inform the recommendations might not represent the entire population. To address this limitation, ongoing community outreach, and efforts to reach unsurveyed Tribal members should be a priority in future planning efforts for upland expansion. The other limitation of the survey was the vulnerability of the survey to bot responses. This outcome limited the reliability of the survey data. To address this limitation, changes to future survey distribution methods are recommended to reduce the likelihood of bot responses.

5.2.2 Scope Limitations

Given the amount of time that is critical for building meaningful relationships with community partners in community-based participatory research methodologies, the limited amount of time to conduct this research is another limitation of this study. Since the timeline for this thesis only spanned nine months, there were limited opportunities for ongoing relationship-building with the community partners. Longer and ongoing timelines for research could produce more detailed community feedback and ongoing community engagement over longer periods of time has positive outcomes for community-based research.

5.3 Areas for Future Research

5.3.1 Writing Building Standards

The recommendations proposed as the result of this research could be the basis for writing new building standards for the upland expansion. Building standards are policies that specify the standards for construction methods and establish requirements for new construction. Building standards can be established in order to achieve the maximum sustainability benefits from the key principles of the architectural frameworks and to achieve the goals of the community towards establishing a resilient community in the uplands. The language and identified principles of the sustainable frameworks can provide a foundation for the terminology used in these new building standards to help support sustainable development.

5.3.2 Develop Housing Placement Framework

Through the community engagement and feedback processes, it became clear that there is a wide range of priorities and preferences for housing in the upland site. There is an opportunity for future research that develops systems to organize and categorize housing preferences to help inform housing placement for households wanting to move to the uplands. One of the next steps in the upland expansion the process is understanding how many households would want different housing typologies (ie. single-family vs. multifamily). If there was a framework to categorize

these preferences, this could help the planning department to identify the required area for different housing types to accommodate different household preferences.

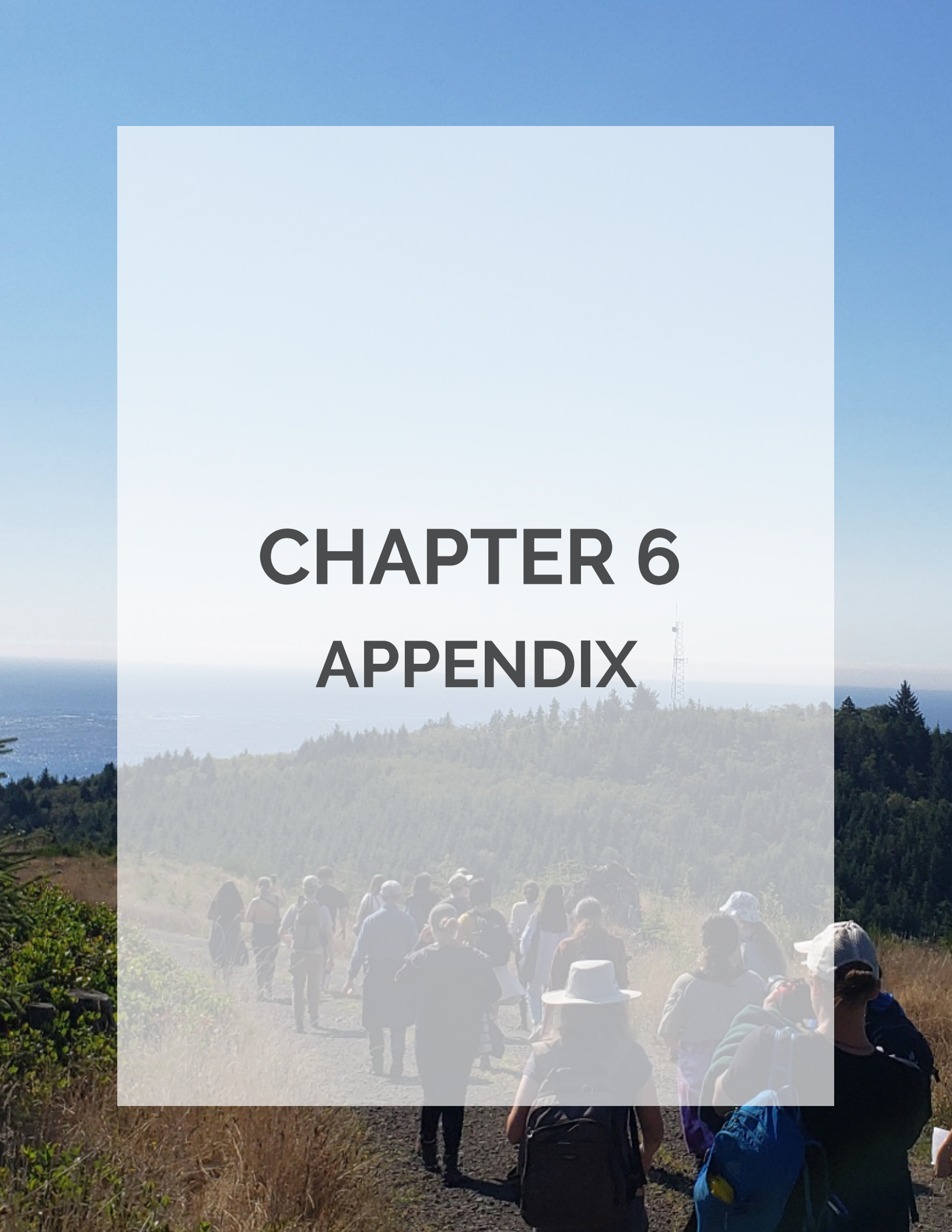
5.3.2 Supplement to Grant Funding with Evidence of Commitment to Sustainable Development

One of the next steps in the upland expansion process is gaining funding to support and start the moving process. Given the expressed commitment to sustainable development and construction, there are opportunities to use the co-designed recommendations from this thesis to provide an action plan for achieving the high-performance, resilient community that the tribal members have shown interest in. This action plan could potentially supplement grant applications to indicate the commitment to environmentally friendly building strategies and sustainable approaches to the upland expansion process.

5.4 Conclusion

In conclusion, the community-based co-design process was critical for developing meaningful recommendations that are specific to the unique identity and priorities of the Shoalwater Bay Indian Tribe. The synthesis of key principles from existing frameworks provided a technical language that could be adapted to help support the community values and preferences expressed by community members through several stages of community engagement. This co-design process resulted in

culturally responsive, placed-based, recommendations, which can help inform future community engagement to create meaningful design solutions.



CHAPTER 6
APPENDIX

6.1 Appendix

Table 1. Survey Variables

Variable	Question/Source of Measures	Answer Choices
Demographics	What is your age?	- Under 18 - 18-29 - 30-61 - 62-Older
Place Attachment	How long have you lived in your house?	- Less than 1 year - 1-5 years - 6-10 years - Over 10 years
Demographics	How many people are in your household?	
Demographics	What is the composition of your household? (How many members are in each age category)	- Young Children (0-12) - Teens (13-17) - Young Adults (18-29) - Adults (30-61) - Elders (62+)
	Does anyone living with you have a need for accessible accommodations? (ie. wheelchair ramps, single-story living space, vision or hearing impaired considerations, etc)	- Yes - No - Maybe in the near future
	Which accessible accommodations do/will your household need?	- Single Story House - Access Ramps - Grab Bars in Bathroom - Wheelchair Accessible Counters - High Contrast Materials - Wider Hallways - Other (Please specify)
	Housing Considerations (Select your top 3)	- Intergenerational housing - Having a front porch/deck - Having the ability to expand or add onto housing - Being close to neighbors & community buildings - Having privacy from neighbors & community buildings - Single-Story housing - Multi-Story housing - Including a bonus room/flexible

		space - Other (Please specify)
	Construction Considerations (Select your top 3)	- Modular building methods for ease of construction - Constructing low maintenance buildings - Houses are built for longevity in all stages of life - Low waste construction methods - Having well-researched climate resistant materials - Building covered outdoor spaces - Having a small building footprint - Incorporating local natural materials - Utilizing natural light - Constructing well insulated buildings - Other (Please specify)
	Economic Considerations (Select your top 3)	- Ability for community members to construct houses - Ability for community members to add onto houses - Affordable cost to build - Economic enterprises to support the manufacturing of building components - Proximity to services - Large lot size - Housing with added features/functionality - Other (please specify)
	Activities on the Land (Select your top 3)	- Playgrounds - Open Space - Views - Gardens - Space for Art - Hunting - Walking Paths - Edible Trails - Other (Please specify)
	Communal Buildings (Select your top 3)	- School - Wellness Center - Community Center & Tribal Center - Makerspace (Crafts, Woodworking, etc) - Food Processing & Storage Center - Library - Grocery Store - Gym

		- Police & Fire Station - Restaurants - Museum - Tribal Justice Center - Elder acre - Digital Technology Center (computer lab, printing, other tech access) - Other (Please specify)
	Energy Systems (Click and drag the selections to rank from most to least important, with the most important at the top of the list, 1=most important, 6=least important)	- Wind Turbines for Renewable Energy - Having a Wood Stove for Heat - Solar Panels for Renewable Energy - Using High Efficiency Heat Pump to heat buildings - Using efficient appliances for energy conservation - Striving for completely self sustained home (100% Renewable Energy)
	Water Systems (Click and drag the selections to rank from most to least important, with the most important at the top of the list, 1=most important, 8=least important)	- Collecting & recycling water on an individual level (cistern at my house) - Collecting & recycling water on a communal level (cisterns at a communal space) - Using low flow appliances for water efficiency - Developing irrigation systems - Backup water systems - Earthquake resistant water systems - Having an on-demand water heating system - Having a traditional water heating system
	Are ther any other considerations that were not addressed in the prior questions that you would like to share?	
	Would you be interested in being contacted for an in-depth focused interview regarding resilient building and development options for the upland expansion?	- Yes - No

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