

# North Dakota State University Graduate School

---

**Title**

BEYOND MEMORY: A PERSON-CENTERED APPROACH TO DEMENTIA DESIGN

---

**By**

Samantha Quaal

---

The Supervisory Committee certifies that this *thesis* complies with North Dakota State University's regulations and meets the accepted standards for the degree of

**MASTER OF ARCHITECTURE**

**SUPERVISORY COMMITTEE:**

Dr. Stephen Wischer

Thesis Coordinator

DocuSigned by:

*Stephen Alexander Wischer*

CBA6CA6223024AC...

Charlott Greub

Primary Advisor

DocuSigned by:

*Charlott Greub*

5907ED19439D49D...

**Approved:**

05/09/2024

Date

DocuSigned by:

*Susan Schaefer Kliman*

C9FF1C4ACFB7438...

Department Chair



BEYOND MEMORY: A PERSON-CENTERED APPROACH TO DEMENTIA CARE  
DESIGN

A Design Thesis  
Submitted to the Graduate Faculty  
of the  
North Dakota State University  
of Agriculture and Applied Science

By

Samantha Quaal

In Partial Fulfillment of the Requirements  
for the Degree of  
MASTER OF ARCHITECTURE

Major Department:  
Architecture

April 2024

Fargo, North Dakota

## **ABSTRACT**

At some point in each of our lives, a loved one or even ourselves will end up in some assisted living facility. Today, there is a negative connotation behind senior care facilities; they are portrayed by having drab interiors mixed with the faint sounds of squeaky wheelchairs that echo long, stale hallways. The population of older adults in the world is constantly growing, and a profound number of them have a form of memory loss like Alzheimer's. How can we design a senior living center that makes those with Alzheimer's feel safe and keep their minds active? How can we use simplistic wayfinding to find a home that effortlessly directs residents to give them a feeling of independence? How do indoor and outdoor spaces for socialization and activities keep minds and bodies moving? The elderly population is a vulnerable generation that does not get the attention they deserve, and most do not have the strength or voice to ask for the help they need.

## TABLE OF CONTENTS

ABSTRACT.....	3
LIST OF TABLES .....	4
LIST OF FIGURES .....	5
VOCABULARY.....	9
1. INTRODUCTION.....	10
1.1. Memory Facts and Figures .....	10
1.1.1. Alzheimer’s vs Dementia.....	10
1.1.2. What is Alzheimer’s?.....	10
1.1.3. Who does it affect? .....	11
1.1.4. What does it affect? .....	12
1.1.5. When does it affect people? .....	13
1.1.6. Treatment: .....	14
1.2. Problem Statement.....	14
1.2.1. Research Question .....	15
1.2.2. Proposal Outcome .....	15
1.3. Objective.....	15
1.3.1. Aim .....	15
1.3.2. Significance.....	15
2. BACKGROUND.....	16
2.1. Facility Size and Attributes .....	17
2.1.1. Population Size and Layouts.....	17
2.1.2. Interiors Design.....	20
2.1.3. Amenities .....	21
2.2. Salutogenic Design.....	23
2.2.1. Three Domains of Salutogenesis in Healthcare Design.....	25
2.3. Spatial Orientation Design – Place Knowing .....	27
2.3.1. Wandering.....	27
2.3.2. Wayfinding .....	27



2.3.2.1. Decision Points .....	28
2.3.2.2. Spatial Reference Frame using landmarks and nodes.....	29
2.3.2.3. Place Attachment .....	30
2.4. Behavioral Design .....	32
2.4.1. Anxiety and Stigma Behind Dementia .....	32
2.4.1.1. Zeisel’s Hope Versus Despair Model .....	33
2.4.2. Stimulation.....	34
2.4.2.1. Sensory Stimulation and Therapies .....	36
2.4.2.2. Sundowning .....	37
2.5. Biophilia .....	38
2.5.1. Biophilia for elders with dementia.....	38
2.5.2. Visual connection with nature .....	39
2.5.3. Therapy Sensory Gardens .....	39
2.6. Gap Identification.....	40
2.7. Typology.....	41
2.7.1. Memory Care Center.....	41
2.7.2. Dementia Villages.....	42
2.8. Project Issues .....	42
3. METHODOLOGY .....	43
3.1. Approach .....	43
3.1.1. Data Collection .....	43
3.1.2. Analysis.....	43
3.1.3. Conclusion .....	44
3.2. Texas – Project Location.....	44
3.3. Sunnyvale .....	47
3.4. Specific Site.....	49
3.4.1. Climate.....	50
3.4.2. Wind.....	50
3.4.3. Sun .....	52
3.4.4. Precipitation .....	54
3.4.5. Topography .....	55

3.4.6. Site Soil and Vegetation.....	56
3.4.7. Traffic Volume.....	57
3.4.8. Zoning.....	58
3.4.9. Amenities.....	60
3.4.10. Site Photos.....	62
3.5. Case Studies.....	68
3.5.1. Alliage Meriant.....	68
3.5.2. Carpe Diem Dementia Village.....	73
3.5.3. Hogeweyk Dementia Village.....	77
3.6. Space Programs.....	81
3.6.1. Project Elements.....	82
3.6.2. User Groups.....	84
4. Results and Conclusion.....	85
4.1. Final Project Description.....	85
4.1.1. Welcome Center.....	86
4.1.2. City Center.....	86
4.1.3. Ash Manor and Oak Estates.....	87
4.1.4. Magnolia Meadows.....	87
4.2. Project Objective.....	87
4.2.1. Salutogenic.....	87
4.2.2. Small Scale.....	88
4.2.3. Wayfinding.....	88
4.2.4. Biophilic.....	88
4.2.5. Community Connection.....	89
4.3. Project Design.....	89
4.3.1. Floor Plans.....	89
4.3.2. Exterior Renderings.....	93
4.3.3. Interior Renderings.....	96
4.4. Conclusion.....	99
4.5. Major Project Elements.....	99
REFERENCES.....	100

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
1:	Projected Number of Americans with Alzheimer's .....	46
2:	Number of Geriatricians .....	46
3:	Care Aide Job Growth .....	46
4:	Case Study Comparison Chart .....	68
5:	Space Programming .....	82
6:	User Groups .....	84

## LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1: Alzheimer’s Brain.....	11
2: Alzheimer’s Disease Continuum .....	13
3: Number and Ages of those with Alzheimer’s.....	13
4: Social Densities.....	18
5: Long Wing Plan.....	18
6: Square Plan .....	18
7: L-plan.....	19
8: Traditional Plan.....	20
9: Grocery Store.....	22
10: Cafe.....	23
11: Miniature Farm .....	26
12: Decision Points .....	29
13: Egocentric vs Allocentric Reference Frame .....	30
14: Tripartite Model of Place Attachment .....	31
15: Memory Boxes.....	32
16: Zeisel’s Hope versus Despair Model.....	34
17: Music Therapy .....	37
18: Views of Nature.....	39
19: Outdoor Garden .....	40
20: Alzheimer’s Disease in Texas Stats.....	45
21: Sunnyvale, Texas.....	47
22: Sunnyvale Texas Satellite Image in 1963 vs 2023 .....	48
23: Site .....	49

24:	Average Temperature .....	50
25:	Wind Directions .....	51
26:	Wind Directions .....	51
27:	Average Wind Speeds.....	52
28:	Hours of Daylight and Twilight.....	53
29:	Winter Solstice Sun Path .....	53
30:	Summer Solstice Sun Path.....	54
31:	Average Monthly Rainfall .....	55
32:	Topographic Map.....	55
33:	Site Topography.....	56
34:	Site Topography.....	56
35:	Map of Texas Soil Diversity .....	57
36:	Traffic Volumes .....	58
37:	Zoning.....	58
38:	Future Zoning .....	59
39:	Medical Institutions Eastern Dallas County Sunnyvale .....	60
40:	K12 and Medical Schools Eastern Dallas County .....	61
41:	Travel Map Eastern Dallas County.....	61
42:	View looking South at Site (Photo by Sammy Quaal, 2023) .....	62
43:	View looking South on Site (Photo by Sammy Quaal, 2023) .....	62
44:	View looking South on Site (Photo by Sammy Quaal, 2023) .....	63
45:	View looking North on Site (Photo by Sammy Quaal, 2023) .....	63
46:	View looking North on Site (Photo by Sammy Quaal, 2023) .....	64
47:	View looking West on Site (Photo by Sammy Quaal, 2023) .....	64
48:	View looking West on Site (Photo by Sammy Quaal, 2023) .....	65

49:	View looking West on Site (Photo by Sammy Quaal, 2023) .....	65
50:	View looking East on Site (Photo by Sammy Quaal, 2023).....	66
51:	View looking East on Site (Photo by Sammy Quaal, 2023).....	66
52:	View looking East on Site (Photo by Sammy Quaal, 2023).....	67
53:	Exterior Walking paths .....	69
54:	Level 1 Floor Plan.....	70
55:	Unit Floor Plan.....	70
56:	Site Diagram .....	71
57:	Garden.....	72
58:	Outdoor Seating Area .....	72
59:	Site View.....	73
60:	Storefronts.....	74
61:	Courtyard Activity .....	75
62:	Floor Plans .....	76
63:	Courtyard .....	76
64:	Courtyard .....	78
65:	Supermarket.....	78
66:	Building Plan .....	79
67:	Site Plan.....	80
68:	Overall Project Space Programming.....	83
69:	Space Programming Per Unit .....	83
70:	Site Map.....	85
71:	City Center Plan.....	90
72:	City Center Plan.....	91
73:	Half of Middle Stage Units .....	92

74:	Half of Later Stage Units .....	92
75:	City Center .....	93
76:	City Center .....	93
77:	Entry Oak Estates.....	94
78:	Entry Oak Estates.....	94
79:	Entry Oak Estates.....	95
80:	Entry Oak Courtyard.....	95
81:	Salon .....	96
82:	City Center Interior .....	96
83:	Bedroom.....	97
84:	Hobby Room.....	97
85:	Interior Oak Estates .....	98
86:	Interior Oak Estates .....	98

## VOCABULARY

ADL's .....Activities of daily living

SF-1 .....Single-Family Zoning

PD .....Planned Development Zoning

Sq ft .....Square footage



## **1. INTRODUCTION**

In response to the rising population and an increase in the median lifespan, there is a spike in the number of individuals living in memory care facilities. The establishments these patients call home are far from places where the vulnerable receive the care they need; they have shifted into institutions crowded with individuals to earn a profit. A number of those who end up in facilities may be physically fit but face mental challenges like dementia, which requires a different approach to care. The architectural environments of today's memory care living centers do not promote socialization or push patients physically. Increasing the opportunity for biophilic and salutogenic design by allowing patients to explore, socialize, and engage in routine tasks they once carried out outside of the care facility promotes an active, healthy lifestyle that is both emotionally and physically stimulating.

### **1.1. Memory Facts and Figures**

#### **1.1.1. Alzheimer's vs Dementia**

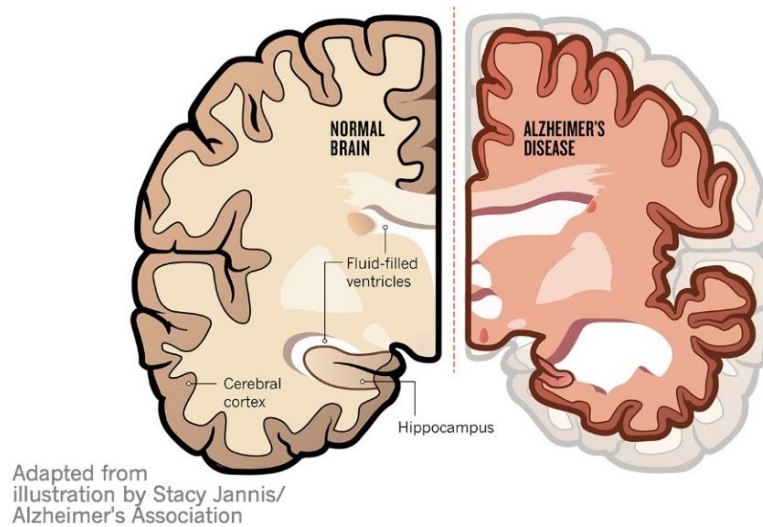
Dementia is a general label used to describe symptoms of a decline in thinking skills and memory loss. Alzheimer's is a specific type of brain disease that accounts for 60-80% of all dementia cases (*Dementia vs. Alzheimer's Disease*, 2023). Alzheimer's accounts for 65% of all dementia patients, followed by 30% vascular dementia, and the last 15% of cases are a combination of both fields (Kuliga et al., 2021).

#### **1.1.2. What is Alzheimer's?**

A degenerative brain disease resulting from damaged nerve cells and or neurons. Those brain neurons are vital for humans to talk, walk, and think ("2023 Alzheimer's Disease Facts and Figures," 2023). In the beginning stages of Alzheimer's, the disease destroys brain neurons in the hippocampus and entorhinal cortex, which are responsible for memories. As the disease

progresses, it takes over the cerebral cortex, responsible for reasoning, language, and behavior (What Happens to the Brain in Alzheimer’s Disease?).

Figure 1: Alzheimer’s Brain



*Note: This graphic shows a comparison of a normal healthy brain versus the brain of someone who has Alzheimer’s disease (from Drew, 2018)*

### 1.1.3. Who does it affect?

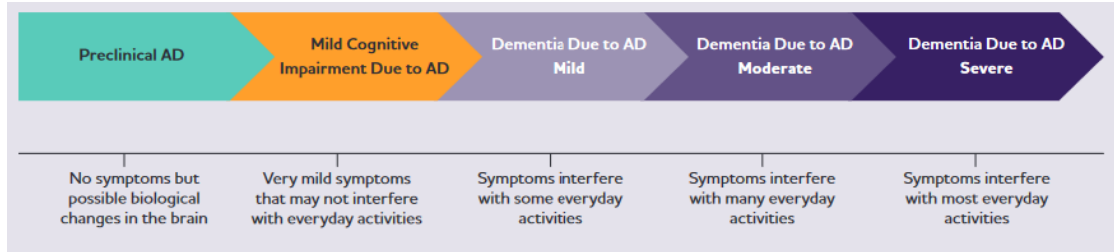
According to Alzheimer’s Disease International, in 2023 there are 55 million people in the world living with dementia, and it is expected to grow to 139 million by 2050 because of our booming population. Every three seconds, someone in the world is diagnosed with Alzheimer’s (“2023 Alzheimer’s Disease Facts and Figures,” 2023). If one has a family history of Alzheimer’s in a first-degree relative, there is a higher chance of getting the disease than those who do not have a first-degree relative. There are also higher risks of the disease if one smokes and is not physically, socially, and mentally active (“2023 Alzheimer’s Disease Facts and Figures,” 2023). Those with Mild Cognitive Impairments also have a higher risk of developing dementia. MCI occurs in the middle stages of the average cognitive decline of the elderly and the severe decline of dementia. The conversion rate of those with MCI to developing dementia is 10% per year, whereas the conversion rate of healthy seniors is 1-2% per year (Miniaci & De

Leonibus, 2018). Like other common chronic diseases, alzheimer's can develop because of multiple factors. Some expectations are still specific to genetic mutation ("2023 Alzheimer's Disease Facts and Figures," 2023).

#### **1.1.4. What does it affect?**

A normal, healthy adult brain contains billions of active neurons firing rapidly with long branching extensions that connect these neurons to fire messages to the brain. These connections create the base of our memories, emotions, and movements. In the case of alzheimer's, there is a buildup of protein fragments beta-amyloid into clumps outside these neurons, slowing the process of transmitting information ("2023 Alzheimer's Disease Facts and Figures," 2023). There is a decline in the brain's posteromedial, medial-temporal, and frontal areas. Early on in the disease, it includes difficulty remembering recent conversations and names, and further along, there are behavioral changes such as changes in processing emotions, feelings, mood, and personality (*Dementia vs. Alzheimer's Disease*, 2023). At this stage, family or friends may start to take notice, and a doctor may be called to identify the symptoms with specific diagnostic tools (*Alzheimer's Disease and Dementia*, 2023). Moderate stages of the disease are typically the longest and can last years. This is where they start to require care and have emotional and responsive behaviors. They may feel withdrawn from social situations and have an increased risk of wandering (*Stages of Alzheimer's - Penn Medicine*, 2020). The later stages of the disease involve more physical changes, such as trouble swallowing, speaking, and walking ("2023 Alzheimer's Disease Facts and Figures," 2023). The persons living with alzheimer's may not be able to initiate conversations but can still benefit from interactions. This stage requires more around-the-clock care, and hospice becomes a part of the conversation about care (*Alzheimer's Disease and Dementia*, 2023).

Figure 2: Alzheimer’s Disease Continuum

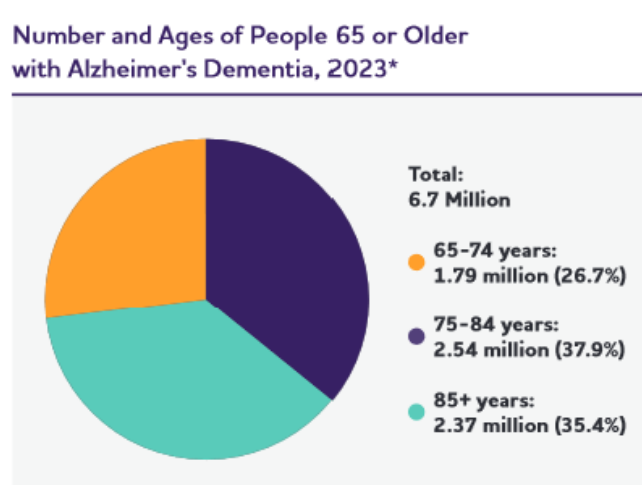


Note: This graphic shows the disease progress and its associated symptoms (from “2023 Alzheimer’s Disease Facts and Figures,” 2023)

### 1.1.5. When does it affect people?

Age is the most significant factor in getting Alzheimer’s. According to the Alzheimer’s Association, the brain changes, and the disease itself can start occurring for more than 20 years before symptoms arise. Age is a significant factor. The vast majority of those with Alzheimer’s are 65 years old and older. 5% of those with Alzheimer’s are 65-74 years old, 13.1% are 75-84 years old, and 33.3% are 85 years old and older (“2023 Alzheimer’s Disease Facts and Figures,” 2023).

Figure 3: Number and Ages of those with Alzheimer’s



Note: Comparison of the number of Alzheimer patients and their respective ages (from “2023 Alzheimer’s Disease Facts and Figures,” 2023)

This is imperative because, by the year 2050, nearly 25% of the world's population will be over 60 (Burzynska & Malinin, 2017). According to the Alzheimer's Association, there are as many as 200,000 Americans under 65 living with young-onset alzheimer's disease (*Dementia vs. Alzheimer's Disease*, 2023). Dementia and alzheimer's are not standard parts of aging and should be taken seriously when symptoms start to occur (*ADI - Dementia Facts & Figures*, 2023).

#### **1.1.6. Treatment:**

No treatment will cure alzheimer's disease, but most drugs that are FDA-approved can assist in managing the symptoms for people in the early or middle stages (*How Is Alzheimer's Disease Treated?*, 2023). Medication may change the disease progression, improve their quality of life, and cope with symptoms; however, no medication today will ultimately diminish the disease (*Treatments for Alzheimer's*, 2023).

### **1.2. Problem Statement**

Today, there is a stigma behind memory care; they are portrayed as stale and bleak facilities that are built on a view of profits instead of patients. The institutional model that is present today is the 70's standard that is focused strictly from a medical point of view and profit. Elderly care is not a one-size-fits-all package; all patients are not equal in the level of care they need. Today's healthcare system model is a monotonous placement of room on top of room with no spaces for socialization and an emphasis on confinement. There is a focus on placing patients around the medical devices rather than letting patients live and putting those devices around them. There is no room for personality or play in the average healthcare establishment. Today's model is based on the organization and dominance of the clinic, with few options for exploration or choices for the patients.

### **1.2.1. Research Question**

How can we design a memory care facility for dementia patients that creates a sense of independence and supports a meaningful and engaging life?

### **1.2.2. Proposal Outcome**

The expected research will go over innovative memory care facilities and patient-centered villages. The research will cover the intellectual, physical, and cognitive impacts made because of each design. Using biophilic and salutogenic design promotes an engaging lifestyle that focuses on movement and socialization rather than strictly treating the disease. Architectural elements that help promote wayfinding and prevent wandering can create a sense of independence for dementia patients and mollify caregivers. Keeping these ideas in mind with a forward-thinking, patient-centered design, the stigma behind memory care facilities can diminish.

## **1.3. Objective**

The research will apply all standpoints of human-centered design, including emotional, physical, and behavioral aspects, to create a user-centered design. The built environment directly affects mental, behavioral, and physical well-being, so research centered on how to approach best and maximize well-being in each category.

### **1.3.1. Aim**

The research will aim to design a memory care facility that promotes a healthy, proactive lifestyle for memory care patients.

### **1.3.2. Significance**

The research behind a new memory care facility can replace our institution-based model. Turing inadequate institution care into a functional humanistic approach focusing on the built

environment as an instrumental tool for success. Architectural elements that help dementia patients conquer everyday obstacles like wayfinding relieve pressure from caregivers, patients, and families. Patient-centered design with an emphasis on a salutogenic method of medication requires less caregivers' time and energy, saves on costs, and is preferred by families and patients.

## **2. BACKGROUND**

Various topics are interrelated with memory loss care and healthcare design. As supported by the research below, the overarching goal is to create a home for individuals with dementia that preserves their independence, provides equal opportunities, and respects their dignity. Alzheimer's is a chronic brain disorder, meaning it has no cure, so the project's goal is to promote the activities and functions that residents can still achieve and facilitate the activities if they have cognitive or physical struggles. The stigma behind chronic disease has detrimental impacts on patients' health and well-being as well as family members. Hence, maximizing the built environment to promote confidence and self-fulfillment prevents both changed behavior and slows the overall decline of the diseases. The ideology of this goal is based on salutogenic design that focuses on engaging dementia patients to promote a more meaningful life. Care for the elderly has switched from the institutional model to person-centered care, emphasizing creating supportive and therapeutic environments. Wandering is a key issue to consider when working with dementia patients, to combat this wayfinding cues and nodes promote independent navigation. Maintaining their independence as long as possible increases their self-concept and reduces anxiety. Giving them independence through differing social sizes and daily activities gives residents a sense of freedom. Another critical factor to consider when working at a healthcare institution is using a biophilic design to reduce anxiety and promote mental

engagement, attentiveness, and overall happiness. Memory care has different factors to consider than regular long-term care facilities, so harnessing all these main ideas is essential in designing a patient-centered, behaviorally sensitive facility.

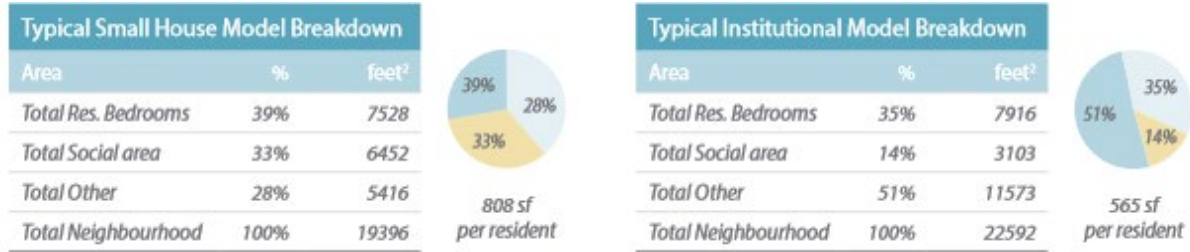
## **2.1. Facility Size and Attributes**

### **2.1.1. Population Size and Layouts**

Countless studies have done a deep dive into the positive effects of small-scale memory care facilities on today's large institutions. There are various universally accepted design recommendations for these smaller-scale dementia-centered care facilities. First are the smaller unit sizes, typically ranging from 8 minimum to 20 maximum, and rooms on exterior walls for views toward nature (Chaudhury et al., 2018; *Towards Human-Centered General Hospitals*, 2021; Wrublowsky, 2017). Research has shown increased well-being, behavior, and overall activity engagement levels (Chaudhury et al., 2018). This ideology has also been shown to give new patients a feeling of ease and help them adapt faster to smaller-scale residential-style care facilities because they remind them of home. There is also a decrease in wandering and the associated anxiety symptoms, such as aggression and pacing, while increasing overall emotional well-being, functions, and mobility (Wrublowsky, 2017). Smaller scale facilities allow nurses to be less overwhelmed by the number of patients to watch over and have a central office location for easy access to all patient's rooms. This also keeps open sightlines to patient rooms and to the various socialization spaces residents may reside in (Chaudhury et al., 2018; *Towards Human-Centered General Hospitals*, 2021; Wrublowsky, 2017). Compared to the typical modern-day institutional model, the small-scale model differs in the overall square footage and how it breaks down the spaces inside.



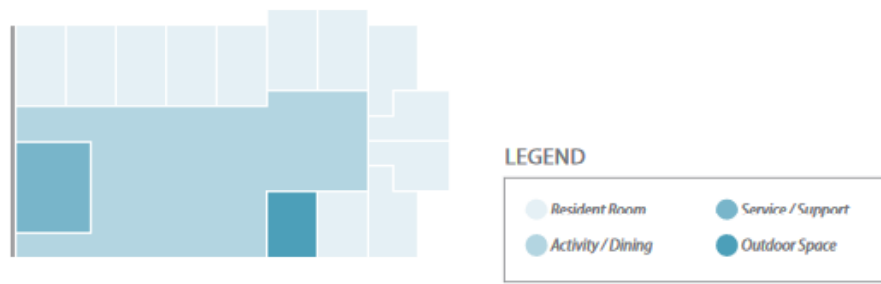
Figure 4: Social Densities



Note: Comparison of the spatial densities of the small house model versus today's medical institutional model (from Wrublowky, 2017)

Unit layouts are crucial if the goal is to create a residential feel, allowing “home clusters” to open into one another to ease patients visiting their “neighbors.” Robert Wrublowky shows the pros and cons of various layouts. First are the basic wing plan, square plan, L-plan, and lastly, a traditional bedroom concept.

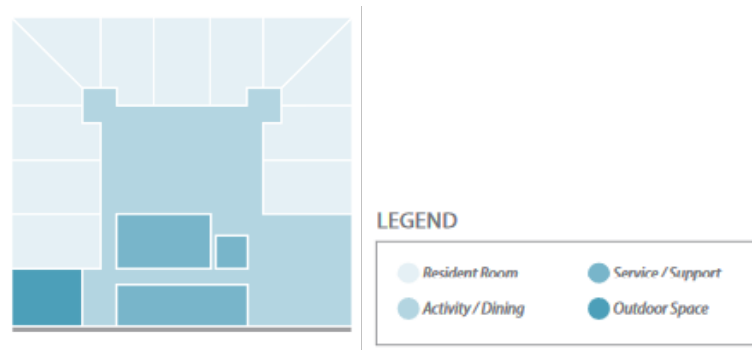
Figure 5: Long Wing Plan



Note: Long wing floor plans are commonly found in long-term care centers (from Wrublowky, 2017)

This floorplan layout allows differing housing unit clusters to open into one another to have larger shared spaces. This allows residents to socialize in larger groups and even have opportunities to participate in large clubs and activities. As a result of its linear nature, there is an opportunity to maximize sunlight from the south and have direct views of outdoor spaces (Wrublowky, 2017). Residents with severe dementia had higher wayfinding abilities in units with straight circulation systems. (Chaudhury et al., 2018)

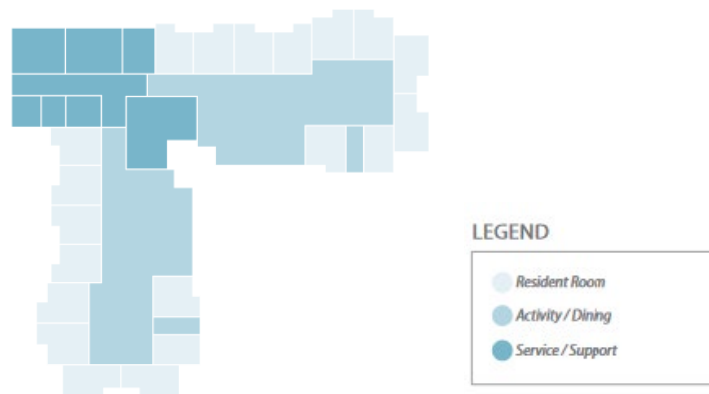
Figure 6: Square Plan



*Note: Square floor plans are commonly found in long-term care centers (from Wrublowky, 2017)*

According to Robert Wroblewski’s memory care guide, a square plan relates to a townhome model. This plan has a practical layout regarding socialization spaces and increased wayfinding abilities due to the central core. The drawbacks of this design layout are the minimal space for natural light and windows pushing social spaces toward the interior and core of the building (Wrublowky, 2017).

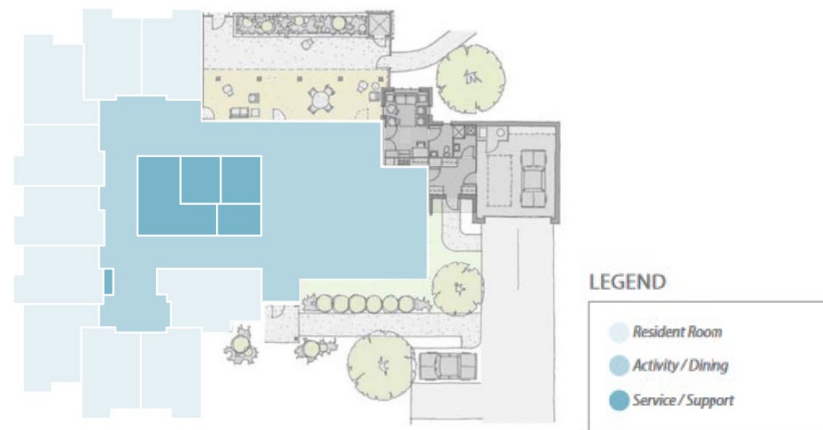
Figure 7: L-plan



*Note: L-Plan commonly found in long-term care centers (from Wrublowky, 2017)*

Robert Wroblewski’s memory care guide states that an L-plan benefits larger-scale projects with 100 patients. This layout creates a private, secure courtyard with sightlines from both household clusters' interiors. There are various areas for socialization spaces in the central common core and the ability to open the connection point between two home clusters (Wrublowky, 2017).

Figure 8: Traditional Plan



*Note: Traditional floor plan commonly found in long-term care centers (from Wrublowky, 2017)*

This floorplan layout resembles a traditional family residence where the sleeping areas are on one side of the facility and the activity areas, such as living quarters, are on the other. The negative aspects or drawbacks of these layouts are those with higher advancements in the disease struggling with navigation and wayfinding (Wrublowky, 2017). Countless sources have gone into what spaces should be included in these layouts besides areas for sleeping and eating and the correlation between the positive results of introducing them.

### **2.1.2. Interiors Design**

It is imperative to utilize design elements that are dementia friendly, especially when it relates to the interior design of these memory care facilities. It is essential to consider patterns, textures, and colors to suit better the cognitive impairments accompanying the disorder. Numerous studies have proven flooring patterns with harsh, busy patterns can have detrimental impacts; dementia patients may feel unsteady, which creates a sense of sensory overload. This sensation is also apparent when two harsh flooring patterns meet; there is a heightened sense of agitation (Parrish, 2016). To aid in perception when picking furnishings for flooring, wall, and ceiling colors, there should also be a stark contrast to help patients differentiate. Design

guidelines also illustrate the significant research behind choosing lighter flooring, as darker colors are more challenging for dementia patients to decipher depth and decrease residents' overall desire to keep moving. It is also crucial to use materials that are easy to clean, as these medical institutions have high cleaning standards (Busch, 2022).

### **2.1.3. Amenities**

There is extensive research on the positive effects of giving dementia patients amenities to choose from every day. When residents of typical memory care facilities have no daily activities that push them physically or cognitively, they stay sedentary, furthering their risk of health decline because their self-care skills are not in use (*Towards Human-Centered General Hospitals*, 2021). Whether it is differing daily activities or supplying varying sizes of seating areas for differing amounts of socialization groups, both lower anxiety and increase overall health and happiness (Chaudhury et al., 2018; Chrysikou et al., 2018; Golembiewski & Zeisel, 2022b; Wrublowsky, 2017). Group conversations in shared living spaces, reading, listening to music, water plants, and areas where they can get groceries and get their hair done are activities that remind them of home (Wrublowsky, 2017).

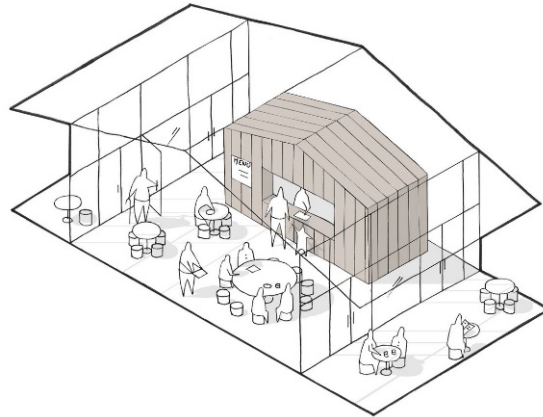
Figure 9: Grocery Store



*Note: Grocery stores as an amenity common in dementia villages to keep an active healthy lifestyle (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

These cognitive abilities in carrying conversations and physically demanding activities are at the forefront of independence. As a result, patients must maintain these capabilities as long as possible to prevent cognitive decline. These declines have been proven to exacerbate the daily risks of those with chronic disorders, limiting the self-sufficient living they once had (Burzynska & Malinin, 2017). Exposure to these stimulating environments and enriched activities has proven to maintain residents' cognitive abilities and decrease wandering (Wrublowky, 2017). Studies indicate that these cognitive interventions mixed with exercise have had a long-lasting positive impact on mental and physical health in aging (Bamidis et al., 2015). Giving residents choices on daily activities showcases their cognitive and physical capabilities instead of focusing on the disability effects of Alzheimer's. These options create a sense of residents living in a city over patients coinciding in a medical institution (Chrysikou et al., 2018). Today, research shows that common spaces inside memory care facilities that create a sense of home for residents are hair salons, restaurants, shops, hobby rooms, and theaters. Spaces outdoors consist of gardens, socialization spaces, and small animal farms (Chaudhury et al., 2018; Chrysikou et al., 2018; Golembiewski & Zeisel, 2022b; Wrublowky, 2017).

Figure 10: Cafe



*Note: A Café is an amenity common in dementia villages to keep an active healthy lifestyle (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

Choosing and completing these daily endeavors returns to maintaining their sense of self (Golembiewski & Zeisel, 2022b). These activities also diminish the sense of boredom and encourage a sense of contribution and accomplishment (Wrublowky, 2017).

## 2.2. Salutogenic Design

“Salutogenesis is a theory of health focused on strengthening the forces that support life and engagement, rather than on preventing or treating disease” (Golembiewski & Zeisel, 2022b). The basis of this design strategy originated from the theory of salutogenesis, which was developed by medical sociologist Aaron Antonovsky in 1979. His theory was based on promoting restorative environments by increasing the wellness factor in healthcare design (Abdelaal & Soebarto, 2019). Antonovsky believed the healthcare system we have in place today could best be described as the disease care system; or sick care because their main focus was solely on understanding and treating illnesses (Fries, 2020). The salutogenic design intends to maximize all available resources to manage cognitive, physical, and other age-related declines. Proactively strengthening these declines propels a person’s sense of coherence, creating a more engaging life that is thus self-filling. Salutogenesis improves a person’s resilience and capacity

to engage in everyday activities (Golembiewski & Zeisel, 2022b). Alzheimer's is a chronic disease, so with salutogenic design, the goal is to establish a long, fulfilling, active, healthy lifestyle that also targets and curates health management (Mazuch, 2017). A salutogenic approach considers the complexity of human health and focuses on understanding the factors that promote healing and well-being. A pathogenic approach, which is more common in Western medical ideology, is centered around understanding the causes and consequences of the disease (Abdelaal & Soebarto, 2019). The precedent medical model of care is switching to this person-centered approach. The approach emphasizes each resident's wants and needs as the main priority of the care (Mileski et al., 2018). The sole focus of this new support-based approach is to emphasize the potential of the person and the capacities and preferences of their choice (Quirke et al., 2023). A factor of the pathogenic biomedical approach is that it tends to become one disease, one cure, meaning that everyone with the same disease will get the same treatment and react the same to it. This Western belief does not consider the complexity of human wellness and health (Fries, 2020). In contrast, a person-centered approach considers residents' diversity, life experiences, and identity in the care (Quirke et al., 2023). Traditional medical care tends to put more time, money, and research into temporary treatments in a repair shop than a system focused on fostering health (McQueen et al., 2007). The critical spaces in a salutogenic building are spaces for diagnosis, treatment healing, and general well-being (Mazuch, 2017). Having spaces for staff and residents to socialize or relax supports health and well-being, increasing productivity and profitability (Chrysikou et al., 2018). A salutogenic design of the built environment pushes residents to make sense of their situations and supports them in their everyday activities, promoting a sense of coherence (Kuliga et al., 2021). Researching the causes of disease and treatment is imperative. However, looking into other ways to promote a healthy

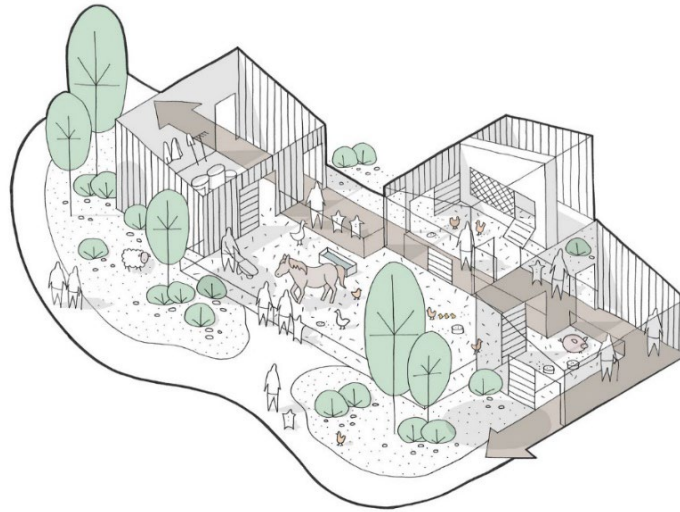
lifestyle, especially in those with chronic diseases, is crucial to maintaining a fulfilling life. A person-centered salutogenic design is not a treatment for Alzheimer's; it is an ideology that promotes a healthy, active lifestyle (Chrysikou et al., 2018).

### **2.2.1. Three Domains of Salutogenesis in Healthcare Design**

According to Abdelaal and Soebarto in their architectural science review, architecture that uses salutogenic design promotes well-being focused on the correlation between health and coping and using design tools that reduce stress from daily activities. There are three main domains of health promotion: compensability, which is compromising and negotiating life challenges; manageability, which is learning to manage daily physical realities; and meaningfulness, which is embracing life. All three are used based on the salutogenic design (Abdelaal & Soebarto, 2019). Salutogenic spaces that promote healthy healing by using comprehensibility can consist of standard rooms for socialization or providing group activities like gardening or feeding pets (Andrade et al., 2017).



Figure 11: Miniature Farm



*Note: Miniature farm is an amenity common in dementia villages to keep an active healthy lifestyle (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

These spaces and activities create a sense of contribution and active participation in a socially enriched activity, thus furthering their healing journey (Andrade et al., 2017). Architectural applications for manageability include having more private resident rooms and fewer centralized nursing stations, fostering a sensation of independence and security in the residents (Andrade et al., 2016). The last design element of meaningfulness can be represented in residential home design settings and provides spiritual spaces that promote a sensation of belonging and meaning in one's life (McCaffrey & Liehr, 2016). Using these three domains as an outline in design can significantly impact residents' physical and mental health (Abdelaal & Soebarto, 2019). Using these salutogenic ideologies, there is a higher focus on supporting the daily changes with the progress of chronic disease and bringing fullness into their life (*Towards Human-Centered General Hospitals*, 2021).

## **2.3. Spatial Orientation Design – Place Knowing**

### **2.3.1. Wandering**

According to the Alzheimer’s Association, wandering is one of the earliest and most problematic side effects of alzheimer’s (Davis & Weisbeck, 2016). It occurs when people with dementia lose track of their location and do not know where to go next; frustration increases, creating behavioral outbreaks. These outbreaks and loss of place attachment put residents and caregivers in a dangerous or even life-threatening environment. 6 in 10 dementia patients will wander in their lives, and some become frequent wanders and are put at high risk (“2023 Alzheimer’s Disease Facts and Figures,” 2023). Wandering can not only be dangerous or life-threatening, but it also creates stressful environments for caregivers, patients, and family members. Residents should also be in environments that are not overstimulating, create confusion, or cause disorientation (*Wandering*, 2023). Wandering may even respond to a bleak and tiring environment when residents desire physical activity and stimulation (Wrublowsky, 2017). To prevent unsecured wandering, residents need to be constantly engaged in new activities that are meaningful and give them structure (Golembiewski & Zeisel, 2022b; *Wandering*, 2023; Wrublowsky, 2017). A key focus in designing memory care facilities for those with memory loss to prevent wandering is using wayfinding cues to help residents independently navigate the facility (Kuliga et al., 2021). When these ideologies are applied, residents confidently walk with a purpose rather than wandering (Golembiewski & Zeisel, 2022a).

### **2.3.2. Wayfinding**

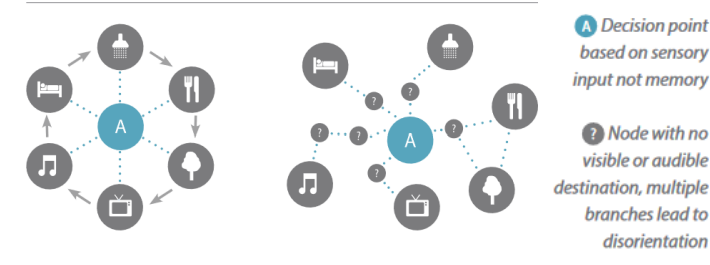
The ability to find one way in the world, known as wayfinding, is impaired in a person with alzheimer’s. Human navigation consists of two operations: wayfinding and locomotion. Wayfinding is a cognitive problem-solving method for deciding the next steps while navigating,

whereas locomotion is understanding obstacles and how to move through a space. Dementia patients face challenges in the pace at which they process the information and the speed at which they move (Kuliga et al., 2021). Wayfinding is crucial for those with dementia, considering they have a heightened sense of panic and distress, causing exorbitant behavioral breakouts when confused while navigating (Davis & Weisbeck, 2016). Principal factors for wayfinding consist of decreasing decision points, using landmarks or nodes, and using place attachments. Various studies prove that having colorful, familiar, personal, and meaningful cues and decreasing decision points can facilitate resident navigation to and from their rooms. Differences in color, texture, lighting, and door structural features help residents distinguish their rooms (Davis & Weisbeck, 2016). Without wayfinding cues, patients decrease their daily independence, decreasing function, self-dignity, and even health (Kuliga et al., 2021).

### ***2.3.2.1. Decision Points***

Decision points are a crucial component to consider when designing a memory care facility. They are at the end of hallways that branch into two different hallways. This forces patients to decide which route to take, creating a sense of discomfort and mental overload (Kuliga et al., 2021). At these points, there should be defining features to help those with memory disorders distinguish their next step. Decision points and long corridors should be avoided as much as possible throughout the design. However, if present, an explicit node should be displayed as an indication or a lounge space where they can sit to take a break (Wrublowky, 2017).

Figure 12: Decision Points

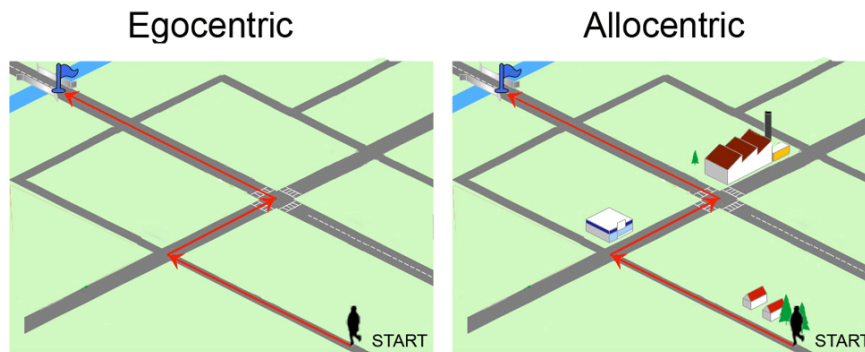


*Note: This graphic shows the comparison of having no decision points versus having those decisions needed between the main activities throughout the day (from Wrublowsky, 2017)*

### **2.3.2.2. Spatial Reference Frame using landmarks and nodes.**

According to Miniaci and Lenonibus, the Spatial Reference Frame is imperative in the cognitive function of wayfinding. Throughout navigation, we use our spatial reference frame to distinguish locations and directions in intricate environments using egocentric and allocentric systems. Egocentric is subject-centered, where those use the body as reference points, harnessing the posterior parietal cortex part of the brain. In comparison, allocentric is object-centered and uses landmarks as visual clues, employing our hippocampus and parahippocampal cortex. Egocentric orientation occurs without visual cues. It is associated with the vestibular and proprioceptive cues generated during locomotion, so residents keep track of relevant positions compared to their starting point. Even though those with memory loss disorders have a reduction in areas of the brain involved in egocentric information processing, egocentric spatial navigation is maintained as one ages. Using egocentric spatial navigation is imperative to navigation in memory care. Key points that facilitate this concept are landmarks and nodes throughout the design (Miniaci & De Leonibus, 2018).

Figure 13: Egocentric vs Allocentric Reference Frame



*Note: This graphic shows the comparison of egocentric with no landmarks versus allocentric with landmarks to assist in wayfinding (from Miniaci & De Leonibus, 2018)*

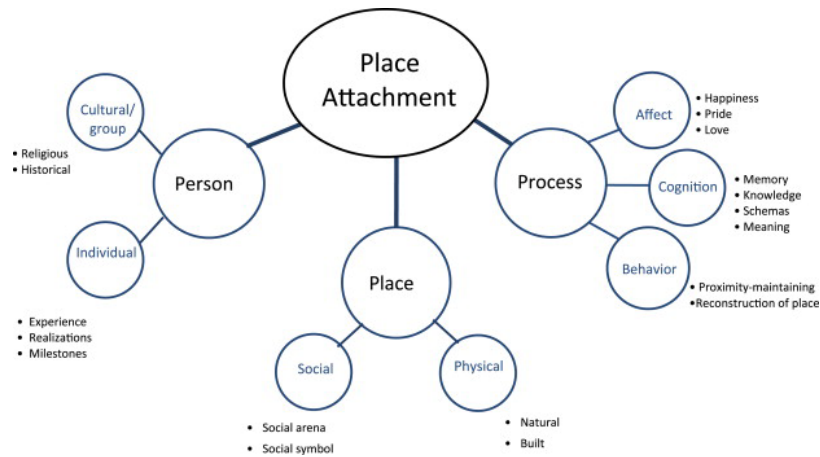
Landmarks and nodes can be architectural elements, furniture, or pictures that are either personable or abstract and fit the residential style most research signifies (Wrublowsky, 2017). Districts are standard space interiors that communicate specific activities, using landmarks they can convey and reinforce their intended use (Golembiewski & Zeisel, 2022b). Concealing doors and areas that residents cannot enter is equally significant to showcasing nodes and landmarks. While navigating, residents may get lost they may try to open a door that is locked, creating frustration and even a behavior eruption when not able to enter (Burzynska & Malinin, 2017; Golembiewski & Zeisel, 2022b; Wrublowsky, 2017). When architectural nodes and landmarks have been used to their full potential, support is needed, and using signage and symbols is an effective way to provide spatial cues (Quirke et al., 2023).

### **2.3.2.3. Place Attachment**

Place attachment is the bonding between people and their environments they find meaningful (Scannell & Gifford, 2010). This sense encompasses who we are, where we live and work, and what matters to us. This ideation also communicates to others a sense of who we are

(Golembiewski & Zeisel, 2022b). Place attachment can also be at varying levels, from group settings such as churches to idealized connections to a place where people may have completed a significant milestone (Scannell & Gifford, 2010).

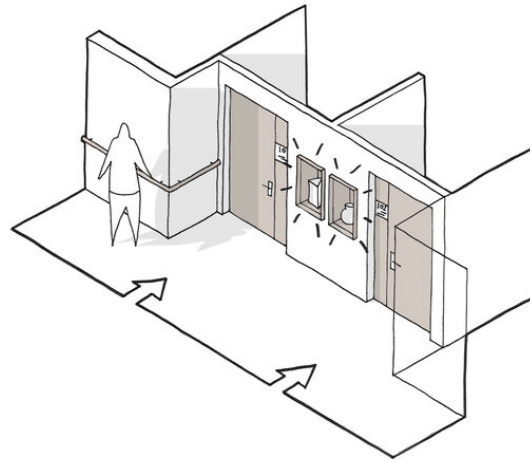
Figure 14: Tripartite Model of Place Attachment



*Note: This graphic shows the relationship of place attachment of people, place, and process which assists in wayfinding (from Scannell & Gifford, 2010).*

There becomes a heightened sense of safety when residents have attachments to items (Scannell & Gifford, 2010). This ideology can aid in wayfinding cues and nodes; using these personal mementos supports memory recollection and increases our sense of self. These personable keepsakes help recall people and memories from home, ranging from pictures of themselves and family to artworks they made or collected. Meaningful nodes convey the impression that residents are in a specific place and are viable passing stations while gingerly getting to their destination. Applying meaningful nodes and landmarks outside doors to patients’ rooms, such as memory boxes or pictures of patients when they were younger, facilitates wayfinding (Golembiewski & Zeisel, 2022b).

Figure 15: Memory Boxes



*Note: Figure shows how to incorporate memory boxes into a memory care facility to assist in wayfinding (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

Bringing in the furniture they had in their homes anchors memories and recalled relationships with family and friends, eliciting that sense of self and personal belonging (Burzynska & Malinin, 2017). Residents are more likely to adapt to their new homes using these familiar objects.

## 2.4. Behavioral Design

### 2.4.1. Anxiety and Stigma Behind Dementia

“The words used about people living with dementia, such as ‘sufferers,’ ‘senile,’ or ‘demented,’ have impacted how dementia is perceived. Not only can this type of language have a dehumanizing effect on individuals living with dementia, but it can also add to stigma, contribute to fear of the condition, reinforce outdated stereotypes, and affect how people living with the condition are treated in the community” (Quirke et al., 2023, p. 2).

Dementia is a misunderstood disease, leading to stereotypes, mistreatment of patients, and stigmatization. Patients' primary focus after diagnosis is a fixation on the fact that there is no

cure and how both cognitive and physical declines are prevalent and unceasing until passing. When those diagnosed with dementia focus solely on the decline of the disease, there is an increase in discomfort, premature institutionalization, self-isolation, and more significant distress on caregivers and families, resulting in increased hospitalization stays and overall cost of care (Riley et al., 2014). Stigma is a result of misinformation and old assumptions that dementia symptoms consist of behavioral outbreaks when the behavioral outbreaks are a result of the inability to communicate their thoughts and feelings as well as their diminished sense of choice and control (Quirke et al., 2023). These neurological changes in the brain harm their ability to recall information and express their personality and feelings like they once could (Riley et al., 2014). These symptoms directly affect their cognitive and physical health, resulting in more significant functional impairments, insecurity, and low self-concept (Wadsworth et al., 2012). This low self-concept and high anxiety trigger patients' concerns about how others see them and ignite a sense of rejection, resulting in increased isolation. Residents avoid group situations or any unfamiliar activities they once may have enjoyed. Dementia patients' anxiety can also be triggered by noisy, chaotic environments, trouble wayfinding, changes in the environment, and the inability to communicate. Anxiety in dementia patients can be severe and have debilitating results on health and quality of life (Riley et al., 2014).

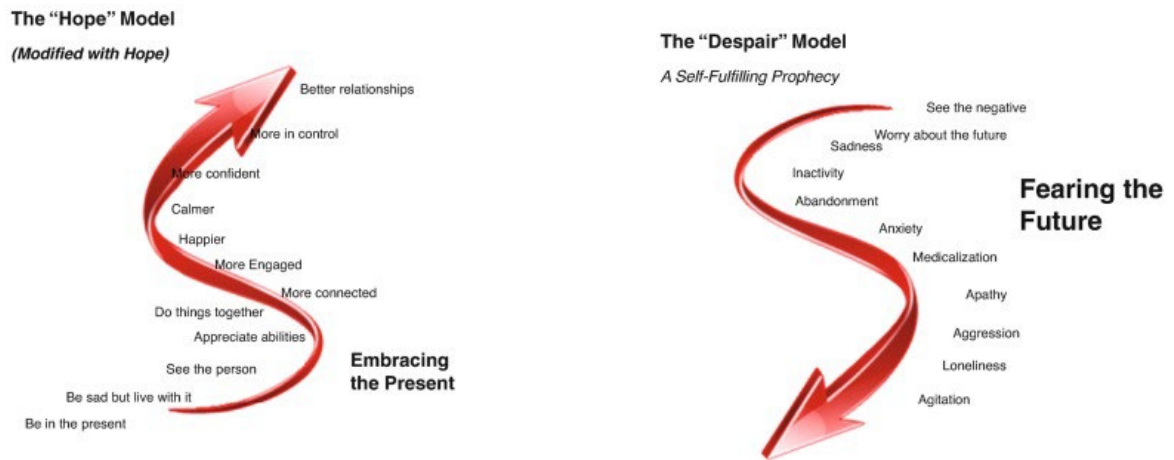
#### ***2.4.1.1. Zeisel's Hope Versus Despair Model***

Zeisel's hope versus despair model is prevalent in Golembiewski and Zeisel's salutogenic approaches to dementia care. The model is based on praxis-based empirical evidence accumulated over several years. The significant stigma behind dementia and the losses that are associated with it has created a narrative of giving up hope because there is no cure. The model



associates the health benefits of maintaining hope when diagnosed with dementia versus the correlation of the decline of despair most collapse into when diagnosed.

Figure 16: Zeisel’s Hope versus Despair Model



*Note: Figure shows the correlation between Zeisel’s hope versus despair mode and their corresponding feeling and associations with each (from Golembiewski & Zeisel, 2022b)*

A positive outlook on what one can still do after diagnosis maintains life’s meaningfulness. This meaningfulness to live fosters the drive to be present, stay engaged, and be creative. There is a value for dementia patients to push themselves in these physical and cognitive realms to slow disease progression. Optimistic looks combined with an engaging architectural design that fits patients’ needs can elicit behavioral reactions to heighten the healing (Golembiewski & Zeisel, 2022b).

#### 2.4.2. Stimulation

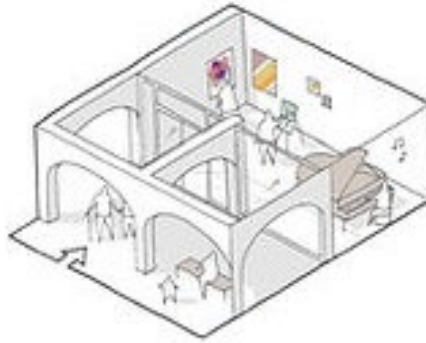
Overstimulation, as well as understimulation, can have adverse effects on dementia patients, given how sensitive they are to the environment around them. Studies show that eating in a noisy, large environment correlates to less food intake (Wrublowksy, 2017). Those with dementia or alzheimer’s tend to enjoy scheduled activities. As a result, to prevent overstimulation and change, various memory care facilities use weekly scheduled activities to

give residents structure throughout the week (Riley et al., 2014). According to Robert Wroblewski's memory care guide, both visual clutter and audio clutter can have detrimental impacts on the responsive behaviors and anxiety levels of dementia patients. For dementia patients, ignoring unwanted stimuli becomes more difficult as they progress. It is imperative to keep busy entryways or high-traffic circulation areas out of the view of residents. Limiting the number of doors that enter socialization spaces is also a key factor, thus minimizing the number of new stimuli entering their space. These long hallways and doorways that open for medical carts, devices, and nursing stations should be centralized in the facilities to shorten the travel distance, limiting the amount that patients see these medical devices to make the environment have more of a residential sense (Wrublowky, 2017). Audio levels can trigger anxiety in residents when they are too overbearing causing overstimulating, as well as decreasing the desire for residents to have engaging conversations with one another (Quirke et al., 2023). An audio level of 50-55 dB has been found to calm residents and keep minds active. To achieve this level, providing residents with music they listen to as young adults has also shown calming effects. This provides the perfect amount of background noise to overpower the typical medical institution noises of beeping medical devices that may cause responsive behaviors. These audio levels decrease anxiety, therefore increasing their drive for social interactions. Both physical and visual clutter have detrimental impacts on the anxiety levels of residents. To prevent overstimulation in both categories, socialization sizes should be gradually increased, from residents' rooms to main socialization spaces such as kitchens and living rooms (Wrublowky, 2017). Non-pharmacological interventions such as various stimulation exercises and therapies have been shown to provide a reduction in behavioral symptoms of dementia (Mileski et al., 2018).

#### ***2.4.2.1. Sensory Stimulation and Therapies***

Research has shown that older patients have a reduced acuity to their senses, putting them at risk of sensory deprivation (Jakob & Collier, 2017). Sensory stimulation can be reinforced in the exterior of a building in the landscape design. This stimulus can be introduced for those who are visually impaired, with raised garden beds filled with plantings of different sizes, colors, and textures. This visual stimulation also allowed patients to touch and feel the plantings placed in raised garden beds. There are also opportunities to use planning that emits strong scents at different areas of the village as markers to help promote memory recall. Sensorial activities such as music therapy have had proven results and admired responses from residents. The brain is malleable, so introducing music can stimulate new brain connections (Moreno-Morales et al., 2020). Several studies have shown that as dementia patients progress, their ability to respond to music is preserved even when verbal communication is lost. Taking these studies into account, music therapy can provide more research on how it affects brain function and its effects to improve speech, memory, attention, and learning (Moreno-Morales et al., 2020). Listening to music also has behavioral effects, providing a sense of pleasure, favorable responses, and a calming effect on residents (Strøm et al., 2016). Therapeutic sounds such as relaxing music, bird noises, or water features can mask unwanted noises and allow residents to communicate unclouded.

Figure 17: Music Therapy



*Note: Music Therapy is an amenity common in dementia villages to keep an active minds (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

Lighting in these memory care facilities also significantly affects recovery rates and overall health. Studies have concluded that varying light levels and light therapies have been shown to facilitate the body's natural circadian rhythms (Peters & Verderber, 2022). The tone and temperature of natural light positively impact overall health and well-being, and these memory care facilities have started mimicking the daylighting temperature in buildings to reduce agitated behavior and nighttime unrest (Quirke et al., 2023). Completing therapies for dementia patients can reduce the risk of stimuli deprivation as well as lower stress rates. They also assist in improving patients' functional levels, quality of life, and overall satisfaction levels (Gonzalez & Kirkevold, 2014).

#### **2.4.2.2. Sundowning**

Sundowning is a behavior response prevalent in dementia patients; it occurs in the evenings when the sun sets, typically when people leave work to go home and make dinner or have plans with friends (Riley et al., 2014). During this time, there is increased confusion and heightened anxiety symptoms like pacing or wandering. Residents become agitated and confused; one way to decrease sundowning is to complete activities or eat to distract them and avoid responsive behaviors (Tips for Coping with Sundowning, 2017).

## **2.5. Biophilia**

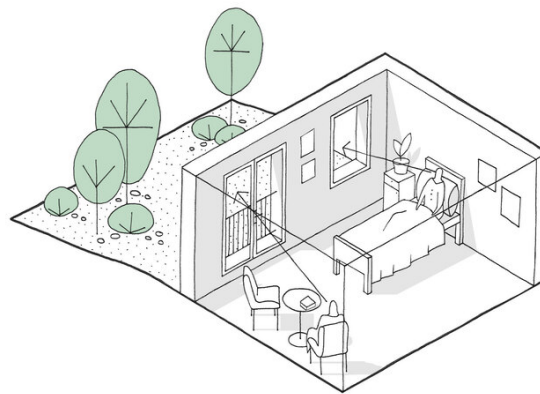
### **2.5.1. Biophilia for elders with dementia**

“Biophilia is defined as people’s innate affinity to other forms of life and the natural world” (Peters and Verderber, 2022, p. 228). Integrating these design strategies into healthcare facilities creates a restorative environment and pushes humans' natural association with nature. As well as creating a healing environment that drives the repair and renewal of the body's well-being and healing (Abdelaal & Soebarto, 2019). Various studies imply the importance of health and well-being to time spent outside, having views of nature, or hearing it. There is a correlation between this exposure and the number of positive effects on residents’ behavior, mood, circadian and melatonin cycle, and overall human physiology (Quirke et al., 2023). The ideology pushed recent research to dive into the relationship between these natural elements and their effects on health. These studies showed a faster recovery rate, reduced medication dependency, and decreased stress for caregivers and family members (Abdelaal & Soebarto, 2019). Introducing these natural elements has also increased a person's sense of coherence, or ability to figure out and control a situation with external and internal resources. This is imperative for dementia patients as they have a low sense of coherence; thus, including these environments can improve their sense of coherence and assist when patients experience these daily stressors (Abdelaal & Soebarto, 2019). Various scientists believe spending time in nature is the most impactful activity to promote cognitive performance (Burzynska & Malinin, 2017). Residents' ability to go outside also assists in recalling the time of day and seasons (Golembiewski & Zeisel, 2022b). Dementia patients having the choice to be in a sensory-stimulating environment has been reported to have considerable physical and cognitive benefits (Gonzalez & Kirkevold, 2014).

### 2.5.2. Visual connection with nature

Viewing nature has been proven to reduce respiration rates, heart rates, and blood pressure. Exposure to sunlight in the mornings has also been shown to decrease depression in residents as well as the average length of hospital stays. This is prevalent because of the correlation between those diagnosed with dementia and their anxiety and depression rates (Mazuch, 2017).

Figure 18: Views of Nature



*Note: Figure shows having views on nature in patients' rooms, as a biophilic design strategy (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

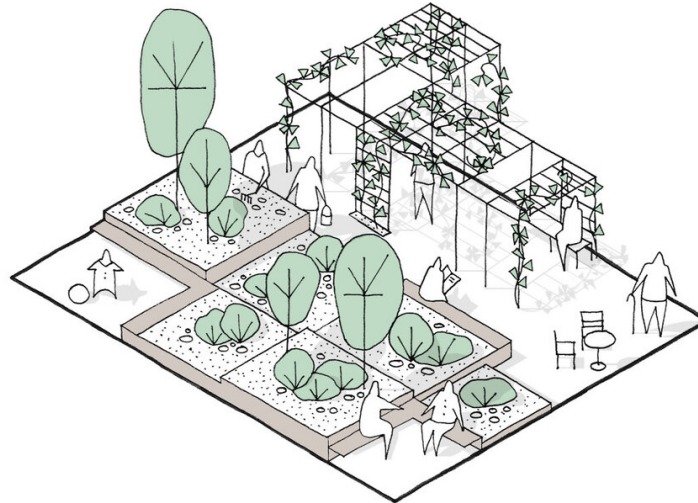
Studies have shown that the psychological effects of outdoor environments contribute to reduced sensory deprivation and increased overall well-being. Being in natural light relates to light exposure therapies in these memory care homes. The availability of natural light has shown detrimental impacts on circadian rhythms and preventing sleep disturbances (Gonzalez & Kirkevold, 2014).

### 2.5.3. Therapy Sensory Gardens

Being outdoors creates a multisensory enrichment environment that constrains passive and active expeditions. Gardens for dementia patients provide a stimulating yet therapeutic environment that doubles as a social activity. These gardens and outdoor spaces are filled with

paths that give dementia patients the ability to wander in a safe and secure area (Gonzalez & Kirkevold, 2014).

Figure 19: Outdoor Garden



*Note: Outdoor gardens are an amenity common in dementia villages to keep active minds and bodies (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

When these spaces are secure, dementia patients feel the drive to venture into these spaces alone, promoting a sense of independence and fulfillment when working in the garden. Spending time outdoors working in a garden relates to salutogenic ideology, pushing residents to use the physical abilities they can still complete and be in group settings that promote socialization (Golembiewski & Zeisel, 2022b).

## 2.6. Gap Identification

Today, no memory care facility in America uses a salutogenic patient-centered approach with an emphasis on this dementia village standard that is prevalent in Europe. This topology of care facility that combines all the research above, thus pushing patients both cognitively and physically to showcase the abilities they still have today, has not been demonstrated in the

United States today. Dementia memory care facilities of this nature need to be at the forefront of care facilities in America to replace the institutional model that reigns supreme today.

## **2.7. Typology**

### **2.7.1. Memory Care Center**

A memory care center is a long-term living community with a residential style design with around-the-clock personal care focused on memory impairments and cognitive conditions. This style of medical facility provides a safe and caring environment with personal care dedicated to assisting residents with everyday activities of daily living such as dressing and bathing. Memory loss disorders look different to each patient, so memory care centers provide resident-specific plans depending on disease progress and their specific symptoms. These centers do not provide the high-level medical care that a typical hospital would deliver; instead, they resemble assisted living facilities. Assisted living facilities typically assist in ADLs, consisting of specialized activity programming, meal preparation, and emergency monitoring (*What Is Memory Care and How Much Should It Cost?*, 2023). These memory care centers that provide residential-style interiors have proven in various research studies the correlation between a positive quality of life and overall well-being among residents (Burzynska & Malinin, 2017; Golembiewski & Zeisel, 2022b; Wrublowsky, 2017). In these residential-style memory care centers, there is a focus on creating a safe and familiar schedule and increasing socialization. The residential-style layout of spaces gives residents cues on the appropriate behavior and activities in each space (*Designing for Memory Care | Health Facilities Management*, 2017). The main drive of these facilities is to push to embrace the physical and cognitive functions residents can still complete versus the standard medical facilities, which focus on restricting them. Caregivers in these memory care facilities have specialized training to assist memory loss patients and



provide patient-centered care emphasizing behavioral care and collaborative care planning. (*What Is Memory Care and How Much Should It Cost?*, 2023) These facilities use the physical environment to promote and improve cognitive function and decrease the number of medications needed and taken by residents. (Wrublowsky, 2017)

### **2.7.2. Dementia Villages**

A dementia village concept is a care center with a large campus footprint to mimic a smaller city or village, with the care centers acting like home clusters to mimic a neighborhood. These clusters are connected via pathways and trails that meander across the campus. Typically, the clusters open to a central community hub. Nature is a critical factor in this village concept, containing spaces for independent walking and navigation and various views of nature and water from all cluster areas. This smaller concept focuses on more privacy in patients' rooms and increased socialization spaces and daily activity options. From an architectural standpoint, this approach fosters an autonomous living environment. Security in this building typology relies on the built environment layout, staff, and volunteers to help mobility. These home clusters promote interactions and communal activities to improve cognitive function and the drive for social interactions. The dementia village concept serves as the foundational framework for the small household model.

## **2.8. Project Issues**

There needs to be a new standard for memory care centers with a salutogenic basis and a biophilic focus as an alternative healing method for chronic disease. There is no cure for memory loss disorders, so providing a built environment that better suits conditions and symptoms, alleviates behavioral outbreaks, and assists in wayfinding techniques improves overall well-being. Providing more spaces for socialization and activities over more medical devices.

### **3. METHODOLOGY**

#### **3.1. Approach**

To better understand the European model of dementia care, research on completed case studies was found imperative. Combining the new knowledge with the previously acquired insights from the literature review to obtain information on memory care facilities.

##### **3.1.1. Data Collection**

Resources that proved helpful during the research phase included utilizing the NDSU Architecture Library online database and the Klai Library. The Alzheimer's Association website supplied facts and figures as a baseline for understanding the disease and its impacts in each state. Census data was also examined during the site selection to show growth and population densities.

##### **3.1.2. Analysis**

While exploring case studies that are already established and operating projects, there are various avenues to examine and draw conclusions from. The main points that were of focus included the following design choices and their design-related effects:

Distinguishing characteristics

Program Analysis

Social Effects

Site Analysis

Research findings

Taking these identified design viewpoints into account while reviewing the following case studies. These design choices and their results will serve as guidelines during the design

development stage of my thesis. The following case studies were chosen as a result of their typology, size, and overall comprehensive design:

Alliade Meriant

Carpe Diem Dementia Village

Hogeweyk Dementia Village

### **3.1.3. Conclusion**

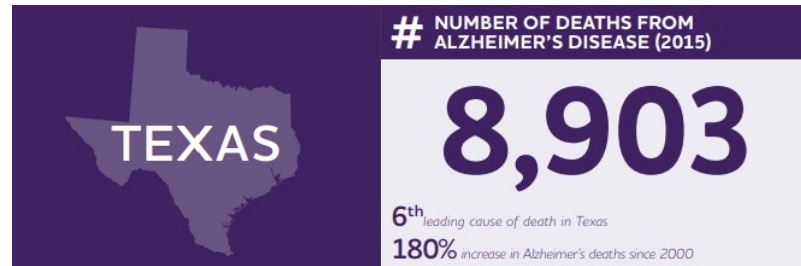
Overall research into the design-related choices regarding memory care varies from behavioral design to biophilic to salutogenic design. This research provided a baseline into the typology of a project. At the same time, case studies examined implemented design characteristics of site and floorplans, showing corresponding effects on behavior and overall well-being responses.

## **3.2. Texas – Project Location**

Over 3,874,000 people in Texas are 65 years old and older. This is partly due to the state's large area but also the lower cost of living and a warmer climate. Homes and land are cheaper in Texas, so it is easier for retirees to move and live without having the steady income they once had (*Which U.S. States Have the Oldest Populations?*, 2021). Texas has been shown to have one of the highest rates of Alzheimer's disease in the United States, over 400,000 Texans are currently living with it. In Texas, it is the sixth leading cause of death, and the mortality rate is 34.8%. There is also a need for these types of facilities, the estimated percentage jump of geriatricians from 2021 was 333 to the now projected number needed in 2050 to serve 30% of those 65 years old and older need to increase by 1031%. The projected job growth of caregivers from 2020 to 2030 is 30.5%. Texas also has a more extensive diversity index with a larger black and Hispanic population. Studies have shown that 14% of Hispanics and 19% of blacks have

been diagnosed with alzheimer's over the average 10% of older white adults (“2023 Alzheimer’s Disease Facts and Figures,” 2023).

Figure 20: Alzheimer’s Disease in Texas Stats



*Note: Figure shows death rates of those diagnosed with alzheimer’s in Texas (from “2023 Alzheimer’s Disease Facts and Figures,” 2023)*

The National Institute on Aging finances various Research Centers, such as South Texas Alzheimers Disease Center and various State Universities that look into alzheimer’s disease diagnoses and treatments, and Texas is one of the 33 states that have one. The Texas facility was recently awarded 14.8 million dollars to understand better the disease and the risk factors prevalent in the early and midlife stages. These facilities offer specific volunteer programs to support the disease, provide various support group opportunities, and have resources to understand the disease better and bring awareness (*Alzheimer’s Disease Research Centers, 2023*). Texas is a hub for advanced geriatrics hospitals, possessing 3 of the top 40 best geriatrics hospitals in America for 2023. Texas has 2 of the top 45 hospitals for Orthopedics in the United States and 4 of the top 25 hospitals in the United States for rehabilitation (*Find the Right Hospital for You, 2023*).

Table 1: Projected Number of Americans with Alzheimer's

States	2020	2025	Percentage increase
California	690	840	12.7%
Florida	580	720	24.1%
<b>Texas</b>	<b>400</b>	<b>490</b>	<b>22.5%</b>
New York	410	460	12.2%
Illinois	230	260	13.0%

*Note: Projections of Total Numbers of Americans Aged 65 and Older with Alzheimer's or Dementia by State (modeled after "2023 Alzheimer's Disease Facts and Figures," 2023)*

Table 2: Number of Geriatricians

States	Number of Geriatricians in 2021	Number of Geriatricians needed to serve 10% of those 65 and older in 2050	Number of Geriatricians needed to serve 30% of those 65 and older in 2050
California	587	1,678	5,029
Florida	362	1,365	4,096
<b>Texas</b>	<b>333</b>	<b>490</b>	<b>3,766</b>
New York	568	818	2,454
Illinois	212	517	1,551

*Note: Number of Geriatricians in 2021 and Projected Number of Geriatricians Needed in 2050 by State (modeled after "2023 Alzheimer's Disease Facts and Figures," 2023)*

Table 3: Care Aide Job Growth

States	Projected Number Needed in 2020	Projected Number Needed in 2030	Percentage increase
California	766,000	985,800	28.7%
Florida	76,140	93,270	22.5%
<b>Texas</b>	<b>320,780</b>	<b>418,500</b>	<b>30.5%</b>
New York	32,360	40,750	25.9%
Illinois	99,460	118,600	19.2%

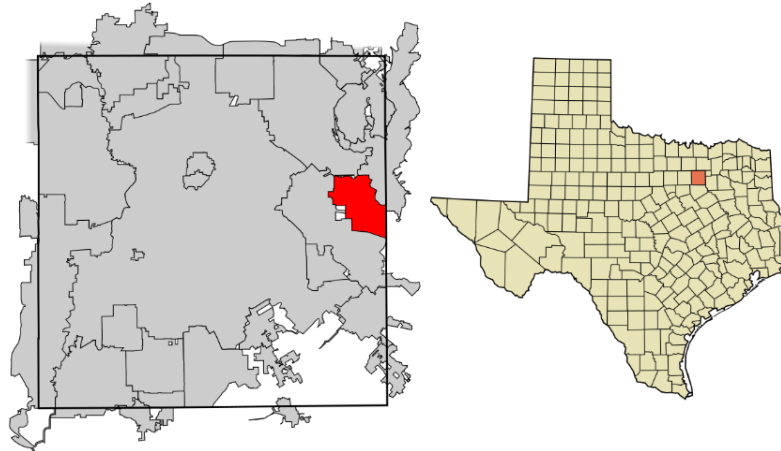
*Note: Expected Home Health and Personal Care Aide Job Growth, 2020-2030 (modeled after "2023 Alzheimer's Disease Facts and Figures," 2023)*

Located in the northeastern part of Texas is one of the state’s largest counties, Dallas County. Dallas County comprises 902 square miles and is the third-largest populated county in Texas and the ninth largest in America. Dallas County has 2.6 million residents compared to the Texas population of 29.53 million (*U.S. Census Bureau QuickFacts*, 2022). The county holds one of the largest American airports, a hub for transportation, and is also known as DFW Metroplex. The county has also become a hub for healthcare; it is home to world-renowned hospitals such as Baylor University Medical Center, Parkland Memorial, and UT Southwestern Medical Center (*Dallas County | Departments*, 2018). Approximately 12.6% of the estimated population in the Dallas area has Alzheimer’s disease, one of the highest counties in the state (Beheraj, 2023).

### 3.3. Sunnyvale

Sunnyvale, Texas, is located in the eastern part of Dallas County, 15 miles from the center of Dallas. Sunnyvale is a suburb of Dallas, Texas, with a population of 8,062, 16.54 square miles, or 10,745 total acres. Sunnyvale, Texas, is a relatively new community in eastern Dallas County. Initially, four different hamlets merged into Sunnyvale in 1953.

Figure 21: Sunnyvale, Texas



*Note: Figure shows Dallas County in Texas (right) and Sunnyvale Texas inside of Dallas County (left) (Town of Sunnyvale, TX - Official Website | Official Website, 2023)*

The city has over 2,400 housing units, with approximately 3.17 as an average household size. The population has had a steady increase every decade. In 2000, there were 2,228, increasing 20.9%; in 2010, there were 5,130 residents, which increased by 90.5% to 7,893 in 2020. Sunnyvale's racial composition as of 2020 consists of 49.67% white, 25.49% Asian, 10.15% African American, and 10.78% Hispanic (Bureau, 2023). Sunnyvale is home to a mix of mainly residential suburban neighborhoods to create a sense of rural life while still having proximity to the larger metropolitan area just 20 minutes away to the east. The west of the city borders the cities of Mesquite and Garland, which contain fine dining, shopping, and various entertainment spaces. East of the city are various bodies of water, such as Lake Hubbard, encompassed by rural farmlands of Kaufman County (*Town of Sunnyvale, TX - Official Website | Official Website, 2023*).

Figure 22: Sunnyvale Texas Satellite Image in 1963 vs 2023

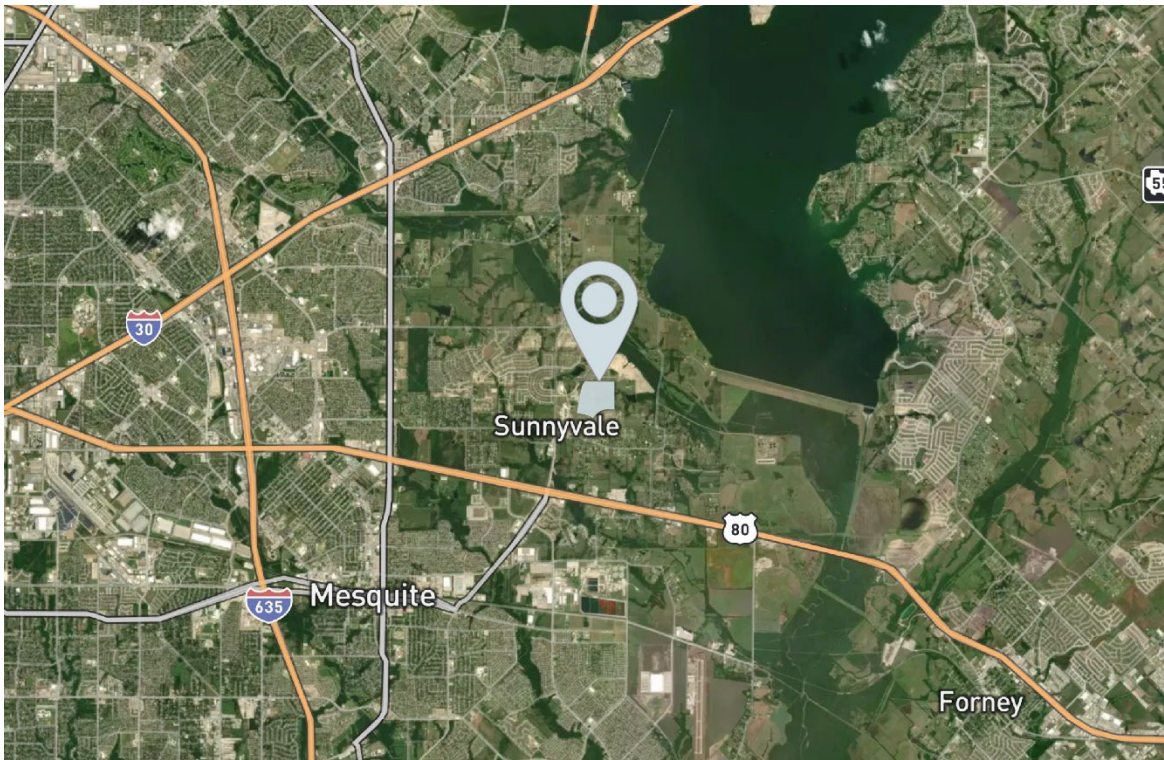


*Note: Figure shows the growth of Sunnyvale Texas from 1963 (left) to the present day (right) (NCTCOG Region: Now and Then, 2023)*



### 3.4. Specific Site

Figure 23: Site



*Note: Figure shows the site in relation to Sunnyvale and surrounding towns (Google Maps, 2023)*

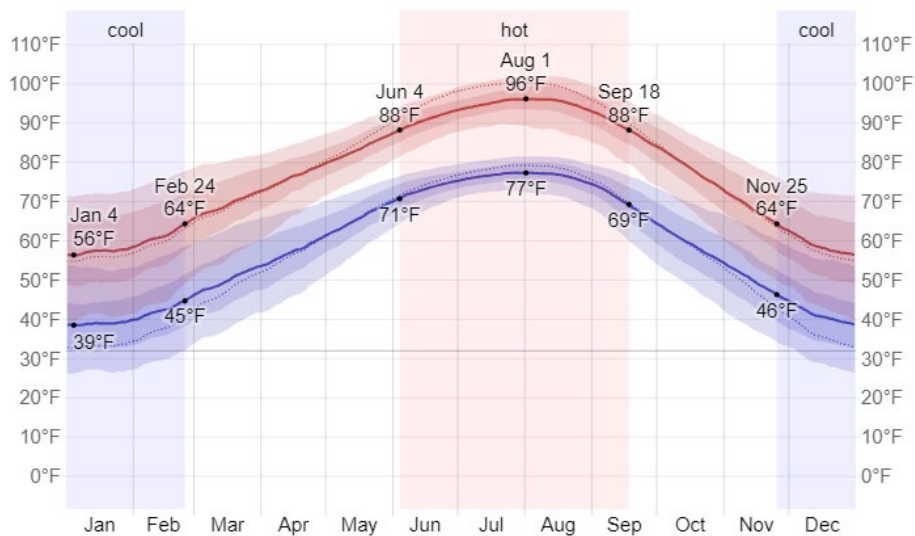
The project site is at 436 Nance Rd, Sunnyvale, TX 75182. The site is between the town's school systems to the west and encompasses residential neighborhoods north and south. The east consists of an open landscape with a small artificial lake. The site contains roughly 4,819,00 square feet of site spaces or 110.64 acres. The site has little to no topography change; it is relatively flat and open. This large site was chosen as a result of the vast area for the dementia home clusters and giving space for parking, meandering trails, landscaping, and areas for outdoor activities. The site is far enough from the highway to be secluded and quiet yet close enough to the main highways for traveling visitors or caregivers. As of today, it sits vacant with plans for more residential development.



### 3.4.1. Climate

The overall temperature of Dallas County is considered a humid subtropical with hot summers and mild winters. The elderly population cannot hold and sense heat like when they were younger. On average, they tend to be comfortable at higher temperatures. It is important to consider the temperature during site selection if outdoor socialization spaces and activity areas are a part of the overall project programming (Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023).

Figure 24: Average Temperature



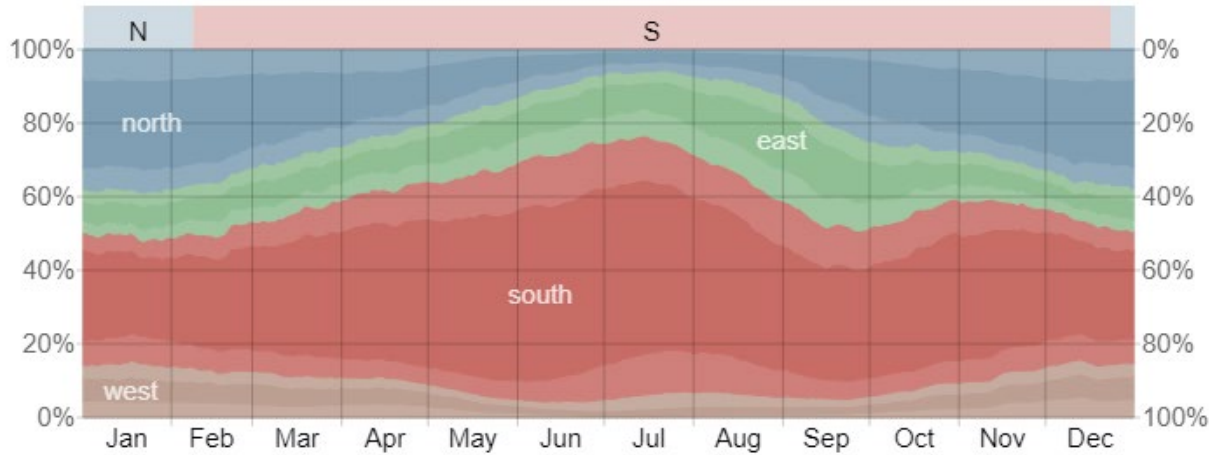
*Note: Temperature graph for Dallas County throughout the year (from Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023)*

### 3.4.2. Wind

Wind in Texas varies throughout the year; in the summer, warm winds assist in the Texas region's dry characteristics. In the winter, various cold fronts are accompanied by a decrease in humidity. The wind directions change throughout the seasons, in the summer months wind comes from the south and southeast which are associated with the warm air from the Gulf of Mexico. Whereas in the winter months, winds come from the north, with colder air moving into

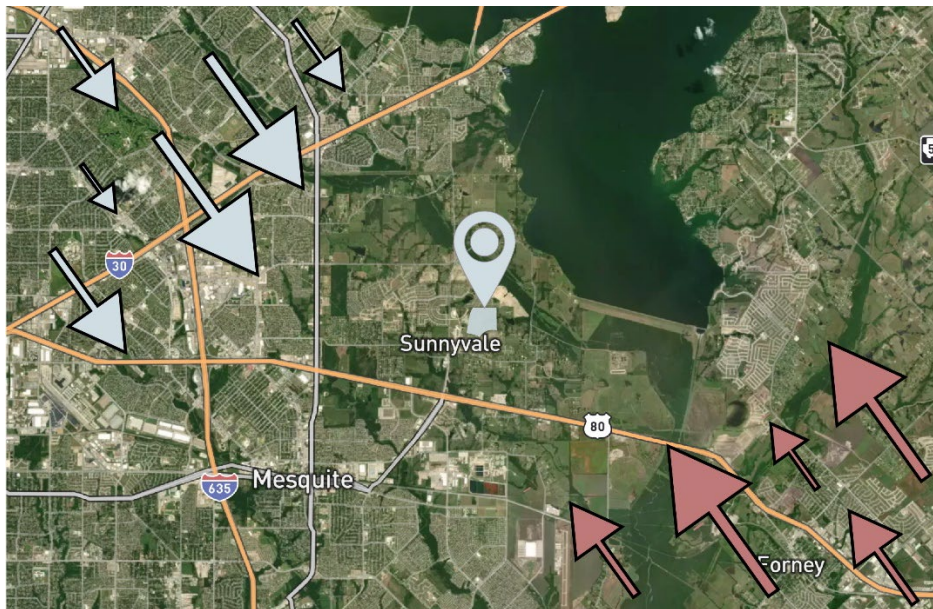
the region. (Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023).

Figure 25: Wind Directions



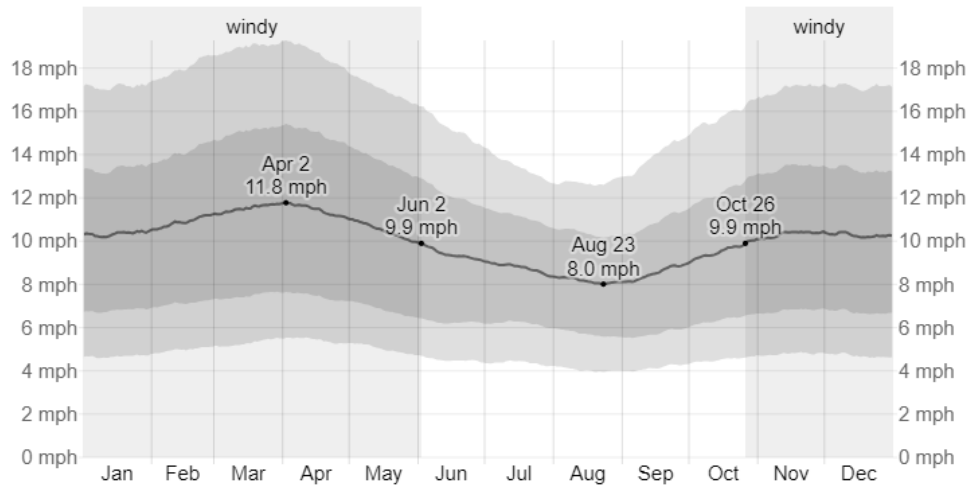
Note: Wind Direction graph for Dallas County throughout the year (from Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023)

Figure 26: Wind Directions



Note: Wind Direction Map on the site winter winds (blue) coming from the northwest, compared to summer winds (red) coming from the southeast (modeled after Google Maps, 2023)

Figure 27: Average Wind Speeds

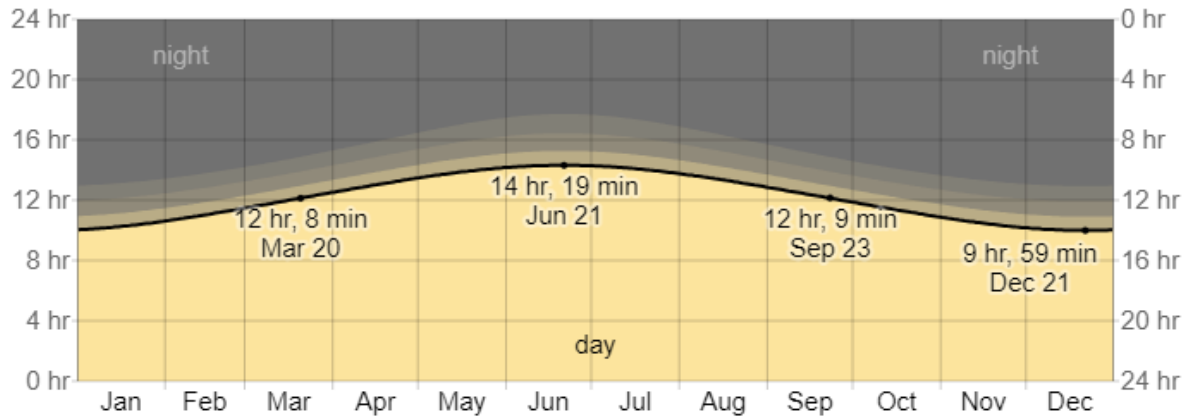


*Note: Wind speed graph for Dallas County throughout the year (from Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023)*

### 3.4.3. Sun

The daylight and twilight hours exhibit noticeable variations throughout the year, influenced by the changing seasons. During the summer, longer daylight hours create warm and well-lit evenings. This is useful for alzheimer’s patients to ease the symptoms of sundowning and overall increase well-being as a direct result of natural light exposure on patients. In the winter, shorter daylight hours and earlier sunsets result in shorter twilight periods (*Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023*).

Figure 28: Hours of Daylight and Twilight



Note: Hours of Daylight and Twilight in Dallas for Dallas County throughout the year (from Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023)

Figure 29: Winter Solstice Sun Path



Note: Winter Solstice Sun Path on project site (from Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023)



Figure 30: Summer Solstice Sun Path

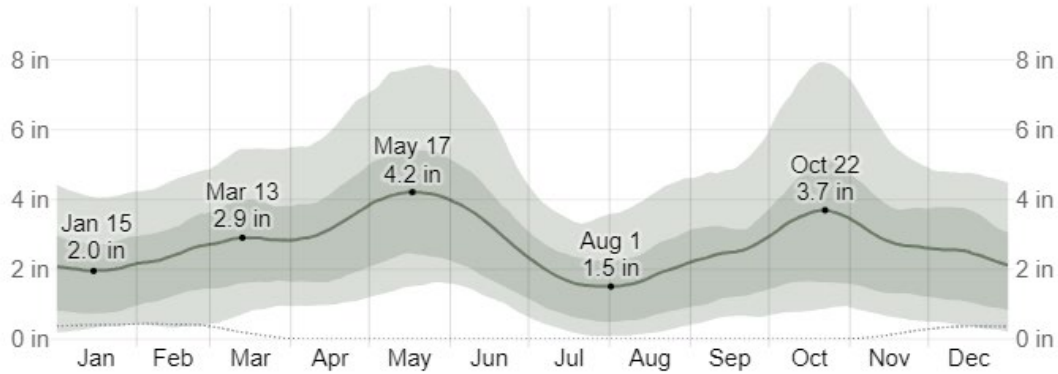


*Note: Summer Solstice Sun Path on project site (from Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023)*

#### **3.4.4. Precipitation**

Dallas County receives an average of 37 inches of rain a year, typically bringing in a steady amount of the most rain in the spring, with occasional thunderstorms in the summer. This is considered moderate rain a year in a humid subtropic climate. Rainfall connects back to biophilic design ideas where patients can have positive reactions to the sounds sight and smell of rainfall. (Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023).

Figure 31: Average Monthly Rainfall

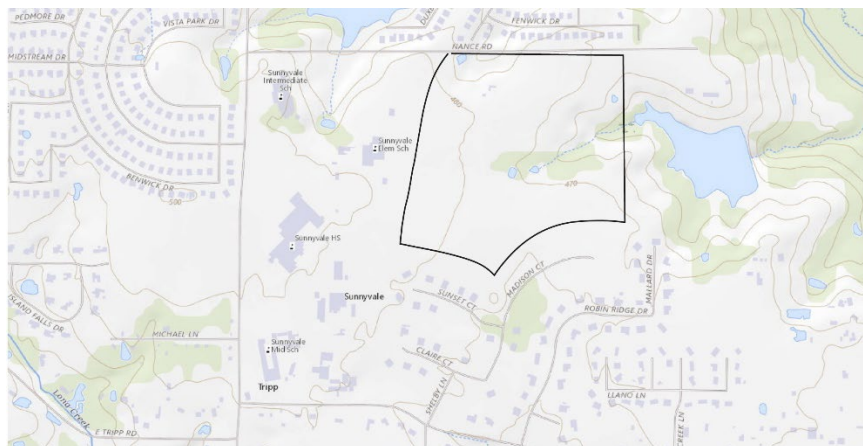


Note: Average Monthly Rainfall in Dallas County throughout the year (from Dallas Climate, Weather By Month, Average Temperature (Texas, United States) - Weather Spark, 2023)

### 3.4.5. Topography

The site itself is very flat, with the westernmost part of the site at 480 feet above sea level and the most eastern part of the site at 460 feet above sea level. Today it sits vacant with plans for more residential development, as a result, the site itself is very flat from the excavation done in the area surrounding. The topography of the region is relatively flat with occasional gentle slopes. (City of Dallas Terrain Map, 2023).

Figure 32: Topographic Map



Note: Terrain Map for Sunnyvale Texas, this map shows the topography change on the site (modeled after City of Dallas Terrain Map, 2023).

Figure 33: Site Topography



*Note: Figure shows the site compared to its surrounding context and the terrain changes (from Google Earth, 2023)*

Figure 34: Site Topography



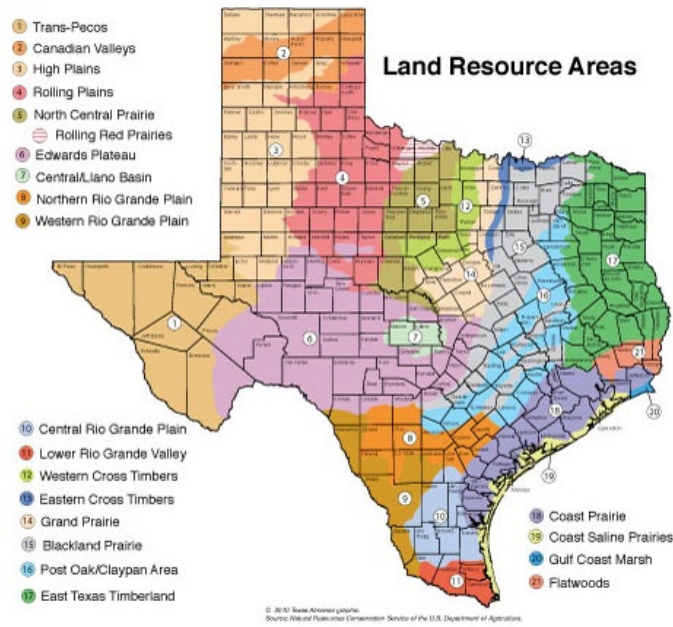
*Note: Figure shows the site compared to its surrounding context and the terrain changes (from Google Earth, 2023)*

### **3.4.6. Site Soil and Vegetation**

The site itself is open with a few trees and open grasslands from the excavation done from the residential neighborhoods surrounding the site. Common types of grassland vegetation in this region are Blackland Prairie and Buffalo grass. Native trees in the Dallas County region consist of post oak, black walnut, and cedar elm as well as a variety of bush species such as mesquite and hawthorn. (Smith, 2023).



Figure 35: Map of Texas Soil Diversity



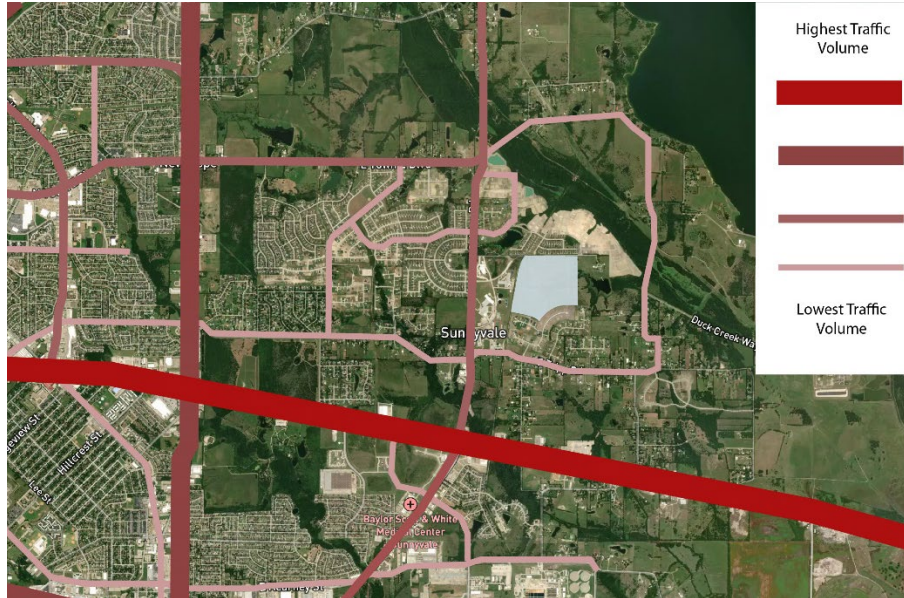
Note: Figure shows the diverse soil types in Texas (from Association (TSHA), 2023)

### 3.4.7. Traffic Volume

The site itself is encompassed in quiet residential neighborhoods with only one main road as an access point. Although, there are main roadways that connect the small town to Dallas and the various suburbs surrounding it (Texas Department of Transportation, 2023).



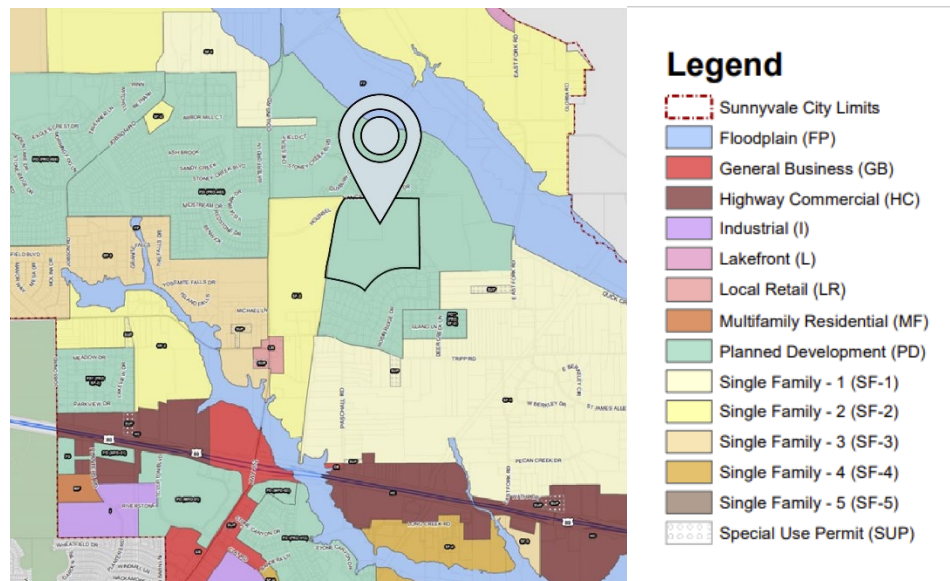
Figure 36: Traffic Volumes



Note: Figure shows traffic volumes and congestion levels of roads surrounding the site (modeled after Google Maps, 2023)

### 3.4.8. Zoning

Figure 37: Zoning



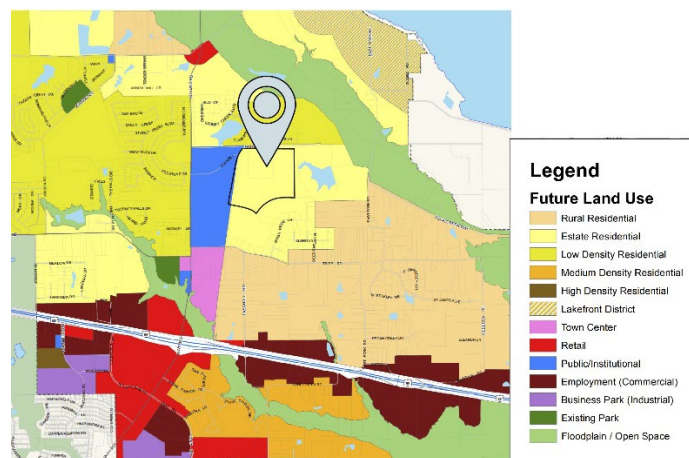
Note: Figure shows the current Zoning of Sunnyvale Texas (modeled after the Town of Sunnyvale, TX - Official Website | Official Website, 2023)

The site is currently located in a Planned development zone and is adjacent to SF-1 or Single-Family Zone 1 to Planned Development as started by the city.

The purpose of this district is to encourage higher quality development in the Town by allowing flexibility in the planning and development of projects. A PD, Planned Development, may permit new or innovative concepts in land utilization or diversification that could not be achieved under conventional zoning approaches. Any combination of residential, commercial, industrial, public, or recreational uses approved by the Town Council may be permitted (*Town of Sunnyvale, TX - Official Website | Official Website, 2023*).

The city of Sunnyvale has a plan to change the land uses in the future, no date year in particular is stated. The current site zoning at Single Family has a plan to change to Estate Residential which according to the City's Unified Development Ordinance is still under Planned Development. To the west, the school system is now going to be under Public/Institutional, and to the south it has plans to stay under Single Family zones (*Town of Sunnyvale, TX - Official Website | Official Website, 2023*).

Figure 38: Future Zoning

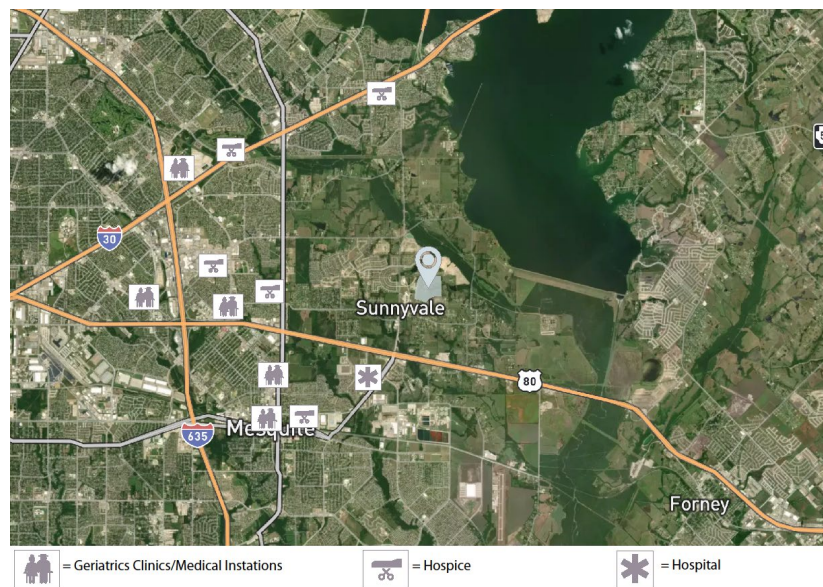


Note: Figure shows the future Zoning of Sunnyvale Texas (modeled after the Town of Sunnyvale, TX - Official Website | Official Website, 2023)

### 3.4.9. Amenities

Surrounding the site are various amenities that will play a role in defining the facility's users. Located directly to the west are Sunnyvale district schools, which provide the opportunity to bring in children to volunteer and raise awareness of memory loss disorders. Located 4 miles south of the site, there is a large Baylor Scott and white hospital in case of emergencies or checkups needed, five differing smaller hospitals and clinics that provide geriatric medicine, and five hospice care centers within a six-mile radius. Along with those medical centers are three nursing schools, two physical therapy schools, and one occupational therapy school within a 10-mile radius of the site to bring in students, thus providing jobs as caregivers or assisting in the schooling as a clinical location as learning opportunities. Lastly, within an 8-mile radius, there are a variety of hotels in case traveling family or friends are visiting out of town. A smaller airport is located 5.5 miles to the south, and the Dallas/Fort Worth International Airport is 34 miles away.

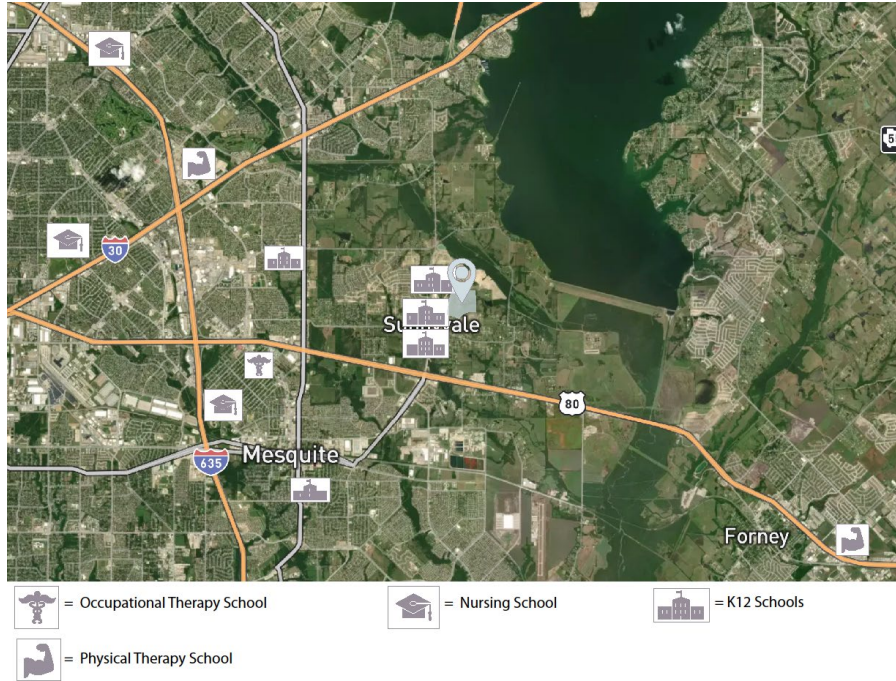
Figure 39: Medical Institutions Eastern Dallas County Sunnyvale



*Note: Figure shows Geriatric clinics, medical institutions, hospice, and hospitals near the site in case of emergencies for patients in eastern Dallas county (modeled after Google Maps, 2023)*

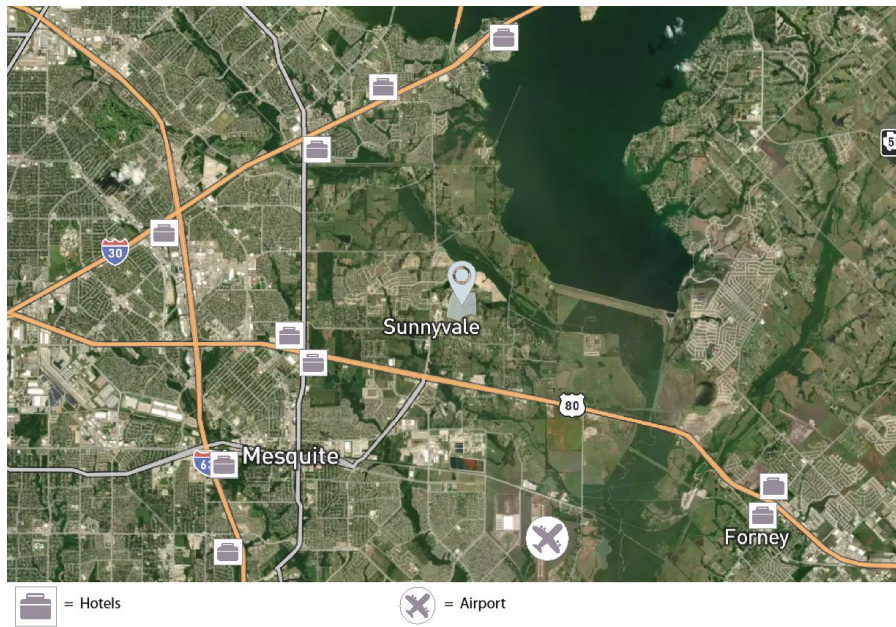


Figure 40: K12 and Medical Schools Eastern Dallas County



*Note: Figure shows occupational and physical therapy school, nursing school, and K-12 schools in eastern Dallas county (modeled after Google Maps, 2023)*

Figure 41: Travel Map Eastern Dallas County



*Note: Figure shows nearest hotels and airports in eastern Dallas county for traveling families and friends (modeled after Google Maps, 2023)*

### 3.4.10. Site Photos

Figure 42: View looking South at Site (Photo by Sammy Quaal, 2023)



Figure 43: View looking South on Site (Photo by Sammy Quaal, 2023)





Figure 44: View looking South on Site (Photo by Sammy Quaal, 2023)



Figure 45: View looking North on Site (Photo by Sammy Quaal, 2023)



Figure 46: View looking North on Site (Photo by Sammy Quaal, 2023)



Figure 47: View looking West on Site (Photo by Sammy Quaal, 2023)





Figure 48: View looking West on Site (Photo by Sammy Quaal, 2023)



Figure 49: View looking West on Site (Photo by Sammy Quaal, 2023)





Figure 50: View looking East on Site (Photo by Sammy Quaal, 2023)



Figure 51: View looking East on Site (Photo by Sammy Quaal, 2023)



Figure 52: View looking East on Site (Photo by Sammy Quaal, 2023)



### 3.5. Case Studies

Table 4: Case Study Comparison Chart

Case Studies			
Project Elements:			
Case Studies:	Alliade Meriant	Carpe Diem Dementia Village	Hogeweyk Dementia Village
Location:	Dax, France	Bærum, Norway	Weeps, Netherlands
Architect:	Nord Architects	Nord Architects	BuroKade
Size (Acres):	2.65	4.4	4
Size (Units):	80	136	165
Completion:	2020	2020	2009
Amenities:	Grocers, hairdressers, a restaurant and a market square	Cafes, community center, fitness facilities, carpentry, beauty salon, pub, shops, treatment center and an outdoor greenhouse	Supermarket, café, restaurant, market, beauty salon, outdoor theater, artwork exhibitions, and various outdoor courtyards
Salutogenic Design Principles:	X	X	X
Open to the public:		X	
One Building:		X	X
Various Clusters:	X		

*Note: Table compares three case studies, comparing size, amenities provided, their salutogenic design principles, and the way they laid the building footprint out*

#### 3.5.1. Alliade Meriant

Location: Dax, France

Architect: Nord Architects

Size: 2.65 Acres

Units: 80 Units

Completion: 2020

**Distinguishing characteristics:** This project aimed to create spaces with recognizable surroundings with little to no obstructive elements so there would be no clutter to challenge their cognitive abilities. Use local architectural elements to make them feel at home to make the transition to assisted living effortless. There are four main housing clusters with 30 residents each to create a home-like approach to the design to promote socialization in a smaller setting.



Figure 53: Exterior Walking paths



*Note: The figure shows outdoor walking paths that connect different amenities of the dementia village (from Alzheimer's Village /NORD Architects | ArchDaily, 2021)*

**Salutogenic Amenities:** Grocer, hairdressers, a restaurant, and a market square that is reminiscent of the residents' previous lives in their neighborhoods.

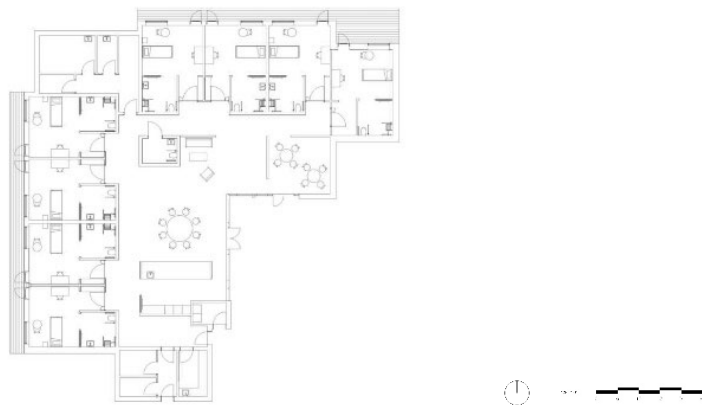
**Social Effects:** Each home cluster focuses on a family-like aspect to promote social interactions and make the transition to assisted living feel less institutional. Those with dementia tend to get overstimulated, so the quaint living setting is to prevent behavioral and mental breakdowns. Each home contains adequate indoor and outdoor social spaces for both large and small groups, so they can choose the correct sized space depending on how social the residents want to be. Giving residents the space to explore and make decisions independently with the correct safety measures builds confidence in residents, staff, and family members.

Figure 54: Level 1 Floor Plan



*Note: The figure shows the main level floor plan and the outdoor landscape elements that connect the clusters and amenities of the dementia village (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

Figure 55: Unit Floor Plan



*Note: The figure shows the main level floor plan of one individual dementia village cluster (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

**Site Analysis:** Trails are woven between buildings as connections but also create independent spaces for residents to relax or explore. Long paths throughout the site to persuade

residents to walk and continuous paths that loop back to starting points prevent confusion on dead ends and help residents gain confidence to keep going. Outdoor seating is placed throughout as stopping points when tired, and tall landscaping elements take place as handrails that residents can grab hold of when finding their way. Enormous courtyard outdoor seating elements are placed in the center of clusters of homes to encourage residents to socialize with other parts of the village. The main entry point is on the site's north end, where they have rooms for larger congregations with family members or friends.

Figure 56: Site Diagram



*Note: The figure shows the various dementia clusters and their relation to the other clusters in the dementia village (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

**Research findings:** Overall, this dementia village is innovative when it comes to the social-based approach over using medical-based decisions. When pondering layouts and design, understanding residents' medical and social needs was always in question. The architects kept respect for the residents and did not diminish their self-worth. However, after reviewing the site and buildings, there was little to no discrepancy between each cluster of homes, making it hard for residents to distinguish which one was theirs.

Figure 57: Garden



*Note: Figure shows the outdoor gardens that are provided as an amenity to keep active minds and bodies (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*

Figure 58: Outdoor Seating Area



*Note: Figure shows the outdoor seating area that is adjacent to the café that is provided as an amenity for socializing and relaxation (from Alzheimer's Village / NORD Architects | ArchDaily, 2021)*



### 3.5.2. Carpe Diem Dementia Village

Location: Bærum, Norway

Architect: Nord Architects

Size: 4.4 Acres

Size: 136 Communal housing units, 22 high-care dementia units

Completion: 2020

**Distinguishing characteristics:** What makes Carpe Diem different from the other dementia villages is that it is entirely open to the public. Their main goal for the public is to bring awareness to the disease and to make the village feel like an average city in Norway for the residents. The openness to the public will help achieve the goal of feeling like its own city by having new stimuli moving in and out and bringing awareness to the disease for anyone wanting to learn more for themselves. Various building heights and roof angles, as well as rough maintenance materials, are to make the whole campus look like a diverse city rather than one vast institution.

Figure 59: Site View



*Note: Figure shows the building shape, as it is not multiple clusters like a typical dementia village, but one smaller building surrounded by one larger building with a courtyard between (from Gallery of Carpe Diem Dementia Village / Nordic Office of Architecture - 4, 2023.)*



**Salutogenic Amenities:** Cafes, community center, fitness facilities, carpentry, beauty salon, pub, shops, treatment center, and an outdoor greenhouse

Figure 60: Storefronts



*Note: Figure shows storefronts of salutogenic amenities such as the pub and café used to remind patients of what they used to do before diagnosis (from Gallery of Carpe Diem Dementia Village / Nordic Office of Architecture - 4, 2023.)*

**Social Effects:** This case study contains many options to keep residents busy and their minds active. All spaces in the village are easily accessible and marked to persuade those to enter. The muted tone and materials give off a calming sense and feel. Using materials native to the region and common in surrounding architecture simplifies the transition into this care center. This village has an interior courtyard wholly encompassed between buildings, so residents have complete freedom. Gardens and walking paths separate buildings and treatment centers, so they have felt minor distinguishment between home, where they have private space and go to bed, and their day-to-day activities, such as shopping and eating.

Figure 61: Courtyard Activity



*Note: Figure shows a group of patients completing a group activity with a caregiver to keep patients active and mobile (from Gallery of Carpe Diem Dementia Village / Nordic Office of Architecture - 4, 2023.)*

**Plan Analysis:** This village depicts each smaller dementia unit as a home beside another to portray homes in a neighborhood. They then used the landscape to create outdoor spaces for activities. This facility also chooses to adopt a residential-style building with connecting spaces that portray a smaller city. As a result, there are various communal living areas where they can enjoy their once-familiar domestic settings. The spaces and activities include a gym, salon, community center, pub, greenhouse, and other communal areas. These areas are open to the lower level of care, comprising 136 communal housing units. Whereas the high-care dementia units of 22 are not given full access to the amenities but are still accustomed to other safe communal functions.

Figure 62: Floor Plans



*Note: Figures show the first second and third floor of the dementia village, how each cluster is laid out, and how they interact with the other clusters (from Gallery of Carpe Diem Dementia Village / Nordic Office of Architecture - 4, 2023.)*

**Site Analysis:** As a result of the interior courtyard, there is complete freedom for residents and visitors. Using this courtyard design, there is complete freedom for residents to walk freely throughout the entire site with no closed doors while providing ample views for caregivers from all parts of the facility to supervise. The courtyard contains various walking trails, urban squares for outdoor activities, and a “streetscape” line with shop facades containing the pub, boutique, and salon.

Figure 63: Courtyard



*Note: courtyard with a meandering path that connects differing clusters with various seating options along the path in case patients need a break (from Gallery of Carpe Diem Dementia Village / Nordic Office of Architecture - 4, 2023.)*

**Research findings:** Overall, there are positives in keeping the village open to the public. However, there are also various downfalls when it comes to security measures and the public not fully understanding the safety measures that need to be taken when working with those with dementia. The interior courtyard provides safety measures where patients can always be supervised, allowing for different socialization spaces and room for activities. However, those in the village with exterior-facing windows could be frustrated seeing and viewing areas they cannot access.

### **3.5.3. Hogeweyk Dementia Village**

Location: Weeps, Netherlands

Architect: BuroKade

Size: 4 Acres

Size: 165 Units

Completion: 2009 – Extension in 2018

**Distinguishing characteristics:** De Hogeweyk was the first dementia village constructed in the world. As a result, there was heavy research into what this new facility should include and the overall layout. The project emphasizes promoting independence as long as possible for all residents and making the whole facility feel like a small-scale secure village over a sizeable medical institution filled with caregivers and medical devices. There are diverse opportunities for residents of the village to stay active, as well as a high motivation from the facility to have the community involved to diminish the stigma and bring awareness of the disease. De Hogeweyk also became a leader in implementing wayfinding cues in memory loss medical institutions. Various water fountains with large sculptures facilitate wayfinding and bright milestones implemented in the built environment.



Figure 64: Courtyard



*Note: Figure shows a courtyard to resemble a courtyard in a city with a water fountain and seating. There are various shops to promote the salutogenic amenities surrounding the courtyard to promote active bodies. (from DVA De Hogeweyk - Projects - DVA Dementia Village, 2023.)*

**Salutogenic Amenities:** Supermarket, café, restaurant, market, beauty salon, outdoor theater, artwork exhibitions, and various outdoor courtyards

Figure 65: Supermarket



*Note: Figure shows a supermarket where residents can go shopping like they once did before the diagnosis. Providing these amenities to promote active bodies. (from DVA De Hogeweyk - Projects - DVA Dementia Village, 2023.)*

**Social Effects:** A push in De Hogeweyk is to have significant community engagement to help decrease the stigma today about dementia. These outsiders walking throughout the facility

and attending said concert reinforce the idea of residents in a village over patients in a memory care center. There are various activities and clubs for residents to participate in to promote the salutogenic ideology to keep minds and bodies active. Inside the dementia village, all 23 homes are clustered together to create a sense of living in a neighborhood surrounded by other homes to mimic life before the village. This is a result of both the salutogenic ideology being implemented as well as the built environment reinforcing the life they had before diagnosis.

Figure 66: Building Plan

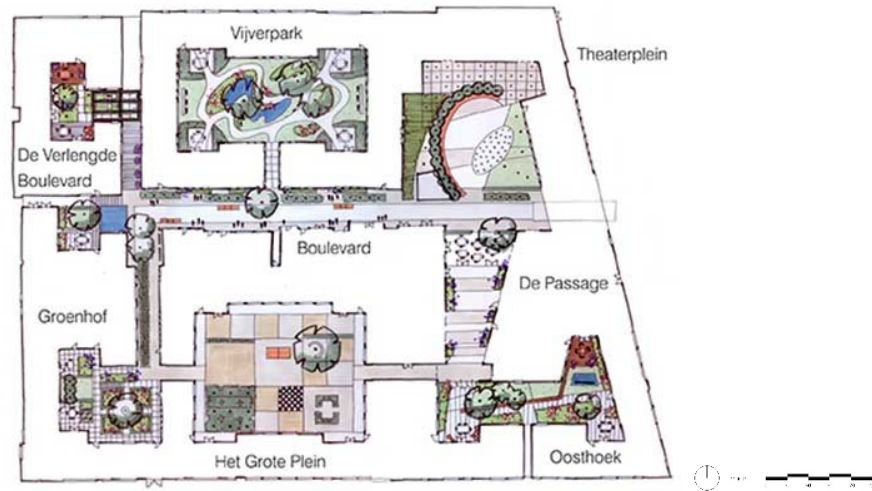


*Note: Figure shows the relation between the site and the clusters (from DVA De Hogeweyk - Projects - DVA Dementia Village, 2023.)*

**Site Analysis:** The typical Netherlands city and village formation inspire the overall plan and layout of the facilities. These consist of buildings broken up by streets surrounding squares containing garden beds and various water features. The village is broken down into various sections, so one section is an interior courtyard that mimics a large garden, while another is set to look like a courtyard surrounded by shops where they can get their hair done and get groceries. Whereas another section of the courtyard is set to mimic an outdoor theater where community

members are welcome. 50% of the total site includes landscaping elements such as diverse vegetation and water features with various seating for taking breaks while exploring the facility or socializing. This creates a sense of choice and promotes independence for residents from being able to pick and choose where they want to explore and rest each day.

Figure 67: Site Plan



*Note: Figure shows the various outdoor elements provided in the courtyards, such as the outdoor theater and the water fountain (from DVA De Hogeweyk - Projects - DVA Dementia Village, 2023.)*

**Research findings:** The project aimed to allow residents to participate in everyday activities and groups they achieved before diagnosis. Their vision had a high focus on salutogenesis, which focuses on patients' mental well-being and physical abilities, rather than emphasizing the drastic symptoms and results of the disease. They were innovators when introducing this new facility typology to the world and were the first to emphasize this salutogenic ideology. With this in mind, there is a push for residents to feel like they are living an everyday life. This project was also one of the first memory care centers to emphasize community engagement to diminish stigma.

### **3.6. Space Programs**

Using the Desing guide by Robert Wrublowsky as a baseline for this project, user groups and the space show the area required for 96 memory loss residents, 46 caregivers, and 41 support staff and allow space for visiting friends and family. Using the design guide as a basis, it brings the square footage of the dementia village to 76,680 square feet of built environment. Residents will also have various outdoor environments to keep their minds and bodies active. This layout will have eight dementia units or clusters containing 12 residents and four caregivers. There will be a central welcoming hub that visitors will enter first and will be the headquarters for those support staff (Wrublowsky, 2017).



### 3.6.1. Project Elements

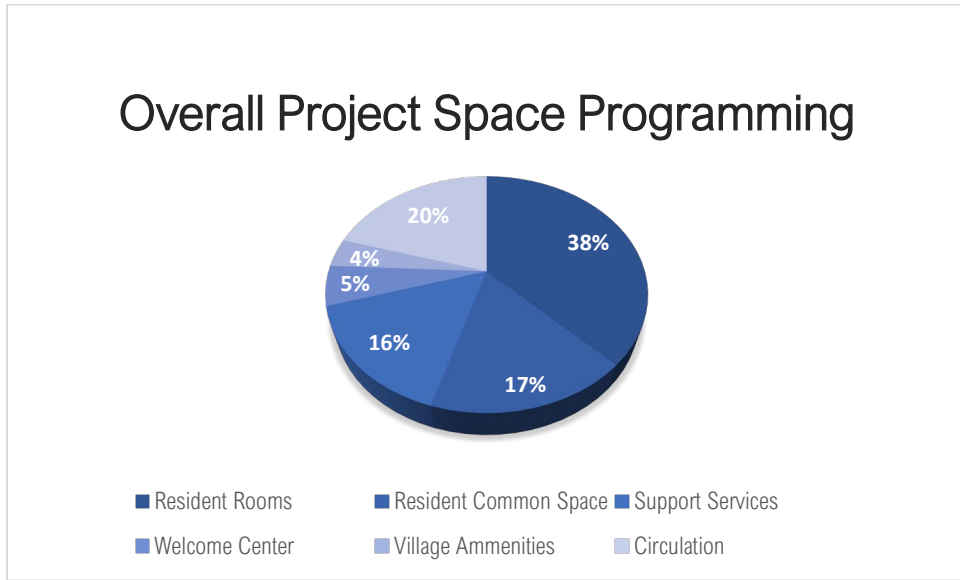
Table 5: Space Programming

Space Programming							
Project Elements:							
Home Cluster:	Footprint:	Quantity:	Area (sq ft):	The Community:	Footprint:	Quantity:	Area (sq ft):
<b>Residents Area:</b>				<b>Welcome Center:</b>			
Resident Rooms	250	12	3,000	Main Entrance	200	1	200
Resident Restrooms	64	12	768	Reception	80	2	160
<b>Residents Common Spaces:</b>				<b>Director and Supervisor Office</b>			
Living Room	400	1	400	Resident Service Offices	100	3	300
Community Kitchen	650	1	650	Administration Offices	100	3	300
Dining	400	1	400	Printing Area/Storage	100	1	100
Pantry	60	1	60	Storage	250	1	250
Hobby Area	100	1	100	Staff Meeting Room	300	1	300
Socialization Spaces	50	2	100	Staff Breakroom	500	1	500
<b>Support Services:</b>				<b>Staff Storage/Changing Room</b>			
Assisted bathing room	200	1	200	Janitors	64	2	128
Laundry	120	1	120	IT Closet	80	1	80
Soiled Storage	120	1	120	Mechanical/Electrical	80	1	80
Clean Storage	120	1	120	Recycling and Waste Disposal	300	1	300
Janitors	64	1	64	Shipping and Distribution	250	1	250
Mechanical/Electrical	80	1	80	ADA Restrooms	64	5	320
IT Closet	80	1	80	Family Activity Room	400	1	400
Nurse Offices	250	1	250	Lounge	200	1	200
Medication Room	64	1	64	<b>Village Amenities:</b>			
ADA Restrooms	64	2	128	Café	300	1	300
Meeting Room	350	1	350	Church	200	1	200
				Salon	150	1	150
				Gym/PT	450	1	450
				Sensory Rooms	150	2	300
				Supermarket	500	1	500
				Post Office	400	1	400
				Theater	300	1	300
				Shop	500	1	500
Total Square Feet:			7,054	Total Square Feet:			7,468
20% Circulation			1,411	20% Circulation			1,494
Total with Circulation:			8,465	Total with Circulation:			8,962
8 Clusters in Village:			67,718				

**Total Square footage: 76,680**

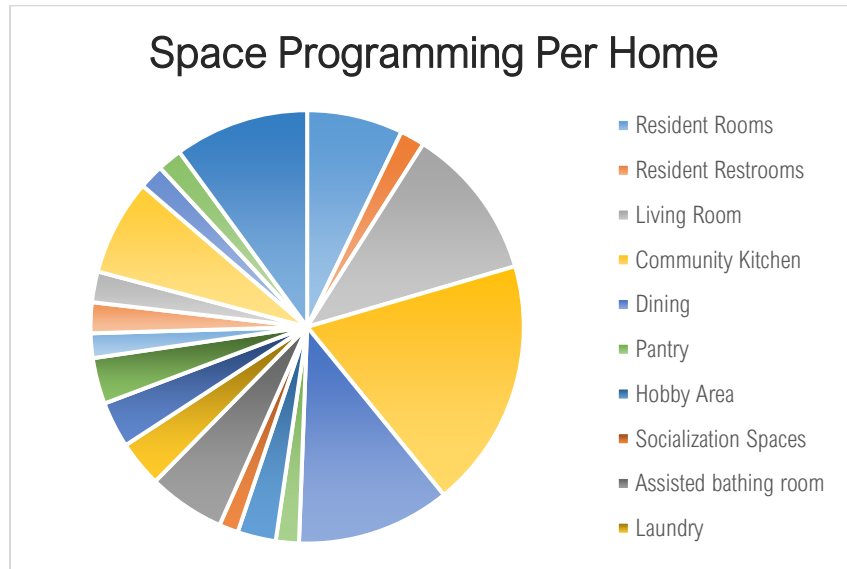
Note: Space programming for the project, breaking down the residential cluster, welcome center, and village amenities (Wrublowky, 2017)

Figure 68: Overall Project Space Programming



Note: Figure shows the overall space programming for the whole project, showing the relation between the area for residents, the welcome center, and the amenities that support salutogenic design (Wrublowky, 2017)

Figure 69: Space Programming Per Unit



Note: Figure shows the overall space programming for a dementia village cluster, showing the among of residents area consisting of residents room and common spaces (Wrublowky, 2017)

### 3.6.2. User Groups

Table 6: User Groups

User Groups			
Project Elements:			
Users:	Description:	Users Per Dementia Unit:	Total Users:
<b>Residents:</b>			
Persons with Alzheimer's/Dementia	Require care for daily activities. Experiences Memory Lapses and Behavioral Outbursts	12	96
		Total:	96
<b>Caregivers:</b>			
Geriatric Nurse	Provide care for daily activities. Help maintain overall wellbeing	2	16
Nurse Aid	Assist Nurses in care for daily activities. Help maintain overall wellbeing	2	16
Occupational Therapists	Special training in ADLs Assist in resident care plans	0.5	4
Physical Therapists	Help residents gain back strength and endurance. and safe, functional mobility	0.5	4
Dietitian	Specialized training in meal planning to meet nutritional needs of all residents		2
Social Worker	Specialize in the social well-being of residents. Assist in care plans.		4
		Total:	46
<b>Support Staff:</b>			
Director	Oversee staff and communicate with residents. and family members		1
Supervisor	Coordinates activities and directs staff work		1
Administration Staff	Creates schedules, completes finances, Organize residents' records.		3
Resident Services	Assists in transitional into the facility Oversee day-to-day operations		3
Receptionist	Welcomes Visitors and Family Assists Administration staff when needed		2
Housekeeping	Clean staff rooms, social spaces, and complete laundry for residents	1	8
Maintenance	Maintains building	0.5	4
Café Staff	Creates dining programs with Dietitian and cooks' meals for residents	2	16
Pastor	Provide Spiritual guidance Lead services		1
Hairstylists	Complete Haircuts and styles for residents		2
		Total:	41
<b>Others:</b>			
Volunteers	Assists staff with activities or events Aids with the care of residents		20-60
Visitors	The number of family members visiting family will vary every day.		20-60
Total without the other category:			183

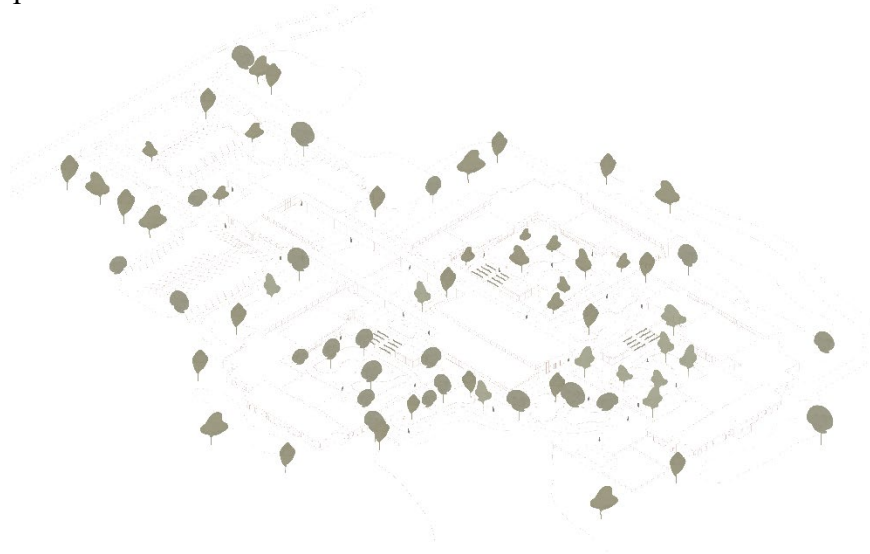
Note: User groups for dementia village, consist of the residents themselves, caregivers, support staff, volunteers, and visitors (modeled after Wrublowsky, 2017)

## 4. Results and Conclusion

### 4.1. Final Project Description

Overall, for the whole Stoneybrook campus, there are three different buildings for residents, two being for the middle stages of dementia since they are the longest stage and one building for the later stages. There is a centralized building for residents to bring family members or socialize with others from different wings or buildings. This building also provides an opportunity for members to complete activities they once did before. On campus, there is also a welcome center for all visiting family members or friends to check in, as well as a hub for support staff and administration. This building also provides areas for nurses to keep personal belongings, eat their lunch, and take breaks. The last component of the programming consists of a small barn with animals' residents can feed or take care of to remind them of the life before diagnosis. As well as providing an opportunity where they can keep their minds and bodies moving without having to socialize with larger groups of people.

Figure 70: Site Map



*Note: Figure shows the relation between the site and the all of the buildings (Figure by Sammy Quaal, 2023)*

#### **4.1.1. Welcome Center**

Starting with the first building all users enter the welcome center. This is where family, friends, and volunteers can check-in. This also holds most of the back-of-house utilities such as mechanical, maintenance, shipping, trash, and mail. The last main function of the building is to hold the offices of administration, dietician, direction, and supervisor. It provides a breakroom space, as well as an area for nurses to drop off personal items. This building also provides areas for family members to have larger gatherings. Moving from this space there is a covered walkway that leads to the city center. The total square footage of this building footprint is 13,809 sq ft.

#### **4.1.2. City Center**

This building is at the core of the whole campus. It is a hub for activities and socialization of all community members. Residents can bring family members or friends to get lunch at the bistro, they can go get their hair done at the salon, or even go to the market to pick up dilation-approved snacks. All workers or volunteers in the city center have gone through extensive training to work with people with dementia. There is also a worship space for members, that doubles as an area where large groups such as kids from the neighboring school can go to learn more about memory loss diseases. There is a post office where residents can go to pick up mail from family or send family letters. The last area in this building is the fitness center to work with salutogenic design this space is less of a physical therapy gym with weights and more or so a space for group activities such as yoga, or dance to keep bodies moving. As well as providing opportunities for renting equipment such as assisted bicycles. The total square footage of this building footprint is 12,800 sq ft.

### **4.1.3. Ash Manor and Oak Estates**

Moving to the units for those in the middle stages of the disease, Ash Manor and Oak Estates. These units, as stated before, have bedrooms placed in the exteriors of the building, leaving ample space in the core for different areas of socialization and providing full views of the nature around the buildings. At the hinge point between the two wings is the core of the back of house uses such as janitorial services, mechanical, and a shared break room with the nurses so they can socialize with the nurses in the different wings, as well as provide views into the shared courtyard. At the core is the interactive kitchen and shared dining room, this is because in most homes the kitchen and dining are the center of the home where most interaction would happen thus easing the transition for these patients and reminding them of home. The total square footage of this building footprint is 27,782 sq ft.

### **4.1.4. Magnolia Meadows**

Moving to the units for those in the later stages of the disease, Magnolia Meadows. This layout is similar to those in the middle stages but has a centralized nurse station, assisted bathing and restroom, and more areas for socialization and engagement as those in the facility may not have the strength to venture out into the city center. There is also a sunroom to provide a view of the nature around the building. The total square footage of this building footprint is 27,782 sq ft.

## **4.2. Project Objective**

### **4.2.1. Salutogenic**

When researching I kept coming across Salutogenic design, this theory of health is focused on strengthening the forces that support life and engagement, rather than trying to prevent or treat a disease. Salutogenic design for dementia patients means to establish a long, fulfilling, active, healthy lifestyle that also targets and curates health management since there is

no cure. The sole focus of this new support-based approach is to provide unique treatment plans and provide opportunities or choices for socialization and activities in their daily life to increase independence. A salutogenic design of the built environment pushes residents to make sense of their situations and supports them in their everyday activities, promoting a sense of coherence.

#### **4.2.2. Small Scale**

Inspired by dementia villages and the neighborhoods residents once lived in, in place of one large care center, the spaces are divided into multiple buildings on one site with areas for socialization and activity woven between. Smaller units with 8-12 residents have shown an increase in overall emotional well-being, functions, mobility, behavior, and activity engagement levels because it reminds them of their home. There is also a decrease in wandering, aggression, and pacing. This smaller scale and open concept plan design allows nurses to be less overwhelmed by the number of patients to watch over.

#### **4.2.3. Wayfinding**

Wayfinding is the ability to find one's way in the world, which is impaired in a person with Alzheimer's. They have a heightened sense of panic and distress, causing behavioral breakouts. To assist in wayfinding for dementia care it is imperative to decrease decision points, use landmarks or nodes, and have colorful, meaningful, textural, cues. Without wayfinding cues, patients have a decrease in their amount of daily independence, function, self-dignity, and even health.

#### **4.2.4. Biophilic**

Biophilia is people's innate affinity to other forms of life and the natural world. Integrating biophilic design strategies creates a healing environment that drives the repair and renewal of mind and body, reintegrating the whole body's well-being and healing. Studies have

shown there is a significant correlation between this exposure and the number of positive effects on residents' behavior, mood, circadian and melatonin cycle.

#### **4.2.5. Community Connection**

Dementia is a misunderstood disease, leading to stereotypes and mistreatment of patients. Patients' primary focus after diagnosis is a fixation on the fact that there is no cure and how both cognitive and physical declines are prevalent and unceasing until passing. When the focus is solely on the decline of the disease, there is an increase in discomfort, premature hospitalization, and more significant distress for caregivers and families. Bringing in opportunities for the community to assist in activities and bring awareness to learn more about Dementia can help end the stigma and make this new facility truly part of the community.

### **4.3. Project Design**

#### **4.3.1. Floor Plans**



Figure 71: City Center Plan



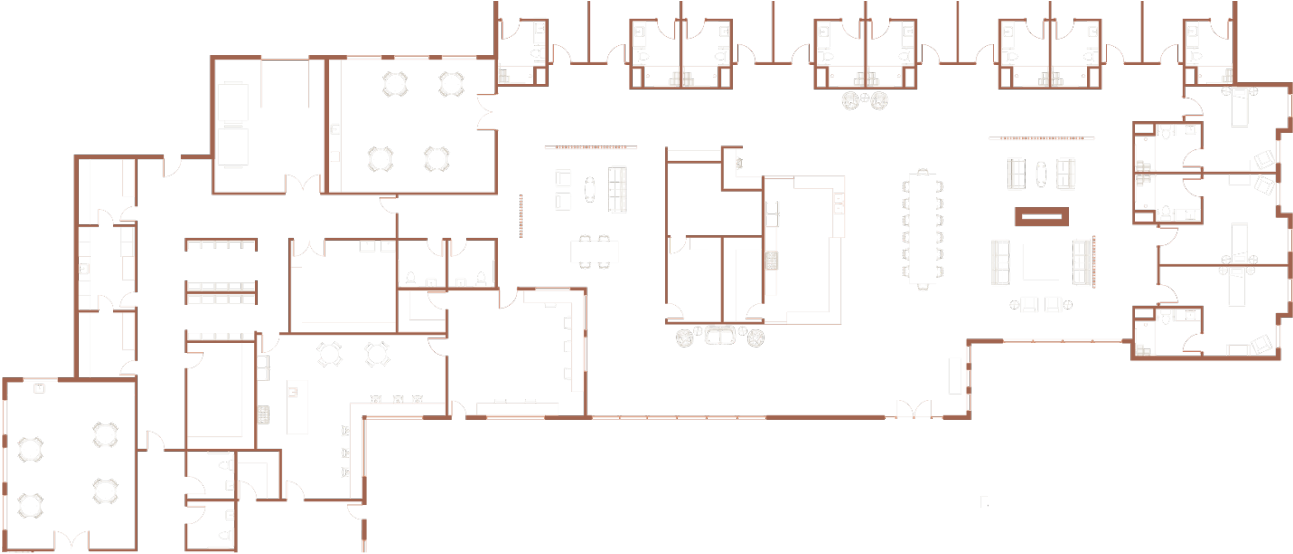
Note: Figure shows the overall layout of the Welcome Center (From Sammy Quaal, 2023)

Figure 72: City Center Plan



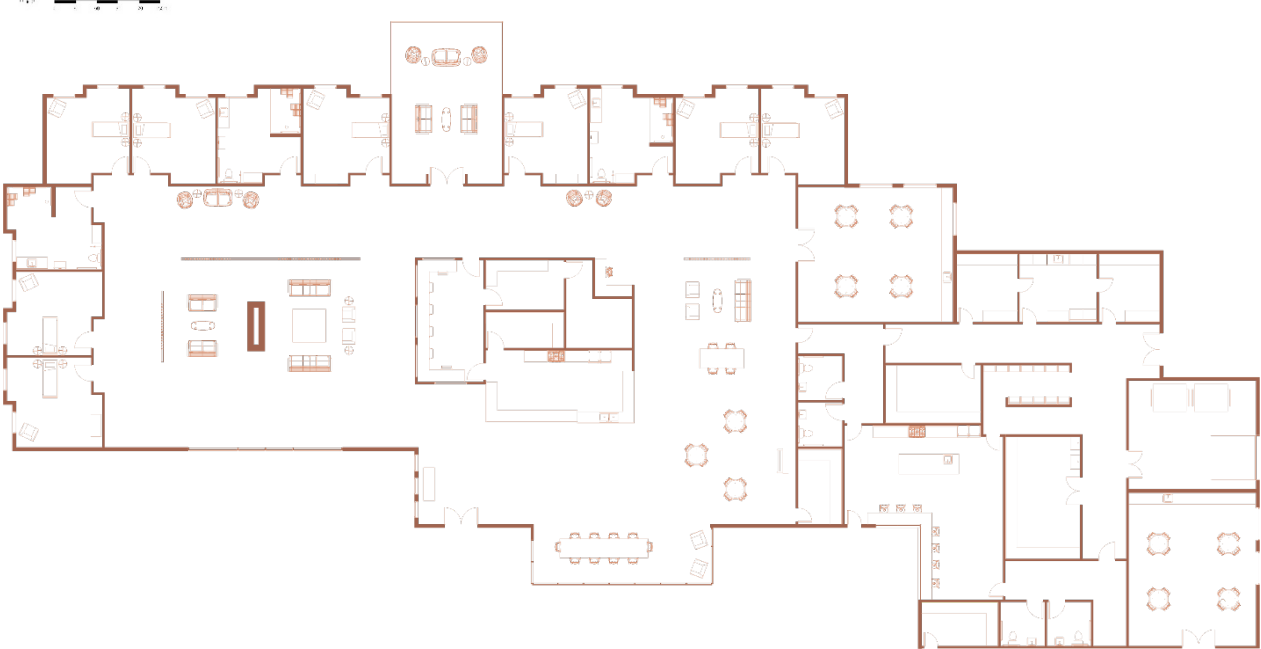
Note: Figure shows the overall layout of the City Center (From Sammy Quaal, 2023)

Figure 73: Half of Middle Stage Units



Note: Figure shows half of the plan of the middle stage units (From Sammy Quaal, 2023)

Figure 74: Half of Later Stage Units



Note: Figure shows half of the plan of the later stage units (From Sammy Quaal, 2023)

### 4.3.2. Exterior Renderings

Figure 75: City Center



*Note: Figure shows the view from the Welcome Center walkway into the City Center (From Sammy Quaal, 2023)*

Figure 76: City Center



*Note: Figure shows the view from the Welcome Center walkway into the City Center (From Sammy Quaal, 2023)*



Figure 77: Entry Oak Estates



Note: Figure shows the view from the City Center into Oak Estates (From Sammy Quaal, 2023)

Figure 78: Entry Oak Estates



Note: Figure shows the view from the City Center into Oak Estates (From Sammy Quaal, 2023)



Figure 79: Entry Oak Estates



Note: Figure shows the view from the entry gate into Oak Estates (From Sammy Quaal, 2023)

Figure 80: Entry Oak Courtyard



Note: Figure shows the view into the secured courtyard in Oak Estates (From Sammy Quaal, 2023)



### 4.3.3. Interior Renderings

Figure 81: Salon



*Note: Figure shows the salon inside the city Center (From Sammy Quaal, 2023)*

Figure 82: City Center Interior



*Note: Figure shows the main hallway inside the city Center (From Sammy Quaal, 2023)*

Figure 83: Bedroom



Note: Figure shows the bedrooms inside Oak Estates (From Sammy Quaal, 2023)

Figure 84: Hobby Room



Note: Figure shows the Hobby Room inside Oak Estates (From Sammy Quaal, 2023)



Figure 85: Interior Oak Estates



Note: Figure shows the shared dining and interactive kitchen inside Oak Estates (From Sammy Quaal, 2023)

Figure 86: Interior Oak Estates



Note: Figure shows the view from the entry inside Oak Estates(From Sammy Quaal, 2023)

#### **4.4. Conclusion**

Overall, I believe that this project can replace the institution-based model we have today. Turing inadequate institution care into a functional humanistic approach focusing on the built environment as an instrumental tool for success. Increasing the opportunity for biophilic and salutogenic design by allowing patients to explore, socialize, and engage in routine tasks they once carried out outside of the care facility promotes an active, healthy lifestyle that is both emotionally and physically stimulating.

## REFERENCES

- 2023 Alzheimer's disease facts and figures. (2023). *Alzheimer's & Dementia*, 19(4), 1598–1695.  
<https://doi.org/10.1002/alz.13016>
- Abdelaal, M. S., & Soebarto, V. (2019). Biophilia and Salutogenesis as restorative design approaches in healthcare architecture. *Architectural Science Review*, 62(3), 195–205.  
<https://doi.org/10.1080/00038628.2019.1604313>
- ADI - Dementia facts & figures. (2023). <https://www.alzint.org/about/dementia-facts-figures/>  
*Alzheimer's Disease Research Centers*. (2023, May 30). National Institute on Aging.  
<https://www.nia.nih.gov/health/alzheimers-disease-research-centers>
- Alzheimers Village / NORD Architects | ArchDaily*. (2021, December 21).  
<https://www.archdaily.com/973948/alzheimers-villa-nord-architects>
- Andrade, C. C., Devlin, A. S., Pereira, C. R., & Lima, M. L. (2017). Do the hospital rooms make a difference for patients' stress? A multilevel analysis of the role of perceived control, positive distraction, and social support. *Journal of Environmental Psychology*, 53, 63–72.  
<https://doi.org/10.1016/j.jenvp.2017.06.008>
- Andrade, C. C., Lima, M. L., Devlin, A. S., & Hernández, B. (2016). Is It the Place or the People? Disentangling the Effects of Hospitals' Physical and Social Environments on Well-Being. *Environment and Behavior*, 48(2), 299–323.  
<https://doi.org/10.1177/0013916514536182>
- Association (TSHA), T. S. H. (2023). *Soils of Texas*. Texas Almanac.  
<https://www.texasalmanac.com/articles/soils-of-texas>
- Bamidis, P. D., Fissler, P., Papageorgiou, S. G., Zilidou, V., Konstantinidis, E. I., Billis, A. S., Romanopoulou, E., Karagianni, M., Beratis, I., Tsapanou, A., Tsilikopoulou, G.,

- Grigoriadou, E., Ladas, A., Kyriallidou, A., Tsolaki, A., Frantzidis, C., Sidiropoulos, E., Siountas, A., Matsi, S., ... Kolassa, I.-T. (2015). Gains in cognition through combined cognitive and physical training: The role of training dosage and severity of neurocognitive disorder. *Frontiers in Aging Neuroscience*, 7.  
<https://www.frontiersin.org/articles/10.3389/fnagi.2015.00152>
- Beheraj, S. P., Alex Fitzpatrick, Kavya. (2023, August 1). *Alzheimer's prevalence in Texas*. Axios. <https://www.axios.com/local/houston/2023/08/01/alzheimers-prevalence-in-texas>
- Bureau, U. C. (2023). *Decennial Census of Population and Housing*. Census.Gov.  
<https://www.census.gov/decennial-census>
- Burzynska, A., & Malinin, L. (2017). *Enriched Environments for Healthy Aging: Qualities of Seniors Housing Designs Promoting Brain and Cognitive Health*.
- Busch, K. (2022, March 29). *Interior Design for Healthcare and Senior Living: The Best Material Choices for Safe, Clean Spaces*. Material Intelligence.  
<https://www.materialintelligence.com/material-iq/healthcare-and-senior-living-best-interior-design-material-choices-for-safe-clean-spaces>
- Chaudhury, H., Cooke, H. A., Cowie, H., & Razaghi, L. (2018). The Influence of the Physical Environment on Residents With Dementia in Long-Term Care Settings: A Review of the Empirical Literature. *The Gerontologist*, 58(5), e325–e337.  
<https://doi.org/10.1093/geront/gnw259>
- Chrysikou, E., Tziraki, C., & Buhalis, D. (2018). Architectural hybrids for living across the lifespan: Lessons from dementia. *The Service Industries Journal*, 38(1–2), 4–26.  
<https://doi.org/10.1080/02642069.2017.1365138>



*City of Dallas Terrain Map.* (2023).

<https://developmentweb.dallascityhall.com/publiczoningweb/>

*Dallas Climate, Weather By Month, Average Temperature (Texas, United States)—Weather*

*Spark.* (2023). <https://weatherspark.com/y/8813/Average-Weather-in-Dallas-Texas-United-States-Year-Round>

*Dallas County | Departments.* (2018, January 5). [Page]. Aa-Full.

<https://www.dallascounty.org/departments/>

Davis, R., & Weisbeck, C. (2016). Creating a Supportive Environment using Cues for

Wayfinding in Dementia. *Journal of Gerontological Nursing*, 42(3), 36–44.

<https://doi.org/10.3928/00989134-20160212-07>

*Dementia vs. Alzheimer’s Disease: What is the Difference?* (2023). Alzheimer’s Disease and

Dementia. <https://alz.org/alzheimers-dementia/difference-between-dementia-and-alzheimer-s>

*Designing for memory care | Health Facilities Management.* (2017, March 1).

<https://www.hfmmagazine.com/articles/2730-designing-for-memory-care>

Drew, L. (2018). An age-old story of dementia. *Nature*, 559(7715), S2–S3.

<https://doi.org/10.1038/d41586-018-05718-5>

*Find the Right Hospital for You.* (2023). [https://health.usnews.com/best-](https://health.usnews.com/best-hospitals/rankings/rehabilitation)

[hospitals/rankings/rehabilitation](https://health.usnews.com/best-hospitals/rankings/rehabilitation)

Fries, C. J. (2020). Healing Health Care: From Sick Care Towards Salutogenic Healing Systems.

*Social Theory & Health*, 18(1), 16–32. <https://doi.org/10.1057/s41285-019-00103-2>

*Gallery of Carpe Diem Dementia Village / Nordic Office of Architecture—4.* (2021, December

21). ArchDaily. <https://www.archdaily.com/955466/carpe-diem-dementia-village-nordic->

office-of-architecture/601b1df9f91c81915a00049e-carpe-diem-dementia-village-nordic-office-of-architecture-photo

- Golembiewski, J. A., & Zeisel, J. (2022a). Salutogenic Approaches to Dementia Care. In M. B. Mittelmark, G. F. Bauer, L. Vaandrager, J. M. Pelikan, S. Sagy, M. Eriksson, B. Lindström, & C. Meier Magistretti (Eds.), *The Handbook of Salutogenesis* (2nd ed.). Springer. <http://www.ncbi.nlm.nih.gov/books/NBK584132/>
- Golembiewski, J. A., & Zeisel, J. (2022b). *The Handbook of Salutogenesis*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-79515-3>
- Gonzalez, M. T., & Kirkevold, M. (2014). Benefits of sensory garden and horticultural activities in dementia care: A modified scoping review. *Journal of Clinical Nursing*, 23(19–20), 2698–2715. <https://doi.org/10.1111/jocn.12388>
- Google Earth. (2023). <https://earth.google.com/web/@0,-0.2535,0a,22251752.77375655d,35y,0h,0t,0r>
- Google Maps. (2023). Google Maps. <https://www.google.com/maps/@32.7982657,-96.5532184,4439m/data=!3m1!1e3?entry=ttu>
- How Is Alzheimer's Disease Treated?* (2023). National Institute on Aging. <https://www.nia.nih.gov/health/how-alzheimers-disease-treated>
- Jakob, A., & Collier, L. (2017). Sensory enrichment for people living with dementia: Increasing the benefits of multisensory environments in dementia care through design. *Design for Health*, 1(1), 115–133. <https://doi.org/10.1080/24735132.2017.1296274>
- Kuliga, S., Berwig, M., & Roes, M. (2021). Wayfinding in People with Alzheimer's Disease: Perspective Taking and Architectural Cognition—A Vision Paper on Future Dementia

- Care Research Opportunities. *Sustainability*, 13(3), Article 3.  
<https://doi.org/10.3390/su13031084>
- Mazuch, R. (2017). Salutogenic and Biophilic Design as Therapeutic Approaches to Sustainable Architecture. *Architectural Design*, 87(2), 42–47. <https://doi.org/10.1002/ad.2151>
- McCaffrey, R., & Liehr, P. (2016). The Effect of Reflective Garden Walking on Adults With Increased Levels of Psychological Stress. *Journal of Holistic Nursing*, 34(2), 177–184.  
<https://doi.org/10.1177/0898010115594934>
- McQueen, D. V., Kickbusch, I., Potvin, L., Pelikan, J. M., Balbo, L., & Abel, T. (2007). *Health and Modernity: The Role of Theory in Health Promotion*. Springer.  
<https://doi.org/10.1007/978-0-387-37759-9>
- Mileski, M., Baar Topinka, J., Brooks, M., Lonidier, C., Linker, K., & Vander Veen, K. (2018). Sensory and memory stimulation as a means to care for individuals with dementia in long-term care facilities. *Clinical Interventions in Aging*, 13, 967–974.  
<https://doi.org/10.2147/CIA.S153113>
- Miniaci, M. C., & De Leonibus, E. (2018). Missing the egocentric spatial reference: A blank on the map. *F1000Research*, 7, 168. <https://doi.org/10.12688/f1000research.13675.1>
- Moreno-Morales, C., Calero, R., Moreno-Morales, P., & Pintado, C. (2020). Music Therapy in the Treatment of Dementia: A Systematic Review and Meta-Analysis. *Frontiers in Medicine*, 7, 160. <https://doi.org/10.3389/fmed.2020.00160>
- NCTCOG Region: Now and Then*. (2023).  
<https://nctcogis.maps.arcgis.com/apps/instant/media/index.html?appid=bfc4774dae33411dbe11966245230764>

- Parrish, J. (2016, April 12). *Designing Interiors That Work for Memory Care Residents*. Progressive AE. <https://www.progressiveae.com/interiors-for-memory-care/>
- Peters, T., & Verderber, S. (2022). Biophilic Design Strategies in Long-Term Residential Care Environments for Persons with Dementia. *Journal of Aging and Environment*, 36(3), 227–255. <https://doi.org/10.1080/26892618.2021.1918815>
- Quirke, M., Bennett, K., Chau, H.-W., Preece, T., & Jamei, E. (2023). Environmental Design for People Living with Dementia. *Encyclopedia*, 3(3), 1038–1057. <https://doi.org/10.3390/encyclopedia3030076>
- Riley, R. J., Burgener, S., & Buckwalter, K. C. (2014). Anxiety and Stigma in Dementia: A Threat to Aging in Place. *The Nursing Clinics of North America*, 49(2), 213–231. <https://doi.org/10.1016/j.cnur.2014.02.008>
- Scannell, L., & Gifford, R. (2010). Defining place attachment: A tripartite organizing framework. *Journal of Environmental Psychology*, 30(1), 1–10. <https://doi.org/10.1016/j.jenvp.2009.09.006>
- Smith, T. P. & W. D. (2023). *Texas Parks & Wildlife Department*. <https://tpwd.texas.gov/>
- Stages of Alzheimer's*. (2023). Alzheimer's Disease and Dementia. <https://alz.org/alzheimers-dementia/stages>
- Stages of Alzheimers—Penn Medicine*. (2020, December 31). <https://www.pennmedicine.org/updates/blogs/neuroscience-blog/2019/november/stages-of-alzheimers>
- Strøm, B. S., Ytrehus, S., & Grov, E.-K. (2016). Sensory stimulation for persons with dementia: A review of the literature. *Journal of Clinical Nursing*, 25(13–14), 1805–1834. <https://doi.org/10.1111/jocn.13169>

*SunCalc sun position- und sun phases calculator.* (2023). <https://www.suncalc.org>

*Texas Department of Transportation.* (2023). <http://txdot.gov/en/home.html>

*Tips for Coping with Sundowning.* (2017, May 17). National Institute on Aging.

<https://www.nia.nih.gov/health/tips-coping-sundowning>

*Towards human-centered general hospitals: The potential of dementia-friendly design.* (2021, June 12).

<https://www.tandfonline.com/doi/epdf/10.1080/00038628.2021.1933889?needAccess=true>

*Town of Sunnyvale, TX - Official Website | Official Website.* (2023).

<https://www.townofsunnyvale.org/>

*Treatments for Alzheimer's.* (2023). Alzheimer's Disease and Dementia.

<https://alz.org/alzheimers-dementia/treatments>

*U.S. Census Bureau QuickFacts: Dallas County, Texas.* (2022).

<https://www.census.gov/quickfacts/fact/table/dallascountytexas/PST045222>

Wadsworth, L. P., Lorus, N., Donovan, N. J., Locascio, J. J., Rentz, D. M., Johnson, K. A.,

Sperling, R. A., & Marshall, G. A. (2012). Neuropsychiatric symptoms and global functional impairment along the Alzheimer's continuum. *Dementia and Geriatric Cognitive Disorders*, 34(2), 96–111. <https://doi.org/10.1159/000342119>

*Wandering.* (2023). Alzheimer's Disease and Dementia. <https://doi.org/10.1159/000342119>

*Wandering.* (2023). Alzheimer's Disease and Dementia. [https://alz.org/help-](https://alz.org/help-support/caregiving/stages-behaviors/wandering)

[support/caregiving/stages-behaviors/wandering](https://alz.org/help-support/caregiving/stages-behaviors/wandering)

*What is Memory Care and How Much Should it Cost?* (2023). AssistedLiving.Org.

<https://www.assistedliving.org/memory-care/>

*Which U.S. States Have the Oldest Populations?* (2021, December 22). PRB.

<https://www.prb.org/resources/which-us-states-are-the-oldest/>

Wrublow, R. (2017). *Design Guide for Long Term Care Homes*.

[https://www.fgiguilines.org/wp-](https://www.fgiguilines.org/wp-content/uploads/2018/03/MMP_DesignGuideLongTermCareHomes_2018.01.pdf)

[content/uploads/2018/03/MMP\\_DesignGuideLongTermCareHomes\\_2018.01.pdf](https://www.fgiguilines.org/wp-content/uploads/2018/03/MMP_DesignGuideLongTermCareHomes_2018.01.pdf)