ABSTRACT

Title of Thesis: DEAF SPACE AND THE VISUAL WORLD - BUILDINGS THAT SPEAK: AN ELEMENTARY SCHOOL FOR THE DEAF

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Thesis Directed By: Ralph Bennett, Professor Emeritus, School of Architecture, Planning, and Preservation

Deaf Space and the Visual World is a set of principles providing understanding of the perceptions and special needs of the deaf. More frequently deaf and hard of hearing school children are attending mainstream public schools, in which deaf-friendly design is not well-understood or implemented. This work analyzes these principles and applies them to the design of a mainstream elementary school at a site within the King Farm community of Rockville, Maryland.

Primarily, the ideas of establishing visual connectivity, circulation, collective being, and sense of home guided the school design. These are reflected in numerous design features of the school that will benefit not only the deaf students, but hearing and other special needs children as well. The ultimate objective of this work is to promote understanding of the needs of the deaf in educational settings, as well as to establish a useful set of architectural guidelines.

DEAF SPACE AND THE VISUAL WORLD - BUILDINGS THAT SPEAK:

AN ELEMENTARY SCHOOL FOR THE DEAF

By

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Introduction

A phenomenon called "mainstreaming deaf children" is at force in the educational world today. Rather than having them attend a dedicated school for the deaf, many parents want their deaf children to be in the public schools, close to home, and associating with the hearing community on a daily basis. Notwithstanding the challenges for a deaf child greatly outnumbered by hearing children in the school, mainstreaming allows him a social context more akin to what he will face throughout his life. As so well put by researcher Dr. Claire Ramsey,

> "neither deaf nor hearing children can develop in isolation from others, nor do they develop in neutral settings...For many deaf children for whom signing is their primary language, the contexts of schooling, and the people they interact with there (deaf and hearing peers, teachers, and interpreters) play a critical role in their lives, especially if they return to families and neighborhoods where there are few signers."[1]

So, it is inevitable that deaf and hard of hearing children will be present in mainstream schools.[2] In fact, a representative of the Montgomery County Public

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[1] Ramsey, Claire L. *Deaf Children in Public Schools: Placement, Context, and Consequences*, Washington, DC: Gallaudet University Press, 1997.

[2] Information provided by Sandra J. Nelson, Montgomery County Public Schools special needs education representative, indicates a significant number of deaf and hard of hearing children in the county (353) attending the public school system, as the following tallies indicate:

- Number of deaf students: 85
- Number of hard of hearing students: 268

The total number of students in center-based programs in Rockville is 150, consisting of 50 oral elementary school students, 17 cued speech elementary school students, 25 sign language elementary school students, 24 middle school students with all three communication modalities, and 34 high school students with all three communication modalities. The total number of itinerant students (attending neighborhood schools or other special education programs) is 203.

Schools system in Montgomery County, Maryland noted that there never would be a public school for the deaf in the county school system.[3] This raises the question: have the special needs of deaf children been properly accounted for in the architectural design of public schools? Unfortunately the answer to that question is no: the architecture of Montgomery County schools has not been addressing the needs of deaf children. If designers have not been actively thinking about meeting these needs or more likely are not even aware of the issues, they will fail in this respect.

This thesis develops an exemplary design for an elementary school for both hearing and deaf children, located in Rockville, Montgomery County, Maryland. It has been guided primarily by a set of logical and often intuitive Deaf Space principles, as well as insights gained by an exploration of the unique perceptions of the deaf. These principles lead to specific design and architectural features of an elementary school that primarily benefit the deaf, but will also be found to be of benefit to all students in the school, hearing or not.

From these numbers, it can be concluded that there will likely be several deaf and hard of hearing elementary school children in any school district in Montgomery Country that could benefit highly from the availability of a deaf-friendly school in their immediate locale.

[3] Nelson, 2010.

Chapter 1: Site - Knowing the Community

The site considered for the elementary school is within the King Farm development in Rockville Maryland, located on the west side of Frederick Road/Highway 355 across from the Shady Grove Metro station. Figure 1 shows King Farm (shaded area) in relation to highways, parks, and nearby neighborhoods in Montgomery County. Quick access to multiple transportation options, including the Washington Metro and major highways including I-270 and 355 are available. Research and treatment facilities including Shady Grove Adventist Hospital and hearing clinics are located within a few miles.

Figure 1 - Location of King Farm Development in Rockville Maryland. Map adapted by author from Bing Maps, Microsoft Corporation.

Site History

The present King Farm site was originally a dairy farm owned and operated by Lawson King. King had consolidated this farm in 1925 by buying the 1825-era 122-acre Graff farm fronting Frederick Road, along with several adjoining farms. After Lawson King's death in 1985, the 430-acre farm eventually went into foreclosure and the site was sold to developers, and annexed by the City of Rockville in 1995.[4]

In 1997, the King Farm community was founded. The developer King Farm Associates began to build on the 430-acre site, for which 3,200 homes have been planned.[5] Construction continues, but large sections have been completed and a vibrant community has taken root.

The original King Farm barn buildings have been retained in a five-acre heritage park on the north end of the development as shown in Figure 2, in order to provide educational and recreational opportunities for the residents of King Farm and Rockville.[6] Next to the heritage park on the northwest side of the development is a larger 28-acre park named after Mattie J. T. Stepanek (1990-2004), a young man who in his short life inspired many with his courage in the face of affliction with a debilitating neuromuscular disease, possession of wisdom rare in one so young, and desire for peace and understanding in the world.

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[4] "Peerless Rockville," Historical Information on King Farm, 2005.

[5] "Smart Growth Illustrated – King Farm, Rockville, Maryland," U.S. Environmental Protection Agency, Office of Policy, Economics, and Innovation & Office of Cross-Media Programs, Smart Growth Program information webpage, 2010.

[6] Smart Growth Illustrated, 2010.

Figure 2 - King Farm Barns viewed from Elmcroft Boulevard to the south. Image by author.

Site and New Urbanism

Planning for King Farm utilized the principles of traditional neighborhood design. These principles are characteristic of well-loved and successful neighborhoods of times past, and as noted by the town planner for King Farm,

> "encourage and embrace animated street activity, multiple forms of transportation (pedestrian, bicycles, automobiles, buses, light rail), reduced dependency on the automobile, coherent streetscapes, emphasis on quality open spaces, and the harmonious relationship of landscape, architecture and open space."[7]

[7] Torti Gallas and Partners. "King Farm," 2010.

In philosophical scope the development of King Farm has conscientiously embraced the "Charter of the New Urbanism," from the organization Congress for the New Urbanism.[8] The principles of the charter are grouped into three categories applicable to large scale (metropolitan and city), medium scale (neighborhood) and small scale (blocks and buildings), and in all three scales it is apparent that effort has been made to follow these principles wherever applicable. Some examples are as follows:

- The entire King Farm development presents as a well-defined and bounded small town, in accordance with the principle of maintaining definition of city and town areas.
- The original farm aspect of the area was honored in keeping the King Farm barn buildings, as well as buffered corridors protecting streams and ponds in accordance with the principle of maintaining relationships of developed areas to the natural and agrarian hinterland states.
- The King Farm layout is dense, interconnected by a close grid of narrow streets with broad sidewalks. Walking from one's apartment or house takes one quickly to small galleries, shops, restaurants and cafes, a supermarket, and offices nestled in the development. This is in accordance with the principle of putting the places of activity of everyday life in easy walking distance and reducing the use of the automobile. This is reinforced by a series of interconnected bicycle paths running

[8] Charter of the New Urbanism", Congress for the New Urbanism, 2001.

throughout the development. Additionally, shuttles to the Shady Grove Metro station run throughout the development, allowing commuters to avoid the automobile entirely as they connect to their jobs anywhere in the Washington DC Metro-serviced region.

- Architecturally, the homes and businesses in King Farm are pleasant and interesting. They are well-varied in type, from apartments to single family homes, integrated with commercial areas. Setbacks are limited or removed, and parking for houses and shops has been moved behind the buildings and to parking garages in the back, avoiding ugly expanses of parking between street/sidewalk and buildings, garage doors dominating the facades of houses, and so on. The gas station at King Farm is "gas – backwards," with the pumps located behind, and the convenience store brought to the corner for easy pedestrian access.[9] These types of features, incorporated throughout Kings Farm, are in accordance with the principles of maintaining pleasant, safe, and interesting streets and squares for the residents.

Site Description

Specifically, the elementary school site comprises the existing 12-acre open sports/park quadrangle known as King Farm Park enclosed by four streets: 1) Watkins Pond Boulevard, 2) Trotter Farm North Drive, 3) Deer Meadow Lane and 4) Grand Champion Drive. This general area is shown in Figure 3. Although

[9] Smart Growth Illustrated, 2010.

currently a general use public park, the area is designated for a future Montgomery County Public School system elementary school, and accordingly will be given over to school use when required by the county.

Figure 3 - Proposed site for the elementary school, King Farm Park shown in context with surrounding residential units. Satellite image from Google Earth.

Currently, the following features and amenities are located in King Farm Park:

- open play field
- restrooms (open during permitted activities)
- play equipment sets
- park benches
- softball/baseball field (for minors' use only)
- 1 soccer/multi-use field
- lighted tennis courts
- basketball courts
- 2 water fountains
- park shelter
- picnic area with grills
- art in public places with sitting area[10]

The location of the park/school site in relation to the rest of King Farm can be seen in Figure 4. The park/future school site is in the upper right side of the map, which happens to be in the midst of an area of single family homes.

[10] City of Rockville, Maryland web pages, 2010.

Figure 4 - Map of King Farm. Map from King Farm Citizens Assembly webpage, 2010 with annotations by author.

The elementary school site is connected to a future middle school site (currently a large park) via Pleasant Drive, which passes through the town center of King Farm. Along this axis, a number of small “pocket” parks/green areas are located as illustrated in Figure 5. Also as shown in this figure, the elementary school site connects to King Farm town center and has access to major traffic routes such as Redland Boulevard and Highway 355.

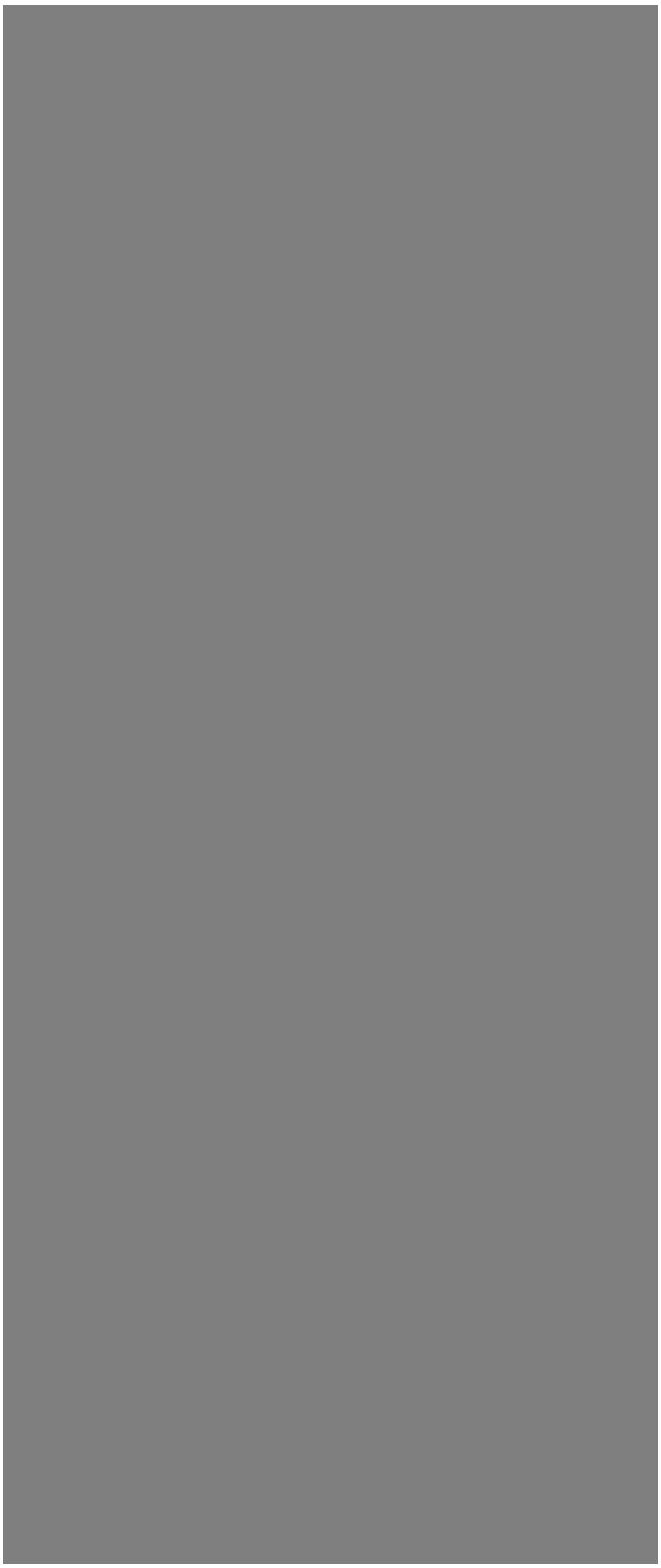

Figure 5 - King Farm Connections. Satellite image from Google Earth with annotations by author.

Figure 6 provides a site survey/photo montage, giving an idea of the appearance of the school site in dissected views.

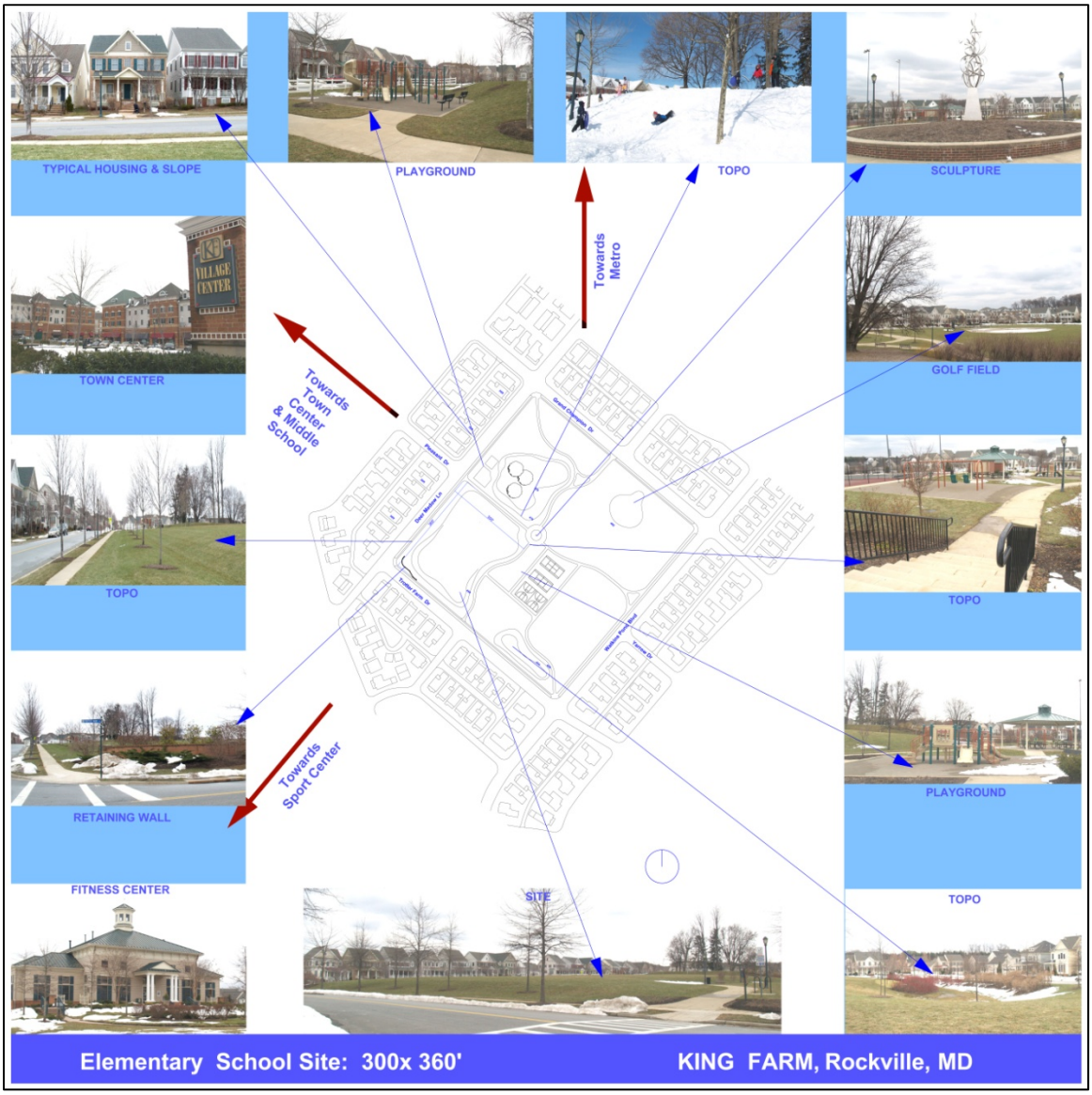

Figure 6 - Site Survey. Images by author.

Figure 7 provides section diagrams along the west-east and south-north cuts.

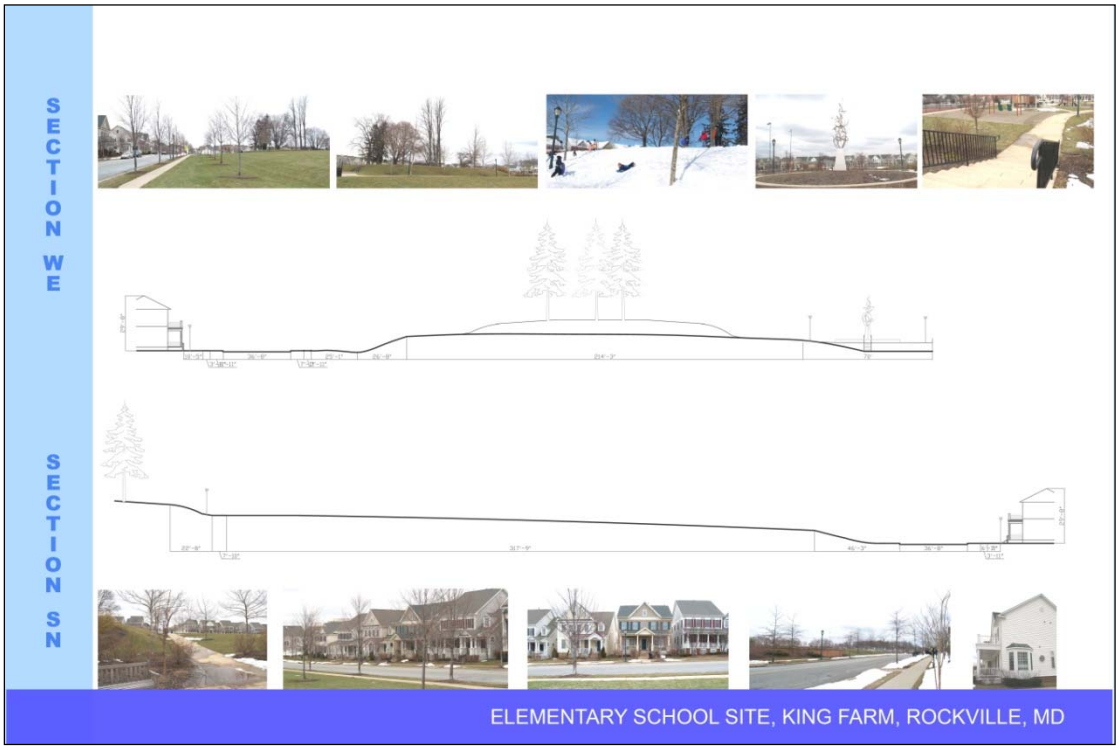

Figure 7 - Site Sections. Images by author.

The following illustrations show the elevations of the single family houses surrounding the square/proposed school site, and select neighborhood views. It is a pleasant and beautiful neighborhood.

Figure 8 - North Elevation opposite elementary school site. Image by author.

Figure 9 - West Elevation opposite elementary school site. Image by author.

Figure 10 - Neighborhood views. Images by author.

Topography

The existing topography of the school site is shown in Figure 11. As required by the city, the northwest hill with existing trees and plantings must be left untouched in future development. However, the other areas are available for locating school buildings and grounds.

As can be seen in the topographic map, the grade change on the northwest side of the site is approximately 16’ from an elevation of 466 from the pathway extending into the site from Pleasant Dr., to an elevation of 450 at Trotter Farm Drive. Therefore, the average slope in this quadrant is 2.8°.

Figure 11 - Site Topography. Map adapted by author from topographic map courtesy of the City of Rockville, Maryland Department of Information and Technology, Geographic Information Systems (GIS) database, 2010.

Site Selection Criteria

The process of selecting a school site factors in technical requirements having significant effect on feasibility and cost effectiveness of a site. Combined with the educational program, these result in a set of standards against which the potential of a site can be evaluated. These criteria include:

- Size/Shape
- Location
- Topography/drainage
- Access/traffic
- Utilities
- Security/Safety

Figure 12 - School Site Selection Criteria. Image from “The School Site Planner,” Public Schools of North Carolina, State Board of Education, Department of Public Instruction, Division of School Support, School Planning, Raleigh, North Carolina, 1998.

The criteria have specific impacts in school design. For example, separate parking for buses and service vehicles from teacher/visitor parking is a safety and traffic/accessibility issue, as is separation of access points for vehicular traffic vs. pedestrian/bicycle only. Required utilities (including electricity, water, gas, and sewer) need to be available or extendable to the site. (Incidentally, in King Farm all necessary utilities are buried in place with suitable capacity for a school to be added).

Site Assessment

Figure 13 shows a preliminary site concept to guide location of the elementary school and its grounds. This has taken into account the existing site features, context, and other key criteria for siting a school.

Because site access from the north and south is suggested by the existing traffic flows, parking is located near these site access points. Separate parking areas for buses/service vehicles and for teachers/visitors is required by established convention.[11]

An essential constraint on the school layout is that it connects meaningfully to the terminus of Pleasant Drive on the northwest side. Accordingly, this axis to the northwest can be thought of as a “front door” to the school, and appropriately is set off-angle to the vehicular traffic flows into the site. Thereby this becomes the most attractive approach to the school, and using this approach to directly access the school site is only available to pedestrian or bicycle traffic and not automobiles, in accordance with the King Farm philosophy of emphasizing walking and non-automobile use. Moreover, the children walking to school can preferentially use this approach (and the other pedestrian accesses connecting to the walking paths cutting through the site) to avoid the main traffic flows to the north and south and the other street intersections for both convenience and safety. These ideas are depicted in Figures 14 and 15.

Whatever the location of the school buildings, the remaining grounds can be utilized for park area, playgrounds and recess/sports areas.

[11] “The School Site Planner,” 1998.

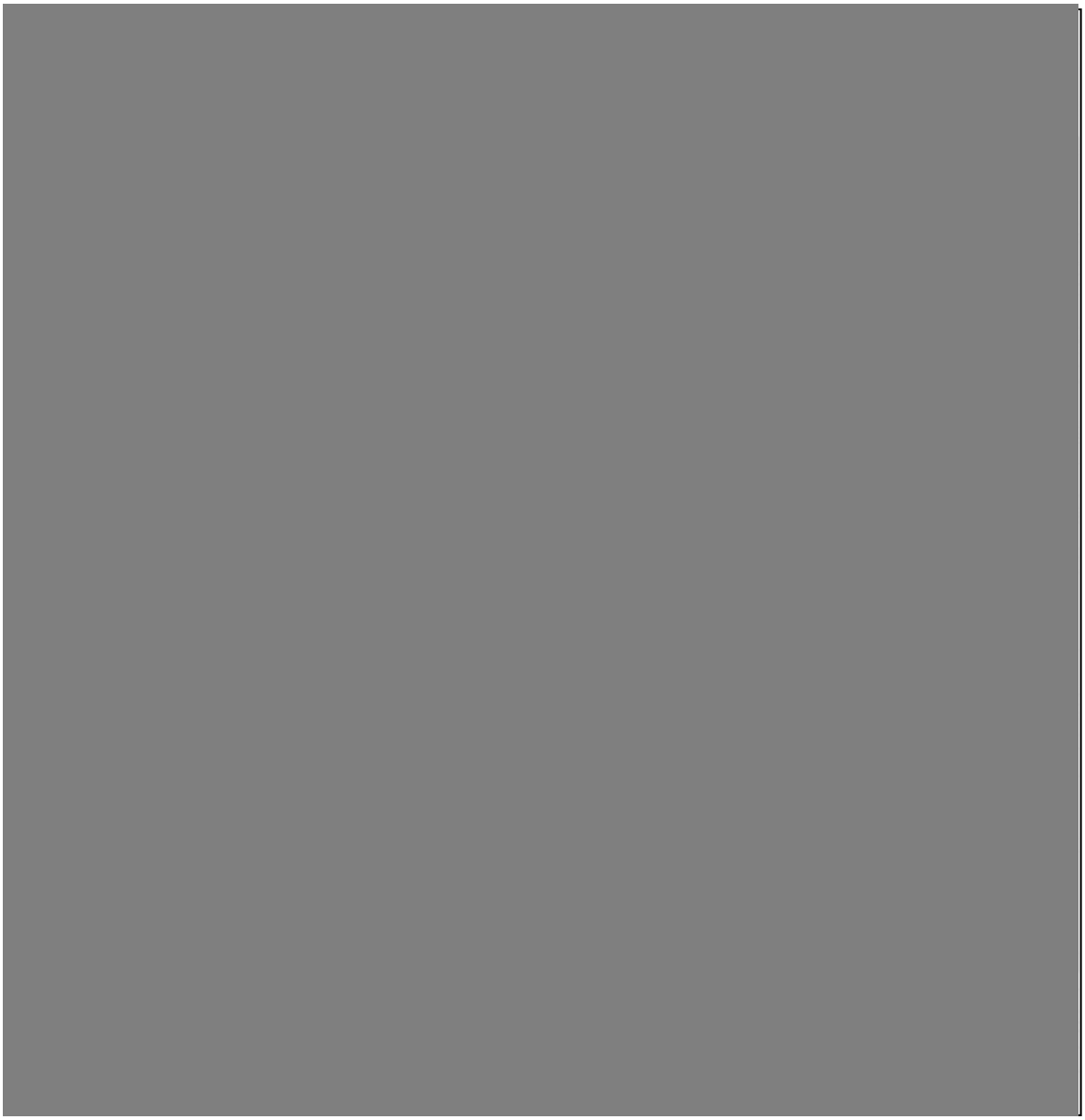

Figure 13 - Site Assessment. Map adapted by author from topographic map courtesy of the City of Rockville, Maryland Department of Information and Technology, Geographic Information Systems (GIS) database, 2010.

It would be an injustice to remove the existing park from the community by letting the new school take it over completely. Instead, a portion can be preserved and improved by establishing a shared-use park area for the community and school, most appropriately in the area depicted in green in Figure 14. This park area assumes a public character, as opposed to the private school area at back.

Figure 14 - Site characterization. Image by author.

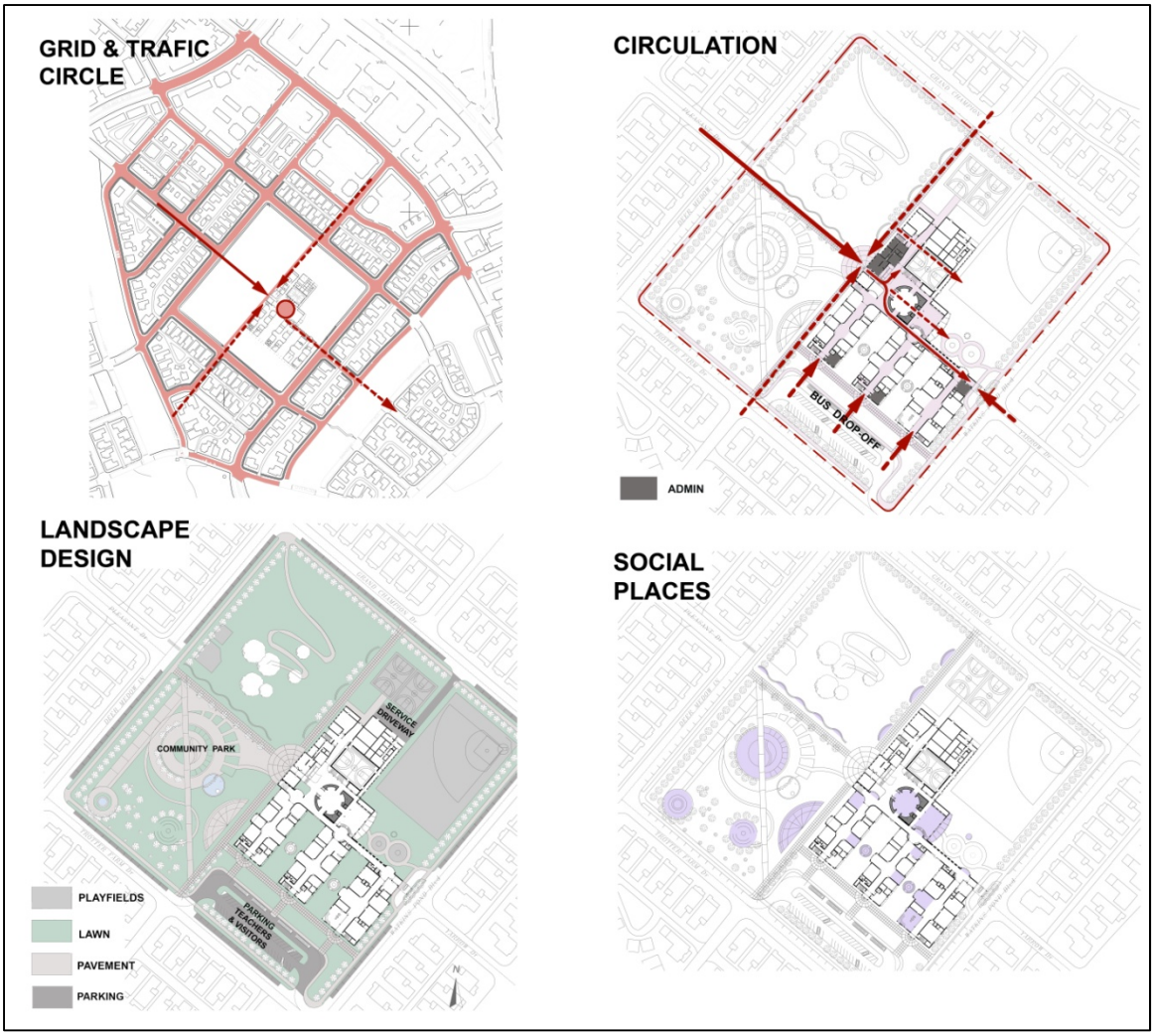

Figure 15 - Site influences for design. Image by author.

Site Consistency with Community Principles

Above all, a school site should foster the safety of the children who will attend it. The site chosen for the deaf principles school is ideally located with this principle in mind. The streets bounding the site have low speed limits characteristic of King Farm neighborhoods (25 mph or less). Drivers need not be forced to obey the limits in King Farm by speed bumps, speed cameras and the like; moderate speeds naturally follow on these streets which are narrow with on-street parking and frequent stop signs.

The school site will also put it in walkable distance for large numbers of school-age children. King Farm seems to have attracted a well-varied demographic of residents, including a large number of young families with small children. With a total of 3,200 homes in the immediate King Farm development and other residential areas immediately beyond, there will be a significant number of elementary school children to attend a school located here.

Because King Farm includes no schools at the present, the principle of including places for all activities of everyday life in the New Urbanism philosophy seems to demand that a school be located here for the all-important everyday activity of a child's education.

Chapter 2: Theory & Functional Considerations

Deaf Space

The concept of Deaf Space[12] (initially referred to as visu-centric design) began at Gallaudet University as part of the development of the Sorenson Language and Communication Center (SLCC) building designed by SmithGroup. Architect Hansel Bauman was retained as a consultant by the University for SLCC development, and is currently the director of Campus Planning and Design and is also a faculty member leading the Deaf Space Project which evolved out of the SLCC process. Bauman and colleagues at Gallaudet are beginning to develop the Deaf Space Project into an Institute.[13]

A core idea of Deaf Space is the awareness that sign language is fundamentally direct visual contact and beholding of a person's being, and as such is much different than hearing communication. A sense of safety and well being comes by knowing what is in the periphery and behind. Total visual access/connectivity in buildings therefore is a key Deaf Space idea. Another idea is the collective aspect of deaf culture, in which groups will tend to form interactive, rounded geometries. The idea of wide, clear circulation pathways to not obstruct or confuse movement of the deaf is another key idea in Deaf Space.[14] These other Deaf Space principles are illustrated in Figures 16-19.

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[12] Bauman, Hansel. "Gallaudet, Deaf/Diverse Campus Design Guide," Gallaudet University, Washington, DC, 2010; Byrd, T. and Consoli, J.T. "Deaf Space," *Gallaudet Today*, Spring 2007.

[13] Dearie, Alick. E-mail to Karina Tsymbal dated 5 June 2010.

[14] Bauman, Hansel. "(Speakers and Signers) Hansel Bauman: Deaf Architecture -- The Resonance of Place and the Senses," MIT Tech TV, 2009.

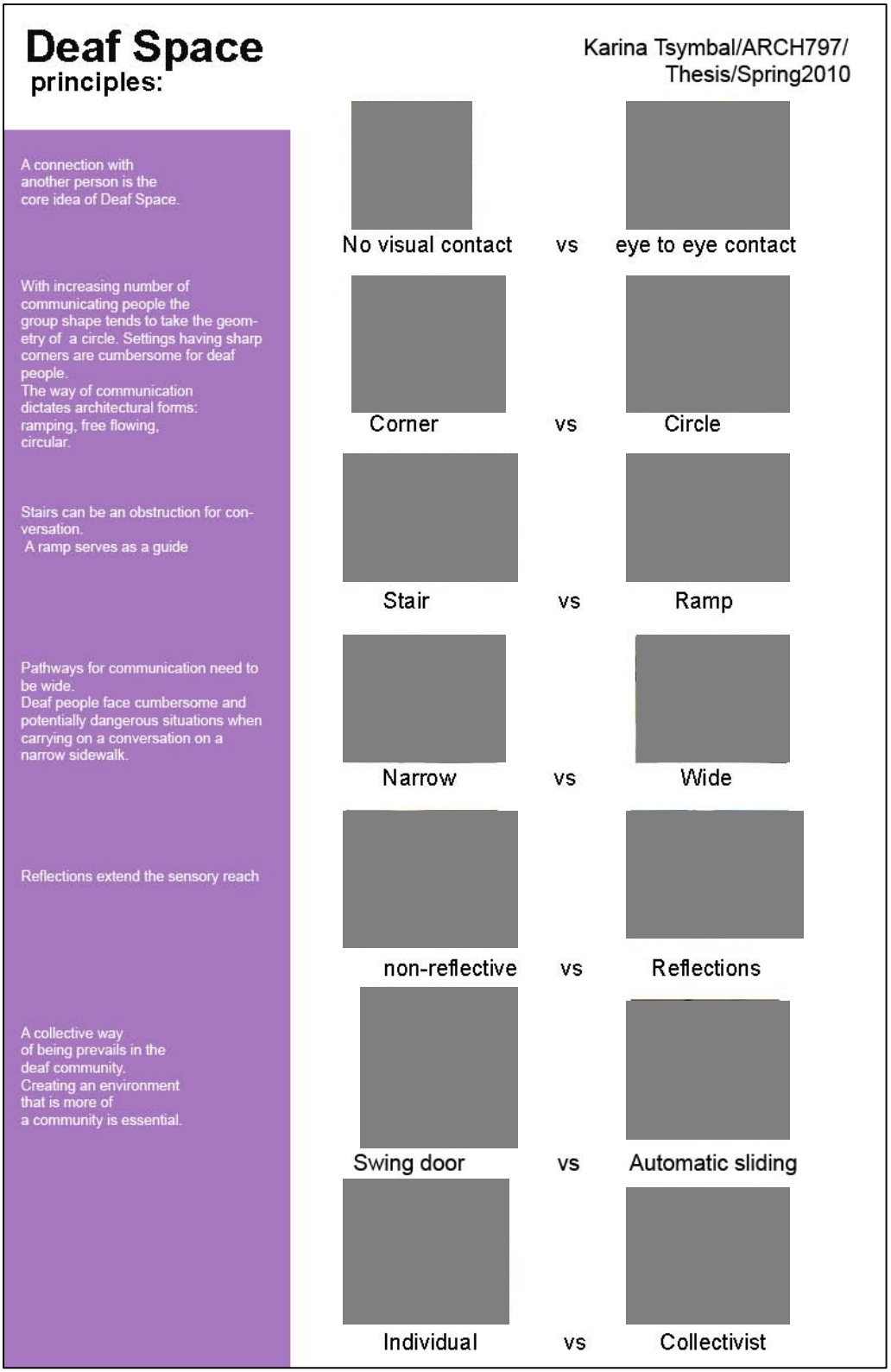

Figure 16 - Deaf Space principles 1st set. Adapted by author from material in Bauman 2010 and Byrd & Consoli 2007, additional images from Google Images and Flickr.com.

Figure 17 - Deaf Space principles 2nd set. Adapted by author from material in Bauman 2010 and Byrd & Consoli 2007, additional images from Google Images and Flickr.com.

Figure 18 - Deaf Space principles 3rd set. Adapted by author from material in Bauman 2010 and Byrd & Consoli 2007, additional images from Google Images and Flickr.com.

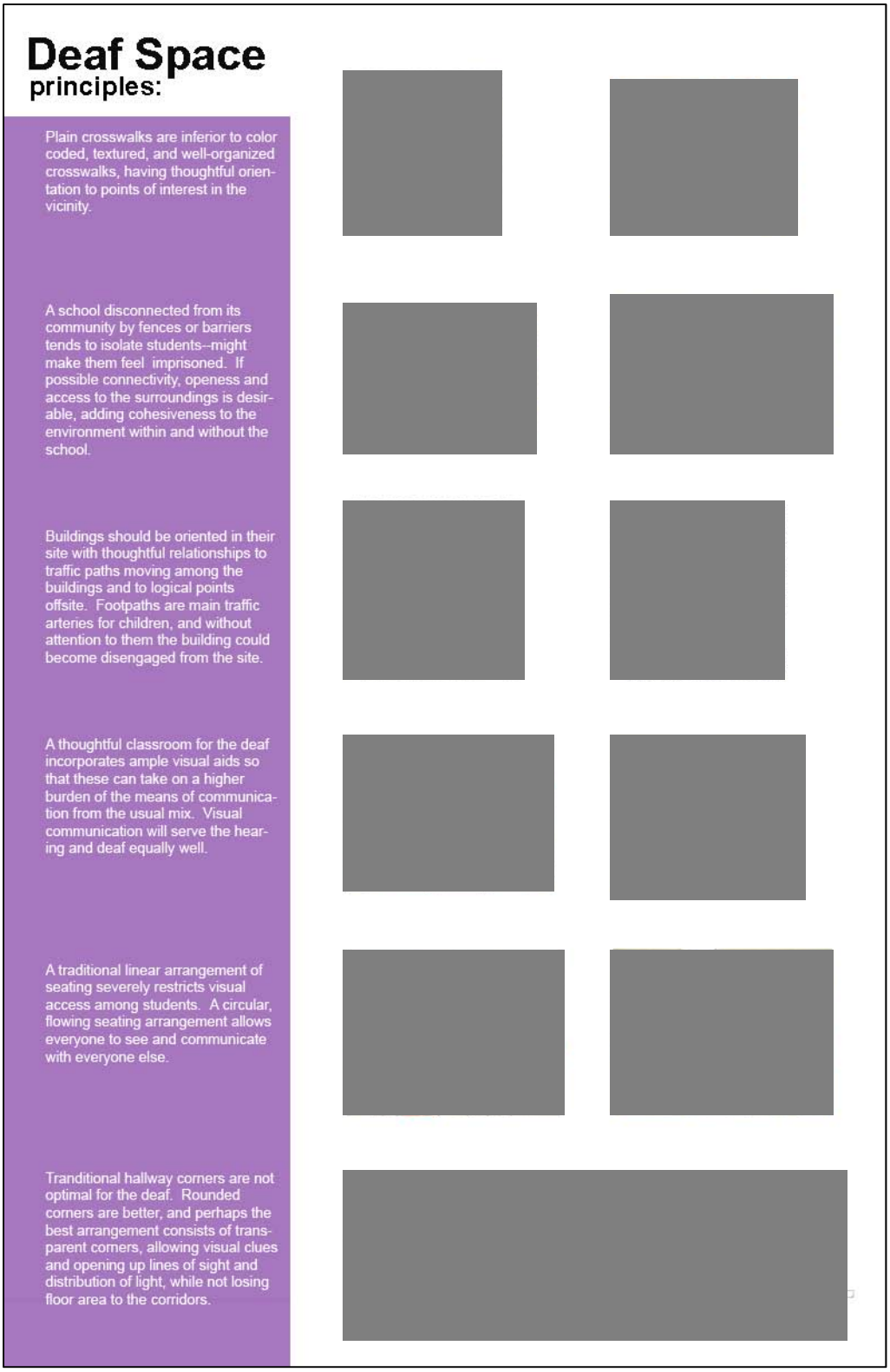

Figure 19 - Deaf Space principles 4th set. Adapted by author from material in Bauman 2010 and Byrd & Consoli 2007, additional images from Google Images and Flickr.com.

Functional Space Requirements

Whatever the design of the buildings, the school must have a suitable allocation of space to various required functional areas. Figure 20 provides a visual depiction of the functional space requirements for an elementary school, K-5. These provide a guideline for determining suitable classroom sizes, needed administration areas, etc. Areas for circulation will be significantly higher (perhaps by 1/3) than normally allowed.

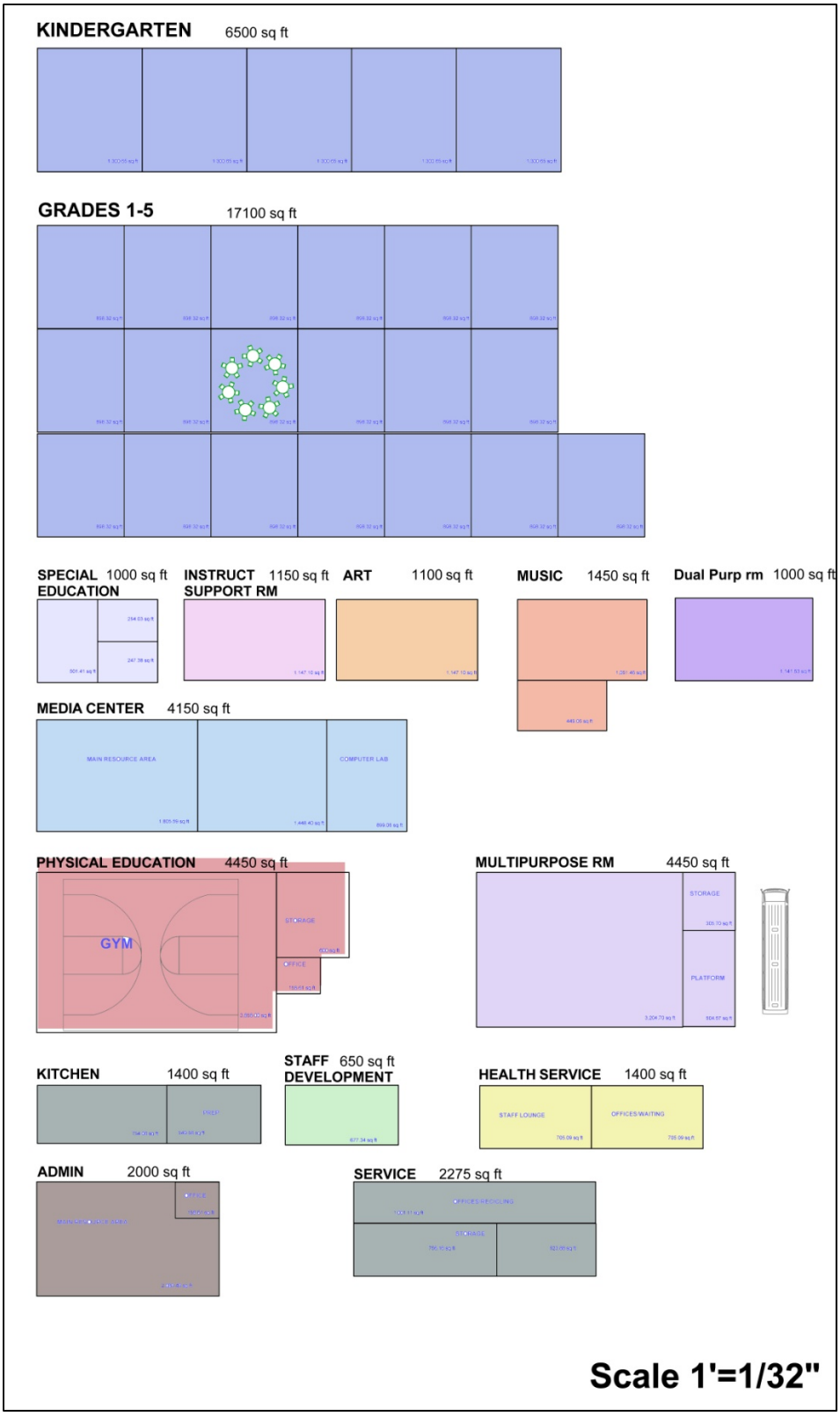

Figure 20 - School Program/Functional Space Requirements. Image by author.

Visibility, Lighting, and Building Orientation

Ideally the school should be oriented to the sun to maximize natural daylighting potential, minimize morning and late afternoon glare from sun low on the east and west skies, and prevent excessive solar heating on the west side of buildings. The sun path diagram for Rockville is shown in Figure 21. This provides information for determining necessary lengths of sunshades, cantilevers, and window placement and heights to take best advantage of natural light.

Although the foregoing considerations apply to any building, for the hearing impaired visibility of lips and signing is critical. Harsh or inadequate lighting will get in the way of this. As documented previously in deaf space principles, the requirement for visibility for signing and lip reading needs to be kept in mind as lighting design is worked out. Orientation of buildings on directional axes would be as shown at the lower left, with 18° appropriate for buildings located in temperate zones.[15]

[15] Hindrichs, Dirk U. *Plusminus 20 /40 Latitude: Sustainable Building Design in Tropical and Subtropical Regions*, Stuttgart: Edition Axel Menges, 2007.

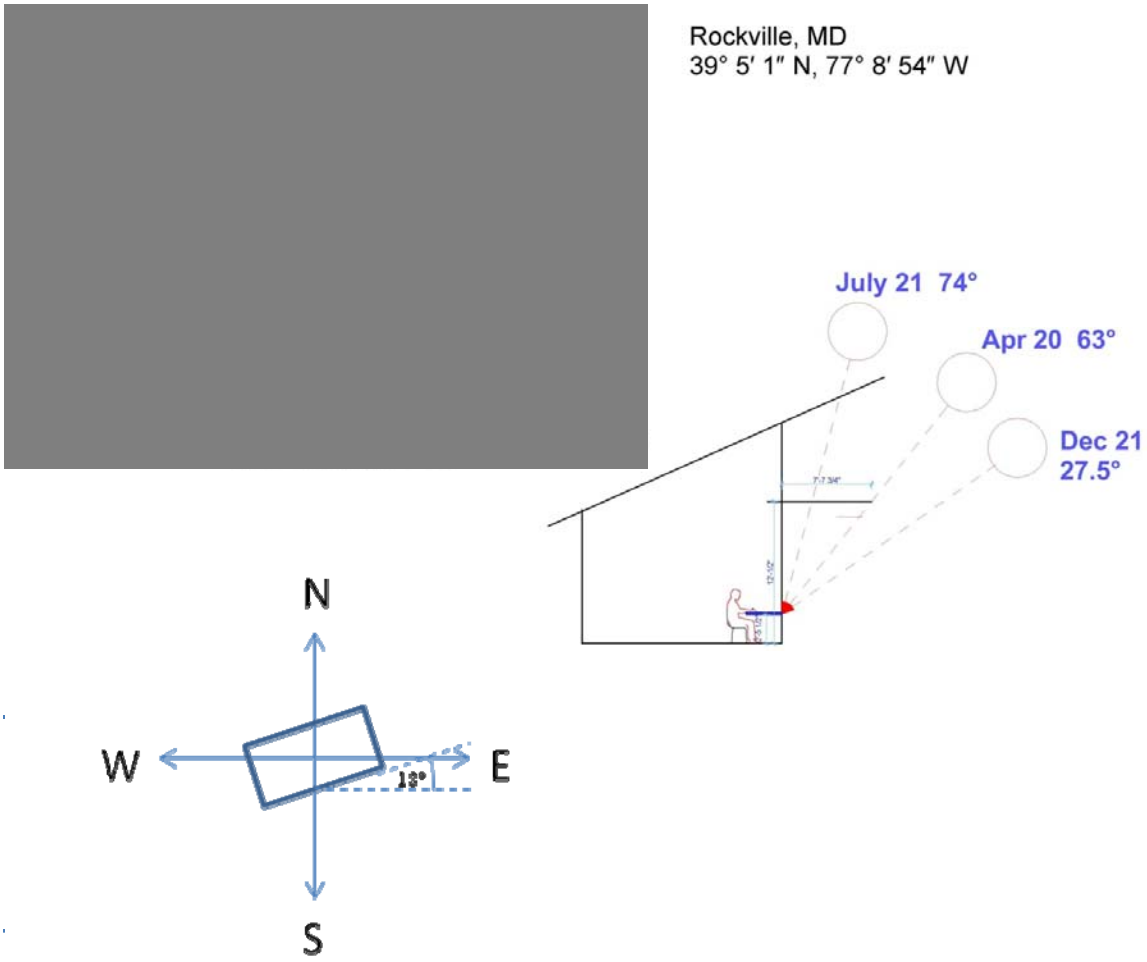

Figure 21 - Sun Path Diagram for Rockville School Site, Building Orientation. Main image of sun path generated by the sun path chart program available at http://solardat.uoregon.edu/SunChartProgram.html, University of Oregon Solar Radiation Monitoring Laboratory; additional annotations and diagrams by author.

Climate

Rockville lies on the edge of the humid subtropical climate zone, with hot, humid summers and mild to chilly winters with plentiful precipitation year-round. Mean temperatures and precipitation levels in Rockville are given in Figure 22.

Figure 22 - Mean temperatures and precipitation levels in Rockville, Maryland. Image from Local Information Data Server (IDcide), 2010.

Approximate prevailing wind directions and speeds for Rockville Maryland are given in Figure 23. The average values are in the last column.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
Prevailing Wind	NW	NW	NW	NW	S	S	S	S	S	N	NW	NW	NW
Wind Speed (mph)	8	9	9	9	7	7	6	5	6	7	8	9	7
Peak Gust Wind Velocity (mph)	69	71	79	71	79	74	85	69	68	54	62	66	85

Figure 23 - Prevailing wind directions and speeds for Rockville Maryland. Data from National Climatic Data Center (NCDC). "Climatic Wind Data for the United States," Ashville, North Carolina, 1996.

Deaf Principles & New Urbanism

Finally, it is interesting to consider possible connections or reinforcement between the New Urbanism principles followed in King Farm development and Deaf principles guiding the school design. Reviewing the New Urbanism principles which apply to the block, street, and building scale, those that might apply to the design of an elementary school could be summarized as follows:

- Physical definition of public spaces for shared use.
- Seamless linking of an individual architectural project to its surroundings, transcending style.
- Reinforce safety but not at expense of accessibility and openness.
- Architectural consistency with local climate, topography, history, and building practice.
- Encourage walking and neighbor interaction.
- Buildings should provide inhabitants with a clear sense of location, weather, and time; natural heating and cooling are preferred.

Many of these principles obviously reinforce deaf principles (such as accessibility and visual openness), and in the design we will find that all of these points are addressed in some aspects of the design of the school, grounds, and park spaces developed in the final design.

Chapter 3: Precedent Analysis

Sorenson Language and Communication Center

Figure 24 is a photograph of the main atrium in the Sorenson Language and Communication Center at Gallaudet University, Washington DC, in which certain design and building features reflect Deaf Space principles. The flowing curves, openness, and ample visual connections from this central space to other parts of the building are characteristic of deaf-friendly design.

Figure 24 - Sorenson Language and Communication Center. Image by author.

In contrast to the Sorenson Center, consider a typical elementary school design, e.g. the Forest Ridge Elementary School in Howard County. The plans of the Sorenson Center and Forest Ridge are shown side by side in Figure 25.

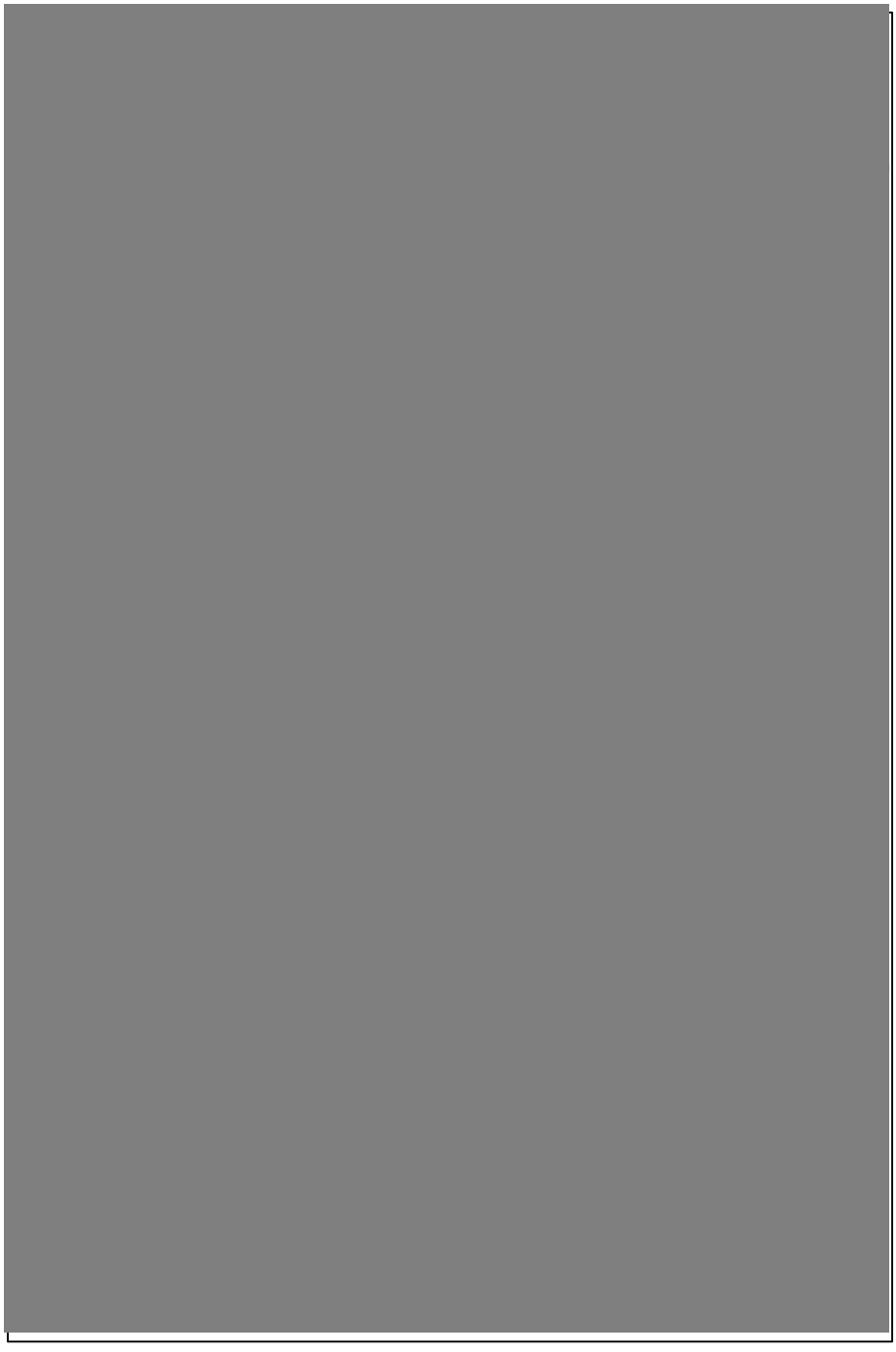

Figure 25 - Sorenson Center Plan (top) and Forest Ridge School (bottom). Adapted by author from fire hazard placard at SLCC; Forest Ridge plan courtesy Smolen Emr.

Note that the central space of Sorenson (hatched area) is large and connects all of the building areas cohesively, creating many lines of sight throughout. Corners (also hatched) are rounded for visual connectivity. On the other hand, the Forest Ridge School demonstrates everything wrong, as it has little or no lines of sight along its disjointed and narrow corridors, limited circulation area, angularity, abrupt corners and so on.

Millennium High School

Located in the Financial District in lower Manhattan, Millennium High School was not designed as a deaf school, yet it incorporates many of the features necessary to deaf school design and comfort. A plan of one of its floors is shown in Figure 26, along with what would be a typical plan using traditional corridors and walled-off classrooms.

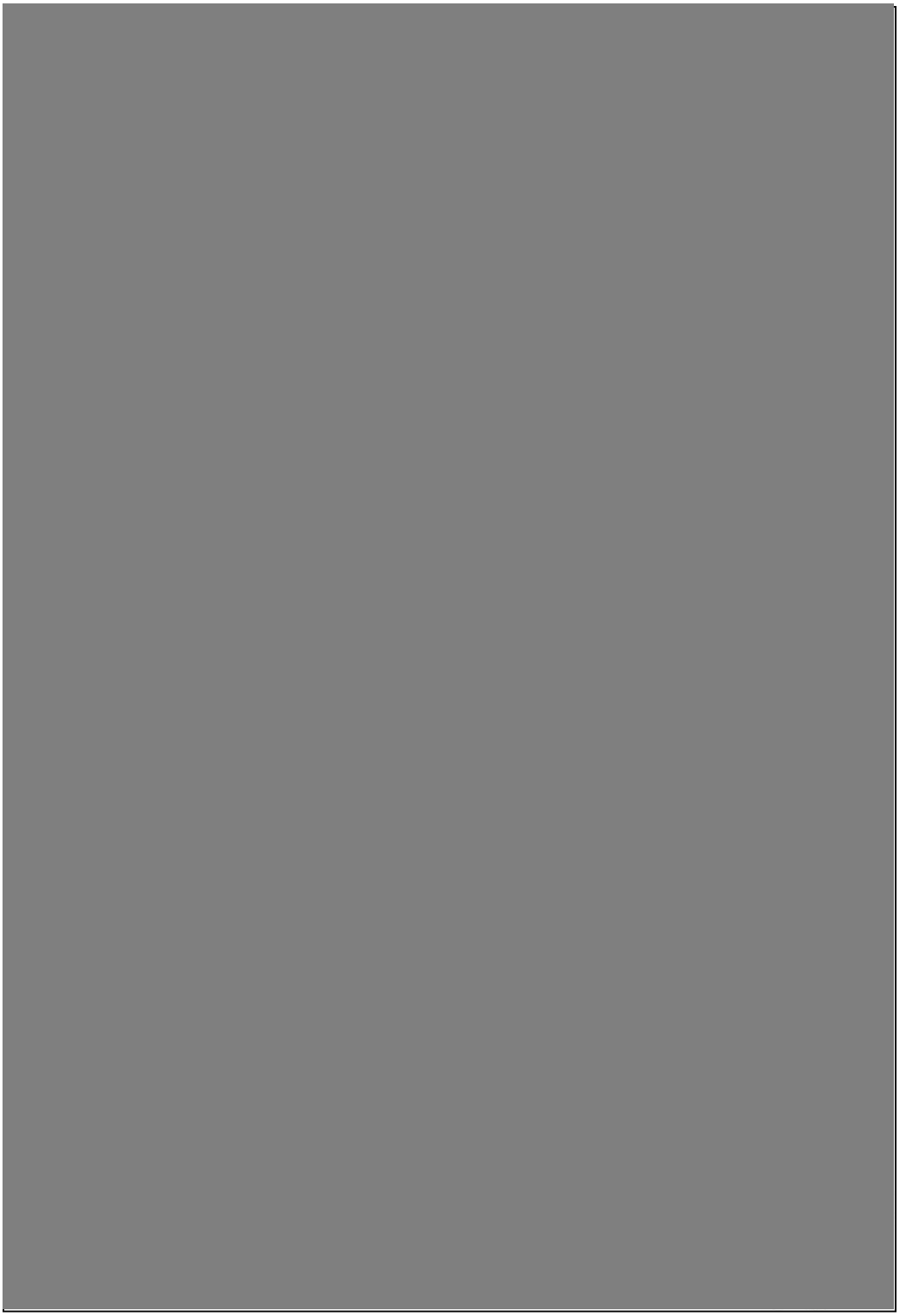

Figure 26 - **Millennium High School Layout (top) vs. Traditional Corridors.** Images from Nair, Prakash and Fielding, Randall. *The Language of School Design: Design Patterns for 21st Century Schools*, India: Designshare.com, 2007.

Strictly speaking, Millennium High School has no corridors at all. All areas of circulation are useable as learning spaces. Instead of traditional desks, common tables are used to enhance group learning. Interior windows spread natural light from outside right to the center of the plan, and light fixtures include direct/indirect lighting as appropriate for minimizing glare and establishing needed illumination. Angles of the walls scatter sound and moderate it between areas. Breakout niches are available, but no closed-off classrooms are present.[16] Clearly, such a design meets many needs of the hearing impaired, with its openness, lines of sight, and enabling of circular group settings.

Hogar Calasanz Center and Maihara Kindergarten

The Hogar Calasanz Center for Special Education in San Jose, Costa Rica illustrates building design that creates excellent visual connectivity between building areas, and the flowing deaf space principle. The Center's plan is roughly that of a half circle, with the building flowing around the exterior part of the circle, and leaving an open courtyard area inside. From any part of the school's inside face, it is possible to see across to the other areas of the school.

We see the same kind of connectivity in the Maihara Kindergarten designed by Shuhei Endo and located in Shiga, Japan. The interior face of the school consists of an expanse of glazing that admits much natural light and establish a constant sense of connection from inside to outside and across the whole school. Plans are shown in Figure 27.

[16] Nair, Prakash and Fielding, Randall. *The Language of School Design: Design Patterns for 21st Century Schools*, India: Designshare.com, 2007.

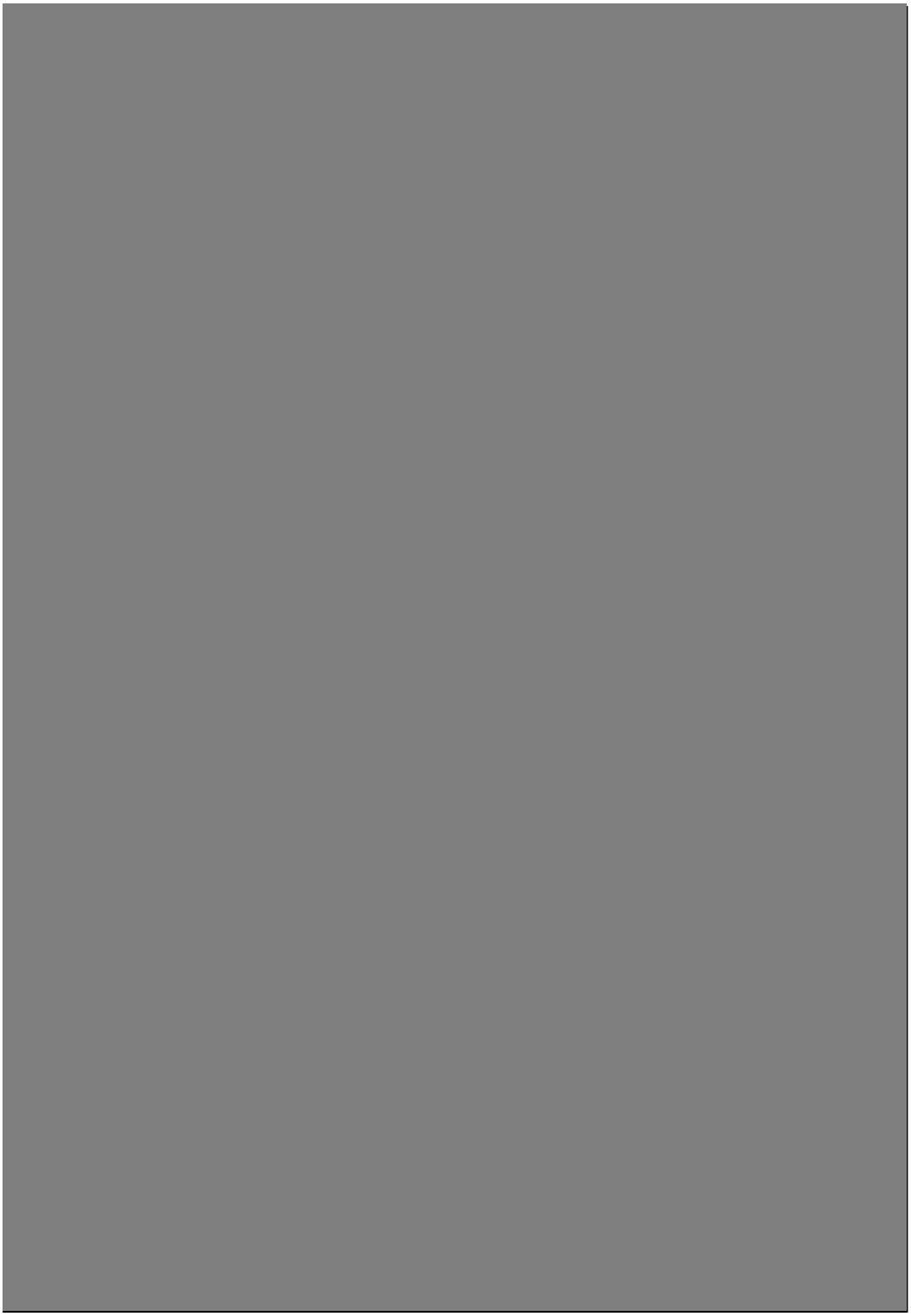

Figure 27 - Hogar Calasanz Center (top) and Maihara Kindergarten (bottom). Annotations by author with images from Dudek, Mark. *A Design Manual, Schools and Kindergartens*, Basel: Birkhäuser, 2007.

Nærum Amtsgymnasium (Copenhagen) & Secondary School (Lorch)

The Nærum secondary school in Copenhagen utilizes an innovative design, with the intention of creating a compact building which would do away with traditional corridors. It adopted a contemporary office plan, but surrounding a dramatic central atrium where public spaces such as auditorium, cafeteria, and library are located. Extensive glazing is present to provide views across the atrium from all areas of the school. The library is located in the kidney bean-shaped area at center (Figures 28-29), and is also glazed to provide panoramic views from within the library.[17] This unconventional design is strong on visual delight and connectivity, particularly welcome to the hearing impaired.

Figure 28 - Nærum Secondary School Library. Image from Dudek, 2007.

[17] Dudek, 2007.

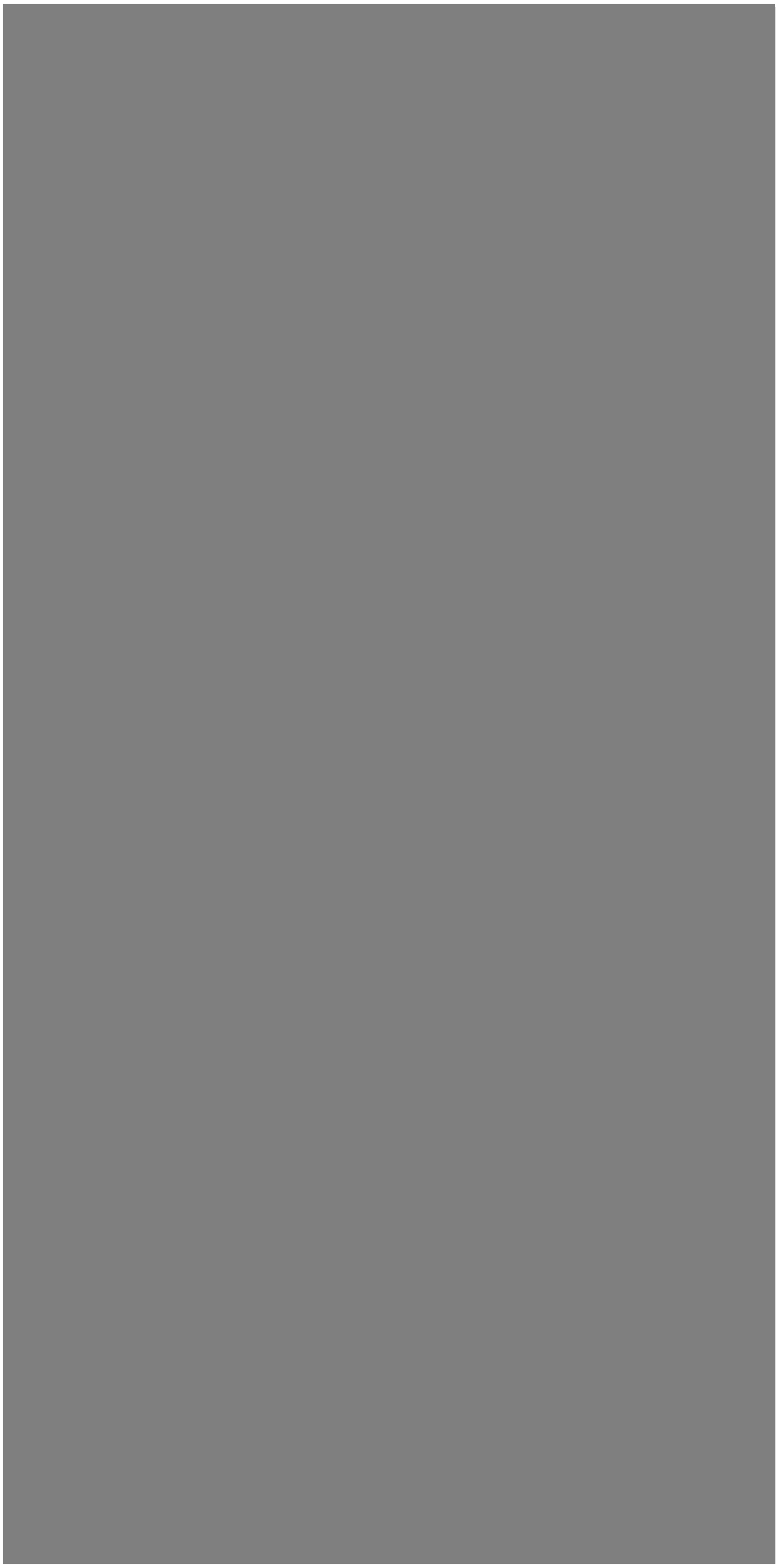

Figure 29 - Nærum Secondary School (top) and Secondary School in Lorch (bottom). Adapted by author with images from Dudek, 2007.

The Secondary School Auf dem Schäfersfeld in Lorch, Germany, shown at the bottom of the previous figure, takes the geometry of the school to a complete circle. Here again, we find visual connectivity across all areas of the school.

Central Spaces and Circulation

Within buildings, the idea of spacious, naturally illuminated, and deaf-friendly circulation areas that are sought after in good design are as depicted in the collage of Figure 30.

Figure 30 - Central Spaces. Images from Ford, Alan. *Designing the Sustainable School*, Victoria: The Images Publishing Group Pty Ltd, 2007.

Media Centers

A heavy reliance on comfortable, inviting media areas with ample views/connections to the outdoors is important in deaf school design. Figure 31 depicts desirable precedents for media centers in school designs.

Figure 31 - Media Centers. Adapted by author with images from Ford, 2007.

Outdoor Courtyards and Spaces

Outdoor courtyards and spaces can be useful extensions of the learning areas within the walls of the school, and should allow creation of meaningful relationships between indoor and outdoor spaces. Concepts for successful accomplishment of these relationships are depicted in Figure 32.

Figure 32 - Outdoor Courts. Adapted by author with images from Ford, 2007.

Small Learning Communities

Small learning communities foster a friendly environment where all know each other and can learn well together. Plan-wise, these might fall into “fingers” of small classroom areas flanking small commons areas, as shown in Figure 33, or more ideally small learning communities of clusters of individual workstations around breakout areas as shown in Figure 34.

Figure 33 - Finger Plan. Image from Nair and Fielding, 2007.

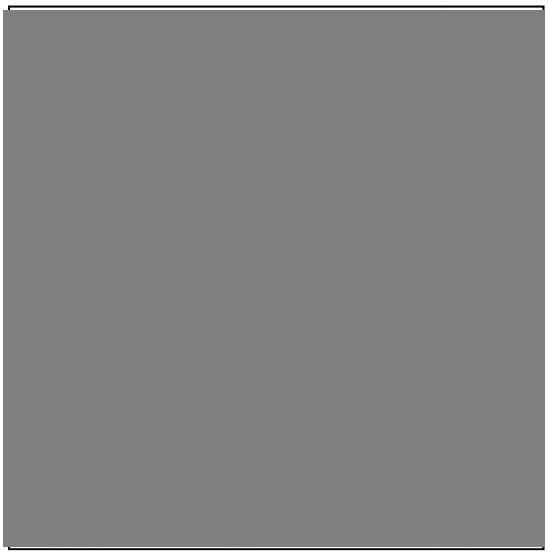

Figure 34 - Small Learning Communities. Image from Nair and Fielding, 2007.

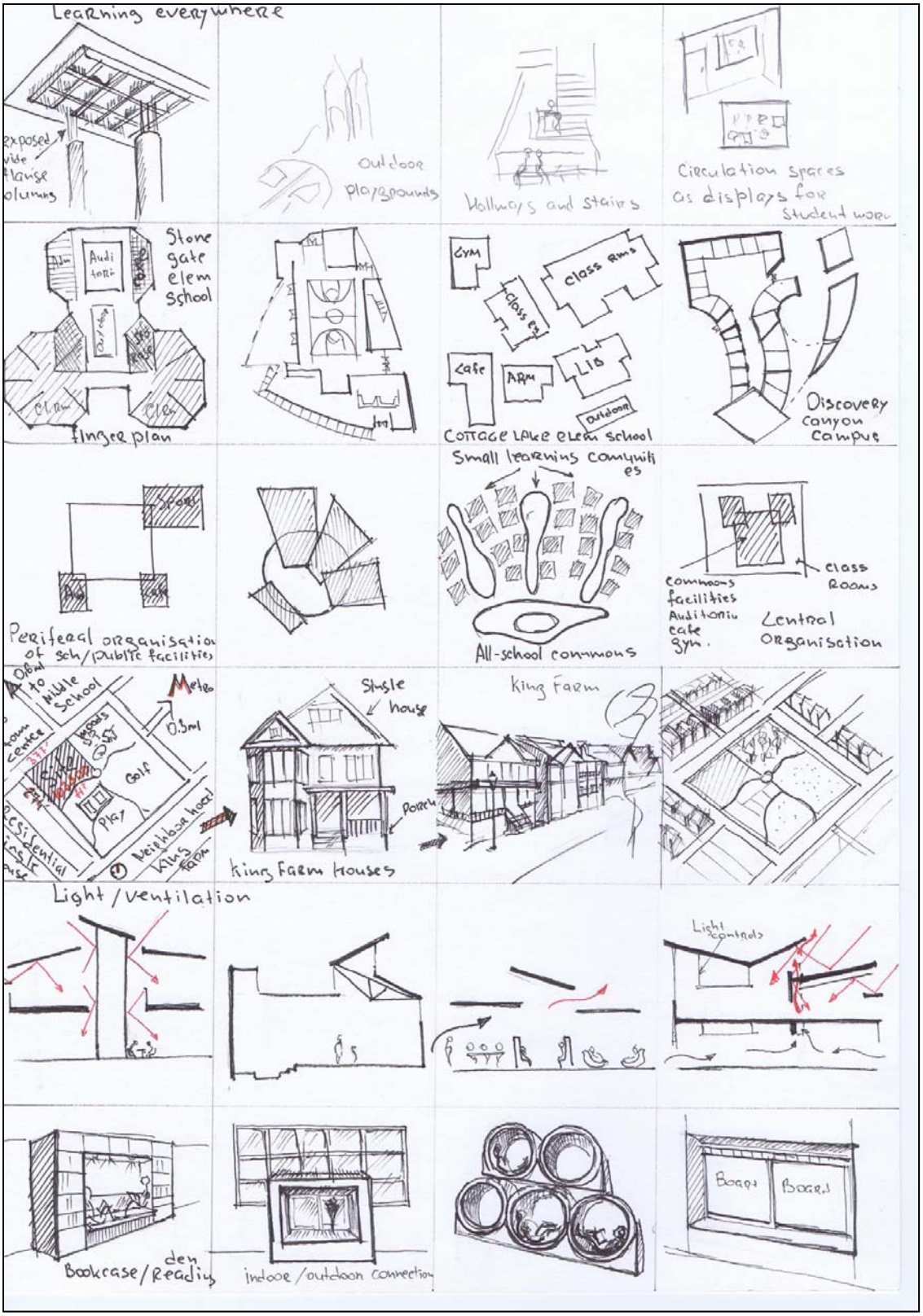

Figure 35 - Influences Informing Elementary School Design. Image by author.

Chapter 4: Concepts of Design Strategy

In development of the elementary school design, four concepts have been the primary drivers: 1) visual connectivity, 2) circulation, 3) collective being, and 4) sense of home. These draw primarily from Deaf Space principles as introduced earlier, yet expand on them and apply them to an environment containing both the deaf and the hearing. In this way it is believed that a school well suited to all will emerge.

Visual Connectivity

We have noted that the difference between the hearing and the deaf is that they must keep one another in the field of vision. This requirement for direct visual contact has immediate impacts on designing a building with a deaf person in mind. It is important to make a building porous, and create a fabric of visual connections throughout the building, connecting people visually within and outside of the building. This can be achieved using transparency, such as transparent railings vs. opaque, transparent corners, and transparent doors or doors with view ports. This is important for safety and a sense of well being that deaf people will not run into others. Use of framed views and vistas also help to create visual connectivity. These concepts are illustrated in Figure 36. Hints of the final design are shown: the main entry into the school is framed, as is the view through the multipurpose room to cafeteria and to outside. Both horizontal and vertical views are set in this example. Also, the view of the main entry which terminates on the Pleasant Drive axis is framed.

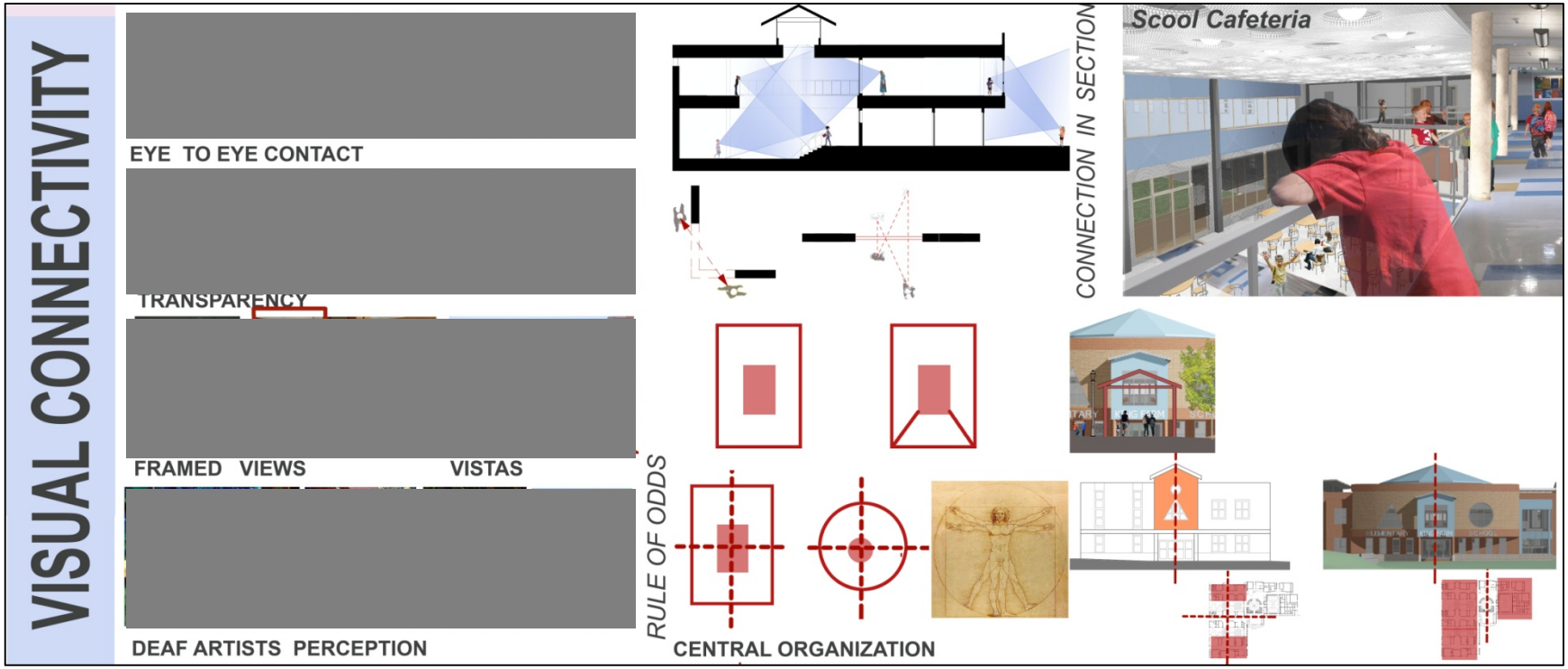

Figure 36 - Visual Connectivity Design Concepts. Image by author with additional photos from Google Images and Flickr.com.

When considering deaf artists' visual sense and perceptions, one comes to the conclusion that deaf artists tend to centralize and zoom into the figure of interest in a work, framing it with surrounding objects. This is illustrated in a collection of deaf artists' works that can be seen in the previous figure.

One might observe that the artistic compositional technique known as the "rule of odds" best describes the deaf sensibility. The rule of odds is framing the object of interest in an art work with even number of objects on either side. It becomes more comforting to the eye, thus creates a feeling of ease and pleasure. It is based on the assumption that humans tend to find visual images that reflect their own body pleasing and attractive; the idea of the Vitruvian Man. Accordingly, this central organization resonates the best with deaf sensibility.

The insights gained from this study of deaf artists' works were influential in the school design. Specifically, the rule of odds is followed in major aspects of the school elevations, namely 1) the arrangement of the north façade of the school, with the main central entrance and surmounting dome framed by building wings on either side, and 2) three Learning Community structures on the east side which present an odd number with the center unit framed by one on either side.

The school design aims for visual connectivity in the arrangement of its spaces. The multipurpose area is essentially open with sweeping views across and from floor to floor. Clerestories at the dome and the central gables on the learning communities admit natural daylight right into the centers of the structures, aiding in good visual connectivity.

Circulation

Concepts related to circulation and associated impacts on design are illustrated in Figure 37. Returning to the idea of eye-to-eye contact and the notion of personal safety, consideration of the circulation problem when deaf people try to keep visual contact while walking and having conversation must influence design. Blind corners could prevent visual connection and cause danger. Rounded corners are better, though transparent corners are the best option for the design. Obstacles in the middle of circulation paths such as columns and barrier posts also can create danger of collision.

Floor texture and ceiling texture can improve circulation and wayfinding. Wide pathways are necessary. Examples of classroom layouts are illustrated, depicting a clear circulation pathway shown by texture. In the school design, wide pathways with social places are set aside from the main pathway and will not interfering with it. The main entry is logically set on same axis as entry to the site. Multipurpose space directs the circulation and acts like a traffic circle. The typical layout of the small learning community and texture signifies the different activities going on in the school and the outdoor learning space. This area could be suitable for play or informal outdoor lectures, and for conversations. Different textures highlight different activities.

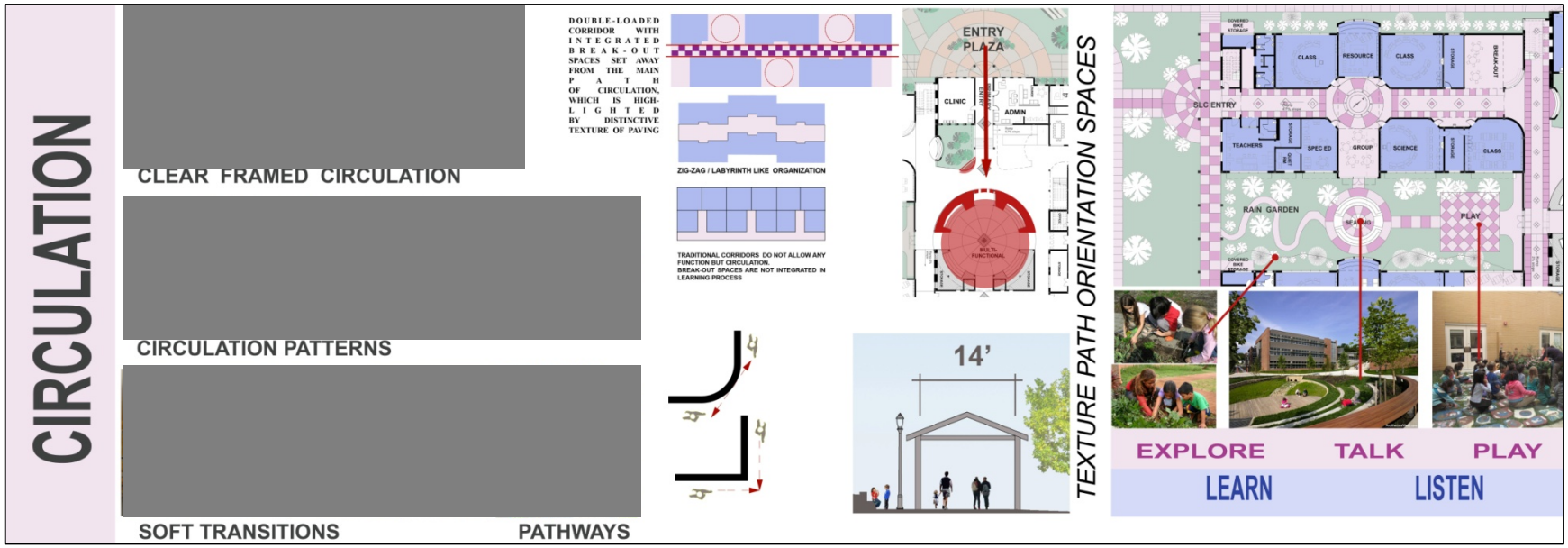

Figure 37 - Circulation Design Concepts. Image by author with additional photos from Google Images and Flickr.com.

Collective

A collective way of being prevails in the deaf community. Creating an environment that is more of a community is essential to meet the needs of the deaf, and will benefit the hearing students as well. We return again to the dynamics of eye-to-eye contact, in which circular and radial arrangements are better for keeping people together, while linear arrangements tend to keep people apart as illustrated in Figure 38. Increasing numbers of communicating deaf people tend to arrange in circles. In this spirit, group seating areas and multipurpose space are created with circular arrangements. People can keep eye-to-eye contact in such spaces.

Sociofugal space (grid-like or linear) tends to keep people apart and suppress communication and interaction. Think of lines of houses in suburbia. This is the arrangement of desks in traditional school classrooms, Sociopetal space (radial) does just the opposite: it brings people together and stimulates interaction as routes merge and overlap. Think of a central town square, the center of a community. Deaf communities are sociopetal by necessity, needing eye-to-eye contact and direct involvement. Circular arrangements are ideal.

In the school design, many examples of sociopetal spaces are hinted at here. Gathering/talking spaces inside and outside the school are circular or semicircular to bring the group together. Arrangement of furniture in rooms is in circles, and even the shape of furniture items such as tables is circular to help sociopetal interaction.

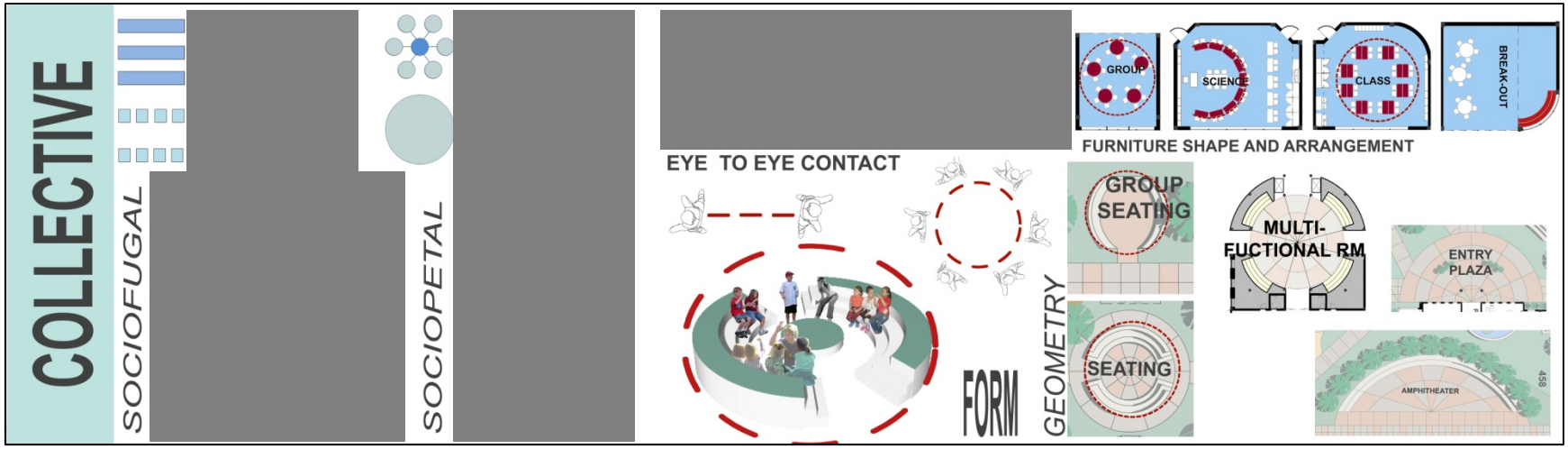

Figure 38 - Collective Being Design Concepts. Image by author with additional photos from Google Images and Flickr.com.

Sense of Home

Another key objective was to achieve a sense of home, to create a building that will evoke in the students a sense of identity and belonging. The concept of small learning communities discussed earlier is invaluable for this end. Instead of creating one big building, breaking down the scale into smaller learning communities is most effective. In small learning communities everyone knows each other. The children are then more likely to interact and help each other in these cohesive groups, like a family. In this way the sense of home comes into being.

Ask a very young child to draw a house for the first time, and the result is a symmetrical gable roof house. The design of the entrances to the learning communities and main entrance was inspired by this image. Also, many of the adjacent houses to the school site have these same gables, and reflecting this in the school design helps associate the school with home.

The façades of the small learning communities are intentionally varied in color, form of windows and markers, which help the children instantly identify them and develop a sense of belonging to “their” learning community.

These concepts are illustrated in Figure 39.

Figure 39 - Sense of Home Design Concepts. Image by author with additional photos from Google Images.

Chapter 5: Elementary School Design - Buildings that Speak

Main Entrance & Approaches

The school design resulting from deaf space and visual world concepts and additional functional considerations is described in this chapter. To begin, Figure 40 provides a view of the front of the school with its main entrance. This depicts the pleasant features of the front façade and grounds on the approach to the front of the school.

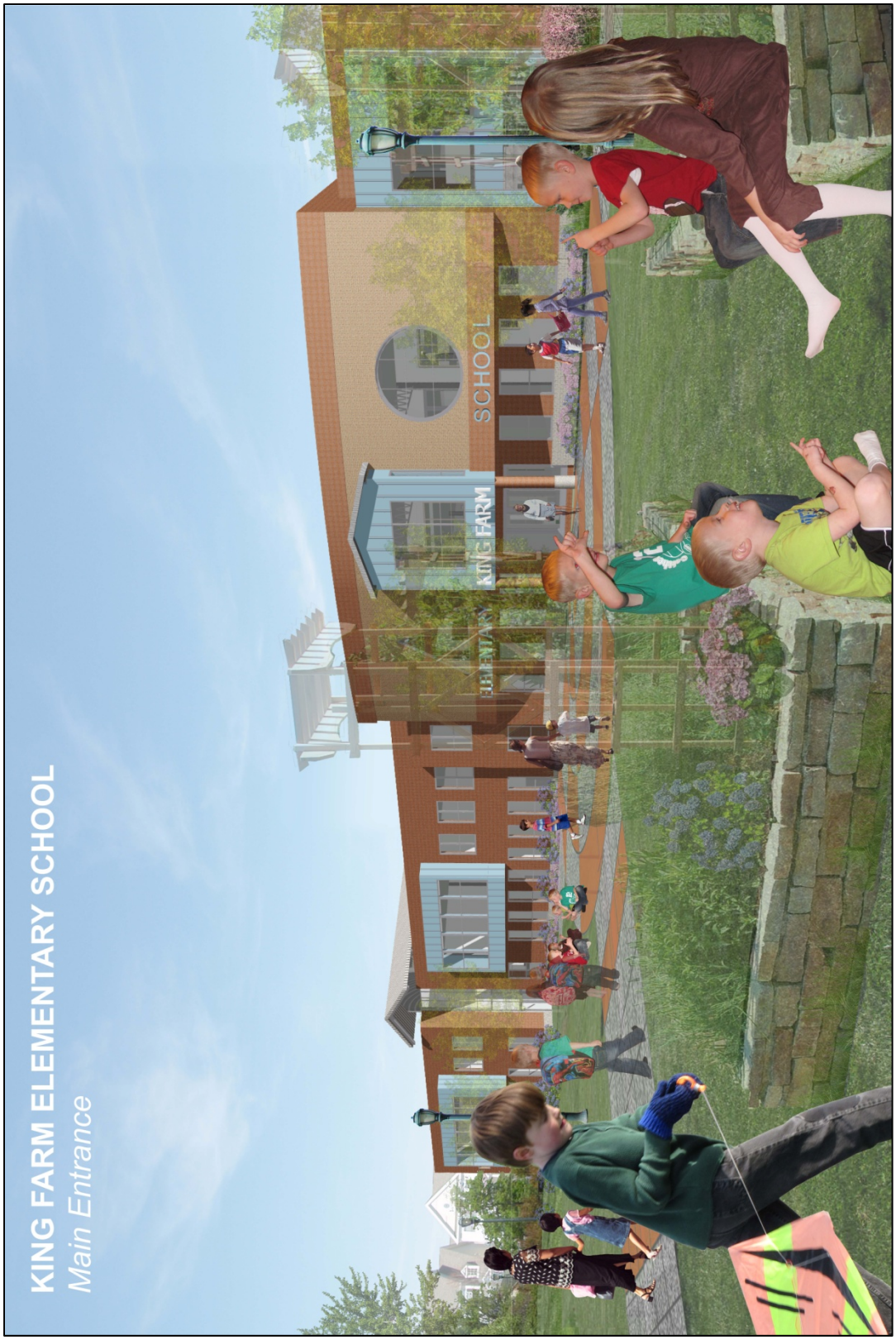

Figure 40 - View of Elementary School Main Entrance. Image by author.

Building Layout and Use

Figures 41 and 42 illustrate the ground floor and second floor plans of the school. The general arrangement of the plan is governed in part by the program and other considerations depicted in Figure 43. The main entrance opens into the central multipurpose space of the school. To the right are the main classroom areas consisting of three small learning communities (SLCs), and to the left are gym, service, and specialty suites designated for art and music.

The separation of the small learning communities from the rest of the school is deliberate, because these have the option to be closed off after hours as private areas, while the gym, multipurpose space and such can be made available for shared public use such as for sports, music, arts, and so on. The school art suite has direct access into an outdoor terrace, and wide views.

An overall axonometric view of the whole school complex is provided in Figure 44.

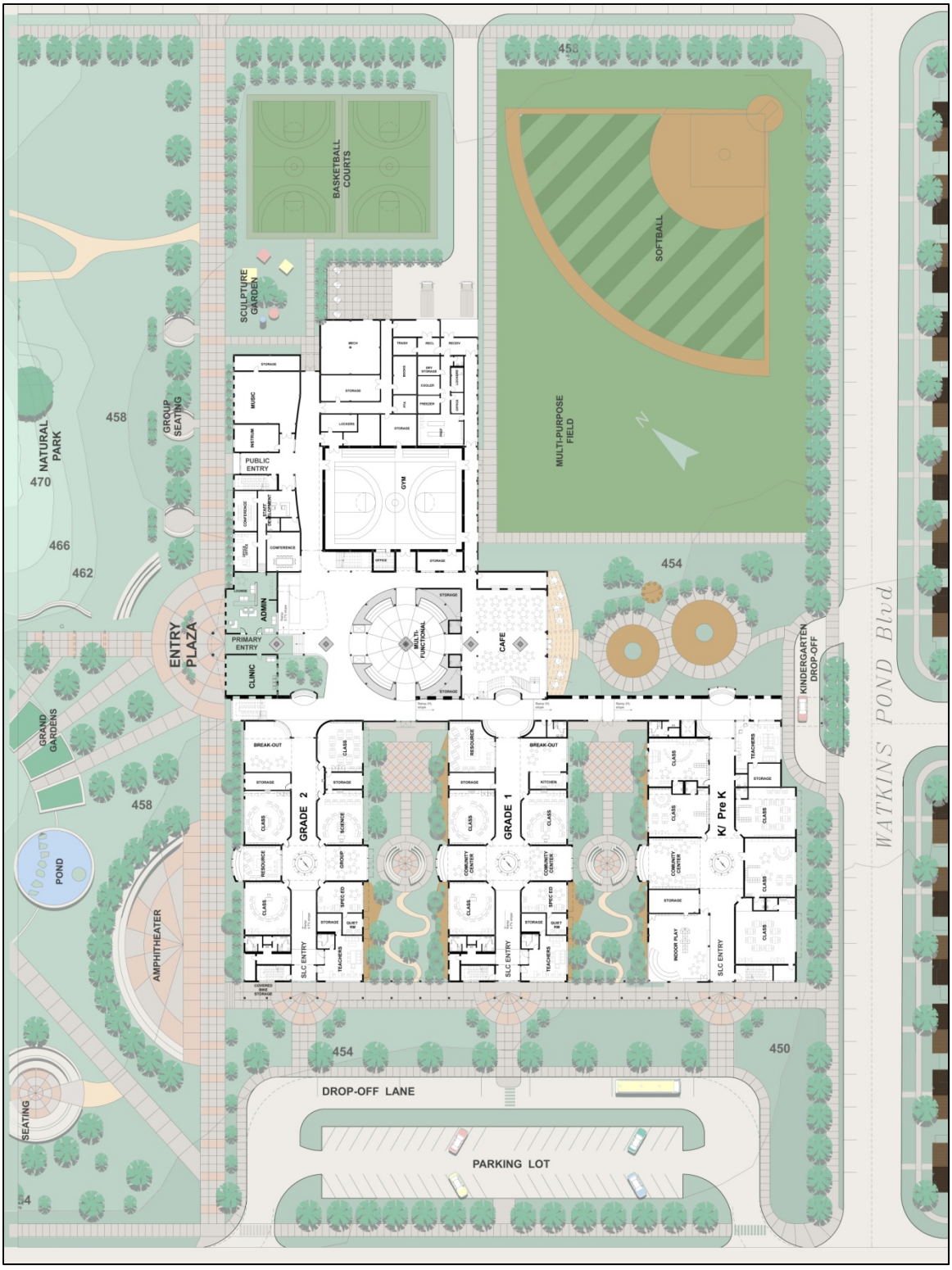

Figure 41 - Ground Floor Plan with surrounding landscaping. Image by author.

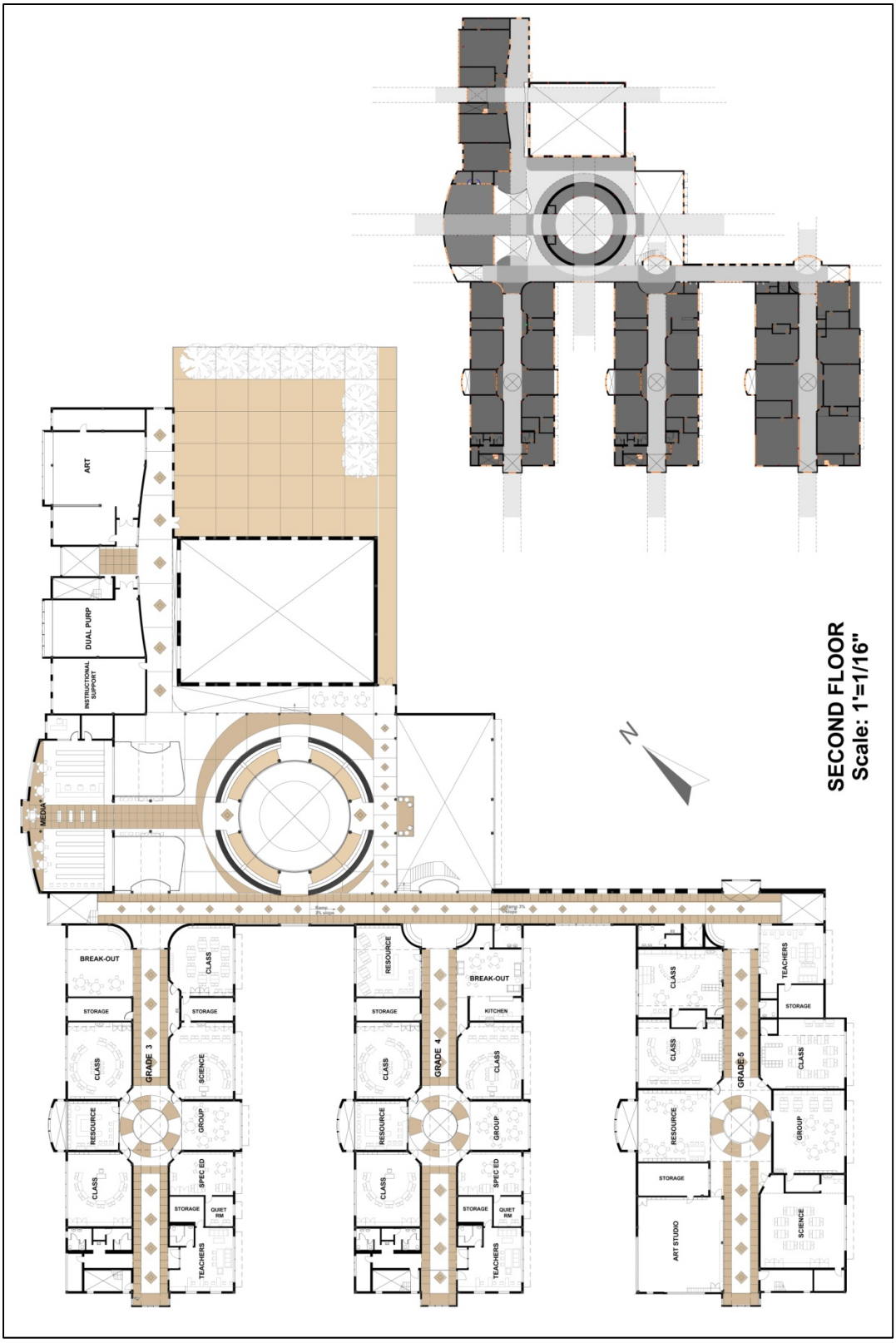

Figure 42 - Second Floor Plan including circulation. Image by author.

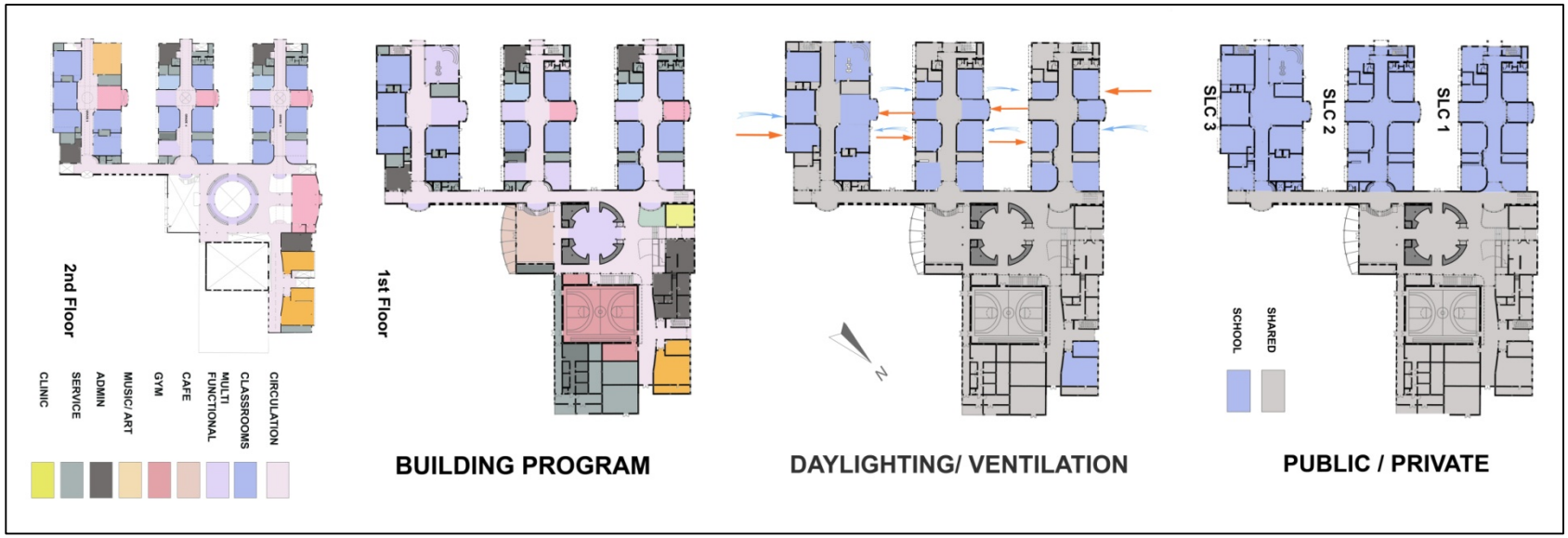

Figure 43 - Building Program and Features. Image by author.

Figure 44 – Axonometric view of school. Image by author.

Modeled views of the school front and back are provided in Figures 45 and 46. These illustrations also show the general relationship of the school to the adjacent grounds and park areas.

Earlier we mentioned the orientation of the school site to King Farm, but in a more detailed way the whole organization of the school is in coherence with the grid of the surrounding community. The ideal orientation of the school would be north-south to take best advantage of natural light, but the constraint that the school must connect meaningfully with the termination of Pleasant Drive dictates a change. Therefore the main entrance is connected to the Pleasant Drive axis. Framed views are created towards the main entrance, particularly through the use of the wide (14') pergola over the main walkway connecting the Pleasant Drive terminus to the main entrance. This framing and approach can be seen more clearly in model views provided in Figures 47 and 48.

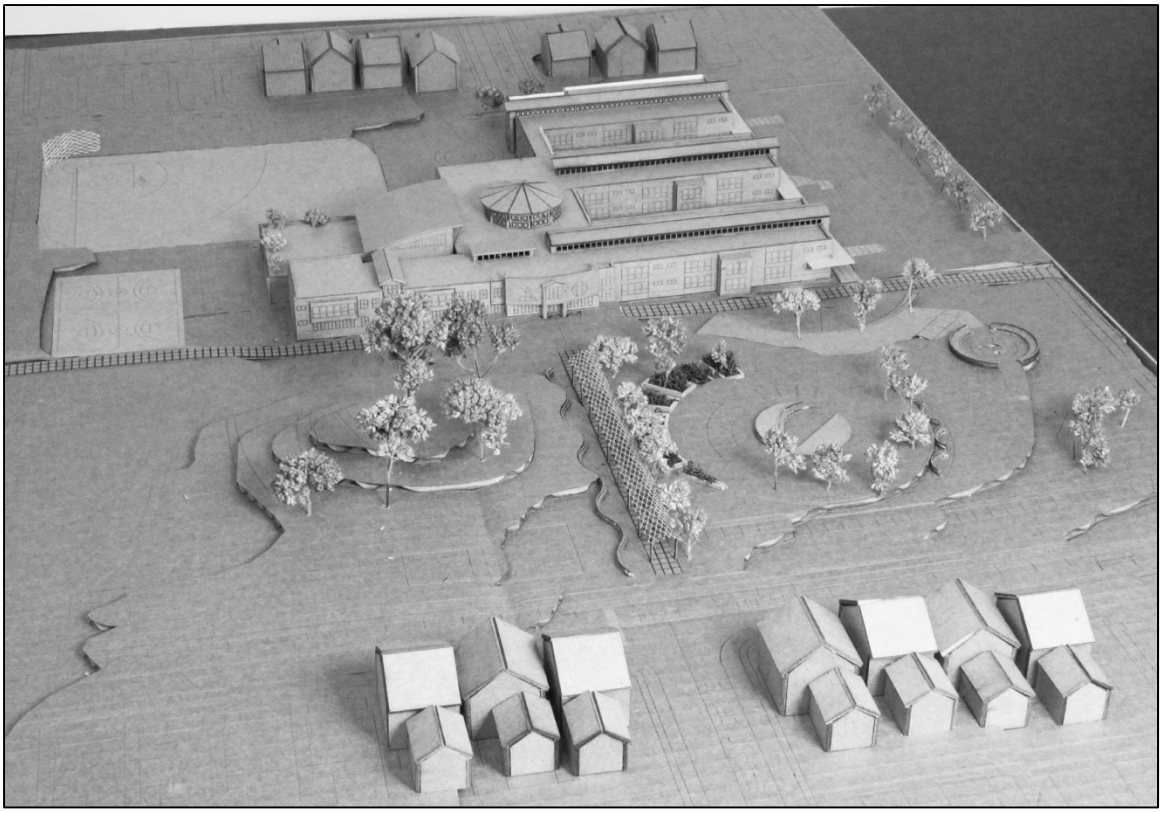

Figure 45 - Front view of school. Image by author.

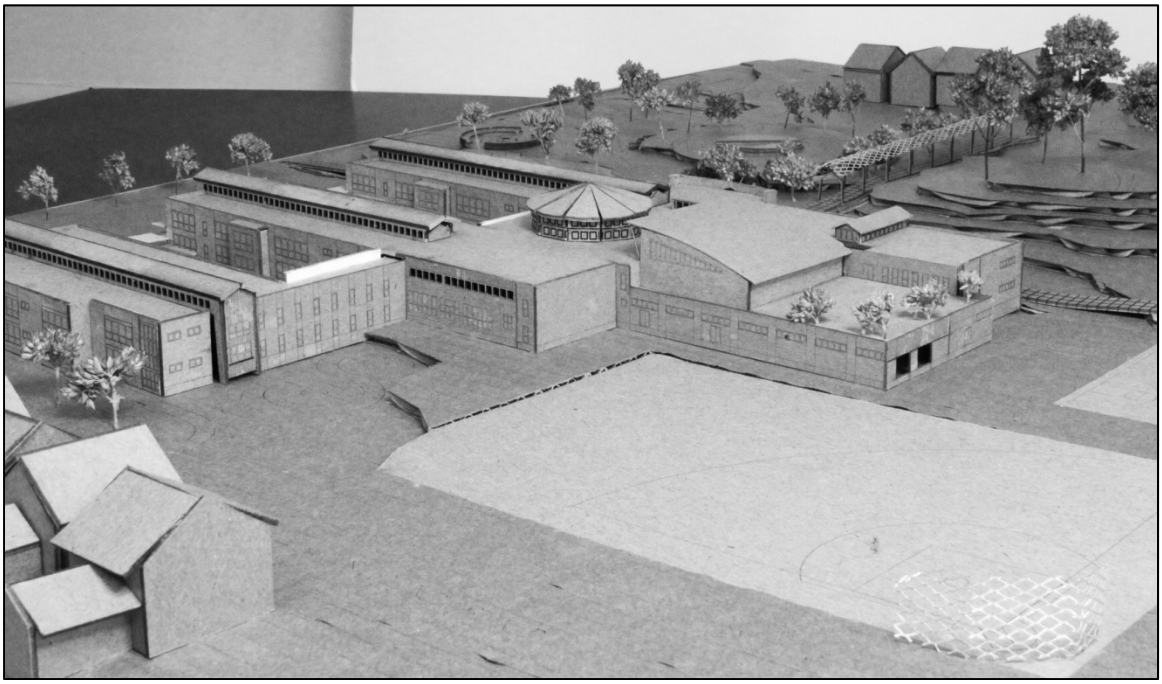

Figure 46 - View of school fields. Image by author.

Figure 47 - Main Entrance of school with approach from neighborhood. Image by author.

Figure 48 - Framing of main school entrance from Pleasant Drive access. Image by author.

Building Detail

Figure 49 provides entry wall detail at the main entrance of the school. This part of the building is of the more technically involved parts of the structure.

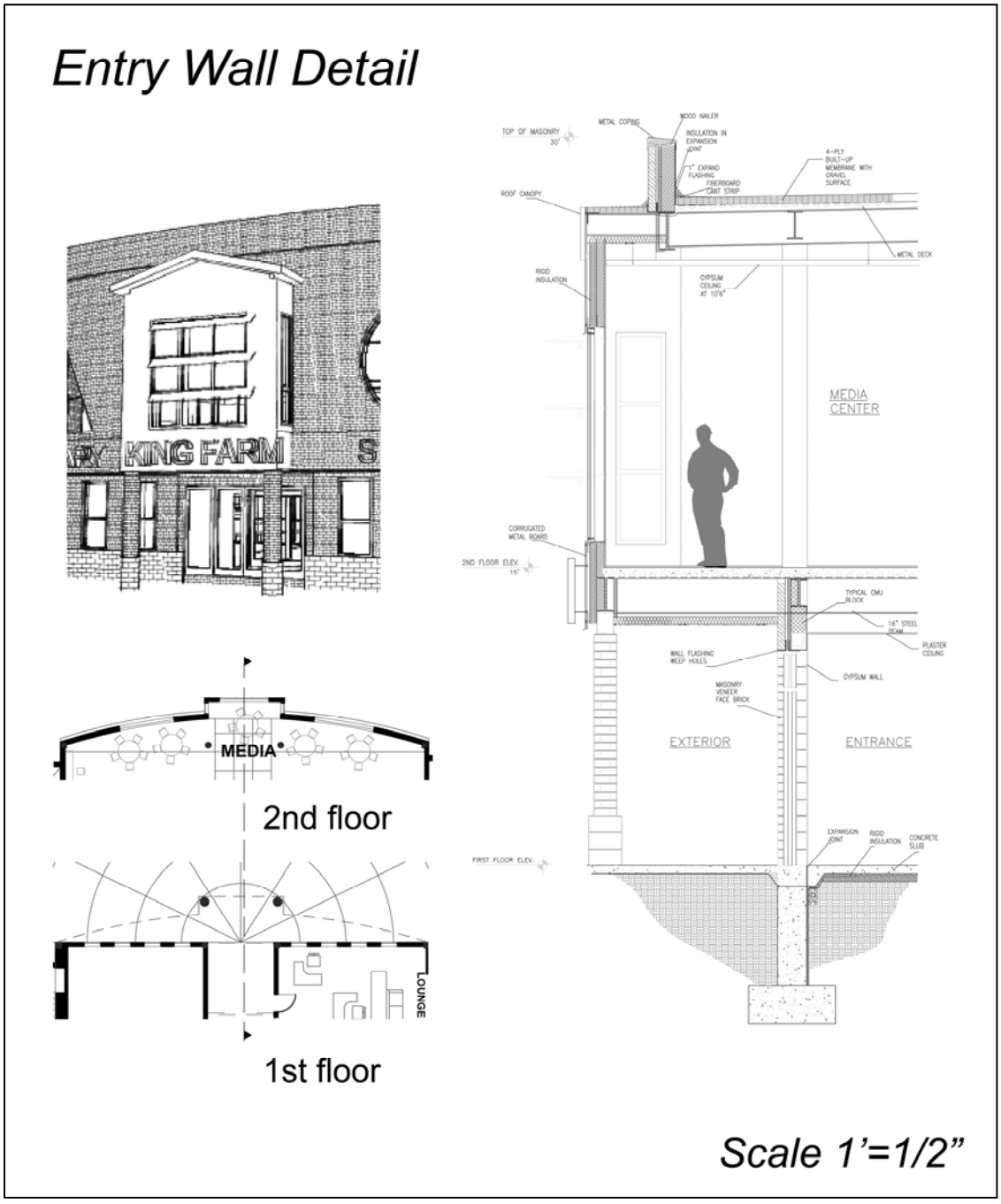

Figure 49 - Detail of wall at main entrance of school. Image by author.

Small Learning Communities

The small learning communities are the formal classroom wings of the school. They follow the ideas of SLCs described earlier, including group gathering areas both inside and out in mostly circular (sociopetal) arrangements, well directed circulation, and an effort to create a sense of home in comfortable, well lighted, and well ventilated spaces. Each entrance into the SLCs (depicted in Figure 50) is flanked by teacher's office suites as a safety/security feature. A separate Kindergarten drop-off is available at the outside SLC, where parents of the youngest children can wait for them. The SLCs are made to look different from each other by color or markings, as suggested by Figures 51 and 52.

Figure 50 - View of Elementary School SLC Entrances. Image by author.

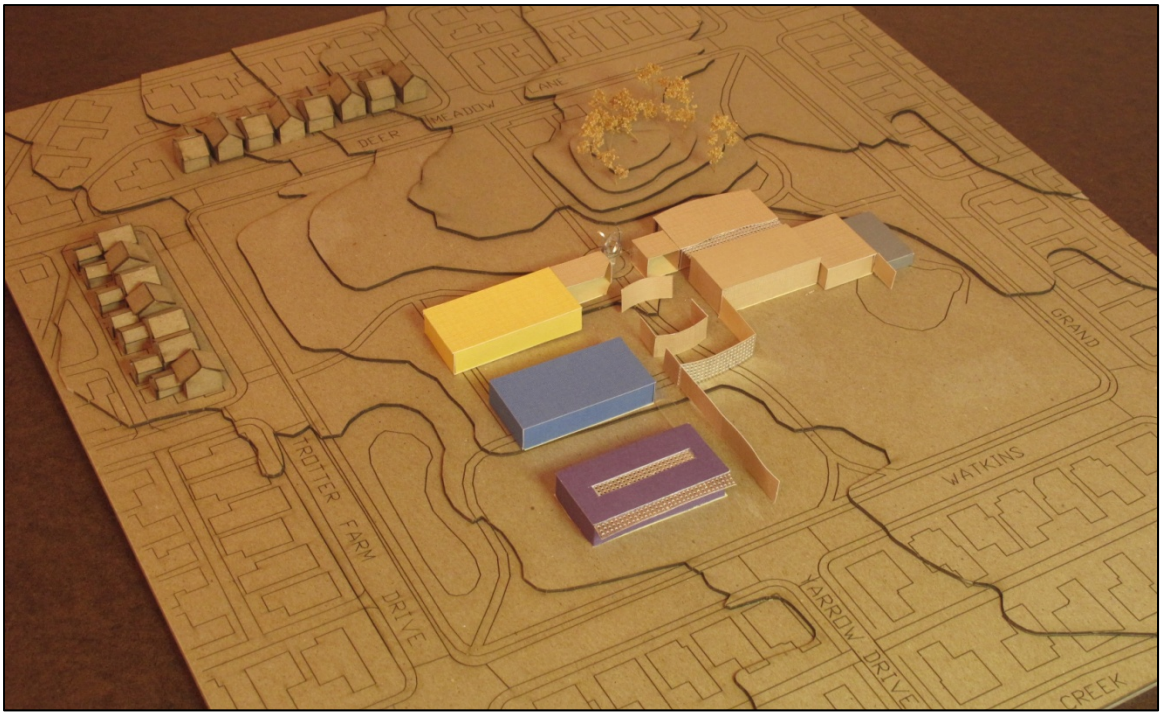

Figure 51 - Small Learning Communities. Image by author.

Figure 52 - Elevation, Small Learning Communities. Image by author.

Figure 53 provides a depiction of the “school street” connecting the internal entrances of the SLCs. Here numerous deaf-friendly features are worked out, including break-out niches out of circulation paths with texture wayfinding, broad visual connections, and inviting character.

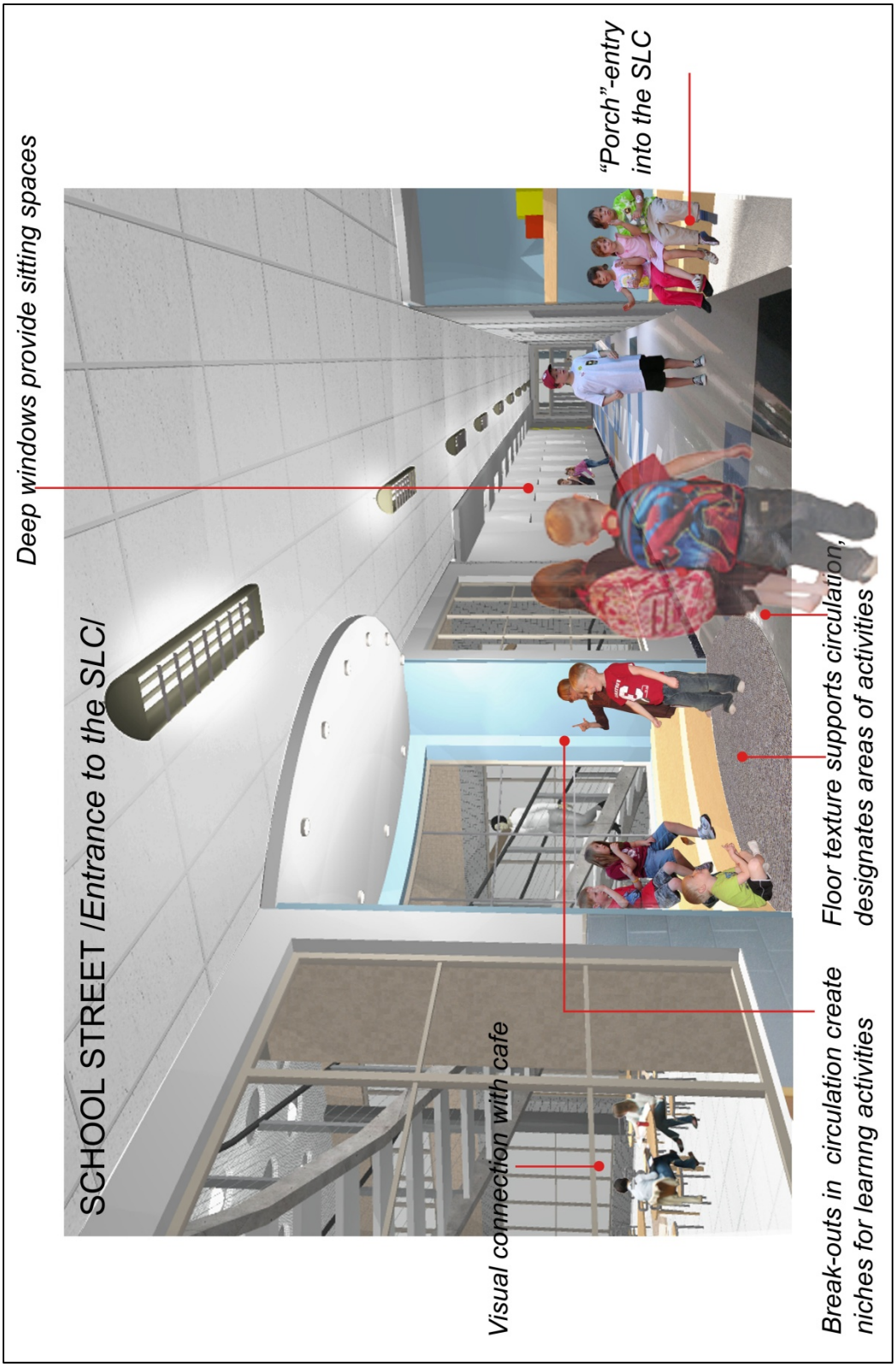

Figure 53 - School Street entrance to SLCs. Image by author.

Figure 54 - View of multipurpose space. Image by author.

The multipurpose room adjacent to the SLC school street is depicted in Figure 54. The shape of the multipurpose room was indicated by the idea of collective space, smooth corners, and directing circulation to other areas of the school.

Building Sections

Figures 55-57 provide sections through the school, emphasizing the visual connectivity within school spaces and inside to outside, and cross ventilation and natural lighting provided by the design features called for by deaf space principles. The open volume of the multipurpose space, clerestories running along the SLCs, and light shelves are main design features providing these benefits.

The NW-SE section and NE-SW section both intersect the multipurpose space at the center of the school. The latter section also gives some idea of the internal character of the gym space and structural features of its roof and supports.

Figure 55 - School Sections. Image by author.

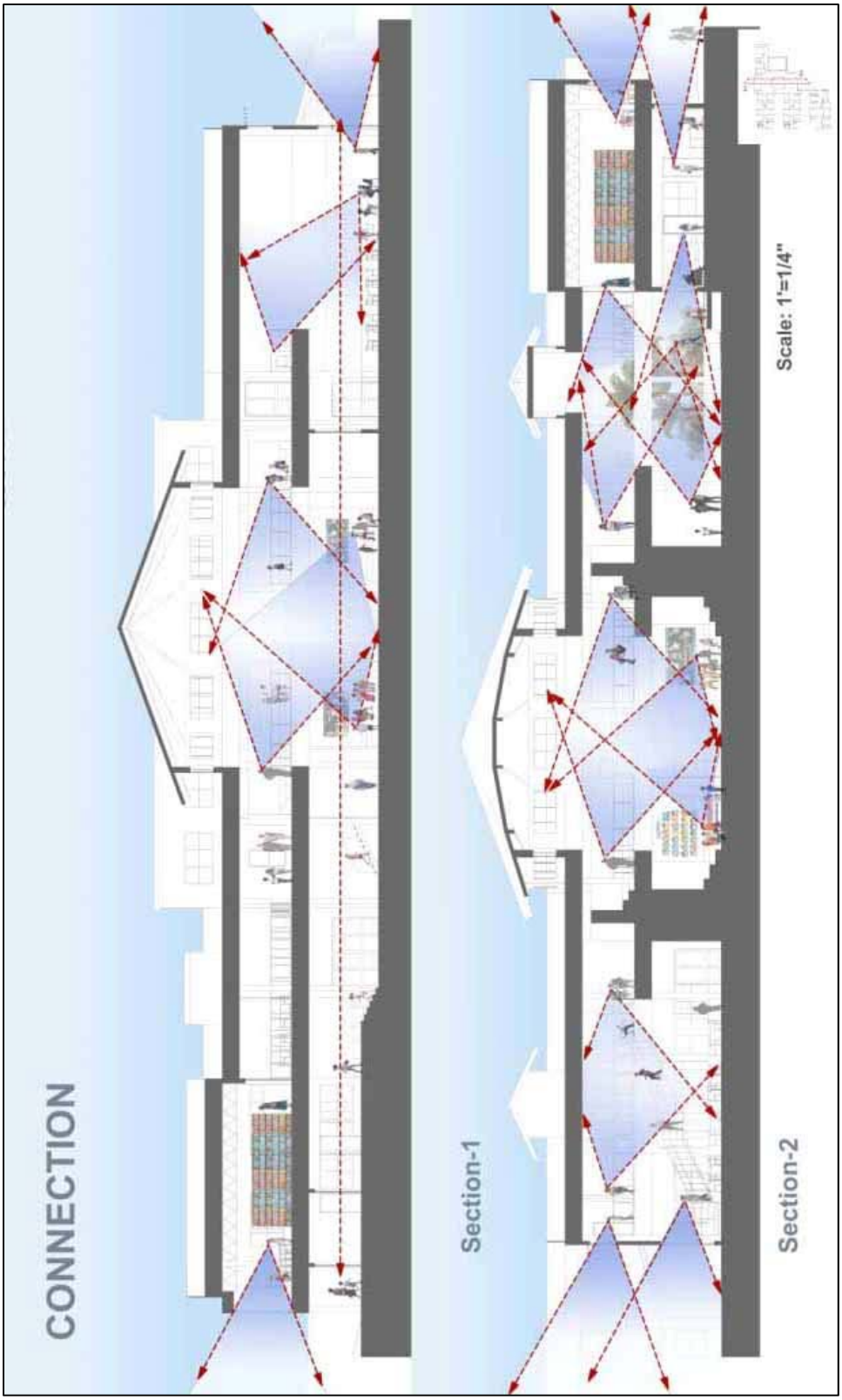

Figure 56 - Section/Diagram of visual connections. Image by author.

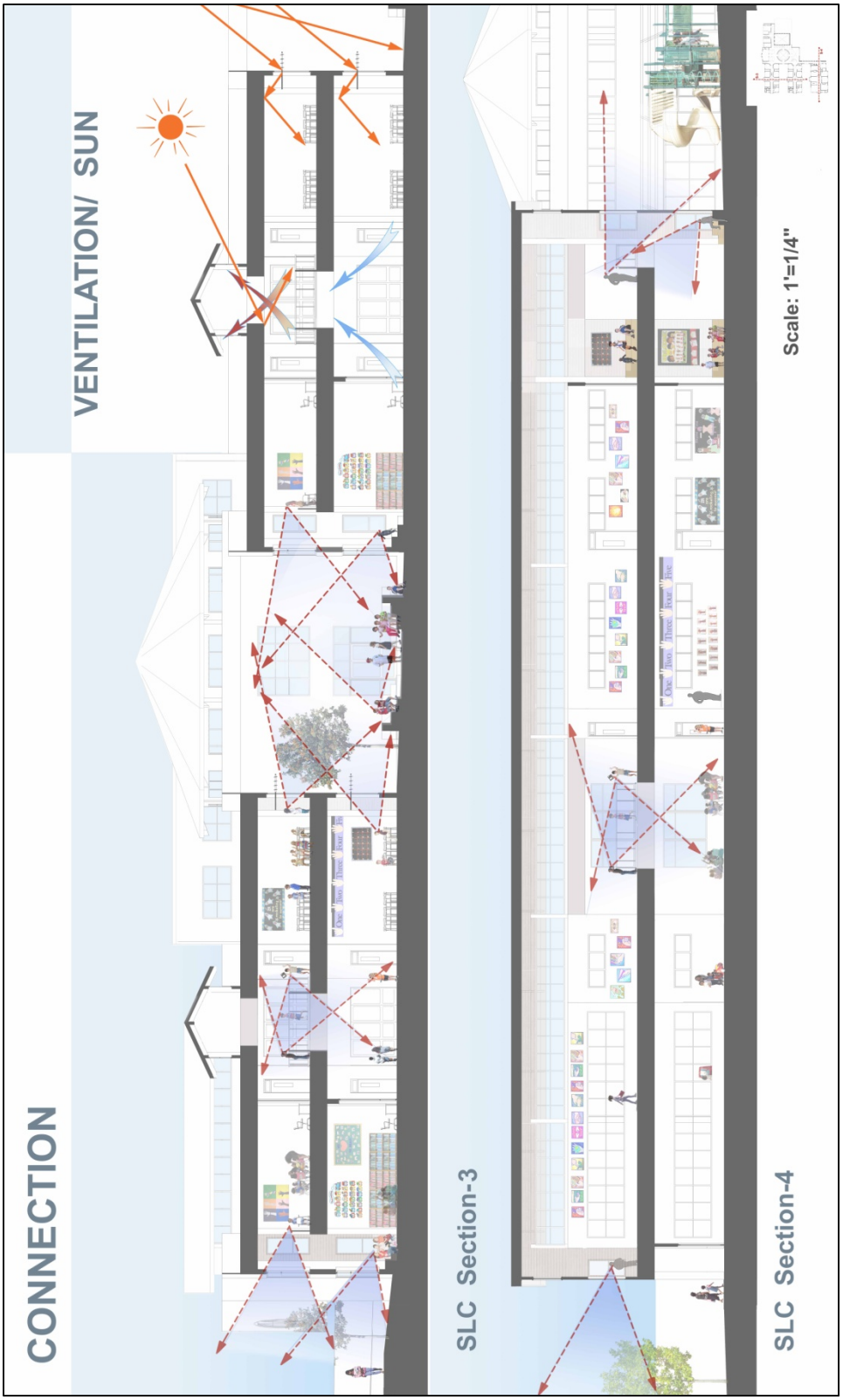

Figure 57 - Section/Diagram with ventilation and illumination. Image by author.

Park and Grounds

Green areas of the site and public park as depicted in Figure 58 in front of the school allow opportunities to take learning outside, and afford nice places for students to wait after school. An additional western elevation showing the park and school is provided.

The more active sports sites/multipurpose field are located away from the learning spaces and quieter park like areas.

Figure 58 - Community Park. Images by author.

Conclusion

The ideas of deaf space are relevant and address issues not only of deaf children, but many other groups such as non-native English speakers, children affected with Attention Deficit Disorder, and so on. Moreover, applied design with these principles tends to result in places with a sense of well being for the majority of hearing people as well. It is hoped that one day these studies will contribute to a set of standards for architecture that could be equal in effect and importance to the deaf community, to what the Americans with Disabilities Act of 1990 did for the disabled. The King Farm community at large will also benefit greatly from a good school and improved park.

In continued work, more detailed and extensive design of interior spaces of the school would be valuable in further exploration of deaf space concepts. In particular, many opportunities to apply innovative design features in the small learning communities are available, and these extend beyond the scope considered here to include additional ergonomics, more involved energy efficiency/green technology, and acoustic optimization that can contribute to increased effectiveness of the learning environment.

As noted by Josh Swiller in his memoir about Peace Corps experiences in Zambia, his youthful, idealistic view was that "we are all one people, black or white, hearing or deaf."[18] In this spirit it is hoped that improved architecture for the deaf as demonstrated in this elementary school design will benefit all.

[18] Swiller, Josh. *The unheard: a memoir of deafness and Africa*, New York, New York: Henry Holt and Company LLC, 2007.

Figure 59 - Gallery. Images by author.

Bibliography

1. Bauman, Hansel. "Gallaudet, Deaf/Diverse Campus Design Guide," Gallaudet University, Washington DC, 2010.

2. Bauman, Hansel. "(Speakers and Signers) Hansel Bauman: Deaf Architecture -- The Resonance of Place and the Senses," MIT Tech TV, 2009. http://techtv.mit.edu/videos/3535-speakers-and-signers-hansel-bauman-deaf-architecture----the-resonance-of-place-and-the-senses

3. Byrd, Todd and Consoli, John T. "Deaf Space," *Gallaudet Today: the Magazine*, Spring 2007. http://aaweb.gallaudet.edu/deaf_space_spring2007.xml

4. "Charter of the New Urbanism", Congress for the New Urbanism, 2001. http://www.cnu.org/charter

5. City of Rockville, Maryland web pages, 2010. http://www.rockvillemd.gov/parks-facilities/kingfarm.htm

6. City of Rockville, Maryland Department of Information and Technology, Geographic Information Systems (GIS) topographic maps, 2010.

7. Dearie, Alick. E-mail to Karina Tsymbal dated 5 June 2010.

8. Dudek, Mark. *A Design Manual, Schools and Kindergartens*, Basel: Birkhäuser, 2007.

9. Ford, Alan. *Designing the Sustainable School*, Victoria: The Images Publishing Group Pty Ltd, 2007.

10. Google Earth. Europa Technologies, 5.1.3534.0411, Build Date Mar 27, 2010.

11. Hindrichs, Dirk U. *Plusminus 20 /40 Latitude: Sustainable Building Design in Tropical and Subtropical Regions*, Stuttgart: Edition Axel Menges, 2007.

12. King Farm Citizens Assembly webpage, 2010. http://www.kingfarm.org/Community-Maps~74997~12658.htm

13. Local Information Data Server (IDcide), 2010. http://www.idcide.com/weather/md/rockville.htm

14. Nair, Prakash and Fielding, Randall. *The Language of School Design: Design Patterns for 21st Century Schools*, India: Designshare.com, 2007.

15. National Climatic Data Center (NCDC). "Climatic Wind Data for the United States," Ashville, North Carolina, 1996. http://www.ncdc.noaa.gov/oa/mpp/wind1996.pdf

16. Nelson, Sandra J., Montgomery County Public Schools special needs education representative, e-mail communications to Karina Tsymbal, February 2010.

17. "Peerless Rockville," Historical Information on King Farm, 2005. http://peerlessrockville.org/peerless_places/peerless_places_King%20Farm.htm

18. Ramsey, Claire L. *Deaf Children in Public Schools: Placement, Context, and Consequences*, Washington, DC: Gallaudet University Press, 1997.

19. "The School Site Planner." Public Schools of North Carolina, State Board of Education, Department of Public Instruction, Division of School Support, School Planning, Raleigh, North Carolina, 1998. http://www.schoolclearinghouse.org/pubs/schsite.pdf

20. "Smart Growth Illustrated – King Farm, Rockville, Maryland," U.S. Environmental Protection Agency, Office of Policy, Economics, and Innovation & Office of Cross-Media Programs, Smart Growth Program information webpage, 2010. http://www.epa.gov/dced/case/kingfarm.htm

21. Swiller, Josh. *The unheard: a memoir of deafness and Africa*, New York, New York: Henry Holt and Company LLC, 2007.

22. Torti Gallas and Partners. "King Farm," 2010. http://www.tortigallas.com/project.asp?p=50180