URBAN AGRICULTURE

A CASE STUDY OF PUBLIC TOWN HOUSING IN WINNIPEG

A PRACTICUM SUBMITTED TO THE FACULTY OF GRADUATE STUDIES, UNIVERSITY OF MANITOBA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE, MASTER OF LANDSCAPE ARCHITECTURE.

RUEY YUAN CHIANG, DEC. 1985

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I WISH TO EXPRESS MY SINCERE APPRECIATION TO MY COMMITTEE - CHARLES THOMSEN (CHAIRMAN), DAVID WITTY AND TED McLACHLAN FOR THEIR CRITICISM AND ASSISTANCE THROUGHOUT THE PREPARATION OF THIS PRATICUM.

I WOULD LIKE TO TAKE THIS OPPORTUNITY TO ALSO THANK MY FRIENDS FOR THEIR ENCOURAGEMENT; IN PARTICULAR G. LIND FOR HIS PATIENCE AND UNDERSTANDING.

MY DEEPEST GRATITUDE TO MY PARENTS, NOT ONLY FOR THEIR INDISPENSABLE FINANTIAL SUPPORT, BUT SPECIALLY FOR THEIR MORAL ONE BY MEANS OF THEIR TRULY INSPIRING LIVING EXAMPLE WHICH HAS NOURISHED MY HEART AND SOUL, GUIDING MY LIFE.

THE STUDY ATTEMPTS TO DEMONSTRATE AN ALTERNATIVE USE OF RESIDENTIAL OPEN AREAS IN AN URBAN ENVIRONMENT. THE ONCE PRODUCTIVE LAND WHERE THE CITY NOW THRIVES CAN BE PARTIALLY REGAINED AS AGRICULTURAL LAND FOR THE BENEFIT OF THE CITY DWELLERS. THE APPLICATION OF URBAN AGRICULTURE INTEGRATED INTO THE EXISTING URBAN FABRIC WILL DEMONSTRATE THE VIABILITY OF URBAN LAND AS A PRODUCTIVE LANDSCAPE AS OPPOSED TO THE STERILE LAND WHICH IS COMMONLY TRANSFORMED WHEN THE CITY ADVANCES INTO THE RURAL AREA.

THIS STUDY ALSO HAS AS AN ADDITIONAL OBJECTIVE THE IMPROVEMENT OF THE URBAN LIVING ENVIRONMENT AND THE PROMOTION OF A SENSE OF COMMUNITY BY ENCOURAGING COOPERATION AND INTERACTION BETWEEN THE RESIDENTS OF THE COMMUNITY.

A FINAL SITE DESIGN IS PRESENTED FOR A SELECTED PUBLIC TOWN HOUSING DEVELOPMENT IN WINNIPEG. THIS DESIGN SOLUTION IS NOT ONLY DIRECTED TO THIS SPECIFIC PROJECT BUT CAN BE EXTENDED TO OTHER RESIDENTIAL OPEN AREAS IN WINNIPEG AS WELL. THE DESIGN PROCESS INVOLVES ESTABLISHING A SERIES OF DESIGN CRITERIA FOR THE SELECTION AND PLANNING OF GREENHOUSE AND GARDEN SITES WITHIN A RESIDENTIAL TOWN HOUSE COMPLEX.

1. PROBLEM

THE CENTRALIZATION OF THE FOOD PRODUCTION AND DISTRIBUTION SYSTEM IN NORTH AMERICA HAS REACHED THE POINT THAT URBAN AGRICULTURE OR LOCALLY GROWN FOOD IS BECOMING MORE IMPORTANT TO THE SURVIVAL OF THE CITY. AFTER THE ENERGY CRISIS IN 1973, PEOPLE REALIZED HOW VULNERABLE THE PRESENT FOOD SYSTEM IS. FOR INSTANCE, AS THE PETROLEUM FUEL COSTS INCREASE SO DOES THE PRICE OF FOOD. THIS IS DUE TO THE FACT THAT URBAN RESIDENTS ARE HIGHLY DEPENDENT ON COMMERCIALLY PRODUCED, PROCESSED AND DISTRIBUTED FOOD SUPPLIES. IT IS ALSO POSSIBLE THAT A STRIKE OF TRUCK DRIVERS OR A CLIMATIC DISASTER COULD CURTAIL THE FOOD SUPPLY GENERATING A CATASTROPHIC SHORTAGE BECAUSE THE PRESENT SYSTEM FAVOURS THE LARGE AND CENTRALIZED MONOCULTURAL FARMS AT THE EXPENSE OF SMALL AND LOCAL FARMS①.

THE IMPACT OF RISING ENERGY COST TOGETHER WITH A RENEWED INTEREST IN ECOLOGY, HUMAN HEALTH AND NUTRITION HAS LED PEOPLE TO DESIRE MORE CONTROL OVER THEIR OWN BASIC LIFE-SUPPORT SYSTEMS IN ORDER TO HAVE THE ABILITIES TO EXPAND THEIR CONCERNS INTO ACTION. THE RESULT IS THE CREATION OF VARIOUS GROUPS OR ORGANIZATIONS IN MANY CITIES IN NORTH AMERICA, SUCH AS FARALLONES INSTITUTE IN CALIFORNIA WHICH ASSISTS URBAN DWELLERS IN PROMOTING URBAN AGRICULTURE GEARED TO SELF-SUFFICIENCY.

THE PROBLEM OF FOOD SYSTEM CENTRALIZATION BECOMES MORE CRUCIAL TO THE LOW-INCOME POPULATION, PARTICULARLY AS FAR AS THE COST OF FOOD IS CONCERNED. POORS TEND TO SPEND MORE ON FOOD THAN THE REST OF THE POPULATION - 25.5% OF THEIR TOTAL INCOME HAS BEEN REPORTED AS THEIR SPENDING ON BASIC FOODS, COMPARED WITH NON-POORS WHO SPENT 16.0 %②.

① THE CORNUCOPIA PROJECT, EMPTY BREADBASKET? RODALE PRESS 1981. PP 15-22
② STATISTICS OF CANADA, FAMILY EXPENDITURES, 1983

2. ISSUES

IT IS WITH LOW-INCOME FAMILIES THAT THIS STUDY IS CONCERNED. DUE TO THEIR ECONOMIC SITUATION THEY ARE DEPENDENT ON A GOVERNMENT SUBSIDY FOR SHELTER. IN WINNIPEG AREA, MOST OF THE SUBSIDIZED HOUSING IS TOWN HOUSE TYPE OF DEVELOPMENT. THE APPLICATION OF THE SELF-SUFFICIENCY CONCEPT IN PUBLIC TOWN HOUSING WILL BENEFIT THE LOW-INCOME RENTERS A GREAT DEAL, PARTICULARLY REGARDING THEIR DOMESTIC BUDGETS. OTHER DIRECT BENEFITS SUCH AS HEALTHFUL OUTDOOR RECREATION, EXERCISE AND ENVIRONMENTAL EDUCATION WILL RESULT AS WELL.

ALTHOUGH THE FOCUS OF THE STUDY WILL BE ON BRINGING FOOD PRODUCTION TO THE URBAN ENVIRONMENT, WE CANNOT IGNORE THE PROBLEM THAT PUBLIC TOWN HOUSE DEVELOPMENTS FACE REGARDING THE QUALITY OF LIVING ENVIRONMENT. OFTEN MANAGEMENT HAS BEEN CRITICIZED AS BEING UNRESPONSIVE, WITH THE QUALITY OF OPEN AREAS BEING LESS THAN DESIRABLE OR USEFUL③. THIS STUDY IS BASED ON THE BELIEF THAT URBAN AGRICULTURE, TOGETHER WITH AN ADEQUATE PROVISION OF SOCIAL AND RECREATIONAL FACILITIES WILL PROMOTE A MORE LIVABLE AND HEALTHIER ENVIRONMENT IN PUBLIC TOWN HOUSE DEVELOPMENTS.

③ THE CANADIAN COUNCIL ON SOCIAL DEVELOPMENT, A REVIEW OF CANADIAN HOUSING POLICY, JAN '77

3. STUDY GOAL

BASED UPON THE PREMISES, WHICH ARE CRITICAL TO OVERALL WELL BEING OF THE RESIDENTS, THAT THE DECENTRALIZATION OF FOOD PRODUCTION WILL BENEFIT THE CONSUMERS AND THAT MOST OF THE OUTDOOR SPACE IN PUBLIC TOWN HOUSING IS USUALLY AN ACCIDENT AND NEGLECTED, THE GOAL OF THIS STUDY IS TO EXPLORE ALTERNATIVE USES OF OPEN SPACE ON PUBLIC TOWN HOUSE SITES IN WINNIPEG AREA. THE TOO COMMON 'PEDIGREED LANDSCAPE' AND MAINLY CAR ORIENTED OPEN AREA SHOULD ACCOMMODATE ADDITIONAL FUNCTIONS WHICH ARE ESSENTIAL TO ENSURE A HEALTHIER LIFE AN SOCIAL SURVIVAL AS A GROUP. PRODUCING URBAN AGRICULTURE GEARED TO SELF-SUFFICIENCY IS THE ALTERNATIVE THAT INVARIABLY BENEFITS THE LOW-INCOME POPULATION, PARTICULARLY IN REGARD TO THEIR DOMESTIC BUDGET AS WELL AS DAILY DIET.

4. OBJECTIVES

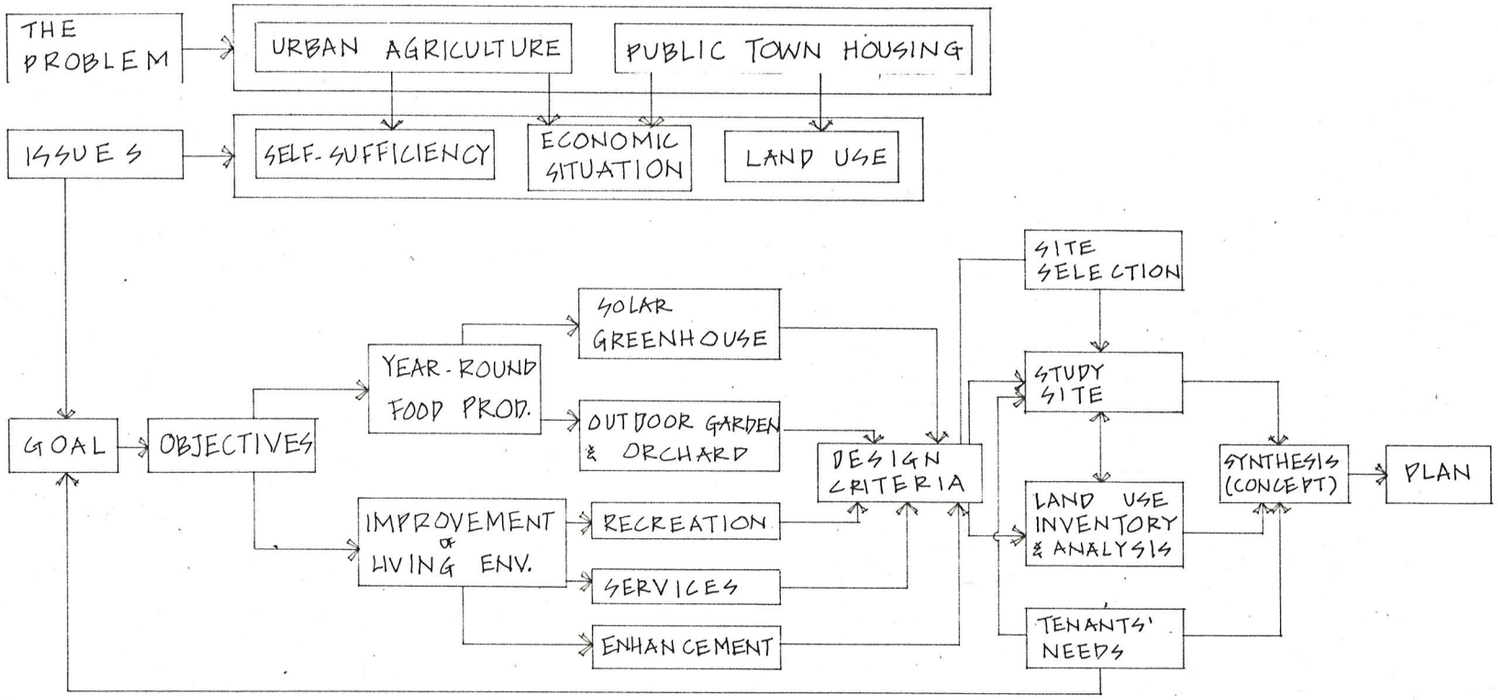
A. TO PROVIDE YEAR ROUND FOOD PRODUCTION:

- MAKE FRESH LOCAL FOOD AVAILABLE FOR THE RESIDENTS ON A YEAR-ROUND BASIS. THE GREENHOUSE CAN PROVIDE AN ENVIRONMENT THAT IS IDEAL FOR EARLY SEEDING AND GROWING SEASON EXTENSION THROUGHOUT THE WINTER. THE OUTDOOR GARDEN WILL PROVIDE MOST OF THE FOOD PRODUCED IN A YEAR IN BOTH QUANTITY AND VARIETY.
- COMPLEMENTARY FACILITIES THAT SUPPORT URBAN FARMING WILL BE PROVIDED THROUGH A BOOK AND TOOL LIBRARY WHICH ASSISTS THE RESIDENTS ON FARMING TECHNIQUES AND SAVES IN TOOL EXPENSES THROUGH SHARING SYSTEM.

B. IMPROVEMENT OF LIVING ENVIRONMENT BOTH SOCIALLY AND PHYSICALLY:

- RECREATIONAL ACTIVITIES WILL BE PROVIDED FOR ALL AGE GROUPS.
- THE OUTDOOR ENVIRONMENT WILL BE TREATED AS A WHOLE, ENSURING ITS ESTHETIC AND FUNCTIONAL QUALITIES.

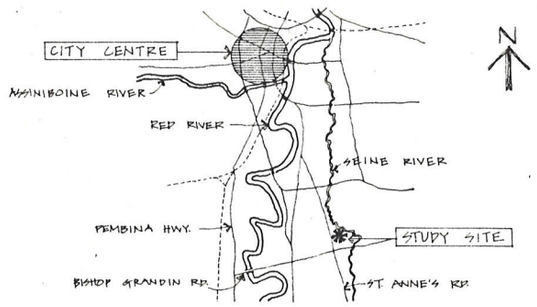
5. METHODOLOGY



6. STUDY SITE

FOR THE PURPOSE OF THIS STUDY, A PUBLIC TOWN HOUSE DEVELOPMENT HAS BEEN SELECTED TO SERVE AS A PROTOTYPE FOR SIMILAR DEVELOPMENTS IN THE WINNIPEG AREA. THE SPECIFIC AREA OF STUDY IS LOCATED IN ST. VITAL IN A WELL-TREED RIVERBANK, ON THE WEST SIDE OF SEINE RIVER. THIS DEVELOPMENT IS COMPRISED OF ELEVEN 6-UNIT BLOCKS OF ROW HOUSES AND TWO APARTMENT BLOCKS. THE TOTAL NUMBER OF 98 UNITS ARE COMPOSED OF 66 UNITS OF 3-4 BEDROOM TOWN HOUSES AND 32 UNITS OF 2-BEDROOM APARTMENTS. THE DEVELOPMENT FOCUSES ON A CENTRAL OPEN AREA WHERE A PLAYGROUND IS LOCATED. ALL THE DWELLINGS ARE ARRANGED AROUND A LOOP-TYPE DRIVEWAY WITH PARKING LOCATED IMMEDIATELY TO THE BACK OF ROW HOUSES AND AT THE ENTRANCES OF APARTMENT BLOCKS. THE SITE IS SITUATED IN A RESIDENTIAL NEIGHBORHOOD AND ADJACENT TO A SCHOOL YARD. IT IS CONVENIENTLY LOCATED NEAR SUPPORTIVE RETAIL AND COMMERCIAL AMENITIES AND IT IS ALSO SERVED BY PUBLIC TRANSPORTATION.

THIS SITE HAS BEEN CHOOSEN BECAUSE IT PRESENTS A MULTITUDE OF PROBLEMS AND PHYSICAL CHARACTERISTICS COMMON TO PUBLIC TOWN HOUSE DEVELOPMENTS IN THE WINNIPEG AREA. IN ADDITION, THE POTENTIAL OF THE SITE FOR AGRICULTURE IS REVEALED IN TERMS OF OPEN AREA AVAILABILITY AND SOLAR ACCESS TO IT. DUE TO THE SOLAR ACCESS, THE VARIED ORIENTATION OF THE TOWN HOUSE BLOCKS WILL GENERATE A MULTITUDE OF SOLUTIONS WHICH WILL SERVE AS AGRICULTURAL LAND PLANNING MODELS FOR A WIDE RANGE OF PUBLIC TOWN HOUSING SITES.



7. TENANTS

THE FOLLOWING DATA WERE OBTAINED MOSTLY FROM A SURVEY CONDUCTED BY MHRC (MANITOBA HOUSING AND RENEWAL CORPORATION) DURING 1972-73 PERIOD, IN WINNIPEG AREA. PART A IS THE RESULT OF SURVEY FROM 13 PUBLIC TOWN HOUSE DEVELOPMENTS AND PART B IS THE OPINIONS AND CONCERNS OF THE TENANTS SPECIFICALLY FROM THE STUDY SITE.

A. TENANTS' PROFILE

FAMILY STRUCTURE

HUSBAND & WIFE WITH CHILDREN	56%
HUSBAND & WIFE NO CHILDREN	3%
SINGLE MOTHER WITH CHILDREN	43%
SINGLE FATHER WITH CHILDREN	2%

NUMBERS OF CHILDREN

UP TO 3	32%
3 TO 5	60%
MORE THAN 5	8%

AGES OF HOUSEHOLD HEADS (YEARS)

25 OR YOUNGER	15%
25 TO 34	47%
35 TO 44	23%
OLDER THAN 45	15%

% THAT OWNS CARS

49%

SOCIALIZATION

SOCIALIZATION AMONG THE TENANTS IS POOR. MOST OF THE TENANTS KNOW THEIR NEIGHBORS ONLY SLIGHTLY.

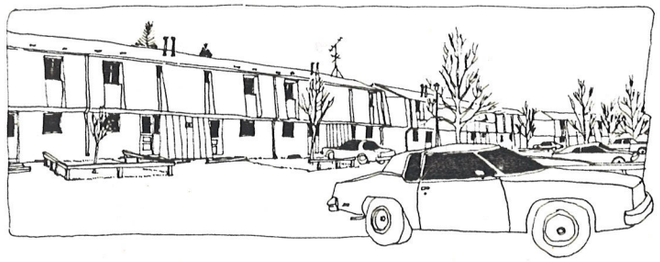
• VISIT THE NEIGHBORS	
FREQUENTLY	27%
INFREQUENTLY	35%
NOT AT ALL	38%

• KNOW THE NEIGHBORS	
VERY WELL	18%
SOMEWHAT	54%
NOT AT ALL	28%

B. OPINIONS & CONCERNS

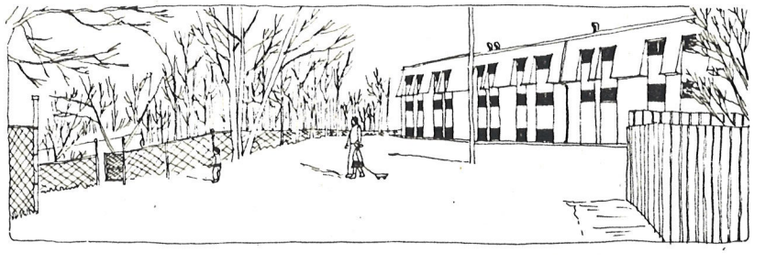
- TENANTS EXPRESSED PREFERENCE FOR CHILDRENS PLAY AREAS WITHIN THE SITE AT A LOCATION ADJACENT TO THE UNITS AS WELL AS THE LARGE CENTRAL AREA (45% AND 55% RESPECTIVELY)
- THE EXISTING CHILDREN'S PLAY AREA IS ADEQUATE (95%) AND ADEQUATELY SEPARATED FROM STREET TRAFFIC (42%). (HOWEVER, IT WAS OBSERVED THAT CHILDREN'S PLAY OCCURS MORE FREQUENTLY IN LOCATIONS OTHER THAN THE EXISTING PLAYGROUND. THEY PLAY ON RIVER-BANK AND ON A VACANT LOT AT THE SOUTH AND REAR YARD④
- PREFERRED GROUND COVER FOR PLAY AREA: GRASS (70%) AND SAND (15%).
- THERE WAS CONCERN THAT RESIDENTS WERE UNABLE TO OBSERVE THE YOUNGER CHILDREN'S PLAY FROM THE HOUSE (83%).
- NO ADEQUATE PRIVACY EXISTED IN THE REAR AND FRONT YARDS⑤ (92% AND 68%, RESPECTIVELY).
- THE TENANTS EXPRESSED A NEED OF SPACE FOR FLOWER GARDEN (80%).

④ REAR YARD REFERS TO THE SPACE BY THE ENTRANCE ON THE BACKLANE.
⑤ FRONT YARD REFERS TO THE YARD BY THE LIVING ROOM.



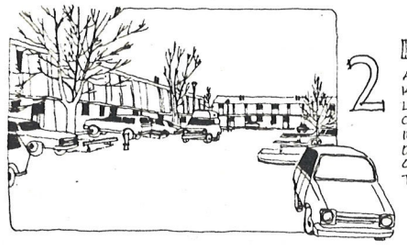
1 ENTRANCE

ENTRANCE TO THE RESIDENTIAL UNITS IS FROM THE PARKING LOT WHICH IS A SEMI-PRIVATE TERRITORY SHARED BY TWO UNITS. EACH PARKING LOT IS SEPARATED BY A SMALL PATCH OF GRASS WHICH IS WEAKLY OUTLINED BY LOW FENCES. VANDALISM IS COMMON AGAINST FENCES AND TREES



3 CLEARING

THIS AREA IS ORIENTED TO THE SOUTH AND HAS A VIEW TO RIVERBANK. IT IS A POTENTIAL SITE FOR RECREATIONAL AND AGRICULTURAL PURPOSES.



2 DRIVEWAY

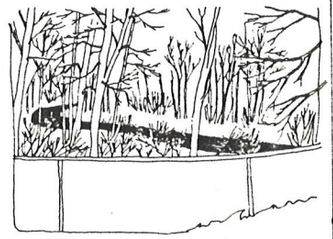
AN EXTENSIVE AREA IS USED FOR VEHICULAR DRIVEWAY WHICH CAN BE DECREASED IN WIDTH TO ALLOW OTHER ACTIVITIES TO OCCUR, SUCH AS VEGETABLE GARDEN.

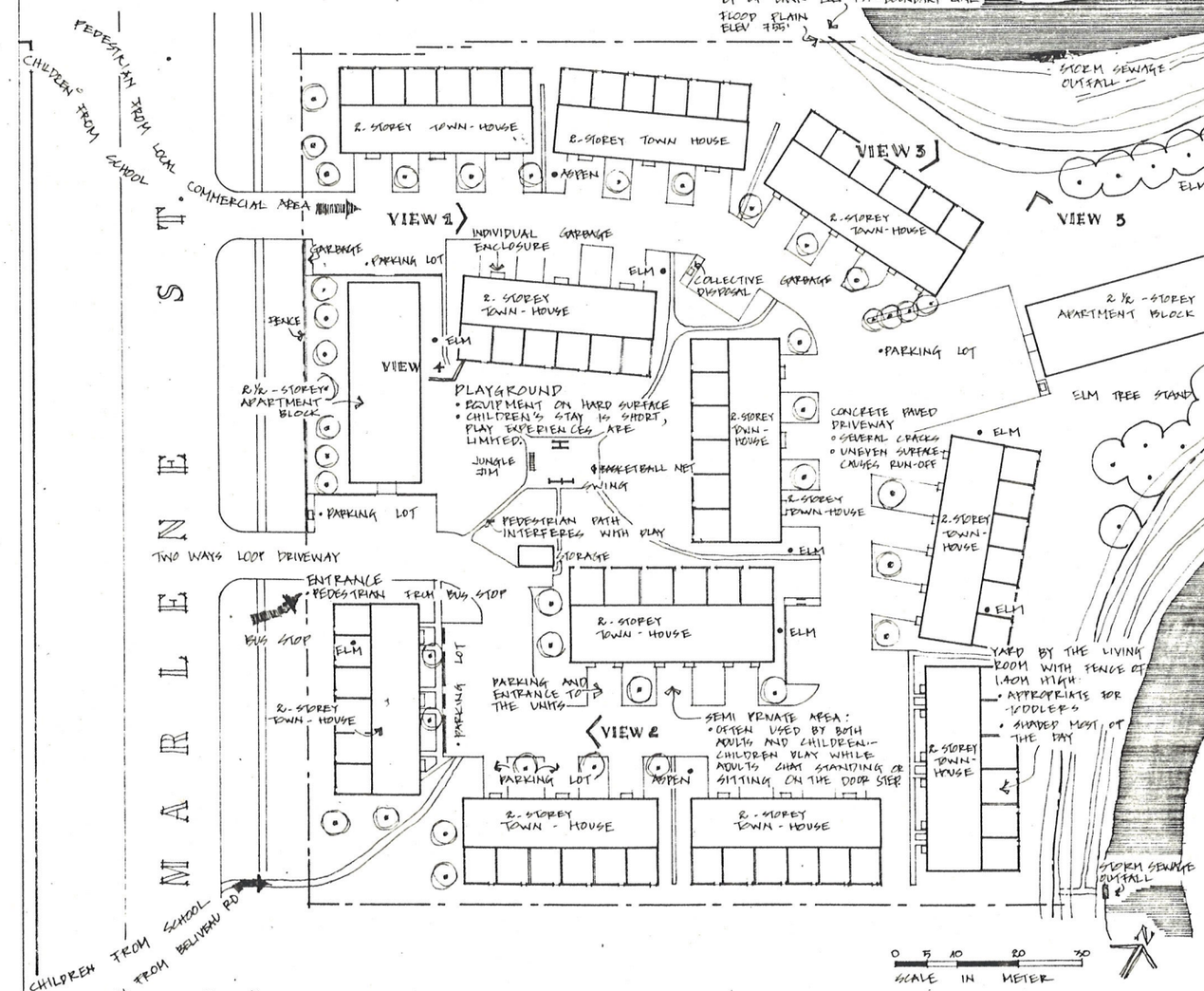
4 PLAYGROUND

THE EXISTING PLAYGROUND IS LOCATED AT THE CENTER OF HOUSING DEVELOPMENT; ITS EQUIPMENT IS ARRANGED AT THE INTERSECTION POINT OF WALKWAYS. HERE, CONFLICT BETWEEN FUNCTIONS OCCURS. BOTH PLAY ACTIVITY AND THOROUGHFARE INTERFERE WITH EACH OTHER. IN ADDITION, THE NUMBER OF PIECES AND TYPES OF EQUIPMENT ARE DEFICIENT FOR THE SIZE OF THE CHILD POPULATION. IN THE DEVELOPMENT. UNCHALLENGING, UNSAFE AND LACKING OF AMENITIES ARE OTHER DISADVANTAGEOUS ASPECTS OF THE PLAYGROUND.

5 SEINE RIVER

RIVERSIDE OFFERS OPPORTUNITIES FOR WALKING, BICYCLING AND NATURE APPRECIATION. THE RIVER ITSELF PROVIDES YEAR-ROUND RECREATIONAL ACTIVITIES - BOATING IN SUMMER, AND SKATING AND CROSS COUNTRY IN WINTER.





PLAN - EXISTING CONDITIONS

SITE AREA
• 19,824.00 M²

UNITS
• TOWN-HOUSES: 66 UNITS
• APARTMENTS: 32 UNITS

DENSITY
• 202.28 M² PER UNIT OR 20 UNITS PER ACRE.

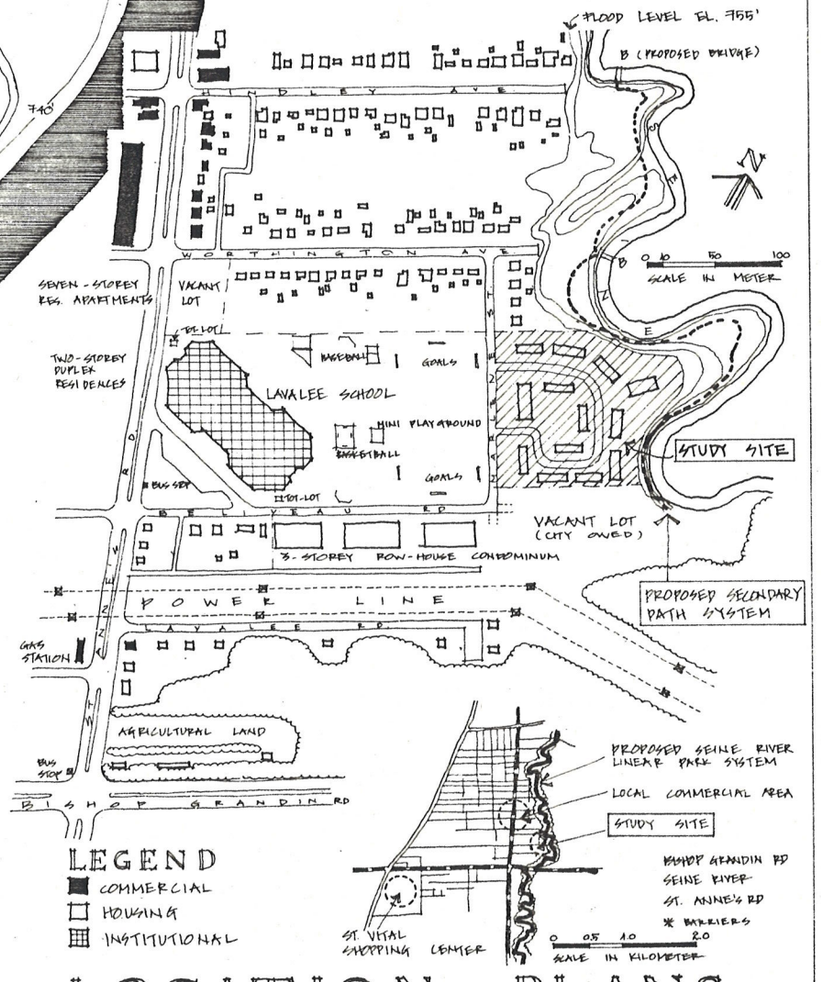
WATER
• POLLUTED BY CATTLE WASTE FROM THE UPSTREAM FARMS.
• SUITABLE FOR AGRICULTURAL IRRIGATION PURPOSE.

SOURCE: REPORT, "SEINE RIVER PARK", WATER WORK WASTE & DISPOSAL DIVISION ET. AL.

SOIL
• ON THE SITE: DISTURBED SOIL, FILLED WITH GOOD SOIL IN THE SODDED AREA
• ORIGINAL SOIL: LACUSTRINE FINE CLAY, WELL-DRAINED ST. NORBERT CLAY.
• MEDIUM HIGH NATURAL FERTILITY

SOURCE: SOIL MAP, RECONNAISSANCE SURVEY OF WINNIPEG AREA IN MANITOBA

PLANT
• ON THE SITE: MOSTLY YOUNG TREES WITH 4~10 CM TD. BIGGER TREES ARE INDICATED AND SPECIFIED ON THE PLAN.
• ALONG THE RIVER: UNDISTURBED BY CONSTRUCTION. VEGETATION CONSISTS OF ILOOD PLAIN COMMUNITY - GREEN ASH, ASPEN, ELM, BASSWOOD, MANITOBA MAPLE WITH DOGWOOD, HAZEL AND SNAKEROOT UNDERGROWTH.



LOCATION PLANS

STUDY SITE 2

SOLAR GREENHOUSE

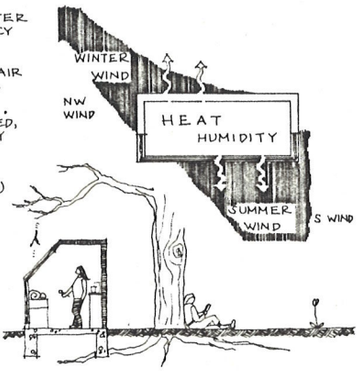
OBJECTIVES

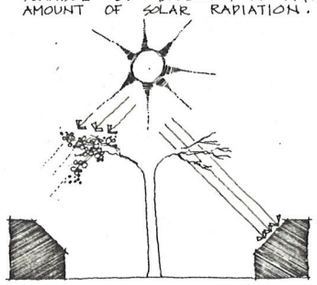
TO CREATE AN OPTIMUM ENVIRONMENT FOR VEGETABLE GROWTH USING SOLAR ENERGY AS THE MAIN SOURCE OF HEAT AND LIGHT. THE STRUCTURE WILL PROVIDE:

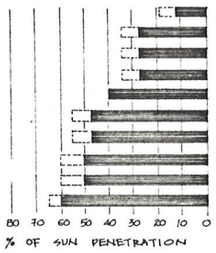
- A MAXIMUM HEAT GAIN AND MINIMUM HEAT LOSS DURING HEATING SEASON.
- A MAXIMUM INCOMING LIGHT BOTH IN INTENSITY AND DURATION.
- A CONSTANT AIR TEMPERATURE AT LEVELS THAT ALLOW PLANT GROWTH.

1. SITE SELECTION

- SITES FOR GREENHOUSES SHOULD RECEIVE MAXIMUM SUNLIGHT DURING THE HEATING SEASON AND BE SHADED DURING SUMMER. IDEALLY, IN SPRING AND FALL SUNLIGHT SHOULD BE AVAILABLE BETWEEN 9:00 AM TO 3:00 PM; IN WINTER 10:00 AM TO 2:00PM.
- SITES SHOULD BE THE ABOVE FLOOD LEVEL (755')
- GREENHOUSES SHOULD NOT BE BUILT OVER UTILITY PIPES AND WIRES.
- THE SITE SHOULD BE PROTECTED FROM PREVAILING PATH OF WIND. WIND IN WINTER CAN CONSIDERABLY DECREASE THE EFFICIENCY OF THE GREENHOUSE BY DIMINISHING THE INSIDE TEMPERATURE TOO QUICKLY. SUMMER WIND CAN THE RELATIVE HUMIDITY OF THE AIR OR BE CHILL ENOUGH TO HARM THE PLANTS.
- SITES WITH LARGE TREES ARE NOT SUITABLE. LARGE TREES ARE TOO COSTLY TO BE REMOVED, IF KEPT ON SITE THE CONSTRUCTION MAY DAMAGE THE ROOTS AND THE WINDFALL BRANCHES CAN DAMAGE THE GLASS.
- SMALLER TREES (LESS THAN 7.5 CM OF TD) CAN BE EASILY REMOVED, IF NECESSARY.
- DECIDUOUS TREES ARE DESIRABLE. THE SHADING KEEPS THE GREENHOUSE FROM OVERHEATING IN JUMMER, WHILE IN WINTER THE BARE BRANCHES ALLOW THE INCOMING SUNLIGHT. HOWEVER, THE DENSITY OF BARE BRANCHES VARY ACCORDING TO SPECIES; SOME OF THEM MAY NOT BE SUITABLE BY BLOCKING A SIGNIFICANT AMOUNT OF SOLAR RADIATION.





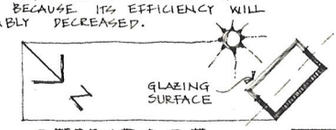


SOURCE: W.B. HUTCHINSON "WINTER CANOPY SHADE OF ELEVEN SPECIES OF LANDSCAPE TREES", 1980.

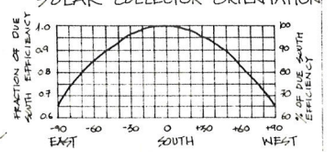
2. SITE PLANNING

ORIENTATION

THE OPTIMUM ORIENTATION FOR A GREENHOUSE GLAZING SURFACE IS IDEALLY SOUTH. DEVIATIONS OF UP 15° FROM SOUTH IN EITHER DIRECTION (EAST OR WEST) HAS LITTLE CHANGE IN THE EFFECTIVENESS OF ITS PERFORMANCE. DEVIATIONS UP TO 30° OF SOUTH IS STILL ACCEPTABLE; HOWEVER, THE PERFORMANCE DECREASES BY 10%. WIDER THAN 30° IS NOT RECOMMENDED BECAUSE ITS EFFICIENCY WILL BE CONSIDERABLY DECREASED.



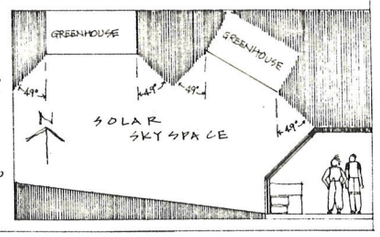
SOLAR COLLECTOR ORIENTATION



SOURCE: SITE PLANNING FOR SOLAR ACCESS, D. ELEY ET AL (AMERICAN PLANNING ASSOCIATION U.S., GOV. PRINTING OFFICE, WA DC, MAY '80)

SOLAR SKYSPACE

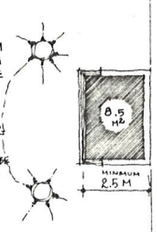
ANY SURROUNDING OBJECTS (TREES, BUILDINGS, ETC) THAT OBSTRUCT THE SOLAR ACCESS ON THE GLAZING SURFACE CAN AFFECT ITS EFFECTIVENESS. IT BECOMES MORE CRITICAL IN WINTER, PARTICULARLY ON DECEMBER 21, WHEN THE SUN ANGLES ARE THE LOWEST AND THE SHADOWS ARE THE MOST EXTENSIVE OF THE YEAR. DUE TO THIS ASPECT, ANY OBJECTS WHICH ARE KEPT BELOW THE ALTITUDE OF SUNPATH (7° IN WINNIPEG) ON THIS DATE, AND BEYOND THE AZIMUTH (49° IN WINNIPEG) FROM 9:00 AM TO 3:00PM ON THE SAME DATE, THE SOLAR ACCESS WILL AUTOMATICALLY BE PROTECTED FROM THE ENTIRE HEATING SEASON.



3. LAY-OUT

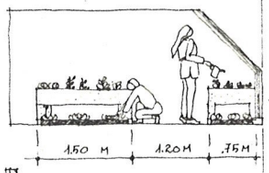
SIZE

TO TAKE ADVANTAGE OF SOLAR DESIGN THE MINIMUM TOTAL AREA OF GREENHOUSE SHOULD BE 8.5 M², WITH TOO SMALL A SIZE THE INTERIOR TEMPERATURES ARE SUBJECTED TO FAST FLUCTUATIONS AS THE OUTSIDE TEMPERATURES CHANGE. THIS WILL CAUSE THE USE OF GREENHOUSE TO BE UNFEASIBLE FOR OPTIMUM PLANT GROWTH WHICH REQUIRES A RELATIVELY STABLE TEMPERATURE. MINIMUM DEPTH SHOULD BE 2.5 M; AGAIN, A NARROWER WIDTH WILL CAUSE THE GREENHOUSE TO BE INEFFICIENT DUE TO RAPID TEMPERATURE CHANGES.



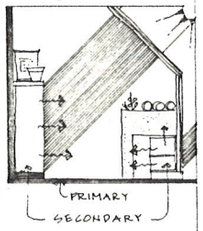
GROWING BENCHES

VEGETABLES CAN BE GROWN IN BEDS ON THE FLOOR LEVEL OR IN RAISED BENCHES. WHEN REACHING FROM ONE SIDE, THE GROWING BENCHES SHOULD NOT EXCEED 75 CM WIDE, AND 1.50M FROM BOTH SIDES. THE IDEAL WIDTH OF WORKING PATH SHOULD BE AT LEAST 1.20 M.



THERMAL STORAGE

THE FUNCTION OF THERMAL STORAGE IS TO AVOID EXTREME FLUCTUATIONS OF DAILY TEMPERATURES IN THE GREENHOUSE. THE STORAGE ABSORBS HEAT WHEN SUN RADIATION IS AVAILABLE AND RELEASES IT AT NIGHT OR CLOUDY DAYS. THE STORAGE ALSO AVOIDS THE BUILD-UP OF WARM AIR IN THE GREENHOUSE. THE HEAT HOLDING CAPACITY OF THERMAL STORAGE VARIES ACCORDING TO THE TYPE OF MATERIAL AND TO ITS VOLUME. PRIMARY HEAT STORAGE MATERIALS ARE THOSE THAT HAVE A SHORT-TERM HEAT STORAGE CAPACITY, THAT IS, THE HEAT, ABSORBED DURING THE DAY, IS RELEASED AT NIGHT. PRIMARY THERMAL STORAGE MATERIAL CAN BE BRICK OR CONCRETE SLAB FLOOR. ON THE OTHER HAND, SECONDARY THERMAL STORAGE MATERIALS HAVE THE CAPACITY TO RESERVE HEAT FOR LONGER PERIODS; THIS IS INDISPENSABLE IN ANY GREENHOUSE DESIGNED FOR PLANT GROWTH BECAUSE IT MAY SUPPLY HEAT WHEN CLOUDY WEATHER PERSISTS FOR DAYS AND THE BACK-UP HEATING SYSTEM, THEN, MAY BE SPARED. SECONDARY THERMAL STORAGE CAN BE WATER CONTAINED DRUMS PILED ALONG THE NORTH WALL OR A THICK LAYER OF BRICK OR ROCKS CONSTRUCTED UNDER THE FLOOR OR ON NORTH WALL. ALTHOUGH VARIOUS MATERIALS HAVE BEEN USED AS THERMAL STORAGE, WATER IS A BETTER STORAGE MEDIUM BECAUSE IT CAN STORE MORE HEAT PER VOLUME THAN OTHER MATERIALS. IT IS RECOMMENDED THAT 75 TO 125 L OF WATER BE USED FOR EVERY SQUARE METER OF GLAZING SURFACE.



FRUIT TREES

1. SITE SELECTION

FRUIT TREES NEED DIRECT SUNLIGHT EXPOSURE DURING THE HOTTEST PART OF THE DAY. IDEALLY, SITES THAT ARE FREE OF SHADE BETWEEN 10:00 AM TO 4:00 PM IN SUMMER ARE THE POTENTIAL SITES. THE LOCATION OF FRUIT TREES SHOULD BE SUCH THAT THEY WILL NOT CAST SHADE ON VEGETABLE GARDEN SITES AND BLOCK THE RESIDENTS' SOLAR RIGHTS.

FRUIT TREES SHOULD BE PROTECTED FROM PREVAILING WINDS IN ALL SEASONS. STRONG WINDS IN SUMMER AND WINTER INCREASE EVAPORATION AND CAUSE TREES TO DRY OUT. IN SUMMER WINDS CAN DESTROY THE BRANCHES AND BLOSSOMS, IN FALL WINDS CAUSE FRUIT TO FALL FROM THE TREES.

2. SITE PLANNING

SPACING

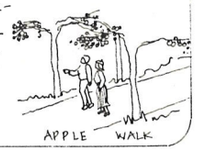
WHEN FRUIT TREES ARE PLANTED IN GROUPS, SPACING SHOULD BE ENOUGH TO ALLOW PLENTY OF AIR AND SUNLIGHT BETWEEN THE TREES. IN GENERAL, THE SPACING OF APPLES, CRABAPPLES, APPLECRABS, PEARS AND APRICOTS ARE AT LEAST 7.5 M APART; PLUM TREES ARE 6.0 M, AND CHERRY-PLUM HYBRIDS AND SOUR CHERRIES ARE 4.5 M. INDIVIDUAL SASKATOON TREES ARE PLANTED 2.0 M APART BETWEEN THE CENTERS; IF PLANTED AS HEDGE, THE SPACING IS 1.5 M WITHIN THE ROWS AND 2.5 M BETWEEN THE ROWS.

DEFINING SPACE

FRUIT TREES AND SHRUBS SHOULD BE INCORPORATED INTO THE LANDSCAPE AS A WHOLE. FRUIT PLANTS WITH THEIR CONSPICUOUS FLOWERS AND FRUITS CAN BE VERY EFFECTIVE ELEMENTS IN GIVING CHARACTER TO A SPACE.

PARKING

FRUIT TREES SHOULD NOT BE USED FOR SHADING IN PARKING LOTS.



VEGETABLE GARDEN

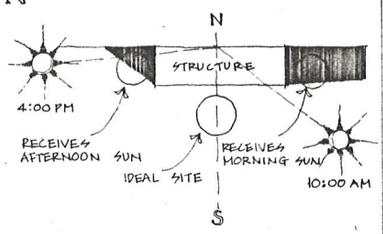
1. SITE SELECTION

SOLAR EXPOSURE

MOST OF THE VEGETABLES NEED AT LEAST 6 HOURS OF SOLAR EXPOSURE, ALTHOUGH SOME OF THEM CAN TOLERATE PARTIAL SHADE. IDEALLY, THE GARDEN SITE SHOULD BE EXPOSED TO SUNLIGHT BETWEEN 10:00 AM TO 4:00 PM.

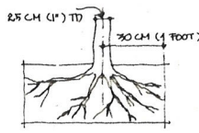
SOLAR ORIENTATION

THE BEST LOCATION FOR VEGETABLE GARDENS SITUATED CLOSE TO STRUCTURES IS ON SOUTH SIDE. SITES ORIENTED TOWARD THE SOUTH-WEST AND SOUTHEAST ARE ALSO SUITABLE. HOWEVER, THE SOUTHWEST IS PREFERRED TO THE SOUTHEAST ORIENTATION BECAUSE ON SOUTHWEST THE HIGH INTENSITY OF AFTERNOON SUN CAUSES A FASTER GROWTH BY RAISING THE SOIL AND AIR TEMPERATURES. ON THE OTHER HAND, SOUTHEAST ORIENTATION MAY RESULT IN SLOW GROWTH OF PLANTS DUE TO LOW INTENSITY OF MORNING SUN.



TREES & SHRUBS

GARDEN SITES SHOULD BE KEPT SOME DISTANCE AWAY FROM TREES AND SHRUBS SO THAT THEY WILL NOT COMPETE FOR WATER AND SOIL NUTRIENTS, AS WELL THEY WILL NOT BECOME SHADED OUT. AS GENERAL RULE, 90% OF TREE ROOTS ARE LOCATED WITHIN THE CIRCLE AROUND THE TREE TRUNK EQUIVALENT TO ONE FOOT RADIUS FOR EVERY INCH IN TRUNK DIAMETER; THUS, GARDEN SITES SHOULD BE LOCATED BEYOND THIS CIRCLE.



SOIL & WATER

VEGETABLES REQUIRE SOIL WITH GOOD DRAINAGE, TILTH, FERTILITY AND ORGANIC MATTER. IN GENERAL, 100 GALLONS (378 L) OF IRRIGATION WATER PER WEEK IS REQUIRED FOR A 150 SQ FEET (14 M²) OF GARDEN SPACE. A GROWING SEASON, WHICH LASTS IN AVERAGE 130 DAYS①, NEEDS A TOTAL WATER VOLUME OF 1,850 GALLONS (7,000 L) PER SEASON.

LOCATION

GARDENS CAN BE LOCATED ON EITHER BACKYARD OR FRONTYARD PROVIDED IT IS SEPARATED FROM OTHER FUNCTIONS.

① SOURCE: DEPARTMENT OF ENVIRONMENT, CANADA, FROST DATA, 1941-1970.

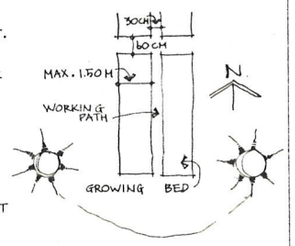
2. SITE PLANNING

SIZE

THE MINIMUM TOTAL AREA PROVIDED FOR EACH HOUSING UNIT SHOULD BE 14 M², WHICH IS THE AREA NECESSARY TO SUPPLY FOOD FOR AN AVERAGE FAMILY FOR A YEAR.

GROWING BEDS

GROWING BEDS ARE BEST ORIENTED ALONG NORTH-SOUTH AXIS FOR AN EQUAL DISTRIBUTION OF SUNLIGHT. THE WIDTH SHOULD NOT EXCEED 1.50 M. OTHERWISE WORKING ON PLANTING, WEEDING, CULTIVATING AND HARVESTING FROM EITHER SIDE OF THE BED WILL BE DIFFICULT.



WORKING PATH

A HIERARCHY OF PATH SIZE SHOULD BE ESTABLISHED TO PROVIDE A MORE EFFICIENT USE OF LAND. THE PATH WIDTH SHOULD BE AT LEAST 30 CM ALONG THE LONG AXIS OF THE BEDS TO ALLOW A COMFORTABLE WORKING SPACE, AND AT LEAST 60 CM ALONG THE SHORT AXIS TO ALLOW THE USE OF GARDEN EQUIPMENT.

COMPOST SITE

THE COMPOST SITE SHOULD BE CLOSE TO THE PLANTING AREAS. DUE TO THE LIMITED LAND AND CLOSENESS TO THE HOUSES, COMPOST MAY BE A PROBLEM. FOR URBAN ENVIRONMENTS THE ANAEROBIC METHOD MAY BE THE BEST SUITED. IT CONSISTS OF COMPOSTING THE ORGANIC WASTES IN WELL-SEALED BLACK PLASTIC BAGS. THE ADVANTAGES OF THE METHOD ARE: IT DOES NOT REQUIRE MUCH SPACE, IT CAN BE PLACED DIRECTLY ON PLANTING BEDS, IT DOES NOT SMELL DURING THE BREAK-DOWN PROCESS, IT IS CHEAP - DOES NOT REQUIRE A WOODEN BOX OR FRAME, IT DOES NOT NEED TURNING, IT IS FAST - ONLY TAKES 4 TO 6 WEEKS TO COMPOST, AND THE FINAL VOLUME IS ALMOST THE SAME AS THE ORIGINAL.

SECURITY

GARDEN SITES NEED TO BE PROTECTED FROM CHILDREN AND ANIMALS. LOW FENCES OR SHRUB SHELTERBELTS CAN BE USED. THESE SHOULD BE LOCATED IN SUCH A WAY THAT WILL NOT CAST SHADE ON THE GROWING BEDS.

SMELL & NOISE

PROTECTION OF THE SURROUNDING HOUSES FROM THE SMELL OF COMPOSTING WHILE PREPARING SOIL FOR PLANTING SHOULD PROVIDED. NOISE OF MECHANICAL EQUIPMENTS SHOULD BE MINIMIZED.

PLAY AREA

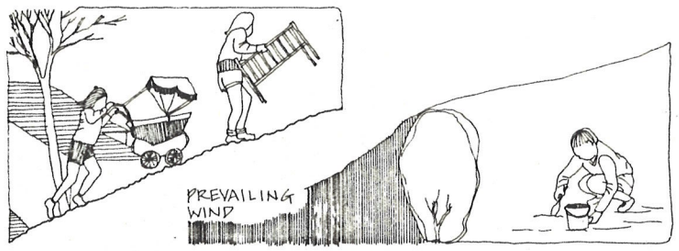
1. SITE SELECTION

SIZE

AS SPECIFIED IN CMHC'S SITE PLANNING CRITERIA, THE MINIMUM SIZE FOR A CHILDREN'S PLAYGROUND SHOULD BE AT LEAST 2,5 MR PER BEDROOM, EXCLUDING THE MASTER BEDROOM. OF THIS TOTAL 1,00 MR IS ASSIGNED FOR PRE-SCHOOL CHILDREN AND 1,5 MR FOR SCHOOL AGE CHILDREN. IDEALLY, THE PLAY AREA SHOULD ACCOMMODATE A VARIETY OF EQUIPMENT WHICH PROMOTES ACTIVE, SOCIAL, CREATIVE AND QUIET PLAY.

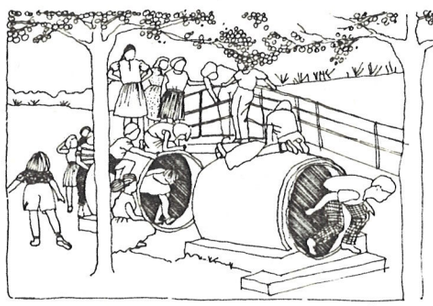
TOPOGRAPHY

NATURAL OR MAN-MADE TOPOGRAPHICAL FEATURES SHOULD BE INCORPORATED WITHIN THE PLAY AREA, A SIMPLE AND RELATIVELY LOW MAINTENANCE PLAY DEVICE SHOULD BE PROVIDED.



MICROCLIMATE

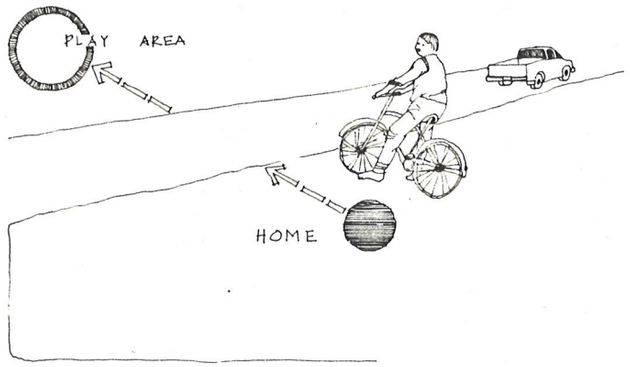
THE SITE FOR A PLAY AREA NEEDS TO BE PROTECTED FROM PREVAILING WINDS. SHADE IS DESIRABLE IN SUMMER; HOWEVER, THE SITE SHOULD RECEIVE FULL-SUNLIGHT DURING WINTER MONTHS.



DECIDUOUS TREES OR SHRUBS ARE PREFERRED ON SITE, EXCEPT ALONG THE PREVAILING WIND EDGE(S) WHERE CONIFEROUS PLANTS ARE MORE APPROPRIATE.

ACCESS

THE PLAY AREA SHOULD BE EASILY REACHED BY WALKING OR BICYCLING. NO HAZARDOUS BARRIERS SHOULD EXIST BETWEEN THE PLAY AREA AND THE CHILDREN'S HOME.



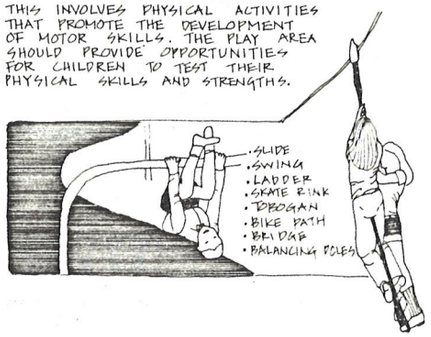
2. SITE PLANNING

FUNCTION & ORGANIZATION

PLAY AREAS SHOULD PROVIDE OPPORTUNITIES FOR PHYSICAL, SOCIAL, CREATIVE AND QUIET PLAY. ALTHOUGH THESE FORMS OF PLAY SHOULD BE SPATIALLY SEPARATED, THEY SHOULD ALSO BE INTERRELATED.

PHYSICAL PLAY

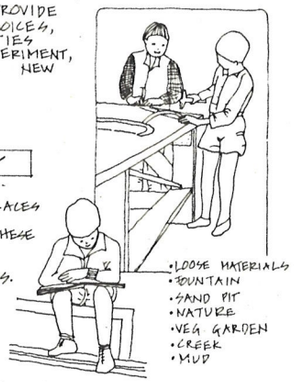
THIS INVOLVES PHYSICAL ACTIVITIES THAT PROMOTE THE DEVELOPMENT OF MOTOR SKILLS. THE PLAY AREA SHOULD PROVIDE OPPORTUNITIES FOR CHILDREN TO TEST THEIR PHYSICAL SKILLS AND STRENGTHS.



- SLIDE
- SWING
- LADDER
- SKATE RINK
- TOBOGAN
- BIKE PATH
- BRIDGE
- BALANCING POLES

CREATIVE PLAY

PLAY AREAS SHOULD PROVIDE WIDE RANGE OF CHOICES, OFFERING OPPORTUNITIES FOR CHILDREN TO EXPERIMENT, MODIFY AND DISCOVER NEW THINGS.



- LOOSE MATERIALS
- FOUNTAIN
- SAND PIT
- NATURE
- VEG GARDEN
- CREEK
- MUD

QUIET PLAY

PLAY AREAS SHOULD PROVIDE ISOLATED PLACES FOR A MOMENT OF ISOLATION. HOWEVER, THESE PLACES SHOULD BE VISIBLE BY THE SUPERVISORS OR ADULTS.

- SMALL ENCLOSED SPACE
- BEHIND SHRUBS
- SITTING AREA

SOCIAL PLAY

CHILDREN ARE NOT ONLY ABLE TO COMMUNICATE AND COOPERATE WITH OTHERS, BUT ALSO TO UNDERSTAND "THE RULES" AND ABILITY TO WORK TOGETHER TO A COMMON GOAL. THEY ALSO SOCIALIZE BY ASSUMING ROLES WHICH ARE BEYOND THE LIMITS OF THEIR IMMEDIATE REALITY. PLAY AREAS SHOULD PROVIDE EQUIPMENT AND ENVIRONMENT THAT PROMOTES SOCIAL INTERRELATION AND STIMULATES THE CHILDREN'S IMAGINATION.

- ACTIVE PLAY AREA
- SITTING AREA
- LARGE ENCLOSED SPACE
- NATURE
- LOOSE MATERIALS: BOXES, WOODS, ETC.

AGE GROUPS

PRE-SCHOOL AGE CHILDREN

IN GENERAL, PRE-SCHOOL CHILDREN ARE CHARACTERIZED BY EGOCENTRIC BEHAVIOUR, THEY LIVE IN THE WORLD CREATED BY THEMSELVES. ALTHOUGH THEY ENJOY PLAYING SIDE BY SIDE, THE INTERACTION WITH OTHERS OCCURS ONLY OCCASIONALLY; MOST OF THE TIME THEY ARE IMMERSED IN THEIR WORLD OF FANTASY. THIS IS THE AGE-GROUP THAT NEEDS CLOSE SUPERVISION. THUS, THE PROVISION OF BENCHES FOR ADULTS NEARBY PLAY AREAS IS REQUIRED. ESSENTIAL PLAY SURFACES ARE: SOFT SAND AND A HARD SURFACE SUCH AS CONCRETE SLAB, WHERE CHILDREN CAN PLAY WITH TRICYCLES, CARTS, TOYS, ETC. SAND IS THE MAIN PLAY MATERIAL. OTHER MATERIALS CAN BE PROVIDED: SCREENED AREA BY SHRUBS FOR HIDING OR JUST AN ISOLATED SPACE. WOODEN EQUIPMENT ALSO ARE RECOMMENDED FOR PHYSICAL EXERCISES - CLIMBING AND HANGING ON.

SCHOOL AGE CHILDREN

SCHOOL AGE CHILDREN ARE CHARACTERIZED BY THE DEVELOPMENT OF SOCIAL RELATIONSHIPS. INTUITION IS SUBSTITUTED BY LOGICAL THINKING AND THE EGOCENTRIC WORLD BY THE SOCIAL WORLD AS THEY DEVELOP AWARENESS AND ABILITIES TO RECOGNIZE OTHER'S NEEDS. THIS IS THE PHASE WHEN THEY ARE INTERESTED IN PLAYING GAMES WITH RULES AS THE CHILDREN DEVELOP A MORE SYSTEMATIC PATTERN OF THOUGHT AND ABILITY TO WORK TOGETHER TO A COMMON GOAL. THE PLAY AREA SHOULD BE SEPARATED FROM PRE-SCHOOL CHILDREN. SCHOOL AGE CHILDREN NEED A LARGER PLAY AREA AND MORE VARIED AND ADVANCED EQUIPMENT THAT STIMULATES CHALLENGE AND CREATIVITY. THEY NEED SOFT SURFACES FOR A MULTITUDE OF PLAY, HARD SURFACES FOR THE BIKES, TABLES AND BENCHES FOR GATHERINGS AND PLAY, AND ISOLATED PLACES FOR A MOMENT OF LONELY PLAY.

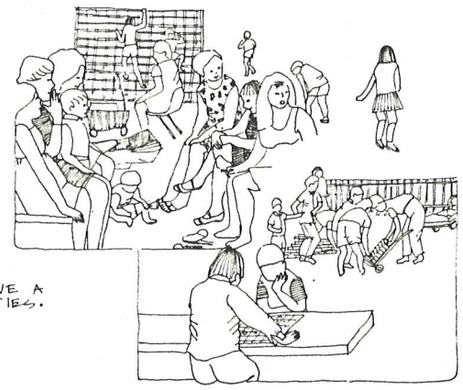
ENTRANCE

ENTRANCES TO PLAY AREAS SHOULD BE EASILY IDENTIFIABLE. IT SHOULD ALSO ALLOW THE EMERGENCY AND MAINTENANCE SERVICES.

SITTING AREAS

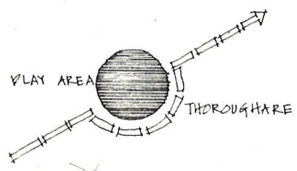
SITTING AREAS BY PLAY ACTIVITY AREAS SHOULD BE PROVIDED FOR THE ADULTS TO CASUALLY SUPERVISE CHILDREN PLAY. THE LAY-OUT SHOULD ALLOW BOTH GROUP GATHERING AND ISOLATION. THEY SHOULD ALSO BE SHELTERED FROM DIRECT AND PROLONGED SUN AND PREVAILING WINDS.

SITTING AREAS FOR CHILDREN SHOULD HAVE A VIEW TO OTHER CHILDREN'S PLAY ACTIVITIES.



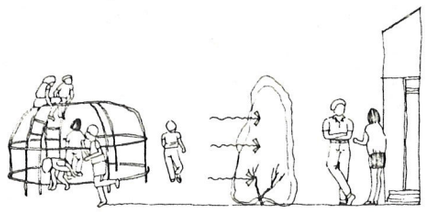
CIRCULATION

VEHICULAR CIRCULATION AND PEDESTRIAN PATHS SHOULD NOT TRAVERSE THE PLAY AREA.



NOISE

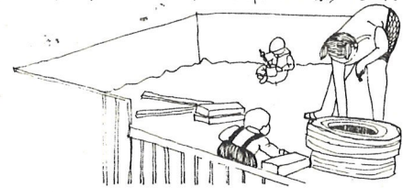
WHEN PLAY AREAS ARE LOCATED CLOSE TO DWELLINGS, NOISE SHOULD BE BUFFERED.



SAFETY

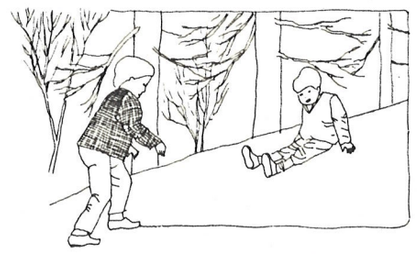
SURFACING MATERIALS SHOULD BE APPROPRIATELY INTRODUCED FOR THE SAFETY OF CHILDREN IN THE PLAY ENVIRONMENT. SOFT SURFACE, SUCH AS SAND AND GRASS, SHOULD BE USED WHERE IMPACT OF FALLING IS POSSIBLE OR ANTICIPATED. FOR EXAMPLE, AT THE BOTTOM OF SLIDES OR UNDER THE SWINGS, THE PROVISION OF SAND CAN CUSHION THE FALL WITHOUT HARM.

ANY PLAY SPACE FOR TODDLERS SHOULD BE SURROUNDED BY BARRIERS WHICH WILL KEEP THE TODDLERS IN AND LARGER KIDS OUT.



MAN-MADE CONTOURS

GROUND CAN BE SHAPED INTO HILLS OR PITS, GIVING INTERESTING CONTOURS WHICH OFFER A WIDE VARIETY OF EXPERIENCE IN PLAY ACTIVITY BESIDES BEING WIND SHIELDS AND VISUAL AND NOISE BARRIERS; THE VARIED RELIEF SERVES AS BANKS FOR CLIMBING, SLIDING, ROLLING DOWN, ETC. WHEN THE SLOPE IS COVERED WITH GRASS THE GRADIENT SHOULD NOT EXCEED 35°; SHARPER SLOPES CAN BE ADOPTED IF THE HILL IS COVERED WITH A HARD SURFACE.

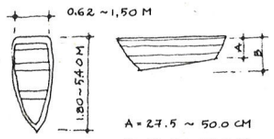


SITTING AREA

ON SUNNY DAYS, NEIGHBORS TEND TO GATHER BY THEIR HOUSES STANDING OR SITTING ON THE DOOR STEPS. SHADED, SMALL GATHERING PLACES CLOSE TO THE DWELLINGS, PREFERABLY WITHIN VIEWING RANGE FROM INSIDE THE LIVING UNITS, SHOULD BE PROVIDED FOR CASUAL GATHERINGS. THE AREA SHOULD PROVIDE BENCHES, TRASH RECEPTACLES AND SAND BOX FOR TODDLERS, AS WELL AS OBJECTS FOR CHILDREN'S PLAY.

WALKING PATH

WALKING PATHS SHOULD BE PROVIDED LINKING RECREATIONAL SITES, NATURAL ATTRACTIONS AND REFERENCE POINTS. THESE PATHS DO NOT NEED TO FOLLOW THE MOST DIRECT LENGTH BUT THEY CAN MEANDER. WHEN BICYCLING PATHS ARE PROVIDED, THESE SHOULD BE SEPARATED FROM WALKING PATHS BY BARRIERS OR DIFFERENT PAVING MATERIALS.



BOATING

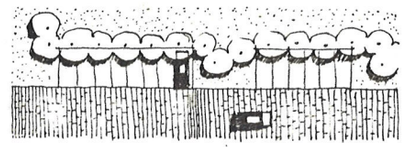
THE ACCESS TO BOAT LANDING (DOCK) SHOULD ACCOMMODATE MOVING AND LAUNCHING OF SMALL BOATS AND CANOES. THE ACCESS SHOULD NOT BE AUTOMOBILE ACCESSIBLE.

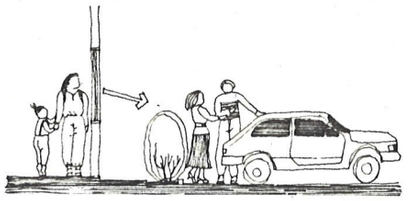
THE DOCK IS PREFERABLY LOCATED CLOSE TO OTHER RECREATIONAL ACTIVITIES.

PARKING

SIZE

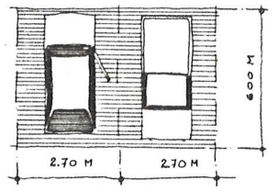
AT THE RATE OF ONE STALL PER EACH UNIT, PARKING SHOULD BE PROVIDED IN SMALL GROUPS OR LOTS CONSISTING OF 5 TO 8 CARS PER LOT. SMALL LOTS GIVE VISUAL CONTROL AND CREATE A VISUAL RELIEF ABLE TO INTEGRATE TREES (FOR SHADE) OR OTHER PEDESTRIAN RELATED FUNCTIONS SUCH AS BENCHES, TRASH RECEPTACLES, MAIL BOXES. IN ADDITION, IN THE SMALL PARKING LOT, USERS TEND TO MAINTAIN IT BY CLEANING UP THE LITTER AND SHOVELLING THE SNOW.

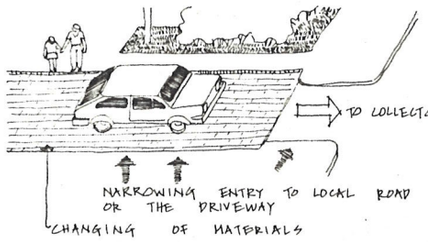




CONTROL

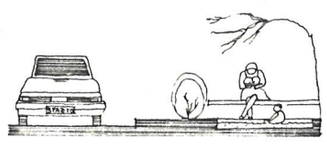
PARKING LOT SHOULD BE VISIBLE FROM INSIDE USERS' DWELLINGS.





DRIVEWAY

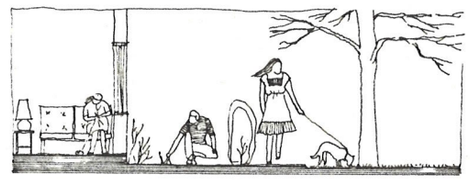
THE SPEED OF TRAFFIC ON LOCAL DRIVEWAYS SHOULD BE KEPT LOW FOR THE SAFETY OF PEDESTRIANS, PARTICULARLY SMALL CHILDREN WHO DO NOT HAVE A TRUE NOTION OF CAR SPEED. NARROWING, ADDING CENTRAL ISLANDS OR CHANGING OF SURFACING PATTERNS AND MATERIALS ARE SOME OF THE EFFECTIVE DEVICES THAT DECREASE VEHICLE SPEED.



TRANSITION

SEPARATION BY FENCES OR SHRUBS SHOULD BE PROVIDED AT A HEIGHT OF A MINIMUM 80 CM IN BETWEEN THE FOLLOWING ZONES:

- PARKING LOT AND SITTING AREA
- DRIVEWAY AND SITTING AREA
- PATHWAY AND ENTRY COURT TO UNIT



SURFACING

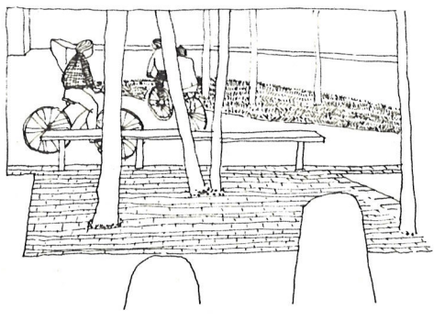
EACH PAVING MATERIAL HAS ITS CHARACTERISTICS WHICH DETERMINE THE SUITABILITY FOR A GIVEN FUNCTION, AS WELL AS THE ESTHETIC EFFECTS THAT IS INTENDED.

HARD SURFACE

HARD SURFACES ARE: CONCRETE PAVING, ASPHALT, PRE-CAST CONCRETE AND BRICK ON CONCRETE BASE, ETC.
THEY ARE DURABLE AND CONTINUOUS, SUITABLE FOR WHEELED TOYS, VEHICLES, BICYCLE AND PEDESTRIAN TRAFFIC.

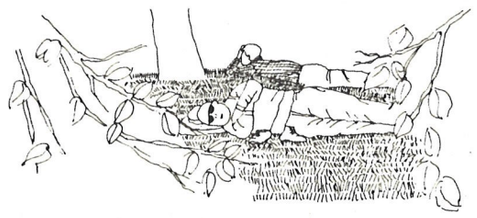
DISCONTINUOUS SURFACE

SOME OF THE DISCONTINUOUS SURFACES ARE: PRE-CAST PAVERS AND BRICK WITH GRASS AND SAND JOINT.
THEY ARE DURABLE AND WITHSTAND THE LAND MOVEMENT.
THEY ARE APPROPRIATE TO DELINEATE SPACE, CREATE A RICHNESS OF TEXTURE AND COLOR AND GOOD IN LOW TRAFFIC AREAS.



SAND & GRASS

SAND SOFTENS THE IMPACT OF FALLS, MAKING IT ESSENTIAL AS A SURFACE MATERIAL IN PLAY AREAS. GRASS IS IDEAL FOR SITTING, PLAYING ON, VISUAL AMENITIES, ETC.

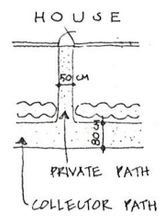


PATHWAY

A HIERARCHY OF PATH SIZES SHOULD BE ESTABLISHED TO REFLECT THE INFLUENCE OF THE FLOW OF PEDESTRIAN TRAFFIC.

- COLLECTOR PEDESTRIAN PATHWAYS SHOULD BE A MINIMUM OF 80 CM.
- PRIVATE PATHS TO THE UNITS SHOULD BE 60CM MINIMUM.

PATHWAYS ON ONE SIDE OF DRIVEWAY AT LEAST SHOULD BE PROVIDED. FOR THE SAFETY OF PEDESTRIANS THEY SHOULD BE RAISED 15 CM OR SEPARATED BY BOLLARDS, FENCES OR PLANT MATERIAL.



ENTRY

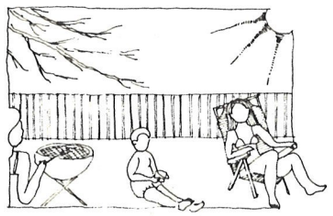
- ENTRY COURTYARD OF UNITS SHOULD BE WELL DEFINED AND SEPARATED FROM PUBLIC WALKWAYS.
- ENTRY TO THE UNITS SHOULD NOT TRAVERSE THE GREENHOUSE.
- IF CHANGE OF ENTRY IS NECESSARY, THE HOUSE STRUCTURE SHOULD NOT SUFFER MAJOR RENOVATION.

LIBRARY

TOOLS FOR GARDENING AND FOOD PROCESSING EQUIPMENT CAN BE PURCHASED AND SHARED BY THE RESIDENTS. MAINTAINED BY TENANTS' ASSOCIATION, THE LIBRARY, THE MEETING ROOM AND THE CHILD CARE CAN BE LOCATED IN THE SAME BUILDING.

GARBAGE

GARBAGE DISPOSAL STATIONS SHOULD BE LOCATED FOR EASY ACCESS AND THERE SHOULD BE PROVIDED ONE FOR EVERY 15 UNITS. A CLEARANCE OF 3.00 X 10.00 M BY THE CONTAINER SHOULD PROVIDED TO ENABLE THE TURNING OF A GARBAGE PICK-UP TRUCK.



PATIO

AN OUTDOOR LIVING AREA SHOULD BE PROVIDED FOR BARBEQUES, SUNBATHING OR SMALL CHILDREN'S PLAY. BUFFERS SHOULD BE PROVIDED FOR PRIVACY FROM NEIGHBORS AND PUBLIC WALKWAYS. THE AREA CAN BE COMBINED WITH A VEGETABLE GARDEN. IT SHOULD HAVE SUN ACCESS FOR SUNBATHING AND SHADED FOR BARBECUING, GATHERINGS OR READING.

OTHER ELEMENTS

SHADE PATTERN - METHOD

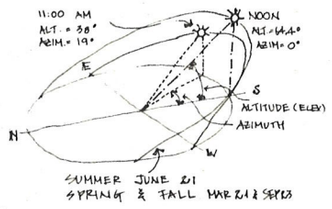
SITE SELECTION FOR GREENHOUSE, OUTDOOR VEGETABLE GARDEN AND ORCHARD IS DEPENDENT ON SOLAR AVAILABILITY DURING THE PERIOD OF THE YEAR WHEN EACH ACTIVITY DEMANDS A CERTAIN AMOUNT OF SUNLIGHT FOR OPTIMUM PLANT GROWTH. AS FOR GREENHOUSES, IN WHICH ITS FUNCTION IS TO EXTEND THE GROWING SEASON, SUNLIGHT SHOULD BE AVAILABLE DURING SPRING, FALL AND/OR WINTER. SITES THAT HAVE SUN ACCESS ONLY IN SPRING AND FALL ARE APPROPRIATE FOR EARLY SEED STARTS AND EXTENSION OF GROWING SEASON BEFORE WINTER. ON THE OTHER HAND, SITES THAT HAVE SUN ACCESS THROUGHOUT WINTER ARE SUITABLE FOR YEAR-ROUND FOOD PRODUCTION (IN THIS CASE, WINTER PLANTING SHOULD BE LIMITED TO CROPS WHICH ARE RESISTANT TO LOW TEMPERATURES). THE IDEAL PERIOD OF THE DAY FOR SUN ACCESS TO GREENHOUSE SHOULD BE BETWEEN 9:00 AM AND 3:00 PM IN SPRING AND FALL, AND 10:00 AM TO 2:00 PM IN WINTER.

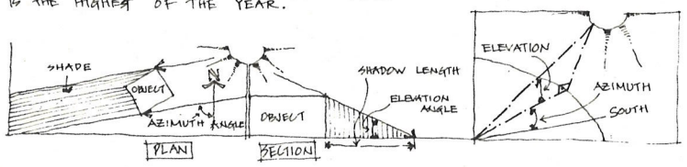
AS FOR VEGETABLE GARDEN AND ORCHARD, THE IDEAL PERIOD OF THE DAY IS BETWEEN 10:00 AND 4:00 PM IN SUMMER.

BY KNOWING THE PERIODS OF THE YEAR AND OF THE DAY FOR EACH ACTIVITY TO OPERATE IN OPTIMUM CONDITION, THE SHADOW PATTERN CAN BE DELINEATED TO FIND THE POTENTIAL SITES BY REFERING TO SUN'S POSITIONS OF RESPECTIVE SEASON. SUN'S POSITION IS DEFINED BY ITS AZIMUTH AND ELEVATION.

SUN'S POSITIONS

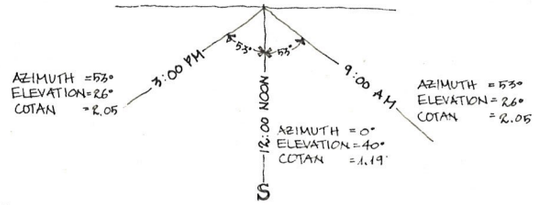
AZIMUTH ANGLE IS MEASURED FROM SOUTH FROM 0° TO 180°, AT NOON THE AZIMUTH IS ZERO FROM THIS POINT THE AZIMUTH INCREASES TOWARD EAST OR WEST TO DEGREES WHICH VARIES WITH SEASONS. IN SUMMER THE SUN RISES AND SETS FURTHER NORTH THAN OTHER SEASONS IN NORTH HEMISPHERE.
THE ELEVATION ANGLE ON SUNRISE AND SUNSET IS ZERO, THE ANGLE INCREASES UNTIL IT REACHES THE MAXIMUM ANGLE WHICH CORRESPONDS TO 12:00 NOON. THE ALTITUDE ANGLE ALSO DEPENDS ON THE SEASONS, THE SUN'S ALTITUDE IN SUMMER IS THE HIGHEST OF THE YEAR.



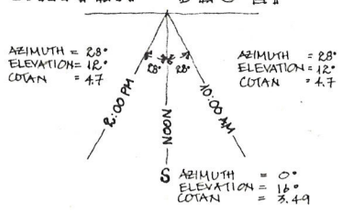


IN OUTLINING SHADOW PATTERN TO DETERMINE SUITABLE SITES FOR GREENHOUSE, VEGETABLE GARDEN AND ORCHARD, ONLY THREE TIMES OF THE DAY IN EACH SEASON ARE NEEDED: THE TWELVE NOON AND THE EARLIEST AND LATEST HOURS OF THE DAY DURING THE PERIOD OF THE ABOVE MENTIONED OPTIMUM HOURS OF SUN ACCESS.

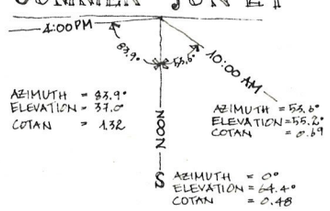
SPRING MARCH 21 & FALL SEPTEMBER 23



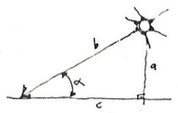
WINTER DEC 21



SUMMER JUN 21



IN ORDER TO FIND THE LENGTH OF SHADOW, HEIGHT OF THE OBJECT IS MULTIPLIED BY THE COTANGENT OF ELEVATION ANGLE.

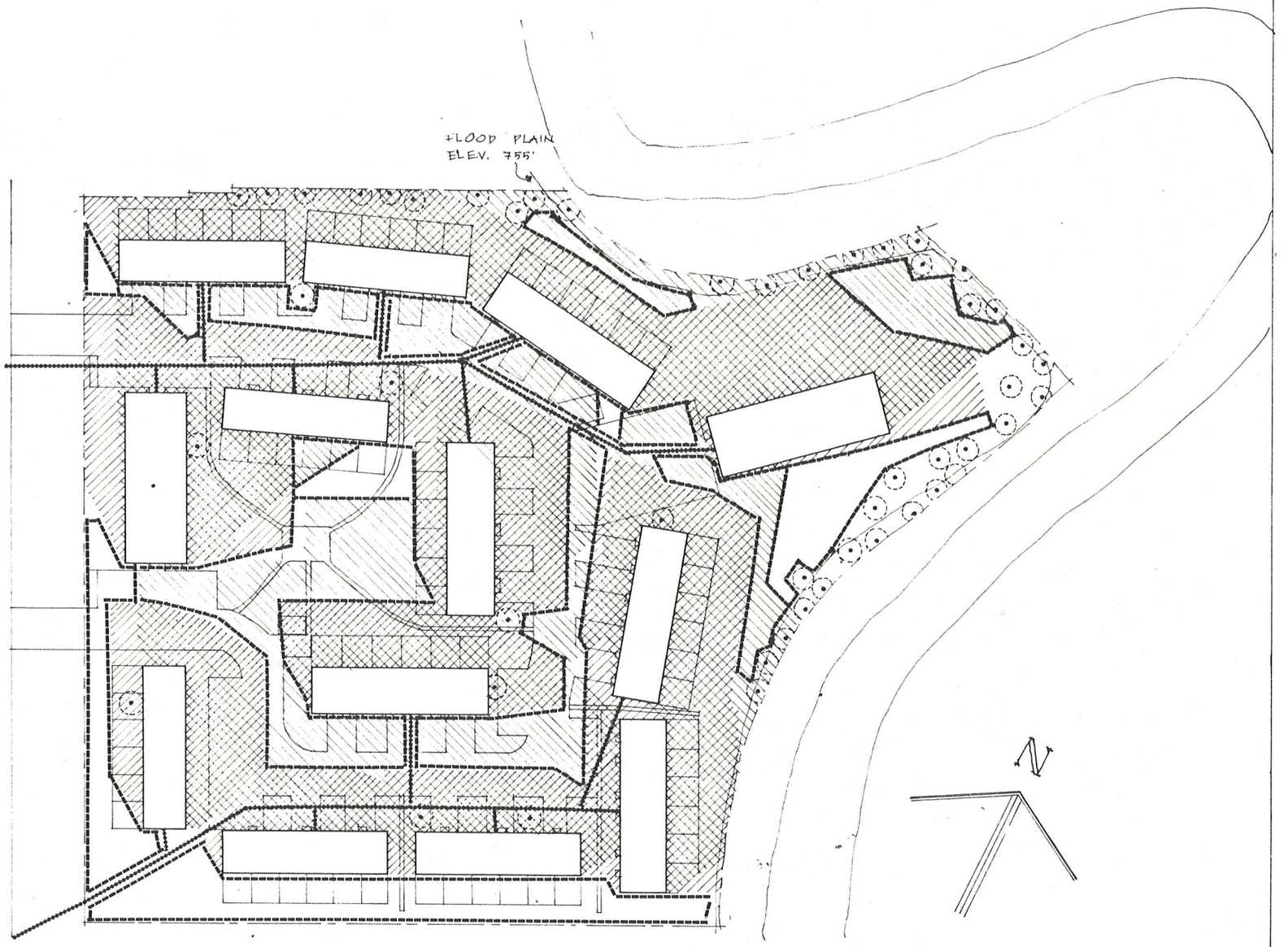


α = ELEVATION ANGLE
a = OPPOSITE SIDE = HEIGHT OF OBJECT
c = ADJACENT SIDE = LENGTH OF SHADOW.

COTAN α = (ADJACENT) LENGTH OF SHADOW / (OPPOSITE) HEIGHT OF OBJECT

LENGTH OF SHADOW = COTAN α × HEIGHT OF OBJECT

FOR EXAMPLE: AN OBJECT OF 7.00 M HIGH ON SEPTEMBER 23 AT NOON, THE LENGTH OF SHADOW WILL BE 8.33 M AT LATITUDE 41° N.
∴ ELEVATION 40° → COTAN = 1.19 ∴ LENGTH OF SHADOW: 1.19 × 7.0 = 8.33 M



SUITABLE SITES FOR GREENHOUSE

METHOD OF SITE SELECTION

POTENTIAL SITES ARE CHOOSEN BASED ON THE FOLLOWING CRITERIA:

1. SITES SHOULD BE FREE OF SHADE DURING SPRING/FALL AND/OR WINTER.
2. POTENTIAL SITES SHOULD HAVE A MINIMUM LENGTH OF 8.5 M.
3. GREENHOUSES CANNOT BE BUILT OVER UNDERGROUND UTILITIES.
4. SITES SHOULD BE LOCATED ABOVE THE FLOOD LEVEL.
5. SITES SHOULD BE BEYOND THE FEEDING ROOTS ZONE OF LARGE TREES IN ORDER TO PROTECT THE ROOTS. THIS ZONE IS EQUIVALENT TO 1 FOOT FOR EVERY INCH OF TRUNK DIAMETER. ON SITE THE EXISTING LARGE TREES TRUNK DIAMETER RANGES FROM 18 TO 24 CM (6~8"), THEREFORE, THE FEEDING ROOTS ZONE RADIUS IS 1.80 ~ 2.40 M (6 ~ 8')

LEGEND

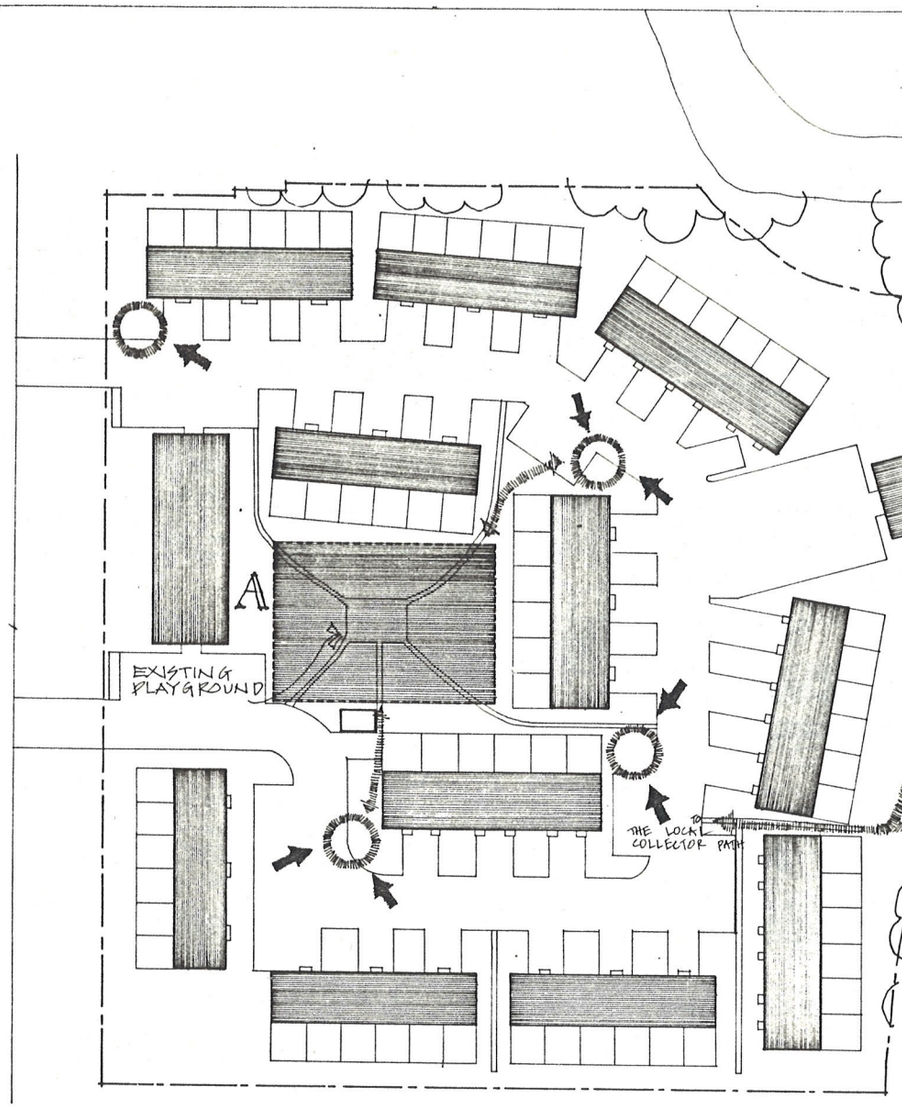
SUITABLE SITES

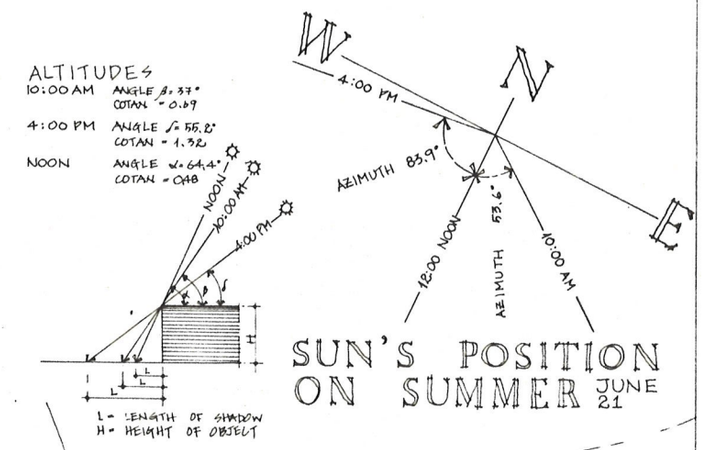
- SUITABLE SITE FOR YEAR-ROUND USE
- SUITABLE SITE FOR SUMMER, SPRING AND FALL

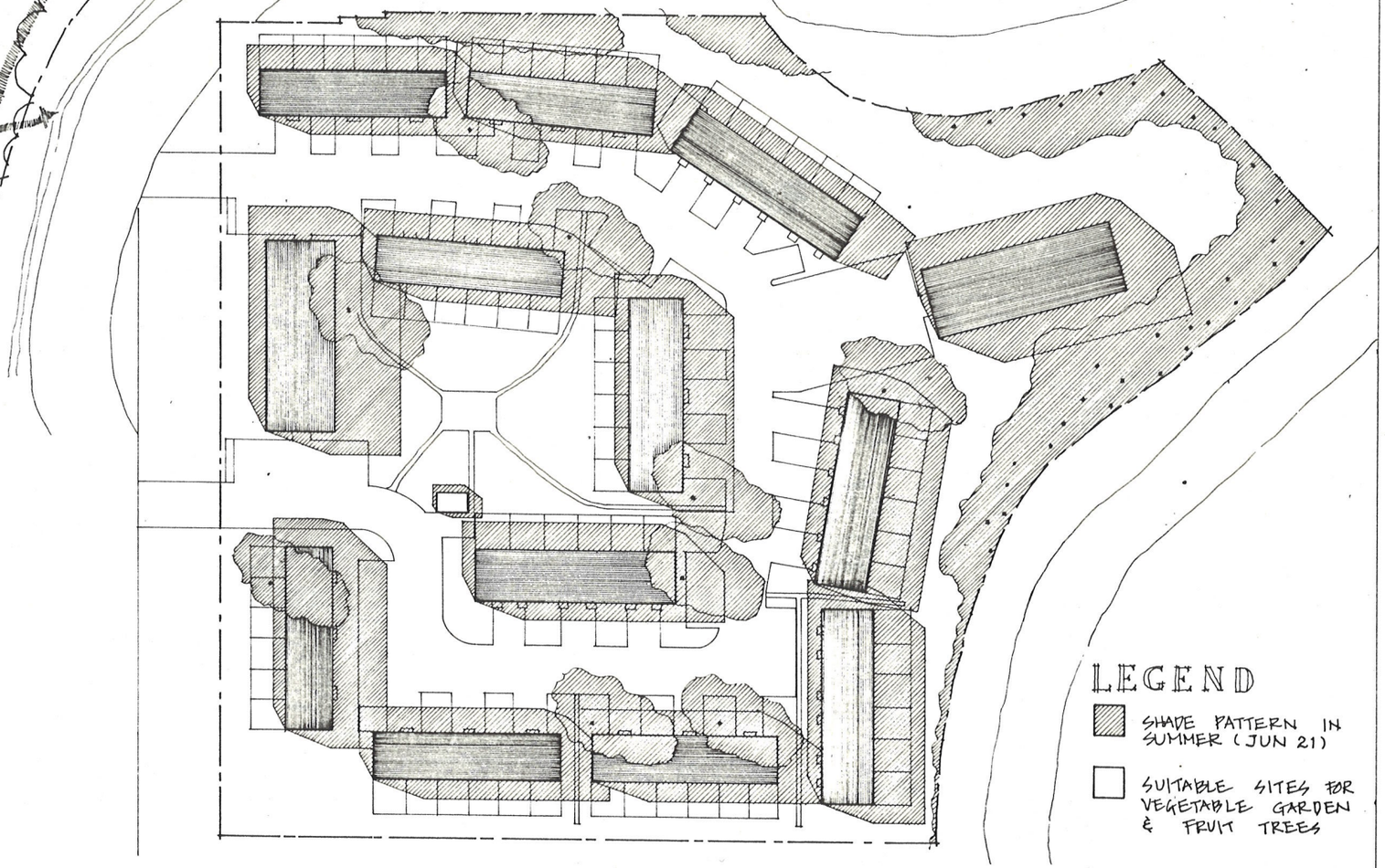
CONSTRAINTS

- SHADED AREA IN SPRING AND FALL
- SHADED AREA IN WINTER
- SHADED AREA IN SPRING, FALL AND WINTER
- LARGE TREES AND THE FEEDING ROOT ZONE
- UTILITY LINES

SITE ANALYSIS 6







SITES FOR RECREATION

PLAY AREA

SITE "A" IS CONVENIENTLY LOCATED IN THE MIDDLE OF THE DEVELOPMENT ALLOWING AN EQUIDISTANT ACCESS FROM ALL THE UNITS. HOWEVER, IT IS CLOSE ENOUGH TO DISTURB THE HOUSING UNITS THAT SURROUND THE SITE. SITE "B" IS LOCATED CLOSE TO OTHER RECREATIONAL ACTIVITIES THAT ARE RELATED TO THE RIVER. THIS SITE IS SEPARATED FROM THE HOUSING UNITS ; THUS, ELIMINATING THE NOISE PROBLEM.

SITTING AREAS WITH SAND-BOX

THEY ARE LOCATED WITHIN THE VIEWING RANGE OF THE UNITS. IT CAN BE INCORPORATED INTO THE WALKING PATH SYSTEM, DEPENDING ON THEIR LOCATION.

WALKING PATH

IT CONNECTS RECREATIONAL AREAS AND MEANDERS THROUGH DIFFERENT LANDSCAPE SETTINGS (RIVER BANK, VEGETABLE GARDEN, ETC.) IT IS ALSO CONNECTED TO LOCAL COLLECTOR PATHS.

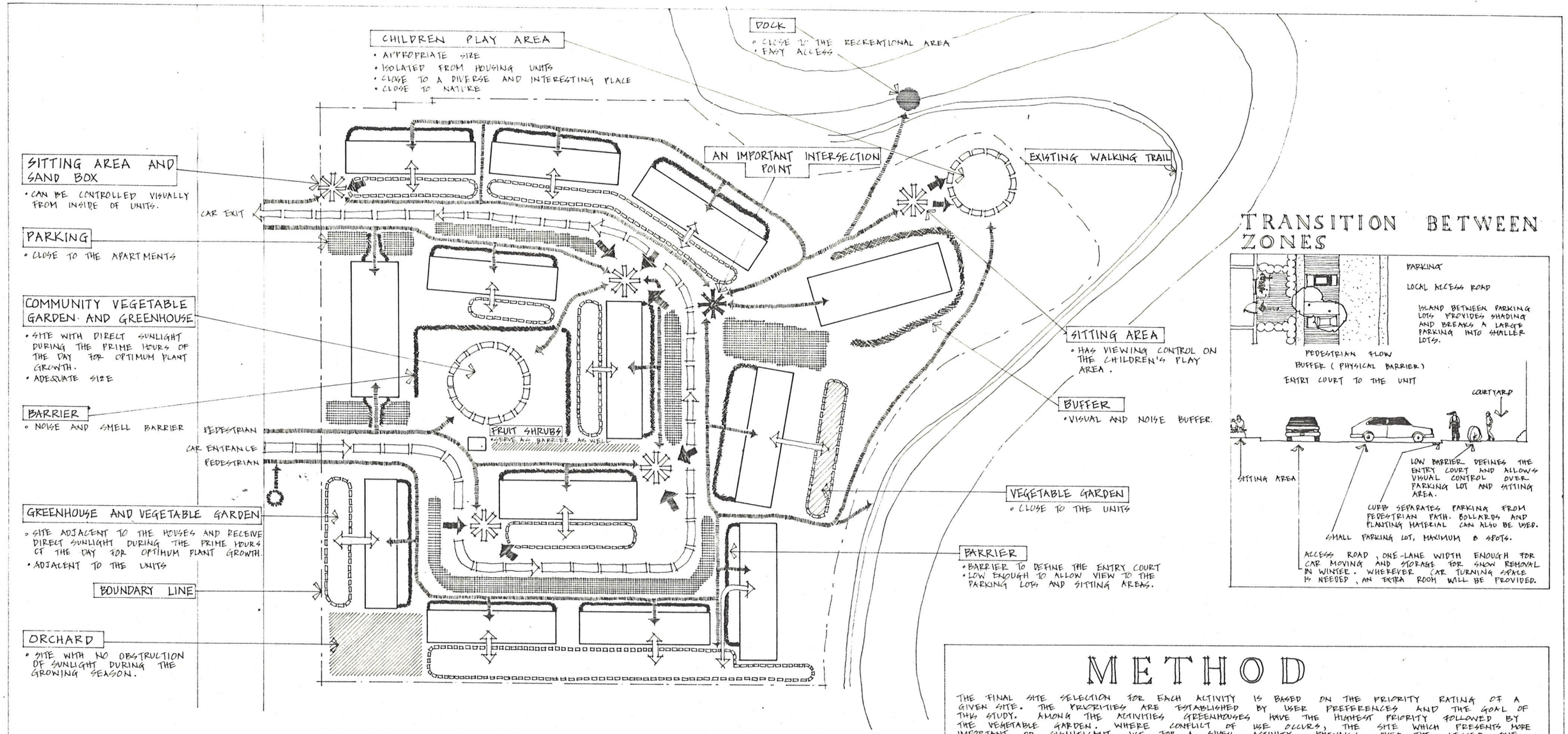
DOCK

IT CONSISTS OF A CLEARING SPOT FOR SMALL BOAT AND CANOE LAUNCHING, FISHING, CONTEMPLATION, ETC. THE PAVEMENT CAN BE WOODEN STRUCTURE OR CRUSHED ROCK ON CONCRETE BASE. ITS LOCATION SHOULD BE CLOSE TO OTHER RECREATIONAL ACTIVITIES AND HAVE EASY ACCESS. THIS SHOULD HAVE A SLOPE LESSER THAN 8%.

VISUAL CONTROL

SITES FOR VEGETABLES & FRUIT TREES

SITE ANALYSIS 7



TRANSITION BETWEEN ZONES

METHOD

THE FINAL SITE SELECTION FOR EACH ACTIVITY IS BASED ON THE PRIORITY RATING OF A GIVEN SITE. THE PRIORITIES ARE ESTABLISHED BY USER PREFERENCES AND THE GOAL OF THIS STUDY. AMONG THE ACTIVITIES GREENHOUSES HAVE THE HIGHEST PRIORITY FOLLOWED BY THE VEGETABLE GARDEN. WHERE CONFLICT OF USE OCCURS, THE SITE WHICH PRESENTS MORE IMPORTANT OR SIGNIFICANT USE FOR A GIVEN ACTIVITY PREVAILS OVER THE LESSER ONE.

GREENHOUSE

PRIORITY ONE SITES ADJACENT TO UNITS AND HAVING SUN ACCESS DURING PRIME TIME PERIODS DURING SPRING/FALL AND WINTER. SITES SUITABLE FOR ATTACHED GREENHOUSE.

PRIORITY TWO SITES ADJACENT TO UNITS AND RECEIVING SUNLIGHT DURING PRIME TIME PERIODS DURING SPRING AND FALL ONLY. SITES THAT ARE SUITABLE FOR ATTACHED GREENHOUSE.

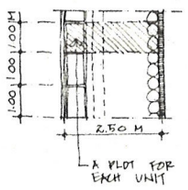
❋ THE ABOVE SITES ALLOW THE CONSTRUCTION OF ATTACHED GREENHOUSES, WHICH IS PREFERRED TO FREE-STANDING ONES. THE ATTACHED GREENHOUSE HAS MANY ADVANTAGEOUS ASPECTS OVER THE OTHER: IT IS LESS EXPENSIVE AS LESS MATERIAL IS REQUIRED FOR CONSTRUCTION AND LESS EXPENSIVE FOR LIGHT AN WATER AS THE UNIT CAN BE CONNECTED DIRECTLY TO THE EXISTING HOUSE UTILITIES WITHOUT RUNNING SPECIAL LINES OR PIPES FAR OUTSIDE THE HOUSE. ALTHOUGH THE EXCESS HEAT OF THE GREENHOUSE MIGHT NOT BE SIGNIFICANT TO BE USED IN THE ADJACENT HOUSE, THE PLANTS CAN CONTRIBUTE TO AN ADDITIONAL SUPPY OF HUMIDITY AND OXYGEN. THE HOUSE, IN ITS TURN, CAN CONTRIBUTE CARBON DIOXIDE THAT IS NECESSARY FOR PHOTOSYNTHESIS DURING THE DAYTIME.

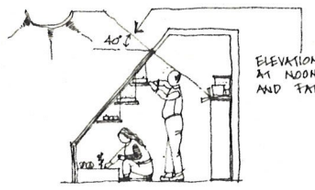
PRIORITY THREE SITES ADJACENT TO UNITS BUT ONLY SUITABLE FOR FREE-STANDING GREENHOUSE. SITES RECEIVE SUNSHINE DURING SPRING, FALL AND WINTER.

PRIORITY FOUR SITES ADJACENT TO UNITS BUT ONLY SUITABLE FOR FREE-STANDING GREENHOUSES. SITES HAVE SUN ACCESS ONLY DURING SPRING AND FALL.

PRIORITY FIVE SITES THAT ARE LARGE ENOUGH TO ACCOMMODATE A COMMUNITY GREENHOUSE, SERVING THOSE UNITS THAT ARE NOT POSSIBLE TO HAVE SITES ADJACENT TO THEM.

❋ A CENTRALIZED GREENHOUSE IS PREFERRED TO VARIOUS SMALL GROUPS BECAUSE IT ALLOWS A CHEAPER INSTALATION OF UTILITIES, AS WELL AS BETTER INSULATION BY HAVING A LESSER AREA OF EXTERNAL WALL AND GLAZING SURFACE EXPOSED TO THE VARIATION OF TEMPERATURES. THE GREENHOUSE SHOULD BE ASSOCIATED WITH THE VEGETABLE GARDEN TO FACILITATE THE MOVING OF PLANTS TO GARDEN FOR PLANTING, AND TO THE GREENHOUSE TO SHELTER THE PLANT FROM COLD ON FALL. ON THE STUDY SITE, ONLY SITES THAT PROVIDE SUN ACCESS ON SPRING AND FALL ARE AVAILABLE FOR THE COMMUNITY GREENHOUSE. THEREFORE, THE FUNCTION WILL BE LIMITED TO THE EARLY SEED STARTS IN SPRING AND TO THE EXTENSION OF SOME VEGETABLE GROWTH UP TO THE BEGINNING OF WINTER. TO MAKE MOST OF THE SPACE, GROWING BENCHES CAN BE STAGGERED.





VEGETABLE GARDEN

PRIORITY ONE SITES THAT ARE ADJACENT OR CLOSE TO THE UNITS, RECEIVING FULL SUNLIGHT DURING PRIME TIME PERIODS IN SUMMER.

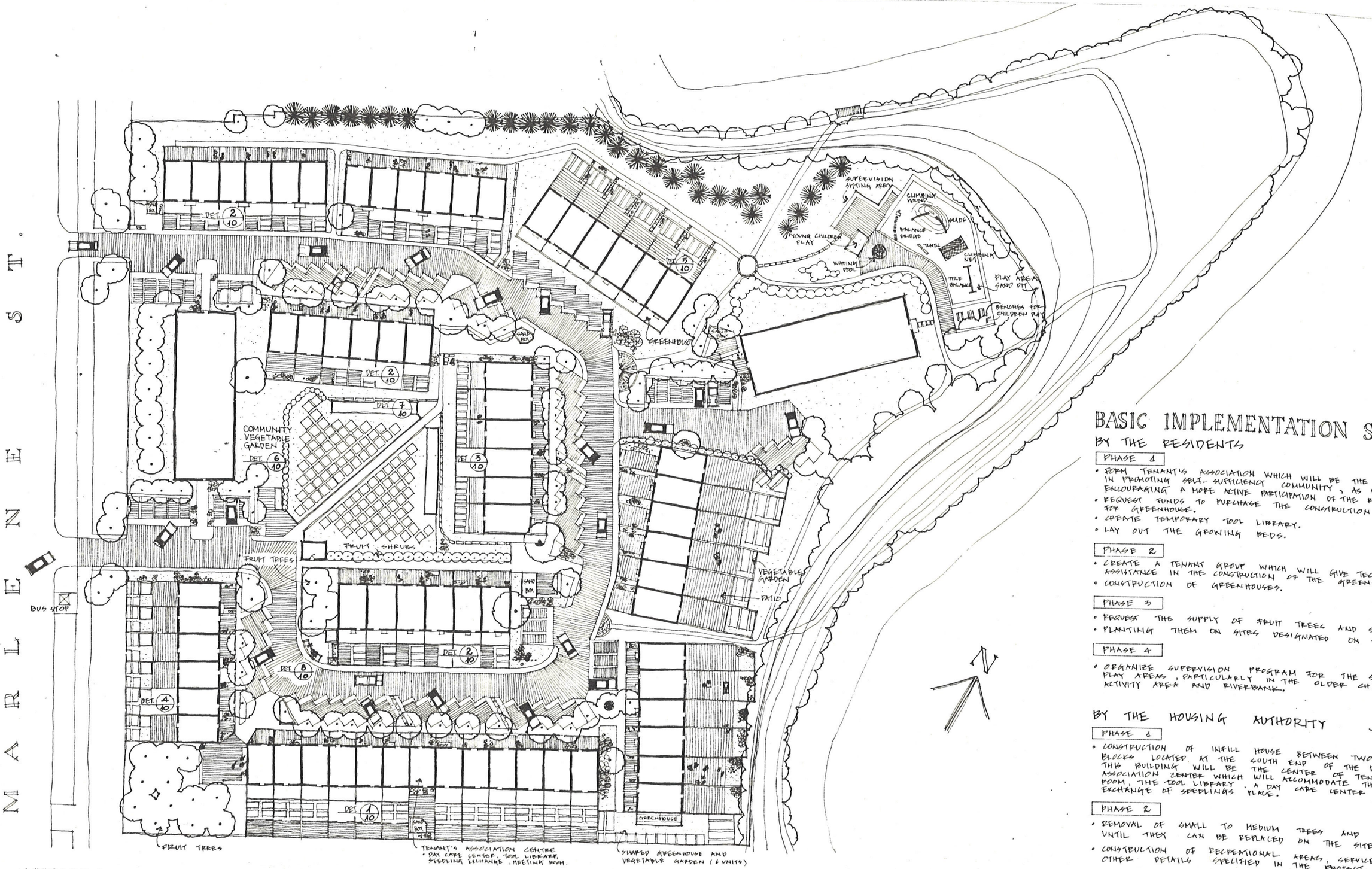
PRIORITY TWO SITE THAT IS LARGE ENOUGH TO ACCOMMODATE A COMMUNITY VEGETABLE GARDEN. SITE THAT HAS SUN ACCESS DURING PRIME TIME PERIODS IN SUMMER. THE CENTRAL AREA IS THE ONLY PLACE THAT SATISFIES THESE REQUIREMENTS.

❋ THE NUMBER OF UNITS THAT CANNOT HAVE VEGETABLE GARDEN CLOSE TO THEM ARE 35 UNITS, THESE INCLUDE ALL THE APARTMENTS AND THREE UNITS OF TOWN HOUSE. IF THE MINIMUM SIZE REQUIRED PER UNIT IS 14 M², THE TOTAL SIZE OF GROWING BED WILL BE 490,00 M². CONSIDERING THAT THE WORKING PATH OCCUPIES AROUND 25% OF THE TOTAL AREA OF GROWING BED, THEN, THE TOTAL AREA REQUIRED FOR VEGETABLE GARDEN WILL BE 612.5M².

PLAY AREA

THE SITE BY THE RIVERBANK PRESENTS MANY ADVANTAGEOUS ASPECTS OVER THE CENTRAL AREA. IT IS LOCATED CLOSE TO OTHER RECREATIONAL ACTIVITIES AND ISOLATED FROM THE HOUSING UNITS. IN ADDITION, THE VEGETATION AROUND IT PROVIDES A FAVOURABLE MICROCLIMATE BY PARTIALLY SHADING AND PROTECTING FROM PREVAILING WINDS. THE PLAY ACTIVITIES IN THE PLAY AREA CAN BE SUPERVISED FROM THE ADJACENT SITTING AREA; ADDITIONALLY, AN ADULT SHOULD BE ASSIGNED TO SUPERVISE CHILDREN'S PLAY IN THE DEVELOPMENT, PARTICULARLY ALONG THE RIVER.

SYNTHESIS 8



BASIC IMPLEMENTATION STEPS

BY THE RESIDENTS

PHASE 1

- FORM TENANT'S ASSOCIATION WHICH WILL BE THE KEY ELEMENT IN PROMOTING SELF-SUFFICIENCY COMMUNITY, AS WELL AS ENCOURAGING A MORE ACTIVE PARTICIPATION OF THE RESIDENTS.
- REQUEST FUNDS TO PURCHASE THE CONSTRUCTION MATERIALS FOR GREENHOUSE.
- CREATE TEMPORARY TOOL LIBRARY.
- LAY OUT THE GROWING BEDS.

PHASE 2

- CREATE A TENANT GROUP WHICH WILL GIVE TECHNICAL ASSISTANCE IN THE CONSTRUCTION OF THE GREENHOUSE.
- CONSTRUCTION OF GREENHOUSES.

PHASE 3

- REQUEST THE SUPPLY OF FRUIT TREES AND SHRUBS.
- PLANTING THEM ON SITES DESIGNATED ON THE PLAN.

PHASE 4

- ORGANIZE SUPERVISION PROGRAM FOR THE SAFETY OF PLAY AREAS, PARTICULARLY IN THE OLDER CHILDREN ACTIVITY AREA AND RIVERBANK.

BY THE HOUSING AUTHORITY

PHASE 1

- CONSTRUCTION OF INFILL HOUSE BETWEEN TWO TOW HOUSE BLOCKS LOCATED AT THE SOUTH END OF THE DEVELOPMENT. THIS BUILDING WILL BE THE CENTER OF THE DEVELOPMENT. ASSOCIATION CENTER WHICH WILL ACCOMMODATE THE MEETING ROOM, THE TOOL LIBRARY, A DAY CARE CENTER AND EXCHANGE OF SEEDLINGS PLACE.

PHASE 2

- REMOVAL OF SMALL TO MEDIUM TREES AND STORE THEM UNTIL THEY CAN BE REPLACED ON THE SITE.
- CONSTRUCTION OF RECREATIONAL AREAS, SERVICES AND OTHER DETAILS SPECIFIED IN THE PROJECT.

SUMMARY

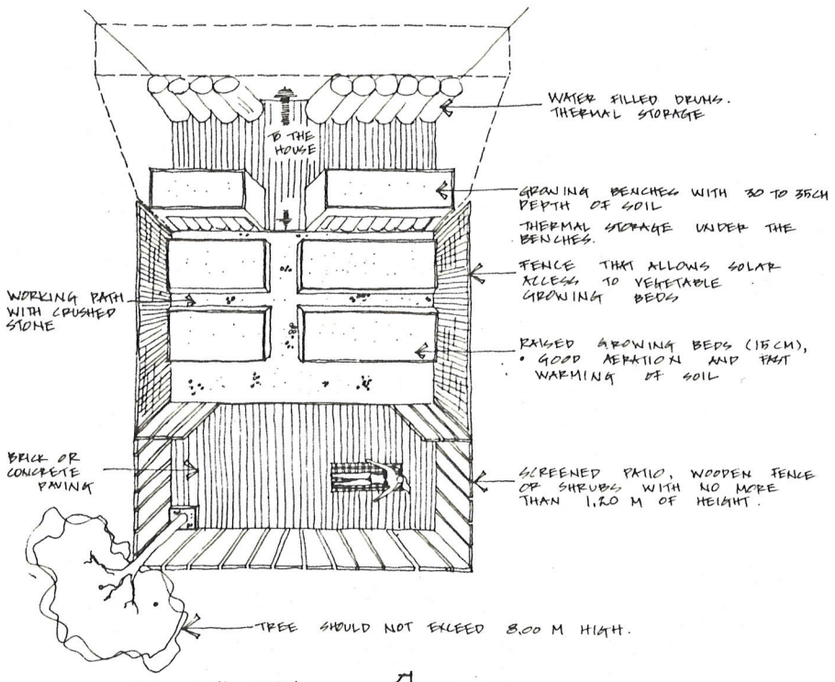
THE REORGANIZATION OF THE OPEN SPACE FOR THIS PUBLIC TOWN HOUSING SITE IS BASED ON DESIGN CRITERIA THAT MAKES POSSIBLE DIRECT ACCESS OF ALL HOUSING UNITS TO PORTIONS OF THE SITE FOR FOOD PRODUCTION. ADJACENT OR CLOSE TO THE LIVING UNITS, EACH PIECE OF DESIGNATED GARDEN AREA PROVIDES AN IDEAL CONDITION FOR PLANT GROWTH AND SUFFICIENT AREA TO SUPPORT AN AVERAGE FAMILY.

ALTHOUGH YEAR-ROUND FOOD PRODUCTION WAS ONE OF THE ORIGINAL OBJECTIVES, BECAUSE OF THE CLOSENESS OF THE STRUCTURES, THE SITES HAVE PRESENTED MANY LIMITATIONS. MANY SITES WERE NOT ABLE TO PROVIDE WINTER PLANTING (ALTHOUGH THE WINTER YIELDS ARE NOT AS SIGNIFICANT AS THE SUMMER'S). THIS PROBLEM LEADS TO THE RECOMMENDATION THAT WITH ANY FUTURE HOUSING DEVELOPMENTS SITE PLANS SHOULD ALLOW FOR YEAR-ROUND SOLAR ACCESS TO SPACE EQUIVALENT TO THE MINIMUM SIZE VEGETABLE GARDEN AND GREENHOUSE AREAS REQUIRED TO SUPPORT RESIDENTS.

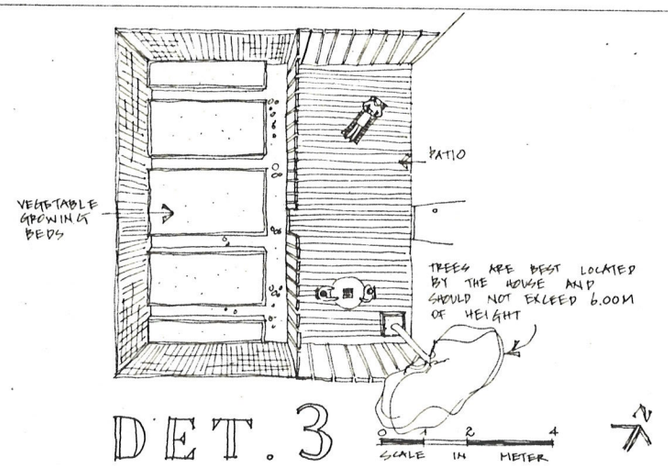
BRINGING FOOD TO URBAN ENVIRONMENTS IS NOT SIMPLY AN OUTGROWTH OF A DESIRE TO HAVE FRESH VEGETABLES AVAILABLE TO THE URBAN DWELLERS. BUT RATHER IT IS A LONG-TERM PLANNING STRATEGY FOR THE FUTURE; IT IS BASED ON THE BELIEF THAT PRESENT URBAN EXPANSION ONTO PRODUCTIVE AGRICULTURAL SOILS WILL ULTIMATELY RESULT IN THE PERMANENT LOSS OF A VALUABLE AND IRREPLACEABLE RESOURCE. IT IS ALSO BASED ON THE BELIEF THAT A SELF-SUFFICIENT COMMUNITY IS NEEDED TO DECENTRALIZE AS MUCH AS POSSIBLE FOOD PRODUCTION AND DISTRIBUTION SYSTEMS. HISTORY DOES NOT LACK EXAMPLES: THE ALLOTMENT SYSTEM FOR KITCHEN GARDENS DEVELOPED IN EARLY 19TH CENTURY IN ENGLAND WERE ABLE TO PREVENT THE POPULATION FROM POSSIBLE STARVATION DURING W.W. II WHEN THE FOOD SUPPLY WAS CUT OFF.

BY DEVELOPING SCHEMES FOR THE IMPLEMENTATION OF URBAN AGRICULTURE, THIS STUDY INTENDS TO DEMONSTRATE THAT THE COEXISTENCE OF TWO TRADITIONALLY DISTINCT LANDSCAPE IS POSSIBLE AND THAT THE INTEGRATION NOT ONLY BENEFITS THE URBAN DWELLERS ECONOMICALLY BUT ALSO BRINGS ENHANCEMENT TO THEIR LIVING ENVIRONMENT.

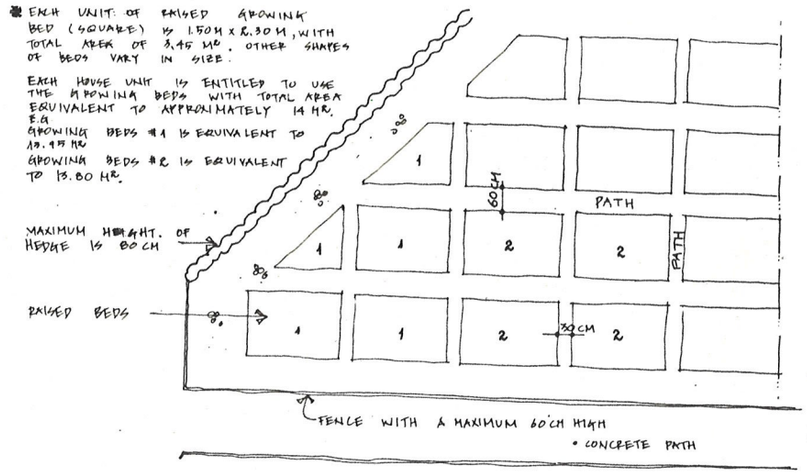
PLAN 9



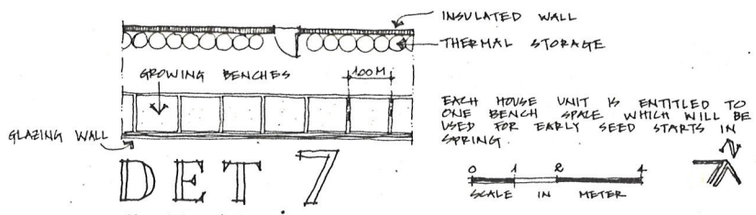
DET. 1
SOUTHEAST FACING SITE
GREENHOUSE, VEGETABLE GARDEN & PATIO



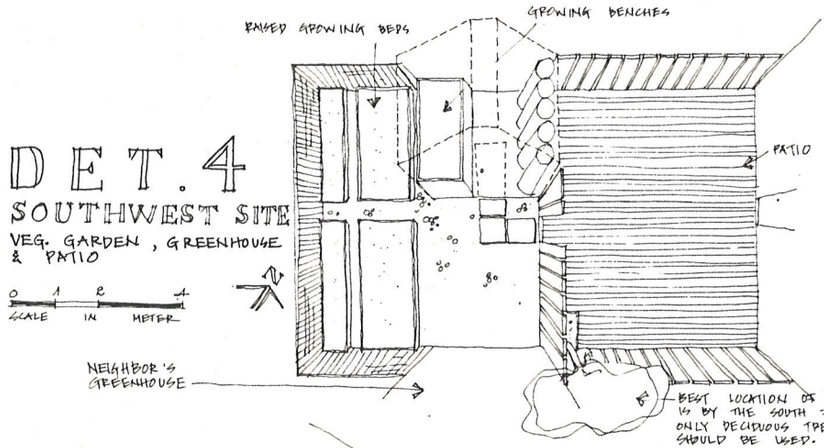
DET. 3
SOUTHWEST SITE
VEGETABLE GARDEN & PATIO



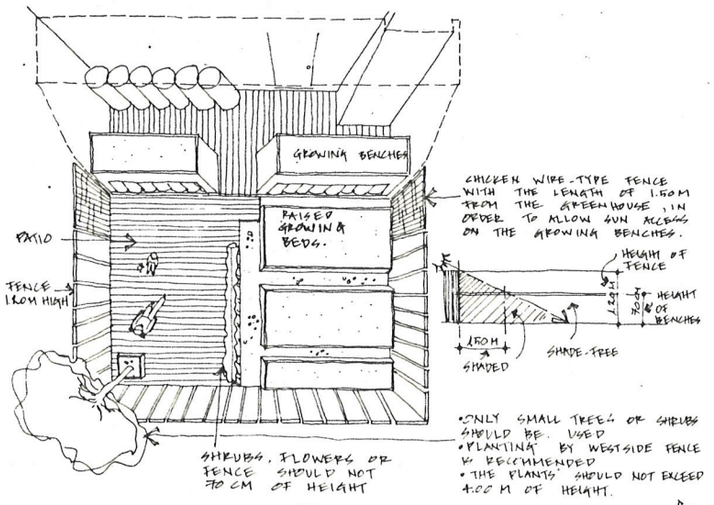
DET. 6
COMMUNITY VEGETABLE GARDEN



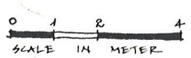
DET 7
COMMUNITY GREENHOUSE

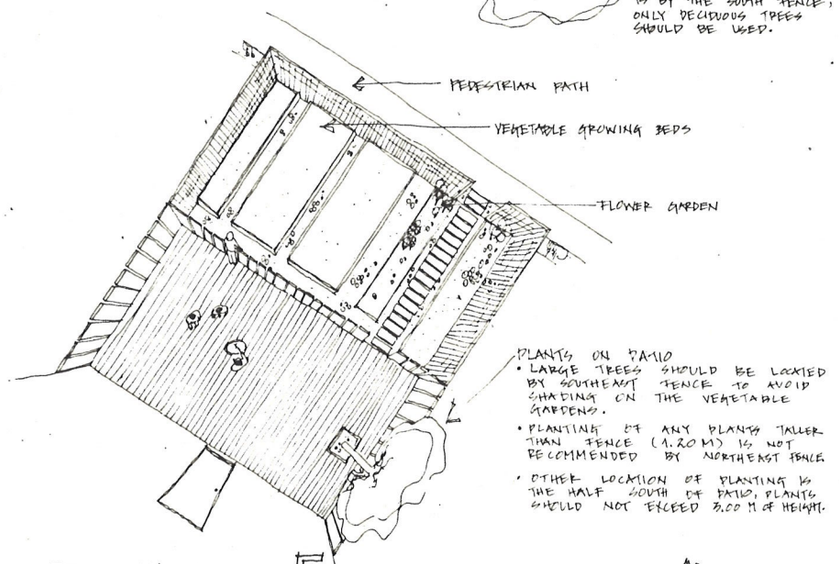


DET. 4
SOUTHWEST SITE
VEG. GARDEN, GREENHOUSE & PATIO

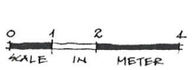


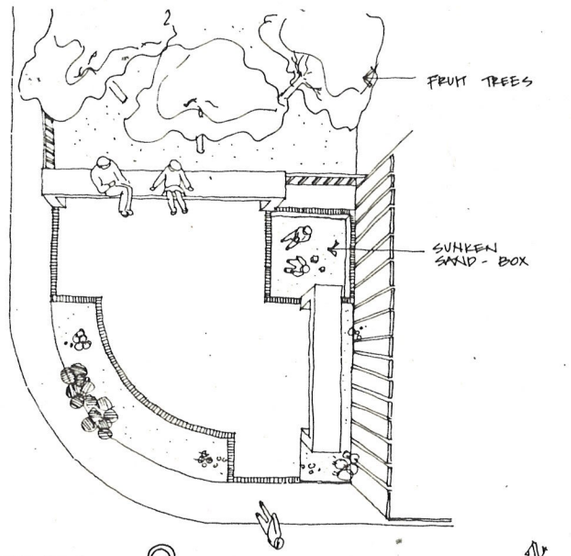
DET. 2
SOUTHEAST FACING SITE
GREENHOUSE, VEGETABLE GARDEN & PATIO





DET. 5
SOUTH FACING SITE
VEGETABLE GARDEN & PATIO





DET. 8
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DETAILS 10

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