Water Harvesting: Architecture Towards an Ecologically Integrated Community

by

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A thesis submitted to the Faculty of Graduate and Postdoctoral Affairs in partial fulfillment of the requirements for the degree of

Master of Architecture

in

Azrieli School of Architecture and Urbanism

Carleton University
Ottawa, Ontario

ABSTRACT

This thesis presents a proposal for the integration of domestic dwellings with a locally-scaled, water harvesting infrastructure on an agricultural site on the Naramata Bench of the South Okanagan Valley of British Columbia. In this design scheme, rain and meltwater are harvested on site and directed to both agricultural irrigation and non-potable domestic use. The design proposal is a response to the possibility of future water scarcity in the Okanagan Valley and to the region's complex housing conditions. The design scheme is discussed with respect to the concept of the *oikos* in classical Greek philosophy and its implication for modern challenges of environmental stewardship.

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PREFACE

The ideas employed in this thesis draw on a knowledge base in ancient Greek philosophy that I developed while studying philosophy at the University of Victoria in British Columbia, as well as interests in land use that developed through my work in both the agricultural and forestry industries of the South Okanagan as a farm worker and tree planter. There are a wealth of theories, ideas and historical case studies that concern the integration of community life with agricultural livelihoods. I believe that a set of robust ecological ideas can be distilled from the concept of the oikos. It is in order to better articulate these ideas that I've limited myself to single model of an agrarian community, but recognize that it is only one of many potential precedents. A more thorough continuation of this thesis would potentially better document that variety of ideas, theories and precedents.

The design proposal developed in this thesis is sited on the unceded traditional territory of the Okanagan/Syilx Nation. It is recognized that this thesis uses a language of resource management that could be challenged within the framework of indigenous philosophy. The Syilx Nation Siwɬkʷ Declaration[i] describes a relationship between the Syilx people and siwɬkʷ (water), in which "siwɬkʷ has the right to be recognized as a familial entity, a relation, and a being with a spirit who provides life for all living things." A subsequent passage

[i] Syilx Okanagan Nation Aliance, Syilx Nation Siwɬkʷ Declaration, pg.3

clearly states, “siwɬkʷ is not a resource or a commodity.” I do not claim to be knowledgeable in the realm of indigenous philosophy, and acknowledge the challenge that this declaration makes to the very language of resource management that undergirds this thesis.

The demographics of the agricultural workforce in the South Okanagan are very complex. Seasonal itinerant workers, both domestic and foreign, who do not have stable or permanent housing arrangements, make up one of its components. It is acknowledged that there is a potential for exploitation in these relationships. This thesis takes the position that the itinerant workers upon whom the agricultural industry relies are fully a part of the community of the South Okanagan Valley. The design proposal developed in this thesis attempts to embody that inclusive vision of the culture of the South Okanagan. Although this thesis takes a primarily ecological perspective, my vision of a resilient agricultural community in the South Okanagan is not only ecologically integrated but also inclusive and egalitarian in character.

INTRODUCTION

This thesis begins by describing the concepts of *oikos* and *kleros* in classical Greek thought, drawing on the text *The Other Greeks: The Family Farm and the Roots of Western Civilisation* by Victor Davis Hanson. In this work it is shown that the idea of the *oikos* had both political and ecological aspects. A modern revitalization of this political tradition in North America imagines the 'homestead farm' to be the basic socio-economic unit of a fundamentally agrarian society. This tradition creates an essential link between a culture and a landscape by uniting a particular vision of the family with the private ownership and management of a farm.

This political tradition tends to assume the validity of the ecological idea embedded in the Greek *oiko*s as well: the idea that the human management of non-human ecologies for sustenance and food production also preserved, or even improved, the vitality of the environment it took place in. In an industrialized, resource economy, this assumption frequently does not hold true. In the book *Refashioning Nature*, authors David Goodman and Michael Redclift provide one analysis of how, in a modern economy, agricultural practice can have destructive impacts on the natural environment.

As an ecological idea, the *oikos* presents a model for environmental stewardship by integrating human habitation with the productive,

agricultural work that sustains it. This thesis explores that idea architecturally through the development of a design that integrates a locally-scaled water infrastructure with modest, adaptable dwellings on agricultural land in the South Okanagan Valley of British Columbia.

PART I: THEORY

The basic unit of Greek society was an *oikos*, or household, that possessed a *kleros*, plot of land—traditionally of ten acres.[1] A ten acre plot of land was one that could both be worked by and sustain a single household. The identification of an *oikos*, which referred to the home itself, the household's property including slaves, and the social unit of the family, along with a plot of land was central to Greek identity. The household was understood as both a corporate identity and a property holding that continued by generational succession within a family. One and the same social unit of family and slaves both operated and lived on the farm and, in this sense the *oikos* integrated the domestic and productive uses of the *kleros*. In fact, within this conceptual framework, productive and domestic work is undifferentiated: the workings of the farm and domestic concerns were as equally a part of the management of a single household. The now antiquated expression 'home economics' preserves the identity of productive and domestic work that was implied by the original Greek *oikos*.

The social unit of the oikos included both men, women and slaves and, thus, embedded within it, the norms, practices and values of classical Greek culture as a whole. Outdoor productive work was typically performed by male members of the household and male slaves and indoor domestic work was performed by female mem-

[1] Victor Davis Hanson, *The Other Greeks*, pg. 12

bers of the household and female slaves. The public sphere (outside the *kleros*) was largely reserved for men and, the urban realms of the market and political forum were considered male spaces. Slaves lived in relatively close proximity to family members, in either the same dwelling or in adjacent dwellings. Not all households kept slaves and the number of slaves rarely exceeded the number of family members. All the agricultural labour required to manage the property was provided for within the household by either slaves or family members.

Figure 01.
An amphora from Athens, Greece circa. 520 BC showing people gathering olives; Victor Davis Hanson suggests that the agrarian roots of Classical Greek culture led to the emergence of its democratic politcal tradition.
British Museum, London
http://www.hellenicaworld.com/Greece/Ancient/en/AgricultureOfAncientGreece.html

The understanding of the kleros as an inheritance implied a need to take care of it, to maintain its health and productive capacity, in order to pass it on to one's own children through successive generations.[2] The understanding of land as an inheritance prevented it from being treated as a commodity, and although land could be bought and sold, social mores prevented that from being a common practice. Writing from a historical perspective, Victor Davis Hanson

[2] Victor Davis Hanson, *The Other Greeks*, pg. 105

presents an argument that the stewardship values associated with the *oikos* are rooted in the social and political practice of private land ownership. According to this line of argument, the private ownership of land was an essential condition for farmers to make the infrastructural investments (e.g. small scale irrigation projects involving canal and dyke construction) that increased the productivity of land and made small-estate farming economically viable.[3]

Oikos as political philosophy

Classical Greek political theory was based on the understanding that the *oikos-kleros* was the fundamental unit of Greek politics and culture. According to Aristotle, the political stability of a city-state (*polis*) required that the majority of its citizens are composed of the *mesoi* (middle or middling) class, which was a class of free, land-holding *georgoi* (farmers) who exist in the economic space between an aristocratic, mercantile elite and the landless, urban poor.[4]

Due to its integration of a vision of agricultural livelihood, domestic life and political values, the concept of the *oikos* has had continuous influence in Western political thought. In North America, its strongest expression is in the idea of the homestead farm, a family-operated farm that pairs the nuclear family with farm ownership and management in a relationship of one to one correspondence. Thomas Jefferson's vision of America, actualized through his land ordnance of 1784, which divided the United States into a grid of

[3] Victor Davis Hanson, *The Other Greeks*, pg. 26
[4] Ibid, pg. 184

family-owned, agricultural plots of land, is one example of a political philosophy that imagines the homestead farm as the basic socio-economic of North American society. Frank Lloyd Wright's Broadacre City is a suburban re-invention of this same vision. In it, the basic unit of a political community is that of a nuclear family in possession of a one-acre parcel that contains both a home and productive garden.

Figure 02.
A satellite photo of agricultural land in Kansas. The size and distribution of agricultrual land parcels is the direct result of the Public Land Survey System and the idea of the Jeffersonian grid that underlies it.
NASA Earth Observatory
https://en.wikipedia.org/wiki/Public_Land_Survey_System

The modern, North American one family--one farm re-envisioning of the *oikos* has tended to assume that, with the aid of machine technology, the requirements for farm labour can and will be provided within the farming family and this political tradition gives little consideration to other labour conditions. Although this political tradtion roots the egalitarian and democratic ideals of North American culture in the socio-economic unit of the homestead farm, it

does not accurately reflect the modern, agricultural economy that frequently divorces farm ownership and farm labour. This tradition in political philosophy is one stream of Western thought that stems from an interpretation of the Classical Greek *oikos*. The concept of ecology, a word which is derived directly from the Greek '*oikos*', is also stems from this tradition of Greek philosophy.

Oikos as ecology

In the *oikos*, the human management of the natural world for sustenance and food production works harmoniously for the preservation and improvement of the whole (human and non-human) system. Because complete biological cycles processes took place on the farm site, it could be imagined as self-sustaining, complete in itself and as the place of integration of human and non-human ecologies. The modern study of ecology, which studies the complex layering and interaction of life processes that make up the environment, is rooted in this integrative idea.

The closed loops that defined the *oikos* were not limited to biological process of food production but included the human realm in a closed economy. For example, the food that was needed by the farming household was produced on the farm, and the all of the labour required to produce it came from within the household, thus creating a closed loop that included the social requirement of housing labour. According to Hanson, simple tools and farm implements

were often manufactured using readily available material on the farm; moreover, simple food processing, such as winemaking, was carried out on the farm in dedicated outbuildings.[5] In all cases, the farm site was understood to circumscribe a territory in which entire process of production and consumption took place.

Figure 03.
Waste material from the wine making process composted on a vineyard near to Little Engine Winery; re-use of compost an example of a closed loop ecology occuring entirely on a farm site
author's photo

In the book *Refashioning Nature*, David Goodman and Michael Redclift present an ecological analysis of modern farming practices that contrasts strikingly with the harmonious vision embedded in the Greek idea of an integrated *oikos*. One example whereby these authors site a contemporary reversal of the traditional closed-loop farm ecology involves waste and compost.[6] In traditional farming practice, the majority of farms both produced crops and kept livestock. The waste produced by the livestock as well as the unused portions of crops were both composted on site. This compost (in tandem with practices of fallowing) was used to replenish the soil that was again used to grow the crops for human consumption, to feed livestock and for sale in markets. Whole cycles of growth and

[5] Victor Davis Hanson, *The Other Greeks*, pg. 24
[6] In this study, Goodman and Redclift make their argument using case studies from English farming practice.

decomposition occurred entirely on the farm site fostering closed loops within a closed system.[7] Alternatively, Goodman and Redclift argue that under present conditions the farm property is treated as an open system in which the addition of chemical inputs produces agricultural outputs. In this practice, the chemical nutrition added to the soil is derived from offsite sources, the nutrition within crops is lost to the farm site, and even unused portions of it are removed form the site as waste.[8]

Figure 04.
Fertilizer is an example of an nutrient input originating from outside the vineyard being used in the farming process; fertilizers are added to irrigation water at the head of the system.
author's photo

Goodman and Redclift refer to the inputs and outputs of industrial farming as externalities with respect to the farm site. The concept of an 'externality' is important concomitant to the idea of a closed loop. When a process does not occur entirely within a site,

[7] David Goodman and Michael Redclift, *Refashioning Nature*, pg. 48
[8] Ibid., pg. 48

the external sources or termini that the system relies upon can be called externalities. Similar to other industries, as farming becomes increasingly industrialized, it relies on processes of resource extraction and manufacturing far away from the farm site. The environmental consequences of such processes can be difficult to track and evaluate; moreover, when they are far away from the immediate producers or consumers, there is little political will to scrutinize the off-farm processes that lead to the final agricultural product. There are also off-farm, environmental consequences of industrial farming when, for example, chemical fertilizers or pesticides infiltrate groundwater. The majority of environmental concerns associated with modern farming are connected with its externalities, either in the form of the processes of resource extraction it requires or with the consequences of chemical pesticides and fertilizers re-entering the environment.

The potential for environmentally exploitative agricultural practices in a resource economy challenge the assumption that a homestead farm is a model for environmental stewardship. The design developed in this thesis tests that idea in the context of the agricultural economy of the South Okanagan Valley. In doing so, it engages with both the water demand required by agricultural production in a semi-arid climate, and the complex housing conditions of the region.

Figure 05.
Map of the Okangan water basin North of the Canadian-American border; the colouration of the map indicates elevation; low elevations (brown) correspond to dry grassland, glades of Ponderosa pine and scrub; higher elevations (green) correspond to denser coniferous forest
Okanagan Water Basin Board https://www.obwb.ca/wsd/about/state-of-the-basin

PART II: CONTEXT

The city of Penticton is located in the South Okanagan Valley of British Columbia, occupying an isthmus between the South end of Okanagan Lake and the North end of Skaha Lake. The Okanagan Valley's arid to semi-arid climate and mild winters make it relatively unique in Western Canada in its suitability for growing winegrapes and tree fruit. Like many communities in the Okanagan, Penticton grew up alongside the development of a commercial orchard industry and its associated infrastructures in the form of flume irrigation systems, human-made reservoirs, transportation networks along land and water, and associated infrastructures such as packing houses.

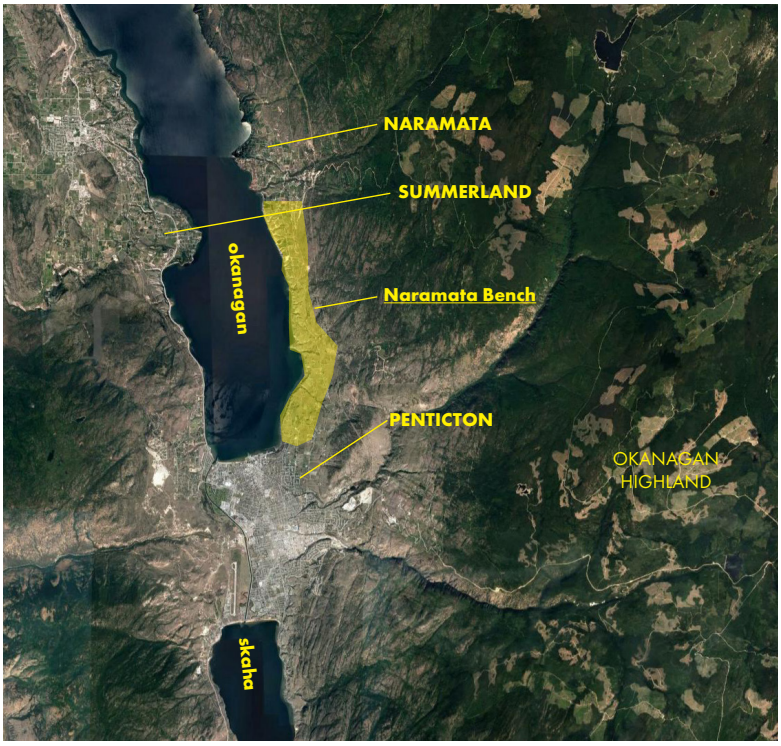

Figure 06.
Annotated satellite image showing the location of Penticton between Okanagan and Skaha Lakes
source image: Google Earth; author's annotation

Historically, as the bottomland territory of Penticton became increasingly urbanised, the 'benches' (terraces of glacial sediment) on the East side of both Okanagan and Skaha Lakes retained their agricultural character. The benches are characterised by a complex topography of slopes and drumlins, frequently interrupted by steep gullies that drain into Okanagan Lake. The Naramata Bench on the East bank of Okanagan Lake stretches between the communities of Penticton and Naramata. The design proposal developed in this thesis is sited on the portion of the Naramata Bench that is within the municipal bounds of Penticton.

Figure 07.
The Naramata Bench in the fall; a complex, rolling topography incised by gullies, cultivated with orchards and vineyards
Preserved Light Photography https://preservedlight.com/aerial-photos-naramata/h873D645A#h873d645a

Okanagan water resources

The Okanagan Valley's water resources and agricultural industry are of central importance to its economy, self-identity and unique appeal as a retirement and tourist destination. It contains both arid

[9] Okanagan Water Basin Board, "Water Use." Accessed March 20, 2019. https://www.obwb.ca/wsd/key-findings/water-use

and semi-arid territories within it, and has the lowest per capita water supply of any basin in Canada.[9] Irrigation accounts for eighty six percent (86%) of water usage in the valley and agricultural irrigation alone accounts for fifty five percent (55%) of usage.[10]

For the portion of the Naramata Bench within municipal bounds of Penticton, irrigation water is provided by its North irrigation system. In this system, water drawn from the Campbell Mountain Reservoir is conveyed to the bench by a buried, three kilometre (3 km) long bypass tunnel.[11] The elevation drop between the reservoir and the study area provides sufficient head pressure to serve the entire system. The irrigation delivery system consists of asbestos cement, cast iron, galvanised iron, PVC and steel pipes and is co-extensive with the transportation network of the study area.[12]

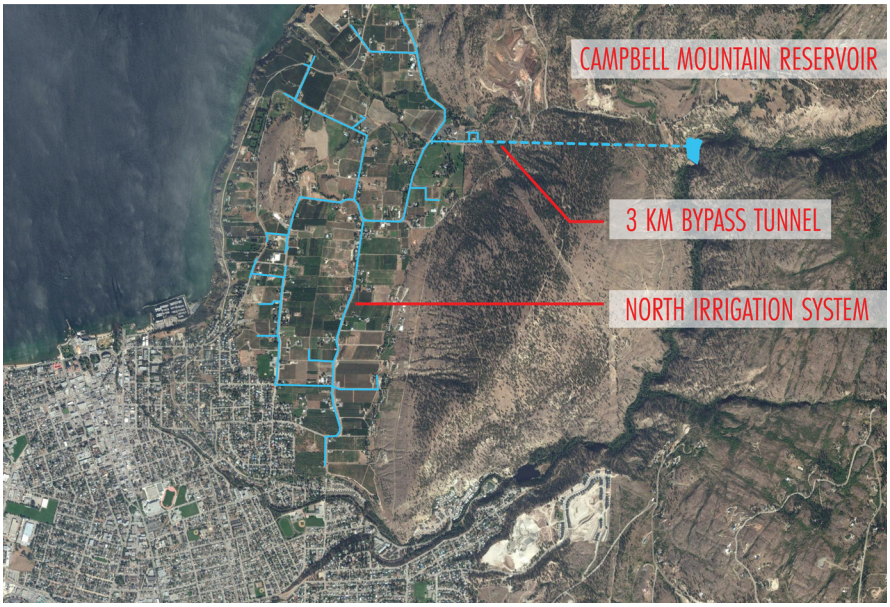

Figure 08.
Map showing the Campbell Mountain Reservoir, the 3 km long irrigation tunnel under Campbell Mountain, the water mains of the North irrigation system
source image: Google Earth; author's annotation

[10] Okanagan Water Basin Board, "Water Use." Accessed December, 2019. https://www.obwb.ca/wsd/key-findings/water-use
[11] City of Penticton, *Irrigation Master Plan*, pg. 9
[12] *Ibid.,* pg. 4
[13] City of Penticton, *Penticton Creek Source Assessment*, pg. 14

Penticton Creek Watershed

Penticton Creek is a snowmelt dominated watershed.[13] It contains three managed reservoirs: Greyback Reservoir, the highest in elevation and largest in volume, serves a vital role by providing sufficient storage to re-supply the smaller, lower elevation Campbell Mountain and Carmi reservoirs. During freshet, meltwater fills the reservoirs to full capacity. From freshet onwards, the balance of water is gradually lost to surface evaporation and human use despite addition of water through rainfalls. Demand for irrigation water is highest when reservoir water supplies are low in the late summer and the valley frequently is in drought conditions. The nonsynchronous relationship of natural water supply and agricultural demand makes the storage of rain and meltwater in reservoirs essential for farming in the area.

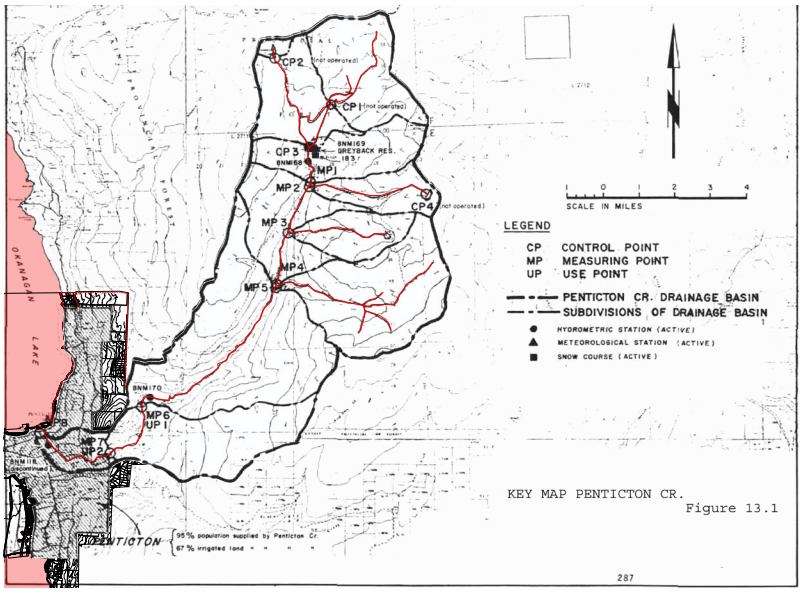

Figure 09.
A map of the Penticton Creek catchment area published in 1974 showing early initiatives to study and manage Penticton Creek and its natural reservoirs

source image: Canada - British Columbia Okanagan Basin Agreement, Technical Supplement I to the Final Report, (Office of the Study Director, Penticton BC, 1974); author's annotation

[14] BC Ministry of Environment, *Penticton Creek Hydrological Risk Assessment*

Numerous reports and climate models have forecast climatic changes that will affect the hydrology of the Penticton Creek watershed.[14] It is predicted that lower winter temperatures will result in more winter precipitation falling as rain rather than snow and a smaller winter snowpack. Freshet is projected to arrive on average two to four weeks earlier, also as a result of warmer winter/spring temperatures. These changes will result in a smaller freshet and less re-charge for upland (high elevation) reservoirs such as the Greyback Reservoir. Studies have predicted a fifteen percent (15%) reduction in water yield by 2050 and a thirty percent (30%) reduction by 2080.[15] This would be caused by a reduced freshet as more precipitation falls as rain during the winter. Additionally, projections of hotter summer temperatures, increased irrigation water demand in response to high temperatures, and longer time span between freshet and peak water demand all raise concerns about the possibility of water shortages in the future.

Efforts to reduce water demand through conservation are one avenue of response to concerns of future water scarcity. The agricultural industry has the potential to be a leader in this front by adopting more water-efficient practices. In most cases this can be done without threatening the industry's commercial viability and, in the case of viticulture, best practices in winegrowing dovetail with water conservation practices.[16] A wine grape that expresses the

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[15] BC Ministry of Environment, *Penticton Creek Hydrological Risk Assessment*, pg. 40

[16] Interview with David Kozuki conducted on Nov. 17, 2018.

minerality of its unique terroir comes from a vine whose roots have grown deeply in search of water. Overwatering grapes produces a vine with a shallow root system that is over-vigorous and requires laborious pruning and management. Modern vineyards are established with drip irrigation systems and weather station data, and soil moisture probes are employed to ensure that vines get enough water but not excess. Due to the specific demands of wine grapes, viticulture is a leader on this front but, in any case, the agricultural industry as a whole is already moving towards practices of greater water conservation.

Figure 10.
Soil moisture probe and telemetry unit at Tightrope Winery; real-time data on soil moisture allows winegrowers to be conservative in their watering practices.
author's photo

Another avenue of response to the possibility of water scarcity is to increase water supply by increasing the number and capacity of res-

[17] Steve Kidd, "Upgrades coming for Penticton reservoir." published in Penticton Western News, April 7, 2017.

ervoirs for upland water storage. The City of Penticton has acted on this strategy: in 2017 the City of Penticton received grant funding to enlarge the Carmi Reservoir in order to have more storage capacity to supply drinking water.[17] Although the upgrading and maintenance of large infrastructures will continue to be necessary in the future, this thesis explores the possibility of using smaller, locally-scaled water infrastructures that work in conjunction with natural ecologies as a supplement to traditional 'grey' infrastructures.

Groundwater represents one alternative water source in the Okanagan. The use of ground water for both domestic and irrigation water purposes is increasing. The Okanagan Groundwater Monitoring Project attempts to document existing wells and monitor groundwater levels.[18] Many observation wells are now operating throughout the valley and indicate that groundwater levels are dropping. It is believed that practices of clear cut logging have resulted in less interception of run-off and precipitation and, therefore, less soil percolation and groundwater re-charge.[19] Although groundwater is a potential water source, groundwater levels are ultimately dependent on the percolation of rainfall and snowmelt into the earth. Because of the complex relationship between ground and surface water, it is not known how available and reliable this resource will be in the changing hydrological conditions of the future.

Of all the precipitation that falls in the Okanagan Valley, only nine-

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[18] Government of B.C., "Groundwater Level Data Interactive Map." Accessed December 12, 2019. https://www.obwb.ca/wsd/key-findings/water-use

[19] Government of B.C.: Ministry of Water, Land and Air Protection. "Groundwater Resources of British Columbia." Accessessed December 12, 2019. http://www.llbc.leg.bc.ca/public/PubDocs/bcdocs/162844/groundwater.pdf

teen percent (19%) drains into the Okanagan Lake. The remaining eighty-one percent (81%) is returned to the atmosphere through evapo-transpiration before reaching the lake.[20] The design proposal presented in this thesis explores the possibility of a small-scale infrastructure designed to retain and harvest surface run-off water and divert it to storage for agricultural and domestic use. It explores a response to water scarcity that targets as a resource the eighty-one percent (81%) of the region's water supply that is not presently collected in natural or human-made reservoirs.

Preservation of Agricultural Land

The two most productive farming areas in British Columbia, the Lower Mainland and the Okanagan Valley, are also home to growing populations, and urban and suburban development frequently threatens agricultural land usage. There is a strong public support for the preservation of agricultural land both throughout British Columbia and in the Okanagan Valley. In the paper "Hobby Farms and the Protection of Farmland in British Columbia", authors Stobbe, Cotteleer and van Kooten, describe the four broad categories of values that motivate support for the protection of farmland in British Columbia: "(i) agrarian values relate to food production and protection of the agricultural heritage and traditions of an area; (ii) environmental values concern protection of wildlife habitat, flood control and other environmental services that agriculture provides; (iii) aesthetic values focus on the preservation of open space; and

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[20] Okanagan Basin Water Board, *Okanagan Water Supply and Demand Project: Phase 2 Summary Report*, pg. 17

[21] Stobbe *et al.*, "Hobby Farms and Protection of Farm Land in British Columbia", published in *Canadian Journal of Regional Science*, pg. 395

(iv) anti-growth values see land protection as a safeguard against urban sprawl."[21]

In 1973, the Agricultural Land Commission (ALC) and Agricultural Land Reserve (ALR) were created in direct response to the loss of agricultural land due to suburban development, particularly in the Lower Mainland of British Columbia. The Agricultural Land Reserve identifies the land registry parcels that compose the five percent (5%) of British Columbia's land base that has been deemed arable land, whereas the Agricultural Land Commission is an independent administrative tribunal that oversees the application of the ALC Act, the ALR Regulations and other non-formalized policies. The stated mandate of the ALC is to preserve agricultural land and encourage farming in British Columbia.[22]

The primary tool by which the ALC protects agricultural land is by limiting the construction of non-farming buildings. The ALC limits residential construction to one owner-occupied, single family home per land registry parcel, within which, one secondary suite is permitted.[23] Jointly, the prevention of land sub-division and the limitation of residential construction to one home per land parcel are the primary strategies by which the ALR preserves seeks to preserve the agricultural land base of British Columbia.

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[22] Agricultural Land Commison, "About the ALC". Accessed on March 20, 2019. https://www.alc.gov.bc.ca/alc/content/about-the-alc

[23] Agricultural Land Commission, *Agricultural Land Reserve Use Regulation*

Figure 11.
Images of vineyards and orchards in November that showcase the areas rich colouration, variety of tree fruits and complex topography
author's photos

In comparison to other farming regions, the Naramata Bench is composed of small land parcels due to, in part, its complex topography, the intensive nature of tree farming, and the sub-division of larger farms properties before the ALC Act took effect. Under present economic conditions, agricultural businesses frequently link together multiple properties in order to create the economies of scale necessary for viable commercial farming. An example of this phe-

nomenon can be seen in the operation of small-estate wineries in the area. The Naramata Bench has been recognized by the British Columbia Vintners Quality Alliance (BC VQA) as a 'geographic designation', a term that denotes distinct winegrowing *terroirs* within British Columbia. The opportunity to market wine with a geographic designation on its label incentivizes wineries to source their wine grapes locally. Because of this, small estate wineries will often buy multiple parcels within a limited geographic area. Doing so allows these wineries to secure a reliable source of local wine grapes while operating as a single enterprise with respect to vineyard management, moving tractors, equipment and personnel between nearby properties without undue waste of time and expense.

When a single business links multiple properties the existing residences on the consolidated parcels become available for a use other than owner-occupancy. Under the right economic conditions this phenomenon creates an opportunity whereby permanent or itinerant agricultural workers who are not property owners can find or be provided with housing on agricultural land, notwithstanding the strict limitations on housing put into effect by the ALC. Increasingly, agri-tourism ventures that link the production of agricultural products with experiences, (such as, wine-tasting rooms, bed and breakfasts, or restaurants), create additional sources of income for agricultural businesses. The shift from an agricultural industry to an agri-tourism industry on the Naramata Bench has had a significant

effect on the usage of its limited housing stock. As revenues for agri-tourism grow, property owners are incentivized to use available housing stock as tourist accommodation. Although these units may be unoccupied for much of the year, the revenue gained from a few months of tourist rentals is more than could be charged to lower income itinerant workers, and outweighs the lost convenience to growers of having short-term housing available for itinerant workers.

Figure 12.
Marketting image for the Okanagan wine industry; the image evokes a sense of luxury and relaxation, and employs the scenic vista of Okanagan the lake; *https://www.tourismkelowna.com/eat-and-drink/dive-into-wine-food/*

The agricultural industry in British Columbia is reliant on a seasonal, off-farm workforce that is supplied both domestically and through federal programs that connect farmers with temporary foreign workers. A report by the Ministry of Agricultural and Lands, "Regulating Temporary Farm Worker Housing in the ALR," projects that due to an aging demographic among farmers, the decline of farm succession within families, and the lack of farming skills in the general population, there will be a continuous and increasing need for foreign temporary workers in the future.[24] Most temporary foreign workers in British Columbia enter the province as a part of the Seasonal Agricultural Worker Program (SAWP), which requires that

[24] Ministry of Agricultural Lands, "Regulating Temporary Farm Worker Housing in the ALR", pg. i

[25] Government of Canada, "Hire a temporary worker through the Seasonal Agricultural Worker Program". Accessed on March 20, 2019. https://www.canada.ca/en/employment-social-development/services/foreign-workers/agricultural/seasonal-agricultural.html

farmers supply adequate housing for sponsored workers, either on the farm site or in neighbouring urban areas.[25] The economic trend towards increased demand for off-farm, full-time and temporary agricultural workers guarantees that housing availability will continue to be a challenge to the agricultural industry for years to come.

Is Agricultural Land Preservation Incompatible with Housing?

Current ALC regulations that limit farm properties to a single residence are designed for an agricultural economy of economically self-sufficient, family-operated farming households. The ideal of one family—one farm differs greatly from the actual social and economic conditions of the agricultural industry of the Naramata Bench. The ALC regulations create a condition that limits housing stock for agricultural workers on agricultural land, and contributes to the general lack of affordable housing in cities with a large urban-rural interface, such as Penticton. The ALC regulations create a condition in which the housing of the agricultural workforce is essentially an externality with respect to agricultural sites.

This thesis explores an alternative approach to housing that is committed both to properly housing agricultural workers and to ensuring the viability of agricultural land uses.

PART III: DESIGN DESCRIPTION

The site selected for this study consists of four legal parcels within the ALR that have been consolidated into a single commercial vineyard and housing development. The site is bounded by two gullies, the smaller of which forms the southern boundary of the site and joins the larger, McCulloch Gully that forms the northern boundary of the site. The majority of the area of the site forms a natural catchment that drains into the smaller gully.

Figure 13.
Map showing the project site in realtionship to Campbell Mountain, Okanagan Lake and urban and agricultural areas of Penticton
source image: Google Earth; author's annotation

The proposed interventions on the site are organized around a single, architecturally-considered watercourse. This watercourse begins with a series of check dams that harvest water from an intermittent stream that flows through the southern gully. Harvested water is conveyed by natural fall onto a ridge that parallels the

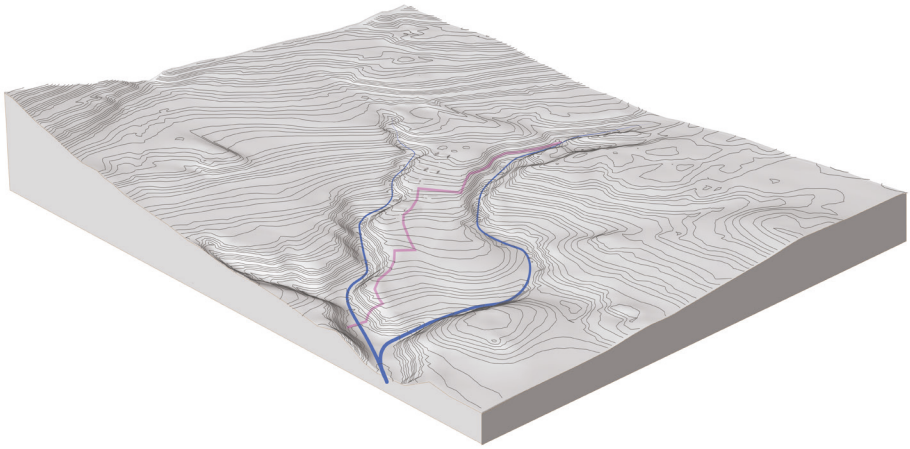

Figure 14.
Axonometric drawing showing intermittent water flows in the two gullies that bound the project site. The purple line indicates the path of the transect that is developed in the design proposal.
author's image

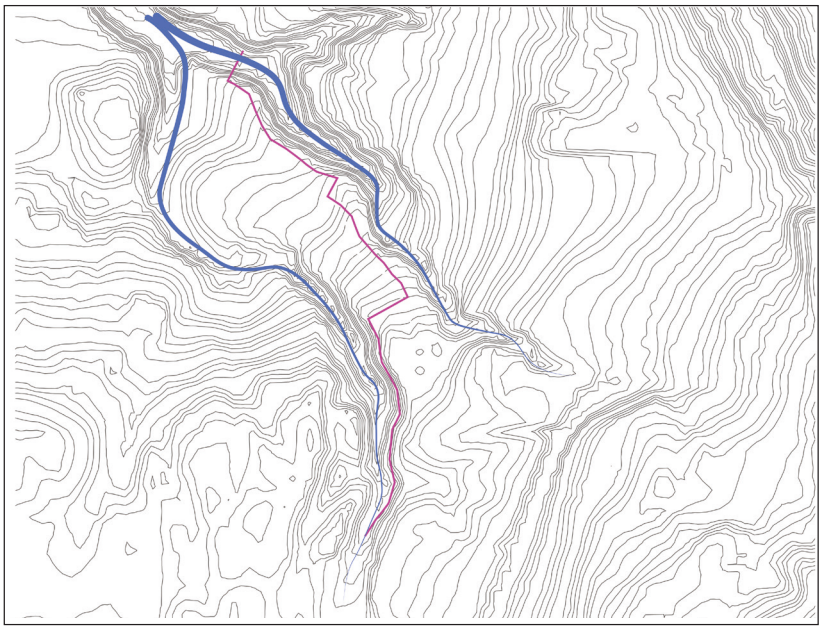

Figure 15.
Map, coordinating with Figure 14. (above), showing topography, the location of gullies and the path of the transect employed in the design proposal.
author's image

northern bound of the site. This water is stored in a series of connected tanks, each of which would overflow and fill the one below in the manner of a natural watercourse. The water held in these tanks is used as a source of both irrigation and non-potable domestic water. Domestic greywater from households is collected, filtered for larger particulates and excess nutrients in a constructed wetland and returned to the constructed water course at a lower elevation. Finally, water is returned to the McCulloch Gully and eventually drains into the Okanagan Lake.

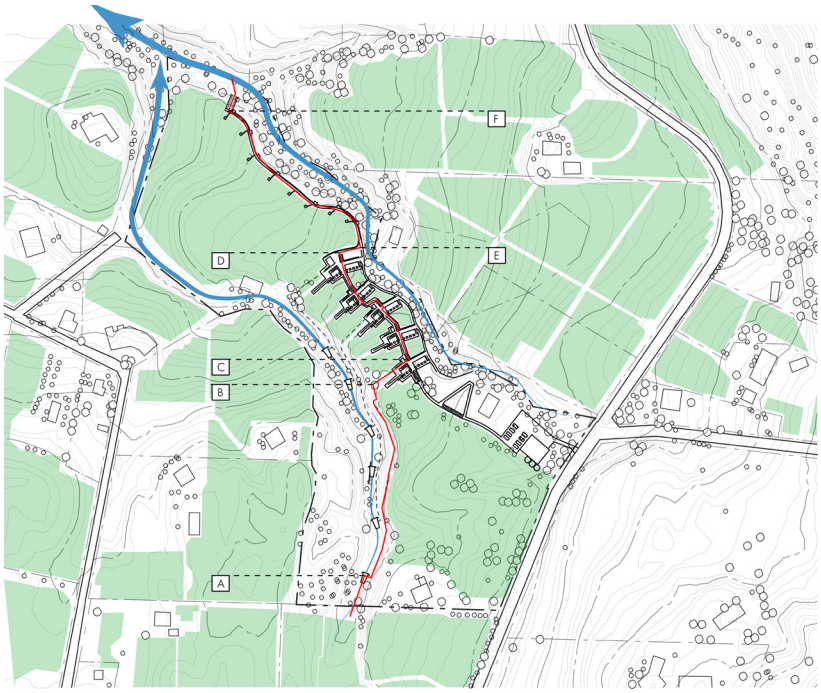

Figure 16.
Site plan showing the consolidation of four existing legal parcels into a single 9.5 acre property, together with the surrounding context of vineyards, orchards and pasture.
author's image

The organization of the site around a constructed watercourse is a response to the primacy of water to human habitation and agricultural production in a semi-arid landscape. The design makes purposeful use of the topography in order to harvest water that has

already been collected by the site's natural contours. Employing a series of small-scale, passive interventions allows the gully to support multiple uses and benefits; such as, in addition to being a place for water harvesting, the gully retains its role as a wildlife corridor and, it is hoped, a place of beauty to be enjoyed by the site's human inhabitants.

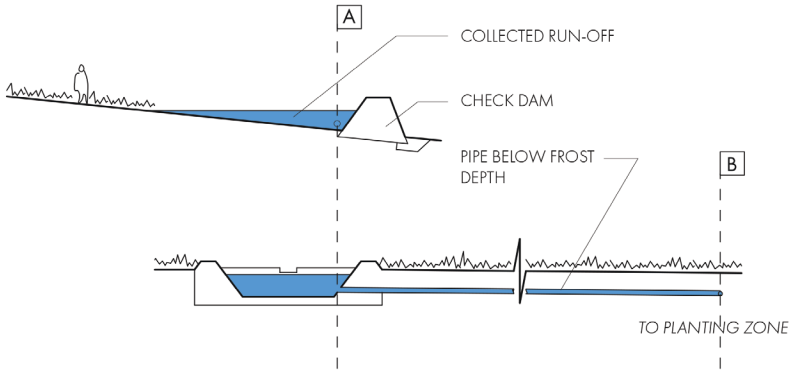

Figure 18.
Sections of check dams for harvesting spring run-off water. Harvested water is conveyed to storage that integrated with the human dwellings and non-potable water systems.
author's image

This series of small interventions in the form of check dams would be built with less impact to the site, and would require less capital investment than larger dams and reservoirs. The designed water harvesting and storage intervention collects, conveys and stores water by gravity alone. Such a system would have a lower operational cost than a more active, technological one that would involve ongoing pumping and controls. Furthermore, a passive scheme involves fewer of the lifecycle costs associated with the replacement and maintenance of mechanical equipment. These qualities of the designed system ensure that it is sustainable, and affordable to operate and maintain by a relatively small, mixed-income community.

Dwellings are located along the ridge that parallels the northern boundary of the site. They are modest in scale and adaptable in the range of occupants and family types that they can house. Each module of housing consists of a pair of units—one 1-bedroom and one 2-bedroom—sited three meters below an integrated water storage tank. The water storage tank that is adjacent to a pair of dwellings is placed at an elevation that allows it to serve the pair of units below. The modules are connected by a central pedestrian path and watercourse, which passes between the two units of each module. This central path leads to parking that is located at the top of the site along Naramata Road and towards the commercial vineyard and secondary access at Sworder Road.

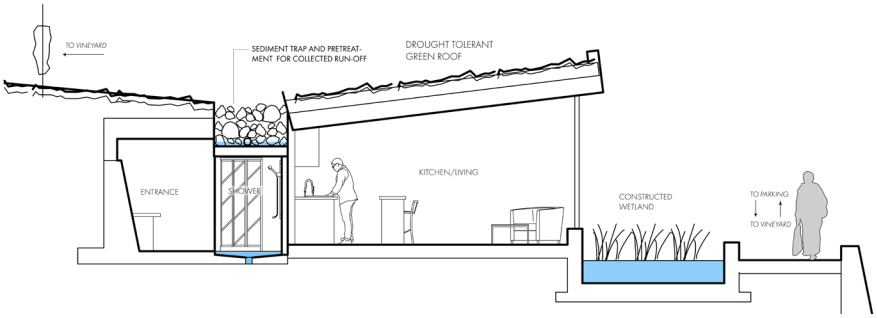

Figure 19.
Section through one dwelling showing run-off water collection on roof surface and opening of view toward the Okanagan Lake.
author's image

Simple cut and fill practices are used to create the terraces that each pair of dwellings is built upon. The dwellings themselves are partially dug into the earth in order to create opportunities to interact with the landscape on multiple levels. For example, the rooftops of the northernmost dwelling can be accessed from grade

above. The earth removed in order to set the dwellings into the hillside is used to create the garden terraces that define the North side of the site.

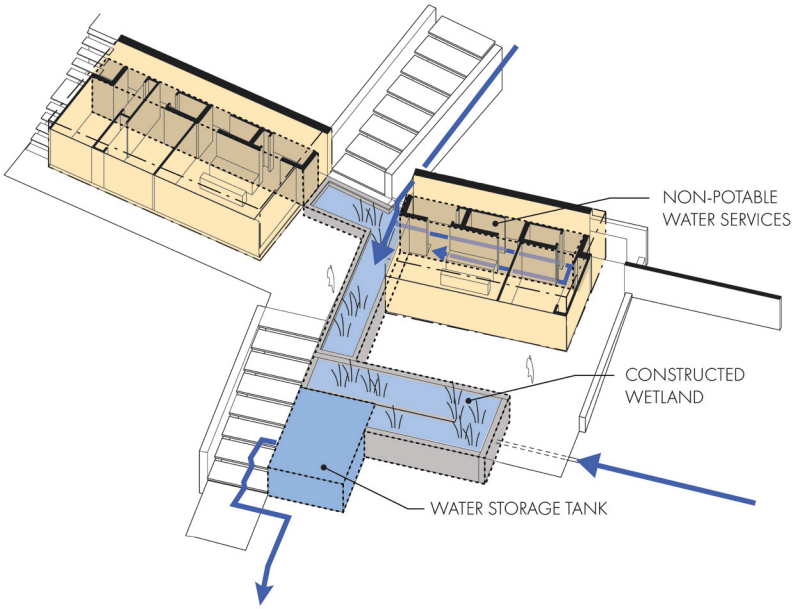

Figure 20.
Cutaway axonometric showing the organisation of dwellings around a linear core of water services . The design proposal imagines dwellings as extensions of an integrated water system.
author's image

The dwellings are designed to balance privacy and community. The central connecting path lends connectivity to the development and the separation of parking from dwellings creates the possibility of incidental meetings as one goes to and from one's home. The terracing of the landscape creates semi-private outdoor spaces where one can sit in relative privacy.

The community design would be well suited for an intentional community that reserves some dwellings for itinerant, agricultural workers. Itinerant workers could occupy both units of a housing pair to maintain a sense of privacy, or be integrated with permanent

residents by using one unit of a pair, in order to promote interaction and inclusion. Moreover, units that are unoccupied by itinerant workers can be rented as agri-tourism units, bringing another source of income to the whole community and increasing its economic resilience.

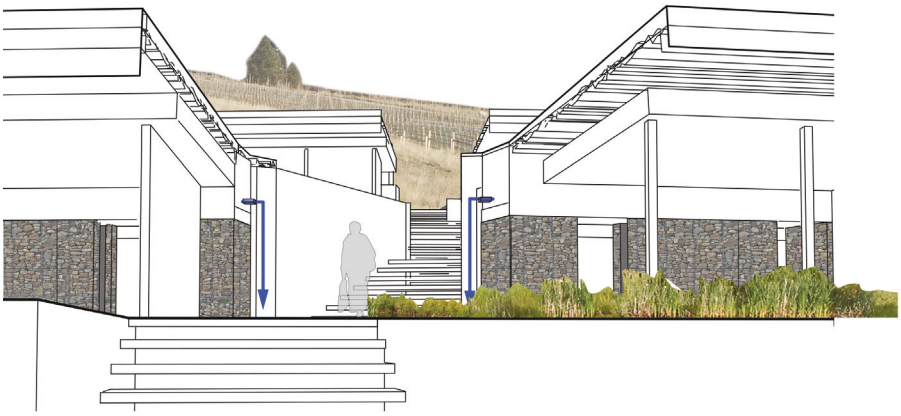

Figure 21.
Perspective looking upwards from central path showing run-off water collection, a constructed wetland and multiple dwellings.
author's image

The design of the dwelling units is closely integrated with the projects governing organization around water stewardship and conservation. Each dwelling is organized around a linear core or 'water wall' of plumbing services (figure). This core conveys greywater directly to the constructed wetland that returns it to the water system. Each dwelling enters onto a sizable and functional mudroom, which is directly adjacent to a shower for the convenience of residents returning home from outdoor work in all weather conditions.

This design proposal understands human habitation in a landscape as an extension of our relationship to its sustaining resources. The

organization of each dwelling around its water services is a tangible and experiential expression of this value. The proposed dwellings can be imagined as complex extensions of the constructed water-course that makes human habitation and agricultural production possible on this site.

FIGURE 22. 1:2500 SITE PLAN

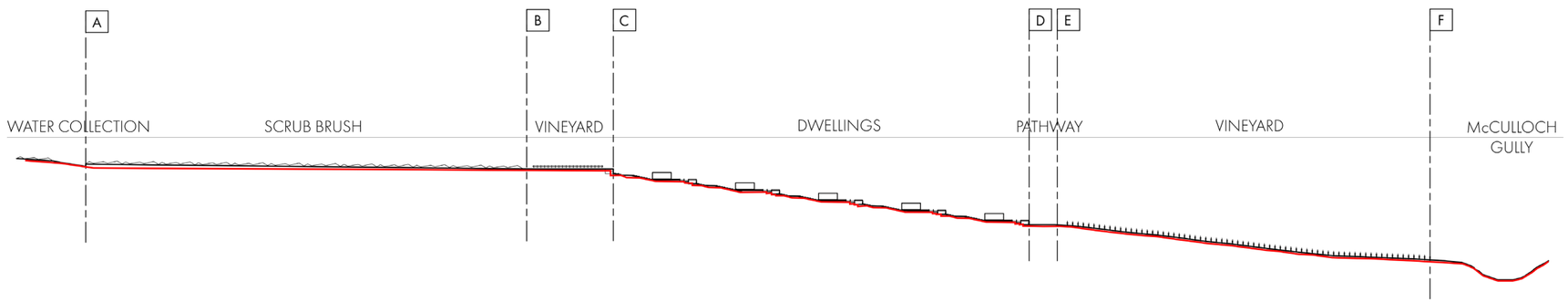

FIGURE 23. 1:2500 WATERCOURSE SECTION

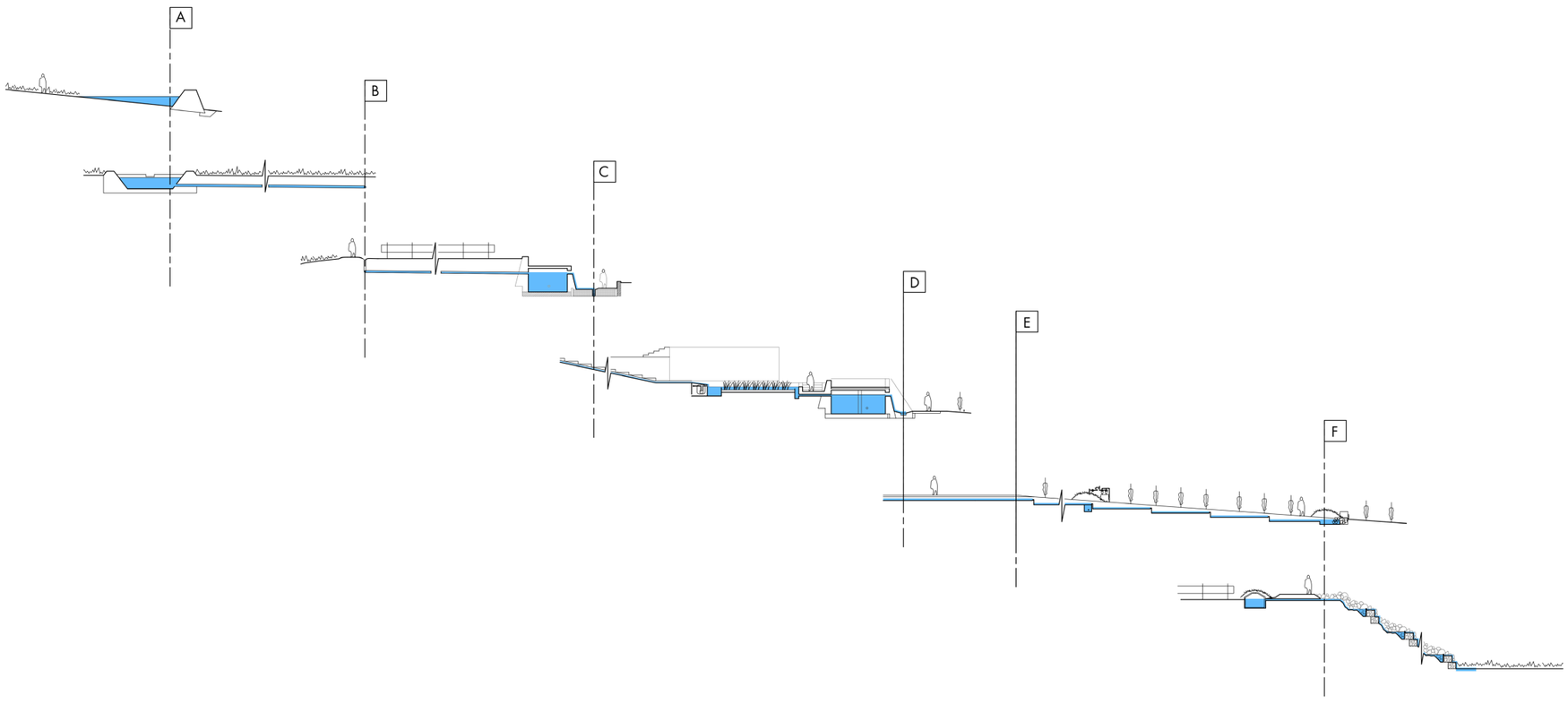

FIGURE 24. 1:400 WATERCOURSE SECTION DETAILS

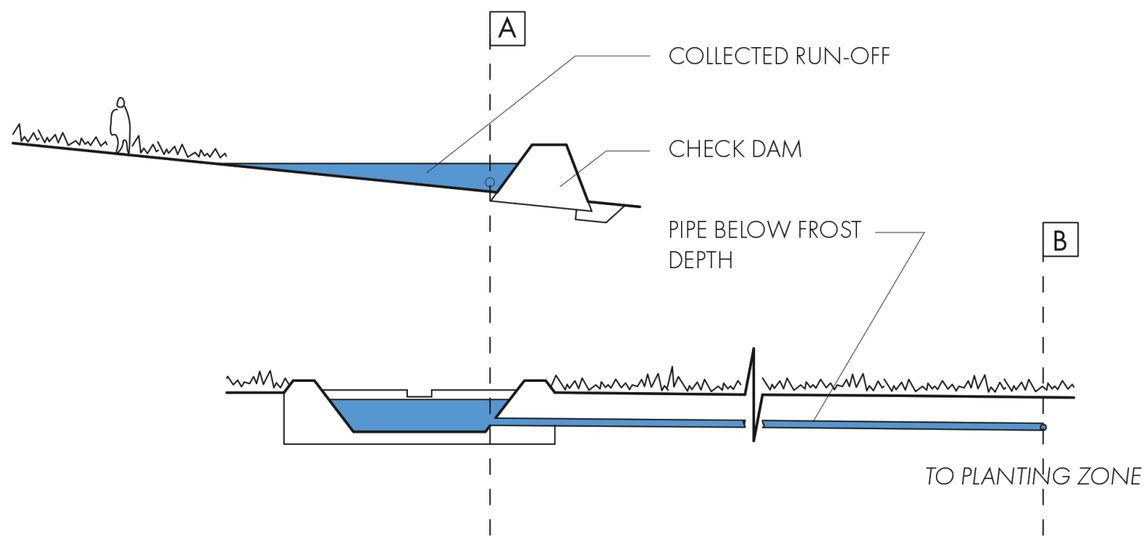

FIGURE 25. 1:100 WATERCOURSE SECTION DETAIL 01

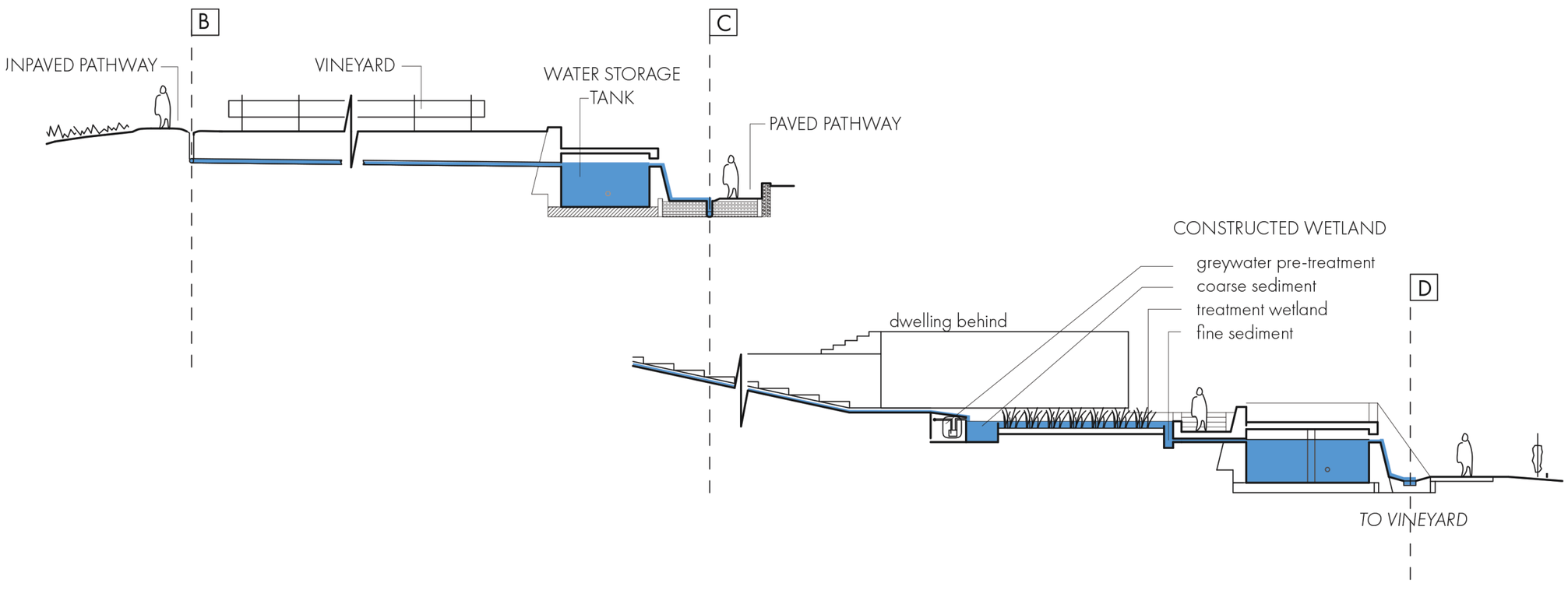

FIGURE 26. 1:100 WATERCOURSE SECTION DETAIL 02

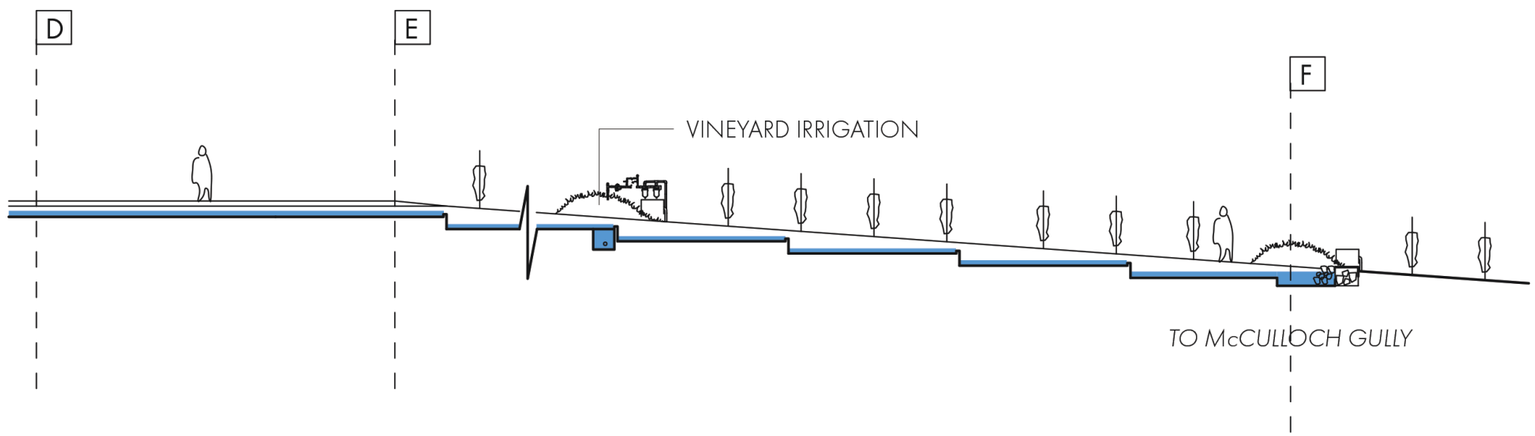

FIGURE 27. 1:100 WATERCOURSE SECTION DETAIL 03

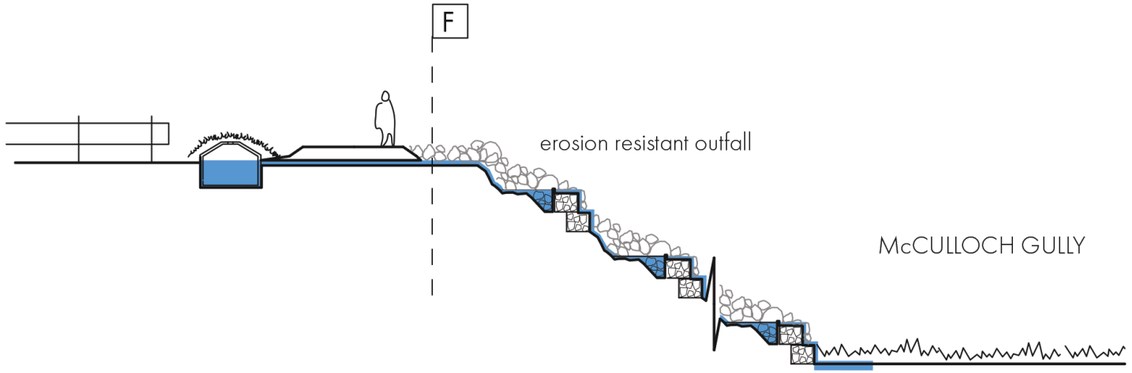

FIGURE 28. 1:100 WATERCOURSE SECTION DETAIL 04

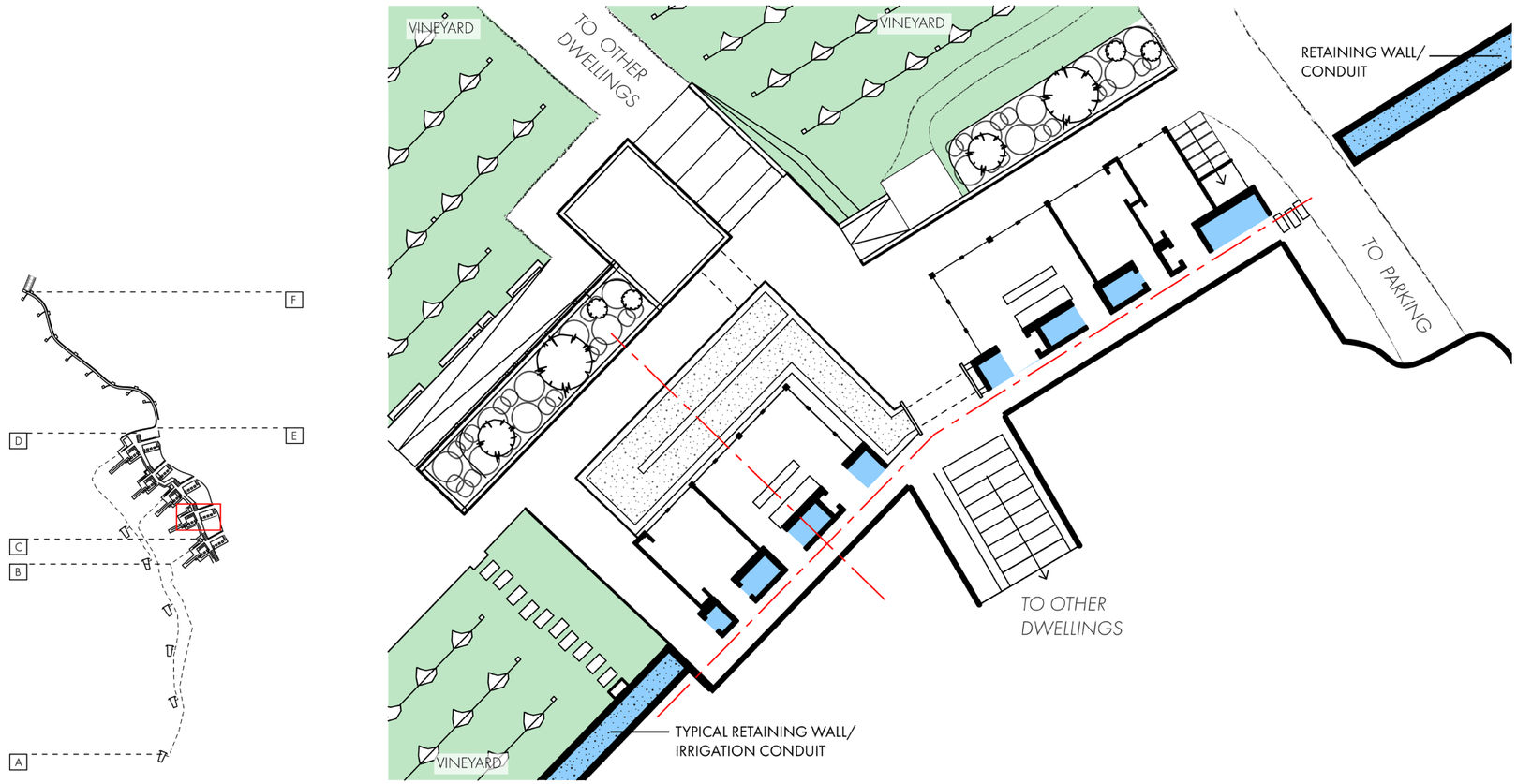

FIGURE 29. 1:150 DWELLING MODULE PLAN

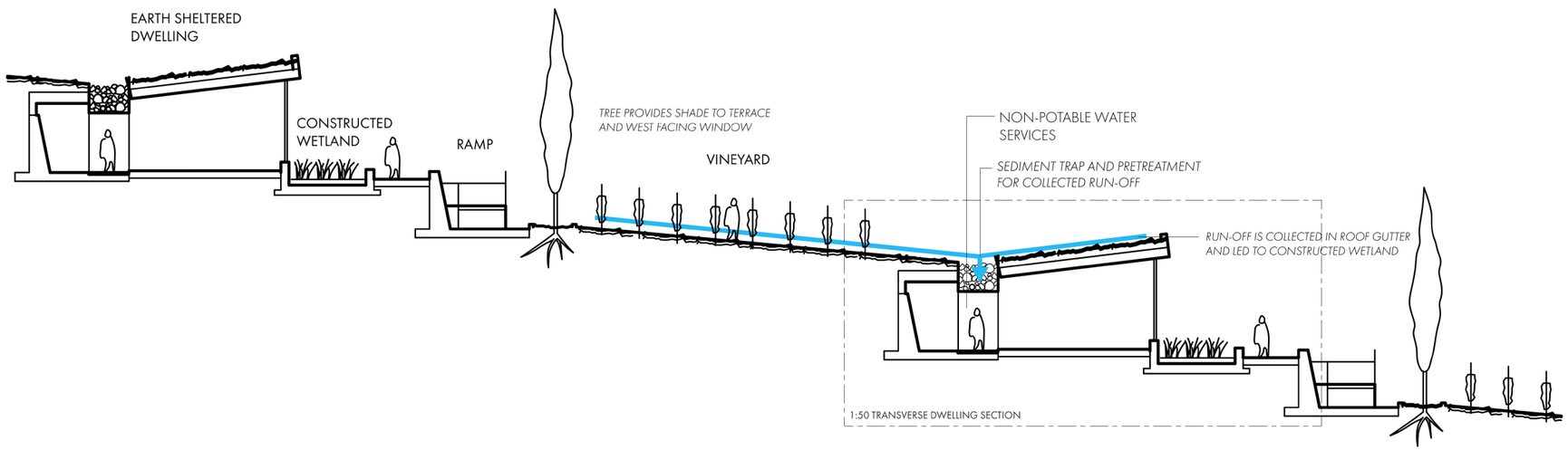

FIGURE 30. 1:150 LANDSCAPE SECTION

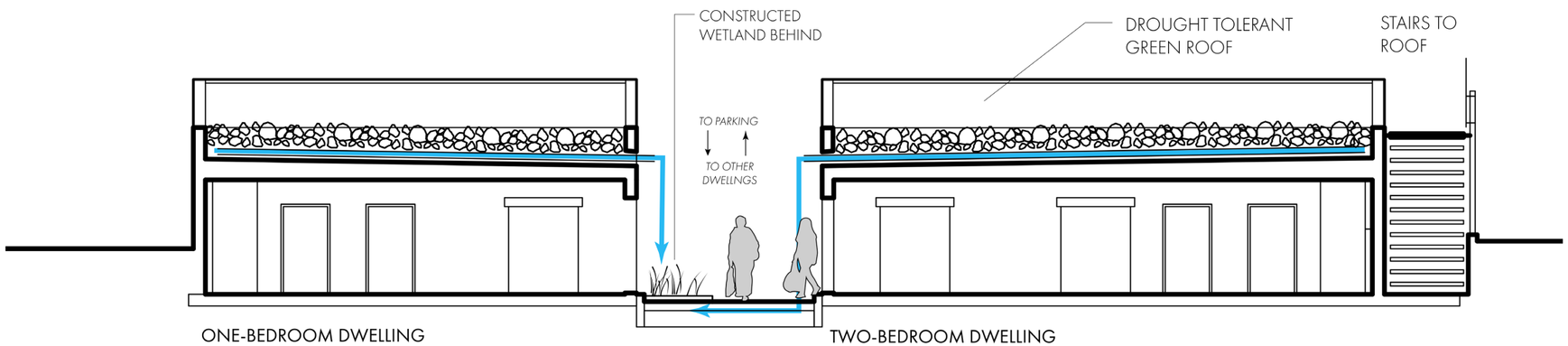

FIGURE 31. 1:00 LONGITUDINAL DWELLING SECTION

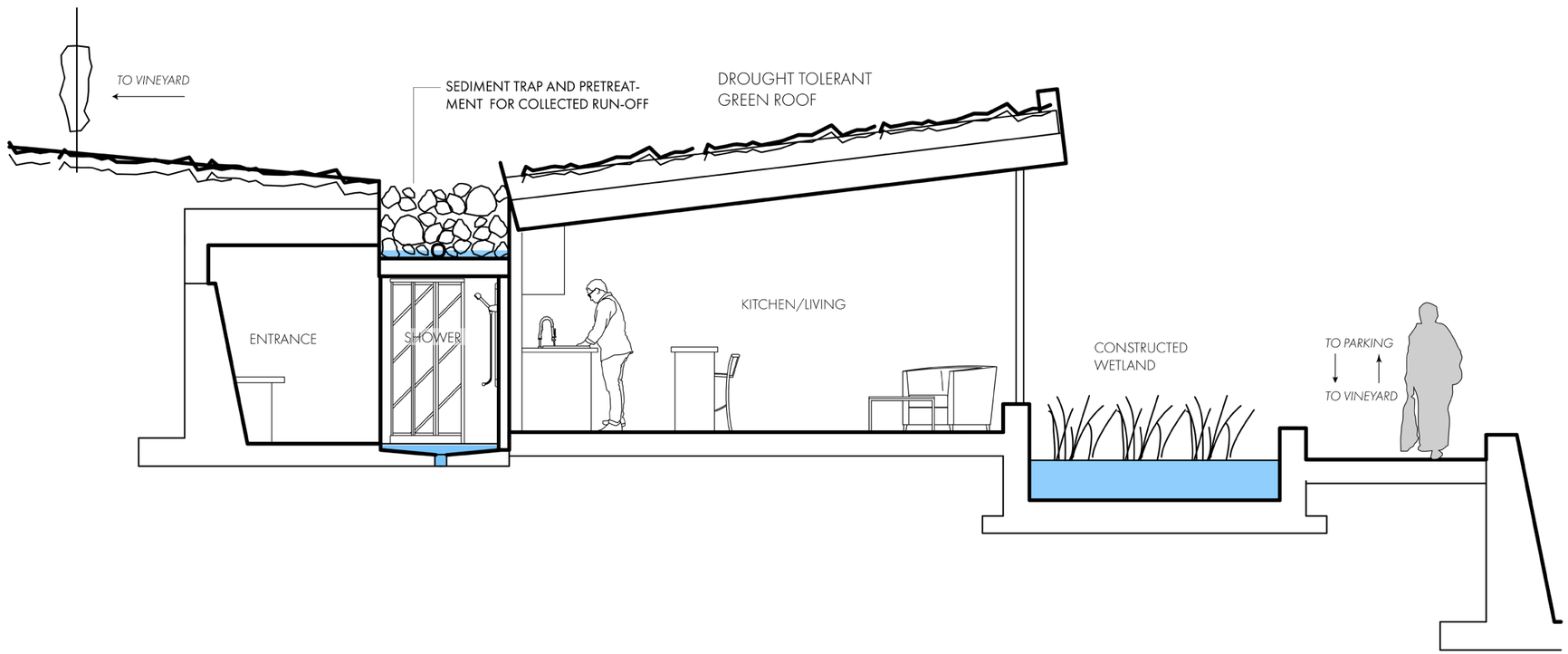

FIGURE 32. 1:100 TEANSVERSE DWELLING SECTION

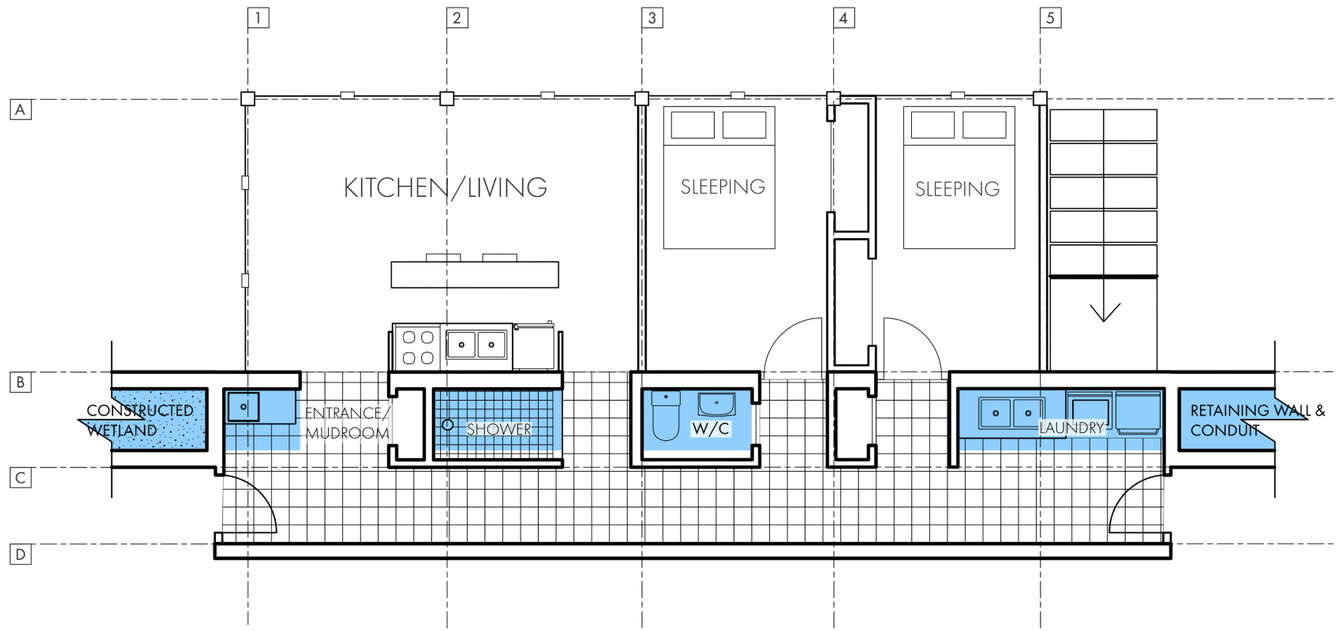

FIGURE 33. 1:50 TWO-BEDROOM UNIT PLAN

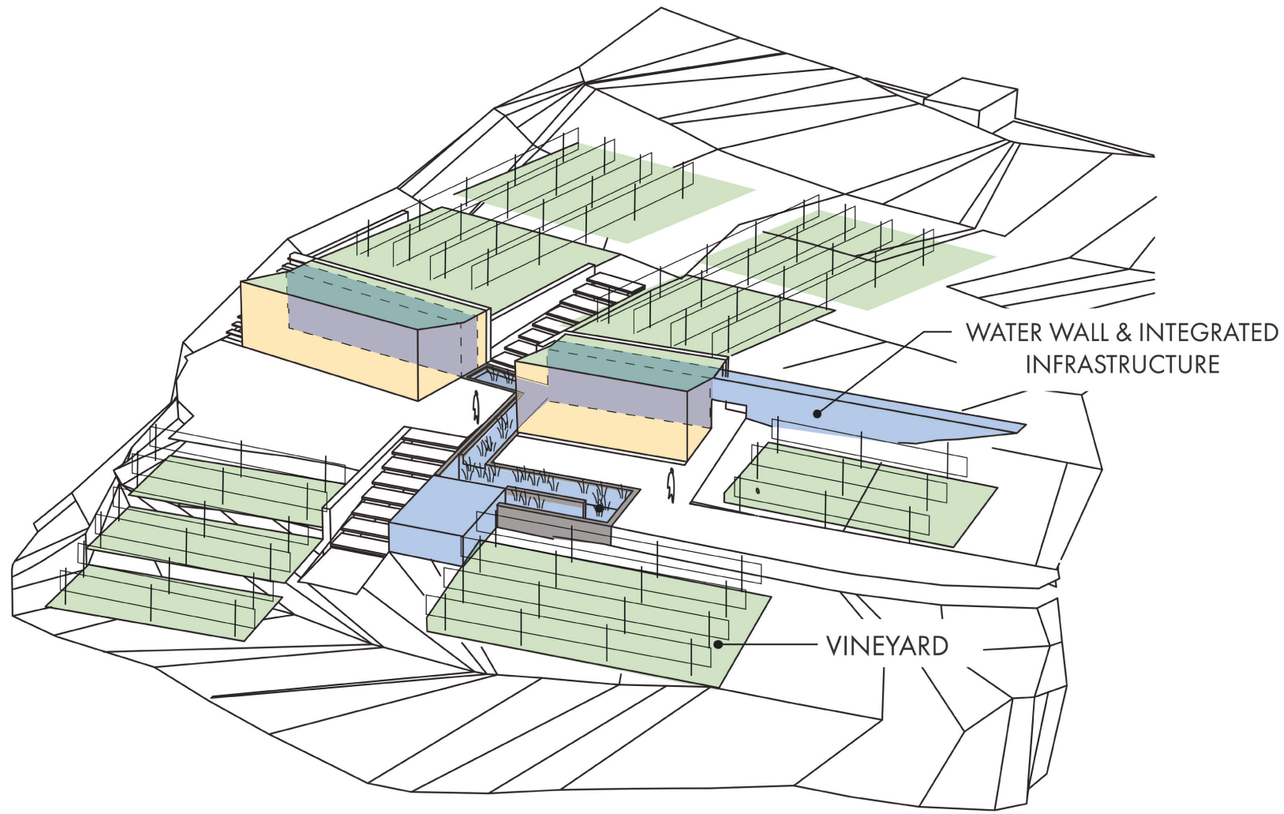

FIGURE 34. *(NTS)* DWELLING MODULE AXONOMETRIC

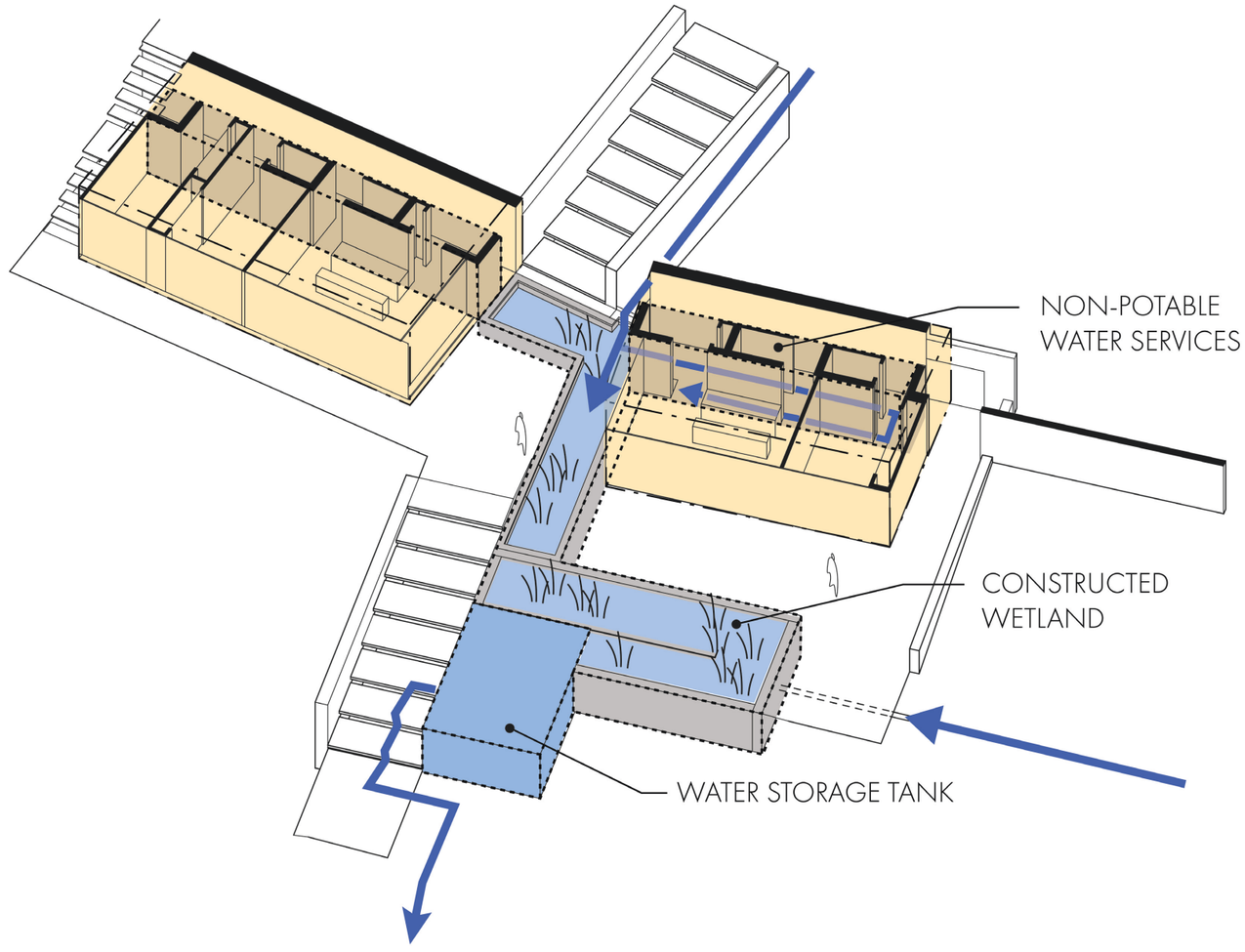

FIGURE 35. *(NTS)* INTEGRATED WATER INFRASTRUCTURES

FIGURE 36. *(NTS)* VIEW OF DWELLINGS IN THE LANDSCAPE

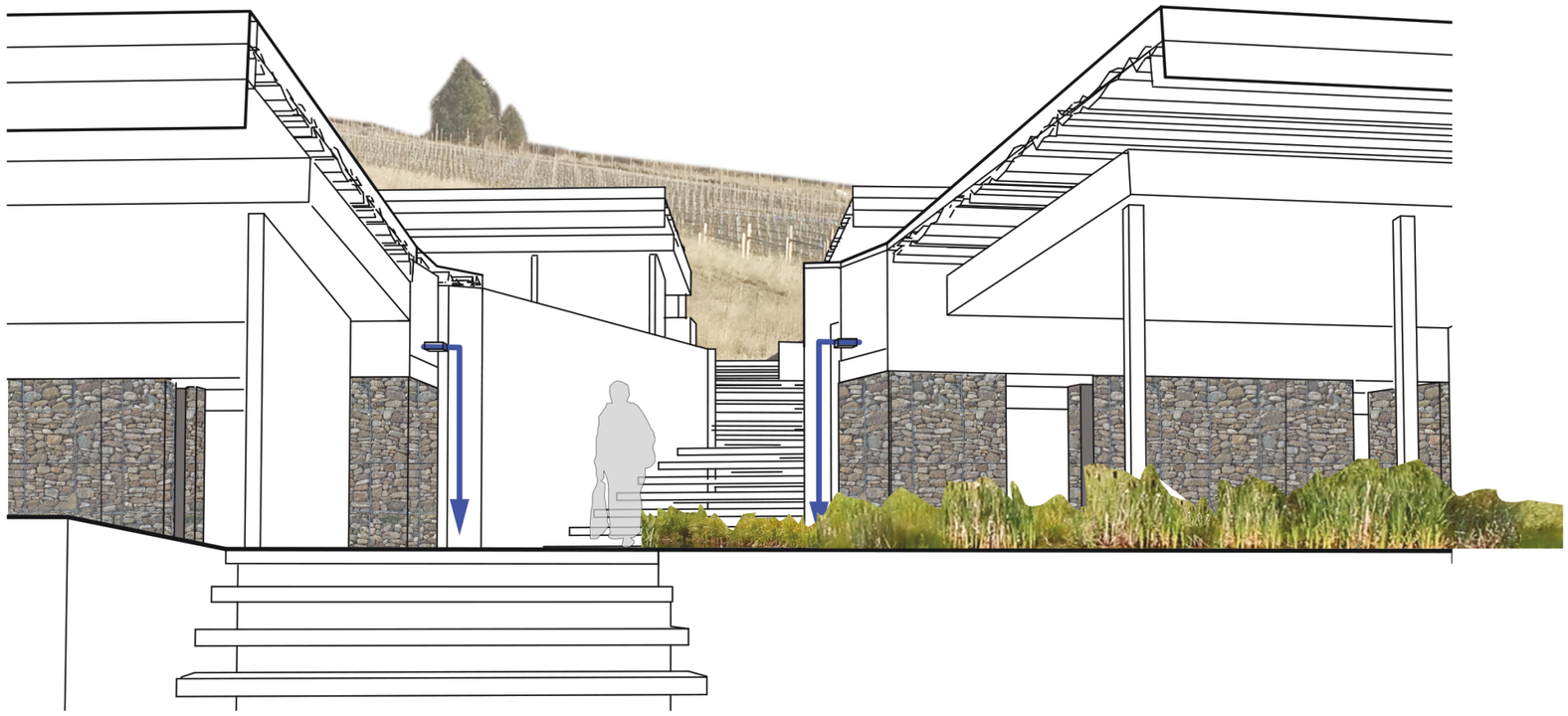

FIGURE 37. *(NTS)* VIEW ALONG CENTRAL PATHWAY

PART IV: CONCLUSION

The ecological model of the oikos underscores the need for restoration and regeneration in natural systems, and imagines a role for human participation in those processes, whereas modern, industrialized economies reduce our relationship to resources to one of extraction and use. The unsustainable practices that arise in such an economy frequently fail to recognize the limits of natural systems. This thesis pursues both infrastructural and architectural strategies towards addressing this challenge by fostering a relationship between a group of people and the ecologies that sustain their life in a landscape. The infrastructural strategy that has been developed towards this goal has already been discussed in some detail, but the architectural strategy deserves to be considered more fully.

As an architectural strategy, the dwellings designed in this thesis allow the inhabitants of the site to tangibly experience the natural process that restore its scant water resources. During the spring run-off, melt water is led through the site, collected in gullies and on rooftops and, generally, is able to be seen, heard and felt by the occupants of the site while its many water storage devices are filled in preparation for the dry summer.

As an architectural poetics, the designed dwellings present the occupants of the site with a mirror through which they can experi-

ence, and participate in, the larger ecological process that sustains their life in the landscape. The very same run-off that fills the site's human-made cisterns, also recharges the upland reservoirs, groundwater aquifers, rivers and lakes that the regions life depends on. By bringing the experience of freshet into the household, this project would foster a strong sense of connection people who live in it and the seasonal processes of restoration that sustain the region's ecology.

The modern reinterpretation of the oikos developed in this thesis tries to account for both the complex social and economic conditions of the South Okanagan and their dynamic character. Many factors shape the housing and working conditions of the region's agricultural industry: agricultural work is highly seasonal and frequently does not provide full-time work, the demographics of farm ownership and farm work are changing and frequently delinked, and the Penticton's agricultural community needs to respond to the housing needs of the wider community. To design a modest and adaptable housing stock is one potential response to this challenge.

A resilient built environment is one that can serve a community under a variety of ownership and living arrangements. As previously described, one could imagine the scheme developed in this thesis as well-suited for some form of intentional community, such as cohousing. And in such a case, the design could be further elabo-

rated to include additional shared, indoor spaces to serve the vision of such communities. However, one can imagine other means by which this design scheme is deployed. For example, a corporately owned vineyard could invest in such a built infrastructure as a means of combining agri-tourism with workers' accommodation. One could even re-imagine this design scheme as an alternative vision of suburbia—one in which each dwelling module and micro-vineyard is privately owned and becomes the means by which every citizen of a community is ensured access to nourishing green space. A resilient built environment is one that can be redeployed under a variety of socio-economic conditions. Although the values that underlie intentional communities have shaped the development of this thesis, they are not necessary to its deployment. It is not the role of an architect to be prescriptive in living arrangements and social values, but to design flexible and adaptable environments that can serve communities in their realized diversity.

One possible continuation of this project would involve asking how the strategies and values it embodies could be applied at a larger scale. This thesis has argued that the current conditions of low housing density on agricultural land is an artificial product of strict regulation and has argued that these conditions contribute to a general lack of affordable housing in the South Okanagan. To scale the values and ideas discussed in this thesis would involve imagining other means of increasing population density on agricultural

land while respecting the limited nature of its water resources. The integration of urban living with localized water collection and agricultural production would be fertile ground for a continued imaginative exploration. Such a continuation could fruitfully draw on many existing studies and precedents in the fields of landscape urbanism and urban agriculture.

Stewardship values are rooted in cultural connections to landscapes and ecologies. The classical Greek idea of the *oikos* is imagined as an essential link between an agrarian culture and a rural, agricultural landscape. The North American political tradition that imagined the 'homestead farm' as the basic socio-economic unit of an agrarian society is a continuation of that tradition. However, a modern re-envisioning the *oikos* need not be a specifically agrarian project: an integration of human dwelling with the resource harvesting it requires is perhaps a more faithful realization of the stewardship values that are embedded in the *oikos* concept.

A resource economy relies on the harvesting of materials and resources far from their sites of consumption and end use. When few people live in the places where materials and resources are harvested, the consequences of human interventions on non-human ecologies are seldom directly seen or witnessed. This thesis presents an architectural response to that ethical challenge: the design it proposes attempts to establish a relationship between human

dwelling and water by bringing together the place of harvest and the place of use.

The design presented is unlike the traditional ideal of the homestead farm in form and in the social and economic life it supports. In a complex, resource-based economy, a commitment to the stewardship of our land and water resources is not be realized in the preservation of the agricultural landscape we are familiar with, but in the reconfiguration of human dwelling around the resources that sustain it.

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